Report Quality Evaluation
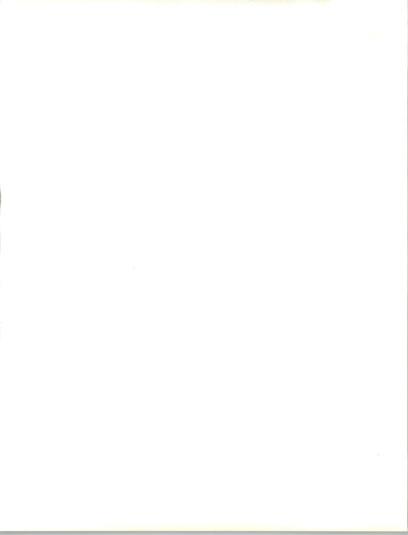
1. Report title: **U.S. Systems Software Products, 1991-1996** (MASSP)

2. Please indicate your reason for reading this report:
   - ☐ Required reading
   - ☐ Area of high interest
   - ☐ Area of general interest
   - ☐ New product development
   - ☐ Business/market planning
   - ☐ Product planning
   - ☐ Future purchase decision
   - ☐ Systems planning
   - ☐ Other _____

3. Please indicate extent report used and overall usefulness:

	Extent		Usefulness (1=Low, 5=High)				
	Read	Skimmed	1	2	3	4	5
Executive Overview	☐	☐	☐	☐	☐	☐	☐
Complete Report	☐	☐	☐	☐	☐	☐	☐
Part of Report (____ %)	☐	☐	☐	☐	☐	☐	☐

4. How Useful was:

	1	2	3	4	5
Data presented	☐	☐	☐	☐	☐
Analyses	☐	☐	☐	☐	☐
Recommendations	☐	☐	☐	☐	☐

5. How useful was the report in these areas:

	1	2	3	4	5
Alert you to new opportunities or approaches	☐	☐	☐	☐	☐
Cover new areas not covered elsewhere	☐	☐	☐	☐	☐
Confirm existing ideas	☐	☐	☐	☐	☐
Meet Expectations	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

6. Which topics in the report were the most useful? Why?_____

7. In what ways could the report have been improved? _____

8. Other comments or suggestions: _____

Name _____ Title _____

Department _____

Company _____

Address _____

City _____ State _____ ZIP _____

Telephone _____ Date Completed _____

Thank you for your time and cooperation.

M&S 633/01 12/89

INPUT

November 27, 1991

Dear Colleague:

Enclosed is a corrected page from Chapter VI of the *U.S. Systems Software Products, 1991-1996* report. This chapter was recently shipped to you and we would ask that you replace the enclosed page.

The error is in Exhibit VI-5 Selected Leading Software Products Vendors, U.S. Systems Software Revenues, 1989 and 1990. The errors were in the "percentage change" column: Both Sterling and Informix should have shown positive percent changes not negative.

We apologize for this error.

Sincerely,

Douglas H. Tayler

Douglas H. Tayler
Vice President, Research

Erata letter

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Sincerely,

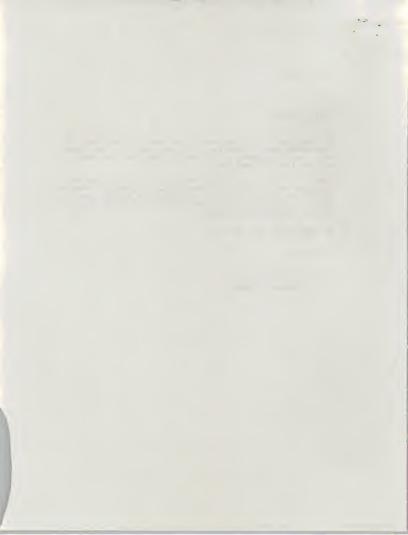Douglas H. Tayler
Vice President, Research

EXHIBIT VI-5

Selected Leading Software Products Vendors
U.S. Systems Software Revenues
1989 and 1990

Vendor	1989 ($ M)	1990 ($ M)	Percent Change
Computer Associates	463	470	1
Oracle	283	390	38
Novell	263	358	36
Microsoft	242	415	72
BGS	144	152	6
Pansophic	109	110	1
Adobe	99	140	40
SAS	87	105	21
Ashton-Tate	84	73	-13
Sterling	74	81	9/10 10
Informix	69	70	1 1
Total	1,917	2,363	23

EXHIBIT VI-6

Public Systems Software Products Vendors
Revenue and Net Income

Growth (Percent) — line graph with two series: Net Income and Revenue, plotted from 1986 to 1990.

Net Income: 48 (1986), 67 (1987), 56 (1988), 26 (1989), 25 (1990)
Revenue: 44 (1986), 57 (1987), 46 (1988), 20 (1989), 19 (1990)

Note that these revenue numbers are based on discussion with vendors as well as INPUT estimates. Also, the apparent 7% decline in Digital's systems software revenues may be due to price negotiations for combinations of equipment, software and services.

Revenue growth for the leading systems software products vendors, as shown in Exhibit VI-6, was 25% in 1990, compared to 26% in 1989, 46% in 1988, and 57% in 1987. An increasing portion of this growth is attributable to increasing international revenues.

3. Systems Software Forecast

In 1990, actual expenditure on systems software products grew 13%, reaching $16.4 billion. Actual 1990 expenditures are in line with INPUT's forecasted 1990 expenditures.
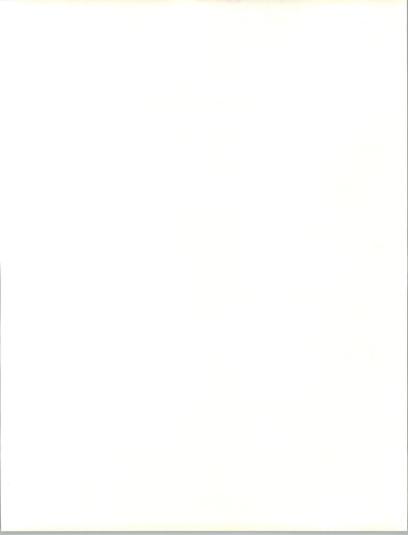
- During 1990, the fastest growing systems software product area was operations management tools, which encompass network administration and control products. In addition to pressures to improve processing efficiency, the trend toward multiplatform, multivendor networks and network integration has begun to fuel the growth of this product area.

- Applications developments—especially CASE tools—experienced strong growth in 1990 due to the ongoing need to improve software development productivity.

The change in outlook for systems software in last year's report and this year's report is shown in Exhibit VI-7.

- The systems software products forecast has been adjusted downwards for all products and platform sizes.

- Products whose forecasts have changed the most are workstation and PC-based products for all three submodes. In this year's report, INPUT forecasts these products to grow at 19% compounded annually through 1996. In last year's report, however, INPUT forecast workstation and PC-based systems software products to grow at a compound annual rate of 24%.

U.S. SYSTEMS SOFTWARE PRODUCTS

1991-1996

Market Analysis Program (MAP)

U.S. Systems Software Products, 1991-1996

MASSP • 504 • 1991

Abstract

This annual report provides analysis and five-year forecasts of the U.S. systems software products market for the period 1991-1996. The forecasts contained in this report divide the market into systems control, applications development tools and operations management tools. The market is also segmented by platform size: mainframe, minicomputer and PC/workstation platforms.

The report discusses the underlying trends in the information services market as they impact systems software, analyzes the key trends in the systems software products market that are driving and inhibiting growth, and projects growth patterns for the next five years.

The report contains 166 pages and 72 exhibits.

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Exhibits

Exhibits (Continued)

Exhibits (Continued)

I

Introduction

This report is part of a series of market analysis reports written each year by INPUT on the key segments (delivery modes) of the U.S. information services industry. The delivery modes analyzed during 1991 are as follows:

1. Applications Software Products
2. Turnkey Systems
3. Processing Services
4. Systems Software Products
5. Network Services
6. Professional Services
7. Systems Integration
8. Systems Operations

The first six delivery modes are covered in reports included as part of INPUT's Market Analysis Program (MAP), a planning service for information services vendors. The last two delivery modes are covered in market analysis reports included in INPUT's Systems Integration and Systems Operations programs.
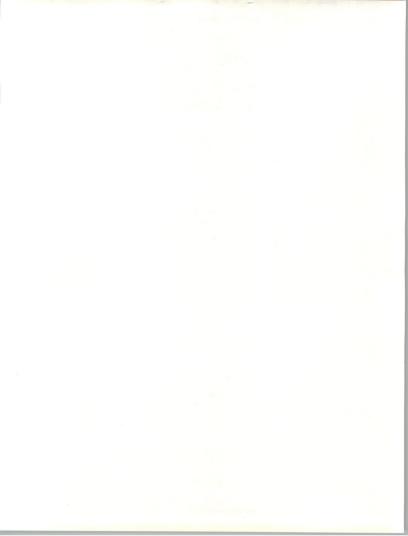
A	
Purpose and Organization	**1. Purpose**

This report analyzes the systems software products delivery mode of the U.S. information services industry.

• The report includes five-year forecasts, an assessment of market drivers, analysis of competitive trends, and identification of leading vendors.

- The report assesses trends and events within the U.S. economy, the U.S. information services industry, and the systems software delivery mode to provide the reader with a comprehensive foundation for understanding this market sector and for anticipating future directions.

The report provides readers with insights and information that will help them:

- Review the forces shaping the market
- Develop internal corporate financial projections
- Identify new markets and product and services opportunities
- Assess the competitive trends
- Determine potential market directions
- Assist in prioritizing investments

2. Organization

This report is organized as described in Exhibit I-1. Each delivery mode report within the Market Analysis Program follows this format. The industry and cross-industry sector reports, described below, follow a very similar format.

This report is published in segments throughout the year to subscribers to INPUT's Market Analysis Program. Subscribers will receive the material as the research and analysis is completed, with the first chapters shipped in the second quarter. The forecast is shipped in the third quarter.
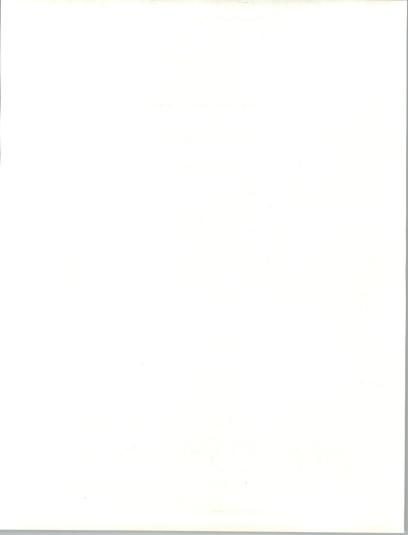
EXHIBIT I-1

Market Reports Format

I.   Introduction
- Introduction and definition of the delivery mode and its substructure or segments.

II.   Executive Overview
- Synopsis of the entire report, written at the end of the year.

III.   General Business Climate
- An overview of the business climate within the information services industry as a whole and the particular market segment of each report.

IV.   Information Systems Environment
- The information systems environment and user perspective as it relates to the specific delivery mode or market.

V.   Vendor Issues and Trends
- An assessment of the delivery mode from the vendor point of view.

VI.   Information Services Market Forecast
- Presentation of the information services market forecast by delivery mode and submode.

VII.   Competitive Environment
- Discussion of the competitive environment for information services within the delivery mode—with market share analysis and vendor profiles.

VIII.   Conclusions and Recommendations
- Summary of risks and opportunities.
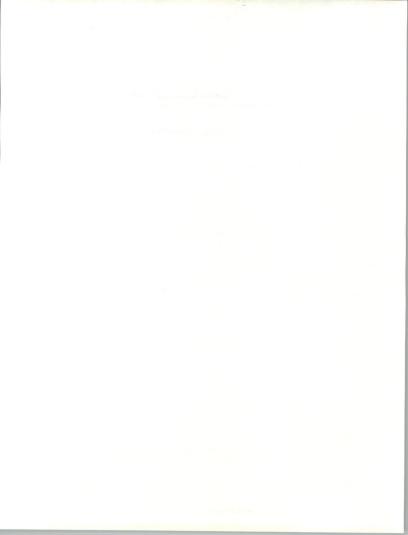
A.   INPUT Definition of Terms
- Definitions and descriptions of market structure and terms used throughout INPUT's reports.

B.   Forecast Data Base
- A detailed forecast by delivery mode, submode, and industry/cross-industry sector. Contains a reconciliation to the previous year's Appendix B.

B

Scope and
Methodology
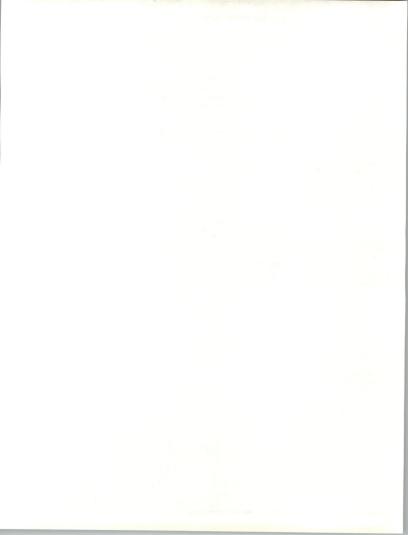
1. Scope
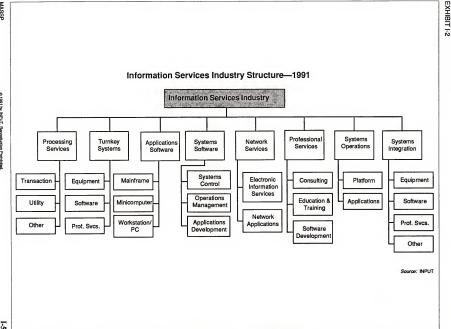
This report addresses the U.S. information services industry for the
systems software sector (delivery mode). It includes user expenditures
that are noncaptive and generally available to vendors. Many large
organizations have portions of their information services requirements
satisfied by internal divisions. The resulting expenditure is not available
for competitive bid by the general vendor community and is not included
in INPUT's projections. The noncaptive distinction is important and is
addressed in more detail in Appendix A.

a. Information Services Industry Structure

Exhibit I-2 defines the structure of the information services industry as
used by INPUT in its market analysis and forecasts. The industry con-
sists of eight delivery modes, each of which contains a number of sub-
modes.

- *Delivery modes* are specific products and services that satisfy a given
  user need. *Market sectors* specify who the buyer is and *Delivery
  Modes* specify what the user is buying.

- INPUT develops a five-year forecast for the delivery mode and each of
  the submodes.

EXHIBIT I-2

Information Services Industry Structure—1991

Information Services Industry

| Processing Services | Turnkey Systems | Applications Software | Systems Software | Network Services | Professional Services | Systems Operations | Systems Integration |

- Processing Services
  - Transaction
  - Utility
  - Other
- Turnkey Systems
  - Equipment
  - Software
  - Prof. Svcs.
- Applications Software
  - Mainframe
  - Minicomputer
  - Workstation/PC
- Systems Software
  - Systems Control
  - Operations Management
  - Applications Development
- Network Services
  - Electronic Information Services
  - Network Applications
- Professional Services
  - Consulting
  - Education & Training
  - Software Development
- Systems Operations
  - Platform
  - Applications
- Systems Integration
  - Equipment
  - Software
  - Prof. Svcs.
  - Other

Source: INPUT

INPUT also publishes market sector reports analyzing 15 industry and 7 cross-industry market sectors. These reports, published annually by INPUT, analyze the information services opportunities in industry sectors such as insurance, transportation, and discrete manufacturing—and in cross-industry sectors such as accounting, human resources and office systems.
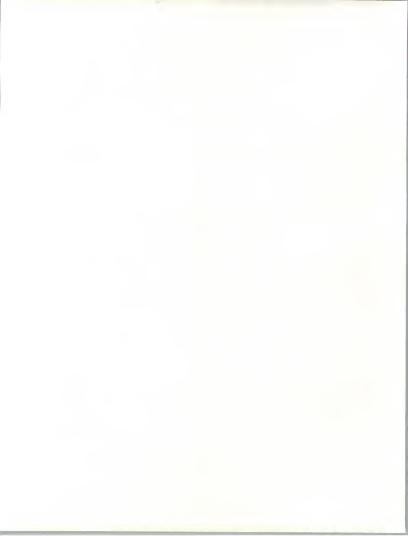
The relationship between delivery mode forecasts and market sector forecasts is shown in Exhibit I-3.

For a more complete discussion of INPUT's information services industry structure and market sector definitions, please refer to INPUT's *Definition of Terms*.

EXHIBIT I-3

Delivery Mode versus Market Sector Forecast Content				
		Market Sectors		
Delivery Mode	Submode	Industry Sectors	Cross-Industry Sectors	Other
Processing Services	Transaction Utility Other	X	X	X X
Turnkey Systems		X	X	
Applications Software Products		X	X	
Systems Operations	Platform Applications	X X		
Systems Integration		X		
Professional Services		X		
Network Services	Network Applications Electronic Information Services	X X		X
Systems Software Products				X
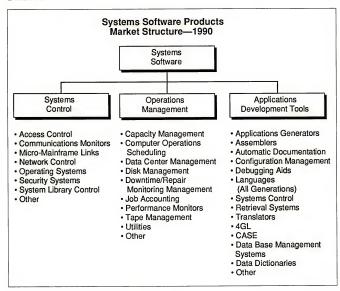
b. Delivery Mode Description

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. The systems software products delivery mode, as shown in Exhibit I-4, is composed of the systems control products, operations management tools, and applications development tools submodes.

EXHIBIT I-4

**Systems Software Products
Market Structure—1990**

Systems
Software

Systems Control	Operations Management	Applications Development Tools

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

Operations 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
• Applications Generators
• Assemblers
• Automatic Documentation
• Configuration Management
• Debugging Aids
• Languages (All Generations)
• Systems Control
• Retrieval Systems
• Translators
• 4GL
• CASE
• Data Base Management Systems
• Data Dictionaries
• Other

These submodes are described below:

- *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.

- *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

- *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base systems, and other development productivity aids. Also included are system utilities (e.g., sorts) that are directly invoked by an applications program.

Systems software involves user purchases of software packages for in-house computer systems. Lease and purchase expenditures are included, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included.

Systems software that is sold as part of other delivery modes—turnkey systems, professional services, systems operations, and systems integration—is not included in systems software but in each of these other delivery modes.

Systems software products are not specialized by industry. Thus, the forecasts for the systems software products delivery mode and its submodes are provided in total rather than separately for each of the industry or cross-industry sectors.

2. Methodology

INPUT's methodology for market analysis and forecasting is summarized in Exhibit I-5. As in past years, INPUT has continued to survey information services vendors to determine their U.S. information services revenues, and to query information systems organizations about expenditures and outside services acquisition plans. INPUT interviewed vendors a second time to understand their views of market opportunities over the short and long terms.

EXHIBIT I-5

INPUT Research Methodology

I. Base Year

```
                        ┌──────────┐
                        │ Vendor   │
                        │ Revenue  │
                        │ Surveys  │
                        └──────────┘
   ┌──────────┐            ( Data )          ┌──────────────┐
   │ IS Industry│          ( Cleansing)      │ User Expenditure│
   │ Research   │                            │ Survey          │
   └──────────┘                              └──────────────┘
                       ( Projecting )
                       ( Sample     )
                       ( to Industry)

   ( 8 Delivery )      ( Aggregation )       ( 22 Vertical )
   ( Modes      )      ( of Vendor   )       ( & CI Markets)
                       ( Revenues    )

                       ( Adjustment for )
                       ( Distribution   )
                       ( Channels       )

                       ( User          )     1990 Base Year
                       ( Expenditures  )
```

II. Market Forecasts

```
   ┌──────────────┐                          ┌──────────────────┐
   │ User Planning │      ( Forecasts )       │ Industry, Economic│
   │ Survey        │                          │ and Technology    │
   └──────────────┘                          │ Research          │
                                             └──────────────────┘
   ┌──────────────┐
   │ Vendor Planning│
   │ Survey         │
   └──────────────┘
                       ( Reconciliation )
                       ( to Prior Year  )

   ┌──────────┐         ┌───────────┐         ┌──────────────────┐
   │ 8 Delivery│◄────────│ 5-Year    │────────►│ 22 Vertical and  │
   │ Modes     │         │ Forecasts │         │ Cross-Industry   │
   └──────────┘         └───────────┘         │ Markets          │
                                             └──────────────────┘
```

INPUT's annual forecasting process is broken into two major parts: base-year expenditure calculations and market forecasts. Each is briefly described below.
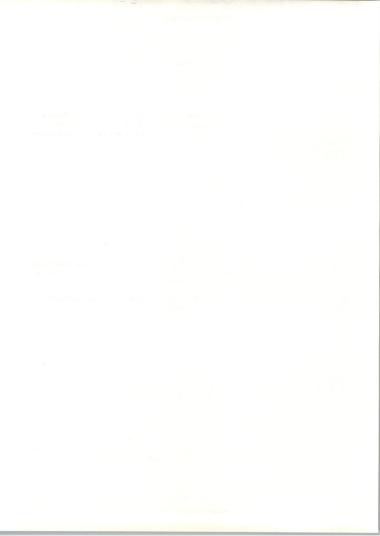
a. Base-Year Expenditure Calculations

• INPUT determines previous-year information services revenues for the eight delivery modes and 22 industry and cross-industry sectors for hundreds of vendors. Estimates rely upon interviews, public data, and INPUT's own estimates.

• The initial data are projected to represent the entire information services industry.

• Adjustments are made to eliminate duplications due to distribution channel overlap and to assure that captive information services expenditures are not included.

• The result is a base-year (1990) user expenditure for each of the 22 vertical and cross-industry sectors and the 8 delivery modes.

b. Market Forecasts

• In the forecasting step, INPUT surveys information systems executives to determine their projected expenditure levels, both in aggregate and for each of the outside information services categories.

• In addition, a second set of vendor interviews is conducted later in the year to obtain an understanding of how key vendors view the market and its opportunities.

• The result is a five-year forecast for each of the 22 vertical and cross-industry sectors and the 8 delivery modes. The delivery mode and market sector forecasts are correlated according to the diagram in Exhibit I-3.

To complete the process, INPUT reconciles its new forecasts with those from the previous year. Differences due to market restructuring and other factors are explained. One may use these projections to track INPUT's forecasts from year to year.

C
Economic Assumptions

INPUT forecasts are presented in current dollars (i.e., 1996 market sizes are in 1996 dollars, including inflationary forecasts). In developing the five-year forecasts, INPUT has incorporated economic assumptions for the U.S. economy as a whole.

The GNP and GNP Deflator growth rates used in INPUT's market projections for 1991 through 1996 are from the CONSENSUS™ forecast, a product of Blue Chip Economic Indicators of Sedona, Arizona. The Blue Chip CONSENSUS forecast is derived from a leading panel of economists representing leading financial, industrial, and research firms across the U.S. and has a 13-year track record of balanced and accurate projections.

The 1991-1996 assumptions are contained in Chapter VI, Information Services Market Forecast.

D
Related Reports

Related reports of interest to the reader are:
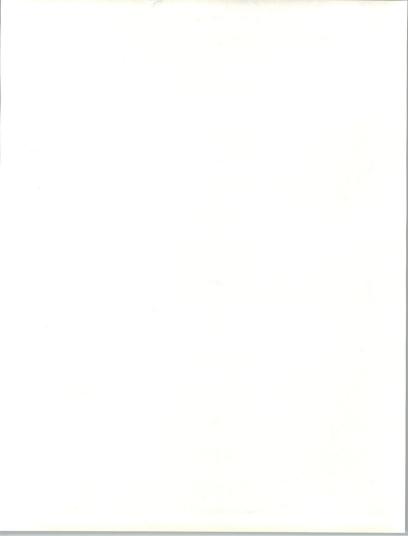
1. U.S. Markets
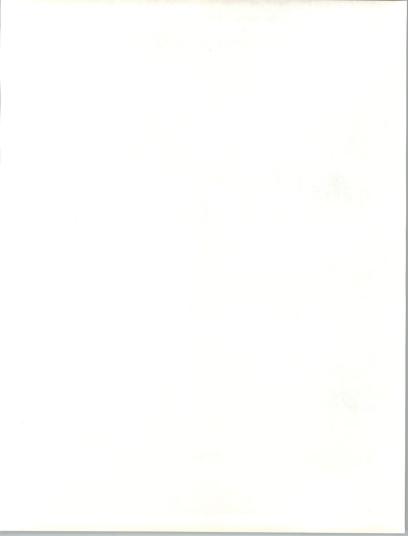
- *U.S. Applications Solutions Market Analysis Report, 1991-1996*
- *U.S. Processing Services Market Analysis Report, 1991-1996*
- *U.S. Systems Software Products Market Analysis Report, 1991-1996*
- *U.S. Professional Services Market Analysis Report, 1991-1996*
- *U.S. Systems Integration Market Analysis Report, 1991-1996*
- *U.S. Systems Operations Market Analysis Report, 1991-1996*
- *U.S. Industry Sector Markets, 1991-1996* (15 reports on all major industry sectors—e.g., insurance)
- *U.S. Cross-Industry Sector Markets, 1991-1996* (7 reports on information services markets that serve all vertical industry sectors—e.g., accounting)

2. European Markets

- *The Western European Market for Computer Software and Services, 1991-1996*
- *Systems Software Products—Western Europe, 1991-1996*
- *Trends in Processing Services—Western Europe, 1991-1996*
- *Systems Integration Market Forecast—Western Europe, 1991-1996*
- *Systems Operations Market Forecast—Western Europe, 1991-1996*
- *Western European Network Services Markets, 1991-1996*

The European markets are also analyzed on a vertical basis for discrete and process manufacturing, insurance, banking and finance, and retail and wholesale distribution.

II

Executive Overview

Systems software encompasses systems control products, operations management, and applications development tools.

In this Executive Overview, INPUT provides a summary of user issues and driving forces that will impact systems software over the next five years, presents overall growth projections for systems software products, and draws conclusions about this fast-moving portion of the information services industry.

A
User Issues
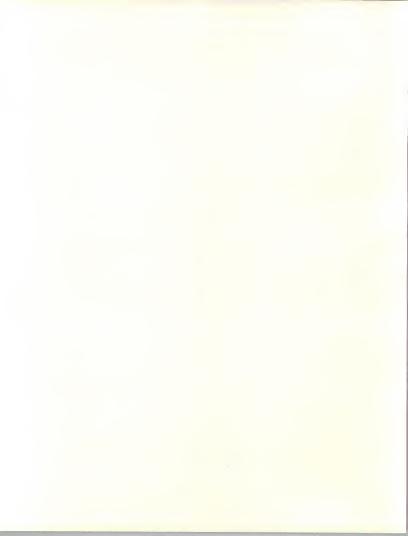
User issues are outlined in Exhibit II-1 and briefly described below.

EXHIBIT II-1

Systems Software Products
User Issues

- Data center infrastructure intact
- LAN integration a high priority
- Wait-and-see attitude toward client/server
- High maintenance expenditures
- More operations management tools needed
- More support needed

The infrastructure of the data center is not being downsized to any large degree. Overall, few operations managers view downsizing the central computer as an objective during the next several years or after 1993. In fact, primary CPU performance is being enhanced and efforts are strongly being made to improve data center productivity.

Over the next several years LAN integration, and network integration in general, will be a top IS objective. This high degree of interest in integration implies keen interest in improving productivity and efficiencies through data sharing, resource and peripherals sharing, and an increasing movement toward decentralized computing. LAN integration is a first and necessary step.

Integration of LANs and networks will be an important catalyst for future implementations of client-server technology, distributed DBMSs, and UNIX/open systems. Thus INPUT expects accelerated activity in these other areas, especially after 1993. Even so, it appears that the mainframe and corporate data center will continue to thrive and that expenditures to support centralized operations will continue to grow at a healthy pace.

Lack of consensus exists about what client/server means and thus measures of the level of implementation lack meaning. Suffice it to say that a high level of interest exists in client/server technology, but most IS managers have adopted a wait-and-see attitude rather than enthusiastic endorsement. The push to client/server may come from the departmental or functional level—areas that stand to gain the most through easier access to data—rather than from the data center operations themselves.

Expenditures on systems software products are primarily for maintenance of existing products and annual license fees; on average, almost four times more is spent on existing products than on purchasing new products. This ratio is not expected to change over the next several years. Thus strong vendor-customer relationships are critically important because of the customers' reliance on vendors for continuing product maintenance and, in turn, vendors' reliance on customers for maintenance revenues.

IS managers feel that overall systems software prices are too high but that these high prices are not as much of a problem as lack of adequate operations management tools and the need for improved support. Reputation for support is the single most important selection criterion mentioned. Price is fourth in importance out of a list of nine. Thus data center operations managers are willing to pay higher prices in order to have solid support.

B
Driving Forces

INPUT has identified five key forces that drive systems software products. These driving forces are outlined in Exhibit II-2 and discussed below. All of these forces act as growth promoters and as inhibitors to varying degrees during different timeframes.

EXHIBIT II-2

Systems Software Products
Driving Forces

- Slowed economy
- Downsizing and client/server
- UNIX and software frameworks
- Integration/interoperability efforts
- Emphasis on solutions
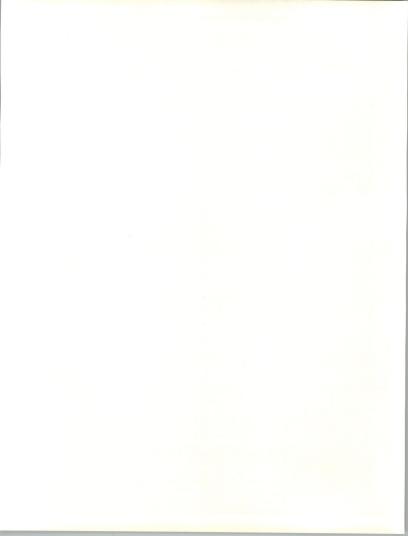
Even though downsized solutions running on workstations and personal computers provide compelling price/performance advantages, purchases of computers—including smaller platforms—are down. What negatively impacts hardware shipments—including an economic slump—will also negatively impact new purchases of systems software products.

INPUT's user surveys asked questions regarding 1992 purchase plans for applications software and systems software products. The results indicate that systems software products budgets for 1992 will show a much more modest increase compared to applications software products budgets.

The movement toward downsizing and client/server models will promote the growth of long-term systems software products. These trends will open the systems software market to all sorts of new product needs and opportunities. The kinds of systems software products that reside on mainframes will become increasingly necessary in some fashion on minicomputers, workstations, and personal computers.

UNIX implementation over the next several years is an IS objective for 32% of INPUT survey respondents; implementation of software frameworks such as SAA, NAS, or CA90s is an objective for only 20% of respondents. Because UNIX and software frameworks are still in such a formative stage on the vendor side, on the user side they are causing more confusion than anything else. INPUT believes that, at present, so-called standards will inhibit growth of systems software expenditures in the short term. One can't help but think that, over the long term—and perhaps as early as 1994—standards will become a growth promoter; there will be rules to follow and therefore more people will want to play.

Products and services that enhance multivendor and multiplatform computing solutions will be widely popular. And in fact, interoperability—of which LAN and networking solutions are a major part—will drive the use of other systems software products such as distributed DBMSs, client/server, and cooperative processing models.
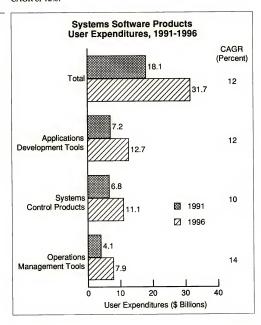
An obvious and fundamental shift is occurring that makes the solution aspect of software the number-one priority. In this respect, applications software products are more synonymous with solutions, whereas systems software products are considered to be supporting, albeit necessary, products. To the extent that systems software products are presented as solutions, they will be eagerly embraced.
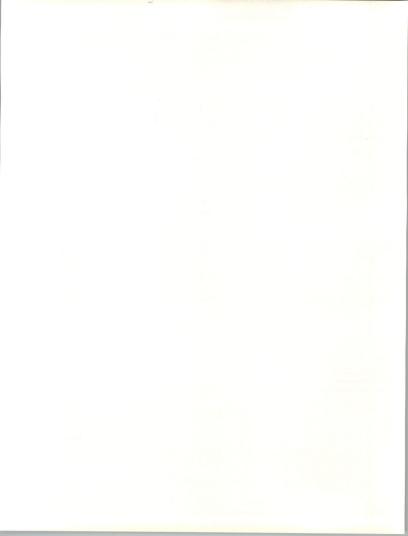
C

User Expenditures

As shown in Exhibit II-3, the overall systems software market will expand from $18.1 billion in 1991 user expenditures to $31.7 billion by 1996, a CAGR of 12%.

EXHIBIT II-3

Systems Software Products
User Expenditures, 1991-1996

	CAGR (Percent)
Total: 18.1 / 31.7	12
Applications Development Tools: 7.2 / 12.7	12
Systems Control Products: 6.8 / 11.1	10
Operations Management Tools: 4.1 / 7.9	14

Legend: ▨ 1991   ▨ 1996

User Expenditures ($ Billions)

INPUT's forecast for systems software products of a 12% CAGR for the 1991-1996 period compares to INPUT's applications software products forecast of 14% over this same five-year period. INPUT believes that the kinds of technology shifts that will have a positive impact on the applications software products market will also have a positive impact on systems software products. Although the fact that these technology shifts are still in the initial stages is not deterring the purchase of applications software products, it will—in the short term—be a deterrent to the purchase of systems software products.

Applications development tools—including DBMSs and CASE tools—is the largest submode, accounting for 40% of total user expenditures on systems software products in 1991. Applications development backlogs, compounded by the need to maintain and re-engineer existing software products, are continuing to drive this market. Also driving this market is the increasing complexity of software product development requirements.

Because the majority of expenditures for systems control products are for operating systems, and because new hardware units are at a low shipment rate, overall growth for this submode will shrink. Due to price increases, most of the growth is in the maintenance of existing systems control products. Proprietary operating systems will grow at the rate of price increases—plus a small increase for new installations. Growth areas for systems control products include UNIX products, network control software, and systems control products for smaller platforms.

The fastest growing submode will be operations management tools, which encompass network administration and control products. The trend toward multiplatform, multivendor networks and network integration will fuel this growth.

D

Vendor Competition

Exhibit II-4 shows the top five systems software products vendors. IBM commands an estimated 16% share of the U.S. market. Digital commands a strong and lasting presence in the midrange sector of systems software.

The other three leaders have a curious history of simultaneously competing and cooperating with each other. For example, the companies that Computer Associates is seeking to acquire are IBM business and development partners. Microsoft, on the other hand, has strongly severed its previously close ties with IBM and is competing directly against IBM in the systems software arena for workstations and personal computers.

EXHIBIT II-4

Leading Vendors

- IBM
- Digital Equipment
- Computer Associates
- Microsoft
- Oracle

As is true in the applications software products industry, the trend toward standards and integration will continue to cause industrywide consolidation in systems software products. A number of significant acquisitions have taken place in 1990-1991. In fact, only two dozen independent systems software product companies of significant size—$50 million or above—are left.

Computer Associates acquired only one company in 1990—DBMS Inc., provider of DBMS tools for CA-IDMS. In August, Computer Associates was back on the acquisition trail with the acquisition of On-Line Software and Pansophic.

E
Conclusions and Recommendations

Exhibit II-5 outlines INPUT's systems software products conclusions and recommendations.

EXHIBIT II-5

Systems Software Products
Conclusions and Recommendations

- Plan for slower growth
- Prepare for the long term
- Provide exceptional service and support
- Endorse standards
- Find niche opportunities

During the last five years, user expenditures for systems software grew at a rate of 21% compounded annually. Over the next five years, growth will average only 12% compounded annually. Reasons for this slower growth include a lackluster economy, the shift in technology foundations (including a slow transition to standards), fundamental changes in vendor product and marketing strategies, and marketplace confusion.

The movement toward standards, downsizing, and client/server architectures will be long-term systems software products growth promoters. In the meantime, systems software vendors must prepare for bad times.

Systems software products vendors cannot afford to be short-sighted. Key product transitions—client/server, migration to standards, data base interoperability, integrated CASE—are all in their infancy and will take time from the vendor development perspective and the customer adoption perspective. Satisfying a great deal of what customers really need must be put on hold. In the meantime vendors must seek ways to maintain and enhance the loyalty of their existing customers.

Given that so much is spent on existing products, the ongoing relationship that a vendor develops with its customers is critically important for long-term vendor success. A great deal of the relationship has to do with provision of exceptional service and support. In fact, INPUT surveys indicate that of all vendor selection criteria, a strong reputation for support came out on top. This criterion even ranked higher than price, ease of use, and ease of installation.

A product strategy that endorses and adheres to standards as they become available is the key. Vendors will need to continue to make a fundamental transition from differentiation based on proprietariness, to differentiation based primarily on service. As part of a standards-based strategy, vendors must provide UNIX along with other systems software product architectures.

In the long term, the large systems and software vendors will increase their market shares because they are the only vendors that can drive standards. Other medium-sized and small companies must sooner or later follow. In the meantime, numerous smaller systems software companies are establishing product niches. These smaller vendors, however, must prove themselves in the support arena if they are to become and remain viable.

III

General Business Climate

In this chapter INPUT provides an overview of the current business climate for the U.S. information services industry and for the systems software products delivery mode.

A
1990 Results

In 1990, the U.S. information services industry reached a milestone, ending the decade at about $100 billion in size. As Exhibit III-1 shows, the industry increased in size over five times during 1980s and is 50 times larger than it was in 1970, when the industry represented $2 billion in user expenditures.

EXHIBIT III-1

U.S. Information Services Industry
1970-1990
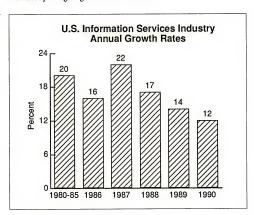
During 1990, the industry grew at just under a 12%—from about $90 billion to $100 billion. As Exhibit III-2 indicates, 1990 reflects an intensification of a decline that started in 1989. The average annual growth during the first eight years of the decade was over 19%.

Worldwide, the industry continues to experience greater growth rates of close to 20%, and many U.S. vendors are experiencing growth that exceeds that of the U.S. industry as a whole. This growth is primarily due to international sales, but is also due to the focus on specific industry markets. Inflation rates and somewhat stronger economies are driving the industry to higher growth levels overseas.

EXHIBIT III-2

U.S. Information Services Industry Annual Growth Rates

On a delivery mode basis:

- The smaller systems integration, systems operations, and network services delivery modes are growing faster than the rest of the industry.

- The software products sectors grew at or slightly above the industry average.

- The larger professional services and processing services sectors, as well as the smaller turnkey systems sector, are growing slower than the industry average.

Exhibit III-3 summarizes 1990 results.
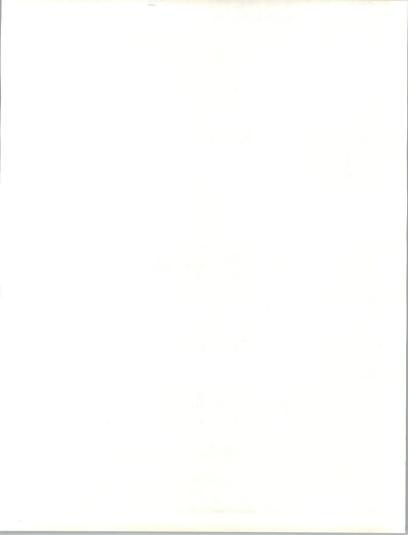
EXHIBIT III-3

U.S. Information Services Industry
1990 Results Summary

- Reached the $100 billion milestone

- Growth 2 to 3 times the economy continues

- Growth slowed in 1990 relative to 1989

- Economy causes confusion

Paralleling the rest of the information services industry, growth in user expenditures on systems software products peaked in 1987 at 30%. The high growth rate that year was due in large part to the strong presence of departmental/minicomputer systems (AS/400 introduction) and to the strong growth in personal computer shipments. Since 1987, growth has declined; the 1990 performance for the systems software products delivery mode was just about par with the rest of the information services industry. Expenditures on systems software products reached $16.4 billion in 1990, a 13% increase over 1989.

B

Driving Forces

There are a number of fundamental forces impacting the information services industry in the 1991-1992 timeframe that will have measurable impact on the overall growth rate for the 1991-1996 five-year period covered by this market analysis report. Each force will affect the industry as a whole, as well as each of the eight delivery mode sectors used by INPUT to analyze the industry and its key trends. The fundamental 1990 driver was the economy; as the economy slowed, so did new hardware shipments—and new systems software product purchases are directly tied to hardware shipments.

Exhibit III-4 identifies six primary driving forces impacting the U.S. information services industry. The impacts are multidimensional, fundamental, and long lasting. Each is discussed in this chapter and throughout this report.
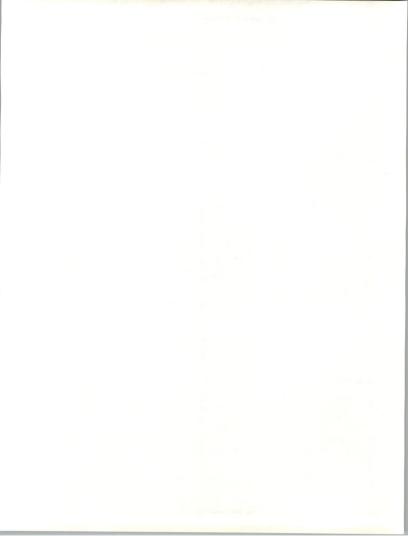
EXHIBIT III-4

**Information Services Industry
Primary Driving Forces, 1991-1996**

- The economy

- Globalization

- Influence of large vendors

- Outsourcing (buy versus make)

- Shifting technology foundation

- The changing buyer

C

Key Trends

1. Economic Impacts

The economy, as well as the overall size of the information services industry, is a significant factor in the user expenditure level for information services and software products.

- The inflation rate of the past few years has been much more modest than in the mid-1980s. INPUT forecasts and market sizes are in current dollars—thus lower inflation means lower growth.

- Real economic growth had been modest over the past few years prior to the recession that started in late 1990. Deferred and canceled expansion plans in all industry sectors certainly slow the expansion of information services expenditures.

- The shift of information processing to smaller computers lowers the software products investment, based on current pricing practices. Quantities of software products sold increase, but revenue levels grow at more modest rates.

In 1990, a year with little to no real growth in the overall economy and inflationary growth of about 5%, the information services industry grew 12%.

- INPUT's 1990 and 1991 economic assumptions were for nominal GNP growth of 5.4%; real GNP growth was 1% or less.

- At this point in 1991 (the second quarter), the economy remains in no-growth status, with some improvement expected by late in the year. At the same time, inflationary pressures are modest. INPUT expects another modest growth year in 1991 and again in 1992. The expected slow upturn will have the following positive and negative impacts on the U.S. information services industry in the near term:

- Positive impacts include:

  - Increased motivation to buy rather than make, in particular for larger systems requirements. Response time and impact on business operations are the key criteria. With newer thinking, a vendor can often react much faster.

  - The interest in systems operations, which permits organizations to redeploy capital investments and lower direct headcount, is being reinforced.

  - A tight economy is helping develop interest in lower-cost solutions that come from client/server-based applications software products.

- Negative impacts include:

  - Decision processes are lengthened in a tight economy, causing deferral of major information systems projects.

  - With tight information systems budgets, the internal information systems staff can be favored over contracted professional services vendors, thus negatively impacting a major segment of the industry.

The tight economy impacts submodes within systems software products in different ways. Systems control products, for example (which are composed predominantly of operating systems), are more closely tied to, and therefore impacted by, the slowed growth in hardware shipments—as opposed to operations management tools and applications development tools. Because the latter two submodes are for tools that enhance productivity or cut costs—regardless of hardware shipment rates—the submodes are less likely to be impacted by fluctuations in the economy. In fact, these submodes may be positively impacted by a weak economy.

2. Globalization

INPUT has cited globalization as a driving force for the past three years. During that time markets have opened, vendors have expanded their international focus, and users have begun to expect global capabilities.

- The European market is making progress toward a single market. Now 1992 is less than a year away and many changes are apparent. In addition, the European market is stronger than the U.S. market, although both are suffering in the current economy.

- The worldwide orientation of the larger services vendors is verified by the investments in Europe by Computer Sciences Corporation and Digital Equipment and by the ever-expanding interest of Japanese vendors in the U.S. information services industry.

The primary positive impact of globalization is the ability of larger vendors to balance their businesses in multiple markets with less impact from market downturns.

The primary negative impact from globalization is that it may make it harder for smaller vendors to grow and/or maintain independence.

The impact of globalization on systems software products is an increased interest in standards, including international communications standards and open systems such as UNIX. A trend toward these standards is a growth inhibitor in the short term, as they are not fully formulated and potential customers postpone purchases while waiting for stronger vendor endorsements of standards.

3. Influence of Large Vendors
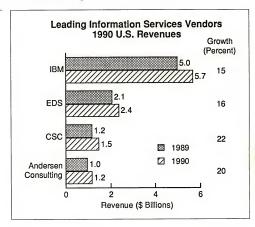
The influence of the larger information services vendors has increased significantly over the past few years.

- The newer systems integration and systems operations sectors, though smaller than more traditional sectors such as professional services and processing services, are growing faster than the traditional sectors and are dominated by the leading vendors.

- A number of larger vendors are growing faster than the overall market. Exhibit III-5 lists four of the largest information services vendors that can be considered multi- or full-service vendors and reveals their U.S. 1989 and 1990 information services revenues. All four increased information services revenues by at least 15%, greater than industry growth as a whole.

- Certainly there are numerous smaller firms that are also growing faster than the general market, but overall, the dominance of the larger vendors is increasing.

EXHIBIT III-5

Leading Information Services Vendors
1990 U.S. Revenues

Growth (Percent)

Vendor	1989	1990	Growth (Percent)
IBM	5.0	5.7	15
EDS	2.1	2.4	16
CSC	1.2	1.5	22
Andersen Consulting	1.0	1.2	20

Revenue ($ Billions)

The large vendor influence is increasing in other ways as well.

- Starting with IBM, many large services vendors are making minority and majority investments to gain influence on technology, access to software products for remarketing, and market share.

- DEC's investment in Kienzle in Europe and EDS's investment in ASK Computer Systems are two examples of large vendors' seeking new channels and resources.

- Consolidation is also a factor. Mergers among the major accounting firms have reduced the number of players, but have given two of the firms (Ernst & Young and Deloitte Touche) added resources to follow the example of Andersen Consulting. A third—Price Waterhouse—is also experiencing significant growth in its information technology-based business.

The increasing use of business consulting linked to professional services has provided a wedge for the large accounting and consulting firms, as well as some large information services firms, to gain a greater share of the industry.
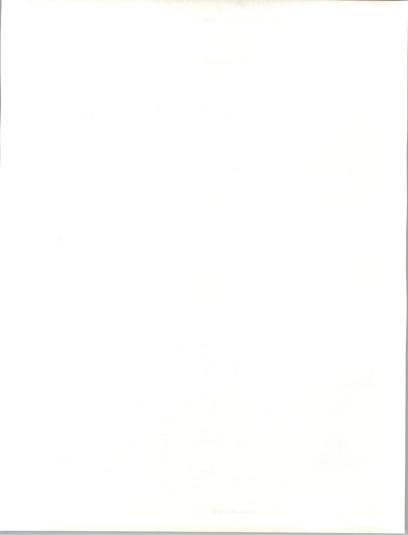
INPUT expects this trend to continue over the next few years. The opportunity for the smaller, more specialized software product or services vendors is not disappearing, but it is changing character.

• Alliances with larger vendors will be essential, at least as secondary sales and support channels.

• Specialization—in terms of the technology used or the industry served or both—will become more important and common.

The continuing increase in the strength and impact of the larger vendors will have the following positive and negative impacts:

• Positive impacts include:

  - The larger vendors have the financial strength to help assure that the risk element of systems management services is minimized.

  - The larger vendors have financial resources available to invest in new technologies, often through investment in smaller and specialized firms.

• Negative impacts include:

  - Alliances may become a requirement for smaller technology firms to survive and prosper.

  - The dominance of the larger vendors will continue to grow.

  - Larger vendors tend to move more slowly, which will hamper development and acceptance of new technology. This slowness will provide opportunity to small vendors that seize technology initiative.

With regard to systems software products, it is true that the large vendors—most notably IBM—are getting larger, but not necessarily at the expense of savvy niche players. Opportunities abound for specialized products— such as RDBMS tools, automated change tools, and network management—in all systems software products delivery modes. Alliances will abound and new distribution channels will be tested.

4. Outsourcing (Buy versus Make)

Since its inception, the information services industry (services and software products) has tended to outgrow the internal information services budget by continuously creating new products and services that permit the information systems function to outsource (buy versus make). This has always been an outsourcing industry. And though growth has slowed, a number of factors will permit continued growth that exceeds growth in the economy, the computer hardware sector, and the internal information systems budget.

Key trends in outsourcing are listed in Exhibit III-6.

EXHIBIT III-6

Outsourcing:
Buy versus Make—Key Trends
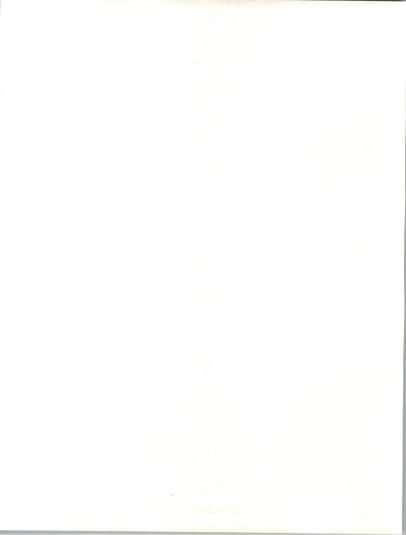
- Systems management

- Solutions buying

- Applications maintenance

- Applications management

a. Systems Management

Outsourcing the management of information systems or at least significant elements of information systems continued to gain momentum during 1990. Helped more than hindered by the recessionary economy, the inclination of the general management of large organizations to consider outsourcing increased.

The ability to transfer much of the financial risk and, perhaps more importantly, the technological risk to a specialist has numerous attractions for general management.

- The attraction that will become more and more important will be the ability to disconnect the information technology part of the solution from the business decision. General management wants results, an impact on the business, and does not want to listen to the pros and cons of a technology. The appeal of the vendor's offer to take on risk either in a project (systems integration) or in operations (system operations) can only grow during the 1990s.

- The nature of most outsourcing activities within larger organizations often makes them favor the large vendors, adding impetus to the trend described above. If there is major risk involved, the buyer will bet on the company most able to accept risk and take responsibility.

- Perhaps the most important attraction is the ability of buyers to gain access to a broad information technology on an arm's-length business basis in a single decision.

  - The systems integration vendor can provide all the needed expertise in a new technology at the beginning of a project. There is no internal training lag time while the information systems staff gains the knowledge and experience required.

  - The systems operations vendor can provide a full utility-based service at a predictable cost over a number of years. This should make for fewer surprises from the overall information systems program.

b. Solutions Buying
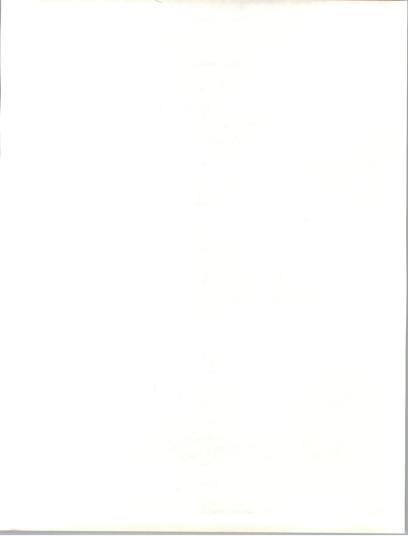
Buying applications software is a well-established practice in the U.S. market where the use of packaged software is commonplace. However, the current change in the way U.S. organizations are managed and the availability of low-cost, high-performance client/server computing is bringing new impetus to the application solutions market.

- The fundamental decentralization of U.S. business management with the corresponding reduction of corporate staffs is creating a major requirement for business unit (distributed) application systems. Furthermore, the buyer is not an information systems professional and is willing to outsource (buy) with some customization.

- Just when the smaller business unit needs independent application solutions, there is a hardware revolution to support the need. Client/server technology provides affordable, high-powered computing.

The ability to find a VAR that can provide a package plus customized systems on client/server-based software is bringing the solution value of systems integration to the decentralized business unit.

c. Applications Maintenance and Applications Management

In line with the shift to outsourcing systems management to systems integrators and systems operations firms, the buyer is also seeking to gain more-defined relationships with more-traditional professional services vendors. Instead of contracting for temporary personnel, the buyer is beginning to contract for services like applications maintenance and applications management.

- Applications maintenance is contracted, 24-hour support of existing applications systems. The vendor provides a set level of services and interacts directly with the end user.

- Applications management is contracted management of development and maintenance of a set of applications. The vendor provides the software and all of the expertise and staff to assure that the application is successfully used over an extended period. Applications software products firms can become applications management vendors for their clients or let some other vendor do it.

5. Shifting Technology Foundation
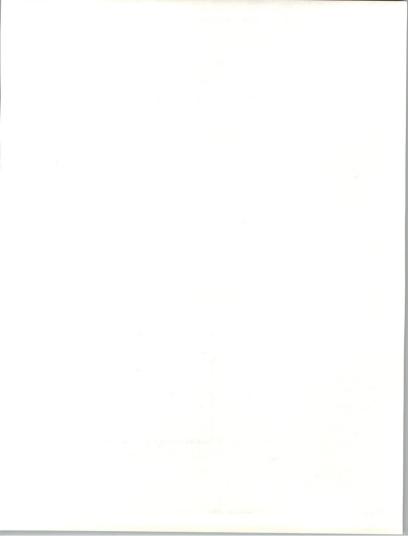
Significant new technologies became available in the late 1980s and are gaining momentum in the 1990s. An underlying characteristic of much of this new technology is a shift in the technological foundation. Many elements of technology are shifting to new foundations.

Exhibit III-7 lists the key elements of this shift in underlying technology. Each element is causing organizations to stop and rethink key aspects of their information systems infrastructure strategy. Rethinking can slow the adoption in the short term, and create new vendor opportunities over the longer term.

EXHIBIT III-7

New Technology Foundations

- International standards

- Graphical user interface

- Client/server

- Networking and integration

- Distributed data

- Imaging

- Engineered/re-engineered software

Systems software products are impacted by—or are part of—every technology foundation listed in Exhibit III-7. Far-reaching impacts of these major shifts include large R&D expenditures and new kinds of technology transfer alliances, vendor repositioning, new pricing strategies, reorientation of sales personnel, and shifts in channels of distribution, to mention only a few.

All of these new technologies and foundations cause confusion in the industry and with the buyer. Confusion causes a slowdown in decisions both by buyers and vendors. Strategies need to be revised and investment plans shifted, and education is required.

- Standards are driving every major computer manufacturer and software products developer to revise strategies and change product development plans. New products are delayed and then require longer initial sales introductions.

- The user interface of the personal computer in its graphical pull-down menu and windowing form will be the only interface acceptable to users from now on. The text-based interfaces of the 1970s and 1980s will no longer be tolerated. Every major software product developer is re-engineering the user interfaces to its products.

- Downsizing, the common term for moving an application to a client/server-based installation, will be the greatest phenomenon of the early 1990s. Whether or not the installation is actually downsized, it will be moved to a new processing location and take on new characteristics. Major reengineering of internal systems by the information systems function and a shift to buying server-based application products is underway. All of the impacts are not known. One, software products pricing based on the size of the platform will have to change. Certainly some confusion exists and is impacting buying decisions.

The movement to new processing locations and re-engineering of internal systems presupposes the availability of systems software products that make client/server technology a reality. Another concern is the exponential increase in the complexity of the whole software arena. Key vendor issues are products and methods that improve ease of use, integrate functions, and are flexible enough to accommodate customer "tweaking" without diluting fundamental benefits.
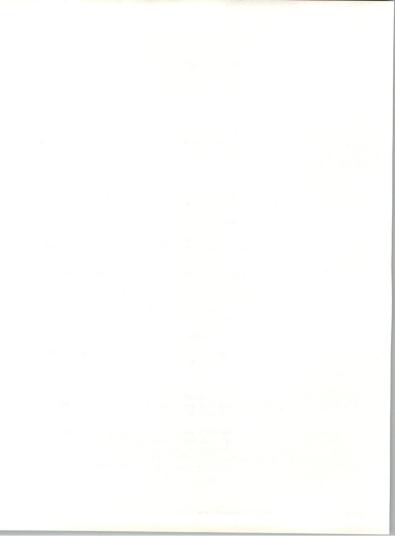
- The growing use of PCs, workstations, and LANs has mandated a move to integrate the information networks of large and small organizations. Today's networking products permit the distributed applications that have been discussed for years but were never possible. LANs in particular will create new product opportunities and growth

for operations management products, including network management and integrated performance monitoring tools. The market will be limited in the short term only by the availability of truly useful products.

• The way data is stored and turned into information has been fairly constant since the creation of the first hierarchical DBMS in the early 1970s. For almost 15 years the challenge was to build data bases, not consider building them with new types of components. The shift started with commercial use of relational DBMSs, but it is the distributed DBMS, and perhaps more importantly image processing, that will cause major reengineering of the data base architectures of larger organizations. Major new investment is required and of necessity will come over time.

• The age of truly engineered and reengineered software through CASE technology is dawning. In five years the approach to maintenance will have finally changed and there will have been major advances in programmer productivity.

The positive and negative impacts of the shift in technological foundation are listed below. Certainly over the five-year period the positives greatly offset the negatives.

• Positive impacts from this shifting technology foundation include:

  - New types of solutions will become available.

  - The role of the end user in information systems can continue to expand.

  - Opportunities for new as well as existing vendors are created.

  - Application systems can be increasingly molded to the character of the organizations they support.

• Negative impacts are:

  - Any shift causes confusion and hesitation in the near term. The magnitude of the current technology shift could cause confusion and slow investment through the middle of the decade.

  - The size of the task to shift to client/server technology in organizations with large centralized systems causes conflicting priorities between reengineering and meeting new requirements.

- The technology shift now in process is creating a significant additional training and education requirement.

- Growth is slowed while the new technology is understood and learned.

6. The Changing Buyer

The decision maker for the purchase of information services remained relatively constant until the late 1980s. The information systems executive and key staff (systems development and data center operations managers) decided when to go outside and who to contract with.

This leadership has changed significantly in the past few years and promises to change even further. As the information services vendor moves to provide a full long-term service or a full solution, the general manager is becoming the buyer. The impacts are significant.

• Technology becomes less important and the business or operational impact becomes more important.

• The impact of the information systems function becomes more consultative and less direct.

• The ability to try new ideas and approaches is increased.

• The time to completion is controlled by the organization's ability to afford, not the ability of information systems to develop.
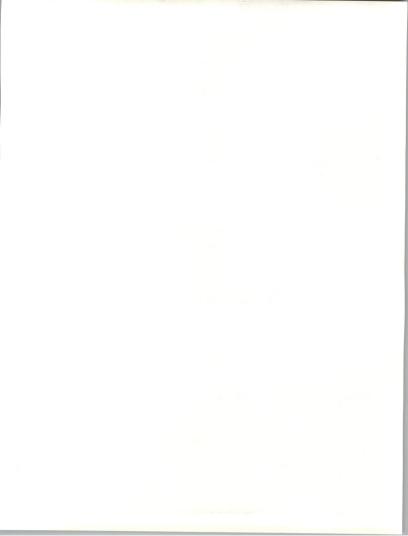
Equally important for buyers of systems software products is the fact that purchase decisions become much more complex. The purchaser will need to keep abreast of a host of new technologies—networking, UNIX, client-server architectures to name a few—and the products available on the market will be much more numerous and varied than before. Buyers must be willing to experiment and to make mistakes if they are to come out on top of the shifting technology foundations.

D
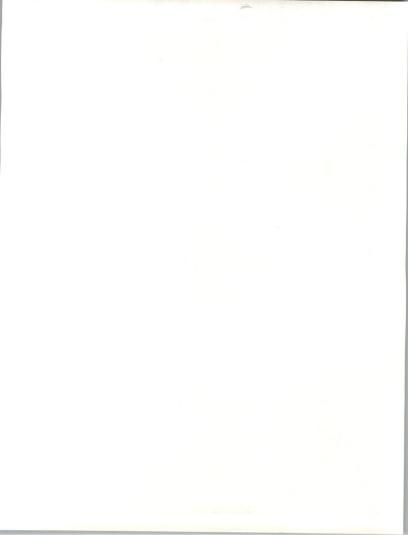
Summary

The year 1991 is exhibiting significant changes from the 1980s. The changes suggest more modest, but continued strong and stable, growth for the information services industry.

• An economy that does not shift quickly helps management make longer term decisions, albeit at a slower pace.

• A market of $100 billion that is strongly impacted by the direction of the larger vendors should be expected to grow somewhat slower.

- The increasing tendency of larger organizations to turn to vendors for services that include real and significant elements of systems management and have a solutions orientation will lead to larger, longer term decisions—decisions that can take longer but have a lasting impact.

- The shift in the underlying technology foundation is for the better— more valuable and productive applications solutions will result. But shifts bring re-engineering, reinvestment, and retraining—and require time and money.

- The role of the general manager concerning the deployment of information technology continues to increase. In many instances the general manager is a greater factor than the information systems manger, in particular relative to major decisions. Over time the general manager's influence will have positive impacts on the size and growth of the information services industry —as long as the vendors provide satisfaction.

IV

Information Systems Environment

In order to better understand what was on the minds of IS managers regarding systems software products, INPUT sent out a questionnaire to computer executives in medium- to large-sized corporations. INPUT also conducted a series of telephone interviews with the respondents to obtain additional information and clarification of the written questionnaire.

The purpose of the questionnaire was to probe managers about specific areas of systems software products such as current and future objectives and priorities, purchase plans, vendor preferences, and unmet systems software needs. INPUT was therefore able to test its previous conclusions about the marketplace as well as obtain additional insights.

Individuals completing the questionnaire were predominantly operations managers, computer services managers, and data center managers. Thus the results reflect opinions and attitudes of centralized DP operations. The survey document itself is Appendix C of this report.

The views of 50 IS managers are tabulated and the results analyzed. The results clearly show that centralized operations are expanding their budgets and operations, even with the trend toward offloading the mainframe and using smaller decentralized hardware platforms.

A
Demographics

Exhibit IV-1 shows the distribution by vertical sector, and Exhibit IV-2 shows the distribution by revenues of the corporations that participated in the survey.

The sample represents a good cross-section of vertical sectors. Nonetheless, systems software products are not specialized by vertical sector and are therefore treated as a single market by INPUT.

EXHIBIT IV-1

Demographics of User Organizations
Industry Segmentation

- Other 12%
- Discrete Manufacturing 22%
- Wholesale Distribution 4%
- Banking & Finance 6%
- Process Manufacturing 8%
- Business Services 8%
- State & Local Govt. 12%
- Insurance 12%
- Education 16%

Percent of Respondents

EXHIBIT IV-2

Demographics of User Organizations
Revenue Size

- Over $10 billion 2%
- Under $50 million 26%
- Over $1 billion 17%
- Over $500 million 15%
- Over $50 million 9%
- Over $100 million 31%

Percent of Respondents

Almost half of the companies have revenues between $100 million and $1 billion, and another 19% have revenues above $1 billion.

In addition to industry sector and revenue size, information was gathered about the type of primary CPU platform. For 65% of the respondents, the primary CPU platform is a mainframe; for 32%, the primary platform is a minicomputer; and for 4% (2 respondents), a workstation is the primary CPU platform. IBM and DEC are the dominant vendors.

Exhibit IV-3 shows the distribution of the systems software budgets of the 38 companies in the sample that answered this question. The systems software budgets of 18% of the companies exceed $1 million.

EXHIBIT IV-3

Demographics of User Organizations' Systems Software Budget

Over $1 million
18%

Over $500,000
5%

Under $100,000
40%

Over $250,000
21%

Over $100,000
16%

Percent of Respondents

B

Data Center Objectives and Plans

Exhibit IV-4 is a listing of current and future IS objectives as they relate to data centers and computer operations. The objectives are categorized by major type of objectives and timeframes. LAN and network integration are clearly the most significant objectives over the next several years. Upgrading the central computer is also an often-mentioned objective over the next several years. Downsizing and implementing proprietary frameworks such as SAA or NAS are clearly at the bottom of the list.

Many respondents indicated a single objective for more than one time period. LAN integration, for example, might have been indicated as a current objective and also a 1992/1993 objective because implementation may take several years. The survey results were edited to avoid double counting. In other words, an objective for any given respondent shows up in only one timeframe. Thus the data are not indicators of penetration levels.

EXHIBIT IV-4

IS Objectives and Their Timing Percent of Respondents				
	Current	1992/ 1993	After 1993	Cumulative Total
LANs and Networks				
LAN integration	49	27	4	80
Network Integration	43	20	4	67
Use of communication stds.	43	14	8	65
Voice/data commu. integr.	24	24	12	60
Central Computer				
Upgrading central computer	20	37	16	73
Downsizing central computer	6	8	2	16
Data Center Consolidation/Automation				
Data center consolidation	37	8	2	47
Data center automation	53	14	2	69
DBMS				
Relational DBMS implementation	35	14	10	59
Distributed DBMS implementation	10	33	2	45
UNIX, software frameworks (i.e., SAA, NAS)				
UNIX implementation	20	12	10	42
SAA, NAS, etc.	8	12	8	28

Summary observations of responses within each of the five categories of Exhibit IV-4 are presented below. Additional questions were asked about client-server intentions, effectiveness of network operations, and the use of professional services. These three areas are discussed in subsections 6, 7, and 8.

1. LANs and Networks

- LAN integration is the single most important objective over the next several years. Overall 80% of respondents will have LAN integration as an objective, with as much as 75% of respondents indicating such integration as an objective during 1991–1993. These objectives clearly point to growth for products and services that enhance integration of multivendor, multiplatform computing solutions.

- Almost half of the respondents cited voice/data integration as an objective during the next several years. Similar research conducted by INPUT in late 1990 found that voice/data integration occurs in almost 30% of the companies, and that use will grow to about 55% by the end of 1992. That integration is an objective for 48% of respondents in this survey is therefore not surprising.

2. Central Computer

a. Increase in Capacity

- Upgrading the central computer is the second most significant IS objective after LAN integration. This ranking indicates that centralized operations are far from fading into the background. Even with the increasing interest in client-server architectures and offloading the mainframe, IS managers are anticipating that a large amount of computing will still be done on the mainframe.

- Within the next 18 months, 33% of respondents plan to increase their primary CPU capacity; almost 60% plan to upgrade by year end, 1993.

- Such a high emphasis on increasing the primary CPU capacity could be in part caused by consolidation of data centers as the number of primary CPUs declines; the existing CPU carries more of the load. But perhaps more importantly, the emphasis signals the continued growth in processing load and size of applications that remain on the primary CPU.

b. Downsizing and Offloading

- 43% of respondents have already offloaded or are planning to offload some of the workload from the primary CPU during the next 18 months.
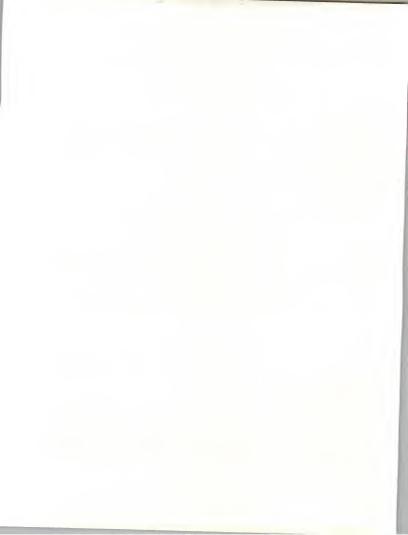
- Just over half of what is currently offloaded is applications software. A wide range of applications is being offloaded, including sales leads and sales forecasting, general ledger, office automation, ad hoc and statistical reporting, drug claims and disability determination, and commercial lending. Offloaded applications tend to be ones that were previously online to remote sites.

- Two respondents (about 10% of those that are offloading) plan to offload all applications.

- Applications development and network management is also being offloaded, which substantiates even further the idea of the mainframe's principal role as the central data repository.

- Even though offloading is taking place, only 14% indicated downsizing the central computer as an objective over the next several years. Downsizing within the context of this questionnaire was interpreted as downsizing the hardware platform—e.g., replacing the primary CPU with a smaller platform, rather than downsizing the application.

3. Data Center Consolidation/Automation

- 53% of respondents cited data center automation as a current objective. This high percentage reflects the continuing concerns of IS managers to improve productivity and reduce costs of their data center operations and implies continued strong growth in the operations management category of systems software products.

- The kinds of products mentioned as new purchases are products that enhance report distribution and maintenance, such as automated tape library systems.

- 37% of respondents cited data center consolidation as a current objective. Consolidation is also a catalyst for purchase of operations management products. As an objective data center consolidation, however, falls off dramatically after the end of this current year, perhaps indicating that after this year much of the consolidation will already have taken place.

4. DBMSs

- Thirty-five percent of respondents are planning for relational DBMSs in 1991 and another 14% during 1992-1993. Thus the move to relational systems is still quite solid, spurred by growing acceptance of IBM's DB2. Users are also indicating purchases of relational products from companies such as Oracle, Informix, and Sybase.

- As expected, distributed DBMS implementation is mentioned more often as an objective during 1992-1993 than currently. LAN and network integration are prerequisites for broad usage of distributed DBMSs. Therefore as LAN integration proceeds, distributed DBMS implementation will follow.

5. UNIX and Software Frameworks

- The relatively low level of UNIX implementation as an objective is consistent with findings of 1991 INPUT research on UNIX. This low-level interest reflects IS management concerns about lack of applications software products that run on UNIX and reveals a lack of standards. Interest also reflects the fact that the large hardware vendors are still formulating their UNIX strategies with varying levels of commitment.

  UNIX is therefore not strongly perceived as the resolution to the challenge of enterprisewide solutions. UNIX is, at least for now, implemented at the departmental level rather than the data center level.

- Even though the survey sample represents a strong contingent of IBM and DEC users, it is interesting to note the relatively low level of mentions of frameworks, such as SAA and NAS, as objectives. IS managers may be going along with these frameworks but not considering them as objectives because they are still being defined by their vendors and so few products are yet available.

- Plans to implement UNIX do not preclude plans for other frameworks such as SAA or NAS—respondents indicated one or both. Multiple standards will most likely coexist.

6. Client/Server Intentions

- When several respondents were probed about their definition of client/server, they indicated a mainframe as the server with PCs as clients for resource sharing. These responses further substantiate that the role of the mainframe may gradually shift from central applications processor to control point for cooperative processing.

- IS managers that define client-server as distributed computing appear to be considering it and are beginning to contemplate what they would offload, but little implementation has as of yet taken place. Survey respondents feel that the choices really aren't here yet and that there will be many choices within the next several years. Respondents indicated a desire to select client-server software products from a variety of vendors and will not necessarily stay with their current vendors.
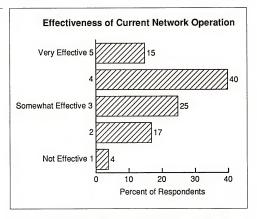
- As with UNIX, interest in client-server computing may be coming more from specific functional areas—such as human resources—rather than the corporate data center.
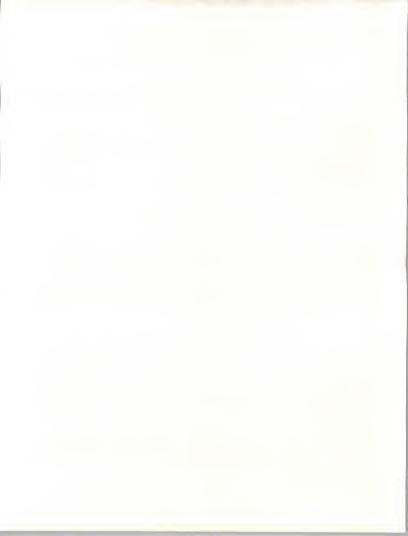
7. Effectiveness of Network Operations

- Respondents were asked to rate on a scale of 1 to 5 the effectiveness of their current network operations. The results are shown in Exhibit IV-5. The overall average score is 3.4, just above the midpoint. It is interesting to note that over half of the respondents rated their network operations as above average with; 15% rated their operations as very effective.

EXHIBIT IV-5

Effectiveness of Current Network Operation

Rating	Percent
Very Effective 5	15
4	40
Somewhat Effective 3	25
2	17
Not Effective 1	4

Percent of Respondents

- Compared to the findings of research INPUT conducted in 1990, LAN effectiveness has improved. In INPUT's earlier research, 32% of respondents rated effectiveness above average, with only 10% giving their operations a very effective rating.

- The primary way respondents plan to improve their network operation effectiveness is through putting more users on their LANs. Ways to get more users on the LANs include more and better training, more network integration and network management, and setting up remote access.

- Several respondents indicated difficulty incorporating minicomputers into their networks or find it too costly.

- Other needs expressed are better interoperability in a general sense, increased throughput between minicomputers and file servers, tools for client-server applications development, and better diagnostic tools.

8. Use of Professional Services

- Thirty-six percent of respondents indicated they use professional services vendors in support of their network operations. Twenty-seven percent said they use professional services from an outside vendor in support of network integration efforts. This 27% is over half of those that cited network integration as a current objective. These relatively high percentages indicate the newness of network integration and lack of in-house expertise in this area.

- Only 14% of respondents indicated they used professional services firms in support of their data center operations.

C

Systems Software Products Purchase Plans

In order to assure as accurate responses about categories of expenditures as possible, INPUT's definitions of systems software product categories were included in the questionnaire as follows:

Systems Control Products—Programs that function during application program execution to manage computer system resources and control the execution of the application program. Examples are operating systems, communications monitors, network integration products, library control, windowing, access control, and spoolers.

Operations Management Tools—Programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Examples are performance monitors, job accounting systems, computer operations scheduling, disk management utilities, and capacity management.

Applications Development Tools—Programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples are CASE tools, DBMSs, languages, assemblers, high-level language processors, application generators, report writers, and source-level debuggers.

Systems software product purchase plans are discussed below in terms of product category and platform size, expenditures on new versus existing products, and significant purchases in 1991.

1. By Product Category and Platform Size

The average respondent's 1991 systems software budget is $613,000 and will grow to $707,000 in 1992, a 15% increase. In 1992 applications development tools will increase slightly as a percent of the whole, as will workstation/PC-based systems software products. Expenditures on new versus existing products (e.g., annual license fees and maintenance) will remain about the same.

2. Budget by Product Category and Platform Size

Exhibits IV-6, IV-7, and IV-8 show the average respondent's 1991 budget by product category and by platform size.

- Twice as much of the budget goes toward systems control products than to operations management tools or applications development tools. This high proportion reflects the move toward increasing the primary CPU capacity, which results in higher operating software licensing fees and increasing purchases of network integration products. The high proportion could also reflect the relatively higher expense of maintaining existing systems control software compared to the maintenance of the other two categories.

- Mainframe-based products still account for the majority of systems software expenditures, although this portion is noticeably declining. The dominance of mainframe products is a reflection of the fact that for 65% of respondents, mainframes are the primary CPU.

EXHIBIT IV-6

Systems Software Budget by Category

Category	1991	1992
Systems Control	56	52
Operations Management Tools	21	20
Applications Dev. Tools	23	27

Percent of Budget

EXHIBIT IV-7

Systems Software Budget by Platform Size
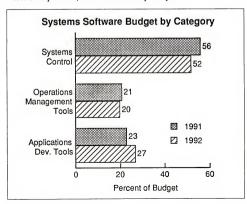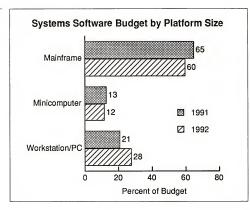
EXHIBIT IV-8

**Systems Software Budget by
Product Category and Platform Size, 1991**

	Mainframe (Percent)	Minicomputer (Percent)	Workstation/PC (Percent)
Systems Control	78	12	10
Operations Mgmt. Tools	65	6	29
Apps. Develop. Tools	39	12	49

- As expected, a proportionately higher percentage of systems control expenditures are mainframe based than for the other two product categories.

- Expenditures on minicomputer-based systems control products are small, given that 30% of the survey sample has minicomputers as the primary CPU. The survey also reflects a low level of expenditures on minicomputer-based operations management tools. The data may reflect a market need for more minicomputer-based systems control and operations management tools rather than declining interest in minicomputers as viable platforms. In fact, lack of product may be a deterrent to downsizing primary mainframe CPUs.

- As expected, workstation and PC-based systems software products are on the increase. Workstation/PC-based systems software products are predominantly applications development tools—including RDBMSs, query tools, and CASE tools. Data center automation products running on smaller platforms are also beginning to appear on the market.

- Spending on workstation/PC-based systems control products is a smaller portion of the whole than expected, perhaps reflecting the bias of the survey sample toward centralized computing.

3. New versus Existing

The budget split between existing versus new systems software products varies slightly by product category, as shown in Exhibit IV-9.

- Eighty-one percent of the budget for systems control products is for maintenance of existing software, leaving only 19% for new product purchases. Because hardware is no longer experiencing the explosive growth of several years ago, systems control is predominantly a maintenance expenditure. New purchases therefore are largely operating systems enhancement products.

- The budgets for new operations management and applications development tools are somewhat higher than for systems control products.

EXHIBIT IV-9

Existing vs. New Systems Software **Percent of 1991 Budget**		
	Existing	New
Systems Control	81	19
Operations Management Tools	74	26
Applications Development Tools	75	25
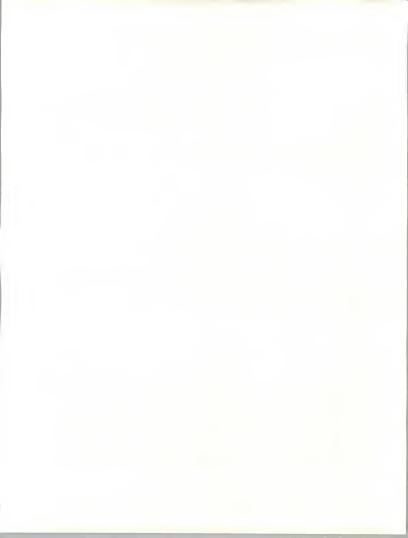
Exhibit IV-10 shows the percent of the total systems software budget that goes toward the purchase of new systems control, operations management tools, and applications development tools. These percentages represent the percent of total budget of each product category, multiplied by the percent toward new software for each category. Thus, of the total systems software budget (100%), 11% goes toward the purchase of new systems control products. Overall expenditures on new systems control products equal the total of expenditures on operations management tools and applications development tools combined.

EXHIBIT IV-10

Percent of Overall Systems Software Budget for New Product Purchases

Product Category	Percent of Total Budget
Systems Control	11
Operations Management Tools	5
Applications Development Tools	6
Total	22

4. Significant 1991 Purchases

Respondents were asked to indicate the three most significant new systems software purchases planned for 1991 and the estimated cost.

• The average expenditure for applications development tools cited is over $120,000, whereas the average expenditure on systems control and operations management products is in the $20,000 to $40,000 range.

• Expenditures on new applications development tools account for over 50% of all significant systems software purchases cited. This response is consistent with interest shown in relational DBMSs, which are relatively expensive and therefore significant as a 1991 IS objective.

• Twelve respondents (24%) indicated no new significant systems software purchases for 1991.

D
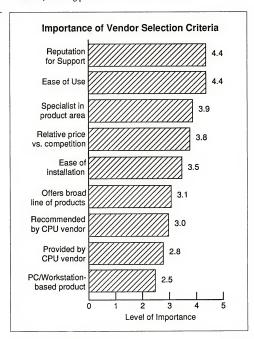
Product and Vendor Selection

The last set of questions dealt with vendor selection criteria, key vendors, and satisfaction with current vendors. Results are summarized in Exhibits IV-11, IV-12, and IV-13.

Respondents were asked to indicate the importance of each of a series of criteria in selecting systems software products. One equals low importance and 5 is high. The results are presented in Exhibit IV-11.

- Support and ease of use are more important than any other selection criterion, including price.

EXHIBIT IV-11

Importance of Vendor Selection Criteria

Criteria	Level of Importance
Reputation for Support	4.4
Ease of Use	4.4
Specialist in product area	3.9
Relative price vs. competition	3.8
Ease of installation	3.5
Offers broad line of products	3.1
Recommended by CPU vendor	3.0
Provided by CPU vendor	2.8
PC/Workstation-based product	2.5

Level of Importance

                   MASSP

- Respondents prefer vendors that are specialists in product areas, especially vendors that have a broad product line within that specialty. Systems software products that are supplied by a hardware vendor or recommended by the primary CPU vendor are not necessarily preferred. As more-specialized systems software products from smaller vendors continue to appear on the market, IS managers will consider these products. New channels of distribution from the traditional hardware equipment vendors may be emerging.

Respondents were asked to identify five of their most important systems software vendors. The results are shown in Exhibit IV-12. The vendors listed were mentioned three or more times.

EXHIBIT IV-12

Most Important Systems Software Vendors		
Systems Control	Operations Management	Applications Development Tools
IBM Computer Assoc. DEC Candle Macro4 Legent KLA Unisys	Computer Assoc. IBM Goal Candle Legent Macro4 Unisys	IBM Computer Assoc. Cognos Unisys

- Not surprisingly, IBM and Computer Associates are mentioned most often. The market is highly fragmented after these two leaders; 20-30 vendors are mentioned in each product category.

- Noticeably absent from the applications development tools vendor list are RDBMSs vendors (such as Oracle), Sybase, 4GL vendors, and network management vendors (such as Systems Center).

As shown in Exhibit IV-13, 50% of the IS managers surveyed are at best only somewhat satisfied with their systems software vendors and products. None are very satisfied. The average level of satisfaction is 3.4.

In order to explain the level of satisfaction, respondents were asked to name the needs that systems software vendors are not currently addressing. Needs not currently addressed fall into four broad categories outlined in Exhibit IV-14. The first—operations management products—is mentioned the most often.

EXHIBIT IV-13

Level of Satisfaction with Systems Software Products and Vendors
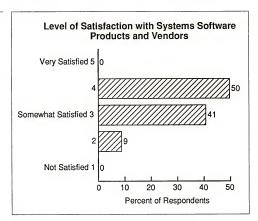
EXHIBIT IV-14

User Needs Not Currently Addressed

- Operations management products
- Support
- Lower Prices
- Connectivity

- It would stand to reason—given the importance of support as a vendor selection criterion—that support may be something IS managers are dissatisfied with. However, the need for additional operations management products was mentioned more frequently than any of the other three areas of dissatisfaction—almost twice as often as the next most popular need, which is support.

- This finding could signal a pent-up demand for operations management tools. Operations management products are needed, especially for minicomputers. Specific product needs mentioned are: network management, memory management, tape management, report resource usage, risk accounting, troubleshooting tools, and performance and tuning software. As more applications are offloaded, the need to distribute, monitor, and manage software that has been distributed through a corporation expands.

- Support needs mentioned include better documentation, ease of installation, and online help.

- Lower prices were mentioned by only 20% of respondents.

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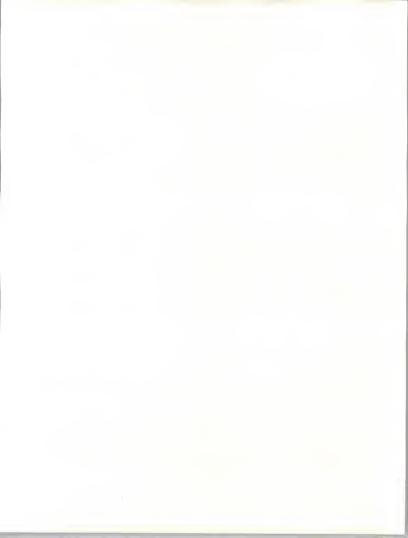
Conclusions

Exhibit IV-15 outlines the conclusions of this chapter and discussion of these conclusions follows.

EXHIBIT IV-15

Information Systems Environment
Systems Software Conclusions

- Data center infrastructure intact

- LAN integration a high priority

- "Wait and see" on client-server

- Expenditures on systems control products the highest

- Mainframes still prevail

- 78% of budget for maintenance

- More operations management tools needed

- More support needed

The infrastructure of the data center is not being downsized to any large degree. Overall, few operations managers view downsizing the central computer as an objective during the next several years or after 1993. In fact primary CPU performance is being enhanced and efforts are strongly being made to improve data center productivity. Upgrading the central computer is a consistent and ongoing corporate data center objective for about 20% of respondents; data center automation is a current objective for over half of the respondents.
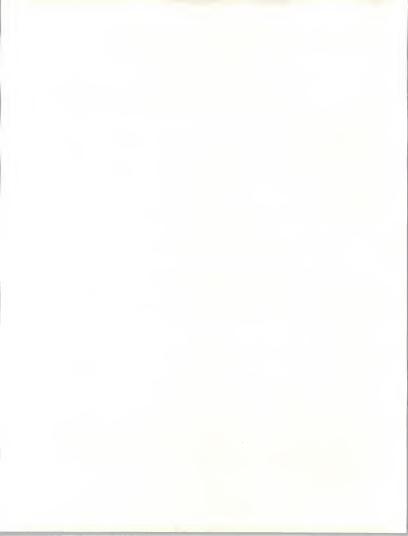
Over the next several years LAN integration, and network integration in general, will be an IS objective for more respondents than any other objective. This high degree of interest in integration implies keen interest in improving productivity and efficiencies through data sharing, resource and peripherals sharing, and an increasing movement toward decentralized computing. LAN integration is a first and necessary step.

Integration of LANs and networks will be an important catalyst for future implementations of client-server technology, distributed DBMSs, and UNIX/open systems. Thus, activity will accelerate in these other areas, especially after 1993. Even so, it appears as though the mainframe and the corporate data center will continue to thrive and that expenditures to support centralized operations will continue to grow at a healthy pace.

Lack of consensus exists about what *client-server* means, and thus measures of client-server's level of implementation lack meaning. Suffice it to say that a high level of interest exists in client-server technology. However, respondents indicated a wait-and-see attitude rather than enthusiastic endorsement. The push to client-server may be more likely to come from the departmental or functional level—areas that stand to gain the most through easier access to data—than from data center operations.

Expenditures on systems control products overshadow expenditures on the other two systems software product categories. In fact, expenditures on systems control products are more than twice those of either operations management tools or applications development tools. Systems control products have been around the longest; some of the needed operations management and applications development tools are just beginning to appear.
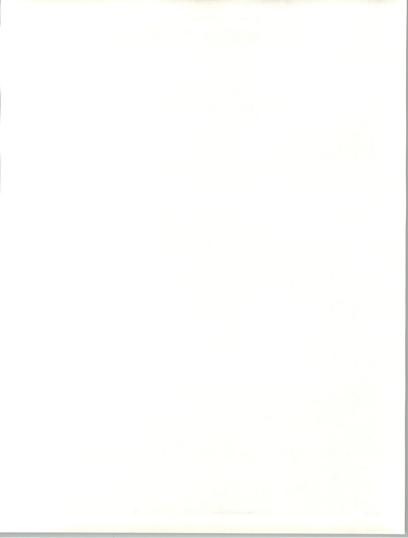
As would be expected, the bulk of expenditures are for systems software products that run on mainframes. A noticeable shift is underway toward operations management and applications development tools that run on workstations and personal computers; systems control products are more heavily entrenched on the mainframe—because of the high mainframe-based operating systems licensing fees.

Expenditures on systems software products are primarily for maintenance of existing products and annual license fees; on average, almost four times more is spent on existing products compared to new products. This ratio is not expected to change over the next several years. Thus strong vendor-customer relationships are critically important because of the reliance customers have on vendors for continuing product maintenance and, in turn, vendors have on customers for maintenance revenues.

Respondents feel that overall systems software prices are too high but that these high prices are not as much of a problem as lack of adequate operations management tools and the need for improved support. Reputation for support is the single most important selection criterion mentioned. Price is fourth in importance out of a list of nine. Thus data center operations managers are willing to pay higher prices in order to get solid support.

The position of the larger established vendors in the systems software products arena is at risk because of the myriad of smaller specialized vendors that are establishing product niches. These smaller vendors, however, must prove themselves in the support arena if they are to become and remain viable.

V

Issues and Trends

Given the IS needs and attitudes expressed in Chapter IV, this chapter will discuss how and at what level of success vendors are responding to these needs.

A

Issues

User needs can be translated into issues facing vendors as shown in Exhibit V-1.

EXHIBIT V-1

Systems Software Products
Key Issues

- Enterprisewide computing

- Data accessibility

- More operations management products

- More useful applications development products

- Provision of support and education

The availability of increasingly powerful desktop computers to practically every professional within a corporation means that a great deal of processing power goes unused most of the time. Ways to take advantage of this distributed computing power need to be found. On a macro level, global competition and industry consolidations are compelling IS to rethink not only the workstation level but all aspects of information services in enterprisewide terms.

Users and vendors alike are seeking ways to use hardware more efficiently and make data more accessible. Network integration, client/server and cooperative processing models, standards, and distributed data bases will all help to accomplish these goals.

Given the findings of INPUT's user survey it is clear that users recognize the strategic advantages of ready access to information. Data access and data sharing is not a new problem. During the last decade vendors have attempted to provide users with better access to data. Graphical user interfaces, RDBMSs and their development tools, report generators and 4GLs are all targeted at solving the data access problem. While these technologies have increased the ability of the end user to more rapidly build standalone data access applications, they have not solved the problem, as many had predicted.
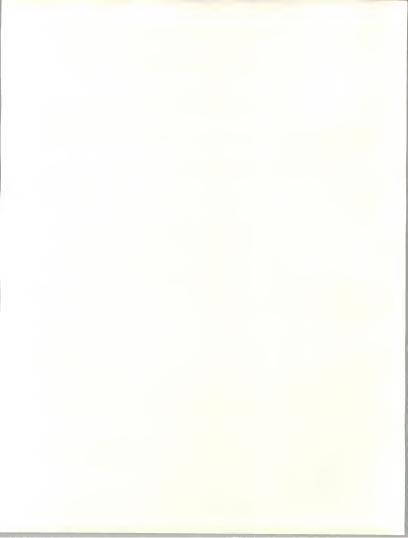
How to integrate LANs and WANs will continue to be a key concern over the next five years. A market need exists for more robust LAN operating systems and development tools, network management and data security features. Integration of LANs and networks will be an important catalyst for future implementations of client/server technology, distributed DBMSs and UNIX/open systems.

The concept of the primary CPU—the mainframe—as the key corporate data repository will continue to gain acceptance. Along with such acceptance comes awareness of the need for more and better mainframe-based systems software products. Even with the increasing interest in client/server architectures and offloading the mainframe, IS managers are anticipating that a large amount of computing will still be done on the mainframe.

Data center automation also continues to create new systems software product opportunities for many companies. As indicated in the previous chapter, 53% of respondents in a recent INPUT survey cited data center automation as a current objective. This high percentage reflects the continuing concerns of IS managers to improve productivity and reduce costs of their data center operations, and implies continued strong growth in the operations management category of systems software products.

As enterprisewide computing makes headway, operations management products will need to be integrated. Data center information, for example, must be gathered and analyzed from more sources, increasing complexity as users must deal with more systems management tasks and more tools to address those tasks.

As more applications are offloaded from the central computing facility, the need to monitor and manage software that has been distributed throughout a corporation expands. Vendors will continue to develop additional operations management products to manage computer systems

and/or network resources such as performance monitors, job accounting systems, computer operations scheduling, disk management utilities, and capacity management. Effective ways of managing software distribution will also be required.

Application development backlogs for traditional software products continue to escalate. And only limited progress is being made in applications development for client/server architectures because it is complicated, time consuming, and requires a high degree of coordination. A growing demand for products that improve efficiency of the development process—including DBMSs, CASE tools, and 4GLs—will continue to persist.

Given that so many new products are coming down the pipeline, users are understandably confused. For example, there's no consensus about what the terms "downsizing", "client/server" and "cooperative processing" really mean. Customers who don't understand what vendors are saying have restricted their buying to what they think they understand—simple price-performance in a commodity market. However, there could be another explanation for the current emphasis on "more bang for the buck." It is possible that users are "downsizing" their orders of new computer technology because it hasn't fulfilled their past expectations.

These market needs/issues will drive systems software products during the 1990s. How vendors are responding and the progress they're making are the subjects of Section B.

B

Trends

INPUT has identified four key systems software products trends, brought about by these user issues, which are summarized in Exhibit V-2 and described in this section. In summary, users needs are being voiced, vendors are responding with products and technologies in various stages of completion, and because there is such a plethora of new products and technologies, users are struggling to assimilate all of it.

EXHIBIT V-2

```
Systems Software Products
Key Trends

• Client/server and cooperative processing
  in infancy

• Vendor migration to standards gaining
  momentum

• RDBMS use and data base interoperability
  in infancy

• Integrated CASE just getting started
```

1. Client/Server and Cooperative Processing Are in Infancy
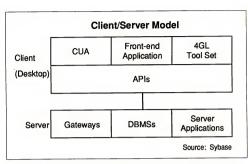
a. Client/Server Models

Much of the next generation of software products will be based on a client/server architecture. Although an industry definition of a client/server architecture is still evolving, the general concept involves matching a particular data processing task to the appropriate machine for execution. The data base and communications portions of an application are usually executed on the server. These portions also provide the client with access to other distributed network-based software and hardware applications/resources on an interactive/dynamic execution basis in a network environment.

The utility software on the server can provide connectivity with remote data bases, manage network communications, and provide data translation among diverse data types. A client/server implementation of a cooperative processing solution also usually implies the utilization of a hierarchical (terminal/workstation to host) processing interchange. Exhibit V-3 illustrates a generic client/server model.

The benefits of utilizing a data base server include increased accessibility of distributed data bases for report generation as well as for distributed application access. In addition, a programmable data base server architecture, in particular, can reduce the complexity of data base structuring and maintenance for the application developer.

EXHIBIT V-3

Client/Server Model

Client **(Desktop)**	CUA	Front-end Application	4GL Tool Set
	APIs		
Server	Gateways	DBMSs	Server Applications

Source: Sybase

The lack of a common industry definition is one of a number of issues surrounding the implementation of client/server software products solutions, which will negatively impact the rate of transition to this new model. Several of the other issues are discussed below:

• There is a lack of product models that help define appropriate software product migration. The few models that exist are primarily in the applications development product category.

  - Computer Associates has disclosed its intention to release new versions of its DBMS products—CA-IDMS and CA-Datacom/DB—for the client/server environment, including ports for UNIX and LANs.

  - Information Builders is preparing to launch a new generation of its Focus Network Architecture based on the client/server model and designed to provide data base interoperability across platforms. The mainframe will act as a central gateway to a variety of data bases and platforms.

  - KnowledgeWare has acquired the technology of a company that is developing client/server applications development products.

  - Cognos is developing tools that support the client/server model.

  - Sybase carved out its niche for client/server-based OLTP RDBMS applications. Sybase has one of the most fully defined client/server architectures, whereby data management and transaction functions are independently managed from the user interface and applications functions.

- Ingres has refashioned its DBMS as a client/server distributed DBMS. It is also vigorously pursuing the development tools market with its Windows/4GL product.

• Implementing multiserver communications ultimately involves the utilization of multiple layers (including several layers at the interapplication level) of a networking protocol stack standard (such as ISO/OSI) or building extensive gateways to bridge disparate protocols supported by the various equipment and applications vendors. Currently there is considerable industrywide support for the lower communication protocol layers, such as TCP/IP, Ethernet, and Token Ring (including bridges, routers and other types of gateways). However, upper layers of the ISO/OSI protocol stack are still in the finalization process, and widespread equipment/applications support is still probably years away.

Therefore, companies implementing multiserver data base communication (Sybase, Oracle, Sun Microsystems, HP, DEC ad IBM, in particular) are promoting their own versions of remote messaging that provide for access to heterogeneous vendor data base servers. Sybase's Client/Server Interface (C/SI) is based on the ISO Remote Database Access (RDA) protocol and ANSI SQL. Increasingly, such inter-server support will also provide access to both relational and nonrelational data management systems, as well as application services.

• The optimal client and server implementation configuration is still in a speculative stage, due partly to the rapid evolution of hardware designs and systems software tools which are being specifically designed to implement the newly distributed data base application models. An optimal server platform for supporting multiple applications should probably be based on a multiprocessing as well as a multiuser/multitasking architecture.

• Keys to success will also involve acceptance of industrywide distributed RDBMS de facto standards that are based on the development of a number of front-end applications by independent software developers. The user interface to RDBMSs must also be simplified. The incorporation of a natural language front-end capability could provide a significant competitive advantage.

Vendors with a background in mainframe and minicomputer platforms appear to be positioning these systems as the data base/repository and network servers to a variety or microprocessor-based platforms, where eventually much of the processing segment of the application execution will occur.

Vendors with a history in the microprocessor arena tend to support client/server architecture based on the workstation server model, utilizing OS/2 or UNIX operating systems. One of the better articulated client/server architectures is Sybase's SQL Open Server product.

Increasingly, workstation hardware is being optimized for a server functionality, including hardware and software, to maximize I/O transaction capability and network management, which now limits PC/workstation-based hardware server solutions, as opposed to minicomputers and mainframes. Multiprocessor (with symmetric multiprocessing) implementation will also address the limitation of being able to efficiently handle multiple-application execution on a server configuration.

b. Peer-to Peer/Cooperative Processing

Industry definitions of peer-to-peer cooperative processing are even more varied than those for client/server cooperative processing. Theoretically, in a peer-to-peer implementation (as opposed to a client/server application architecture) the clients can communicate with other clients or servers without being dependent on routing though a particular server/gateway (host) architecture. Application tasks are built on a modular basis and run on different computers but are all part of a single logical unit. The location of the various elements of the application are transparent to the end user. In essence, the network becomes the computer system.

This technology would be an ideal enterprisewide distributed data processing environment, but it is not likely to be a realistic alternative for at least three to five years, due to the need to not only rewrite applications for single-vendor platform implementation but also to provide multivendor platform interoperability, which will require much more widespread support for communications and application programming standards. The further development of data base management systems that are optimized for concurrent, multiprocessing computer systems will also significantly enhance the efficiency of cross-network execution.

Enhancements of UNIX software for real-time, multiprocessing implementations with the execution of application modules in a parallel function across a network represent one prototype of a peer-to-peer processing implementation. DEC's VAXcluster product, with its loosely coupled multiprocessor, single-file structure architecture and multiuser read/write protection, represents another prototype.

Additional requirements will include the implementation of standards for the upper layers of the network protocol stacks, such as ISO/OSI; the use of cross-platform application development tools (such as portable 4GL tools or a third-generation language such as C); fibre optic networks; and, optimally, a common operating system environment with a scalable product architecture, along with the utilization of a standard data repository for creating distributed data directories.

4GLs such as Information Builders' FOCUS, which have been ported across multiple platforms from various vendors, represent examples of application development tools for distributing data under a single logical structure in a distributed, peer-to-peer architecture.

IBM has used the terminology of peer-to-peer processing in the context of implementing its program-to-program SAA protocols, LU6.2 and PU2.1, for communication among microcomputers, local-area networks, mini-computers, and mainframes with a common user access model that can be built through support for its application programming interfaces and eventually with its AD/Cycle integrated application development tool product.

One of the more explicitly defined peer-to-peer (cooperative processing) application toolkits is Hewlett-Packard's Network Computing System (NCS) and Task Broker utility software. These toolkits facilitate develop-ment of distributed applications in a multivendor, cooperative computing environment. NCS, which has been licensed to other vendors such as IBM, DEC, and Microsoft, runs under MS-DOS, MVS, VM, VMS and UNIX operating systems. It is optimized more for new application devel-opment, where it allows programmers to design applications that can run on several networked computers simultaneously. NCS is also compatible with a number of protocol stacks, including OSI, SNA, MAP/TOP, and TCP/IP. NCS code, which is compiled into the applications, allows for the various subroutines of an individual program to be executed across platforms that support NCS. NCS is competing for the endorsement of the Open Software Foundation against Sun's NFS, which is part of Sun's Open Network Computing environment.

Task Broker software from Hewlett-Packard allows software developers to modify existing applications to run across a number of multivendor plat-forms in a network configuration to maximize distributed CPU capacity. It uses an intelligent bidding process to distribute entire tasks to the com-puter on the network that are best suited for each job. It enables software developers and end users to gain the benefits of distributing applications across a multivendor network without modifying existing applications. It requires no application modification. Task Broker is targeted for applica-tion development on UNIX platforms using TCP/IP protocols, such as HP and Apollo workstations. Future versions are being developed for DEC and Sun Microsystems workstations.

Task Broker is more a computer-system-to-computer-system communica-tions tool in that it requires the complete application to be resident on the various platforms when it designates that a particular user can execute a program wherever CPU facilities (with the application resident) are avail-able across a network.

Task Broker and NCS are key elements of a product strategy that HP is developing for building distributed applications for cooperative process-ing. The product elements also include administration applications for networkwide file system backup and user account registry and the adop-tion of the Open Software Foundation's Motif as a standard workstation and terminal graphics interface.

Hewlett-Packard has introduced the Team Computing program, a co-operative processing approach to multivendor computer configuration in a network environment, which utilizes the Task Broker and NCS technology. Team Computing is initially focused on project team needs in engineering or scientific and research programs and other project/team-oriented groups that share common work objectives and rely on computers and application programs from different vendors. HP describes the connectivity solutions as integrating a variety of individual systems into what is a distributed supercomputer. The program encompasses both existing and newly announced products. It is the first program to combine NCS with the X-Windows System and the Motif user interface.

The first Team Computing components include Task Broker, NCS, NCS-based system administration applications for all HP workstations, and a preconfigured X-Windows environment to provide the same appearance and behavior in HP and Apollo workstations and X Terminals by using the USF/Motif graphical user interface.

2. Vendor Migration to "Standards" Is Gaining Momentum

Standards in one form or another are being adopted by vendors to a much greater degree than even one year ago. Increasingly, computer systems vendors such as IBM, DEC and HP are announcing plans to implement single computer system frameworks and networking architectures as their future product direction. Nearly all are indicating longer-term support for the ISO/OSI model, with TCP/IP as the intermediary internetworking standard. However, there is considerable competition to establish de facto standards for the upper networking protocol layers—including sessions, presentation, and applications layers—where OSI standards are still in the process of definition.

UNIX is being supported by most larger computer systems vendors on some of their hardware platforms—including IBM's AIX, DEC's Ultrix, and the HP-UX—as the best alternative operating system.

The movement towards standards is progressing in virtually every area of information services. A list of some of the many information services standards that are in the process of development is included in Exhibit V-4.

EXHIBIT V-4

Selected Standards in Progress

• Screen	Microsoft Windows; Presentation Manager; OSF/Motif; X/Open; News; NewWave; Nextstep; GEM; Display PostScript; Quarterdeck's Desqview; Open Desktop
• Graphics	TIFF; PICT; CGI; CGM; DMS; WKI; IGES; SGML; ODIF; DDIF (DEC)
• Communications	OSI; SNA; Ethernet; Token Ring; SONET; TCP/IP; MAP/TOPS; LU6.2; APPC; CL/I; NFS C/SI; SGLNet; FDDI; X.400; X.12; X.25; CITT.6 (Group 4); NCS; NetBios; LAN Manager; SMTL CMIS/CMIP SNMP; ISDN
• DBMSs	Codd's Rules; SQL; ANSI SQL; DB2
• Printers	Adobe's PostScript; DDL; Microsoft/Apple emerging standard
• Program Interfaces	IBM's SAA; DEC's enterprisewide architecture; POSIX
• Operating Systems	MS-DOS; OS/2; VM; MVS; UNIX; DEC VMS; PICK
• CASE	AD/Cycle; CDD/Plus; IRDS; EDIF; CIS
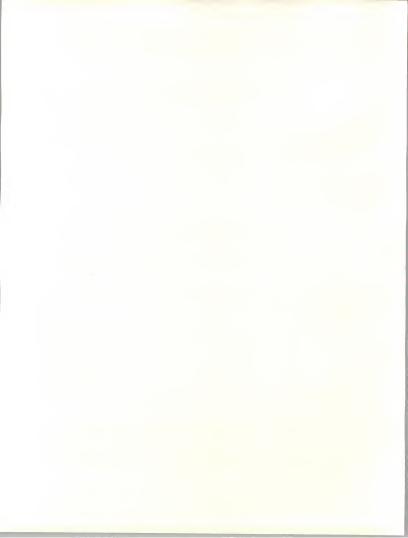
Another example of the movement toward standards is the ACE initiative. ACE, a consortium of more than 80 companies, is developing common hardware and software technology for personal computers and workstations. The platforms are based on Mips Computer Systems Inc.'s R3000A and R4000 RISC chips. Compaq's platform will be among the first ACE product releases and will be a development platform for independent software vendors.

All of these standards impact systems software products and vendors to one degree or another. Although a trend towards standards is underway, so too is a trend towards fragmentation of the systems software products arena. Many new products will be developed and in use during the next

five years. An issue is how to balance the need for standards—and therefore more commodity-like features and functions—with a need for new innovative and differentiated products and technologies.

Due to the trend toward standards as well as the need for new products, technology sharing alliances will continue to be important in systems software products. Small companies with less capital are not the only ones that will form alliances as the recent IBM/Apple joint venture attests. IBM and Apple plan to form a separate company to jointly develop a new operating system for their next generation of personal computers and workstations. The two firms will also design new computer chips which will be manufactured by Motorola and will work jointly on multimedia technology.

Several areas of standards—perhaps the most encompassing—are discussed below.

a. UNIX
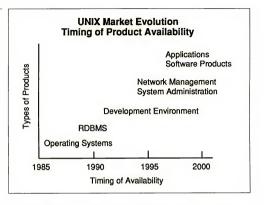
Over the last eight to twelve months, leading midrange vendors have moved from begrudgingly providing proprietary UNIX if users request it; to endorsing UNIX as a viable option; to endorsing a standard operating system kernel; to moving fully in the direction of "open systems" where UNIX is one piece of the whole; to total product line migration to UNIX (NCR). These companies are not only endorsing integration of UNIX with their proprietary systems but they are also beginning to endorse interoperability with other vendors' systems.

IBM as well has begun to change its tune, although not quite as enthusiastically as the midrange vendors. Its strategy is to incorporate the OSF/1 kernel into AIX, whereas before, AIX was IBM's proprietary version of UNIX. Although IBM is not encouraging interoperability with other vendors' hardware, it will integrate AIX under the SAA umbrella, thereby making it interoperable with OS/2, OS/400, VM and MVS environments.

In addition to large systems vendors, all other types of vendors are announcing UNIX plans and making products available. Large independent software vendors, such as Computer Associates, are publicly announcing UNIX intentions, and for some—such as Oracle—close to 50% of revenue now comes from UNIX software products. Clearly the march to UNIX and open systems is gaining momentum.

Exhibit V-5 shows expected timing of marketwide availability of commercial UNIX systems and applications software products.

EXHIBIT V-5

UNIX Market Evolution
Timing of Product Availability

Applications
Software Products

Network Management
System Administration

Development Environment

RDBMS

Operating Systems

Types of Products

1985   1990   1995   2000

Timing of Availability
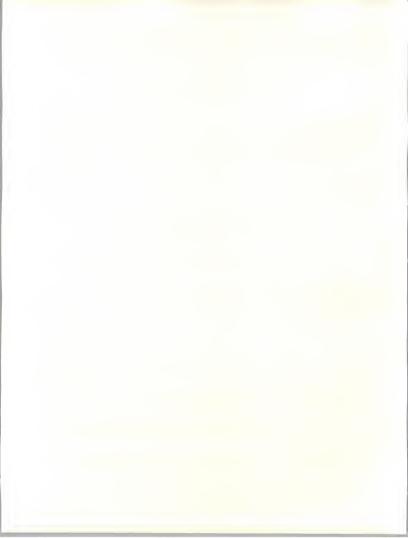
As large systems vendors migrate to UNIX, they have begun a complete reversal of the once-cherished strategy of locking in the customer and locking out the competition. This reversal brings with it a number of difficult challenges, summarized in Exhibit V-6.

EXHIBIT V-6

Systems Vendors'
Strategic UNIX Challenges

- Efficient incorporation of standards as they become available

- Implementing effective differentiation strategy

- Distinguishing between standard-compliant and standardized

- Deciding when to offer technology to other vendors

- Readying distribution channels for UNIX

Although the market for UNIX systems management and design tools is highly fragmented, RDBMS companies are leading the charge. They will need to continue to form alliances with other third-party tool vendors and/or large systems vendors in order to become providers of complete UNIX development environments.

For systems and applications software products vendors alike, the cost of supporting all the different variants and new hardware platforms is enormous and is a drain on development funds that could be spent on improving their core products. Systems software interacts closely with the operating system kernel, which may vary dramatically from vendor to vendor. Informix alone supports more than 600 variations of UNIX on more than 80 hardware platforms. Therefore it is imperative that systems and applications software vendors begin to consolidate their efforts individually and in alliance; the movement towards standards will help.

Product issues and market needs being addressed by operations management and tool vendors as they begin to provide UNIX products are outlined in Exhibit V-7.
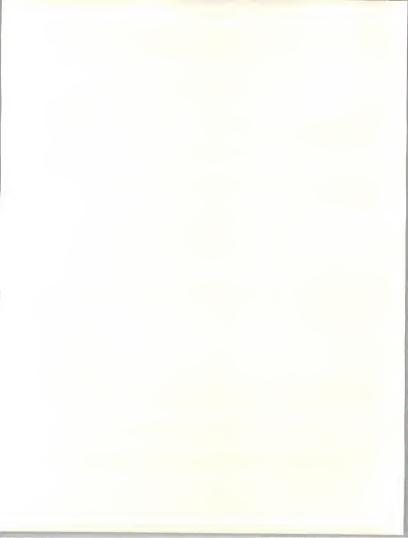
EXHIBIT V-7
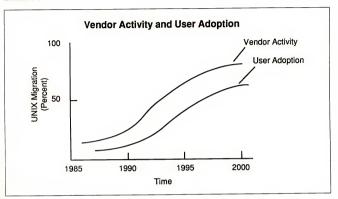
UNIX Operations Management and Development Tools Product Issues/Market Needs

- Network reporting and management

- Tools to "tune" networks and maintain data consistency across a distributed network

- Configuration management tools

- Performance monitoring and capacity management

- Integrated CASE environments

- Improved security

All the components necessary to make UNIX a viable operating system in the commercial arena are not fully formed. However, a level of vendor commitment and planning is present that did not exist even one year ago. Large systems and software vendors are adding to the momentum. Notable examples are IBM's success with its RISC workstation and NCR's total move to a standard UNIX platform.

As Exhibit V-8 shows, however, user acceptance will drag behind vendor activity. UNIX will remain a difficult selling environment over the next several years. Nonetheless, as the traditional vendors commit to open systems, larger numbers of users eventually will follow.

EXHIBIT V-8

Vendor Activity and User Adoption
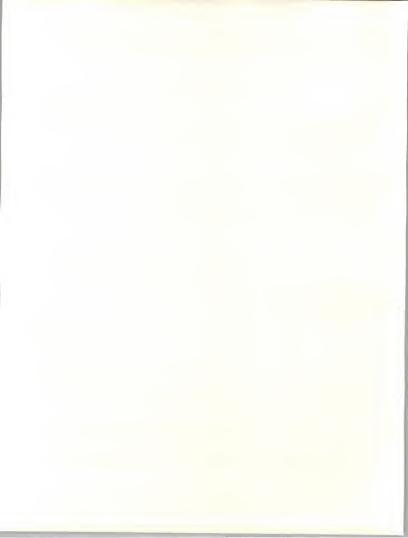
Vendor migration to UNIX and open systems is a tremendously costly undertaking and only the large vendors can sustain both proprietary and open strategies. UNIX directions have been announced and strategies are in place. How effectively and quickly each vendor implements its strategies remains to be seen.

Many transitional issues are surfacing. To protect their proprietary installed bases, vendors are beginning to add "openness" by meeting POSIX standards and X/Open certification requirements.

Although the UNIX evolution poses large challenges for vendors, many exciting opportunities exist. Value and differentiation will be added through service and software and through enhancing hardware technology. UNIX represents a tremendous opportunity for systems and software companies to leverage their R&D dollars and to bring out new and better technologies.

b. SAA, NAS, CA90s

Although deliverables are still far from ready, vendors are making progress toward establishing frameworks for interoparability of their own platforms. They are also beginning to announce plans for interoperability with other vendors' platforms, incorporating UNIX as only one of several options to make this possible.

i. SAA

Introduced in 1987, SAA was originally developed as an architecture to integrate IBM's computers and operating systems, primarily MVS, VM/CMS, OS/400 and OS/2-EE. Now, however, SAA is evolving into an architecture that embraces non-IBM systems. It consists of SystemView, AD/Cycle, and the recently announced Information Warehouse.
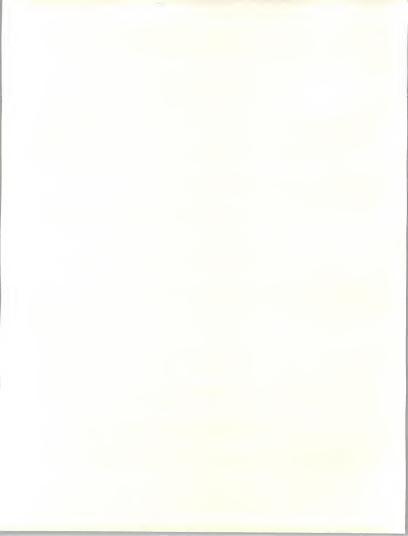
• OfficeVision, positioned in 1988 as the first major SAA application, has been plagued by delays and lack of customer acceptance.

• SystemView, announced in 1990, addresses systems management issues ranging from network management to capacity planning. SystemView's goal is to automate and integrate operations management applications and tools, and create an open structure to extend systems management across multiple platforms.

  IBM has recently stepped up its activities on SystemView, forming business partnerships with several firms to develop SystemView products and evolve the architecture. These companies are Candle, Bachman, Goal Systems and Platinum. However, it will be well into the mid-1990s before products are forthcoming.

• AD/Cycle, IBM's application development initiative, was released by IBM in 1989 and was the first CASE initiative to tightly tie in third-party products. It provides management, tools and procedures for creating software.

• Information Warehouse is the unofficial name of a new IBM architecture that addresses corporatewide data access. Information Warehouse promotes the client/server scheme that uses the mainframe as the hub to manage a multivendor enterprise while allowing customers to continue downsizing key applications. The "data warehouse" will let mainframe users access information stored in any data base in IBM or non-IBM platforms, with the mainframe as the conduit. It would be a major step in allowing customers to integrate data from disparate data bases across their enterprises.

  Information Warehouse draws heavily on technology developed by Information Builders and will undoubtedly involve another series of partnerships.

Because IBM is IBM, SAA is inevitable. The migration to SAA, however, will be slow for a number of reasons:

- Significant changes in SAA since its unveiling in 1987 have confused users. The plan for portability, for example, has evolved into coopera- tive processing and Enterprise Information Systems. All that IS organi- zations can really do at this point is move people into a planning mode in the areas of SAA that appear to be the most stable.

- Users' core systems are already built and many will have to be modified to be compliant with SAA. It will be a costly investment to come into line with SAA and could easily be deferred, considering other priorities in the current economic environment.

- The "why fix it if it's not broken" mentality will slow SAA's accep- tance. Users have become dependent on facilities that operate systems that, in the future, will not be compliant with SAA.
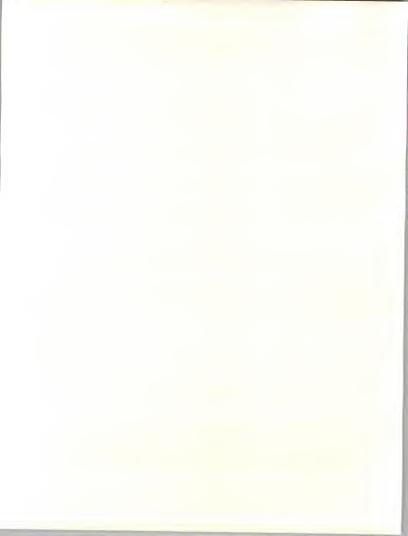
ii. NAS

DEC's overall theme is distributed systems. The company's goal is to have one operating system kernel for all platforms—from the desktop to the data center. Just as IBM's SAA unites various IBM operating environ- ments, DEC's Network Application Support (NAS) will be the "umbrella" providing distributed computing capability and eventual interoperability between DEC VMS, Ultrix (DEC's flavor of UNIX), and OSF/1-based Ultrix. It will also eventually provide interoperability between DEC systems and other vendors' systems, including MS-DOS and OS/2.

- Like IBM, DEC has a systems management framework, Polycenter, designed to manage distributed multivendor systems, including DEC's VMS and Ultrix lines. Polycenter will be based on the NAS architecture and will integrate the management of all functional areas (configuration change, fault/problem performance, security, accounting, and adminis- tration) of all objects (systems, networks, data bases, and applications) across multiple vendors' platforms. DEC, like IBM, plans to publish application programming interfaces and support industry standards such as OSI and the OSF's Distributed Management Environment (DME). DEC has targeted 1996 as the date by which it will attain its unattended goal.

- DEC recently unveiled CDD/Repository—Cohesion's centerpiece— moving away from its VMS world to distributed, multivendor software engineering that embraces VMS and Ultrix.

iii. CA90s

CA90s is defined by Computer Associates as "a software architecture for the 90s that is hardware independent" and is intended to achieve two publicly stated objectives:

- The public disclosure of the company's development methodology

- The provision of a unifying computer architecture to which future software developments will conform

Exhibit V-9 shows the basic layers of the architecture.

EXHIBIT V-9

CA90s—The Architecture

User Interface Services
Software Solutions
Integration Services
Distributed Processing
Platforms

The key significance of CA90s is that this large software vendor is pursuing a strategy that will draw together its far-flung family of systems and applications software products. It is a huge task, but any progress that is made will help reduce the total cost that information systems may incur.

What is also significant is that Computer Associates is beginning to form alliances and progress is being made for CA products to interoperate with other vendors' software:

- CA will support DEC's Polycenter and IBM's SystemView systems management platforms as well as offering its own multivendor product line. CA is already beginning to provide some degree of integrated management across IBM and DEC systems.

- CA and HP will be jointly developing UNIX software for HP systems. They will work together on systems management, data base and applications software. The systems management software will eventually be integrated with the DEC and IBM products. The goal is to manage, control and monitor all system-related activities across IBM MVS, VSE and VM, DEC VMS and HP-UX systems.

CA's Event Notification Facility (ENF) provides a common interface among products. ENF directs communications between products, between products and the operating system, and across operating systems. It is portable among IBM, DEC and HP systems. The ENF service is now

available in a number of CA products including CA-Scheduler, CA-APCDDS report balancing, CA-Opera and CA-ACF1. Other products will be enhanced to allow use of ENF over time. CA's integration strategy, however, does not allow users to share data among different vendors' operations management products.

3. RDBMS Use and Data Base Interoperability Are in Infancy

a. RDBMSs

The DBMS market is over 20 years old; the RDBMS market is 10 years old. Nonetheless, users are just beginning to assimilate RDBMs and make the transition from flat-file data bases.

From the vendor point of view, DBMSs are the heart of enterprise computing and are therefore key strategic products for both systems and software account control. Vendors are struggling to maintain market share at the mainframe and minicomputer levels. IBM's DB2 has gained acceptance as the de facto standard mainframe relational DBMS. As of the end of 1990, 46% of all MVS sites were currently using DB2.

Generally speaking, many user organizations currently have RDBMSs but they're slow to use them for heavy-duty applications development and RDBMSs are not being used yet for very many mission-critical applications.

The reasons are:

- RDBMS technology is still far ahead of users' ability/willingness to fully assimilate it.

- MIS is risk-averse when it comes to making major changes that might affect critical corporate data.

- It is still difficult to translate old DBMS files to new RDBMS formats and to integrate multiple heterogeneous data bases.

- As with CASE, a lot of product went into the market and now users have to learn to more effectively use it.

A bright spot in this scenario, however, is that even though the actual buyers are still strongly MIS people, end users are becoming more adamant about their data access needs and are becoming more interested in RDBMS purchase and implementation. This end-user pull presents vendors with the new challenge of selling their products as a business solution rather than a technology. To the extent that vendors are successful in demonstrating the solution aspects of their products, RDBMS growth will be healthy.

RDBMS vendors are responding to end user needs with increasingly easy-to-use applications development and integration tools. The Ingres Star product can join Ingres and non-Ingres data located in more than one place. Tools accessed through gateways can extract data. Ingres' strategy is "peaceful co-existence with IBM." Sales of these kinds of products are becoming an increasingly large portion of vendor revenues.

b. Data Base Interoperability

There is a clear move towards distributed information processing based on relational data base architectures. A distributed data base system is a collection of data bases or parts of a data base which appear to the user to be one data base. To the user, the location of the data, stored on heterogeneous equipment platforms, does not matter.

True distributed data bases provide transparent, seamless processing across heterogeneous environments. What will emerge, therefore, will be enterprisewide computing networks with applications that will be able to access and update data bases across multiple heterogeneous equipment platforms. These data bases will be distributed over multiple—wide-area and local-area—networks.

At present no vendor provides the transparent seamless processing across heterogeneous environment that a truly distributed data base implies. However, vendors are moving in that direction, mainly in the areas of remote query processing, distributed update processing and the client/server architecture. Companies that have or are working on models of distributed processing, which provide for updating and retrieving data across multiple data bases, include Sybase, Oracle, Ingres Corp. and Software AG.

IBM purportedly will provide distributed data access capability between the OS/2 EE data manager and DB2. This capability will likely be included in the next release of OS/2 Version 2.0. IBM is also working with other vendors on distributed capabilities between DB2 and the vendors' data base management systems.

4. CASE Use Remains Relatively Low; Integrated CASE Is Just Getting Started

CASE has held out the promise since the mid-1980s of making a significant impact on the applications development process. CASE proponents see opportunities for significant improvements in

• The elapsed time it takes to develop applications
• Application quality
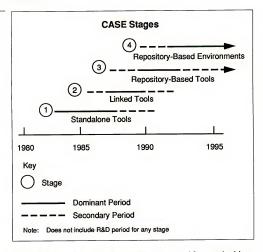
This promise has so far been largely delayed due to user acceptance issues and vendor technology hurdles. INPUT's research shows a low level of perceived effectiveness; and the great majority of organizations are using only a partial set of CASE tools, generally within only a part of the organization. Vendors need to provide integrated CASE; re-engineering technology advances will help.

a. CASE Integration

Integration has been a key CASE issue from the beginning. Dealing with integration—or, more usually, inadequacy in dealing with it—has been an important determinant of CASE progress and acceptance.

INPUT's analysis categorizes CASE into four stages, as shown in Exhibit V-10.

EXHIBIT V-10

CASE Stages

④ Repository-Based Environments

③ Repository-Based Tools

② Linked Tools

① Standalone Tools

1980   1985   1990   1995

Key

◯ Stage

─── Dominant Period

─ ─ ─ Secondary Period

Note: Does not include R&D period for any stage

Looking at the stages of CASE development—past and future—the driving force has been continuing integration. This is squarely in keeping with IS department requirements. Unfortunately, to date the pace of integration has been slow relative to user needs. The announcement and partial reality of AD/Cycle promises to bring CASE practice somewhat closer to CASE needs and realities.

INPUT's view is that the key technical issue over the next five years will be re-engineering. Re-engineering, as INPUT defines it, encompasses:

• Reverse engineering (i.e., stabilizing an application for CASE-led maintenance)

• Re-used applications (i.e., where a repository is populated by the logic of an old application to which forward-engineering technology is then applied)

When re-engineering is fully resolved, it will offer the most payback for the typical IS organization. Currently, CASE technology and methodology is largely forward engineering-oriented. In 1991 this limits CASE to roughly one-third of the potential applications development market (which includes maintenance and modifications activities). By 1996, INPUT estimates that almost half the applications development market could make use of re-engineering technology. Little more than 10% could utilize forward engineering technology, as now defined.
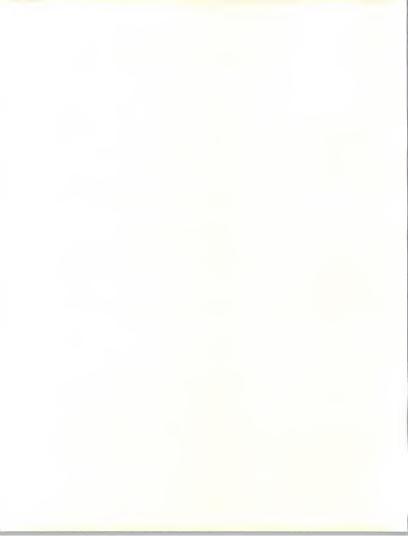
Distributed application development is also an important technical issue. However, the underlying distributed data base technology is still not fully fixed or defined. Therefore, CASE for building distributed applications is essentially on hold until the more basic technology issues have been addressed. INPUT does not expect CASE environments for distributed application development to be available before the mid-1990s.

b. AD/Cycle

AD/Cycle has revolutionized the CASE environment since it was announced in September 1989.

• It meets the market's expectations for an integrated, repository-based product.

• The equity investment strategy means that IBM can credibly offer other vendors' products as an integral part of AD/Cycle.

• Customers and other vendors have generally welcomed the concept of a de facto CASE standard on the IBM platform.

IBM's strategy is to use CASE to sell more, possibly much more, IBM hardware by greatly improving applications quality, timeliness, and development costs. For IBM this is too important to leave to third-party CASE product vendors. Andersen and Texas Instruments have recently concluded agreements with DEC to move their tools from the IBM platform to the DEC platform. This shows that there are few significant impediments to redirecting a CASE tool output from one hardware/software platform to another.

By controlling AD/Cycle, IBM will offer rapid development in a context that will ensure IBM's general control of the process through:

• Maintaining a de facto standard

• Offering CASE product options within AD/Cycle (e.g., KnowledgeWare versus Index versus IBM)

• Co-opting many potential third-party competitors

• Encouraging AD/Cycle-based applications software products

Nothing like AD/Cycle is yet on the horizon in the non-IBM world.

AD/Cycle had a chilling effect on most competing products, as many buyers froze their purchase plans in order to evaluate AD/Cycle. Based on INPUT's research, the majority of new purchasers will move toward AD/Cycle.

Undercapitalized product vendors and/or those with a low share in the IBM market will be faced with several options, including one or more of the following:

• Merger
• Development of niche products
• Conversion to a professional services firm
• Migration to other platforms

INPUT expects the vendor shake-out to continue, leaving a relatively small number of vendors that will offer fully functional integrated CASE products on the major platforms.

VI

Information Services Market

A
Market Overview

1. Historical Perspective

Exhibit VI-1 shows software products (both systems and applications software) as a proportion of the total information services industry from an historical perspective as well as projections for 1996. Software products (systems and applications) has consistently increased as a portion of the whole, from 8% in 1970 to 34% in 1990. The software products sector is expected to remain at roughly one-third of overall IS expenditures through the1990s.

Of the total 1990 software products market, systems software represents roughly half of user expenditures. This proportion is projected to decline slightly through 1996.

User expenditures on systems software grew from $6.3 billion in 1985 to $14.5 billion in 1989 (Exhibit VI-2). User expenditures reached a peak annual growth rate of 30% in 1987, due in large part to the strong growth of departmental/ minicomputer systems (AS/400 introduction) and also the strong growth in personal computer shipments. As indicated in Exhibit VI-3, annual growth since then has declined and will remain at 10% for 1991 and 1992, then pick up to 13% for the 1993-1996 time period.

EXHIBIT VI-1

Software Products Portion of Information Services
1970-1996

$ Billions	1970	1975	1980	1985	1990	1996
Software Products	0.3	0.7	2.9	13.3	34.2	71.0
Total Information Services	3.2	5.7	17.0	48.6	100.4	197.0

Chart (Percent of Information Services User Expenditures):
- 1970: 8
- 1975: 12
- 1980: 17
- 1985: 27
- 1990: 34
- 1996: 36

EXHIBIT VI-2

User Expenditure on Systems Software
1985-1996

EXHIBIT VI-3

Systems Software Growth
1985-1996
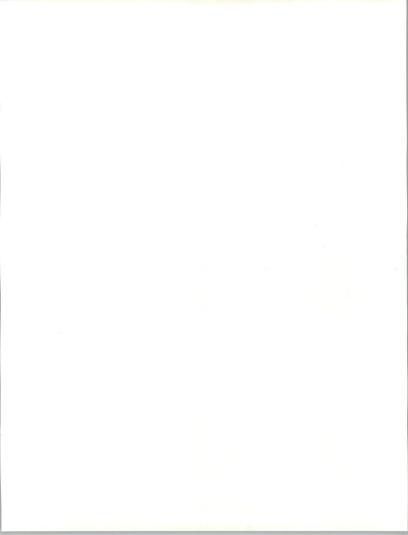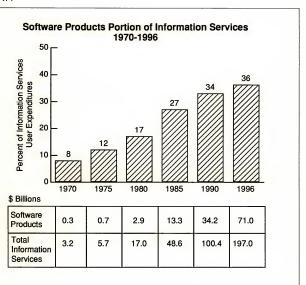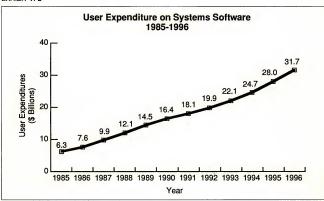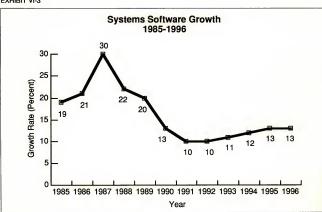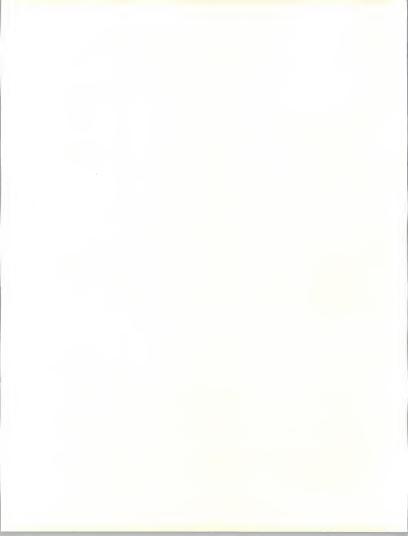
2. Vendor Overview

Exhibits VI-4, VI-5 and VI-6 list revenues of leading systems software products vendors, which indicate the following:

- Growth of hardware vendors' systems software revenues was up 7% in 1990. The hardware vendors' participation in systems software is still skewed toward systems control products. This growth rate is therefore a general indicator of this submode's slowed 1990 growth.

- Independent software vendors continue to do well, but not as well as in the past; 1990 revenues from systems software products were up 23%.

- Taken together, the data indicates growth in revenues of 12% for 1990.

EXHIBIT VI-4

Leading Hardware Vendors
U.S. Systems Software Revenues
1989 and 1990

Vendor	1989 ($ M)	1990 ($ M)	Percent Change
IBM	2,620	2,870	10
Digital Equipment	575	530	-7
Hewlett-Packard	270	325	20
Unisys	206	200	-3
Wang	144	140	-3
Apple	74	82	11
Prime	48	52	8
Amdahl	47	51	9
AT&T	34	35	3
Total	4,018	4,285	7

EXHIBIT VI-5

Selected Leading Software Products Vendors
U.S. Systems Software Revenues
1989 and 1990
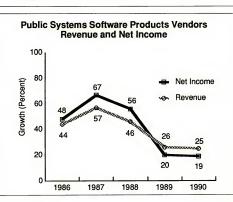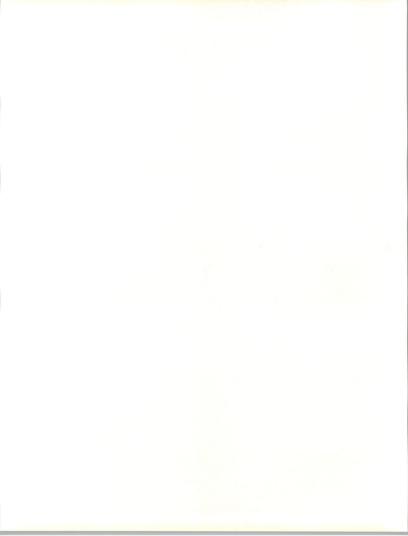
Vendor	1989 ($ M)	1990 ($ M)	Percent Change
Computer Associates	463	470	1
Oracle	283	390	38
Novell	263	358	36
Microsoft	242	415	72
BGS	144	152	6
Pansophic	109	110	1
Adobe	99	140	40
SAS	87	105	21
Ashton-Tate	84	73	-13
Sterling	74	81	10
Informix	69	70	1
Total	1,917	2,363	23

EXHIBIT VI-6

Public Systems Software Products Vendors
Revenue and Net Income

Note that these revenue numbers are based on discussion with vendors as well as INPUT estimates. Also, the apparent 7% decline in Digital's systems software revenues may be due to price negotiations for combinations of equipment, software and services.

Revenue growth for the leading systems software products vendors, as shown in Exhibit VI-6, was 25% in 1990, compared to 26% in 1989, 46% in 1988, and 57% in 1987. An increasing portion of this growth is attributable to increasing international revenues.

3. Systems Software Forecast

In 1990, actual expenditure on systems software products grew 13%, reaching $16.4 billion. Actual 1990 expenditures are in line with INPUT's forecasted 1990 expenditures.

- During 1990, the fastest growing systems software product area was operations management tools, which encompass network administration and control products. In addition to pressures to improve processing efficiency, the trend toward multiplatform, multivendor networks and network integration has begun to fuel the growth of this product area.

- Applications developments—especially CASE tools—experienced strong growth in 1990 due to the ongoing need to improve software development productivity.

The change in outlook for systems software in last year's report and this year's report is shown in Exhibit VI-7.

- The systems software products forecast has been adjusted downwards for all products and platform sizes.

- Products whose forecasts have changed the most are workstation and PC-based products for all three submodes. In this year's report, INPUT forecasts these products to grow at 19% compounded annually through 1996. In last year's report, however, INPUT forecast workstation and PC-based systems software products to grow at a compound annual rate of 24%.

EXHIBIT VI-7

	Systems Software Products 1990 versus 1991 Forecast	
	1990-1995 CAGR	1991-1996 CAGR
Product Category (Submode)		
Systems control products	13	10
Operations management products	16	14
Application development tools	14	12
Platform Size		
Mainframe	11	8
Minicomputer	11	10
Workstation/PC	24	19

The downward revisions in forecasts are due mostly to the protracted negative impacts that technology shifts will have on systems software purchases in the near term. These impacts will last longer than INPUT originally thought.
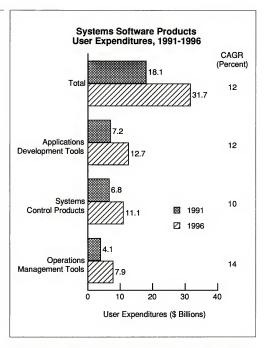
As shown in Exhibit VI-8, the overall systems software market will expand from $18.1 billion in 1991 user expenditures to $31.7 billion by 1996, a CAGR of 12%.

INPUT's forecast for systems software products of a 12% CAGR for the 1991-1996 period compares to INPUT's applications software products forecast of 14% over this same five-year period. INPUT believes that the kinds of technology shifts that will have a positive impact on the applications software market will also have a positive impact on systems software products. But though the fact that these technology shifts are still in the initial stages is not deterring purchase of applications software products, it will—in the short term—be a deterrent to purchases of systems software products.

In addition, an obvious and fundamental shift is occurring that makes the solution aspect of software the number-one priority. In this respect, applications software products are more synonymous with solutions, whereas systems software products are considered supporting, albeit necessary products. To the extent that systems software products are presented as solutions they will be eagerly embraced.

EXHIBIT VI-8

**Systems Software Products
User Expenditures, 1991-1996**

CAGR
(Percent)

Total — 18.1 / 31.7 — 12

Applications
Development Tools — 7.2 / 12.7 — 12

Systems
Control Products — 6.8 / 11.1 — 10

⊠ 1991
☑ 1996

Operations
Management Tools — 4.1 / 7.9 — 14

0   10   20   30   40

User Expenditures ($ Billions)

The fastest growing submode will be operations management tools, which encompass network administration and control products. The trend towards multiplatform, multivendor networks and network integration will fuel this growth.

Even though UNIX's share of the total systems software market will remain relatively small, the U.S. market for UNIX-related systems software is growing almost twice as fast as the systems software market as a whole (Exhibit VI-9).

EXHIBIT VI-9
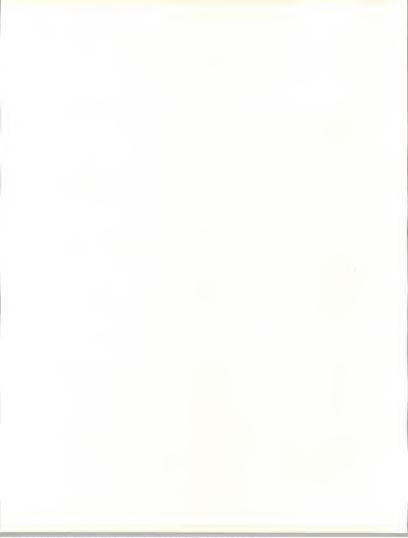
UNIX Share of Systems Software Products Market by Software Type, 1991-1996

| | $ Billions | | | | | | 1991-1996 CAGR | |
| | 1991 | | | 1996 | | | | |
	UNIX	Total	% UNIX	UNIX	Total	% UNIX	UNIX	Total
Systems Control	.7	6.8	10	1.7	11.1	15	20	10
Application Development	.6	7.2	8	1.8	12.7	14	25	12
Operations Management	.2	4.1	5	1.1	7.9	14	41	14
Total	1.5	18.1	8	4.6	31.7	15	25	12

The U.S. market for UNIX systems software is forecast to reach $4.6 billion by 1996. The CAGR of 25% compares with a forecast of only 12% CAGR for the whole systems software market.
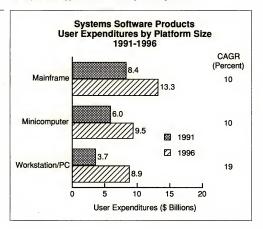
UNIX systems control products, the largest submode in 1991, will be surpassed by slightly faster growth for UNIX-based applications development tools, including RDBMSs. The predominant UNIX systems control product is operating systems, and very little exists at this point in the way of UNIX network control or other supervisory programs. Operations management products are just beginning to appear. Applications development products for UNIX will continue to show strong growth as vendors continue to enter the market with products ranging from RDBMS tools to integrated CASE.

Exhibit VI-10 provides INPUT's forecast of systems software products by platform size. As would be expected, the bulk of expenditures are for systems software products that run on mainframes, in large part because of the generally greater per-unit software product expenditure on mainframes.

With the downsizing trend, and also due to continually increasing prices, mainframe-based expenditures will still continue to increase, especially for products that enhance efficiency. Mainframes will continue to be used for large OLTP applications and as large data repositories.

EXHIBIT VI-10

Systems Software Products
User Expenditures by Platform Size
1991-1996

CAGR
(Percent)

Platform		CAGR (Percent)
Mainframe	8.4 / 13.3	10
Minicomputer	6.0 / 9.5	10
Workstation/PC	3.7 / 8.9	19

▨ 1991
▨ 1996

0   5   10   15   20
User Expenditures ($ Billions)
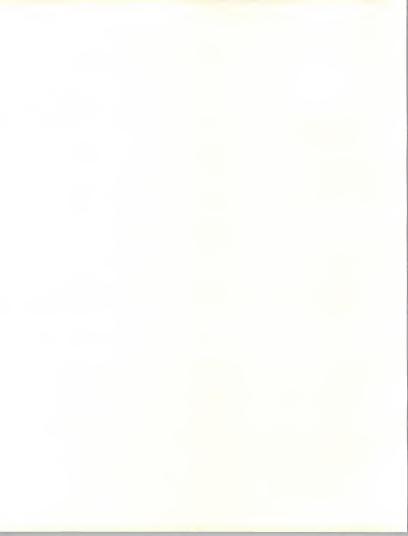
Vendors are beginning to introduce systems control and operations management products for minicomputers. UNIX will eventually gain momentum both at the workstation/PC and minicomputer level.

A noticeable shift is underway toward operations management and applications development tools that run on workstations and personal computers; systems control products are more heavily entrenched on the mainframe because of the high mainframe-based operating systems licensing fees. Graphical user interfaces (GUIs) will enhance the migration of software to the PC level.

By 1996, user expenditures on systems software for workstations and personal computers will have increased to $8.9 billion; expenditures will be just about equal for midrange computers and workstations/PCs.

B
Driving Forces

The key driving forces of the systems software market are listed in Exhibit VI-11 and described in this section.

EXHIBIT VI-11

Systems Software Products Driving Forces

- Slowed economy

- Downsizing and client/server

- UNIX and software frameworks

- Integration/Interoperability efforts

- Emphasis on solutions

All of these driving forces act as growth promoters and as inhibitors to varying degrees and during different timeframes. In this section INPUT describes the timing of each driving force and discusses whether it is an inhibitor or a promoter. These fundamental assumptions drive INPUT's systems software products forecasts.

1. Slowed Economy

Exhibit VI-12 provides the economic assumptions used in developing 1991-1996 U.S. information services market forecasts. As with the 1990-1995 forecasts , INPUT has again used the CONSENSUS[TM] economic forecast published by Blue Chip Economic Indicators.

This economic forecast, when compared to that of the previous year, reflects the impacts of the late 1990 recession on the U.S. economy.

- Nominal growth and inflation in 1990 were less than forecasted, with Real GNP growth of less than 1%.

- The primary effect of the recession is being felt in 1991, where Real GNP growth will be close to zero and with controlled inflation will result in a Nominal GNP growth of less than 4% or about 1.5% less than projected one year ago.

• U.S. economic growth is projected in the CONSENSUS forecast to average about 2.5% Real GNP growth per year from 1992 through 1996, with inflation (GNP Deflator) under 4% and Nominal GNP growth averaging just above 6%.

EXHIBIT VI-12

U.S. GNP and Inflation Growth Assumptions
1990-1991 (Percent)

1990 Report Assumptions*

Overall Economy	1990E	1991E	1992E	1993E	1994E	1995E	1996E
Nominal GNP	5.4	5.4	6.7	6.7	6.7	6.5	6.4
GNP Deflator	4.4	4.6	4.1	4.0	4.0	3.9	3.8
Real GNP	1.0	0.8	2.6	2.7	2.7	2.5	2.6

1991 Report Assumptions**
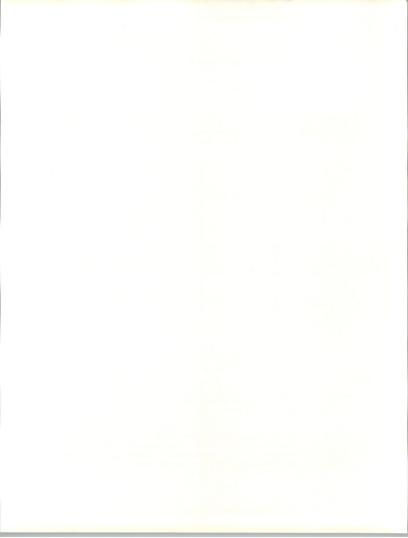
Overall Economy	1990A	1991E	1992E	1993E	1994E	1995E	1996E
Nominal GNP	5.0	3.8	6.3	6.7	6.5	6.0	6.2
GNP Deflator	4.1	3.9	3.6	3.9	3.9	3.8	3.7
Real GNP	0.9	(0.1)	2.7	2.8	2.6	2.2	2.5

Source: CONSENSUS™ Forecast, Blue Chip Economic Indicators

*   Blue Chip Economic Indicators - Vol. 15, No. 10, October 10, 1990

** Blue Chip Economic Indicators - 1991-1992 from Vol. 16, No. 7, July 10, 1990
                                         - 1993-1996 form Vol. 16, No. 3, March 10, 1990

The impact on INPUT forecasts in general is to continue the more modest growth rates forecasted in 1990 into 1991 and 1992. Though the impact varies by delivery mode, the recession is lingering into the second half of 1991 and INPUT does not see a quick recovery for information services spending.

• It is likely that most 1992 information systems budgets will be developed under the current economic pressures and will reflect spending constraints for 1992. The existence of budget constraints may slow spending increases even if recovery comes sooner.

- Beyond 1992, INPUT believes a gradual improvement in growth rates will develop. The growth rates in the later part of the forecast period may actually be driven more by such trends as the acceptance of outsourcing and client/server technology than by improvements in the economy.

Even though downsized solutions running on workstations and personal computers provide compelling price/performance advantages, purchases of computers—including smaller platforms—are down. What negatively impacts hardware shipments will also negatively impact new purchases of both applications and systems software products.

INPUT's user surveys asked questions regarding purchase plans for both applications software and systems software products. The results indicated that 1992 purchases of applications software products would be up by 24%, and in fact respondents indicated that selective installation of new applications software products—including downsized solutions—is viewed as a means of minimizing corporate costs and improving productivity. Thus an economic slowdown could be a promoter rather than an inhibitor of applications software products expenditures.
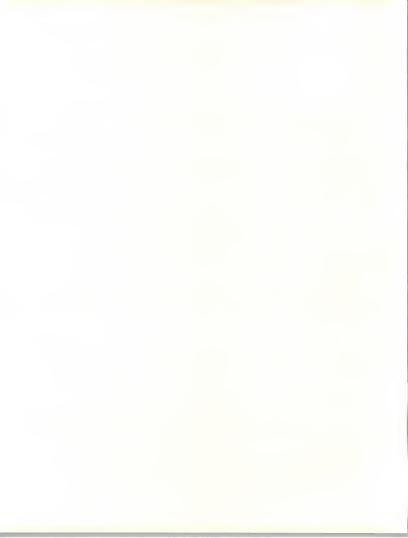
According to the survey sample, systems software products budgets on the other hand will be up only 15% in 1992, considerably less than applications software budgets. Part of the reason may be the economic climate, as most areas of IS spending are restricted.

2. Downsizing and Client/Server

Offloading the mainframe is gathering steam. As indicated in Chapter IV of this report, 43% of INPUT survey respondents have already offloaded or are planning to offload some of the workload from the primary CPU during the next 18 months.

Downsizing requires smaller platforms, many of which are already in place, and new or rewritten applications software products. It does not, however, require client/server frameworks; nor does it, in its elemental form, require a lot of new systems software. Though survey respondents indicated that client/server implementation is being considered, little implementation has yet taken place.

One could argue that downsizing is a software products growth inhibitor. Users' expectations are that products that run on smaller platforms will have smaller price tags than software products for mainframes. Thus it is unclear that lower priced platforms can sustain high priced software. However, there are indications that the pricing structure of much of systems software will change from platform- to user-based. It is unclear what, if any, impact this will have on the user expenditure forecasts.

One could also argue that downsizing will open up the systems software market to all sorts of new product needs and opportunities. The kinds of systems software products that reside on mainframes will become increasingly necessary in some fashion on minicomputers, workstations and personal computers.

INPUT believes that the latter argument will overshadow the effects of the first argument, and that downsizing and client/server models will be long-term growth promoters. In addition, INPUT takes the position that, even though applications will increasingly be offloaded from the mainframe, mainframes will not go away and in fact will get bigger. Their role will change to that of corporate data repositories, and applications will be predominantly very large transaction processing functions. As the mainframes get bigger, systems software products will continue to increase in price.

3. UNIX and Software Frameworks

UNIX implementation over the next several years is an IS objective for 32% of INPUT survey respondents; implementation of software frameworks such as SAA, NAS or CA90s is an objective for only 20% of respondents.

Because UNIX and software frameworks are still in such a formulative stage on the vendor side, on the user side they are causing more confusion than anything else; therefore so-called standards inhibit growth of systems software expenditures in the short term. One can't help but think that, over the long term—and perhaps as early as 1994—standards will start to become a growth promoter; there will be rules to follow and therefore more people will want to play.

The questions that need to be asked include:

• When will frameworks such as SAA and NAS, and open systems become growth promoters rather than confusion promoters?

• How fast will UNIX really be adopted?

INPUT's research earlier this year concluded that by 1996 UNIX would still only account for a relatively small percentage of usr expenditures on systems software. INPUT estimated that the UNIX share of the total spent on systems software in 1991 is 8%, and that this share would only grow to 15% of the total by 1996. Adoption of software frameworks will clearly be a slow evolution as well.

4. Integration/Interoperability

As indicated in Chapter IV, LAN and network integration is the single most important IS objective over the next several years. Thus, products and services that enhance multivendor and multiplatform computing solutions will be widely popular. And in fact, interoperability—of which LAN and networking solutions are a major part—will drive the use of other systems software products such as distributed DBMSs, client/server and cooperative processing models.

Yet as indicated in Chapter V, integration and interoperability solutions remain elusive. With some 20 DOS networks alone, integrating and administering an enterprise solution becomes incredibly complex. Answers will, again, come in an evolutionary fashion. As new network management and control products become available they will be eagerly purchased, but this will take time.
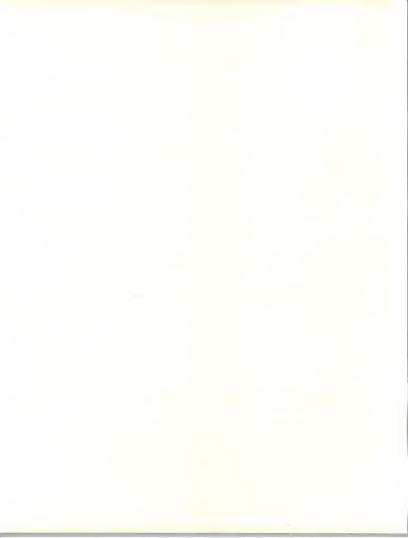
5. Emphasis on Solutions

Lower costs and improvement of overall productivity is cited as the key technology goal as it relates to applications software products; however, this goal is not among top systems software priorities. As applications software products are viewed as a way to lower costs, systems software is perhaps viewed more as a background support product necessary to run applications software.

However, due to the mass confusion caused by conflicting standards, new technology approaches, and various stages of product readiness, many users may view systems software as part of the problem rather than part of the solution. Thus it could be that applications software will drive systems software. Insofar as systems software can be viewed as part of the solution, its strong growth will be assured. This implies that systems software vendors will need to work closely with applications software products vendors from a marketing and sales perspective.

Users can and will continue to purchase existing (traditional) systems software as needed to run solutions. INPUT estimates that existing licenses and maintenance accounts for about 70% of overall systems software expenditures, leaving only 30% for new product purchases. At least half of these new product purchases will be for incremental additions to already existing ways of doing things, e.g., with no new technology content.

Users will be slow to adopt other kinds of new systems software products, not only because they will become available in an evolutionary fashion, but also because the marketplace is confused.
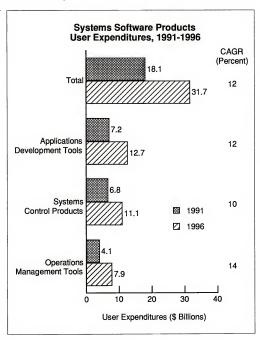
C
Submode Forecasts

In this section the forecast and specific driving forces/inhibitors for each of the submodes within systems software products are discussed. The forecast for each submode is presented for mainframe, minicomputer and PC/workstation categories.

Exhibit VI-8 is repeated here as VI-13 for reference.

EXHIBIT VI-13

Systems Software Products
User Expenditures, 1991-1996

	CAGR (Percent)
Total 18.1 / 31.7	12
Applications Development Tools 7.2 / 12.7	12
Systems Control Products 6.8 / 11.1	10
Operations Management Tools 4.1 / 7.9	14

⊠ 1991
▨ 1996

User Expenditures ($ Billions)

0   10   20   30   40

1. Systems Control Products

Systems control products are supervisory programs that provide automatic management and allocation of systems/network resources during the execution of applications programs. These products include operating systems, emulators, network control products such as NetView and NetMaster, library control, access control, and spoolers.

a. Overview

User expenditures for systems control products will grow from $6.8 billion in 1991 to $11.1 billion in 1996, representing a CAGR of 10%.

As the majority of expenditures for systems control products are for operating systems, and as new hardware units are at a low shipment rate, this will depress overall growth for this submode. Most of growth is maintenance of existing systems control products due to price increases. Proprietary operating systems will grow at the rate of price increases plus a small increase for new installations.

There are, however, several bright spots in systems control products expenditures:

- As indicated previously, expenditures on UNIX systems control products are growing at twice the rate of expenditures on systems control products as a whole. The fact that Sun is making its UNIX operating system available to Intel-based platforms is an indication of vendors' intentions to broaden the appeal of UNIX.

- Major opportunities exist to provide systems control products such as security systems, access control products and configuration managers for smaller platforms. Mainframe-based systems control products are finely tuned; however, product sophistication is lacking at the midrange and workstation/PC levels simply because the markets for these products are newer.

- A major opportunity also awaits vendors of network control software, since users will be dramatically changing the way in which they handle information. Whereas in the past the rapid spread of new personal computers was driven by the arrival of new spreadsheet and word processing packages, now organizations are beginning to seek the benefits of collaborative work and sharing of common data bases.

b. Systems Control Products User Expenditures by Platform Size

Exhibit VI-14 shows user expenditures for systems control products by platform size.

EXHIBIT VI-14

Systems Control Products
User Expenditures by Platform Size
1991-1996

CAGR
(Percent)

Total
6.8
11.1
   10

Mainframe
3.0
4.4
   8

Minicomputer
2.2
3.5
   10

▨ 1991
▨ 1996

PC/Workstation
1.6
3.2
   15

0   5   10   15   20
User Expenditures ($ Billions)
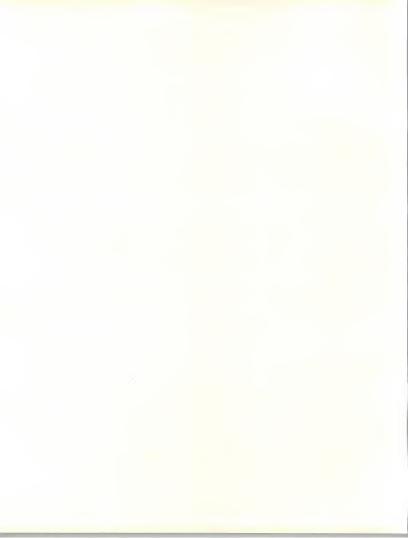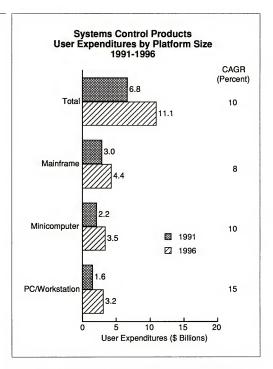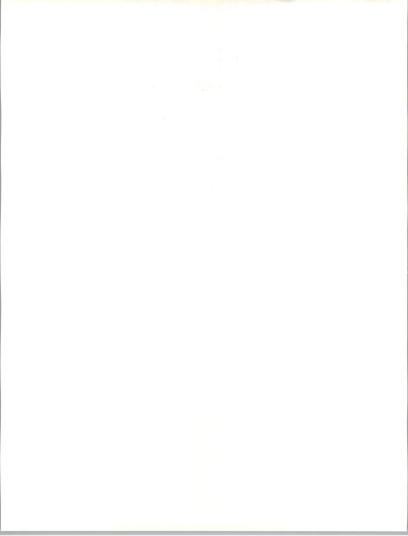
The mainframe portion of the systems control market is projected to grow at a CAGR of 8% over the next five years to reach $4.4 billion by 1996.

Growth will be limited, as mainframe unit shipments are low. This inhibiting effect, nonetheless, will be countered by continuous price increases of existing software. This forecast is based on the assumption that the mainframe will not go away; it will in fact will get larger.

The most significant recent development for mainframe-based systems control software is the announcement of IBM's Enterprise Systems Architecture (ESA), the new version of MVS. With this development, IBM is aiming to overcome virtual storage constraints and solve the problem of overloaded I/O channels.

Over the next five years, IBM mainframe customers are expected to adopt ESA as a standard, since conversion is not expected to be particularly difficult. Labor saving advantages of ESA include automatic disk storage management.

The minicomputer portion of the systems control market is projected to grow from $2.2 billion in 1991 to $3.5 billion in 1996, at a CAGR of 10%.

Minicomputer platform sales have leveled off. Even with the continuing shortfalls in revenues in most minicomputer companies, INPUT does not expect price discounting and bundling of software to put a long-term restriction on user expenditure growth for systems control software for this platform size. Minicomputer vendors will increasingly view software as an important revenue source by itself, and therefore will enhance it and charge for it. DEC's strategy for its UNIX operating system, for example, is to integrate the OSF/1 operating kernel into Ultrix and at the same time emphasize value-added features above the operating system level.

The workstation/PC portion of systems control products will grow from 24% of the total systems control market in 1991 to 29% of the total systems control market in 1996. Expenditures will grow from $1.6 billion in 1991 to $3.2 billion in 1996, at a CAGR of 15%.

This forecast reflects not only the continued growth in workstation/PC unit shipments (albeit temporarily depressed) but also the anticipated strong growth of more expensive operating systems including OS/2 and, by the end of the forecast period, Microsoft's NT operating system as well as the Apple/IBM operating system. GUIs for this platform size will also continue to exhibit strong growth. UNIX and these other multiuser systems are not expected to replace DOS on a large scale, as many users will remain satisfied with PCs as personal productivity tools.

2. Operations Management Tools

Operations management tools are used by operations personnel to manage the computer and/or network resources and personnel more effectively. At the high end, this category includes mainframe job scheduling and accounting systems, disk/tape library systems, performance monitoring/tuning systems, etc. At the level of workstations and PCs, this category currently includes programs such as disk management utilities.

Operations management tools also include DBMS utilities which manage, control and audit data maintained in data bases; DBMS utilities serve functions ranging from security and formatting of data to usage accounting and tuning of applications programs and data base design.

The key distinction between systems control products and operations management tools lies in who is managing what, and within what timeframe. Systems control products are used by the system for real-time self management, with thousands of transactions/decisions being made per second. Operations management tools provide manually directed, macro-level management of resources, with input transactions/decisions measured in tens or hundreds per hour for a large mainframe system.

a. Overview

The operations management tool market, the smallest of the three systems software submodes, will grow from $4.1 billion in 1991 to $7.9 billion in 1996, a CAGR of 14%. Vendors active in this arena include Boole & Babbage, Candle, Goal, Legent and Systems Center, as well as the large vendors Computer Associates and Microsoft.

Operations management is not a new market, having been in existence since the advent of the mainframe. However, the complexity of managing a data center has grown exponentially with the increasing numbers and varieties of computers, terminals and users; the task is especially growing in complexity because of the need to combine different operating systems, data bases and networks. This need is for new and different tools than in the past. Growth is also driven by the fact that applications are becoming more critical to organizations; errors and systems outages are becoming increasingly unacceptable.

An important growth area will be LAN and inter-LAN-based monitoring and control. Earlier generations of LAN operating systems products did not have strong network management capabilities. More sophisticated products, with built-in problem solving capabilities that can monitor remote data centers and networks at one central automated control site, will be provided in the future.

Other growth areas are:

- UNIX-based systems management products—INPUT believes that UNIX-based operations management products account for only 5% of total expenditures on operations management products in 1991. This percentage is expected to increase to about 14% by 1996.

  Market needs that must be addressed by operations management tool vendors as they begin to provide UNIX products include:

- Network reporting and management products on the market today are functionally limited to networks in the 200- to 300-node range, which is one reason users are not adopting UNIX en masse for enterprisewide solutions.

- Few if any configuration management tools exist for UNIX.

- Performance monitoring and capacity management tools do not exist for UNIX.

• Another growth driver for operations management tools is the increased activity by IBM on SystemView and the increased backing of SystemView by third-party vendors. Endorsement in the user community, however, will depend on how well IBM can explain SAA and SystemView to its customers.

In the short term, growth of operations management expenditures will be inhibited by vendors' ability to develop and provide product to the marketplace. Many of the leading operations management software vendors are all relatively small, with revenues in the $150 million to $200 million range. These companies will be incurring heavy development expenditures in the years to come. Multivendor operations management products are complex and present technology development issues that will take years to unravel.
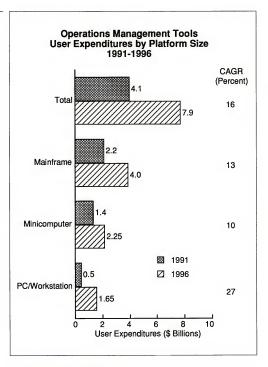
b. Operations Management Tools by Platform Size

The most extensive use of operations management tools is in the mainframe sector. Over 50% of end user expenditures in 1991 will be for mainframe-based products, a fact that reflects not only the generally greater per-unit software product expenditure on mainframes but also Digital's inclusion of such aids within the operating system license on minicomputer systems, in contrast to non-provision by IBM on mainframes.

This market is expected to grow from $2.2 billion in 1991 to $4.0 billion in 1996, a CAGR of 13%, as shown in Exhibit VI-15.

EXHIBIT VI-15

Operations Management Tools
User Expenditures by Platform Size
1991-1996

Users will continue to invest in operations management tools to improve utilization of existing capacity.

• Products that are particularly appealing, even in the sluggish economy, are those that improve the operation of large mainframe systems such as large data base utilities and network performance monitors.

- Users will continue to invest in operations management tools for "lights out" computer centers. Complexities of the data center environment continue to increase as does a shortage of skilled employees, and perceived need persists to address these problems with a lower cost automated solution.

The minicomputer market for operations management tools is projected to expand from $1.4 billion to $2.3 billion by 1996, a CAGR of 10%. As minicomputers become more integrated into networks, and begin to take on the role of servers, more attention will be paid to managing their capacity. Although vendor activity in this arena is not as aggressive as it is for the other two platform sizes, we can expect to see vendors providing additional products for this platform as users continue to demand them.

User expenditures will grow from $500 million in 1991 to $1.7 billion by 1996, a CAGR of 27%. Thus the workstation/PC portion will grow from 12% of total operations management tool market in 1991 to just over 20% in 1996.

- Critical corporate data on workstations will require all of the same types of operations management products that are now available for mainframes.

- Products for this environment include network management software and resource management software. The new, larger machines have bigger disk drives and may be multiuser; a much higher percentage of them have some utilities management.

- Once client/server applications become common, then reasonably higher priced operations management tools supporting workstations and PCs will become more common. Also, existing mainframe tools are beginning to have PC front-end versions with GUIs promoting their ease of use.

- SAA and SystemView will also have eventual positive effects.

3. Applications Development Tools

Applications development tools are used by system developers to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base management systems, CASE tools and other development productivity aids.

Data base management systems are considered systems software because they are normally used to develop applications programs. Though it is possible for individual users to develop personal productivity applications using products like dBase, this is not the general pattern with data base management systems, even on the PC. By contrast, spreadsheets—
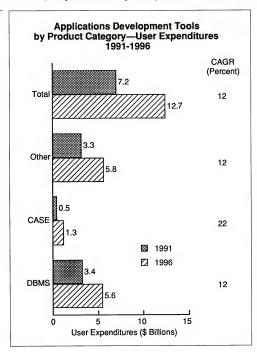
whether implemented on a mainframe or on a PC—are more typically used as personal productivity tools or planning and analysis tools than for developing "applications" as commonly defined.

a. Overview

User expenditures for application development tools are expected to grow from $7.2 billion in 1991 to $12.7 billion in 1996, a CAGR of 12% (Exhibit VI-16), compared to INPUT's previously forecasted 14% CAGR.

EXHIBIT VI-16

**Applications Development Tools
by Product Category—User Expenditures
1991-1996**

CAGR
(Percent)

Total — 7.2 / 12.7 — 12

Other — 3.3 / 5.8 — 12

CASE — 0.5 / 1.3 — 22

▨ 1991
▨ 1996

DBMS — 3.4 / 5.6 — 12

0   5   10   15
User Expenditures ($ Billions)

Applications development tools is the largest submode, accounting for 40% of total user expenditures on systems software products in 1991. Applications development backlogs, compounded by the need to maintain and re-engineer existing software products, are continuing to drive this market. Also driving this market is the increasing complexity of software product development requirements.

Backlog and software complexity are fostering increasing interest within the software development community for the newer generations of applications development tools, including CASE, expert systems programming environments for embedding knowledge-based solutions into traditional data processing applications, and 4GL/DBMS/data query languages and utilities.

Growth will accelerate as standards such as AD/Cycle emerge. AD/Cycle will enhance growth of CASE, because at present, few truly integrated CASE solutions are available, and it is difficult to integrate various tools from different vendors. But AD/Cycle will not be a growth promoter until the 1994-1995 time period.

During the next several years users and vendors alike must sort out how all these various tools—relational, 3GL, 4GL, and traditional DBMSs, CASE, and object-oriented programming—will co-exist. A fundamental and primary education process is needed.

b. Applications Development Tools User Expenditures by Platform Size
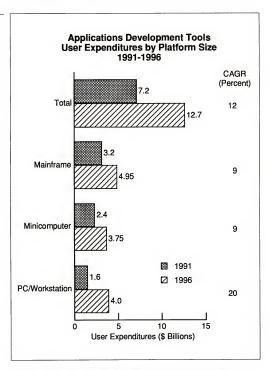
Exhibit VI-17 reflects:

- The mainframe market for applications development tools is projected to show a five-year CAGR of 9%. Much of the back-end development in CASE is currently being done and will continue to be done on mainframes. The IBM MVS/Repository CASE product should also be a plus in using mainframes for I-CASE solutions.

- The growth in the market for minicomputer-based applications development tools is based upon the assumption that the minicomputer will become a major platform of choice in the server portion of the client/server distributed processing model and the anticipated expansion of the use of 4GLs such as FOCUS, Powerhouse and Mantic for applications utilizing multivendor data base access. In addition, several proposed CASE solutions (including DEC's CDD/Plus and IBM's AD/Cycle) will utilize the VAX/VMS and AS/400 platforms.

- The market for the workstation/PC sector is projected to grow twice as fast as for the other equipment platforms. This growth reflects a trend in CASE technology toward workstation/PC-based application development with front-end design/prototype activities as well as appli-

cation code generation performed on the workstation. It also reflects
continuing—albeit slowing—growth of DBMSs for this platform size.
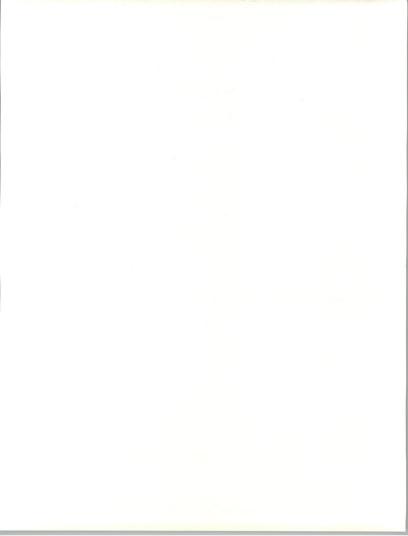
EXHIBIT VI-17

**Applications Development Tools
User Expenditures by Platform Size
1991-1996**

CAGR
(Percent)

Total	7.2	12
	12.7	
Mainframe	3.2	9
	4.95	
Minicomputer	2.4	9
	3.75	
PC/Workstation	1.6	20
	4.0	

▨ 1991
☑ 1996

0   5   10   15
User Expenditures ($ Billions)

• 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 products vendors such as

Ashton-Tate and Microsoft. The trend to client/server models will facilitate the trend towards the workstation/PC platforms for applications development. Applications development for IBM's SAA environment will also be able to more effectively utilize workstations/PCs as development platforms, because of the portability of the architecture.

c. DBMS Forecast

INPUT is adjusting its DBMS forecast downwards again this year from a 14% to 12% five-year CAGR. INPUT forecasts that the DBMS market will grow from user expenditures of $3.4 billion in 1991 to $5.6 billion in 1996. Although short-term issues need to be resolved, INPUT nonetheless believes that the DBMS market will experience strong growth through the 1990s.

Traditional flat-file DBMSs still account for over 50% of user expenditures. These products need to be maintained but they are not going onto new hardware; thus their share of the total is declining.

The market for relational DBMS products is becoming saturated, especially at the mainframe level where DB2 commands a large presence. Greater opportunities exist in the midrange market and in the workstation/PC environment.

Market drivers include:

- As is true with CASE, a lot of RDBMS products have been shipped and now users need to learn how to take advantage of the technology. This is causing vendors expend their RDBMS tool product offerings.

  The increasing availability of easy-to-use RDBMS tools will foster growth in the overall RDBMS market. In fact, over the next several years, the tools portion of the RDBMS market will grow at about twice the speed of the RDBMS portion itself. Users, however, need to gain experience with these development tools.

- RDBMS vendors are moving aggressively into UNIX and client/server models. But this is a small portion of the total and UNIX and client/server technology have yet to be fully endorsed by the user community.

- Better and more distributed data base capabilities will be a growth promoter but not until the latter part of the forecast period. In addition, as client/server technology catches on, the desirability of accessing portions of a single data base that reside on several different platforms will skyrocket. Tools that work over a network to enable interoperation, such as Ingres' Star product, are beginning to appear. More will be forthcoming.

- IBM's Information Warehouse initiative will also be a growth promoter but this new aspect of SAA will not have an impact until 1993 or beyond.

- It does not appear that RDBMS bundling—for example, all DEC VAX machines currently go out with bundled Rdb and its UNIX platforms go out with bundled Ingres RDBMSs—will be a widespread practice; there does not appear to be long-term advantage to a third-party RDBMS vendor. And users will demand choice of software for their equipment. Therefore, INPUT does not expect bundling to be a growth inhibitor.

d. CASE Forecast

CASE began to attract significant attention in the mid-1980s with the common use of personal computers and the development of powerful workstation technology. Since then it has developed into a $450 million market (1991). Growth is forecast at 22% CAGR to reach $1,260 million by 1996.
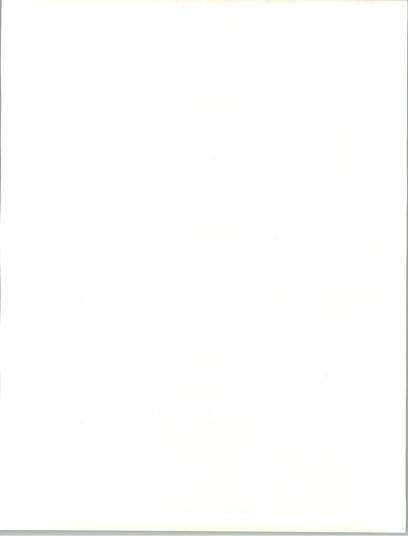
In 1991, about one-third of application development efforts could use CASE tools. By 1996, the potential for CASE will have almost doubled. The greatest need and opportunity will be in the re-engineering area, but this area will not begin to grow substantially until later in this forecast period.

The CASE market's growth will be heavily affected by the following:

- Near-term (1991-1993) considerations will be heavily influenced by organizational readiness. IS organizations that invested heavily in CASE in the late 1980s now have to learn to use it effectively. Continued strong growth is dependent on organizations' willingness to revamp their structures and accept new technology.

  A lot of people still don't believe CASE tools work. A lot of primary selling needs to be done. Market expansion in large part depends on how successful vendors are in primary selling.

- Much hinges on systems integration and professional services companies' ability to provide the necessary assistance.

- Strong growth will be promoted by the support of and product offerings from large systems vendors. The market leaders to date are relatively small—for example, KnowledgeWare's worldwide 1990 revenues were $66.2 million. To provide a viable large revenue stream, CASE must, and will, be supported by large systems and software vendors. IBM is not among the top CASE vendors yet, even though four of the six CASE companies in which IBM has made an investment are among the leaders.

- In the late 1980s, DEC began to offer an increasingly full and sophis-
  ticated set of application building tools. In the summer of 1990, DEC
  announced the future direction of its dictionary product, CDD+.
  CDD+ was announced as being the basis for a repository architecture.
  At the same time, the entire concept was renamed Cohesion. Besides
  being a respository product functionally analogous with AD/Cycle,
  Cohesion would ultimately run on non-VAX platforms (UNIX, OS/2,
  and perhaps others).

- The multitude of CASE tools, in addition to suffering from credibility
  problems, creates a very confusing set of choices for would-be buyers.
  Consolidation is badly needed; AD/Cycle will help.

- AD/Cycle is generating added interest in CASE but will not be a strong
  growth factor for CASE until at least 1993. The role of the repository in
  CASE remains relatively undefined and certainly underdeveloped.
  Uncertainty in the short term will give IS organizations a reason to delay
  CASE evolution. AD/Cycle has been welcomed by both users and
  vendors as offering a potentially fully integrated tool that will serve as a
  de facto standard in the business application market.

- In the near term, CASE technical issues are not serious barriers to
  progress. INPUT has been impressed with the recent progress made in
  the underlying CASE technology generally (i.e., not limited to AD/
  Cycle). These technology improvements will encourage user organiza-
  tions to take CASE more seriously.

- Medium-term (1994-1996) growth will be greatly influenced by devel-
  opments in re-engineering techniques.
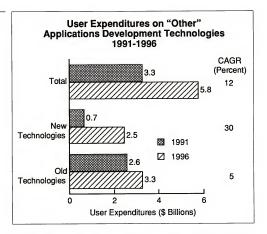
Front-end CASE tools are primarily PC- and workstation-based; back-end
tools are mainframe- or central processor-based. The push in CASE will
remain workstation-oriented. As the power of the workstation grows and
the use of CASE technology, including co-generators, becomes more
graphical in its orientation, the workstation will become the primary
hardware for the systems development process.

e. Other Applications Development Technologies

User expenditures on other applications development products will grow
from $3.3 billion in 1991 to $5.8 billion in 1996, a CAGR of 12%. Old
technologies account for the majority of these expenditures (Exhibit
IV-18).

EXHIBIT VI-18

User Expenditures on "Other" Applications Development Technologies 1991-1996

CAGR (Percent)

	1991	1996	CAGR (Percent)
Total	3.3	5.8	12
New Technologies	0.7	2.5	30
Old Technologies	2.6	3.3	5

▨ 1991
▧ 1996

User Expenditures ($ Billions)
0   2   4   6
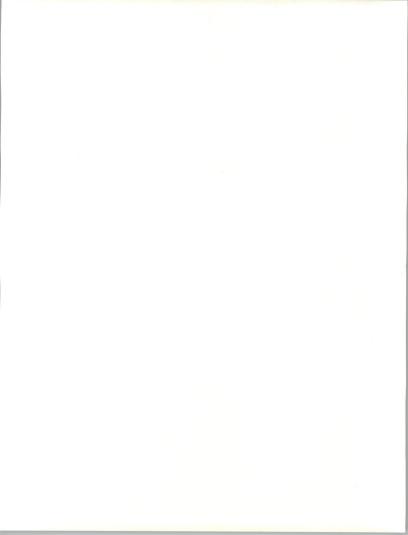
Old technologies include 3GL and support products. A big market, driven by hardware, it is growing slowly at a 5% CAGR. 4GL is an add-on and is highly penetrated with modest new growth.

3GLs resulted from the need to improve productivity at a time when the price/performance of computers was rapidly falling and the human element became the most significant factor in development costs. It is this need to increase productivity that has given rise to the development of subsequent 4GLs and CASE tools. In the late 1960s, 120 or more 3GLs were in existence, but few of these have survived into the 1990s.

The market for 4GLs is following a similar pattern to that for 3GLs: there is initial rapid growth and a multitude of vendors entering the market, followed by a period of consolidation in which the number of vendors falls significantly and growth rates decline.

4GLs brought with them new concepts such as prototype and end-user computing. Heralded as another means of ending the application development backlog, it was claimed that productivity gains of five to ten times could be achieved over the use of 3GLs. The result was that the market grew from a handful of products in the early 1980s to several hundred. Just as the market for third-generation languages consolidated to a few products, so the market for 4GLs is likely to do.

                                           MASSP

New technologies include knowledge-based systems, voice recognition and image processing document management/multimedia applications, and object-oriented DBMS.

The strong growth in product licensing activity and revenue growth exhibited by third-generation expert systems applications development tool vendors, such as Auto Corp., Neuron Data, AI Corp., and Inference Corp., suggests that a healthy market is emerging. Nonetheless, commercial packaged software is still in a very early state of adoption. The real opportunity is in embedding expert systems in new products.

Whereas relational and object-oriented data bases offer flexibility, applications based on the latter are claimed to be easier to maintain because so much of the software can be reused. Though object-oriented programming currently occupies a very small part of the market, there is an identifiable trend towards objected-oriented programming languages.

Since maintenance absorbs so much of the cost of human resources, there are clear advantages over relational types. Moreover, it is claimed that object-oriented technology addresses the major problem of reliability.
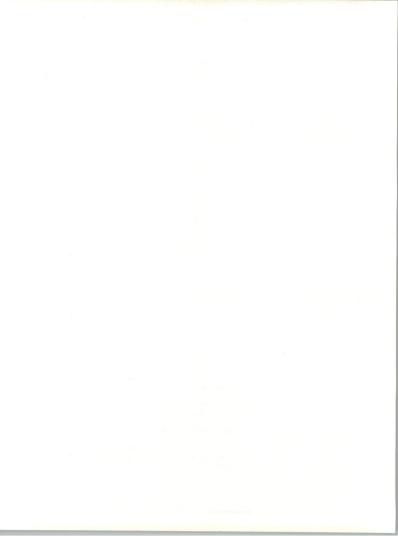
The challenge for data base suppliers, therefore, is to match this market potential. Ingres and Software AG have made a move to market object-oriented systems, and a number of smaller vendors, such as Servio Logic, have also entered the fray. Object-oriented DBMS tools are achieving a modest level of commercial recognition and experimentation; however it will be a number of years before they gain a significant share of the DBMS market.

As a complete language technology, object-oriented programming was first introduced by Xerox, with its Smalltalk product. AT&T added object-oriented features to C to create C++. Smalltalk and C++ are now the dominant object-oriented languages.

Borland and IBM recently signed an agreement whereby Borland will develop specific object-oriented programming languages and development tools for IBM's OS/2 version 2.0. Borland's Objectvision programming tool for OS/2 will be the first product released under the agreement.

Voice recognition is still an emerging technology, and the more advanced speaker-independent recognition (SIR) systems with large vocabulary capabilities are still in the R&D phase. SIR systems are those in which individual speakers do not have to have their voices trained for the system.

A basic current use of speaker-dependent voice recognition products is on the factory floor. However, such computer products can usually only distinguish a rather limited number of words, which must be spoken in a somewhat rigid and predefined syntax. In an industry setting, assembly-

line workers use such systems for logging quality-control or materials-tracking information by voice, which allows them to use their hands for manual tasks.

The major breakthrough for voice recognition—the cross-industry, natural speech product for continuous voice processing (the dictation machine)—is still elusive. This product requires the computer modeling of the entire English language and much more powerful personal computing capability than presently exists on desktop computer platforms. However, rapidly decreasing storage and CPU MIPS costs could help make this a realistic commercial product by the mid-1990s. Another advanced voice recognition product concept is simultaneous language translation.

Some of the principal benefits of LANs in the office environment to date have been E-mail distribution and file sharing. Over the past several years, E-mail technology has been increasingly incorporated into other applications as part of an electronic messaging capability, such as the areas of document generation/management and report distribution and annotation, particularly in the engineering design (CAD) environment and for document preparation and electronic publishing.

Increasingly, multifunction desktop products, such as NewWave from Hewlett-Packard, All-in-1 from DEC, the Wang OFFICE/Freestyle system, Odesta's Management Systems (ODMS), and IBM's OfficeVision are combining document management and workflow functionality.

Many of the leading integrated office product vendors are also providing enabling technologies for third-party vendors to add multimedia applications to their network-based products. This is done through the publication of programming interfaces for creating compound document applications, such as those using image and graphics capabilities. The next stage of multimedia integration will involve the ability to transmit multimedia applications on a cost-effective basis on a LAN-to-WAN inter-networking system. This will require multivendor software and hardware support for the emerging OSI/ISDN standards.

Image processing is also emerging, providing image-based solutions to particular vertical markets. This trend changes the industry's initial product, which was based more on selling hardware systems and applications development tools for internal product development as part of a computer systems hardware or systems integration solution.

A number of independent software developers/VARs have emerged over the past two years that provide customizable image processing applications for various vertical markets. In addition, product marketing has been increasingly focused on document management handling/workflow improvement capabilities through network-based image processing systems.

VII

Competitive Environment

A
Competitor Trends

1. Large Systems and Software Vendors Will Dominate

Large systems and software vendors will increase their market shares because they are the only ones that can drive standards. Other medium-sized and small companies must sooner or later follow.

As hardware sales continue their decline, equipment vendors will gradually transfer more attention to software.

• DEC's Software Products Group was created last year.

• Sun Microsystems spun off its software business and created Sun Software, Inc. Its first product is ToolTalk, which allows interapplication communications on a heterogeneous network. Sun Software's mission is to offer Sun software on other RISC and Intel-based platforms. Sun will make all of its software available for license.

• IBM's stated goal is, by the year 2000, to obtain 50% of its revenues from selling software and services. Software and services contributed $23 billion of IBM's $69 billion in 1990 revenues. Revenues from both systems and applications software products grew from 10% of sales in 1986 to 14% last year.

The thousands of smaller systems software companies face the potential problem of undercapitalization, as they must not only constantly develop new products, but also incur additional ongoing expenses. The kinds of challenges they face, all of which are expensive, include:

• Compliance with standards

• Integration/interoperability issues

- Provision of strong service and support

- Expansion of customer base/geographic presence. An international
  presence will become increasingly important to stay in the market.

Many companies are expected to go public and seek external funding.
Cognos, for example, completed a 2.6 million-share offering in May and
several months later negotiated for a $12 million infusion of equity fund-
ing. Others will participate in technology and marketing alliances and/or
be acquired.

2. Acquisitions and Alliances

As is true in the applications software products industry, the trend towards
standards and integration will continue to cause industrywide consolida-
tion in systems software products. A number of significant acquisitions
have taken place in the 1990-1991 timeframe. In fact, only about two
dozen independent systems software product companies of significant
size—$50 million or above—are left.

Examples of acquisition/merger activity are:

- AT&T acquired NCR.

- ASK acquired Ingres. ASK more than doubled its number of employees
  with its acquisition of Ingres. The company received $30 million in
  equity funding from EDS and Hewlett-Packard for the venture.

- CASE vendor Cadre Technologies acquired start-up DB Software,
  which is developing a line of data base tools.

- Compuware purchased Century Software and XA Systems Corp., two
  companies that develop and manufacture programming tools geared to
  testing and maintaining applications running in conjunction with IBM's
  DB2.

- Computer Associates only acquired one company in 1990—DBMS, Inc.,
  provider of DBMS tools for CA-IDMS.

- In January 1991, Computer Associates acquired the Compete spread-
  sheet product from ManageWare.

- In August 1991, Computer Associates agreed to acquire On-Line Soft-
  ware and Pansophic. The company has stated that it is seeking more
  acquisition candidates.

- Goal Systems International expanded its portfolio with products developed by MVS Software, a major player in the mainframe automated operations market, and by two systems software suppliers, Tower Systems and Essential Software.

- IBM agreed to purchase Metaphor Computer Systems, a firm that is expected to play a large role in IBM's alliance with Apple Computer, Inc.

- KnowledgeWare acquired Language Technology, a reverse engineering vendor, for $6 million. KnowledgeWare has also acquired technologies from Quinsoft Corp. and UDM Technology, both of which have product development under way for generating client/server and cooperative processing applications.

- In August, KnowledgeWare agreed to acquire Intellicorp, an expert systems tools vendor for the UNIX environment. These acquisitions are indicative of the consolidation under way in the CASE product category.

- In July 1991, Novell agreed to acquire operating system developer Digital Research Inc. for about $81 million. This acquisition gives Novell the technology to blend system operating systems with network operating systems.

- In 1990, Systems Center purchased CinCom's NET/MASTER products, and purchased AS/400 software from IME Investments Ltd.; Systems Center sold its DB2 software business to On-Line Software in late 1990.

- Sage Software Inc. and Index Technology merged, forming a new entity to be called Intersolv, Inc. (March 1991).

- Sterling Systems Software Group purchased Canadian-based Asyst Technologies in early 1990

- Sybase acquired SQL Solutions.

- Symantec Corp. purchased Zortech, which specializes in compilers. Zortech is considered a leader in tools for use with the C++ programming language. Symantec has $116 million in revenues and Zortech's 1990 sales were $5 million.

In another interesting development, Oracle sold a minority stake—49%— of its Japanese subsidiary to Tokyo-based Nippon Steel. Under the terms of the agreement, Nippon Steel agreed not to purchase additional shares in Oracle for a 10-year period.

The number of alliances of various types will continue to explode in the years ahead. Alliances are not just the domain of smaller vendors, as these highly publicized alliances attest:

• Apple and IBM will collaborate on a new operating system for their next generation of workstations. They will create jointly owned subsidiaries to develop the operating system as well as to work on multimedia technology.

• IBM and Borland International signed an agreement calling for Borland to develop specific object-oriented programming languages and development tools for IBM's OS/2 version 2.0.

• In partnership with Hewlett-Packard, Computer Associates will develop system management products, DBMSs and applications software products that run under HP UX. CA will first migrate its systems management tools to HP-UX, with product rollouts scheduled for December of this year.

• Hewlett-Packard and Sun are jointly developing an object-oriented software environment for distributed, multivendor computing.

• IBM will continue to sign on business and development partners to promote its SAA components—AD/Cycle, SystemView and Information Warehouse.

3. Expansion of Services

In response to market need, and most especially to sell more product and generate more revenues, the services portion of both systems and applications software companies will continue to expand. Systems and applications software vendors will increasingly become partners with systems integrators.

As an example of the new emphasis on support services, Hewlett-Packard recently announced the creation of a new open systems support division, as well as the HP Professional Services Division, which will offer consulting services to users who need help with issues such as multivendor networking and migration to open systems. According to HP, its professional services business is growing between 20% and 30% per year.

4. Proposed Statement of Position on Revenue Recognition

The American Institute of Certified Public Accountants has published a position statement that would require software vendors to alter their current accounting practices. An area of debate is how and when to recognize revenue from license fees—when the sale is made or when the money is actually received. Additionally, all maintenance and SI revenue

would be recorded throughout the duration of a contract rather than in one up-front lump sum. Restating financials to conform to this position statement could impact net income of some companies by as much as 30%-50%. Companies with more aggressive growth in new license revenue would not be hit as hard.

INPUT does not anticipate that vendor restatement of financials will noticeably impact its forecasts, as the forecasts are based on user expenditures rather than vendor revenues. It may, however, impact future market share positions, which are based on revenue.

5. Copyright Litigation

A decade ago, a software patent was almost unheard of. Now, as a result of the increasing competitiveness of the industry, thousands of programs are covered by patents or copyrights.

The Office of Technology Assessment is readying a proposal for Congress in January. One of the key items on its agenda is to define whether copyright, patents, or neither, can be used to protect the screen appearance, or so-called "look and feel" of a computer program.

• Ashton-Tate's copyright infringement lawsuit against Fox (Perrysburg OH) for copying its dBase products is pending decision. Lack of legal precedents in the microcomputer software industry is allowing developers—especially the large ones—to be protective of their turf.

• Apple's copyright infringement lawsuit against Microsoft and Hewlett-Packard is also setting precedents by asking the court to rescind a 1985 licensing agreement between Apple and Microsoft. In its March 1988 lawsuit, Apple said Microsoft's Windows 2.03 and Hewlett-Packard's NewWave programs infringed copyrights on the screen display of Apple's Macintosh. Both Windows and NewWave are programs aimed at making computers easier to use.

All this is making small software companies nervous about new development projects, because they have don't know whether or not they're infringing on a pending patent. Among their concerns is that patents will be granted for computer interfaces—programs that link different computers or different programs to one another.

B

Market Shares/Leading Vendors

The top 20 systems software products vendors are shown in Exhibit VII-1. Revenues for each company are developed from a combination of INPUT interviews and information from INPUT's vendor files. Revenues are noncaptive U.S. revenues only. IBM commands a 16% share.

Digital commands a strong and lasting presence in the midrange sector of systems software. The other three leaders weave a curious competitive trail of simultaneously competing against each other and working with each other. For example, the companies that Computer Associates is seeking to acquire are IBM business and development partners. Microsoft, on the other had, has publicly and strongly severed its previously close ties with IBM and will be competing directly against IBM in the systems software arena for workstations and personal computers.

EXHIBIT VII-1

Systems Software Products
Leading Vendors' 1990 Market Shares

Vendor	1990 U.S. Revenue ($ Millions)	Market Share (Percent)
IBM	2,870	16
Digital Equip. Corp.	530	3
Computer Associates	470	3
Microsoft	415	2
Oracle	390	2
Novell	360	2
Hewlett-Packard	325	2
Unisys	200	1
BGS	150	1
Wang Laboratories	140	1
Adobe	140	1
Legent	115	1
Pansophic	110	1
SAS	105	1
Information Builders	97	1
Candle	95	1
Cadence	90	<1
Ingres	83	<1
Sterling	81	<1
Ashton-Tate	73	<1

Exhibit VII-2 lists CASE market leaders. KnowledgeWare was the stellar performer in 1990, doubling its revenues. It is no coincidence that KnowledgeWare now comes closest to being AD/Cycle compliant.

EXHIBIT VII-2

Leading CASE Vendors

- KnowledgeWare
- Intersolv
- Texas Instruments
- Cadre
- Pansophic
- Andersen Consulting
- Oracle
- Synon
- CGI
- Viasoft
- Transform Logic
- DEC
- Interactive Development Environments
- Computer Associates
- Manager Software Products
- Bachman

IBM itself is not yet on the list of CASE market leaders, since AD/Cycle is, so far, made up almost wholly of third-party products. Four of the six CASE companies in which IBM had made an investment are on the list. The six CASE-related equity partners are:

- KnowledgeWare
- Intersolv (previously Index Technologies)
- Synon
- Bachman Information Systems
- Systematica
- Easel Corporation

C

Company Profiles

The following are profiles of several systems software products vendors mentioned in this report. They are representative of the types of companies and strategies operating in the systems software marketplace.

1. Cognos Corporation, 67 S. Bedford Street, Burlington, MA 01803-5146, (617) 229-6600

Cognos Inc. began in 1969 as a software consulting firm and began marketing packaged software products in 1979. Its original product, a report writer for the HP 3000 minicomputer, evolved into the application development language now called PowerHouse 4GL, which is its flagship product.

PowerHouse runs on midrange computers from DEC, HP, and Data General—and the IBM AS/400. It also runs on MS/DOS and OS/2 platforms. An Apple Macintosh version is in beta testing now, as is a version for IBM's RISC System/6000. All PowerHouse tools running on the AS/400 will be fully compliant with SAA and AD/Cycle.

In 1989 the company was restructured and the workforce trimmed by 16%. The product line was expanded and the marketing and sales organization rejuvenated. In addition Cognos made a public stock offering this past year.

Now Cognos' expanded strategy is to offer an integrated family of software tools that supports the entire application development cycle for midrange and microcomputer environments. Its newest product is PowerCase, a CASE tool for DEC VAX machines. It is completely integrated with Cognos' PowerHouse, ANSI standard SQL RDBMSs, and DEC's Record Management System. With this integration users can automatically generate menus, screens, batch programs, and reports.

Fiscal 1991 revenues were $141.2 million, up 26% from last year.

2. Computer Associates International, 711 Stewart Ave., Garden City, NY 11530-4787 (516) 227-3300

CA has historically grown through acquisitions of mainframe software companies. Its three largest acquisitions were Uccel in 1987, Applied Data Research in 1988, and Cullinet Software in 1989. It is back on the acquisition path again with intentions to acquire On-Line Software and Pansophic. Although CA's strategy is clearly multivendor and multiplatform, CA continues to be primarily interested in acquiring mainframe-based software companies.

CA90s, introduced last year as the technical foundation for Computer Associates' "Enterprise Software Solutions," will continue to be the underpinning upon which Computer Associates (CA) integrates software product offerings.

CA will support IBM's SystemView and DEC's Polycenter operations management platforms as well as offer its own multivendor product line. CA is already beginning to provide some degree of integrated management across IBM and DEC systems.

UNIX will operate within the CA90s foundation: CA90s will provide service layers for UNIX-based products as well as other operating-systems-based products. CA made known its UNIX position and direction in January; it provides a clear example of vendor intention to provide interoperability as well as UNIX-only products. UNIX products will be integrated closely with all other CA offerings across IBM mainframes, DEC VAX/VMS systems, PCs, and other platforms. Actual implementation of this large undertaking is at least several years away.

CA is a member of UNIX International and the Open Software Foundation. Its first steps in UNIX are to release RDBMS products running on the HP-UX platform, which are in beta testing. It has recently reached an agreement with Hewlett-Packard for joint development and marketing of system management tools based on HP-UX. The first system administration tools are due in early 1992. CA will resell HP's multiuser RISC platform for UX.

CA is also developing Hewlett-Packard HP-UX systems management software, which eventually will be integrated with the DEC and IBM products. The goal is to manage, control, and monitor all system-related activities across IBM MVS, VSE, and VM; DEC VMS; HP-UX; Tandem; PC-DOS; OS/2; AS/400; and eventually other UNIX systems. The company is also pursuing DBMS and applications development tools across all platforms.

3. Digital Equipment Corporation, 146 Main Street, Maynard, MA 01754-2511 (506) 493-2571

DEC's overall theme is distributed systems. The company's goal is to have one operating system kernel for all platforms—from the desktop to the data center. Just as IBM's SAA unites various IBM operating environments, DEC's Network Applications Support (NAS) will be the umbrella providing distributed computing capability and eventual interoperability between DEC VMS, Ultrix (DEC's flavor of UNIX), and OSF/1-based Ultrix. It will also eventually provide interoperability between DEC systems and other vendors' systems, including MS-DOS and OS/2.

Although it initially straddled the fence, DEC has revealed a strategy that makes UNIX of equal importance to VMS over the long term. Ultrix has been even less portable than most other versions of UNIX, since it has many DEC enhancements. Now, however, DEC has indicated that it will integrate the OSF/1 operating kernel into Ultrix.

To differentiate, DEC will emphasize value-added features above the operating system level. DEC currently has no plans to move its popular Rdb relational data base to Ultrix; however, Ultrix users will be able to access Rdb on VMS.

Earlier this year, DEC announced a replacement for its 11-year-old VAX product line, to be completed in two years. Thus DEC is redesigning its entire VAX architecture and VMS operating system—a challenging and expensive undertaking. The new computers will range from workstations to mainframes and all will use RISC. The customer will have a choice of operating systems—VMS or UNIX—for the next RISC product line.

VMS will be compliant with POSIX. VMS will also meet standards and requirements for X/Open certification. With this move, VMS will meet existing portability and interoperability standards and provide many of the user benefits found in UNIX but without being vendor independent. Thus VMS is more acceptable; developers can write applications to run on VMS and then on Ultrix with only minor revisions.

4. Information Builders, Inc., 1250 Broadway, New York, NY 10001, (212) 736-4433

Formed in 1975, Information Builders markets and supports FOCUS, a fourth-generation language for building DBMSs.

Capitalizing on the trend toward moving applications development to the desktop and leaving production data bases on larger machines, it is preparing to launch a new generation of FOCUS products based on the client/server model and designed to provide data base interoperability across platforms. Client/server strategy has not completely unfolded yet.

Products include:

• FOCUS 4GL/DBMS—including PC/Focus application environment for client/server applications. PC/Focus applications can access IBM mainframe data stored in DB2, IMS, and VSAM data base structures. IBI recently announced Hiperfocus—jointly developed with IBM— which is a high-performance version of Focus that will run in IBM's MVS/ESA platform.

FOCUS versions are available for IBM VM, MVS, OS/400, AIX, DOS, and OS/2; DEC VAX/VMS; Wang VS; Hewlett-Packard; Tandem; Bull; and over 20 UNIX processors and RDBMSs and servers.

- FOCNET connectivity software—PC users can also tap into data stored on VAX and HP computers, among others.

- LEVEL5 is a rule-based expert system acquired from LEVEL5 Research in 1987.

IBI is an IBM business partner/industry applications specialist. IBM and IBI will jointly market Hiperfocus. IBI, a direct competitor to Cognos, had fiscal 1990 revenues of approximately $191 million, a 19% increase over 1989 revenue.

5. KnowledgeWare, Inc., 3340 Peachtree Road, Atlanta, GA 30326 (404) 231-8575

KnowledgeWare was founded in 1979 as Database Design, Inc. by James Martin. It changed its name in December 1985. The company exemplifies alliances with IBM, the trend toward smaller platforms, and CASE industry consolidation.
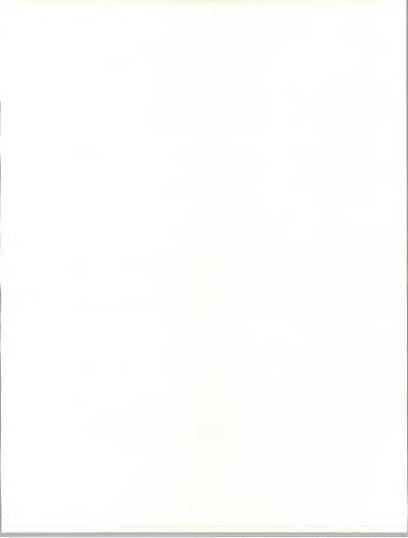
The company's strategic product line, the Information Engineering Workbench, is a set of three PC-based diagramming products to capture and analyze specifications information, a PC-based COBOL application generator, and a mainframe-based COBOL application generator.

The distinguishing characteristic of the product line is its integration around a central, intelligent encyclopedia. This integration supports automatic transitions between the planning, analysis, and design stages of the development life cycle, as well as 100% automated generation of code from diagrammatic specifications.

KnowledgeWare's new generation of CASE products, Application Development Workbench, uses OS/2 Presentation Manger and will conform to SAA's AD/Cycle as it evolves. KnowledgeWare is an IBM business partner for AD/Cycle.

The company has several other agreements with IBM:

- In June 1989 KnowledgeWare entered into a license agreement and a development agreement with IBM, whereby KnowledgeWare licensed a portion of its intelligent encyclopedia technology to IBM, and agreed to jointly develop an application development product for incorporation into the applications development environment announced by IBM.

- In August 1989 IBM purchased approximately 1.1 million shares of KnowledgeWare common stock for $10.5 million.

- KnowledgeWare also established marketing relationships with IBM in the U.S. and Canada. Under the Cooperative Software Supplier Program, IBM will market KnowledgeWare'e Information Engineering Workbench/Workstation CASE diagramming tools. Under the Industry Application Specialist program, KnowledgeWare will market IBM's Cross System Product, DB2 and SQLK.
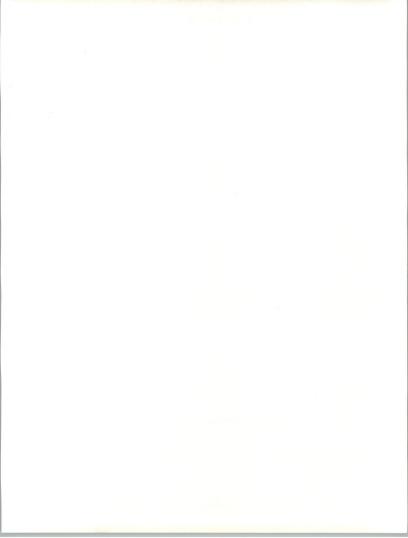
KnowledgeWare's primary focus has been microcomputer-based front-end CASE tools for IBM's mainframes. Now, however, its strategy is to round out its product offerings and become more than an IBM mainframe CASE vendor. To this end, the company will consummate four acquisitions this year. It has has acquired client/server and cooperative processing technologies from the acquisitions of two small companies, Quinsoft and UDM Technologies. It has also acquired Language Technology, Inc., which sells Cobol restructuring tools and has recently announced intentions to acquire Intellicorp.

6. Legent Corp., 8615 Westwood Center Drive, Vienna, VA 22182-2218, (703) 734-9494

Legent is an example of a company that has diversified away from strictly operations management products for IBM mainframes to address heterogeneous environments managed from any IBM mainframe host. Now, in addition to software and services for IBM mainframe and network operations, Legent's systems software technologies can manage other associated information platforms from Digital Equipment Corp., Tandem, and IBM (MS-DOS and OS/2). Legent was formed by the merger of Duquesne Systems Inc. and Morino Inc. in March, 1989.

Legent's 50 software product offerings include the following five technology platforms:

- IS Management—The focal point of Legent's IS Management (resource management) technology is the MICS IS Management Support System, which assists in managing the use, cost, and performance of processor, network, and application resources.

- Performance Management—Performance Management products are NetSpy, Program Management Optimizer, and AccuMax for DB2, ASTEX, and TSO/MON. NetSpy, a network performance monitor, is Legent's top-selling product. In 1990 Legent contracted Network Intelligence Inc. to add LAN management capabilities to NetSpy.

- Operations Productivity—Operations Productivity products automate key aspects of data center operations and include the Automate product line.

- Change management software—ENDEVOR—is Legent's automated software management technology. It operates in 3GL, 4GL, CASE, and PC environments.

- Network Productivity—TPX session manager and L-Comm for enterprisewide communications make up the company's network productivity products.

Legent's fiscal 1991 (9/30/91) revenues totaled $203 million.

7. Microsoft Corporation, 16011 NE 36th Way, Redmond, WA 98073-9717

Microsoft supplies the MS-DOS operating system used on IBM and compatible PCs, and it worked with IBM on OS/2, which was slated to be a successor to DOS. Now, however, Microsoft is moving its software strategy farther away from that of IBM's: IBM continues to support OS/2 and Microsoft is supporting its own program, Windows.

Microsoft is dropping core development of OS/2 3.0 in favor of a Windows-only strategy for PC and RISC workstations. The new release will be called Windows NT (New Technology) and will be available in 1992. A low-end version of Windows will run on top of DOS, and Windows NT will be geared for more-powerful computers and workstations.

Windows was conceived in 1983 as an add-on that made DOS easier to learn and use by allowing users to open multiple applications or "windows" on screen and by using a mouse. Now Windows is viewed as an operating system in its own right and as such is a systems control product. The company has announced plans to release Windows programs that recognize handwriting and manage sound, images, and video. These and other versions of Windows will be scaled to fit different types of personal computers as well as other electronic devices.

Microsoft is also actively involved in network operating systems with its LAN Manager and in the DBMS product area with SQL Server.

Microsoft's fiscal 1991 revenues grew 56% to $1.8 billion.

8. Systems Center, Inc., 18000 Alexander Bell Drive, Reston, VA 22019 (703) 264-8000

Starting life as VM Software, Systems Center developed a family of products to improve the ease of use and performance of IBM's VM operating center. By the end of 1988, the product line had begun to expand beyond VM to the MVS area and—following acquisition of Systems Center, Inc.—the company's name became Systems Center.

Since 1988, Systems Center has broadened its business by acquiring products and development personnel from smaller independent firms rather than incurring heavy R&D expenses.

Acquisitions of the last several years include:

- Acquisition of Systems Center, Inc. in 1988. The key product in the acquisition is Network DataMover, which facilitates the movement of files among multiple computer-operating environments.

- An agreement with International Business Link, Inc. whereby Systems Center purchased products and technology that allows data centers to simplify administration of SNA networks by using object-oriented graphic definitions of the elements making up a network.

- The acquisition of automated management software for IBM's AS/400 midrange line. In a transaction the companies said was worth $2.4 million, Systems Center purchased the AS/400 software and related assets from Informed Management Environments, Inc. of Houston.

- Acquisition of Unitech Software, Inc. for $43 million of stock. Unitech provides systems utilities and network administration software for UNIX environments.

- Systems Center's latest and boldest move is to acquire marketing rights to NetMaster, the leading competitor to IBM's network management product, NetView, from Cincom Systems and to acquire the developer of NetMaster, Software Development International, Pty. This acquisition offers the foundation for Systems Center to become a force in the network integration and network management market, which is expected to be a major growth area in the 1990s.

  Cincom Systems has filed a lawsuit against the company regarding the final payment on the purchase of NET/Master marketing rights. The parties have been unable to reach agreement as to the amount and deferral of that payment.

In 1990 the company divested productivity enhancement and utility software products for users of IBM's SQL/DS and DB2 relational data base management systems and sold these products to On-Line Software International.

Systems Center's strategy is clearly expansion into diverse environments; it now has over 50 products. Its goal has shifted from providing all IBM-compatible products to being a leading independent software company that's not tied to a hardware platform. Future success will require keeping these products up to date.

A private equity investment firm, TA Associates, has recently made an equity investment of approximately $12 million in Systems Center.

VIII

Conclusions and Recommendations

A
Conclusions

Conclusions are outlined in Exhibit VIII-1 and described below.

EXHIBIT VIII-1

Systems Software Products
Conclusions

- Slower growth rates compared to 1985-1990

- Technology transitions will take time

- Operations management product growth the strongest

- Mainframe-based product expenditures still strong

- Maintenance and ongoing license expenditures still high

During the last five years (1985-1990), user expenditures for systems software products grew at a rate of 21% compounded annually. User expenditures reached a peak annual growth rate of 30% in 1987, due in large part to the strong growth of departmental/minicomputer systems (AS/400) introductions and also the strong growth in personal computer shipments. Over the next five years, however, growth will average only 12% compounded annually.

Reasons for this slower growth include a lackluster economy, the shift in technological foundations (including a slow transition to standards), fundamental changes in vendor product and marketing strategies, and marketplace confusion.

The fastest growing submode within systems software products—and currently the smallest—will be operations management tools, which INPUT forecasts to grow from $4.1 billion to $7.9 billion in user expenditures by 1996. Operations management tools include network management, configuration, fault, performance, accounting, administration, and security products. These kinds of tools are becoming increasingly important as corporations adopt downsized and client/server solutions.

Applications development tools is the largest submode and includes CASE tools, DBMSs, and 3GL and 4GL tools. Even though customers' applications development backlogs continue to grow, the tools on the market today are not being as effectively used as they could be; true integrated CASE is a long way off.

The third submode is systems control products. The majority of expenditures on systems control products, currently a $6.8 billion market, are for operating systems, many of which are already installed.

In 1991, 44% of IS systems software budgets was still for mainframe-based products. This proportion is expected to decline but not as rapidly as trade publications would have one believe. The mainframe will not go away; it will in fact get larger. Even though a noticeable shift is under way toward operations management and applications development tools that run on workstations and personal computers, IS managers indicate plans for increasing capacity of their mainframes.

INPUT surveys indicate that expenditures on existing systems software products—maintenance and ongoing license fees—could account for as much as four times the expenditures on new systems software products; user expenditures on new product purchases and licenses could be as little as $4 or $5 billion of the total $18.1 billion market.

B
Recommendations

INPUT's overall recommendations are outlined below and in Exhibit VIII-2.

Systems software products vendors cannot afford to be short-sighted. Key product transitions—client/server, migration to standards, data base interoperability, integrated CASE—are all in their infancy and will take time from the vendor development perspective and the customer adoption perspective. Satisfying a great deal of what customers really need must be put on hold. In the meantime, vendors must seek ways to maintain and enhance the loyalty of their existing customers.

EXHIBIT VIII-2

Systems Software Products Recommendations

- Orient toward long term
- Enhance customer loyalty
- Provide exceptional service and support
- Endorse standards
- Make alliances
- Choose products for efficiency

Given that so much is spent on existing products, the ongoing relationship that a vendor develops with its customers is critically important for long-term vendor success. A great deal of the relationship has to do with provision of exceptional service and support. In fact, INPUT surveys indicate that of all vendor selection criteria, a strong reputation for support came out on top. This criterion ranked higher than price, ease of use, and ease of installation.

A product strategy that endorses and adheres to standards as they become available is the key. Vendors will need to continue to make a fundamental transition from differentiation based on proprietariness to differentiation based primarily on service. As part of a standards-based strategy, vendors must provide UNIX, along with other systems software product architectures.

In the long term, the large systems and software vendors will increase their market shares because they are the only vendors that can drive standards. Other medium-sized and small companies must sooner or later follow. In the meantime, numerous smaller systems software companies are establishing product niches. These smaller vendors, however, must prove themselves in the support arena if they are to become and remain viable.

Considerable opportunity exists now (as well as over the long term) for sales of systems software products that enhance productivity or cut costs—regardless of new technologies. Opportunities exist, for example, for niche products such as RDBMS tools, automated change tools, network management products, and additional operations management tools for downsized solutions. Small vendors, as well as large vendors, have an opportunity to excel in these areas.

Alliances will become a way of life for small as well as large vendors. Small vendors will need to establish alliances for long-term viability or will risk being acquired. Vendors need to ensure that their alliances are strategic. In a successful alliance, each company must be strategic to the other. The challenge becomes keeping two companies' strategies complementary over time, as management teams inevitably change.

As is true in the applications software products industry, the trend toward standards and integration will continue to cause industrywide consolidation in systems software products. Consolidation causes short-term chaos and inefficiencies as management teams become used to each other and product lines merge. Consolidation should reflect long-term positioning rather than current market share.

A

Definition of Terms

A
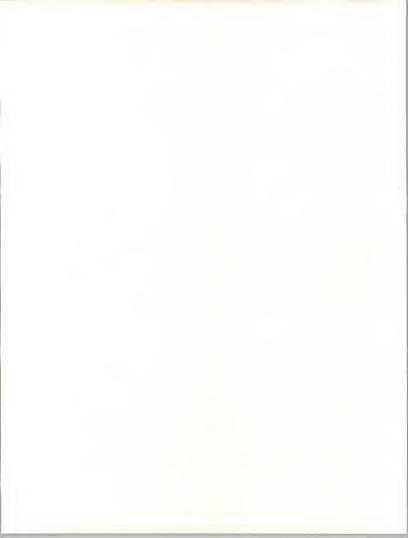
Introduction

INPUT's *Definition of Terms* provides the framework for all of INPUT's market analyses and forecasts of the information services industry. It is used for all U.S. programs. The structure defined in Exhibit A-1 is also used in Europe and for the worldwide forecast.

One of the strengths of INPUT's market analysis services is the consistency of the underlying market sizing and forecast data. Each year INPUT reviews its industry structure and makes changes if they are required. When changes are made they are carefully documented and the new definitions and forecasts reconciled to the prior definitions and forecasts. INPUT clients have the benefit of being able to track market forecast data from year to year against a proven and consistent foundation of definitions.

The changes made in INPUT definitions this year are as follows:

- *Systems Operations Submodes* - the submodes of systems operations have been redefined from processing services and professional services to platform systems operations and applications systems operations.

- *Business Services Industry* - the industry sectors of business services and personal services have been combined into a single business services sector.

- *Transportation Industry* - the information services expenditures relating to airline reservation systems have been returned to the transportation sector where they resided prior to 1990.

B

Overall Definitions and Analytical Framework

1. Information Services

Information Services are computer/telecommunications-related products and services that are oriented toward the development or use of information systems. Information services typically involve one or more of the following:

- Processing of specific applications using vendor-provided systems (called *Processing Services*)

- A combination of hardware, packaged software and associated support services which will meet a specific application processing need (called *Turnkey Systems*)

- Packaged software products, either systems software or applications software products (called *Software Products*)

- People services that support users in developing and operating their own information systems (called *Professional Services*)

- Bundled combinations of products and services where the vendor assumes total responsibility for the development of a custom solution to an information systems problem (called *Systems Integration*)

- Services that provide operation and management of all or a significant part of a user's information systems functions under a long-term contract (called *Systems Operations*)

- Services associated with the delivery of information in electronic form—typically network-oriented services such as value-added networks, electronic mail and document interchange, on-line data bases, on-line news and data feeds, etc. (called *Network Services*)

In general, the market for information services does not involve providing equipment to users. The exception is where the equipment is bundled as part of an overall service offering such as a turnkey system, a systems operations contract, or a systems integration project.

The information services market also excludes pure data transport services (i.e., data or voice communications circuits). However, where information transport is associated with a network-based service (e.g., EDI or VAN services), or cannot be feasibly separated from other bundled services (e.g., some systems operations contracts), the transport costs are included as part of the services market.

The analytical framework of the information services industry consists of the following interacting factors: overall and industry-specific business environment (trends, events and issues); technology environment; user

information system requirements; size and structure of information services markets; vendors and their products, services and revenues; distribution channels; and competitive issues.

2. Market Forecasts/User Expenditures

All information services market forecasts are estimates of *User Expenditures* for information services. When questions arise about the proper place to count these expenditures, INPUT addresses them from the user's viewpoint: expenditures are categorized according to what users perceive they are buying.

By focusing on user expenditures, INPUT avoids two problems which are related to the distribution channels for various categories of services:

- Double counting, which can occur by estimating total vendor revenues when there is significant reselling within the industry (e.g., software sales to turnkey vendors for repackaging and resale to end users)

- Missed counting, which can occur when sales to end users go through indirect channels such as mail order retailers

Captive Information Services User Expenditures are expenditures for products and services provided by a vendor that is part of the same parent corporation as the user. These expenditures are not included in INPUT forecasts.

Non-captive Information Services User Expenditures are expenditures that go to vendors that have a different parent corporation than the user. It is these expenditures which constitute the information services market analyzed by INPUT and that are included in INPUT forecasts.

3. Delivery Modes

Delivery Modes are defined as specific products and services that satisfy a given user need. While *Market Sectors* specify *who* the buyer is, *Delivery Modes* specify *what* the user is buying.

Of the eight delivery modes defined by INPUT, five are considered primary products or services:

- *Processing Services*
- *Network Services*
- *Professional Services*
- *Applications Software Products*
- *Systems Software Products*

The remaining three delivery modes represent combinations of these products and services, bundled together with equipment, management and/or other services:

- *Turnkey Systems*
- *Systems Operations*
- *Systems Integration*

Section C describes the delivery modes and their structure in more detail.

4. Market Sectors

Market Sectors or markets are groupings or categories of the users who purchase information services. There are three types of user markets:

- *Vertical Industry* markets, such as Banking, Transportation, Utilities, etc. These are called "industry-specific" markets.

- *Functional Application* markets, such as Human Resources, Accounting, etc. These are called "cross-industry" markets.

- *Other* markets, which are neither industry- nor application-specific, such as the market for systems software products and much of the on-line data base market.

Specific market sectors used by INPUT are defined in Section E, below.
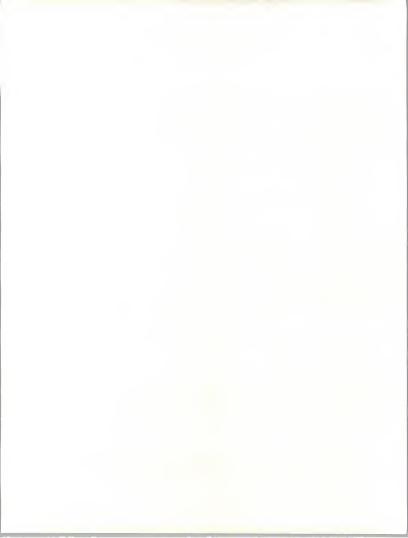
5. Other
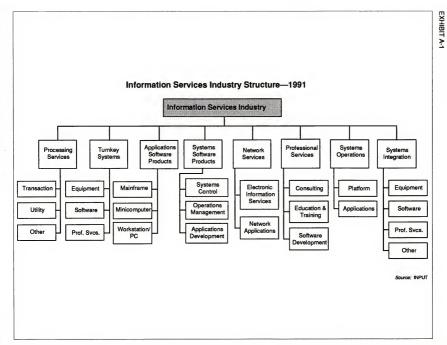
Outsourcing is defined as the contracting of information systems func-tions to outside vendors. Outsourcing should be viewed as the opposite of *insourcing*: anything that information systems management has considered feasible to do internally (e.g., data center operations, applica-tions development and maintenance, network management, training, etc.) is a potential candidate for outsourcing.

Information systems has always bought systems software, as it is infea-sible for companies to develop it internally. However, all other delivery modes represent functions or products that information systems manage-ment could choose to perform or develop in-house. Viewed this way, outsourcing is the result of a make-or-buy decision, and the outsourcing market covers any product or service where the vendor must compete against the client firm's own internal resources. Therefore, the entire information services industry can be considered an outsourcing market.

C

Delivery Modes and Submodes

Exhibit A-1 provides the overall structure of the information services industry as defined and used by INPUT. This section of *Definition of Terms* provides definitions for each of the delivery modes and their submodes or components.

Information Services Industry Structure—1991

Information Services Industry

| Processing Services | Turnkey Systems | Applications Software Products | Systems Software Products | Network Services | Professional Services | Systems Operations | Systems Integration |

- Processing Services
  - Transaction
  - Utility
  - Other
- Turnkey Systems
  - Equipment
  - Software
  - Prof. Svcs.
- Applications Software Products
  - Mainframe
  - Minicomputer
  - Workstation/PC
- Systems Software Products
  - Systems Control
  - Operations Management
  - Applications Development
- Network Services
  - Electronic Information Services
  - Network Applications
- Professional Services
  - Consulting
  - Education & Training
  - Software Development
- Systems Operations
  - Platform
  - Applications
- Systems Integration
  - Equipment
  - Software
  - Prof. Svcs.
  - Other

Source: INPUT

1. Software Products

INPUT divides the software products market into two delivery modes: systems software and applications software.

The two delivery modes have many similarities. Both involve user purchases of software packages for in-house computer systems. Included are both 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. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included here.
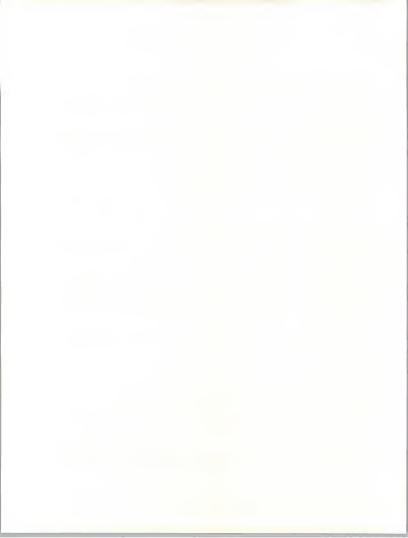
Expenditures for work performed by organizations other than the package vendor are counted in the professional services delivery mode. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

a. Systems Software Products

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. INPUT divides systems software products into three submodes.

- *Systems Control Products* - Software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control, and spoolers.

- *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

- *Applications Development Tools* - Software programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Included are traditional programming languages, 4GLs, data dictionaries, data base management systems, report writers, project control systems, CASE systems and other development productivity aids. Also included are system utilities (e.g., sorts) which are directly invoked by an applications program.

INPUT also forecasts the systems software products delivery mode by platform level: mainframe, minicomputer and workstation/PC.

b. Applications Software Products

Applications software products enable a user or group of users to support an operational or administrative process within an organization. Examples include accounts payable, order entry, project management and office systems. INPUT categorizes applications software products into two submodes.

• *Industry-Specific Applications Software Products* - Software products that perform functions related to fulfilling business or organizational needs unique to a specific industry (vertical) market and sold to that market only. Examples include demand deposit accounting, MRPII, medical record keeping, automobile dealer parts inventory, etc.

• *Cross-Industry Applications Software Products* - Software products that perform a specific function that is applicable to a wide range of industry sectors. Examples include payroll and human resource systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

INPUT also forecasts the applications software products delivery mode by platform level: mainframe, minicomputer and workstation/PC.
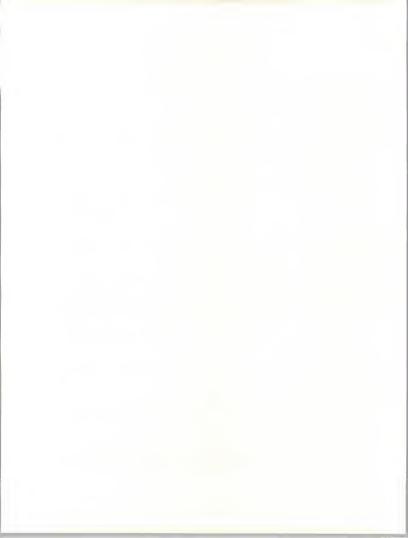
2. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single product developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Most CAD/CAM systems and many small business systems are turnkey systems. Turnkey systems utilize standard computers and do not include specialized hardware such as word processors, cash registers, process control systems, or embedded computer systems for military applications.

Computer manufacturers (e.g., IBM or DEC) that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

• *Value-Added Reseller (VAR):* A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually applications software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.
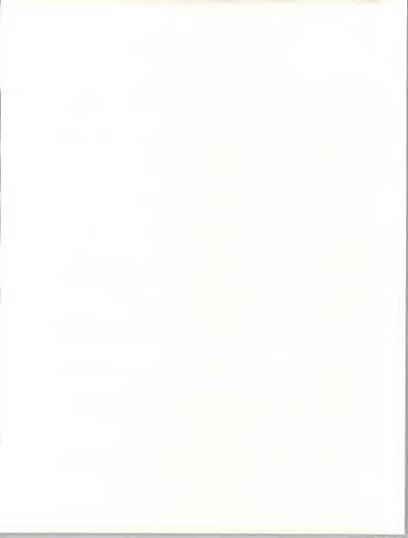
Turnkey systems have three components:

- Equipment - computer hardware supplied as part of the turnkey system

- Software products - prepackaged systems and applications software products

- Professional services - services to install or customize the system or train the user, provided as part of the turnkey system sale

3. Processing Services

This delivery mode includes three submodes: transaction processing, utility processing, and "other" processing services.

- *Transaction Processing* - Client uses vendor-provided information systems—including hardware, software and/or data networks—at the vendor site or customer site to process transactions and update client data bases. Transactions may be entered in one of four modes:

  - *Interactive* - Characterized by the interaction of the user with the system for data entry, transaction processing, problem solving and report preparation: the user is on-line to the programs/files stored on the vendor's system.

  - *Remote Batch* - Where the user transmits batches of transaction data to the vendor's system, allowing the vendor to schedule job execution according to overall client priorities and resource requirements.

  - *Distributed Services* - Where users maintain portions of an application data base and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.

  - *Carry-in Batch* - Where users physically deliver work to a processing services vendor.

- *Utility Processing* - Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and/or data bases, enabling clients to develop their own programs or process data on the vendor's system.

- *Other Processing Services* - Vendor provides service—usually at the vendor site—such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

4. Systems Operations

Systems operations was a new delivery mode introduced in the 1990 Market Analysis and Systems Operations programs. It was created by taking the Systems Operations submode out of both Processing Services and Professional Services. For 1991 the submodes have been redefined as indicated below.

Systems operations involves the operation and management of all or a significant part of the user's information systems functions under a long-term contract. These services can be provided in either of two distinct submodes where the difference is whether the support of applications, as well as data center operations, is included.

- *Platform systems operations* - the vendor manages and operates the computer systems, often including telecommunications networks, without taking responsibility for the user's application systems.

- *Applications systems operations* - the vendor manages and operates the computer systems, often including telecommunications networks, and is also responsible for maintaining, or developing and maintaining, the user's application systems.
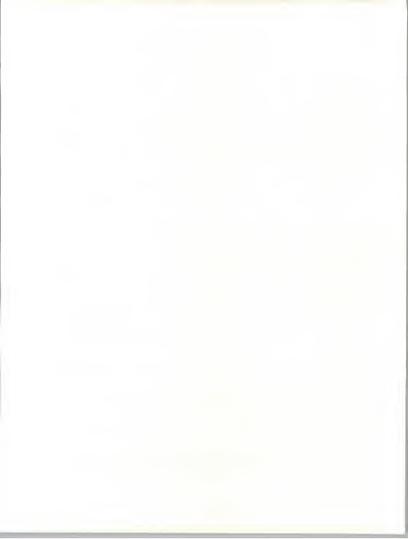
In the federal government market, systems operation services are also defined by equipment ownership with the terms "COCO" (Contractor-Owned, Contractor-Operated), and "GOCO" (Government-Owned, Contractor-Operated).

The ownership of the equipment, which was the previous basis for the systems operations submodes, is no longer considered critical to the commercial market. Most of the market consists of systems operations relationships using vendor-owned hardware. What is now critical is the breadth of the vendor/client relationship as it expands beyond data center management to applications management.

Systems operations vendors now provide a wide variety of services in support of existing information systems. The vendor can plan, control, provide, operate, maintain and manage any or all components of the user's information systems (equipment, networks, systems and/or application software), either at the client's site or the vendor's site. Systems operations can also be referred to as "resource management" or "facilities management."

5. Systems Integration (SI)

Systems integration is a vendor service that provides a complete solution to an information system, networking or automation requirement through the custom selection and implementation of a variety of information
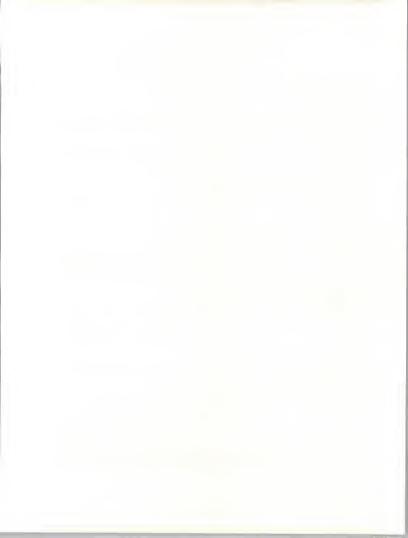
system products and services. A systems integrator is responsible for the overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for the delivery of the specified system function, on schedule and at the contracted price.

To be included in the information services market, systems integration projects must involve some application processing component. In addition, the majority of cost must be associated with information systems products and/or services.

• *Equipment* - information processing and communications equipment required to build the systems solution. This component may include custom as well as off-the-shelf equipment to meet the unique needs of the project. The systems integration equipment category excludes turnkey systems by definition.

• *Software products* - prepackaged applications and systems software products.

• *Professional services* - the value-added component that adapts the equipment and develops, assembles, or modifies the software and hardware to meet the system's requirements. It includes all of the professional services activities required to develop, and if included in the contract, operate an information system, including consulting, program/project management, design and integration, software development, education and training, documentation, and systems operations and maintenance.

• *Other services* - most systems integration contracts include other services and product expenditures that are not easily classified elsewhere. This category includes miscellaneous items such as engineering services, automation equipment, computer supplies, business support services and supplies, and other items required for a smooth development effort.

Systems integrators perform, or manage others who perform, most or all of the following functions:

   - Program management, including subcontractor management
   - Needs analysis
   - Specification development
   - Conceptual and detailed systems design and architecture
   - System component selection, modification, integration and customization
   - Custom software design and development
   - Custom hardware design and development
   - Systems implementation, including testing, conversion and post-implementation evaluation and tuning

- Life cycle support, including
  · System documentation and user training
  · Systems operations during development
  · Systems maintenance

6. Professional Services

This category includes three submodes: consulting, education and train-
ing, and software development.
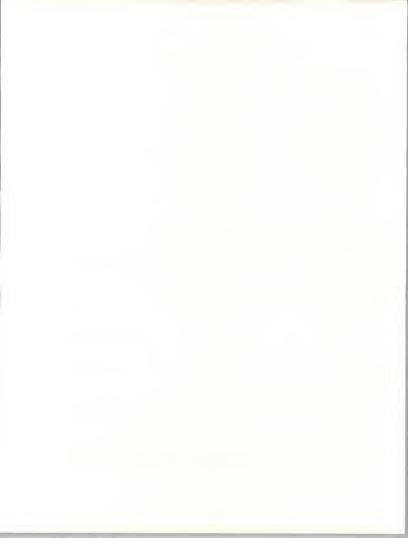
- *Consulting:* Services include management consulting (related to
  information systems), information systems consulting, feasibility
  analysis and cost-effectiveness studies, and project management assis-
  tance. Services may be related to any aspect of the information system,
  including equipment, software, networks and systems operations.

- *Education and Training:* Products and services related to information
  systems and services for the professional and end user, including
  computer-aided instruction, computer-based education, and vendor
  instruction of user personnel in operations, design, programming, and
  documentation.

- *Software Development:* Services include user requirements definition,
  systems design, contract programming, documentation, and implemen-
  tation of software performed on a custom basis. Conversion and
  maintenance services are also included.

7. Network Services

Network services typically include a wide variety of network-based
functions and operations. Their common thread is that most of these
functions could not be performed without network involvement. Net-
work services is divided into two submodes: *Electronic Information
Services,* which involve selling information to the user, and *Network
Applications,* which involve providing some form of enhanced transport
service in support of a user's information processing needs.

a. Electronic Information Services

Electronic information services are data bases that provide specific
information via terminal- or computer-based inquiry, including items
such as stock prices, legal precedents, economic indicators, periodical
literature, medical diagnosis, airline schedules, automobile valuations,
etc. The terminals used may be computers themselves, such as communi-
cations servers or personal computers. Users typically inquire into and
extract information from the data bases. Although users may load ex-
tracted data into their own computer systems, the electronic information

vendor provides no data processing or manipulation capability and the users cannot update the vendor's data bases.

The two kinds of electronic information services are:

• *On-line Data Bases* - Structured, primarily numerical data on economic and demographic trends, financial instruments, companies, products, materials, etc.

• *News Services* - Unstructured, primarily textual information on people, companies, events, etc.

While electronic information services have traditionally been delivered via networks, there is a growing trend toward the use of CD ROM optical disks to support or supplant on-line services, and these optical disk-based systems are included in the definition of this delivery mode.

b. Network Applications

Value-Added Network Services (VAN Services) - VAN services are enhanced transport services which involve adding such functions as automatic error detection and correction, protocol conversion, and store-and-forward message switching to the provision of basic network circuits.

While VAN services were originally provided only by specialized VAN carriers (Tymnet, Telenet, etc.), today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers. The following are examples of VAN services.

• *Electronic Data Interchange (EDI)* - Application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. Specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards. This software may be provided as part of the VAN service or may be resident on the organization's own computers.

• *Electronic Information Exchange (EIE)* - Also known as electronic mail (E-mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex,

TWX, and other messaging services. This also includes bulletin board services.

- *Other Network Services* - This segment contains videotex and pure network management services. Videotex is actually more a delivery mode than an application. Its prime focus is on the individual as a consumer or in business. These services provide interactive access to data bases and offer the inquirer the ability to send as well as receive information for such purposes as home shopping, home banking, travel reservations, and more.

  Network management services included here must involve the vendor's network and network management systems as well as people. People-only services are included in professional services that involve the management of networks as part of the broader task of managing a user's information processing functions are included in systems operations.

D

Sector Definitions

1. Industry Sector Definitions

INPUT has structured the information services market into 15 generic industry sectors, such as process manufacturing, insurance, transportation, etc. The definitions of these sectors are based on the 1987 revision of the Standard Industrial Classification (SIC) Code system. The specific industries (and their SIC Codes) included under these generic industry sectors are detailed in Exhibit A-2.
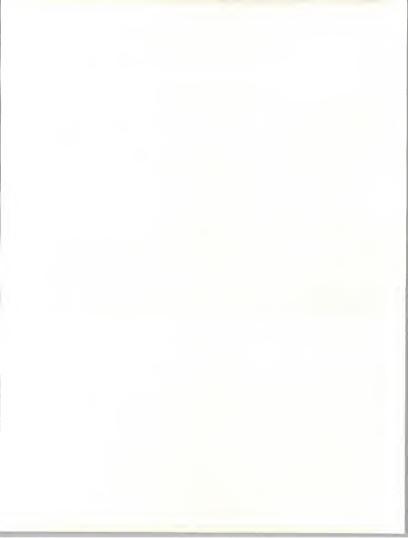
EXHIBIT A-2

Industry Sector Definitions

Industry Sector	SIC Code	Description
Discrete Manufacturing	23xx	Apparel and other finished products
	25xx	Furniture and fixtures
	27xx	Printing, publishing and allied industries
	31xx	Leather and leather products
	34xx	Fabricated metal products, except machinery and transportation equipment
	35xx	Industrial and commercial machinery and computer equipment
	36xx	Electronic and other electrical equipment and components, except computer equipment
	37xx	Transportation equipment
	38xx	Instruments; photo/med/optical goods; watches/clocks
	39xx	Miscellaneous manufacturing industry
Process Manufacturing	10xx	Metal mining
	12xx	Coal mining
	13xx	Oil and gas extraction
	14xx	Mining/quarrying nonmetalic minerals
	20xx	Food and kindred products
	21xx	Tobacco products
	22xx	Textile mill products
	24xx	Lumber and wood products, except furniture
	26xx	Paper and allied products
	28xx	Chemicals and allied products
	29xx	Petroleum refining and related industries
	30xx	Rubber and miscellaneous plastic products
	32xx	Stone, clay, glass and concrete products
	33xx	Primary metal industries
Transportation Services	40xx	Railroad transport
	41xx	Public transit/transport
	42xx	Motor freight transport/warehousing
	43xx	U.S. Postal Service
	44xx	Water transportation
	45xx	Air transportation (including airline reservation services in 4512)
	46xx	Pipelines, except natural gas
	47xx	Transportation services (including 472x, arrangement of passenger transportation)

EXHIBIT A-2 (CONT.)

Industry Sector Definitions
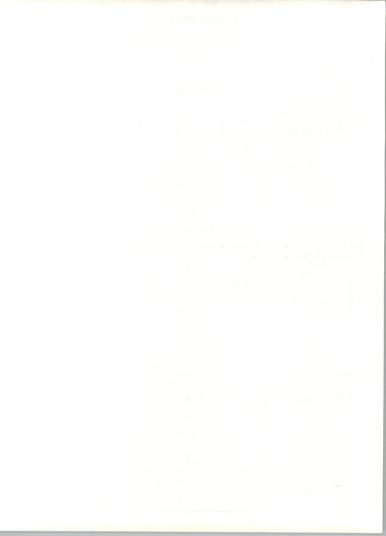
Industry Sector	SIC Code	Description
Utilities	49xx	Electric, gas and sanitary services
Telecommunications	48xx	Communications
Retail Distribution	52xx 53xx 54xx 55xx 56xx 57xx 58xx 59xx	Building materials General merchandise stores Food stores Automotive dealers, gas stations Apparel and accessory stores Home furniture, furnishings and accessory stores Eating and drinking places Miscellaneous retail
Wholesale Distribution	50xx 51xx	Wholesale trade - durable goods Wholesale trade - nondurable goods
Banking and Finance	60xx 61xx 62xx 67xx	Depository institutions Nondepository institutions Security and commodity brokers, dealers, exchanges and services Holding and other investment offices
Insurance	63xx 64xx	Insurance carriers Insurance agents, brokers and services
Health Services	80xx	Health services
Education	82xx	Educational services

EXHIBIT A-2 (CONT.)

Industry Sector Definitions
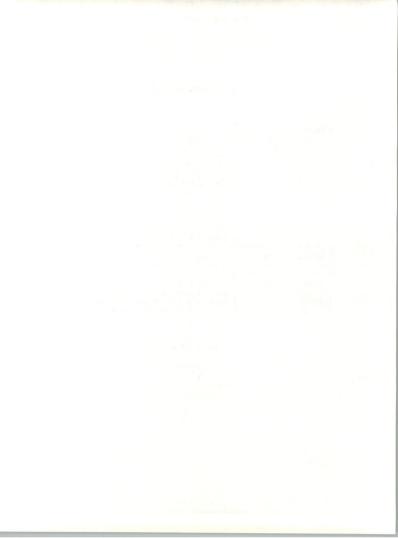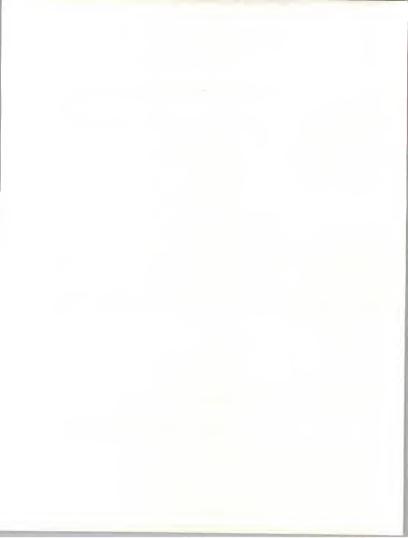
Industry Sector	SIC Code	Description
Business Services	65xx	Real estate
	70xx	Hotels, rooming houses, camps, and other lodging places
	72xx	Personal services
	73xx	Business services (except hotel reservation services in 7389)
	7389x	Hotel reservation services
	75xx	Automotive repair, services and parking
	76xx	Miscellaneous repair services
	78xx	Motion pictures
	79xx	Amusement and recreation services
	81xx	Legal services
	83xx	Social services
	84xx	Museums, art galleries, and botanical/zoological gardens
	86xx	Membership organizations
	87xx	Engineering, accounting, research, management, and related services
	89xx	Miscellaneous services
Federal Government	9xxx	
State and Local Government	9xxx	
Miscellaneous Industries	01xx	Agricultural production - crops
	02xx	Agricultural production - livestock/animals
	07xx	Agricultural services
	08xx	Forestry
	09xx	Fishing, hunting and trapping
	15xx	Building construction - general contractors, operative builders
	16xx	Heavy construction - contractors
	17xx	Construction - special trade contractors

2. Cross-Industry Sector Definitions

In addition to these vertical industry sectors, INPUT has identified seven cross-industry or horizontal market sectors. These sectors or markets involve multi-industry applications such as human resource systems, accounting systems, etc. In order to be included in an industry sector, the service or product delivered must be specific to that sector only. If a service or product is used in more than one industry sector, it is counted as cross-industry. The seven cross-industry markets are:

Accounting - consists of applications software products and information services that serve such functions as:
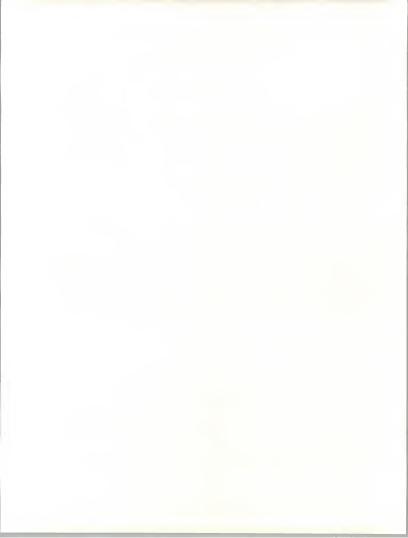
- General ledger
- Accounts payable
- Accounts receivable
- Billing/invoicing
- Fixed assets
- International accounting
- Purchasing
- Taxation
- Financial consolidation

• Excluded are accounting products and services directed to a specific industry, such as tax processing services for CPAs and accountants within the business services industry sector.

Human Resources - consists of application solutions purchased by multiple industry sectors to serve the functions of human resources management and payroll. Examples of specific applications within these two major functions are:

- Employee relations
- Benefits administration
- Government compliance
- Manpower planning
- Compensation administration
- Applicant tracking
- Position control
- Payroll processing

Education and Training - consists of education and training for information systems professionals and users of information systems, as well as the use of computer-based training tools for the training of any employee on any subject.

- The education and training cross-industry sector only considers education and training offered for a noncaptive market; in other words, this sector does not include educational services provided by information services vendors to their customers for training on their own products.

- Education and training that is provided in a classroom setting, live, is not included in this cross-industry sector. This sector is not to be confused with the education industry-specific sector, the subject of another MAP report, which addresses primary and secondary education as a vertical market for IS services.

Office Systems consists of the following:
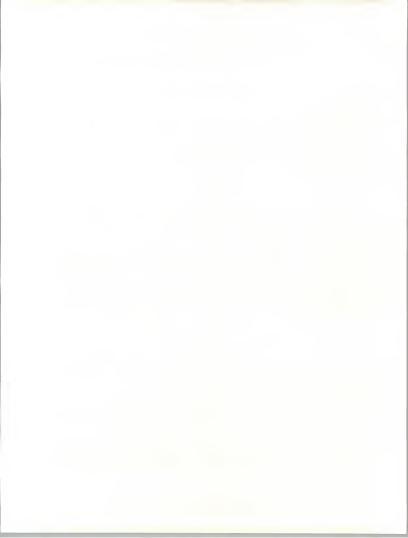
- Integrated office systems (IOS)
- Word processing
- Desktop publishing
- Graphics

- IOSs—such as IBM's OfficeVision, HP's NewWave Office and DEC's All-In-1—typically include the following core functions, all of which are accessed from the same desktop: electronic mail, decision support systems, time management and filing systems.

- Office systems graphics include presentation graphics (which represent the bulk of office systems graphics), paint and line art, page description languages, and electronic form programs.

Engineering and Scientific encompasses the following applications:

- Computer-aided design and engineering (CAD and CAE)
- Structural analysis
- Statistics/mathematics/operations research
- Mapping

- Computer-aided manufacturing (CAM) or CAD that is integrated with CAM is excluded from the cross-industry sector as it is specific to the manufacturing industries. CAD or CAE that is dedicated to integrated circuit design is also excluded because it is specific to the semiconductor industry.

Planning and Analysis consists of software products and information services in four application areas:

- Executive Information Systems (EIS)
- Financial modeling or planning systems
- Spreadsheets
- Project management

Other encompasses marketing/sales and electronic publishing application solutions.

• Sales and marketing includes:

  - Sales analysis
  - Marketing management
  - Demographic market planning models

• The fundamental difference between electronic publishing and desktop publishing (within the office systems sector) is that electronic publishing encompasses a method of document management and control from a single point—regardless of how many authors/locations work on a document—whereas desktop publishing is a personal productivity tool and is generally a lower end product residing on a personal computer.

• Electronic or computer publishing systems that are sold strictly and specifically to commercial publishers, printers, and typesetters are excluded from cross-industry consideration and are included in the discrete manufacturing industry.

3. Delivery Mode Reporting by Sector

This section describes how the delivery mode forecasts relate to the market sector forecasts. Exhibit A-3 summarizes the relationships.

• *Processing services* - the transaction processing services submode is forecasted for each industry and cross-industry market sector. The utility and other processing services submodes are not considered industry or cross-industry specific and are only forecasted for the total market.

• *Turnkey systems* - all of the turnkey systems delivery mode is considered either industry or cross-industry specific and is forecasted for the 15 industry and 7 cross-industry sectors. Each component of turnkey systems (equipment, software products and professional services) is forecasted by market sector.

• *Applications software products* - all of the applications software products delivery mode is considered either industry or cross-industry specific and is forecasted for the 15 industry and 7 cross-industry sectors. In addition, each forecast is broken down by platform level: mainframe, minicomputer and workstation/PC.

• *Systems operations* - all of systems operations is considered industry specific. Each of the submodes (platform and applications systems operations) is forecasted for each of the 15 industry sectors.
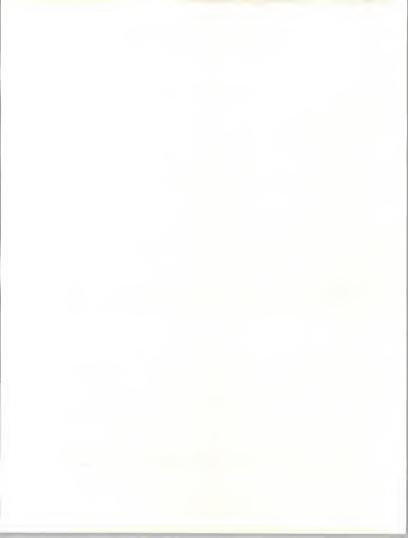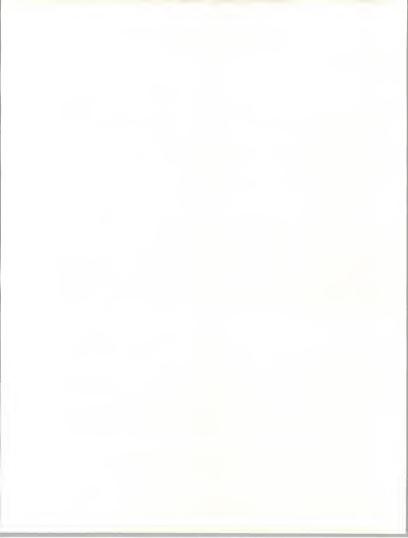
EXHIBIT A-3

Delivery Mode versus Market Sector
Forecast Content

Delivery Mode	Submode	Market Sectors		
		Industry Sectors	Cross-Industry Sectors	Other
Processing Services	Transaction Utility Other	X	X	X X
Turnkey Systems		X	X	
Applications Software Products		X	X	
Systems Operations	Platform Applications	X X		
Systems Integration		X		
Professional Services		X		
Network Services	Network Applications Electronic Information Services	X X		X
Systems Software Products				X

- *Systems integration* - all of systems integration is considered industry specific. Each of the components of systems integration (equipment, software products, professional services and other services) is forecasted for each of the 15 industry sectors.

- *Professional services* - all of professional services is considered industry specific. Each of the submodes (consulting, education and training, and software development) is forecasted for each of the 15 industry sectors.

- *Network services* - all of the network applications submode of network services is considered industry specific and is forecasted for each of the 15 industry sectors. The electronic information services submode is considered to have both industry-specific and non-specific elements.

The forecast for electronic information systems includes forecasts for the 15 industry sectors as well as an additional forecast component that applies to the market as a whole.

- *Systems software products* - All of the submodes (systems control, operations management, applications development) are considered neither industry- nor cross-industry specific. They are only forecasted in total. In addition, each submode forecast is broken down by platform level: mainframe, minicomputer and workstation/PC.

E

Vendor Revenue and User Expenditure Conversion

The size of the information services market may be viewed from two perspectives: vendor (producer) revenues and user expenditures. While the primary data for INPUT's research is vendor interviews, INPUT defines and forecasts the information services market in terms of end-user expenditures. End-user expenditures reflect the markup in producer sales when a product such as software is delivered through indirect distribution channels (such as original equipment manufacturers (OEMs), retailers and distributors). The focus on end-user expenditure also eliminates the double counting of revenues that would occur if sales were tabulated for both producer (e.g., Lotus) and distributor (e.g., BusinessLand).

For most delivery modes, vendor revenues and user expenditures are fairly close. However, there are some areas of significant difference. Many microcomputer software products, for example, are marketed through indirect distribution channels. To capture the valued added through these indirect distribution channels, adjustment factors that incorporate industry discount ratios are used to convert estimated information services vendor revenues to end-user expenditures.

For some delivery modes, including software products, systems integration and turnkey systems, there is a significant volume of intra-industry sales. For example, systems integrators purchase software and subcontract the services of other professional services vendors. And turnkey vendors incorporate purchased software into the systems they sell to end users.

To account for such intra-industry transactions, INPUT uses other conversion ratios to derive the estimate of end-user expenditures.

Exhibit A-4 summarizes the net effect of the various ratios used by INPUT to convert vendor revenues to end-user expenditure (market size) figures for each delivery mode.

EXHIBIT A-4

Vendor Revenue to
User Expenditure Conversion

Delivery Mode	Vendor Revenue Multiplier
Applications Software Products	1.18
Systems Software Products	1.10
Systems Operations	1.00
Systems Integration	0.99
Professional Services	0.99
Network Services	0.99
Processing Services	0.99
Turnkey Systems	0.95

B

Forecast Data Base and Reconciliation

Exhibits B-1 and B-2 give the 1990-1996 user expenditure forecast by submode and by platform.

Exhibits B-3 and B-4 present the forecast reconciliation for the U.S. systems software products market.

The systems software products forecast has been adjusted downward for all products and platform sizes. These 1991 adjustments result in an overall variance of -11% or $3,517 million in user expenditures for 1995.
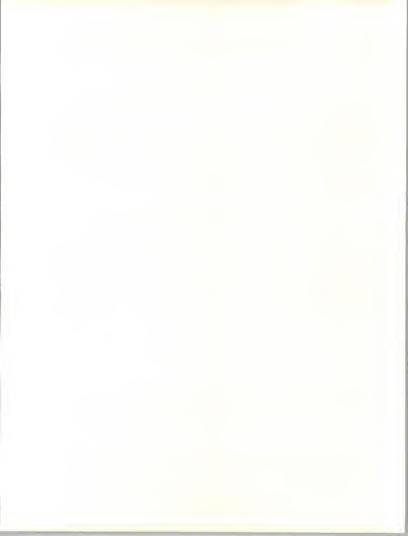
Products whose forecasts have changed the most are workstation- and PC-based products for all three submodes, resulting in 1995 market variances of -20% to -26%.

In essence, the technology shift under way will be a short-term deterrent to purchases of systems software products and is the primary reason for the forecast adjustments.

EXHIBIT B-1
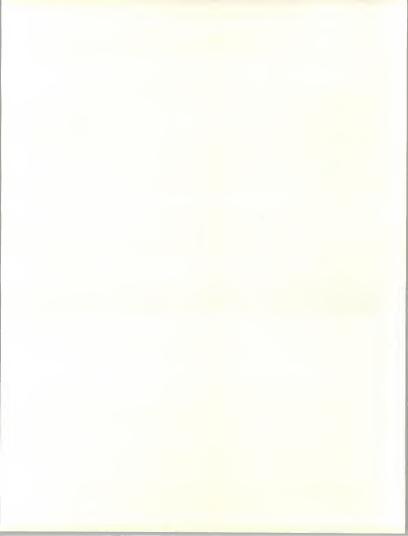
Systems Software Products
User Expenditure Forecast by Submode, 1990-1996
($ Millions)

Delivery Mode	1990 ($M)	Growth 90-91 (%)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	CAGR 91-96 (%)
Delivery Mode Total	16,390	10	18,100	19,910	22,100	24,750	27,970	31,700	12
Systems Control Products	6,200	10	6,800	7,500	8,280	9,140	10,100	11,100	10
- Mainframe	2,900	3	3,000	3,240	3,500	3,780	4,080	4,400	8
- Minicomputer	2,000	10	2,200	2,420	2,660	2,930	3,220	3,500	10
- Workstation/PC	1,300	23	1,600	1,840	2,120	2,430	2,800	3,200	15
Operations Management Tools	3,700	11	4,100	4,570	5,180	5,880	6,780	7,900	14
- Mainframe	2,000	10	2,200	2,440	2,750	3,100	3,500	4,000	13
- Minicomputer	1,300	8	1,400	1,510	1,650	1,800	2,000	2,250	10
- Workstation/PC	400	25	500	620	780	980	1,280	1,650	27
Applications Development Tools	6,490	11	7,200	7,890	8,700	9,700	10,890	12,700	12
- Mainframe	2,900	10	3,200	3,460	3,750	4,090	4,470	4,950	9
- Minicomputer	2,160	11	2,400	2,590	2,800	3,050	3,320	3,750	9
- Workstation/PC	1,430	12	1,600	1,840	2,150	2,560	3,100	4,000	20

EXHIBIT B-2
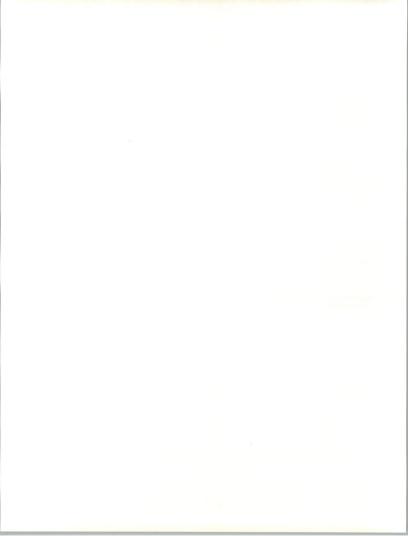
Systems Software Products
User Expenditure Forecast by Platform, 1990-1996

Delivery Mode	1990 ($M)	Growth 90-91 (%)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	CAGR 91-96 (%)
Mainframe	7,800	8	8,400	9,140	10,000	10,970	12,050	13,300	10
- Systems Control Products	2,900	3	3,000	3,240	3,500	3,780	4,080	4,400	8
- Operations Management Tools	2,000	10	2,200	2,440	2,750	3,100	3,500	4,000	13
- Applications Development Tools	2,900	10	3,200	3,460	3,750	4,090	4,470	4,950	9
Minicomputer	5,460	10	6,000	6,520	7,110	7,780	8,540	9,500	10
- Systems Control Products	2,000	10	2,200	2,420	2,660	2,930	3,220	3,500	10
- Operations Management Tools	1,300	8	1,400	1,510	1,650	1,800	2,000	2,250	10
- Applications Development Tools	2,160	11	2,400	2,590	2,800	3,050	3,320	3,750	9
Workstation/PC	3,130	18	3,700	4,300	5,050	5,970	7,180	8,900	19
- Systems Control Products	1,300	23	1,600	1,840	2,120	2,430	2,800	3,200	15
- Operations Management Tools	400	25	500	620	780	980	1,280	1,650	27
- Applications Development Tools	1,430	12	1,600	1,840	2,150	2,560	3,100	4,000	20

EXHIBIT B-3
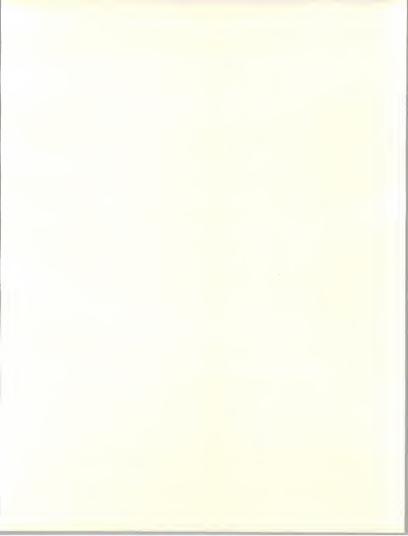
Systems Software Products
1991 Data Base Reconciliation by Submode
($ Millions)

Delivery Mode	1990 Market				1995 Market				90-95 CAGR per data 90 rpt (%)	90-95 CAGR per data 91 rpt (%)
	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report ($M)	(%)	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report ($M)	(%)		
Total Systems Software Products Market	16,390	16,390	-	-	31,487	27,970	-3,517	-11	14	11
Systems Control Products	6,200	6,200	-	-	11,557	10,100	-1,457	-13	13	10
- Mainframe	2,900	2,900	-	-	4,320	4,080	-240	-6	8	7
- Minicomputer	2,000	2,000	-	-	3,431	3,220	-211	-6	11	10
- Workstation/PC	1,300	1,300	-	-	3,807	2,800	-1,007	-26	24	17
Operations Management Tools	3,700	3,700	-	-	7,700	6,780	-920	-12	16	13
- Mainframe	2,000	2,000	-	-	3,917	3,500	-417	-11	14	12
- Minicomputer	1,300	1,300	-	-	2,190	2,000	-190	-9	11	9
- Workstation/PC	400	400	-	-	1,593	1,280	-313	-20	32	26
Applications Development Tools	6,490	6,490	-	-	12,230	10,890	-1,340	-11	14	11
- Mainframe	2,900	2,900	-	-	4,730	4,470	-260	-5	10	9
- Minicomputer	2,160	2,160	-	-	3,570	3,320	-250	-7	11	9
- Workstation/PC	1,430	1,430	-	-	3,930	3,100	-830	-21	22	17

EXHIBIT B-4

Systems Software Products
1991 Data Base Reconciliation by Platform
($ Millions)

Delivery Mode	1990 Market				1995 Market				90-95 CAGR per data 90 rpt (%)	90-95 CAGR per data 91 rpt (%)
	1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report		1990 Report (Fcst) ($M)	1991 Report (Fcst) ($M)	Variance from 1990 Report			
			($M)	(%)			($M)	(%)		
Mainframe	7,800	7,800	-	-	12,967	12,050	-917	-7	11	9
- Systems Control Products	2,900	2,900	-	-	4,320	4,080	-240	-6	8	7
- Operations Management Tools	2,000	2,000	-	-	3,917	3,500	-417	-11	14	12
- Applications Development Tools	2,900	2,900	-	-	4,730	4,470	-260	-5	10	9
Minicomputer	5,460	5,460	-	-	9,190	8,540	-650	-7	11	9
- Systems Control Products	2,000	2,000	-	-	3,431	3,220	-210	-6	11	10
- Operations Management Tools	1,300	1,300	-	-	2,190	2,000	-190	-9	11	9
- Applications Development Tools	2,160	2,160	-	-	3,570	3,320	-250	-7	11	9
Workstation/PC	3,130	3,130	-	-	9,330	7,180	-2,150	-23	24	18
- Systems Control Products	1,300	1,300	-	-	3,807	2,800	-1,007	-26	24	17
- Operations Management Tools	400	400	-	-	1,593	1,280	-313	-20	32	26
- Applications Development Tools	1,430	1,430	-	-	3,930	3,100	-830	-21	22	17

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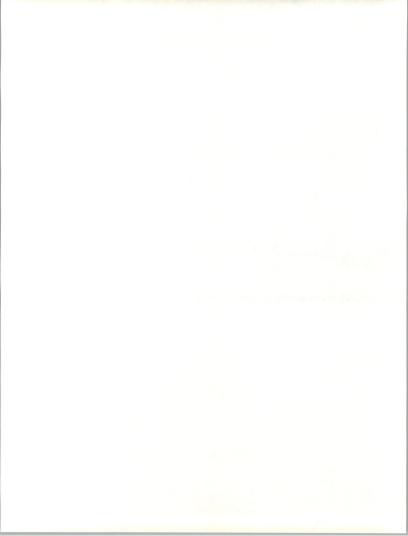
Systems Software and Data Center Questionnaire

INPUT is conducting its annual research on systems software and data center operations. Your response to the following questions will provide a foundation for this research.

The questionnaire can be completed by the corporate computer operations or data center manager. In return, INPUT will send you a summary report of its findings. Your participation is greatly appreciated.

Please mail your completed questionnaire by May 20, 1991 to: MAP, INPUT, 1280 Villa Street, Mountain View, CA 94041-1194, or Fax to (415) 961-3966.
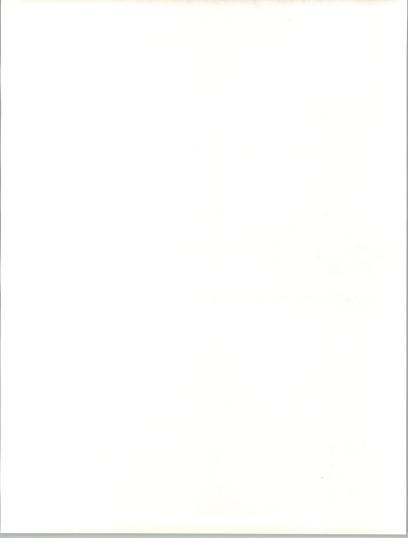
Demographics

1. What is your position/title? _____

2. Which of the following describes your information systems organization?

    _____ Corporate IS   _____ Division IS

3. In which of the following industries is your organization?

_____	Discrete Manufacturing	_____	Insurance
_____	Process Manufacturing	_____	Medical
_____	Transportation	_____	Education
_____	Utilities	_____	Business Services
_____	Telecommunications	_____	Federal Government
_____	Retail Distribution	_____	State & Local Gov't
_____	Wholesale Distribution	_____	Consumer & Home
_____	Banking & Finance	_____	Other (Specify)

4. What are your organization's revenue and number of employees?

a. Revenue		b. Number of Employees	
_____	Over $10 Billion	_____	Over 10,000
_____	Over $1 Billion	_____	Over 5,000
_____	Over $500 Million	_____	Over 1,000
_____	Over $100 Million	_____	Over 500
_____	Over $50 Million	_____	Under 500
_____	Under $50 Million		

Objectives and Plans

5.   What is your primary CPU platform size and vendor?

Platform Size   Vendor
(Check one only)   (name one only)

_____ Mainframe   _____
_____ Minicomputer
_____ Workstation or PC

6a.   Do you plan to change your primary CPU in 1991 or 1992?

_____ Yes   _____ No

b.   If yes, which of the following describes the change? Check all that apply.

_____ Increase in capacity, same vendor
_____ Change in primary CPU vendor
_____ Change in operating system (please describe) _____
_____ Change to client/server (distributed) computing
_____ Change to networked PCs
_____ Mainframe to minicomputer

7a.   Have you offloaded or are you planning to offload any of the workload from your central
      processor?

_____ Yes   _____ No

b.   If yes, what areas are you planning to offload?

Workload category	Currently Offloaded	Planned in 1992
Program Development		
Network Management		
All Applications		
Specific Application Specify _____		
Specific Application Specify _____		
Other Specify _____		
Other Specify _____		
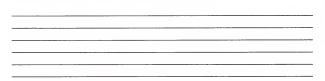
8. Please indicate the types of processors that are integrated into your information network now or planned for 1992 or beyond.
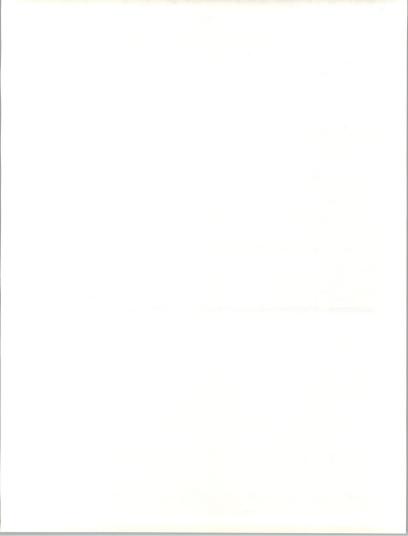
Type of processor	Currently Integrated	Planned for 1992	After 1992
Workstations			
Personal computers			
LANs			
Client/servers			
Minicomputers			
Mainframes			
Other (specify)_____			

9. Please rate on a scale of 1 to 5 the effectiveness of your current network operation.

Low   High
1   2   3   4   5

10. Please describe your current plans to improve this effectiveness.

_____

_____

_____

_____

_____

_____

11. Please indicate whether the following objectives apply to your organization currently, in 1992/1993, beyond 1993, or not at all.

	Currently	1992 /1993	Beyond 1993	Not at all
Data center consolidation				
Data center automation				
Upgrading the central computer				
Downsizing the central computer				
LAN integration				
Network integration				
Use of communication standards				
Voice/data communication integration				
Relational DBMS implementation				
Distributed DBMS implementation				
UNIX implementation				
Migration to frameworks such as SAA or NAS				
New vendor implementation				
Other Specify _____				
Other Specify _____				

12a. Do you use professional services firms in support of your data center and network operation needs?

_____ Yes   _____ No

b. If yes, please indicate in which areas they are used and who the vendor is (name or type of vendor).

Activity			Vendor
Data Center Operations	Yes	No	_____
Network Operations	Yes	No	_____
Network Integration	Yes	No	_____
Hardware Installation	Yes	No	_____
Systems Software Installation	Yes	No	_____
Systems Software Maintenance	Yes	No	_____
Hardware Maintenance	Yes	No	_____

Systems Software Purchase Plans

As you complete the next section of this questionnaire, please use the following definitions:
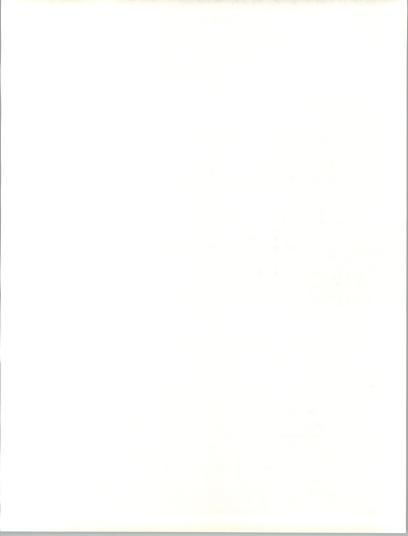
Systems Software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products are structured into the three main categories described below:

> **Systems Control Products**—Programs that function during application program execution to manage computer system resources and control the execution of the application program. Examples: operating systems, communications monitors, network integration products, emulators, library control, windowing, access control, and spoolers.
>
> **Operations Management Tools**—Programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Examples: performance monitors, job accounting systems, computer operations scheduling, disk management utilities, and capacity management.
>
> **Applications Development Tools**—Programs used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples: CASE tools, DBMSs, languages, assemblers, high-level language processors, application generators, report writers, and source-level debuggers.

13a. What is your total systems software budget for 1991 and projected for 1992? ($1000s)

1991 _____   1992 _____

b. Does this amount encompass all systems software purchased/licensed for your entire organization?

_____ Yes   _____ No

c. If no, what percentage of total purchases/licenses do you estimate this to be? (circle one)

<25%   25-50%   50%-75%   75-100%

14. Please break your budget down in the following ways. Estimate expenditures in dollars ($1000s) or percent (%)—whichever is easiest.

a. | Category | 1991 | 1992 |
|---|---|---|
| Systems Control | _____ | _____ |
| Operations Management Tools | _____ | _____ |
| Applications Development Tools | _____ | _____ |
| Total | _____ | _____ |

b.	**Platform**	**1991**	**1992**
	Mainframe	_____	_____
	Minicomputer	_____	_____
	PC/Workstation	_____	_____
	Total	_____	_____

c.	**New versus Existing**	**1991**	**1992**
	New Systems Software	_____	_____
	Existing (Maintenance/annual fees)	_____	_____
	Total	_____	_____

15. For total 1991 expenditures by product category, please estimate the split by platform size.

Category	Main-frame	Mini-computer	Work-station/PC	
Systems Control	_____	_____	_____	100%
Operations Management	_____	_____	_____	100%
Applications Development Tools	_____	_____	_____	100%
Total	100%	100%	100%	
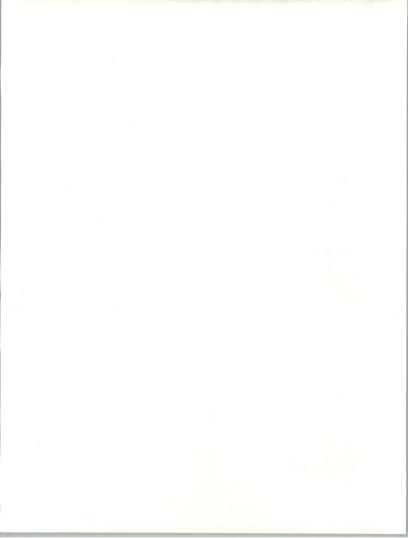
16. For the *new* and *existing* categories, please estimate the percentage for each major category.

	New	Existing	
Systems Control	_____	_____	100%
Operations Management Tools	_____	_____	100%
Applications Development Tools	_____	_____	100%
Total	100%	100%	

Product and Vendor Selection
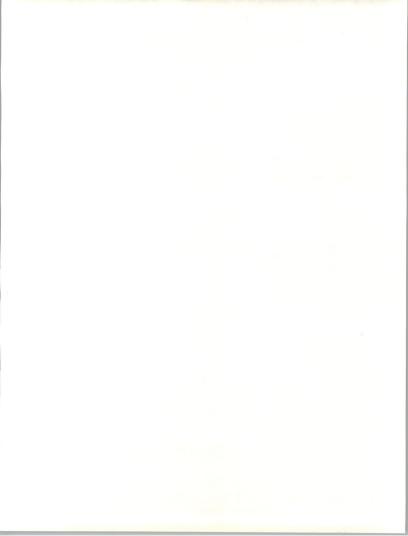
17. Please indicate the importance of each of the following criteria in selecting systems software products.

Selection Criteria	Low		Level of Importance		High
Provided by CPU vendor	1	2	3	4	5
Recommended by CPU vendor	1	2	3	4	5
Specialist in product area	1	2	3	4	5
Offers broad line of products	1	2	3	4	5
Reputation for support	1	2	3	4	5
Relative price versus competition	1	2	3	4	5
Ease of installation	1	2	3	4	5
Ease of use	1	2	3	4	5
PC/Workstation-based product	1	2	3	4	5
Other (specify) _____	1	2	3	4	5
Other (specify) _____	1	2	3	4	5

18.   Overall, how satisfied are you with systems software products on the market today and the
        vendors that provide them?

        Not   **Very**
        Satisfied   **Satisfied**
          1   2   3   4   5

19.   What needs do you have that systems software vendors are not currently addressing?

        _____

        _____

        _____

20.   Please identify three to five of your most important systems software vendors and indicate
        with a check mark the product categories you use them for.

Vendor	Systems Control	Operations Management	Applications Dev. Tools
a.			
b.			
c.			
d.			
e.			

21.   Please indicate the three most significant new systems software purchases planned for 1991
        and 1992, their estimated cost, and the probable vendor.

    a.   **1991 Product Type**   **Estimated cost**   **Probable Vendor**
                                          $ Thousands

        _____   _____   _____

        _____   _____   _____

        _____   _____   _____

b.   **1992 Product Type**   **Estimated cost**   **Probable Vendor**
                                     $ Thousands

——————————   ——————————   ——————————

——————————   ——————————   ——————————

——————————   ——————————   ——————————

Thank you for participating in INPUT's survey. If you would like us to send you a summary of the survey's findings, please provide your name and address. No salesperson will call you and your responses to the survey will be kept in strict confidence.

Name: _____

Company: _____

Address: _____

_____

_____

Phone: _____

About INPUT

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

Subscription services, proprietary research/consulting, merger/acquisition assistance, and multiclient studies are provided to users and vendors of information systems and services. INPUT specializes in the software and services industry which includes software products, systems operations, processing services, network services, systems integration, professional services, turnkey systems, and customer services. Particular areas of expertise include CASE analysis, information systems planning, and outsourcing.

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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