U.S. SYSTEMS SOFTWARE PRODUCTS MARKETS

1980 - 1985

INPUT

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U.S. SYSTEMS SOFTWARE PRODUCTS MARKET

1990-1995

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Market Analysis Program (MAP)

U.S. Systems Software Products Market, 1990-1995

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Abstract

This annual report provides analysis and five-year forecasts of the U.S. systems software products market for the period 1990-1995. 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.

Systems software represents about 15% of the information services market in the U.S. and has been growing faster than the overall market. 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 118 pages and 45 exhibits.

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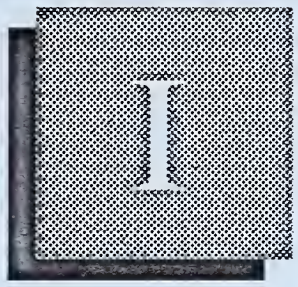
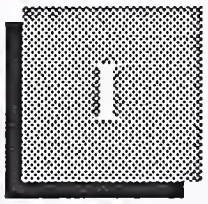


Introduction



Introduction

This report is part of a series of market analysis reports written each year by INPUT on the key sectors (delivery modes) of the U.S. information services market. The delivery modes analyzed during 1990 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 that are part of INPUT's Market Analysis Program, a planning service for information services vendors. The other two delivery modes are covered in market analysis reports included in INPUT's Systems Integration and Systems Operations Programs.

A

Purpose and Organization of the Report

1. Purpose

This report, *U.S. Systems Software Products Market , 1990-1995*, analyzes the systems software sector of the U.S. information services market. The report assesses trends and events within the U.S. economy, the U.S. information services market, 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 includes five-year forecasts, assessment of market drivers, analysis of competitive trends, and identification of leading vendors.

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 competitive trends
- Determine potential market directions
- Prioritize investments

2. Report Organization

This report is organized as follows:

- Chapter II - Executive Overview, provides a summary of the research analysis, conclusions and recommendations of the report.

- Chapter III - General Business Climate, provides an overview of the business climate within the U.S. information services market and the systems software delivery mode.

- Chapter IV - Market Forecast, gives a comprehensive look at the specific delivery mode and submodes; the five-year, 1990-1995 forecasts; and an assessment of the forces driving this market sector. Where appropriate, the forecasts are presented by vertical and cross-industry markets.

- Chapter V - Issues and Trends, discusses the issues and trends that are most critical to this delivery mode immediately and for the long term.

- Chapter VI - Competition, identifies the leading vendors and assesses the key competitive trends within this delivery mode. Profiles of vendors that exemplify the competitive trends are also provided.

- Chapter VII - Conclusions and Recommendations, provides conclusions and recommendations, and identifies opportunities for the information services vendors active in or considering entering this delivery mode.

- Appendix A - Definitions, defines the terms used throughout INPUT's market analyses.

- Appendix B - Forecast Data Base, summarizes the forecast for this market sector and reconciles the current forecast with the 1989-1994 forecast.

B

Scope and Methodology

1. Scope

This report addresses the U.S. information services market for the systems software sector. It includes user expenditures that are noncaptive (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-1 defines the structure of the information services industry as used by INPUT in its market analyses and forecasts. The market consists of eight delivery modes, each of which contains a number of submodes.

- INPUT develops a five-year forecast for each of the submodes listed.
- The following delivery modes are forecasted on a vertical industry and cross-industry basis: applications software products, turnkey systems, processing services, professional services, systems integration, and systems operations.
- The systems software products and network services delivery modes are forecasted for the U.S. market as a whole.

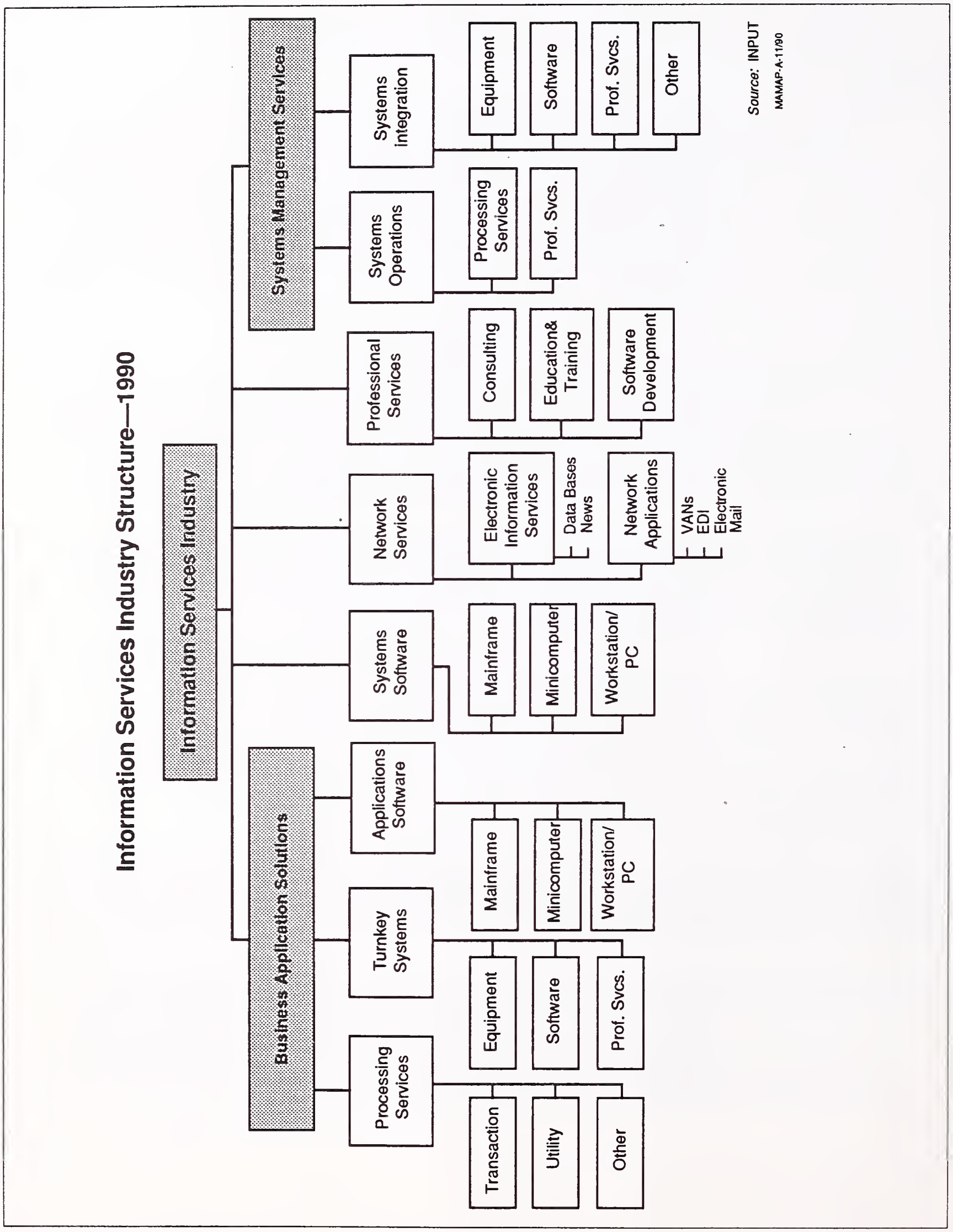
For a more complete discussion of INPUT's information services industry structure and terminology, please refer to Appendix A, Definitions.

b. Delivery Mode Description

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products are structured into three main areas, as shown in Exhibit I-2 and 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.

EXHIBIT I-1

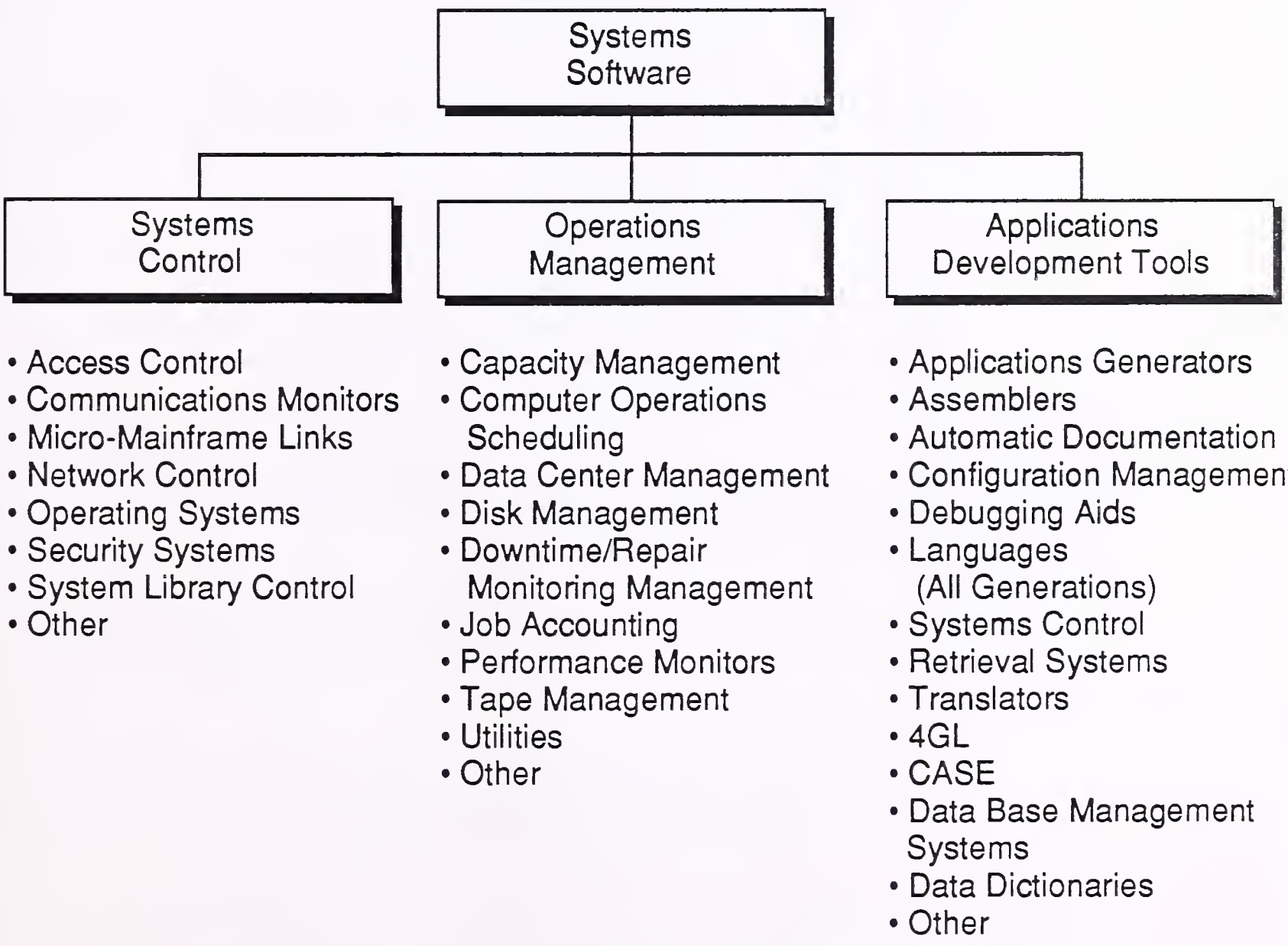


- *Operations Management Tools* - Software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

- *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) which are directly invoked by an applications program.

EXHIBIT I-2

Systems Software Products Market Structure—1990



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

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 three delivery modes.

2. Methodology

INPUT's methodology for market analysis and forecasting is summarized in Exhibit I-3. As in past years, INPUT has continued the process of surveying information services vendors to determine their U.S. information services revenues, surveying information systems organizations to determine their expenditure and outside services acquisition plans, and interviewing vendors a second time to understand their views of the market opportunities over the short and long terms.

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 23 vertical and cross-industry sectors for hundreds of vendors. This is accomplished through interviews, use of public data, and INPUT estimates.

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

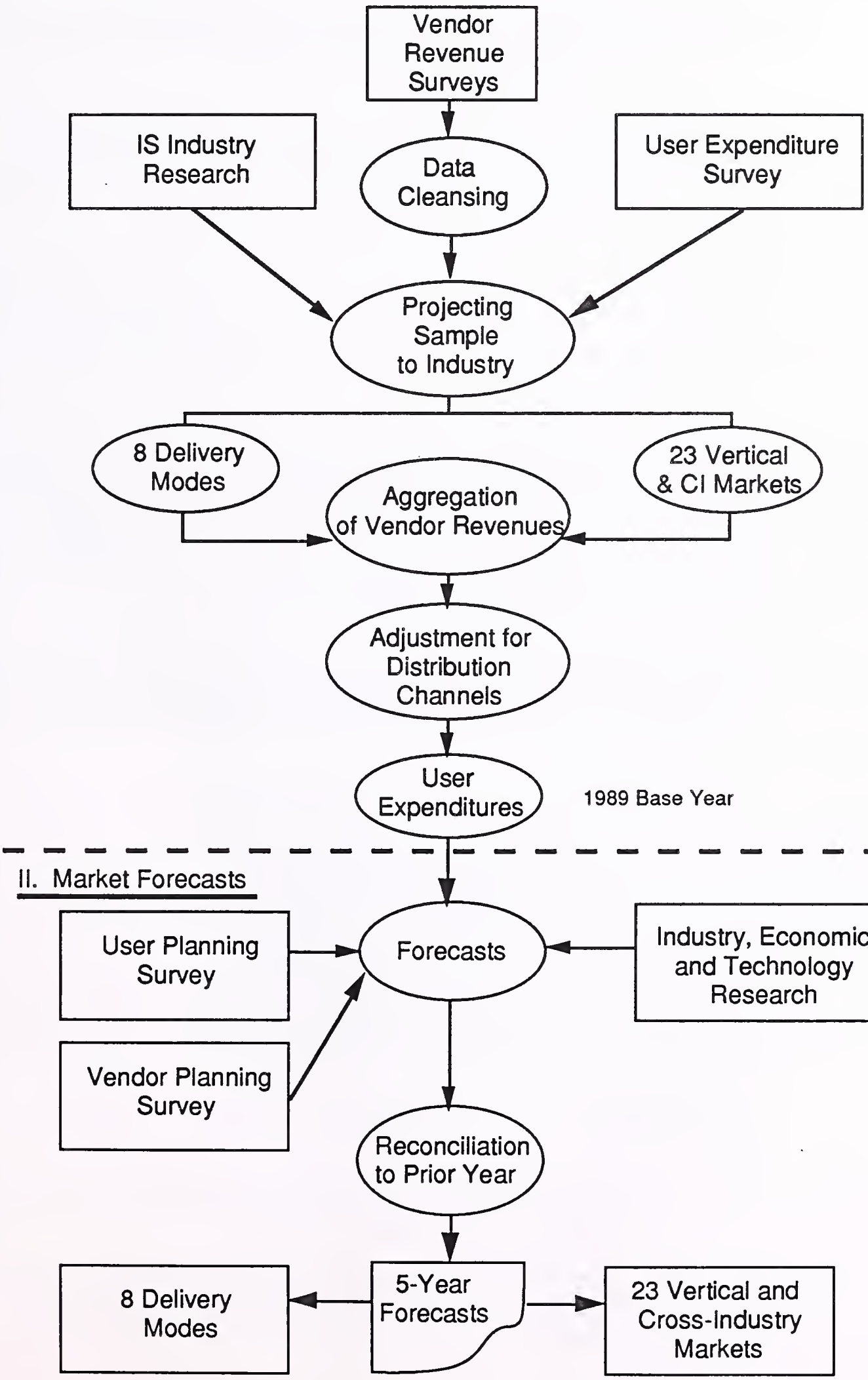
- The end result is a base-year (1989) user expenditure figure for each of the 23 vertical and cross-industry sectors and the eight delivery modes.

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.

EXHIBIT I-3

INPUT Research Methodology



- 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 23 vertical and cross-industry sectors and the eight delivery modes.

To complete the process, INPUT reconciles its new forecasts with those from the previous year. Differences due to market restructuring and other causes are explained, giving users of these projections the ability to track INPUT's forecasts from year to year.

C

Economic Assumptions

Forecasts are presented in current dollars (i.e., 1995 market sizes are in 1995 dollars). In developing the five-year forecasts, INPUT has incorporated the following economic assumptions regarding the outlook for the U.S. economy as a whole.

The GNP and GNP deflator growth rates used in INPUT's market projections for 1990 are from the CONSENSUS™ forecast, Blue Chip Economic Indicators of Sedona, Arizona. The Blue Chip CONSENSUS forecast is derived from a 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.

Exhibit I-4 shows both the economic assumptions used by INPUT in the 1989-1994 market analysis reports and those being used for the 1990-1995 reports. The 1990-1995 assumptions, compared to those used for 1989-1994, indicate:

- Significantly lower real GNP growth for 1990 and 1991

- Stronger real GNP growth for 1992 and beyond

- Inflation at somewhat lower levels using the 1990-1995 assumptions

The resulting nominal GNP growth used by INPUT is for much lower growth in 1990 (5.4% versus the projected 7.7% in the 1989 reports) and 1991 (5.4% versus 7.8%).

- In 1992 and beyond, the nominal GNP growth rates are quite comparable

- For the five-year period 1989-1994, the annual nominal GNP is 6.2% versus the previous 7.1%.

In summary, the economic assumptions used by INPUT reflect significantly reduced growth in the near term, followed by modest, steady growth through 1995.

EXHIBIT I-4

GNP and Inflation Growth Rate Assumptions 1989-1995

1989 Report Assumptions

Overall Economy	1989E	1990E	1991E	1992E	1993E	1994E	1995E	CAGR 89-94 (%)	CAGR 90-95 (%)
Nominal GNP	7.6	7.7	7.8	7.0	6.5	6.5	6.5	7.1	--
GNP Deflator	4.8	5.2	5.5	5.0	4.5	4.5	4.5	4.9	--
Real GNP	2.8	2.5	2.3	2.0	2.0	2.0	2.0	2.2	--

1990 Assumptions (Preliminary Estimate)

Overall Economy	1989A	1990E	1991E	1992E	1993E	1994E	1995E	CAGR 89-94 (%)	CAGR 90-95 (%)
Nominal GNP	6.7	5.4	5.4	6.8	6.8	6.8	6.5	6.2	6.5
GNP Deflator	4.1	4.4	4.6	4.1	4.0	4.0	3.9	4.2	4.1
Real GNP	2.5	1.0	0.8	2.6	2.7	2.7	2.5	1.8	2.2

Note: 1989A based on final figures reported by U.S. Commerce Department

1990 onward from CONSENSUS™ economic forecast reported by Blue Chip Economic Indicators, Sedona, AZ (Vol 15, No 10, October 10, 1990)

It should be noted that the U.S. economic environment has worsened for the short term since this CONSENSUS forecast was published in October, 1990. There are stronger signs of a recession in the first two to three quarters of 1991. The impact of a recession on the 1991 information services market is discussed in Chapters III and IV.

D

Related Reports

Related reports of possible interest to the reader include:

1. U.S. Markets

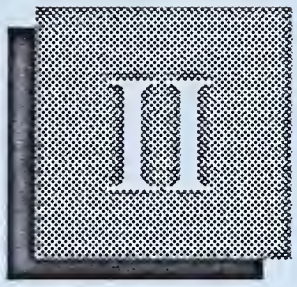
- *U.S. Applications Solutions Market , 1990-1995*
- *U.S. Processing Services Market , 1990-1995*
- *U.S. Professional Services Market , 1990-1995*

- *U.S. Systems Integration Market , 1990-1995*
- *U.S. Systems Operations Market , 1990-1995*
- *U.S. Processing Services Market , 1990-1995*
- *U.S. Industry Sector Markets, 1990-1995* (16 reports on all major industry sectors, e.g., Insurance)
- *U.S. Cross-Industry Sector Markets, 1990-1995* (7 reports on information services markets that serve all vertical industry sectors, e.g., Accounting)

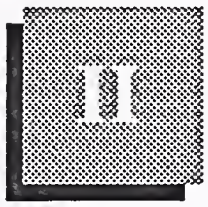
2. European Markets

- *The Western European Market for Computer Software and Services, 1990-1995*
- *Systems Software Products—Western Europe, 1990-1995*
- *Trends in Processing Services—Western Europe, 1990-1995*
- *Systems Integration Market Forecast —Western Europe, 1990-1995*
- *Systems Operations Market Forecast—Western Europe, 1990-1995*
- *Western European Network Services Markets, 1990-1995*

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



Executive Overview



Executive Overview

Corporate data needs are becoming more detailed and frequent, and the tasks computers are expected to perform are becoming more complex. Companies clearly recognize the importance of effectively using information services to remain competitive. Yet software products lag behind. There are several key reasons for this:

- Hardware generation is progressing at such a fast pace that software development has been unable to keep up.
- Although important strides have been made, uncertainties over standards persist.
- The ability on the part of end users to assimilate and use software products lags behind product availability.
- In addition, for the information services industry, the 1990s will be a period of slowed growth due to a slowed economy, overall declining hardware sales, and overall maturation of the information services industry.

Ample opportunity exists for new systems software products and technologies. What must take place, however, is continued progress towards standards, increasing ease of use, and additional ways to enhance understanding, use and integration of software products.

A Information Services Market

The information services market consists of eight delivery modes: processing services, turnkey systems, applications software, systems software, network services, professional services, systems operations, and systems integration.

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 U.S. information services market totaled $89.8 billion in 1989, up 14% from 1988 user expenditures. Overall user expenditures will expand to $100.6 billion in 1990, up 12% from 1989. The modest growth rate of the U.S. information services market will continue, with a projected five-year (1990-1995) compound annual growth rate of 13%.

As INPUT publishes its first set of forecasts for the 1990s, the U.S. information services industry faces a different set of business conditions from those experienced since early in the 1980s.

The 1980s were marked by continuing strong growth following the formation of the information services industry in the late 1960s and early 1970s. Except for slowed growth during the economic downturn that started in 1982, the information services market grew about 20% each year and routinely outperformed the economy as a whole. This overall growth has moderated in the past couple of years. In terms of development, the industry is maturing; in some segments it has reached the top of the "S" curve.

User expenditure on software products, however, has consistently increased as a portion of the overall information services industry. This trend will continue; software products are expected to account for 35% of the total user expenditures by 1995. Systems software products have and will continue to represent about half of user expenditures on software.

B

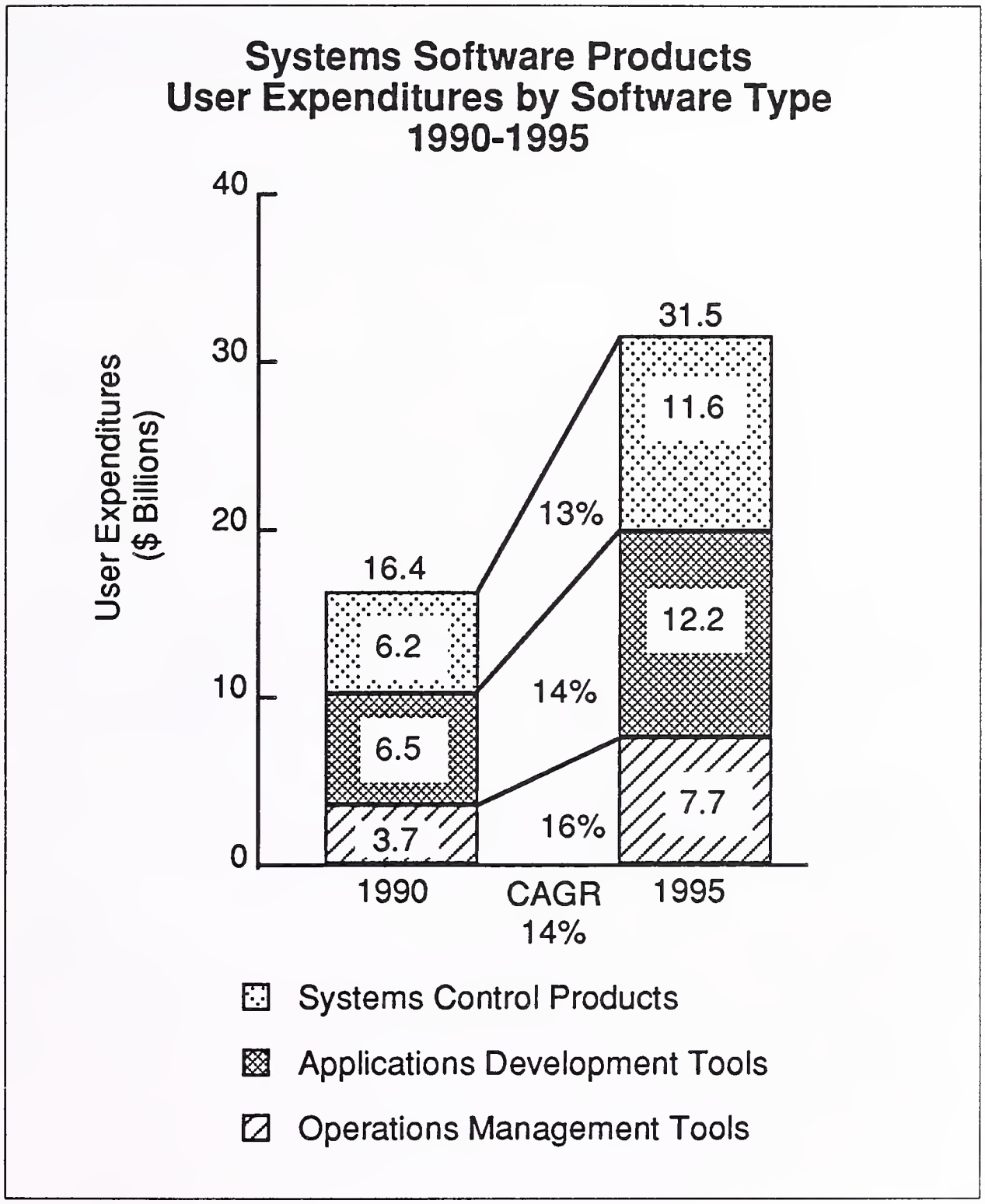
Systems Software Market

The overall systems software market will expand from $16.4 billion in 1990 to $31.5 billion by 1995, at a compound annual growth rate of 14%, as shown in Exhibit II-1.

In terms of platform size, the greatest growth will be at the PC/workstation level, as shown in Exhibit II-2. By 1995, user expenditures on systems software for workstations and personal computers will have increased to such an extent that expenditures will be just about equal for midrange computers and PC/workstations.

Systems software products enable computers and communications systems to perform basic machine-oriented or user interface functions. Thus, as hardware changes, so does systems software.

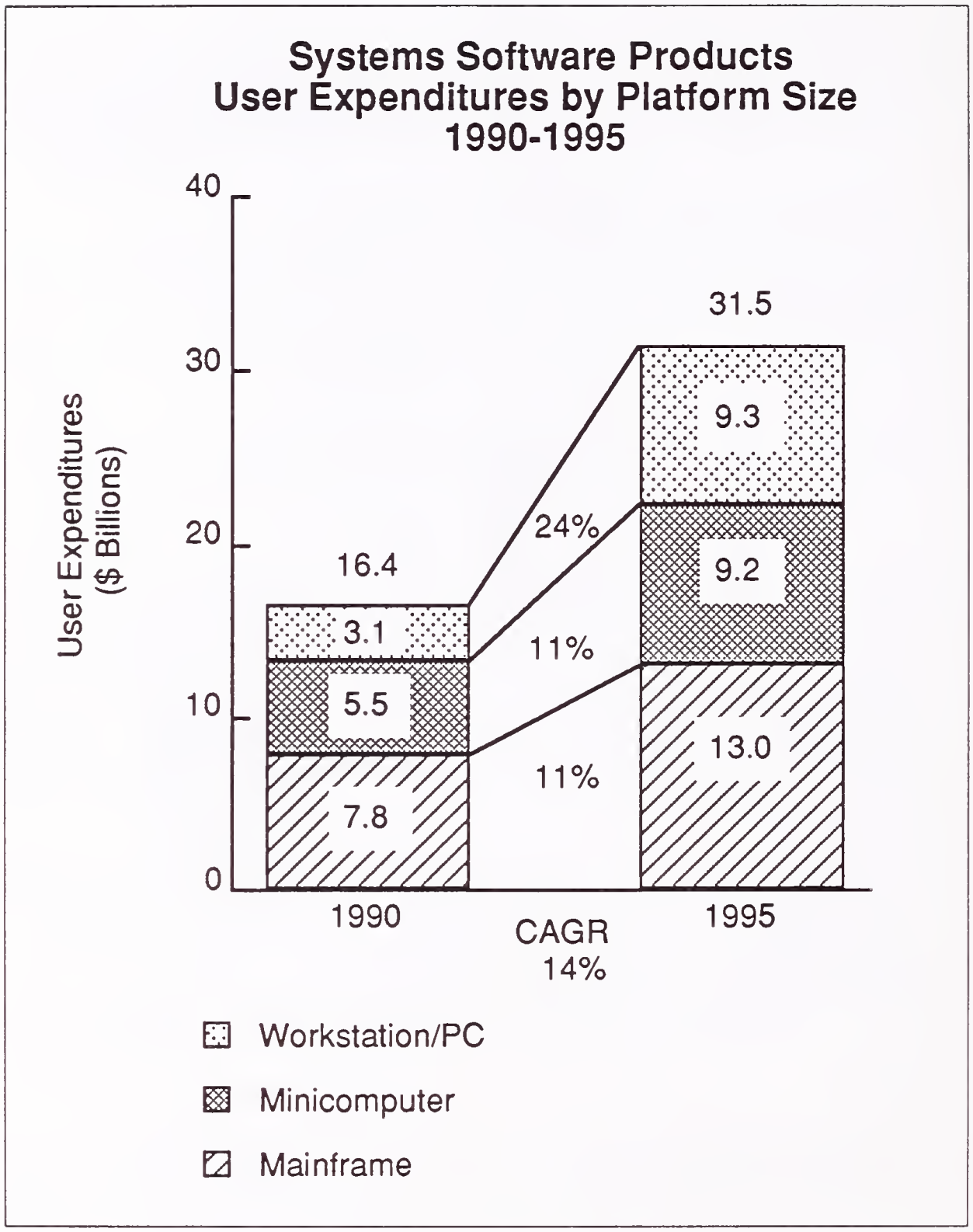
EXHIBIT II-1



During this five-year period, new products will be forthcoming not only due to a trend towards standards-compliant systems software products, but also due to trends towards computer downsizing, distributed processing, and integration.

Overall and in the long term, these trends will fuel the demand for new generations of systems software. In the short term, they will be growth inhibitors, as key standards have yet to be finalized, client-server architecture is in its infancy, and integration is just beginning to be realized.

EXHIBIT II-2



- The slowed economy will have a mixed impact on systems software.
- Hardware sales will slow further in the short term.
- The movement to higher end personal computers will slow somewhat, slowing the adoption of OS/2 and UNIX.
- Pressure to lower processing costs will speed data center consolidation and the sale of high-end operations management tools.

Systems software products are in three main areas: systems control products, operations management tools, and applications development tools.

The fastest growing submode will be operations management tools, which encompass network administration and control products. In addition to pressures to improve processing efficiency, the trend towards multiplatform, multivendor network and network integration will fuel this growth.

Systems control products, the largest submode, 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.

Because hardware unit shipments are no longer experiencing the explosive growth of several years ago, they are no longer a strong growth promoter. New systems control products, however, including network integration products and products that support standards, running on both new and existing hardware, will fuel the market.

Application development tools include data base management systems, CASE tools, traditional programming languages, 4GLs, and data dictionaries, as well as newer technologies such as image and voice processing.

The strongest growth will be in CASE tools, which represent the smallest product grouping within application development tools. The need to improve software development productivity, compounded by the continuing shortage of software engineers, will drive the market. IS organizations, however, have to learn to use CASE effectively. Continued strong growth is dependent on organizations' willingness to revamp their structures and accept new technology. It is also dependent on the strategies and product offerings of the larger systems vendors.

Applications development backlogs, compounded by the need to maintain and re-engineer existing software products, are continuing to deter revenue growth and profitability in the software industry. This backlog is fostering increasing interest within the software development community for the newer generation of application 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.

DBMS growth was not as strong as INPUT originally anticipated and 1989 user expenditures have been adjusted downward. Although interim issues need to be worked out, the DBMS market will experience strong growth through the 1990s. Traditional DBMS technology will account

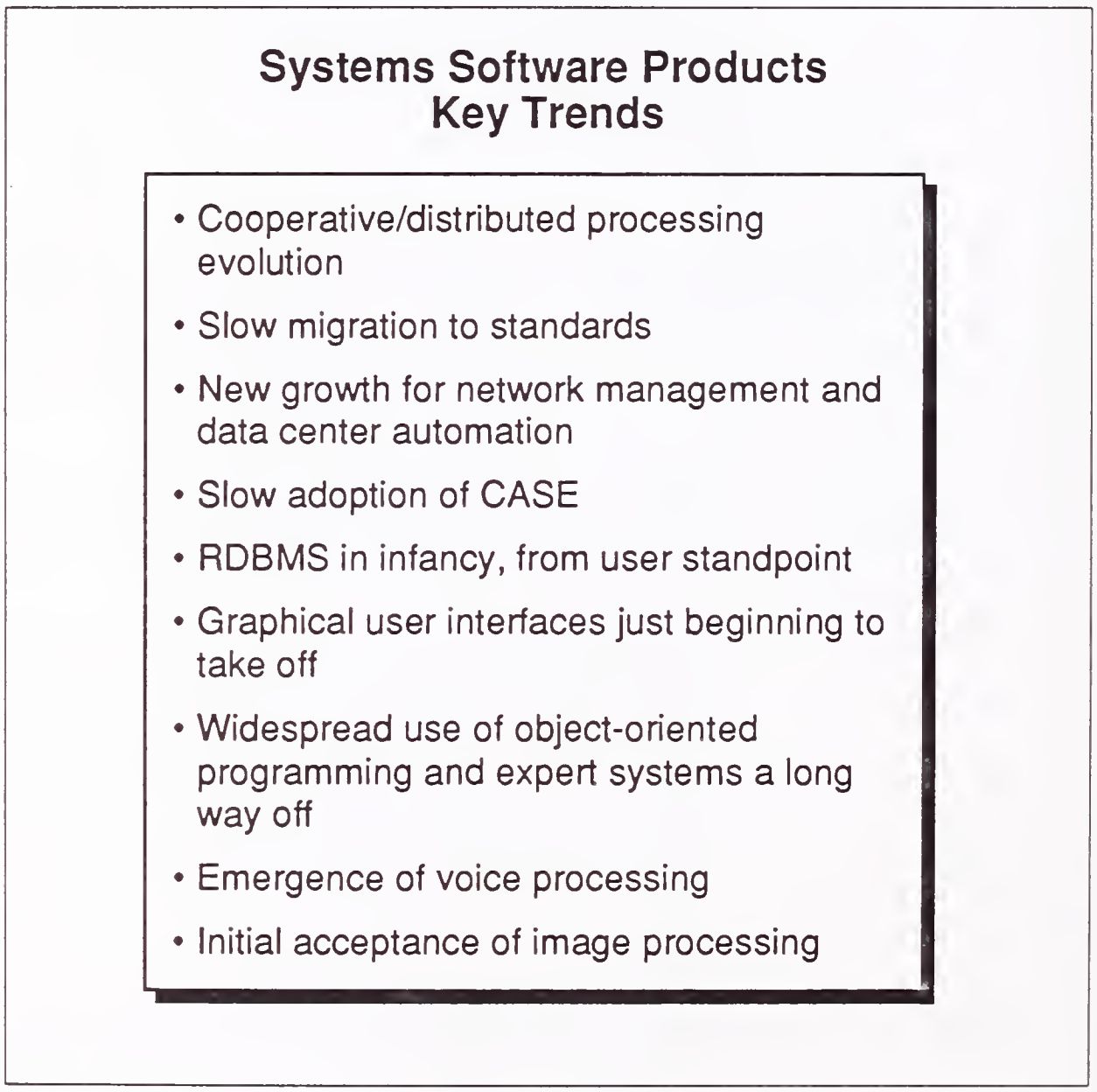
for over 50% of user expenditures in 1990. With the current upsurge in interest in RDBMSs spurred on by recent IBM product announcements and increasing acceptance of DB2 as the de facto mainframe RDBMS standard, this percent of the total will decline.

C

Key Issues and Trends

INPUT has identified nine trends, summarized in Exhibit II-3 and described in detail in Chapter V of this report, that will shape the market in the next five years.

EXHIBIT II-3



The first two trends are briefly described below:

- Cooperative/distributed processing evolution—Client-server computing will move slowly not only because products are just getting out the chute, but also because the vast majority of desktop users are satisfied with using Lotus 1-2-3 and word processing. Those who are using data

bases will have to get out of the mindset of controlling where their data resides. Also, PC networks are typically supporting personal computers for very simple applications and peripheral sharing. Thus, a fundamental cultural shift will need to take place.

- Slow migration to standards—IBM's "proprietary" standard is a blueprint, most of which is not realized yet. A recent INPUT survey found that 25% of IS organizations in large corporations are giving SAA attention and have some SAA implementation activities. That percentage is projected to grow to about 50% in 1992. Portable, SAA-compliant applications are not expected until the mid-1990s as users grapple with the meaning of SAA and vendors and users alike adopt a "wait-and-see" attitude.

In addition to IBM, other vendors—most notably Computer Associates—are providing a framework for their software products. The CA90s framework has been equated to SAA's and, in fact, encompasses it; it is an integration philosophy and marketing commitment designed to develop customer allegiance and to increase penetration within the Computer Associates base. The adoption of UNIX is an evolutionary process. It has a leg up on proprietary standards in that it cuts across multiple vendors.

Up to 1995 and beyond, many software products will evolve into commodity-type offerings. With comparable product offerings by several companies, more emphasis will be placed on value-added service capability, which will become a primary source of growth and profit margin.

Given the eventuality of standards, the cost of switching vendors will become lower. Therefore, vendors will seek ways to differentiate through service, pricing, distribution and/or expertise in a particular niche.

D

Competition

In the 1990s, systems purchases will be made more on the basis of software and services than on the basis of hardware performance. Software is where the power is because if a vendor can provide the software product it can also provide all the services associated with it, such as systems integration, consulting, and facilities management. What will therefore ensue is vendor competition for "control" of the various pieces of the software industry.

Winners will be those that standardize and remain cognizant of IBM's priorities. For example, many software vendors are scrambling to get on the repository bandwagon, now that the computing world has agreed that IBM's AD/Cycle will be the standard for the CASE industry. Vendors who do not pledge support for the IBM repository offering risk losing substantial business.

In light of the integration trend, product breadth is important. A niche company will have to have strong alliances or risk being acquired.

The systems software market structure is shifting in the following ways:

- Merger and acquisition activity continues to be strong, as large companies are better able to afford the investment necessary to cover the increasing costs of product development related to more complex software product requirements. In addition, standards will cause more consolidation, as will the continuing need in the marketplace to eliminate redundancy.

- The rapid formation of startups will continue as new technologies catch on and as standards such as SAA create niche opportunities.

- Even though consolidation is rampant, smaller companies will be able to survive because they have an opportunity to partner, which will allow them to broaden their product offerings and/or marketing and sales capabilities.

- Codevelopment with customers will speed up and help fund new technology.

- Different distribution channels have been necessary to sell each software product type, and the market has become very segmented. However, a movement is underway to consolidate distribution channels. Systems integrators are playing a major role in this consolidation.

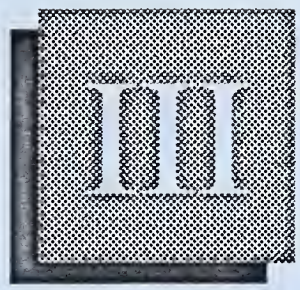
E

Conclusions

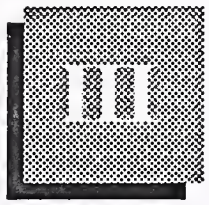
User expenditures on systems software products were $6.3 billion in 1985 and will reach $16.4 billion in 1990, at a compound annual growth rate of 21% over the last five years. Expenditures are forecast to reach $31.4 billion in 1995, at a five-year compound annual growth rate of 14%.

This forecasted slower growth is due in large part to the transition to standards and open systems, and to client-server architectures, as well as—at least in the short term—a slowing economy. The marketplace is adopting a "wait-and-see" stance as systems software companies begin to respond with new products. The user community will need additional support services and training in order to assimilate these new products and to take full advantage of their benefits.

Because of the slowed growth and the movement towards integration and standards, industry consolidation continues and the formation of alliances is accelerating. Only the fittest and most innovative vendors will survive. Vendors are faced with the nothing-to-sneeze-at challenges of overall declining growth, steering a course through the uncharted waters of technology innovation, customers who are challenged with assimilating all the new technology, continued industrywide consolidation, and successfully managing myriad alliances over the long term.



General Business Climate



General Business Climate

In this chapter, INPUT positions the market for systems software products within the overall information services industry. The chapter first characterizes the general business climate, then the issues and climate of the information services industry as a whole. In the last section it positions systems software products within the overall business climate for information services.

The reader will find this chapter quite similar to the corresponding Chapter III in the following market analysis reports:

- *U.S. Applications Solutions Market, 1990-1995*
- *U.S. Processing Services Market, 1990-1995*
- *U.S. Professional Services Market, 1990-1995*
- *U.S. Network Services Market, 1990-1995*

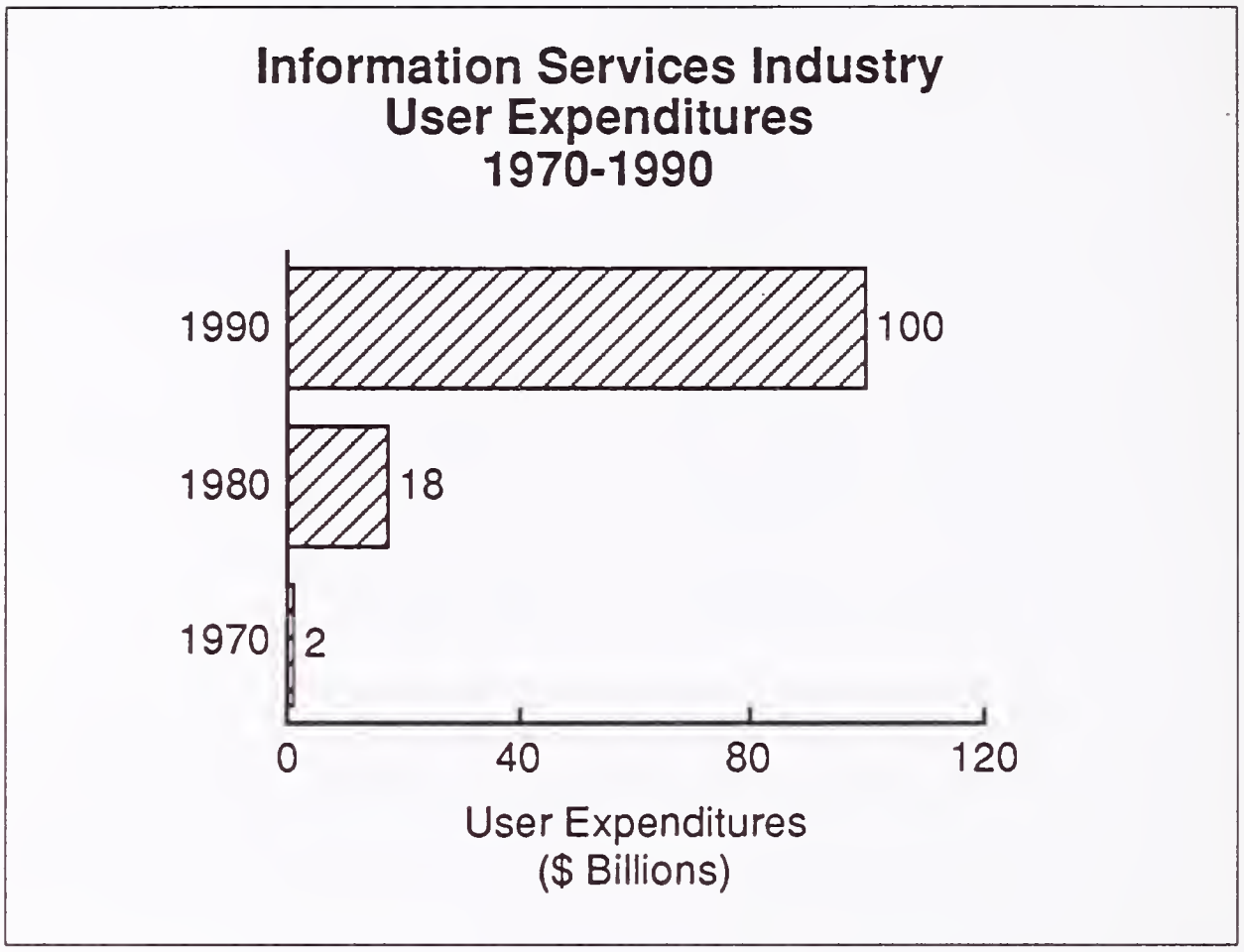
A General Economic Climate

1. A Look at the 1980s

As INPUT publishes its first set of forecasts for the 1990s, the general U.S. economy and the U.S. information services industry face a new set of business conditions, different from those experienced since early in the 1980s, when the last downturn in the economy occurred. As shown in Exhibit III-1, in 1980 the U.S. information services market was less than 20% of its size 10 years later. Today that market represents approximately $100 billion in user expenditures each year.

The 1980s were marked by continuing strong growth following the formation of the information services industry in the late 1960s and early 1970s. Except for slowed growth during the downturn that started in 1982, the information services market grew at about 20% each year and routinely outperformed the economy as a whole.

EXHIBIT III-1



This overall growth has moderated in the past couple of years, with the U.S. information services industry growing about 13% in 1990 as the impacts of the downturn began to be felt. In terms of development, the industry is maturing; in some segments it has reached the top of the "S" curve. Thus, declining growth rates are to be expected, particularly as the market size continues to increase.

The decade ended with much lower growth rates in mainframe and minicomputer shipments and the first signs of maturity in personal computer and workstation sales. Although all of the delivery modes included in INPUT's definition of the information services industry have growth rates above that of hardware, the trends for hardware certainly impact each delivery mode.

Thus, we enter the 1990s with a maturing market for the products and services of information systems and services companies. Yet it remains a market that can and does outgrow the economy and continues to offer new business opportunities, in particular those containing a high degree of solution content.

2. Near-Term Impacts

As noted in Chapter I, the U.S. economy is in or close to entering a recessionary period. Though it is expected to be modest, a recession will directly impact many sectors of the economy, which in turn will impact

expenditures for information services. Real growth in the overall U.S. economy will be very small in 1990 and could drop to zero in 1991.

- For the past few years the information systems budget has reflected tightening spending patterns, with increases averaging less than 10% overall. Many organizations indicate essentially no change from year to year, and some organizations undergo year-to-year reductions of over 10%.

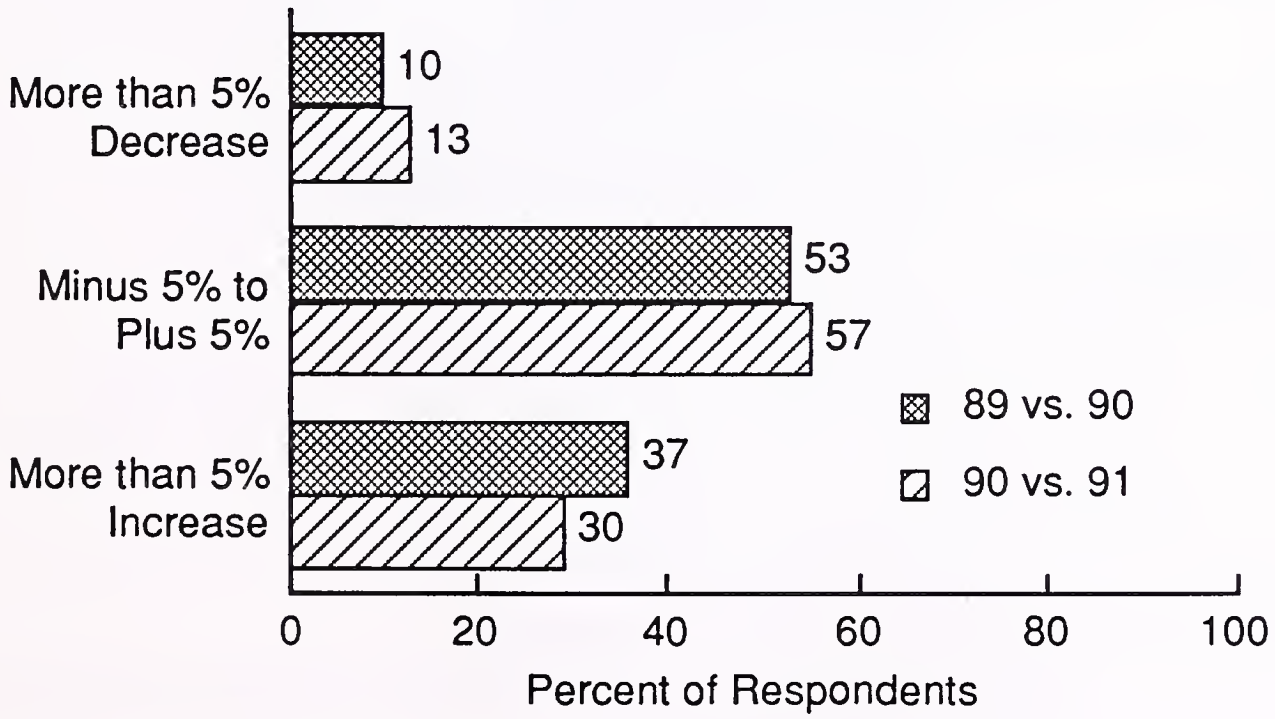
- During this period, growth in expenditures for information services have exceeded the overall growth in information systems budgets. The hardware and internal staff budgets have absorbed much of the impact of tighter budgets.

a. Information Systems User Impacts

Exhibit III-2 gives an assessment of information systems budget plans for 1989 through 1991. The research for this assessment was done in November, 1990.

EXHIBIT III-2

Information Systems Budgets—1989 vs. 1990 and 1990 vs. 1991



- The findings indicate that only about one in three information systems budgets grew by over 5% in 1990 over 1989 levels, and the percentage planning to grow more than 5% in 1991 is even less—three out of ten.

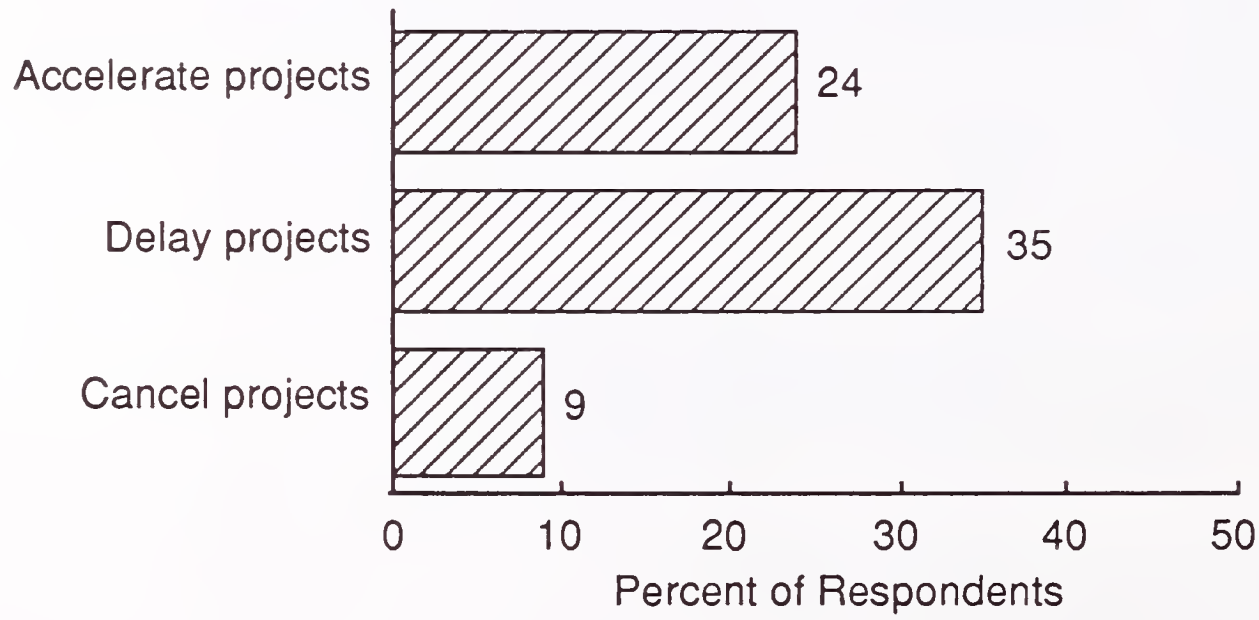
- At the same time, the research found that drastic cuts are not planned, as might have been expected in a full recessionary environment.

Many respondents indicated that after a number of years of tightening budgets, 1991 would just be another year of the same. For most organizations, major strategic projects would not be measurably impacted, given current general business projections.

Exhibit III-3 supports that belief. INPUT found a number of organizations that would actually accelerate some projects in a recessionary economy and very few that would cancel projects.

EXHIBIT III-3

Applications Development Plans Recession Impacts



- Projects identified for acceleration were typically of key value to business operations.

- Projects identified for possible delay or cancelation were typically administrative and often were replacements for existing systems.

INPUT found that the current economy will impact information systems spending in the near term (through 1991 at least), but not significantly. This will lead to slower growth rates in information services expenditures over the next 12 to 18 months, which may in turn create some pent-up demand for 1992 and beyond. The depth and length of the downturn will be a deciding factor in how much demand is delayed until 1992.

For a complete review of INPUT's recent research into the impacts of the current economy on information systems, see INPUT's report, *The 1990 to 1991 U.S. Economic Slowdown—Impacts on Information Systems Budgets and Spending*.

b. Information Services Vendor Impacts

In corresponding research with information services vendors to assess the near-term impacts on information services vendors, INPUT found signs of genuine caution.

EXHIBIT III-4

Information Services Industry Near-Term Economic Impacts

- General belief that recession has started
- Near-term growth will be impacted
  - Professional services first to be impacted
  - Processing services and systems operations—limited impact
  - Network services to see slower growth
- Some new opportunities exist
  - Project acceleration
  - Processing capacity requirements
  - Systems operations

- There was a general belief, particularly in the professional, processing and network services firms, that a recession of some level had started as early as the third quarter. A number of vendors indicated that they were applying or considering internal budgetary constraints.

- Projections for near-term growth (1991) are more modest, reflecting 1990 experience.

  - Professional services will be the first area to be impacted, with growth expectations dropping to perhaps 11%. Information systems will try to protect internal staff, given the reductions experienced over the past few years.

  - Processing services and systems operations tend to be long-term decisions. Business levels of processing services are tied to client usage agreements and will not experience significant cutbacks. And an opportunity exists in the sale of incremental capacity to companies wishing to delay hardware expenditures.

  - Network services has been a strong growth area, with forecasted growth of about 16% per year. Some slowing in growth is expected in the near term, but this sector will still outperform the information services market as a whole.

- The downturn offers opportunities to aggressive vendors. To find these opportunities, it is necessary to stay very close to the current clients and to know the secondary buyers within the prospects.

  - Implementation of critical operational systems may get accelerated, creating opportunities for professional services and software products vendors. Buying a suitable application software solution may become favored over development of a custom solution.

  - As noted above, the solution to fulfilling capacity needs may be engaging a processing services vendor instead of making hardware purchases.

  - Systems operations will become more attractive to a company looking for capital to invest in newer, more strategic application systems.

The next 12 to 18 months will be characterized by the unexpected—delayed decisions and unique opportunities. Solid growth is possible for the alert vendor.

3. The Mid-1990s

Beyond the 1990 to mid-1992 period, there is a general belief that the economy will return to modest growth like that of the late 1980s. Modest real growth rates, combined with inflation and the ability for the information services industry to continue to outgrow the economy as a whole, suggests that annual average growth rates in the low to mid-teen percentages will continue throughout 1990 to 1995.

Growth after 1992 will be stronger than prior to 1992. A true recession will generate some pent-up demand that could cause a real upturn in 1993 if the entire economy returns to the growth rates experienced in the late 1980s.

B

Information Services Industry Issues and Climate

1. Overview

The information services industry ended the decade of the 1980s much differently than it entered it. Exhibit III-5 lists some of the major differences and their related implications for the early 1990s.

EXHIBIT III-5

Information Services Industry
1980 versus 1990

Difference	Implication
Five times as big	Slowing growth
Many large vendors	Consolidation and dominance
Stronger vendors	Greater reliance by user
Willingness to outsource operations	Processing services shifts to systems operations
Greater variety of services	Changing distribution channels
Many small vendors	Alliances to succeed
More technological alternatives	More services required to integrate

- Markets do not grow at 20% forever. On average, information services did for the entire 1980 decade. Overall, slower growth is predictable for the 1990s.

- In 1980 there was not an independent software supplier that had $100 million in revenues worldwide; in 1990 there are many, and $1 billion has been achieved.

  - For some, growth is being fueled through merger and acquisition.

- For others, diversification and a strong element of professional services is driving growth.

- The same can be said for professional services firms. Today, many companies exceed $100 million in revenue and serve a worldwide market.

- The leading information services vendors are much stronger than they were in the early 1980s. They are large, have financial strength and have management that is prepared to take on long-term risks. The result is new market opportunities and a different perspective for the user.

- The end of the 1980s was marked by some significant shifts in the structure of the information services industry.

  - Systems integration emerged as a viable business in the commercial market in the mid-1980s, and systems operations (facilities management) has taken on new importance.

  - Larger vendors are changing the economy of scale in offering information services, resulting in a change in the fundamental channels of distribution. The user can now turn to a single vendor for a complete solution, and the vendors offering these services become customers (distributors) of the other information services vendors.

  - The concept of *outsourcing* has strengthened considerably recently, and will be a trend of the 1990s.

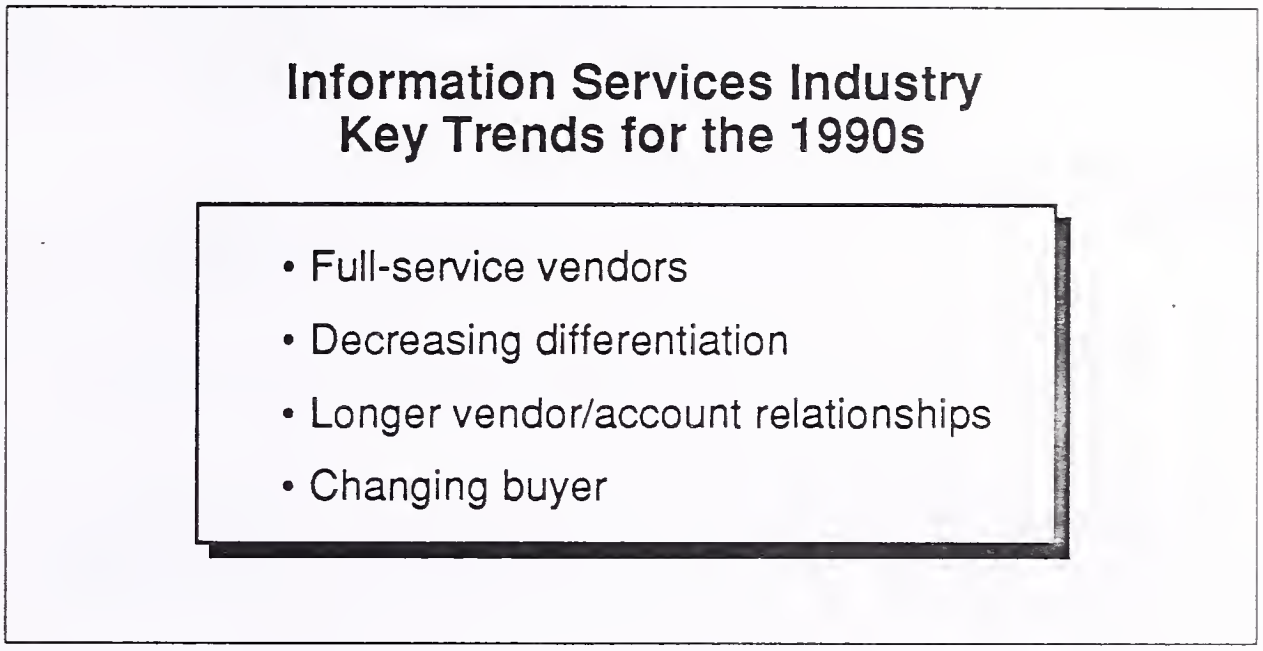
- Information services has been an industry where the initial cost of entry has been modest in many of the subsectors. Software product companies show up overnight, professional services firms start with a few experts joining together, and most processing services firms started by large organizations selling surplus time. Although low cost of entry remains a characteristic, the cost of gaining market recognition and presence has changed. Success in the 1990s for the start-up company will come through alliances with the larger firms, whether systems integrators, professional services, systems operations, or software product firms.

- Information systems' greatest challenge today, after maintaining the current systems, is to choose from the range of information technology now available. The alternatives are great and the implications of some are significant. The result is often delay in decisions and implementation. Relational DBMS technology is about 10 years old, but much of the implementation effort is still ahead for information systems departments. And another generation of data base technology, object-oriented, is already available. The result is greater professional services opportunities.

2. Information Services Trends

Exhibit III-6 identifies four fundamental trends that will impact the information services industry over the next five to ten years. The overall goal of account/client control will become paramount in the 1990s. It is the primary driving force behind these trends.

EXHIBIT III-6



- Full-service vendors will increase their dominance of the information services market. They will achieve increased account control and become the channel of distribution for many of the specialized products firms. And they will do this to a significant degree through consolidation. A maturing market typically results in fewer and larger vendors who serve all aspects of the market.

- Decreasing differentiation - Professional services is now a factor in essentially every delivery mode, whether it is software products, systems operations, systems integration or even processing and network services. That importance will continue to increase throughout the next five years. The end result will be decreasing differentiation of the leading vendors.

- Longer vendor/account relationships - The relationships formed in systems integration and systems operations agreements are multiyear in length, and once formed, the vendors in them become the vendors of choice for the next requirement.

- Changing buyer - The buyer is now commonly a partnership between information systems and an operating executive, certainly for major projects. The result is two buyers to be serviced and the opportunity for the vendor to build relationships in many divisions of the client company. This will also lead to increased client control and longer relationships.

In the 1990s, major vendors have the opportunity to tie up major portions of the market for multiyear periods. This brings a number of new issues, but means there is an improved predictability of revenue in the services industry.

3. Issues for the 1990s

The critical issues for information services vendors in the 1990s are summarized in Exhibit III-7. Many of these issues derive from the current emphasis on account control by the leading vendors.

EXHIBIT III-7

Information Services Industry Issues for the 1990s

- Profitability
- People resources
- Mastering technology
- Buyer skills
- Distribution channels

- Profitability - The shift to long-term relationships, with multiyear agreements and the assumption of risk by the vendor, increases the exposure for the vendor. There are already some concerns about the impact of commercial systems integration on the profitability of larger information services firms. And with the push to gain market share in the systems operations area, this concern could grow. Profitability over the next two years will be a key indicator of probable growth in the mid-1990s as the economy improves.

- People Resources - The increasing importance of professional services throughout the industry adds to the pressure on vendors to find and train qualified staffs.

  - Many of these professionals are being acquired by hiring the staff of companies served under systems integration and systems operations agreements. The need to reorient these people from internal to vendor perspectives will be a major test over the next few years.

- The vendor staffing challenge will also be taxed by the training requirements of new technologies and the decline in college enrollment in computer science. The cost burden for training information systems professionals is shifting to some degree from the user to the vendor, as greater use of outsourcing services develops.

- Mastering Technology - The developers of information technology continue to provide new technologies and products faster than they can be utilized. This is one of the forces behind the growth in the systems integration and professional services delivery modes.

  - The vendor takes on the task of learning the technology and bringing it into the client's environment, and perhaps even operating and maintaining it for some period.

  - Like the general training issue, this is a cost that cannot always be directly recovered by the vendor.

- User Skills - The influence of senior/operating management in the buying decision will continue to increase into the 1990s. Information systems will become an internal consultant and the skills of the end user will continue to increase at lower levels.

- The vendor must become astute at assessing the skills of the buyer at all levels, for it is the end user's skills, not the skills of the information systems function, that will control success.

- Distribution Channels - The larger vendors are going to gain even more control of the user expenditure process, while smaller and specialized vendors serve as vendors to the larger vendors. The behavior of the larger vendors and their multiple, often overlapping strategic alliances may control the success of many of the smaller vendors.

C

Systems Software Products Business Issues and Trends

In this section INPUT briefly positions the systems software products sector against the economic and environmental conditions described above. This sets the stage for INPUT's 1990-1995 forecast for systems software products, presented in Chapter IV.

Two fundamental forces impact the systems software products sector: hardware sales, and tools that enhance return on systems investment (applications development productivity, data center efficiency, and information network usability). The economy drives the first, and new technology drives the second.

1. Hardware Sales

New hardware shipments have been declining for some time and, with the exception of personal computers and workstations, are now well below 10% a year. The current economic environment can be expected to further negatively impact hardware shipments and therefore negatively impact growth in systems software sales.

The bright spots will be cooperative processing and LAN-related products tied to the sale of more powerful and integrated personal computers/workstations.

2. Efficiency Tools

As the 1990s begin, systems software technology is enjoying a positive environment: CASE got off to an exciting start, relational DBMS sales have been strong, and data center and network integration/consolidation is a high priority.

Products that improve utilization of existing or planned computing facilities are enjoying strong sales, but there are some soft spots.

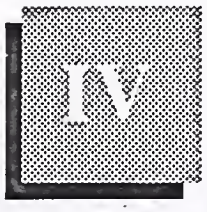
- CASE growth has slowed as the time required for implementation lengthens, the needs for a repository go unsatisfied, and back-end CASE technology is slow to appear.

- The cost of the newer data center and network integration and management software tools remains quite high, and requires significant effort to implement, which slows acceptance.

- The process of distributing and downsizing applications to cooperative/server environments is new and underdeveloped. Just as experience has been needed to use relational DBMS technology, it will also take time to learn to build effective distributed applications.

As Chapter IV shows, the systems software products sector will follow the information services market in general. Growth will be reasonably strong, perhaps slightly higher than for the industry as a whole.

Market Forecast



Market Forecast

A

Market Overview

1. Historical Perspective

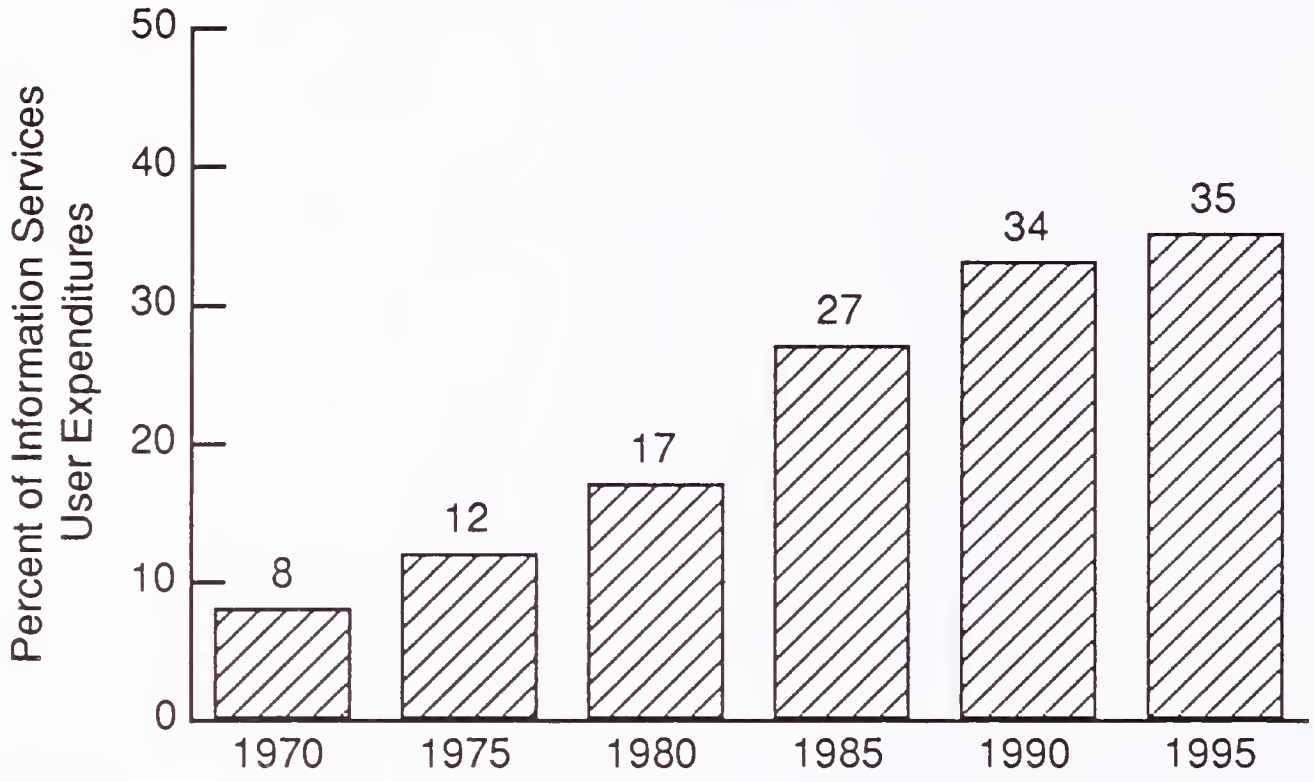
Exhibit IV-1 shows software products (both systems and applications software) as a proportion of the total information services industry from a historical perspective as well as with projections for 1995. Software products (systems and applications) have consistently increased as a portion of the whole, from 8% in 1970 to 34% in 1990; by 1995, software products will account for 35% of total IS user expenditures.

Of the total 1990 software products market, systems software represents roughly half of user expenditures. This proportion is projected to remain about the same through 1995.

User expenditures on systems software grew from $6.3 billion in 1985 to $14.5 billion in 1989 (Exhibit IV-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 to the strong growth in personal computer shipments. As indicated in Exhibit IV-3, annual growth since then has declined and will remain at 12% for 1991 and 1992, then pick up to 15% for the 1993-1995 time period.

EXHIBIT IV-1

Software Products Portion of Information Services 1970-1995



$ Billions

Software Products	0.3	0.7	2.9	13.3	34.2	66.2
Total Information Services	3.2	5.7	17.0	48.6	100.6	187.8

EXHIBIT IV-2

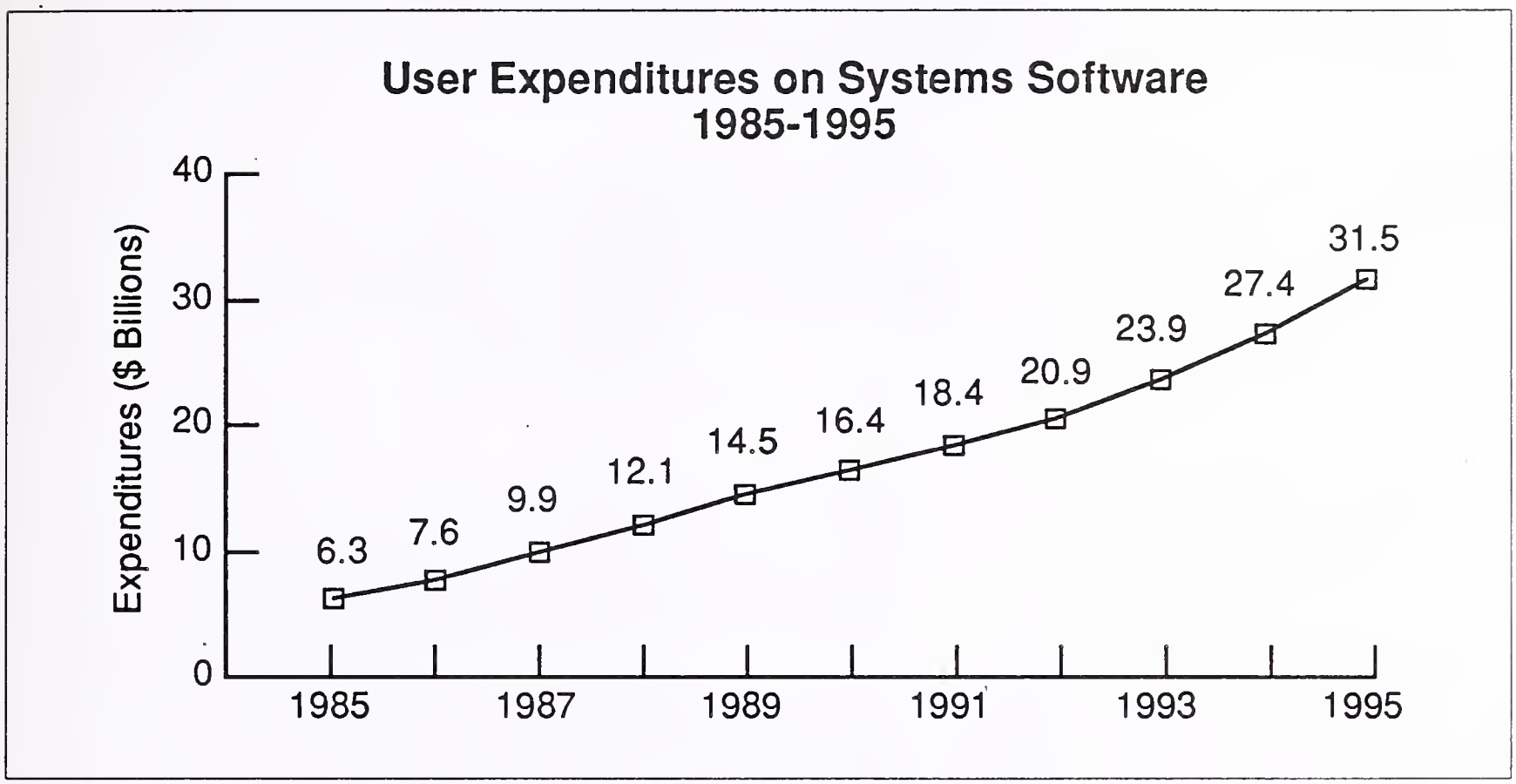
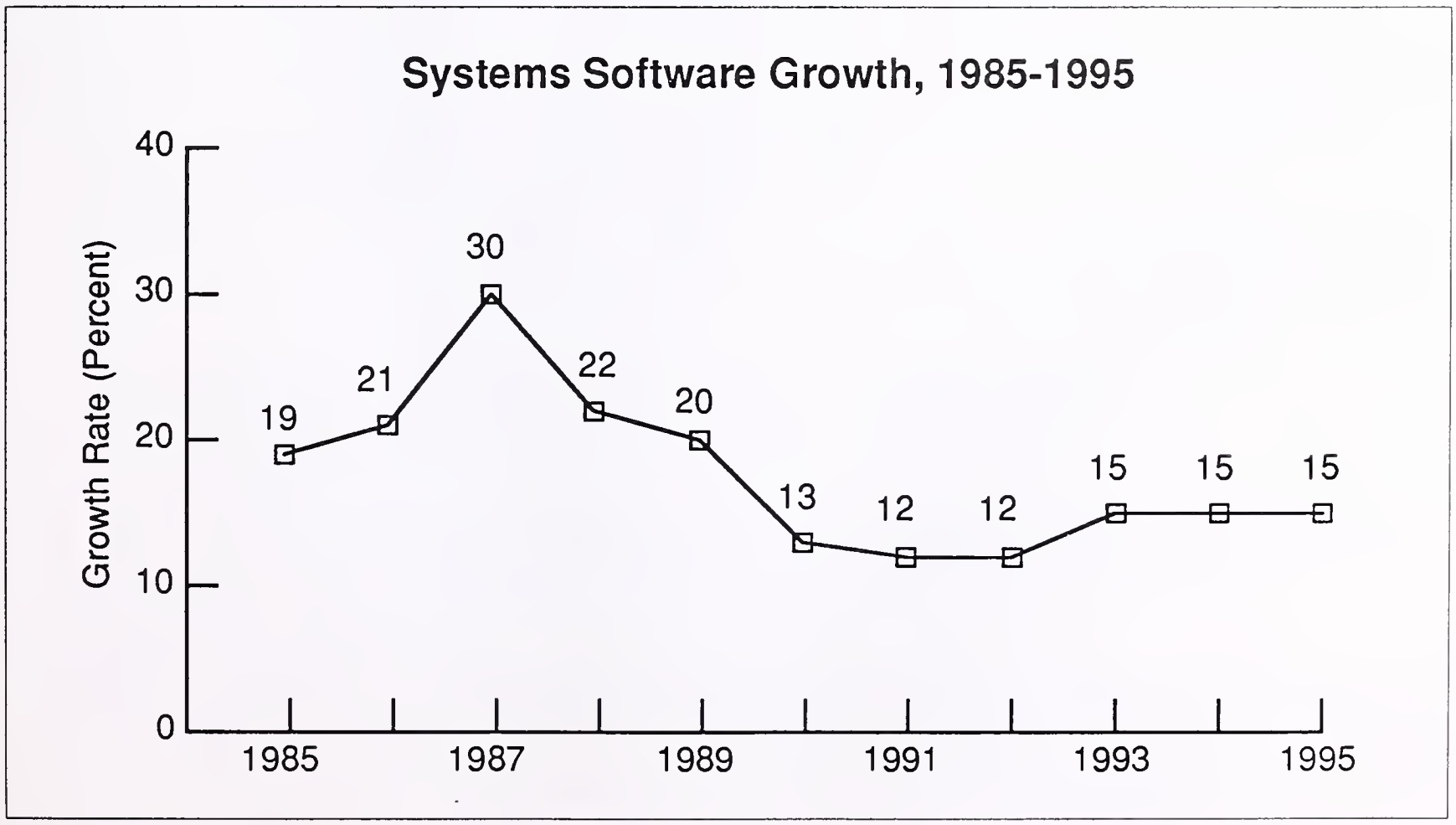


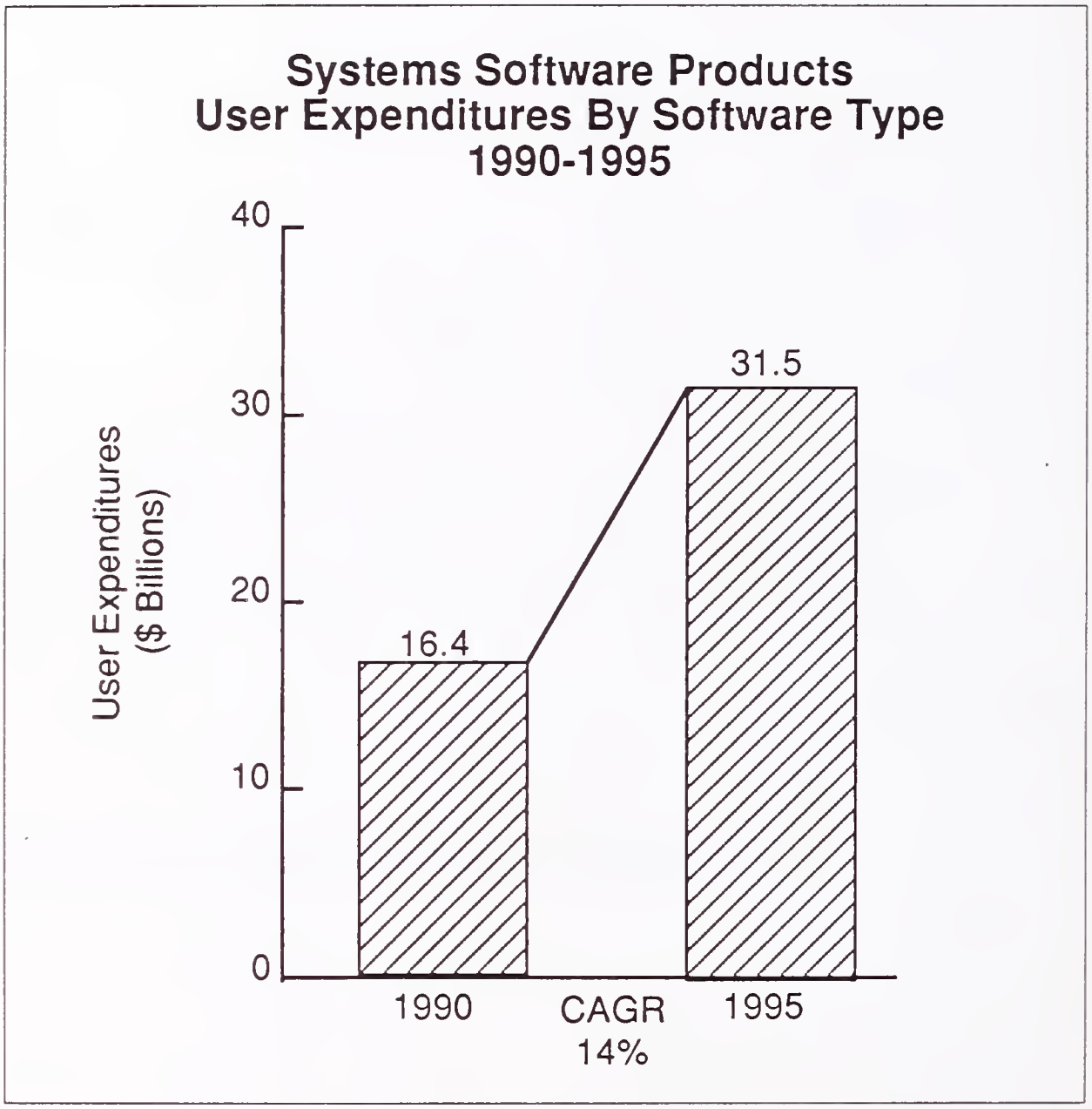
EXHIBIT IV-3



2. Systems Software Forecast

As shown in Exhibit IV-4, the overall systems software market will expand from $16.4 billion in 1990 user expenditures to $31.5 billion by 1995, a CAGR of 14%.

EXHIBIT IV-4



INPUT's forecast for systems software products of 14% CAGR for the 1990-1995 period compares with an 18% CAGR previously forecasted for the 1989-1994 period. As noted above, the reasons for this downward adjustment are described throughout this chapter. One of the core reasons is the near-term slowing of economic growth, which is causing lower year-to-year growth rate projections for the first two years than for the remainder of the 1990-1995 period. Growth will also be hampered by SAA as IS organizations wait and see until 1993 and beyond; and by the steady but slow movement to distributed processing. But again, since all the pieces are not available for true distributed processing, IS organizations will wait and see during the short term.

Opportunity continues to exist for growth of current products and the introduction of new products during the 1990s. The marketplace needs are there—vendors have to catch up with the needs by providing new technologies and assisting users in incorporating them into their existing technology base.

During the forecast period, growth will be hampered by users' inability to assimilate all the new technologies. Education and support services will therefore play an essential role in this delivery mode. The 14% CAGR assumes that the necessary education and support services will be in place. Education and support will be made available not only by hardware systems and software vendors, but also by systems integrators and professional services firms.

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.

In terms of platform size, the greatest growth will be at the workstation/PC level. Exhibit IV-5 shows that by 1995, user expenditures, on systems software for workstations and personal computers will have increased to $9.3 billion, so that expenditures will be just about equal for midrange computers and workstations/PCs.

A production transition to cooperative/distributed processing using microcomputers will take place during the latter part of the forecast period. Graphical user interfaces (GUIs) will enhance the migration of software to the PC level. Growth of UNIX on the installed hardware base as well as on new hardware shipments, and increasing acceptance of OS/2 will also promote systems software growth at this level.

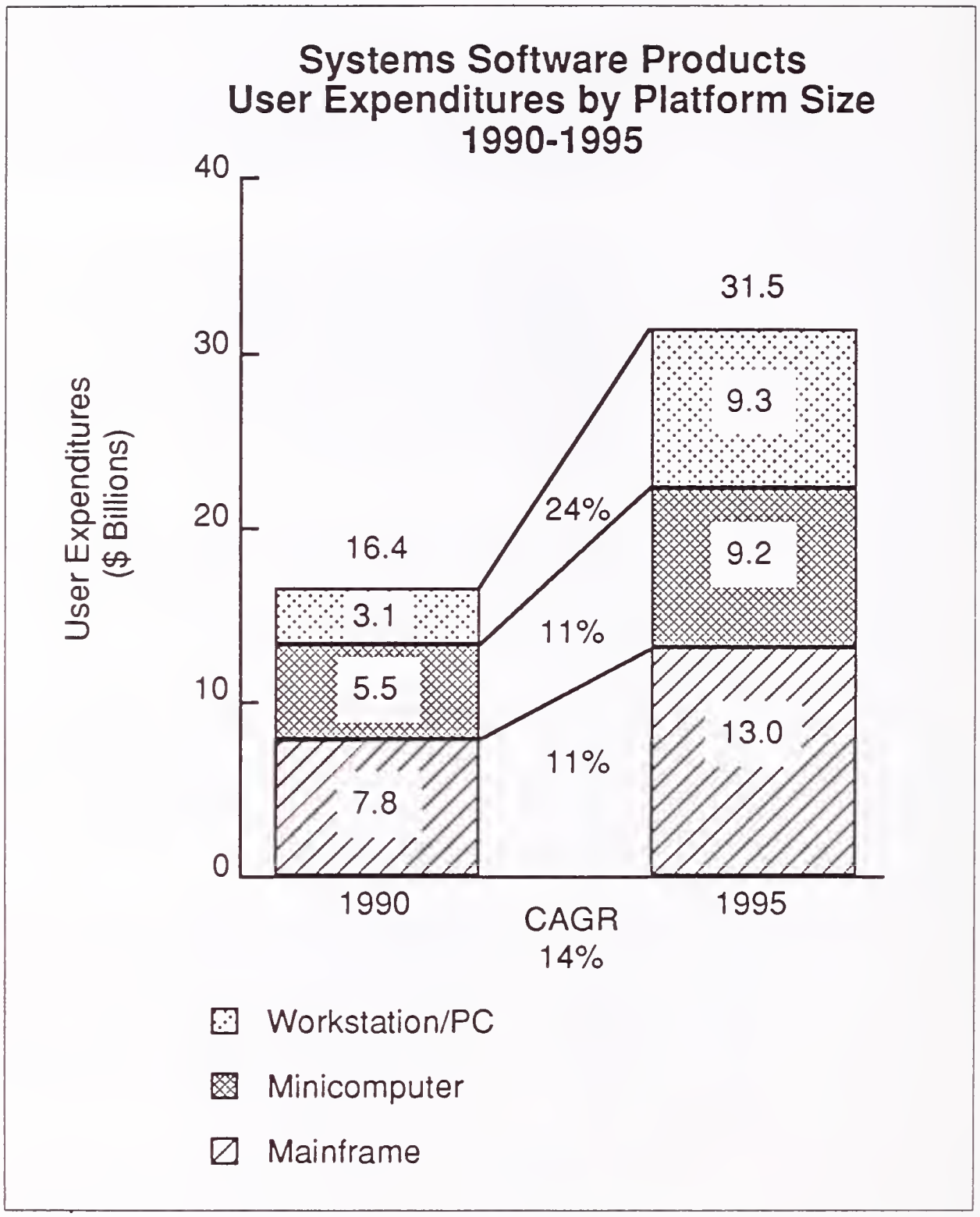
Systems software products will continue to provide a continuous revenue stream from license and lease arrangements for midrange and mainframe computers. Nonetheless, application development and operations management tools will continue to move off of mainframes and minicomputers to workstations and microcomputers.

3. Vendor Overview

Exhibits IV-6, IV-7, and IV-8 provide revenue information for the leading systems software products vendors, which indicates the following:

- Growth of hardware vendors' systems software revenues was up only 5% in 1989. The hardware vendors' participation in systems software is skewed to systems control products. The 5% growth rate is therefore a general indicator of this submode's slowed 1989 growth.

EXHIBIT IV-5



- Independent software vendors continue to do well—1989 revenues were up 27%— but not as well as in the past.

EXHIBIT IV-6

Leading Hardware Vendors' Systems Software Revenues 1988 and 1989

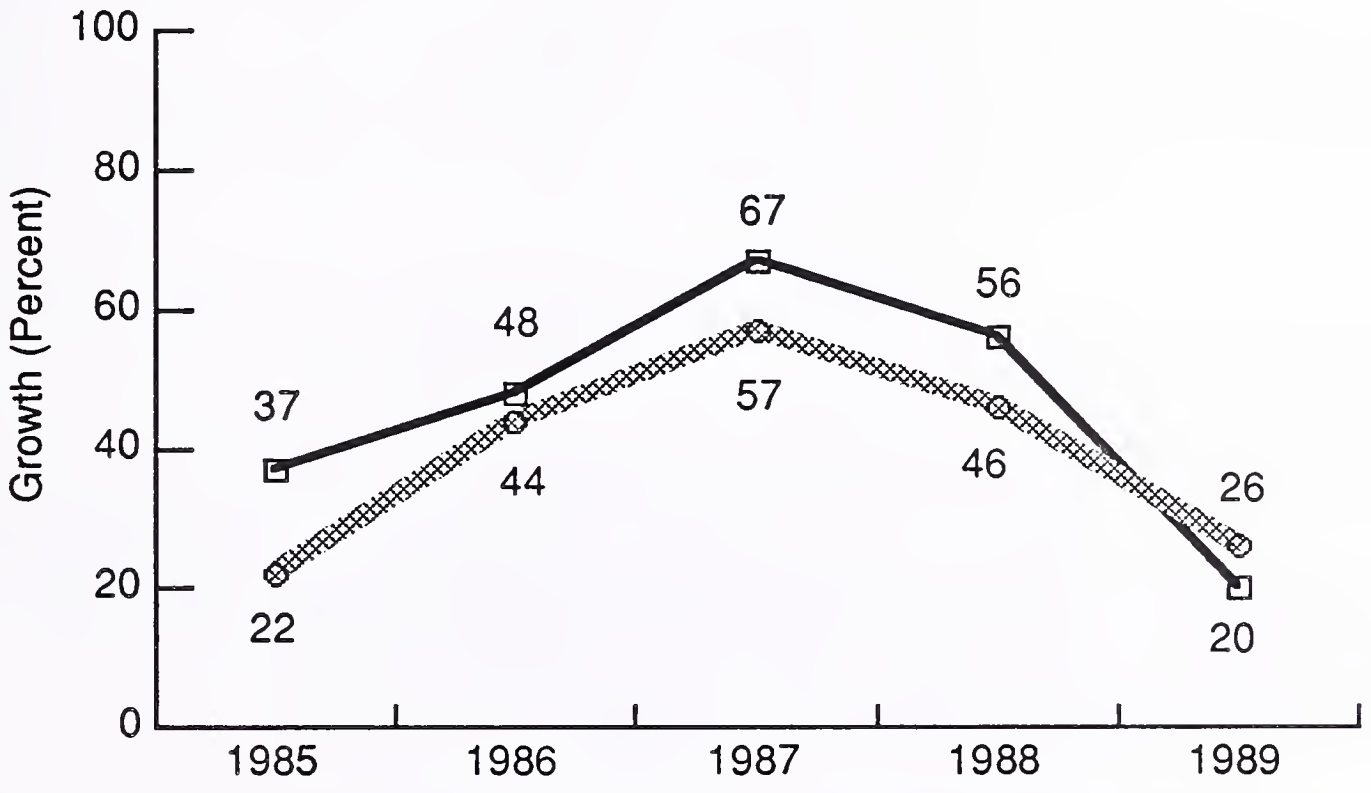
	1988 ($M)	1989 ($M)	$M Change	Percent Change
IBM	2,468.0	2,620.0	152.0	6
DEC	805.0	800.0	(5.0)	(1)
Unisys	263.5	207.0	(56.5)	(21)
Hewlett-Packard	219.0	270.0	51.0	23
Wang	144.4	144.0	(0.4)	-
Apple	63.0	74.0	11.0	17
Tandem	52.0	75.0	23.0	44
Prime	45.1	47.6	2.5	6
Amdahl	40.0	46.7	6.7	17
AT&T	30.0	34.0	4.0	13
Harris Data Corp.	10.5	23.2	12.7	121
Total	4,140.5	4,341.5	201.0	5

EXHIBIT IV-7

Leading Software Vendors' Systems Software Revenues, 1988 and 1989

	1988 ($M)	1989 ($M)	$M Change	Percent Change
Ashton-Tate	147.0	84.4	(62.6)	(43)
Computer Associates	390.6	463.3	72.7	19
Candle	54.0	73.0	19.0	35
CompuWare	48.9	54.8	5.9	12
Ingres	51.5	68.0	16.5	32
Microsoft	182.5	241.8	59.3	32
Oracle	175.8	283.0	107.2	61
Sterling Software	66.8	73.7	6.9	10
Novell	175.0	262.7	87.7	50
Pansophic	75.9	108.6	32.7	43
Adobe	60.2	99.2	39.0	65
Informix	51.5	69.1	17.6	34
Total	1479.7	1881.6	401.9	27

EXHIBIT IV-8



B

Driving Forces

The key driving forces of the systems software market are listed in Exhibit IV-9 and described in this section.

1. The Economy

The current slowdown in general economic conditions will impact systems software product sales positively and negatively in the near term, while a strengthening economy in 1992 and beyond will drive growth.

- Hardware sales will slow further in the short term.
- Pressure to lower processing costs will speed data center consolidation and the sale of high-end operations management tools.

EXHIBIT IV-9

Systems Software Driving Forces

- The economy
- New hardware unit shipments
- Hardware installed base
- New systems software vendors/products
- Standards
- Education

- The movement to higher-end personal computers will slow to some degree, slowing the adoption of higher-cost systems control software for these workstations. OS/2 and UNIX will grow more slowly, while DOS and Windows will be stronger over the next two years.

2. New Hardware Unit Shipments

Since software needs hardware on which to run, the growth of the hardware installed base over a multiyear period has direct impact on systems software product sales.

Roughly eight million personal computers and workstations will be shipped for the year 1990, half of which are replacements. In addition, between one and two million laptops will be shipped. Through 1995, shipments are forecasted to grow 15% per year. As sales of these higher-end personal computers take hold in the corporate market, it will drive a higher investment per computer of systems software products. The impact should begin to be felt to a greater degree by 1992.

386- and 486-based machines are now entering the market at prices in the $15,000-$25,000 range. In the short term, unit shipments are curtailed, but over the long term their presence will have a significant positive impact on systems and applications software expenditures. Just a few years ago, only the biggest companies could have afforded this capacity. Now the $50 million and $100 million companies can afford large-scale automation.

The continuous gains made in desktop price/performance open up a whole new market for software products. Because of the relatively low cost of these machines, the software necessarily needs to be relatively

low cost also. A push for high-quality, mass-produced software and applications development tools to support their production will ensue.

Mainframe shipments are expected to grow 3-5% per year. Much of the growth in mainframe shipments will be new IBM ESA/390 machines, many of which will replace existing installations.

Minicomputer shipments are expected to grow 5-7% per year. These computers are in a nebulous in-between position, pushed from above and below. Where a mainframe stops, and a minicomputer or a workstation begins will continue to become harder to discern.

3. Hardware Installed Base

The mainframe installed base will be essentially flat over the next five years. Mainframes will not go away; they will be used for enterprise-wide systems management, data storage and maintenance, execution of high-volume transactions, and where high-level security is required.

The installed base of minicomputers will also remain essentially flat over the next five years. These midrange computers will be positioned as distributed transaction processing engines, and will continue to have an effective niche role in remote transaction processing and departmental general-purpose processing.

Approximately 40 million workstations and personal computers are in use today, up about 10% from 1989. Corporate America has an abundance of underutilized personal computers. In Fortune 500 companies, an estimated one out of every six white collar workers has a desktop computer; the majority of these computers remain idle 20 or more hours per day. IS departments are seeking ways to exploit this vast MIP storehouse.

Workstations and personal computers will continue to grab a larger piece of the overall installed base. The total number of hardware units installed will continue to increase, rather than workstation growth being at the expense of the existing minicomputer and mainframe installed base. The larger machine markets will simply continue to experience slowing growth in unit sales.

4. Standards

Overall and in the long term, standards will fuel the demand for new generations of systems software that conform to these standards. In the short term, however, the movement towards standards will have a negative impact as a systems software driver. Key standards are yet to be finalized and, as mentioned earlier, users will postpone large purchases in anticipation of products that adhere to standards.

Although SAA is a proprietary standard, it will be the umbrella architecture for many vendors' systems software products in all three submodes—systems control, applications development tools, and operations management products.

Currently, SQL (Structured Query Language), the de facto standard interface to RDBMSs, is promoting the growth of RDBMS front- and back-end products.

Although UNIX is still varied, it is beginning to have a positive impact on systems control and CASE tools as vendors develop new UNIX-based products and more end users begin to use UNIX.

Presentation Manager and Windows have become de facto GUI (graphical user interface) standards that, because of their ease of use, promote growth of both systems and applications software.

5. New Systems Software Vendors and/or Products

New products will be forthcoming not only due to the trend toward standards-compliant systems software products, as mentioned above, but also due to the trends towards downsizing, distributed processing, and integration.

Examples of new product areas are:

- Products and methodologies for applications development using RDBMSs, such as the DataEase products.
- Image processing technology remains in an emerging status. Further advances are expected, leading to stronger application development tool growth.
- Object-oriented programming and DBMS technology is gaining some following but remains in limited commercial use.
- Voice recognition and voice response technology provides a new and expanding alternative for application development.
- Management of the large (huge) data centers and highly integrated multivendor information networks will continue to require new systems control and operations management tools.

6. Education

The rate of absorption of change is lagging far behind technological advances. Need exists in the area of systems software for:

- CASE integration services
- Specialized services to assist with software implementation

The focus needs to be on how to make customers more competitive rather than on the technology.

Professional services organizations will play an increasingly important role. For example, the Big Six accounting firms are pursuing integration services projects with CASE techniques and methodologies. UNIX vendors are forming alliances with systems integrators, and operations management tool vendors are also working more closely with integrators and facilities management firms.

C

Submode Forecasts

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

1. Systems Control Products

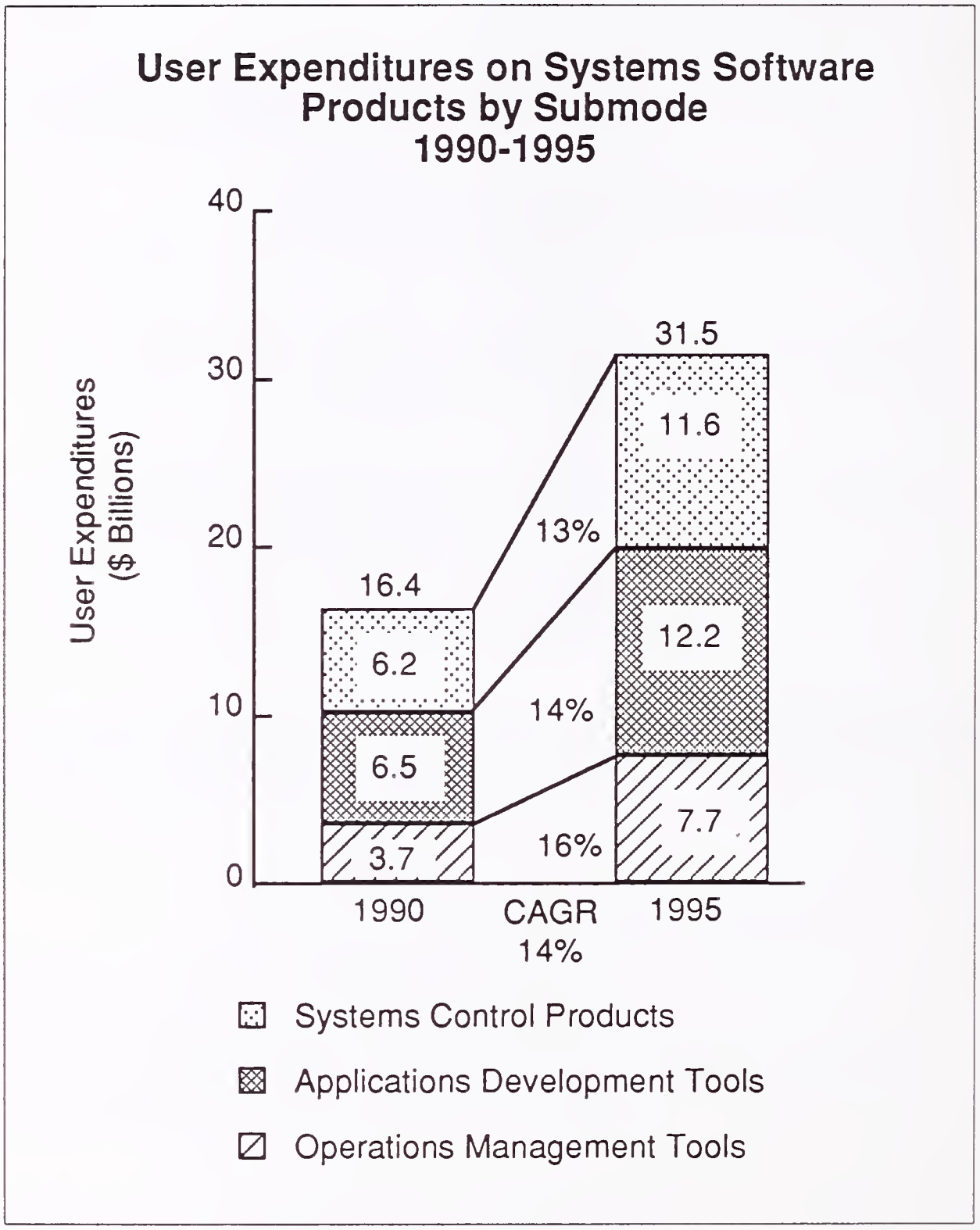
Systems control products are supervisory programs that provide automatic management and allocation of systems/network resources during the execution of applications programs. These products include operating systems, emulators, network control products such as NetView and NetMaster, library control,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

a. Overview

User expenditures for system control products will grow from $6.2 billion in 1990 to $11.6 billion in 1995, at a CAGR of 13%. Growth in user expenditures for systems control software is directly related to hardware unit shipments. Because hardware unit shipments are no longer experiencing the explosive growth of several years ago, they are no longer a strong overall growth promoter.

In addition to an overall slowdown in hardware unit shipments, the fact that standards—SAA, UNIX, and other third-party standards such as CA90—are in the formulation stages will be a growth inhibitor in the short term, as user organizations adopt a wait-and-see attitude. In the long run, however, INPUT believes that standards will have very beneficial impact on the growth of the systems control market.

EXHIBIT IV-10



Growth is also tied to new systems control products, including network integration products and products that support standards, running on both new and existing hardware.

Hardware with the greatest growth potential through 1995 is PS/2-type personal computers, high-level workstations, and RISC-based hardware. These computers will incorporate the OS/2 and UNIX operating systems. INPUT forecasts that OS/2 and UNIX operating systems will grow at 35% compounded annually, whereas other more traditional (proprietary) operating systems will grow at a rate of 8-10% compounded annually through 1995.

Corporate America can afford to replace personal computers; it will do so initially by using lower cost DOS plus Windows or a simple UNIX environment through 1992. High-cost software environments for interconnected workstations in the 1990s, e.g. OS/2, will take another two years for the pace of purchase to quicken substantially. It will also be another two years before UNIX becomes common enough for mainline business applications in a cooperative processing mode. At this point the machine and the systems control software will be more expensive and will account for user expenditure growth.

Communications software sales for protocol conversion and inter-LAN connectivity are also anticipated to continue on a strong upward growth path over the next several years. The anticipated move to cooperative processing solutions, which will require compliance with the multiple levels of the USO/OSI model protocol stack, will also stimulate growth in communications software products, which INPUT defines as part of the operating systems product market.

b. Systems Control Products—User Expenditures by Platform Size

Exhibit IV-11 shows user expenditures for systems control products by platform size.

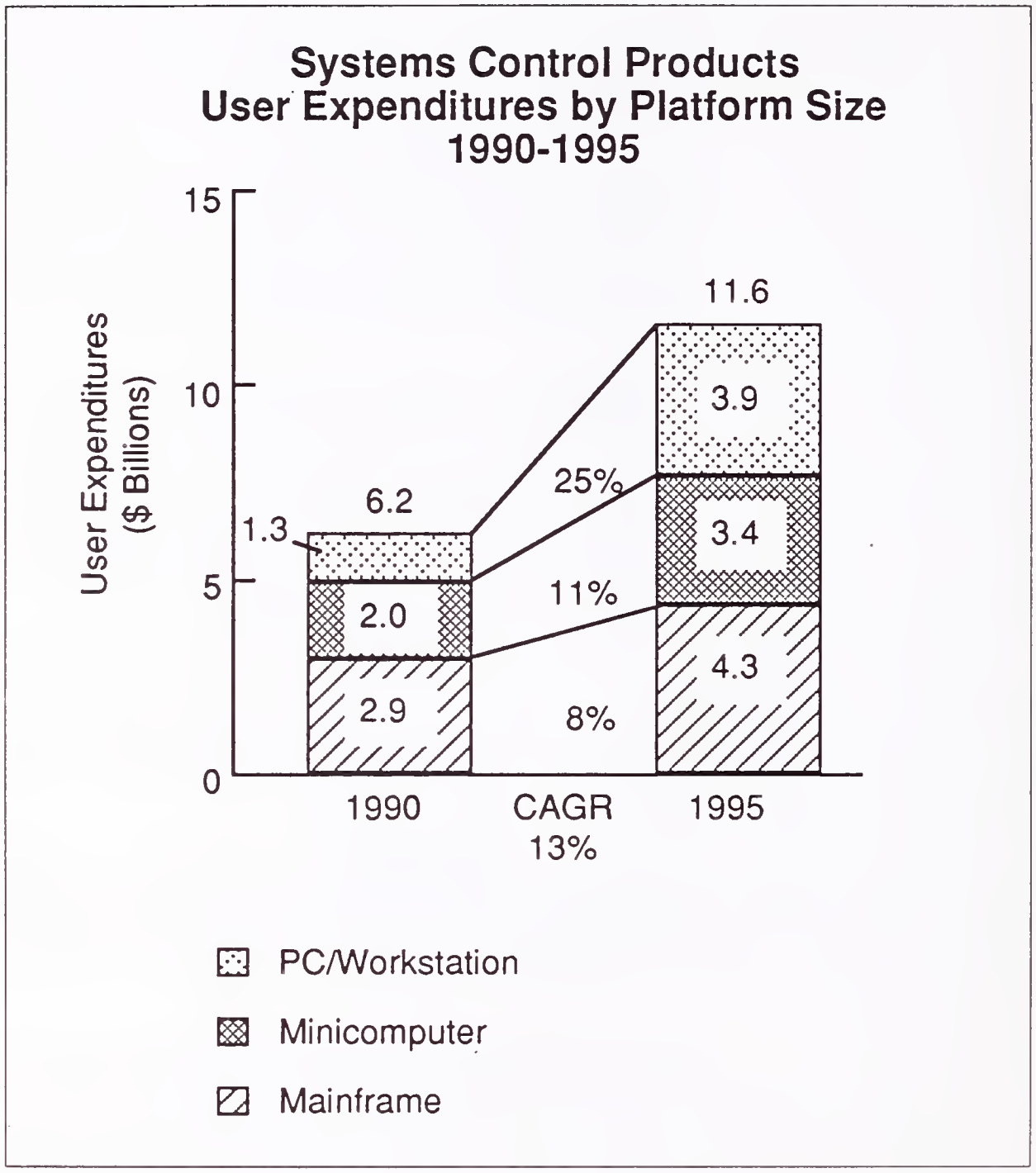
The workstation/PC portion will grow from 21% of the total systems control market in 1990 to 34% of the total systems control market in 1995. Expenditures will grow from $1.3 billion in 1990 to $3.9 billion in 1995, at a CAGR of 25%.

This forecast reflects not only continued growth in hardware unit shipments, but also the anticipated strong growth of more expensive operating systems, namely OS/2 and UNIX, and additional multiuser operating systems. These more expensive operating systems will run predominantly on high-end personal computers and workstations. Growth is also attributed to the continuing incorporation of LANs on new and existing workstations and personal computers.

The minicomputer portion of the systems control market is projected to grow from $2.0 billion in 1990 to $3.4 billion in 1995, at a CAGR of 11%. Its portion of the total systems control market is anticipated to stay about the same.

Minicomputer platform sales have leveled off; anticipated growth is in the range of 5-7% CAGR through 1995. With the shortfalls in revenues in most minicomputer companies continuing, INPUT expects price discounting and bundling of software to put a further—albeit temporary—restriction on user expenditures growth for systems control software for this platform type.

EXHIBIT IV-11



The mainframe portion of the systems control market is projected to grow at a CAGR of 8% over the next five years, to reach $4.3 billion by 1995. Although mainframe platform unit sales are expected to grow at only a 3-5% annual rate, there remains potential for operating systems enhancement products.

2. Application Development Tools

Application development tools are used by a system developer 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. Also included are graphical user interfaces, and system utilities that are directly invoked by an applications program.

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

The need to improve software development productivity, compounded by the continuing shortage of software engineers, will drive the market.

Applications development backlogs, compounded by the need to maintain and re-engineer existing software products, are continuing to deter revenue growth and profitability in the software industry. This backlog is fostering increasing interest within the software development community for the newer generations of application 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.

In the short term, however, growth will be stymied by the following factors:

- The trend towards cooperative/distributed processing will eventually cause large-scale replacement of much of the software that is used today. But this trend will not be a key growth promoter until the latter part of the forecast period.

- 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 again, AD/Cycle will not be a growth promoter until the 1994-1995 time period, and will in fact deter growth as buyers wait and see until then.

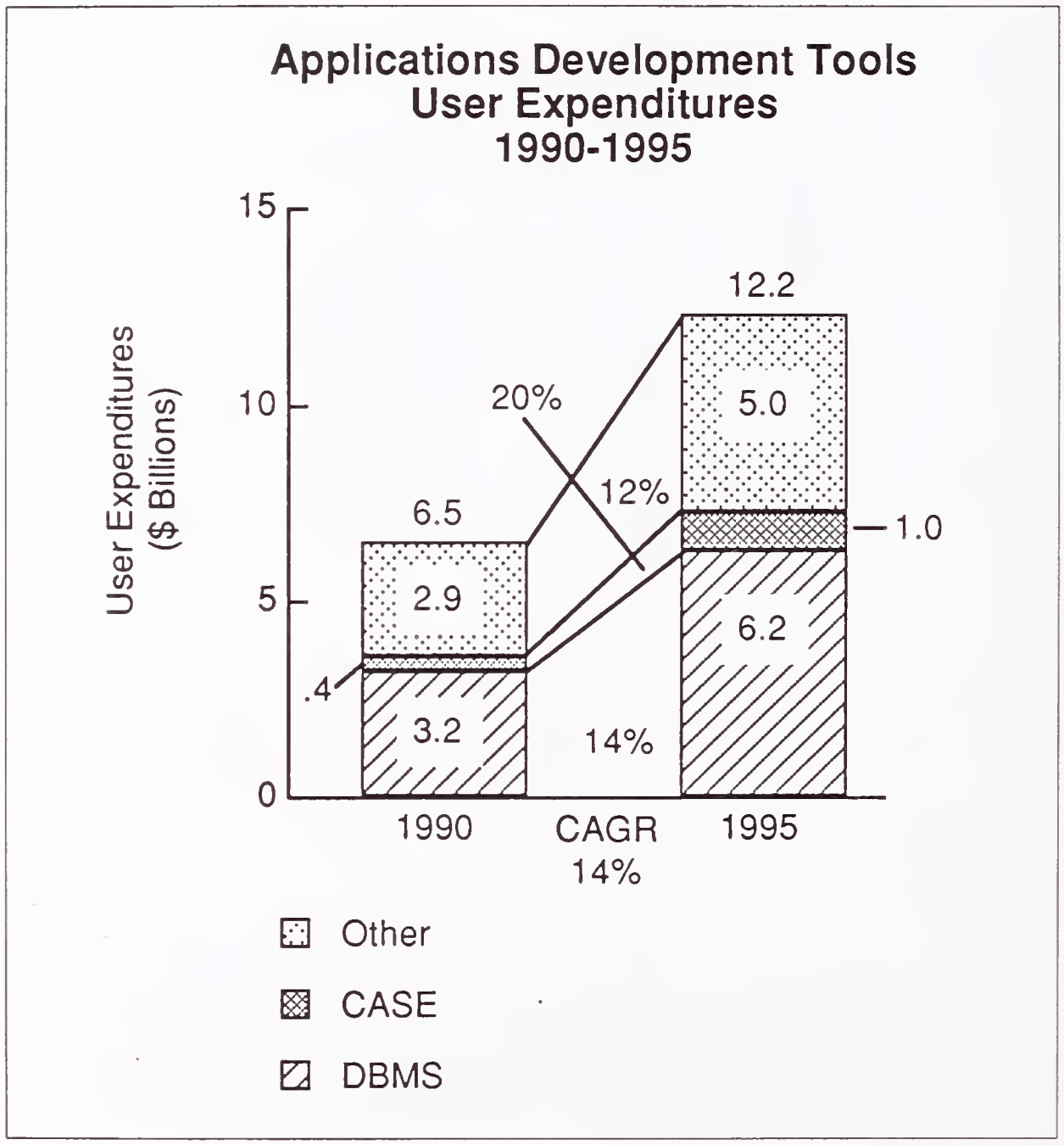
- With regard to the newer technologies, including CASE tools, users are experiencing "analysis paralysis," and extended sales cycles are common.

- Once purchased, many products become "shelf-ware"—they sit on the shelf without being effectively used.

- Users and vendors alike must sort out how all these various tools—relational, 3GL, 4GL, traditional DBMS, CASE, and object-oriented programming—will co-exist.

In light of the above, INPUT has adjusted its user expenditures forecast downward from last year's report. Actual 1989 user expenditures were less than anticipated ($5.7 billion rather than $6.0 billion). User expenditures for application development tools are expected to grow from $6.5 billion in 1990 to $12.2 billion in 1995, at a CAGR of 14% (see Exhibits IV-10 and IV-12), compared to INPUT's previously forecasted 19% CAGR.

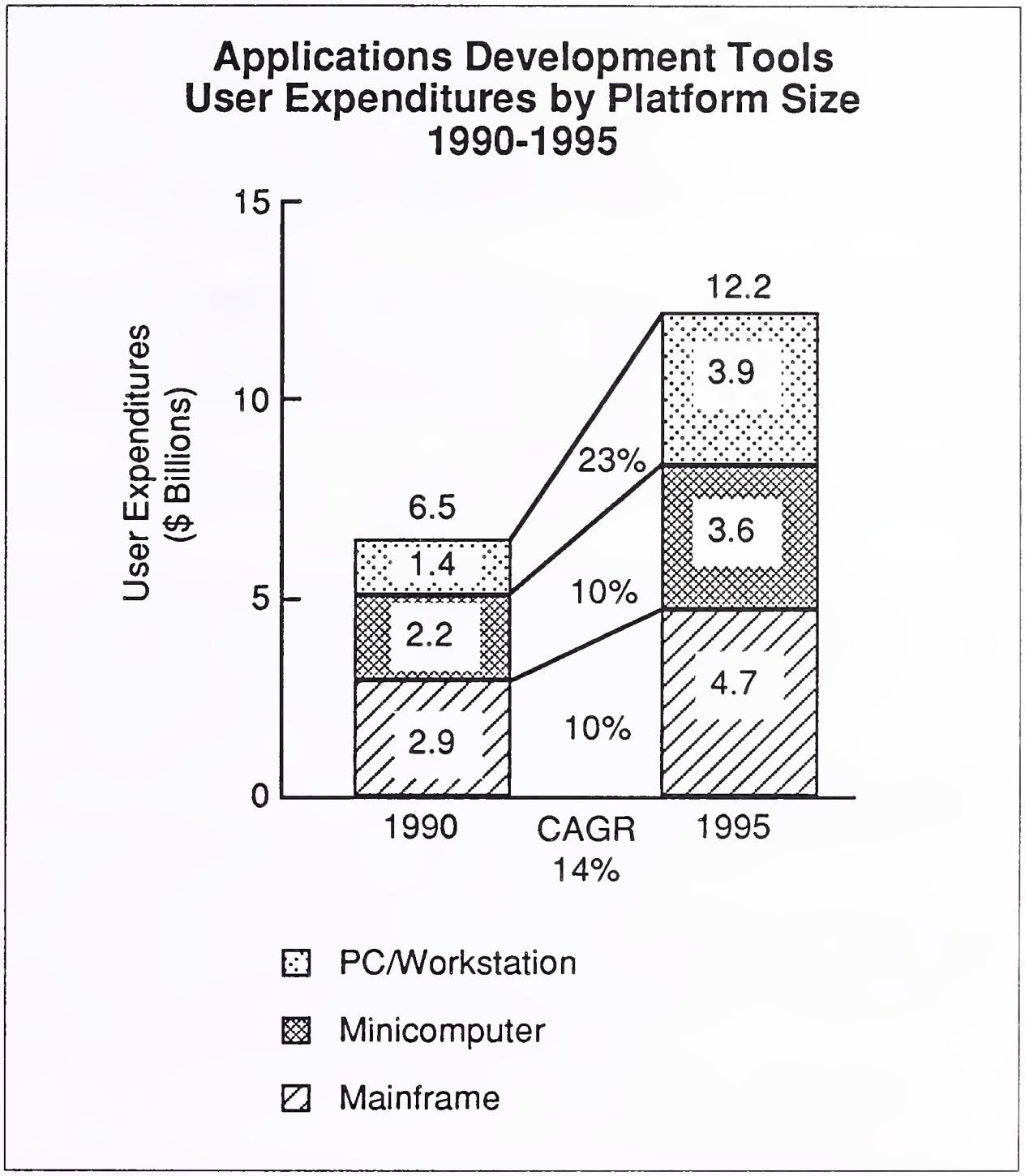
EXHIBIT IV-12



b. Application Development Tools—User Expenditures by Platform Size

As shown in Exhibit IV-13, the market for the workstation/PC portion of applications development tools is projected to grow from $1.4 billion in 1990 to $3.9 billion in 1995, at a CAGR of 23%.

EXHIBIT IV-13



This growth reflects:

- A trend in CASE technology—irrespective of the effects of AD/Cycle—toward workstation/PC-based application development with front-end design/prototyping activities as well as application code generation performed on the workstation.

- SQL-based data query and report-generation tools are rapidly being transferred to the workstation/PC server-based DBMS environment.

- The trend to cooperative processing models, where the workstation does much of the front-end application processing and the mainframe is utilized more for on-line transaction processing and network management, will facilitate the trend toward the workstation/PC platforms for application development.

The market for minicomputer-based application development tools is estimated to grow from $2.2 billion in 1990 to $3.6 billion in 1995, at a CAGR of 10%. Much of the anticipated strength in the minicomputer market is due to the assumption that the minicomputer will become a major platform of choice in the server portion of the client-server distributed processing model and to the anticipated expansion of the use of 4GLs and RDBMSs on midrange computers.

The mainframe market for application development tools is projected to expand from $2.9 billion in 1990 to $4.7 billion in 1995, at a CAGR of 10%. By 1993, the relatively high-priced back-end applications development in CASE for re-engineering will be done on mainframes and minicomputers.

c. DBMS Forecast

Growth in 1989 was not as strong as INPUT originally anticipated, and INPUT has adjusted 1989 expenditures down from $3.0 billion to $2.7 billion. Although some interim issues need to be resolved, INPUT nonetheless believes that the DBMS market will experience strong growth through the 1990s. User expenditures for DBMSs are forecast to grow 14% compounded annually through 1995 to reach $6.2 billion.

Traditional flat-file DBMSs will account for over 50% of user expenditures in 1990. These products need to be maintained but they are not going onto new hardware; thus, their share of the total is declining.

The trend to distributed RDBMSs is fueling most of the growth in this product category. About 44% of user expenditures, or $1.4 billion, in 1990 will be on relational DBMSs, to grow to over 50%—$4.3 billion—by 1995.

The current upsurge in interest in RDBMSs is spurred on by recent IBM product announcements and increasing acceptance of DB2 as the de facto standard mainframe relational DBMS.

IBM is positioning DB2 as the data base server engine sitting on its largest mainframes. A DB2 data base is also at the center of SystemView, IBM's blueprint for managing enterprisewide systems. Similarly, with AD/Cycle, the Repository Manager/MVS is based on a DB2 data base. DB2 also is being groomed as the transaction processing successor to IMS, IBM's non-relational workhorse DBMS.

Other growth promoters are:

- Widespread use of PCs and PC LANs continues to fuel end-user demand for information access which in turn fuels growth for RDBMSs on all sizes of platforms.

- Growing use of graphical user interfaces will make data access easier for users throughout a corporation, thus enhancing the demand for RDBMS products.

- The increased interest in executive information systems (EISs) also makes data access easier, thus fueling demand for DBMSs—relational and hierarchical.

- On the applications development side, the increasing requirement for more-complex applications software solutions, such as the distributed relational model, will eventually fuel demand for RDBMS software and related application development support tools.

Interim issues that need to be resolved for renewed exceptional growth in this product area are:

- The recent financial challenges of several key RDBMS vendors—namely Oracle, Ingres, and Sybase—which will put a short-term crimp on the market as they adjust their strategies to changing market conditions and slower growth.

- Price discounting and bundling—for example, all DEC VAX machines go out with bundled Rdb and its UNIX platforms go out with bundled Ingres RDBMSs.

- As organizations move to UNIX and RISC, they are confused about what RDBMSs they need and what to do with them. There is a market perception that RDBMSs are complex. In essence, the technology is ahead of the users' ability to assimilate it.

- Extended sales cycles due to economic downturn and user confusion.

Because of the trend toward using the mainframe as a central data repository and server, the mainframe-based DBMS market will remain strong over the next several years. IBM will continue to play the dominant role here. Both the mainframe and the minicomputer RDBMS markets will peak, however, in the early 1990s. Workstation/PC RDBMS products will pick up the slack.

Key DBMS vendors—Ashton-Tate, Ingres, Oracle and Sybase—are moving aggressively to UNIX platforms. They are seeking to position their data base products as key multiuser data base development systems. Ashton-Tate, for example, is diversifying from its traditional PC software base to larger hardware platforms in the workstation and minicomputer environments; Ingres is targeting "desktop products" — DOS, OS/2, Macintosh OS, UNIX and connections to workgroup or departmental servers over networks. These companies are aggressively seeking marketing and technology alliances with hardware server companies.

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 $390 million market (1990). Growth is forecast at a 20% CAGR, to reach $970 million by 1995.

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. It is also dependent on the strategies and product offerings of the larger systems vendors.

Much hinges on systems integrators and professional services companies to provide the necessary assist. And it appears as though these companies are positioning themselves to do just that. Ernst & Young has expanded its integration services to include a framework for building large-scale applications with CASE tools that is intended to be consistent with IBM's AD/Cycle blueprint; Andersen Consulting has its Foundation toolkit; and Price Waterhouse is expected soon to unveil a method for transforming existing applications into code usable with AD/Cycle.

Strong growth also will be promoted by the support of and product offerings from large systems vendors. The market leaders to date are relatively small—KnowledgeWare's worldwide 1989 revenues were $34 million and Index Technology's 1989 revenues were $38.8 million. To generate a viable large revenue stream, CASE must, and will, be supported by large systems and software vendors.

In 1989, several large computer systems vendors announced their longer-term initial CASE strategies, with products to be delivered in 1990 and beyond. In addition to IBM's AD/Cycle announcement with the related product support from third-party tool partners, DEC announced a number of new front-end tools to complement its CDD Plus repository. These are expected to be the first of many CASE products from large computer systems vendors and the larger independent software vendors in the early 1990s.

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.

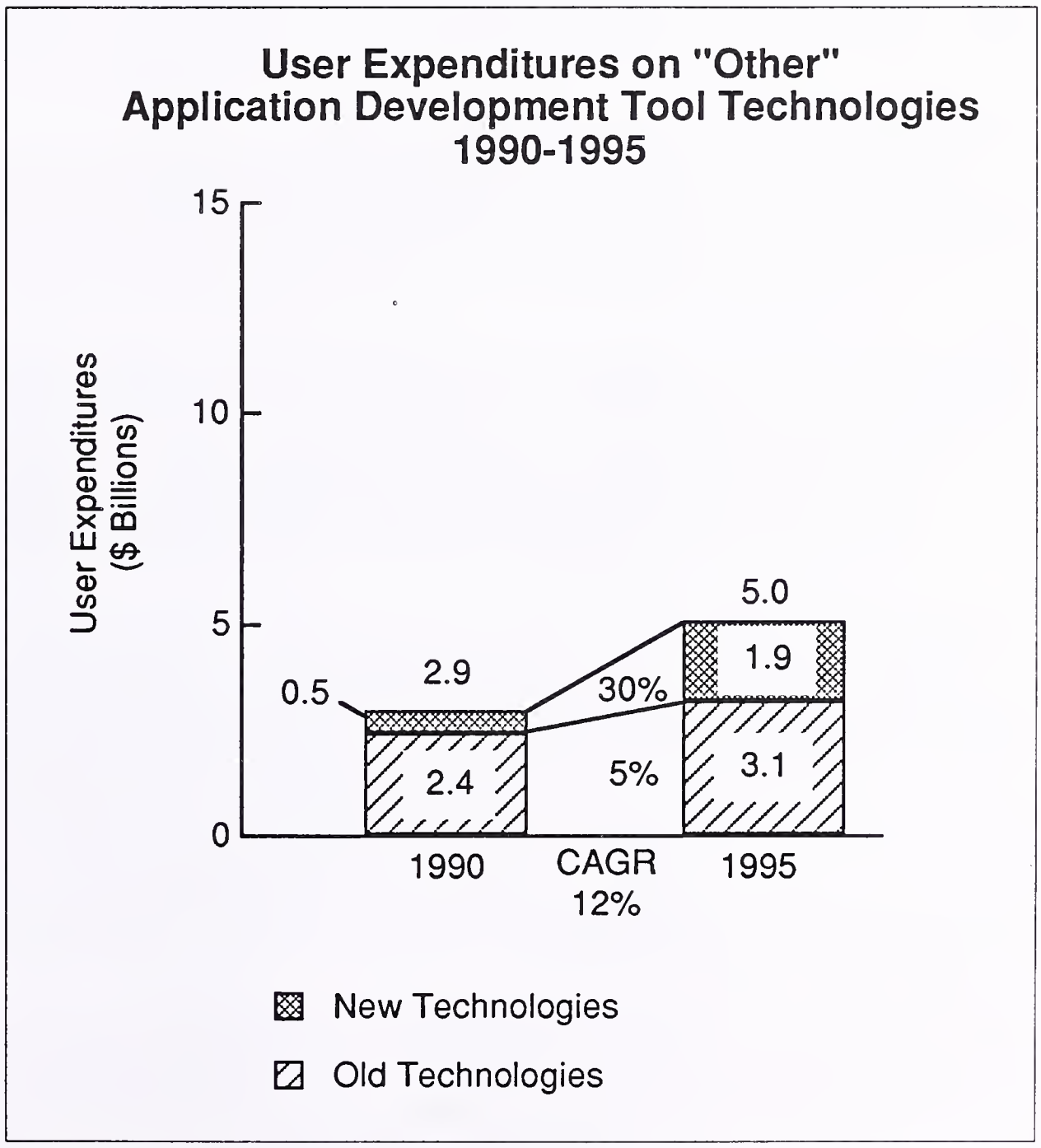
Front-end CASE tools are primarily PC- and workstation-based, and back-end tools are mainframe- or central processor-based. The push in CASE will remain workstation-oriented. As the power of the worksta-

tion grows and the use of CASE technology, including cogenerators, 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 $2.9 billion in 1990 to $5.0 billion in 1995, a CAGR of 12%. Old technologies account for the majority of these expenditures, as shown in Exhibit IV-14.

EXHIBIT IV-14



Old technologies include 3GL and support products. A big market, driven by hardware, it is growing slowly at a 5% CAGR. The market for 4GL products is already highly penetrated so is experiencing only modest new growth.

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

The strong growth in product licensing activity and revenue growth exhibited by third-generation expert systems application development tool vendors, such as Aion 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.

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 internetworking 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 and workflow improvement capabilities through network-based image processing systems.

Objected-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. Information systems is still learning to apply relational DBMS technology on a broad basis.

3. 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, desk/tape library systems, performance monitoring/tuning systems, etc. At the level of workstations and PCs, this category 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 time-frame. 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 $3.7 billion in 1990 to $7.7 billion in 1995, at a CAGR of 16%.

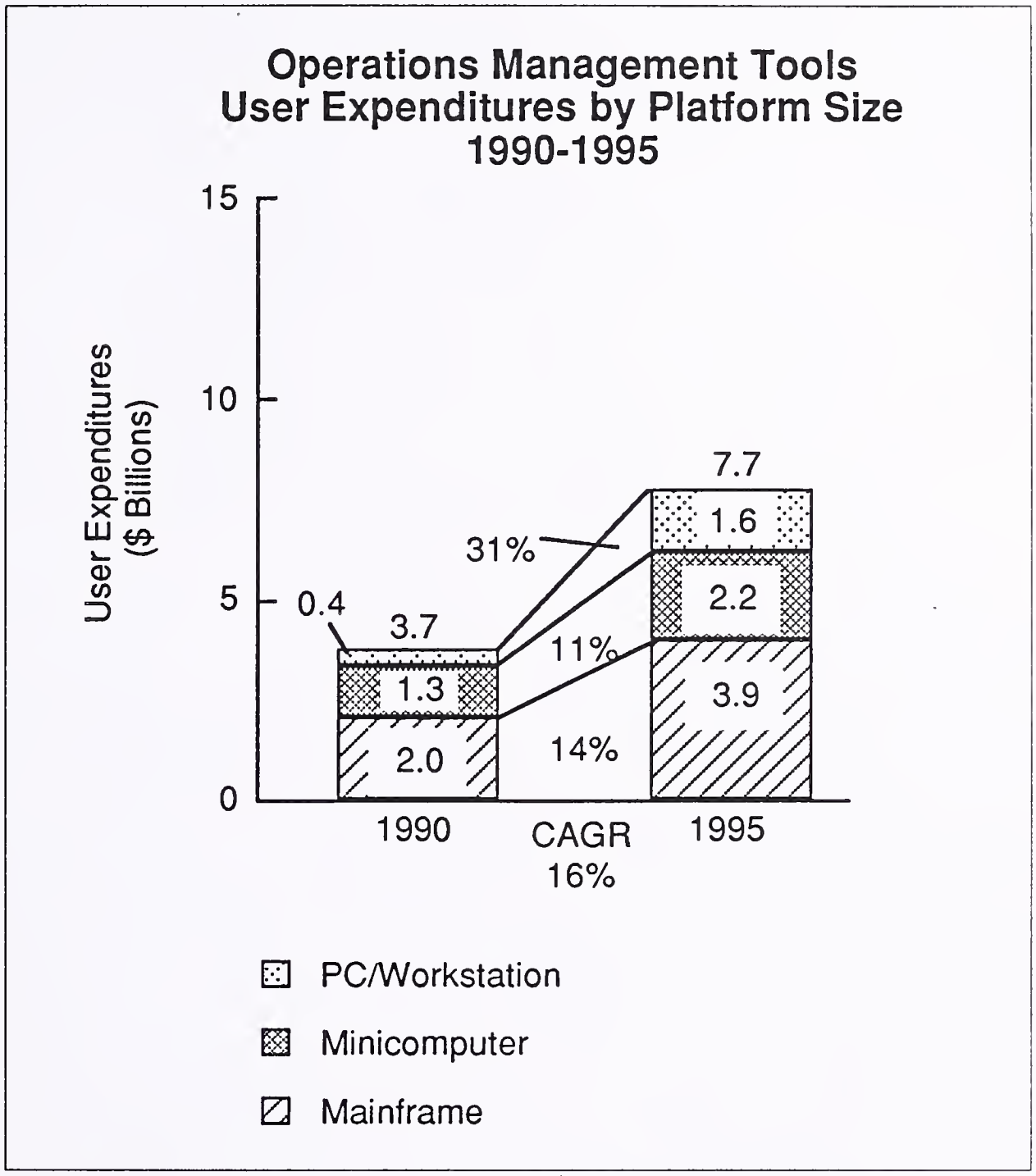
Growth drivers for operations management tools are:

- The complexity of the data center environment continuing to increase rapidly
- The move to consolidate data centers continuing to have a positive impact on growth of data center management products. Users are faced with how to manage all the diverse applications, how to manage increasing numbers of end users, and how to do it cost effectively.
- The increasing requirement for integration and the advent of standard architecture models fueling demand for data center management programs for LAN and inter-LAN-based monitoring and control. SystemView, IBM's new systems and network management product, fuels demand for new integrated network and data center management products.
- A shortage of qualified staff in data centers
- Embedded knowledge-based products enhancing the attractiveness of a variety of operations management tools

b. Operations Management Tools by Platform Size

The mainframe portion of the operations management tools market is expected to grow from $2.0 billion in 1990 to $3.9 billion in 1995, at a CAGR of 14%, as shown in Exhibit IV-15. Opportunities exist for the further automation of the monitoring process, network control programs, and resource cost programs for allocating information services costs to various profit units throughout a company. The percentage of user expenditures for operations management tools residing on mainframes will remain about the same through 1995.

EXHIBIT IV-15



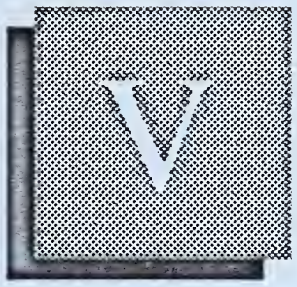
Growth in user expenditures for operations management tools on mainframes is fueled by data center consolidation. Operations management provides for long-term cost savings and ongoing leveraging of power of ever bigger computers. Growth will be stronger in the first part of the forecast period, because once mainframes are fully outfitted, need will drop off and the user expenditure growth rate will decline.

The minicomputer market for operations management tools is projected to expand from $1.3 billion to $2.2 billion by 1995, at a CAGR of 11%. When all mainframes in the data centers are fully managed, and when powerful workstations are being managed, then users will also want to manage their minicomputers. As minicomputers become more integrated into networks, more attention will be paid to managing their capacity.

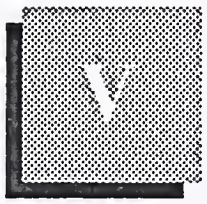
The workstation/PC portion will grow from 11% of the total operations management tool market in 1990 to 21% in 1995. User expenditures will grow from $400 million in 1990 to $1.6 billion by 1995, a CAGR of 31%.

- 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 OS/2 and client-server LAN applications become common, then reasonably higher priced operations management tools supporting workstations and PCs will become common. Also, existing mainframe tools are beginning to have PC front-end versions with GUIs promoting their ease of use.



Issues and Trends



Issues and Trends

A

Key Trends for the 1990s

Corporations are struggling with a mix of independent, non-integrated "islands of technology" and are just beginning to integrate them. Multiple, disparate technologies create redundancies and inaccuracies. Overlapping and incompatible systems often present too many "versions of the truth," varying results from the same request for information from two sources.

Training personnel to utilize, maintain, and support the multitude of diverse hardware and software systems is also inefficient. The existence of so many different systems and technologies tied to various hardware platforms presents too many interfaces between the user and the machine.

Complexity of software development is increasing due to integrated applications, enterprise computing, distributed/cooperative processing, and the eventual need to bring software in line with standards such as SAA. Key corporate applications now depend on networking and the DBMS to make corporate contributions.

Even though this complexity impacts the demand for new applications, the most significant drain on the resources of information systems organizations is and will continue to be the maintenance and enhancement of existing applications portfolios. Development backlogs are increasing; INPUT research suggests software maintenance consumes 65% or more of the application development budget for many companies.

Maintaining a supply of qualified application developers is a challenge that IS organizations are going to find increasingly difficult in the 1990s. Addressing this challenge in today's economic environment is especially difficult when many companies have had to downsize their work forces to reduce operating expenses. Additionally, competition for IS people

has increased as systems integrators and outsourcing firms entered the marketplace. Finally, enrollment in computer science departments of colleges and universities has declined.

This need to improve software development productivity—especially in light of the shortage of qualified personnel— will drive the market for CASE tools and RDBMSs, which should accelerate as standards in these product groups emerge. The integration of all the design and data base elements into a common repository is key to the reverse engineering capability, which addresses the maintenance issue.

Data center automation 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 becoming especially complex because of the need to combine different operating systems, data bases and networks.

These issues, summarized in Exhibit V-1, will drive systems software products during the 1990s.

EXHIBIT V-1

Systems Software Products
Key Issues

- Growing need to share data and applications
- Need to combine new and existing technologies
- Need to improve productivity of software development
- Growing complexity of managing enterprisewide systems

INPUT has identified and described nine trends, summarized in Exhibit V-2 and described in the rest of Chapter V, brought about in large part by these issues. 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 with assimilating all of it.

EXHIBIT V-2

Systems Software Products Key Trends

- Cooperative/distributed processing evolution
- Slow migration to standards
- New growth for network management and data center automation
- Slow adoption of CASE
- RDBMS in infancy, from user standpoint
- Graphical user interfaces just beginning to take off
- Widespread use of object-oriented programming and expert systems a long way off
- Emergence of voice processing
- Initial acceptance of image processing

1. Cooperative/Distributed Processing Evolution

The terms distributed processing, client-server architecture and cooperative processing are used interchangeably in the marketplace and by vendors. INPUT interviews revealed a variety of definitions:

- LANs connecting workstations to servers
- Ability to distribute a data base across desktops, access the data base from multiple platforms, and employ multiple programming techniques
- Ability to spread applications out on more than one machine

In its true form, cooperative or distributed processing allows tasks to be allocated to the computing environment that is most appropriate for the job, and to platforms that provide the most cost-effective solution. The server could, and will be, any sized CPU—mainframe, midrange, or workstation/PC.

If vendors and/or users can make applications and data platform-independent, then distributed processing will really take off. On the systems control side, much of this platform independence will be achieved

through the use of operating systems such as UNIX and OS/2, and GUIs such as Windows 3.0 and Presentation Manager.

However, only limited progress is being made in applications development for client-server architecture because it is complicated, time consuming, and requires a high degree of coordination. Issues like how much and what goes on the back end versus the front end, and how to connect/coordinate front ends and back ends need to be resolved. In addition, developing applications that are optimally tuned for network distribution is a complex task. CASE software products will evolve to support the development of client-server-based applications, but they are slow in coming.

The next challenge will be to provide generic servers. Standard interfaces are needed to support the notion of a generic client and a generic server. Given the multivendor environments of most information networks, it will be essential for new distributed applications to fit easily into the network.

Client-server computing will move slowly, not only because products are just now coming out, but also because the vast majority of desktop users are satisfied with using Lotus 1-2-3 and word processing. Those who are using data bases will have to get out of the mindset of controlling where their data resides. Also, PC networks are typically supporting personal computers for very simple applications and peripheral sharing. A typical LAN consists of 8-12 nodes. Thus, a fundamental cultural shift will need to take place.

Distributed processing is just emerging as a real alternative for applications development; the market is not mature enough to know what it needs; users must be willing to experiment; and vendors must listen closely to what their customers are saying.

2. Slow Migration to Standards

Few vendors offer a full complement of hardware. Therefore, users would rather be in a situation where they can pick and choose from equipment manufactured by many vendors. Standards will allow this to happen to an increasing degree throughout the 1990s.

a. To What Degree Are Users Accepting SAA and What Will Its Impact Be?

SAA was first described by IBM in March 1987. Its objective is to unite OS/2EE, OS/400, VM and MVS environments. IBM promises to provide links between SAA operating systems and AIX, though it has yet to formally include AIX among the chosen platforms. Exhibit V-3 provides a brief description of SAA.

EXHIBIT V-3

Major Components of SAA

- Common User Access (CUA) for end users
- Common programming interface (CPI) for tools and languages needed to create SAA applications
- Common communications support (CCS), a networking information infrastructure

So far, what has come from IBM that is SAA-compliant is OfficeVision, an SAA standard for front-office applications; AD/Cycle, an SAA standard for CASE; and SystemView, the data center or system management component of SAA. All are in the preliminary stages of product development and user acceptance.

SAA cannot solve any of today's problems because in its present form it is only a plan or a blueprint, most of which is not realized yet. A recent INPUT survey found that 25% of IS organizations in large corporations are giving SAA attention and have some SAA implementation activities. That percentage is projected to grow to about 60% in 1992. There is user activity, but it is growing at a modest pace, given that SAA is already three years old.

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

- Significant changes in SAA since its unveiling in 1987 have users confused. The plan for portability, for example, has evolved into cooperative processing and Enterprise Information Systems. All IS organizations 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 acceptance. Users have become dependent on facilities that operate systems that, in the future, will not be compliant with SAA.

Therefore INPUT does not expect portable, SAA-compliant applications until about 1995. In fact, SAA will be a software growth inhibitor over the short term, as users grapple with the meaning of SAA for their organizations and adopt a wait-and-see attitude. Even leading vendors such as D&B Software indicate that their plans for SAA-based products are two to four years away.

b. What Is the Significance of CA90s?

CA90s is a serious effort by the largest independent software products vendor to provide a framework for all of its products. CA90s has been equated with SAA but it is more an integration philosophy and marketing commitment designed to develop customer allegiance and to increase penetration within the Computer Associates base. Exhibit V-4 provides a brief description of CA90s.

EXHIBIT V-4

CA90s Components

- Service layers
  - User interfaces and visualization services
  - Integration services
- Distributed processing services
- Enterprise software solutions layer
  - Systems management software
  - Information management software
  - Business applications software

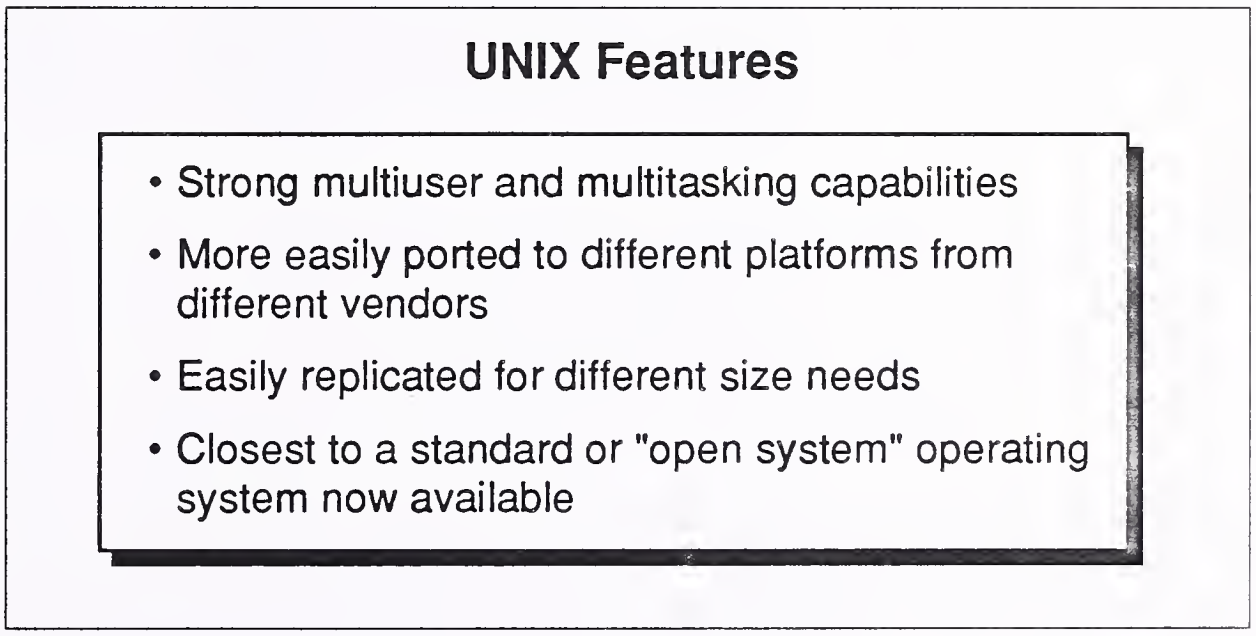
The key significance is that this large, and occasionally criticized vendor has responded with a strategy to draw together its far-flung family of systems and application software products. It is a huge task, but any progress that is made should help reduce the total cost that information systems organizations may incur as their software environment evolves throughout the 1990s.

Whether to SAA or another standard, users are reluctant to move away from proprietary architectures; resistance and major cultural impacts delay change.

c. When Will It Be the "Year of UNIX?"

Traditionally an operating system restricted to the engineering and technical realm, UNIX is making significant inroads into the commercial realm because of the desirability of its features that enhance distributed processing (Exhibit V-5).

EXHIBIT V-5



Recent INPUT research found UNIX in use for some commercial systems in 25% of the information systems organizations surveyed, and that the use would grow to 40% in 1991. Certainly UNIX is not the dominant operating system where it is in use, but it is fair to say it has arrived.

Although sales are somewhat curtailed by the economy at present, 386- and 486-based desktop systems are now available which are well suited to run UNIX.

Key software vendors have endorsed UNIX. For example, Ashton-Tate now offers Dbase IV on UNIX platforms; Oracle is expanding its AIX product offering to include all IBM AIX platforms; and Sybase's predominant push is in UNIX.

IBM's endorsement of its SAA blueprint has caused other systems vendors such as Data General, Unisys, NCR and Hewlett-Packard to place more emphasis on UNIX due to the inevitability of being locked out of the IBM world.

UNIX acceptance is slowed, however, because:

- The commitment of the other (non-IBM) vendors is half-hearted; their stance, at least up until recently, has generally been to offer UNIX as an alternative if customers ask for it. A fundamental incompatibility

exists between their desire to "lock" the marketplace into buying their own hardware and software, and the market's increasing demand for multivendor, open systems.

- Although progress is being made towards a single UNIX standard, dozens of versions exist, which curtail application development efforts.
- UNIX is perceived as not as mature or robust as proprietary systems.
- There is a lack of resources sufficient to support both full-scale UNIX applications development and development for other operating systems.
- UNIX is perceived as complex.
- It is difficult for some to acknowledge the power of desktop computing versus the central mainframe
- Distribution channels are underdeveloped; UNIX is just beginning to appear in the retail channel in shrink-wrapped versions.

Because of the above, rather than at some point it being the "year of UNIX," the adoption of UNIX is clearly an evolutionary process. It has an advantage over proprietary standards in that it cuts across multiple vendors. Open systems with UNIX are less complex than SAA or perhaps CA90s.

- UNIX can be adopted now.
- It does not tie the user to a limited number of single software products or hardware vendors.

If UNIX could ever get a single strong sponsor who assumes ownership, usage may explode—as long as that sponsor doesn't try to turn it into a proprietary environment.

3. New Growth for Network Management and Data Center Automation

The trends towards data center consolidation and tying IBM networks into non-SNA networks is causing IS organizations to re-evaluate their existing systems. It is making people more cognizant of automation and the need for better tools and better management. These factors have caused data processing managers to seek help in the form of productivity-enhancing software from systems software companies.

Network management is one of the key strategic battlegrounds in the computer industry; integrated management of the network helps to assure

account control for computer systems as well as network and data center automation products.

Multivendor, multiplatform network management will evolve within the next five years. The issue of standards in terms of network protocols and services is coming closer to resolution.

After 13 years, the ISO has approved protocol standards for all seven layers of the OSI mode. However, those standards are still being refined to bring them in line with market realities. The Common Management Information Protocol, the OSI network management protocol, was ratified only recently.

SystemView, IBM's new systems and network management product that was announced along with IBM's Enterprise System/9000 line of mainframes, also promotes multivendor and multiplatform network management. It supports the key IBM and non-IBM operating environments, and selected offerings from third-party software suppliers.

The complexity of managing multivendor networks inside an enterprise-wide information system requires extending the management reach of proprietary products across a range of incompatible hardware and software. IBM is addressing, through SystemView, the need to integrate the operations and management of networks and systems. It specifies how applications, the data model, and the user interface will look. It provides a much-needed structure for integrated systems management and brings order to a large market. It gives credibility to other niche players' products because now IBM has defined these product categories. Key aspects of SystemView are summarized in Exhibit V-6.

EXHIBIT V-6

Components of SystemView

- End Use Dimension (CUA standards)
- Data Dimension (data model)
- Application Dimension (categorizes system management applications into "disciplines")

Unlike AD/Cycle, which is fueling an emerging market, SystemView provides new packaging in a mature market. Thus, SystemView will meet less resistance than AD/Cycle; rather than "fighting religion," many of the variables that SystemView is using are already defined in the market.

SystemView will be fleshed out over time with offerings from IBM and independent software vendors. Independent software companies that participated in the SystemView announcement are listed in Exhibit V-7.

EXHIBIT V-7

SystemView Announcement
Third-Party Participation

- Bachman Information Systems
- BMC Software
- Boole & Babbage Inc.
- M. Bryce and Associates
- Candle Corp.
- Goal Systems International
- Legent Corp.
- Platinum Technology
- SAS Institute

SystemView fuels demand for integrated network and data center management products, including programs for LAN and inter-LAN-based monitoring and control. Candle, for example, has announced new products for status management—OMEGAVIEW, with an OS/2-based client-server version—which allows for the consolidated view of information using status displays and images of maps to locate events geographically. It is CUA-compliant and accesses multiple IBM subsystems. OMEGAMON II for MVS is a performance monitor with a CUA-compliant user interface as well as integration of real-time and historical capabilities on-line. AF/PERFORMER implements the three layers within IBM's SystemView application dimension—administration, coordination, and execution.

Integrated system and network management raises data center automation up in the IS organization to the senior information systems executive. Now the average sales order will contain more than one product. It is thus no longer a tactical, but a strategic sale.

4. Slow Adoption of CASE

The use of the term computer-aided software engineering or CASE is still relatively new, having come into common use in 1986. In simple terms, CASE is the application of computer-based tools to the entire software specification, design and programming process. CASE tools address the issues of productivity, quality and maintainability of software.

CASE has typically been characterized as having two basic components. They are referred to as either front- or back-end CASE tools or upper and lower CASE tools.

- Front-end CASE design methodology and modeling tools have evolved through the use of graphics-based workstation and personal computer technology.

- Back-end or lower CASE code generation tools have evolved from the ongoing process of striving for higher-level programming languages and the implied productivity improvement, and are usually central processor-based.

When initially introduced, CASE tools were standalone and characterized by:

- Manual data interchange
- No standards
- Varying quality
- Easy entry by new vendors

By the end of the 1980s, CASE tools—often from different vendors—were beginning to be linked. Though this was an improvement over the standalone environment, there were still significant problems.

- Information loss when exchanging data between products
- Weak links in product chains
- Conflicts between vendor strategies
- Varying staying power of the vendors

Today, non-repository-based CASE is the model that most vendors aspire to. To achieve this requires de facto standards and implicit methodology. However, the business implications are still being sorted out. At minimum, repository-based CASE means:

- Repository vendor control
- High initial and ongoing investment
- Shake-out in the industry

a. Trends and Issues

More than any of the other application development tools, CASE has been touted as the panacea for the software development backlog. Yet it has been estimated that less than 20% of companies use some form of CASE software. Early use has been for selected large-scale strategic projects, or experimentation and prototyping, rather than as a standard for the entire software development effort.

The reasons are two-fold: many CASE tools are still first generation and not completely developed, and response to CASE on the part of IS organizations has been cautious.

Because CASE is still in its infancy, much remains to be determined.

- The majority of the CASE vendors and tools do not directly address the maintenance or re-engineering challenge, and many IS organizations place more emphasis on improving the maintenance problem than on new development. The most prominent efforts have been taking place at Bachman and Language Technologies. Price Waterhouse's recent foray into re-engineering—putting together a worldwide team to devise a re-engineering methodology—will also add impetus to the supply side of this equation.

- To date, CASE only really addresses the planning and analysis, not construction, of software development. Construction or back-end products are not widely available and are developing at a slower rate. Although the original theory and technology of back-end CASE technology is 15 to 20 years old, a lot of rethinking is being done, and major investments are being made in developing back-end tools. New cogeneration technologies will appear over the next several years—modular, icon-driven, and with the ability to select without having to write syntax.

- CASE tools are just beginning to move over to UNIX-networked workstations. It is unclear how these systems will interact, if at all, with the AD/Cycle blueprint.

- There is increasing recognition of the need for a central repository for integrating a total CASE solution in order to obtain the benefits of enhanced maintenance productivity. The role of the repository in CASE, however, remains relatively undefined and certainly underdeveloped (See AD/Cycle analysis, below).

In general, IS organizations have not been eager to tackle CASE because of its highly disciplined design techniques, which are anathema to systems analysts and programmers because of the difficulty of learning to use the tools and the "cultural" change that is required. Because of these issues and the demands on MIS shops to keep business going, CASE has not taken a preeminent position.

CASE training and support on the part of software and systems vendors is just beginning to get up to speed. The number of true experts who can serve as teachers will be a restriction in the short term. Many vendors are just beginning to give real attention to their training programs, let alone true consulting services.

Professional services organizations will play an increasingly important role in educating IS organizations about effectively using CASE. As more systems integration and custom development projects go outside to firms that use CASE as a means to make a profit, the IS organization will begin to have CASE demonstrated. Once the system is delivered, it may well come with the CASE technology that was used to develop it. The result will be that IS departments inherit one or more CASE tools.

The role of professional services firms will therefore be critical to acceptance of CASE and its movement from experimentation to mainstream use. INPUT believes that professional services companies will contribute a great deal to guiding information systems through the cultural aspects of CASE implementation.

Because the commercial success of CASE products will likely be a key to the longer-term competitive success of the systems vendors' hardware, the assimilation of CASE by the user community is directly tied to the efforts of systems vendors. For example, a major product goal of IBM's AD/Cycle strategy is to provide independent software developers with an integrated application development product for developing IBM SAA-based solutions.

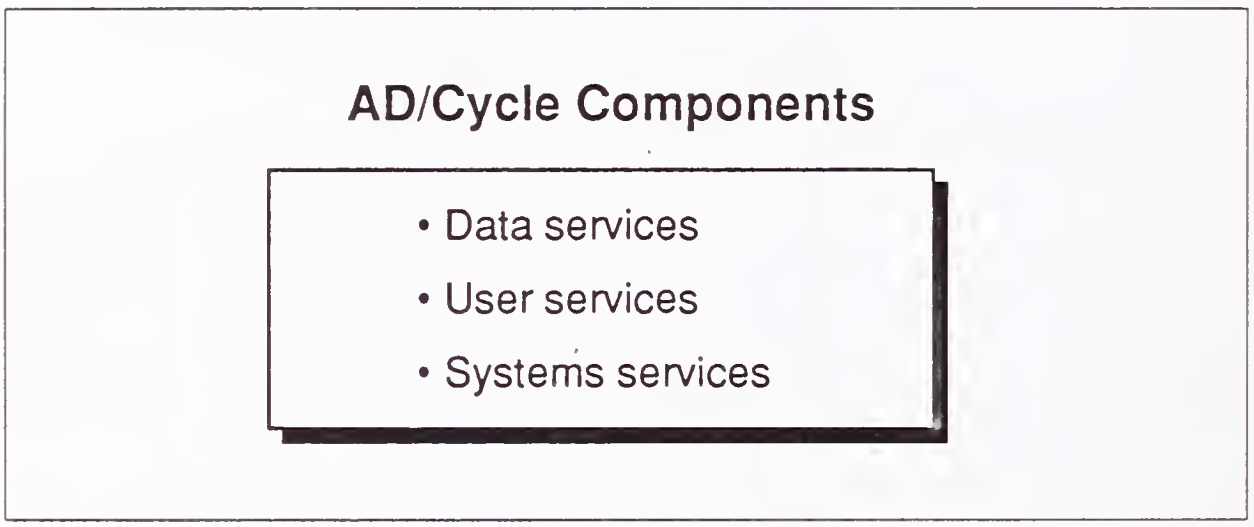
Integrated CASE product offerings by other large computer systems vendors such as DEC and Unisys will also lead to increased interest in using CASE effectively. In addition, standards—brought about primarily by AD/Cycle— should emerge in the industry over the next few years.

b. AD/Cycle Analysis

The AD/Cycle blueprint is a set of SAA specifications for software development. It is intended to enhance the development of third-party applications software that complies with SAA. IBM SAA-compliant hardware platforms are the OS/2-based PS/2 personal computer, the AS/400 minicomputer and the System/370 mainframe.

Key AD/Cycle components are summarized in Exhibit V-8. CASE tools must access the IBM Repository Manager/MVS offering. Repository Manager/MVS, which began shipping this summer, will ultimately hold all the information that's needed for systems development, starting at the front end with planning, analysis and design, and going through to programming, testing and maintenance.

EXHIBIT V-8



The Repository includes a common data model called the Information Model. This data base allows one to integrate various tools from different vendors by sharing data among them—across the entire development life cycle or within a single development phase. With AD/Cycle, IBM has finally admitted that there is no integrated CASE, that no one vendor can supply everything.

AD/Cycle promises to eventually integrate CASE tools from diverse vendors and manage software development from a central point—but it is still no more than a concept in a state of flux. CASE vendors are among the first to grapple with the issue of the repository, since it will not become useful to users or integrators until tools can share information through it. Some applications and tool vendors wonder whether they will be able to keep up with the moving target that is the repository. The instability may slow adoption of AD/Cycle as vendors hold off on developing for the repository until it is deemed functional.

It is, however, inevitable that AD/Cycle will play a major role; a strong sales pitch for a CASE vendor is to be an IBM AD/Cycle partner. The three original business partners are Bachman Information Systems Inc., KnowledgeWare Inc., and Index Technology. AD/Cycle support could prove to be a means to account control.

5. RDBMS Is in Infancy, from User Standpoint

The DBMS market is over 20 years old; the RDBMS market is 10 years old. Nonetheless, users are far from assimilating RDBMSs and making 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 applications software account control. Vendors are struggling to maintain market share at the mainframe level. IBM's DB2 is gaining increasing acceptance as the de facto standard mainframe relational DBMS. As of the end of 1989, nearly one-fourth of all MVS sites were currently using DB2. Although the penetration level is relatively low, what is perhaps more significant is that well over half of total sites plan to procure DB2 or its companion product for DOS/VSE and VM environments, SQL/DS.

IBM's dominance comes at the expense of other suppliers and products in the mainframe DBMS market, most notably Computer Associates, Sybase and Software AG. In acknowledgment of IBM's dominance of the mainframe software environment, Sybase has announced that it will offer connectivity software for IBM DB2 and CICS data instead of a mainframe data base server of its own. Software AG of North America Inc. is transitioning from being a mainframe data base supplier to a supplier of tools and an application development environment for multivendor platforms.

The big push by the independents, including Sybase and Software AG, Informix, Gupta, Ingres and Oracle, is in the area of SQL cooperative processing—SQL network products and SQL application development tools that reside on networked PCs and workstations. These vendors are clearly positioning themselves to work within IBM's SAA framework.

In the midrange market, DEC is the leader—it bundles its Rdb with new VAX operating system sales. Other key vendors in the midrange are Oracle and Sybase.

Even with the acknowledgment by vendors of the significance of a DBMS product line and vendors' push of relational DBMSs into the marketplace, users are not fully embracing their efforts. Generally speaking, many user organizations currently have RDBMSs but they're slow to use them for heavy-duty applications development and they're not being used yet for very many mission-critical applications.

The reasons are:

- RDBMS technology is way ahead of users' ability/willingness to fully assimilate it.
- Political issues related to distributed data bases make it difficult to implement RDBMSs widely.
- Information systems is risk-averse when it comes to making major changes that might affect critical corporate data.

As with CASE, a lot of product went into the market and now users have to learn to more effectively use it. Much of the future RDBMS growth will depend on the suppliers' ability to listen to and educate the marketplace.

6. Graphical User Interfaces Beginning to Take Off

The graphical user interface is upon us. Standards are in place now (PM and Windows), and use is beginning to grow. At the same time, experience is limited, and there are no experts to explain how to build applications with these standards.

There will be immense impact once people get used to GUIs/CUA, if they prove to be intuitive to use and hide the operating system, as the Macintosh does. Nobody has gotten close to pushing their limits. GUIs, along with CUA and SAA standards, will have a significant impact, but as with all advances, they will take time to be understood, learned, and applied. If a user is comfortable with 1-2-3 in its present form and does not need any other program, Windows may not be an adequate reason to relearn 1-2-3.

7. Widespread Use of Object-Oriented Programming and Expert Systems Is a Long Way Off

Companies such as Gupta Technology and Servio Logic have proven that commercial object-oriented DBMS products can be created, but they have yet to establish a general market for them.

Object-oriented programming tools will be a leading edge competitive product—full-featured applications development tools—but this will take five or more years.

In the meantime, object-oriented programming is initially being well received and adopted as an embedded product in the tool-building community. Examples of tools being developed with object-oriented programming include Servio's report writer, help facility, and menu builder,

tools that allow one to define data structures and design forms, and a schema designer that builds a picture of what the data base looks like and generates an underlying configuration.

Some inhibitors to the adoption of object-oriented technology include the following:

- The capability to take all common parts of objects and group them—the object action model of systems development—has not been provided; therefore object-oriented programming has not gone beyond tool building.

- Object-oriented programming languages do not have the richness that 3GLs and 4GLs have today.

- Object-oriented programming is a significantly different paradigm from existing programming. People must work in C++ and SmallTalk to perform object-oriented programming, but the general business programming community doesn't know about these and does not want to learn. People are simply slow to change.

- For an object-oriented data base to catch on in the general user community, it must be possible to access the data base with a language that users are familiar with, such as an object-oriented version of SQL. It must also be able to build front-end tools that make languages transparent to end users.

Leading-edge user companies are running pilots and experimenting with object-oriented programming, but widespread acceptance requires a major player(s) that endorses it.

In the long run, object-oriented programming will fuel healthy growth of CASE. A number of CASE tools, to a varying degree employ rule-based logic and can benefit from object-oriented technology. KnowledgeWare uses the object-oriented program Prolog to build rules into its systems.

8. Emergence of Voice Processing

Solid experience is being gained in the use of voice processing for both incoming and outgoing call management. Specialized applications in the financial services industry and, to a growing degree in retail, are enhancing customer service and lowering costs.

Although it remains a new area, with true, flexible voice recognition technology some time off, the use of voice processing is becoming a serious alternative for certain types of applications.

Beside technology, cost is also a current inhibitor. Over the next two years hardware/software products below the $100,000 level will become available, providing the application development and delivery tools to broaden the use of voice processing.

9. Initial Acceptance of Image Processing

Image processing is now a serious application development alternative, following a number of years of experimentation. The costs remain high, and the applications fairly specialized; however, in paper-dense industries such as health care and insurance, use is growing at a strong and steady pace.

D

Future Issues and Trends

The following are a few projections to 1995 and beyond relative to the systems software products market.

- Applications and systems software products will have the same look and feel under CUA and other GUIs.

- The growing user movement toward open standards and UNIX will lessen the proprietary—and therefore profit-making—value of proprietary DBMSs. Leveraging standards, users will be able to mix and match data from multiple data bases.

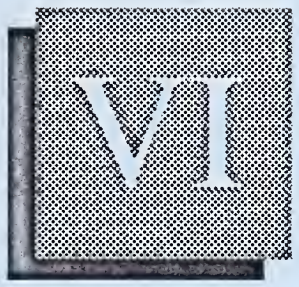
- As many software product areas evolve into commodity-type offerings, with comparable product offerings by several companies, more emphasis will be placed on value-added service capability, which will become a primary source of growth and profit margin.

- Given the eventuality of standards, the cost of switching vendors will become lower. Therefore, vendors will seek ways to differentiate through service, pricing, distribution and/or expertise in a particular niche.

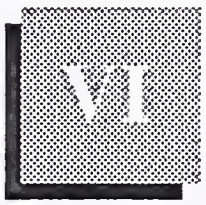
- Applications development tools will, due to standards and the impact of AD/Cycle, integrate to a significant degree. Though this may eliminate some of the differentiation, it will greatly encourage use.

- SQL has lessened the differences between RDBMSs; there are now more similarities in applications developed on SQL RDBMSs.

- Network integration of multivendor environments will be successfully accomplished, giving the user increased freedom of choice in selecting new technologies.



Competition



Competition

In this chapter INPUT provides an analysis of the key competitive trends occurring in the systems software products market.

A Competitive Strategies

1. IBM to Increase Its Dominance

Because SAA sets the software blueprint for vendors and large corporate users, any modifications IBM makes in any portion of SAA can have a major impact on other vendors and users who are beginning to implement SAA. Minor shifts in AD/Cycle direction, for example, can do significant damage to independent software companies that are developing relational technologies. For instance, if IBM decides to scrub CSP—its co-generation facility on which all AD/Cycle co-generation is based—and go with something else, it would change the whole picture for companies that are developing new co-generation technologies.

2. Other Systems Vendors and Open Systems

In light of IBM's dominance and its SAA strategy—as well as midrange stagnation and overall diminishing hardware margins—it is becoming more and more necessary for the other hardware vendors to control software in order to keep market share. At the same time, the impact of UNIX, open systems, and standards in general are further breaking down proprietary systems software environments.

Unisys' recent major announcement of its Integrated Information Environment is a good example. Labeled an open system strategy, it draws heavily on Unisys' proprietary systems software products. It includes UNIX, but more importantly, includes a strong commitment to make Unisys systems software portable across Unisys environments. Unisys will build open system standards into its products to protect its installed base and provide integration with other vendor environments.

Digital Equipment has long gained significant revenue from UNIX-based products (perhaps as much as 15% to 20% of product revenues). It has alliances with companies such as Ingres to provide a complete set of DEC-based UNIX systems software products. Now it is beginning to do what INPUT predicted in 1987. Future versions of its proprietary operating system, VMS, will have compatibility with UNIX.

NCR, on the other hand, is at the other end of the spectrum, and will eventually migrate away from its proprietary architecture altogether. In the fall of 1990, NCR announced its System 3000, a line of computers that extends from laptops to mainframe-class machines running DOS, OS/2 and/or UNIX. It is developing software based on a blueprint called Open Cooperative Computing Architecture (OCCA) and is billing itself as the first company to offer OSI products from the desktop to the mainframe.

3. Independent Software Vendors Show a Diversity of Strategies

Computer Associates, with its CA90s strategy, is driving to position itself as a full alternative to SAA while being reasonably compatible with SAA. Its goal is to assure its installed base that they can keep using CA products, that they will evolve in a consistent fashion, and that the differences in products, caused by the CA acquisition strategy, will disappear over time.

Oracle is the best existing example of an open systems software vendor. Its SQL products run on proprietary as well as standard systems, with the claim that there are no differences. Certainly there are some differences, but the portability image is strong and well accepted. The impact on Oracle is a growing challenge to keep the products all of consistent quality, and the cost of maintaining such high portability.

Systems Center and Candle are maintaining focus on key aspects of the data center/network integration and operations areas, where mainframe software continues to play a dominant role.

- Systems Center, with is acquisition of Netmaster, could be said to be betting the company on integrated network management software products.

- Candle, with its ever more capable operations management products, is looking for ways to reach out to efficiently manage the other levels in the integrated network.

Informix, having strengthened its UNIX product line through internal development and acquisition, continues to bet on and enjoy the growth in the UNIX market. Specializing is paying dividends as long as Informix can maintain a broad, appealing product line at the workstation and server level; and as long as the UNIX market growth of about 30% holds.

4. Who Will the Winners Be in the 1990s?

In the 1990s, systems purchases will be made more and more on the basis of software and services rather than on the basis of hardware performance. Software is where the power is, because if a vendor can provide the software product, it can also run all the services associated with it, such as systems integration, consulting, and facilities management. What will therefore ensue is vendor competition for control of the various pieces of the software industry.

Winners will be those that standardize and remain cognizant of IBM's priorities. For example, many software vendors are scrambling to join the "repository" bandwagon now that the computing world has agreed that IBM's AD/Cycle will be the standard for the CASE industry. Vendors who do not pledge support for the IBM Repository offering risk losing substantial business. DEC has its new Cohesion CASE environment based on the CDD/Repository. Yet DEC must at the same time provide links to Repository/MVS. It will be very difficult for the CASE tool makers—DEC and others— to support multiple repositories.

Operations management tool vendors, in the long run, will all have to go the SystemView route in order to maintain viability.

In light of the integration trend, product breadth is important. A niche company will have to have strong alliances or risk being acquired.

B

Shifting Market Structure

1. Vendor Consolidation

Merger and acquisition activity in the software products industry has accelerated in both transaction activity and total dollar value since 1985. INPUT projects this pattern to continue through 1995.

The reasons for consolidation are:

- Large companies are better able to afford the investment necessary to cover the increasing costs of product development related to more complex software product requirements. Computer Associates—the largest independent software vendor—has some 3,000 systems analysts and programmers at work on CA90s. CA acquired over 20 companies during the 1980s.

- Consolidation of data centers has brought about consolidation of operations management tool vendors, as projects of such enormous size can only be handled by large vendors.

- The eventuality of standards will cause more consolidation, as will the continuing need in the marketplace to eliminate redundancies.

- As the purchase of many systems software products becomes more strategic in nature, vendors will need a sophisticated, polished sales approach. Size, breadth of products, and strong financial positions will become increasingly important in this environment. The "bigger is better" syndrome will take hold.

- Due to the continued decline in stock market interest in high-technology companies, fewer IPOs are taking place, and venture capital funding has dwindled. Thus, opportunities for acquisition—either of entire companies or of product lines—abound for vendors evaluating make-versus-buy product expansion decisions.

Exhibit VI-1 shows examples of systems software products mergers during 1989 and 1990, showing the diversity of activity in all three system software submodes.

EXHIBIT VI-1

Examples of Systems Software Products Mergers

Companies	Technology
ASK/Ingres	Applications/RDBMS
Computer Associates/Cullinet	Broad-based software/DBMS
Computer Associates/DBMS Inc.	Broad-based software/DBMS
Goal Systems/Tower Systems Int'l.	Ops. management/tape and disk management
Santa Cruz Operation/HCR Corp.	UNIX/object-oriented programming
Sterling Software/Assyst Technologies	CASE tools
Sybase/SQL Solutions	RDBMS/systems integrator
Systems Center/Unitech Software	Operations management and UNIX
Systems Center/Software Development International Pty. Ltd.	Operations and network management

Computer Associates has had a great challenge in integrating 24 companies into its fold; CA90s is viewed by many as a marketing ploy to present CA as a single integrated entity. Nonetheless, marketing ploy or not, if any company can pull off such a standards strategy, Computer

Associates can, given its vast resources. It has over a thousand on its R&D staff.

2. Rapid Formation of Startups to Continue

The formation of new companies continues to grow rapidly as new technologies catch on and as standards such as SAA create niche opportunities.

- Venture capitalists seem to be rediscovering the software markets, both systems and applications software products.

- IBM, and now DEC and EDS, are pushing minority investment strategies to assure that their standards are supported by key developers.

Even though consolidation is rampant, smaller companies will be able to survive because they have an opportunity to partner, which will allow them to broaden their product offerings and/or marketing and sales capabilities.

3. Alliances and Partnering to Continue

Reasons for alliances are:

- As a response to customer desire for a single source of a wide range of products

- To get products to market more quickly and less expensively

- To gain more expertise

For long-term viability, it is becoming increasingly important for independent software vendors to build alliances with the longer-term players in the hardware industry, as well as work with the operating systems that will survive the inevitable shake-out in the transition from proprietary to standard systems offerings.

Alliances take many forms:

- IBM is taking on the role of a high technology venture capital firm with its multitude of equity ownerships in a variety of firms. These companies stay in line with IBM strategy, thereby enhancing growth for both partners. Concern is developing about IBM's ability to juggle the interests of its investments, given that some of them compete with each other.

- UNIX vendors are forming alliances with systems integrators, such as EDS and Andersen Consulting, as they seek new ways to sell to commercial accounts.

- DEC has joint development projects rather than equity arrangements. DEC has partnerships with companies—such as Oracle and Ingres—that at first glance could be considered its competitors.

The software industry as a whole lacks experience with successfully managing alliances over the long term. Vendors will eventually need to address issues of long-term strategy and assure that their alliances are strategic in nature. In a successful alliance each company must be strategic to the other. Business alliances tend to rely on management rather than corporate relationships. The challenge then becomes keeping two companies' strategies complementary over time as management teams inevitably change.

For long-term viability an investment of some type—joint venture, royalties, etc.—is necessary to bind the relationship; a monetary arrangement is needed to keep the companies committed, as it is not possible for two companies to have the same objectives for an indefinite period of time.

Exhibit VI-2 gives examples of partnerships involving systems software products.

EXHIBIT VI-2

Examples of Alliances Involving Systems Software Products

Technology	Companies	Type
RDBMS/LAN	Gupta/Gupta	Equity interest
CASE	IBM/Ernst & Young & KnowledgeWare	Equity interest
CASE	Informix/Systematica Ltd.	European joint development
DBMS	Informix/DuPont	DuPont to market and sell Informix's DBMS software products for RISC
RDBMS	IBM/Informix	IBM to market Informix's RDBMS for AIX product
RDBMS	Ingres/DEC	Marketing alliance
RDBMS	Sybase/Sequent	Joint technology, marketing

4. Codevelopment with Customers to Continue

Much more technology has to be developed to support evolution to cooperative/distributed processing and standards. Codevelopment with customers could speed and help fund this new technology. Software vendors—especially those that do not capitalize their development efforts— are all limited in the amount they can invest in R&D. With codevelopment, they can get their own solutions and have a customer finance it.

Software vendors—especially applications software— will make a slow evolution from being software developers to software designers. Customers and vendors will codesign, and then vendors will package and distribute.

5. Expanding Distribution Channels

Different channels have been necessary to sell each software product type, and the market has become very segmented. However, a movement is underway to consolidate distribution channels. Systems integrators are playing a major role in this consolidation.

The Big Six accounting firms are pursuing integration services projects with CASE techniques and methodologies. Andersen Consulting, for example, has its Foundation tool kit, while Price Waterhouse is expected soon to unveil a method for transforming existing applications into code usable with IBM's CASE scheme, AD/Cycle. Ernst & Young has the Navigator Systems Series, which is based on an information engineering model covering the full applications development life cycle. These companies incorporate tools from various CASE vendors in their solutions.

UNIX vendors are forming alliances with systems integrators, such as EDS and Andersen Consulting, as they seek new ways to sell to commercial accounts.

Outsourcing is one scenario brought about by the desire to lower the impact of software maintenance on data processing organizations. Two main functions that outsourcing can provide, in addition to data center operations, are applications development and maintenance. Applications development tool vendors' customers will include outsourcers as well as software vendors and IS/user organizations.

Operations management tool companies can provide IS managers with the data needed to make decisions on whether or not to outsource. The distribution channel does not change in this instance. Some operations management tool vendors are, however, turning to outsourcing vendors (systems operations providers) as an important channel for deploying their data center management tools.

Candle is putting together a plan for working with integrators and facilities managers, an increasingly important channel for deploying its data center management tools. Integrators can provide the exposure to high-level management that smaller software companies may not have.

C. Market Shares/ Leading Vendors

The systems software products market is highly fragmented. IBM leads with an 18% share, leaving close to $12 billion for other competitors. As shown in Exhibit VI-3, only six other companies have greater than 1% share of the overall systems software products market.

As an example of the fragmentation, the CASE submode of applications development tools has in excess of 80 vendors participating (Exhibit VI-4); the top 10 account for 59% of the market; and only nine have greater than 1% share.

The systems software products marketplace is overcrowded; more consolidation can be expected, due not only to the density of vendors, but also to the slowed growth rate and the fact that integration of products is creating a need for a more integrated marketing and sales approach.

EXHIBIT VI-3

Leading Hardware Vendors' Systems Software Revenues and Market Share, 1989

	1989 ($ Millions)	Market Share (Percent)	Area of Activity		
			Systems Control	Applica. Develop.	Opera. Mgmt.
IBM	2,620	18	x	x	x
DEC	800	6	x	x	
Computer Associates	463	3		x	
Oracle	283	2		x	
Hewlett-Packard	270	2	x		
Novell	263	2	x		
Microsoft	242	2	x	x	
Unisys	207	1	x		
Ashton-Tate	147	1		x	
Wang	144	1	x		
Pansophic	109	1			x
Adobe	99	1	x		
Apple	74	1	x	x	
Tandem	75	1		x	
Sterling Software	74	1		x	
Candle	73	1			x
Subtotal	5,943	41 *			
Other Vendors	8,558	59			
Total	14,501	100			

* Does not add due to rounding

EXHIBIT VI-4

Leading CASE Tool Vendors' 1989 Revenue and Market Share

	1989 ($ Millions)	Market Share (Percent)
KnowledgeWare	42	12
Pansophic	35	10
Index	30	9
Texas Instruments	20	6
CGI	20	6
Manager	15	4
Sage	15	4
Synon	10	3
Transform	10	3
Bachman	5	1
Subtotal	202	59*
70 Other Vendors	140	41
Total	342	100

*Does not add due to rounding

D

Vendor Profiles

The following are profiles of several of the independent software companies mentioned in this report. They are representative of the types of companies and strategies underway in the systems software products market.

1. Boole & Babbage, Inc., 500 Oakmead Parkway, Sunnyvale, CA 94086 (408) 735-9550

Founded in 1967 shortly after IBM introduced its System/360 architecture, Boole & Babbage has always focused on the growing and complex needs of large IBM data processing environments. Boole & Babbage introduced the first console automated operations product in 1984; in 1988, it pioneered the use of expert systems technology in performance management (it is working with Chevron Information Technology to

develop Network Advisor, Boole & Babbage's second expert systems-based product); in 1989, it introduced mainframe-based windowing technology.

Boole & Babbage products address performance and capacity management problems. The company's strategy includes:

- Emphasis on product integration and compliance with IBM guidelines. Boole & Babbage's MainView family of products for enterprisewide system management is consistent with IBM's SystemView guidelines.

- Comprehensive services. The Institute for Information Management provides educational services and Applied Software Engineering specializes in new software product evaluation, capacity planning studies, and assistance on large R&D projects.

- Growth through acquisition and distribution of other companies' products. Over the last several years Boole & Babbage has made the following, relatively small, acquisitions:

  - Mission Computer Services in December 1988—processing services

  - Elan Software, summer, 1988—operations automation software

  - Avant-Garde Computing in February 1990

  - The rights to a network monitor product, NetAvail, which was to have become generally available in 1990.

The company's future success depends on its ability to improve its existing products and to acquire or develop additional software products. Boole & Babbage plans to offer performance measurement and automation products beyond host solutions. It is making investments in network management products to expand its product reach beyond the IBM host and storage subsystem, into the IBM/SNA network environment and beyond.

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

Computer Associates International (CAI) is well recognized as the largest software products company with major products lines in both systems and applications software and on all three platform levels (mainframe, midrange and workstation/PC). The growth has been fueled by acquisition throughout the 1980s, with ever-larger acquisitions. The three most prominent were UCCEL (1987), Applied Data Research (1988) and Cullinet (1989).

Computer Associates' strategy reinforces a number of the trends impacting the systems software marketplace.

- Consolidation, as just highlighted. CA has both grown through acquisition and suffered, (at least, recently) because of it. The impacts of the Cullinet acquisition on sales and income growth were negative in the early part of 1990.

- CA has now responded to the pressure on its mainframe DBMS products (Datacom DB from ADR and IDMS from Cullinet) from the movement to relational DBMS. The recently announced relational version of IDMS is a true step forward and a solid answer. CA appears not to have done what some thought it would and simply serve the IDMS installed base with maintenance. Instead it has funded and quickly brought to market what is expected to prove to be a solid alternative to DB2, at least for those customers with existing IDMS investments.

- CA is also working to maintain its position in the operations management and systems control software area and, more importantly, has announced is software strategy for the 1990s, CA90s. Called by some an answer to IBM's SAA, it is at a minimum a strategy statement that users of CAI's systems software products can use to track CAI's commitment to new and enhanced products.

CA90s is the technical foundation for over 250 Computer Associates Enterprise Software Solutions. It consists of three levels of services:

- User Interface and Visualization Services act as the point of entry for users, provide a consistent look and feel for users across the CA-CAS product family, and provide common reporting tools.

- Integration Services supports overall integration among solutions; services include data base integration and advanced security capabilities.

- Distributed Processing Services supports distributed data base operations across multiple platforms.

- Platform Layer allows solutions to extend across a wide range of operating systems and hardware environments. Although the CA-CAS system currently supports the IBM mainframe platform exclusively, CA90s facilitates migrating this solution to multiple operating platforms.

- CA's repository services offering is described by the company as a major component of the company's CA90s.

As the largest independent software company, CA is working hard to provide a framework for its future in the eyes of its customers.

3. Goal Systems International Inc., Goal Systems Building, 7965 N. High Street, Columbus, OH 43235 (614) 888-1775

Goal Systems International typifies the systems software company that has blossomed through quality development and straightforward marketing of products for the IBM mainframe data center. Though it has been in existence for 15 years, the company's industry position has primarily evolved since about 1985. Sales have grown over 400% in the past five years and now exceed $60 million.

In recent years a key part of Goal's strategy has been to expand through product acquisition. It wants to be a strong force in the data center management market and has been acquiring modest and, more recently, larger independent companies to meet that objective. In most early acquisitions Goal would maintain the development staff of the acquired operation while integrating the marketing and sales activities into Goal's established structure.

The two latest acquisitions, Essential Software and Tower Systems International, are speeding Goal's growth due to their size, and greatly strengthen its position in the data center area. They will also provide challenges as Goal learns to absorb full organizations instead of, as was its prior experience, absorbing primarily product development companies.

Throughout this period Goal has carved out a leadership position in the computer-based training market. Contributing about 25% of revenues, the Phoenix CBT system owns the lion's share of the mainframe development market for computer-based training. In addition, the underlying technology spans a number of related products.

Goal has retained its focus on the IBM mainframe data center market, allowing it to constrain its sales and marketing costs and streamline the sales and support process to assure client satisfaction.

4. 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's strategic product line, the Information Engineering Workbench, is a tool set consisting 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 Manager 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 application 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's Information Engineering Workbench/Workstation CASE diagramming tools. Under the Industry Application Specialist program, KnowledgeWare will market IBM's Cross System Product, DB2 and SQL.

KnowledgeWare's primary focus is microcomputer-based front-end CASE tools. It lacks a strong back-end tool.

5. 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, its systems software technologies can manage other associated information platforms, that include those of Digital Equipment Corp. and Tandem, and MS-DOS and OS/2.

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

- IS Management—The focal point of Legent's IS 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.

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

- Software Management—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 comprise the company's network productivity products.

Legent recently announced full support of IBM's Systems View by all five of its software technologies. To support Legent's aggressive growth strategy through acquisitions, in December 1990, the company acquired the assets of FlexLINK International Corp., whose MetaNetwork technology is a critical piece in Legent's strategy to extend its systems software solution across heterogeneous environments. Legent's fiscal 1990 (9/30/90) revenues totaled $170 million, an increase of 25% over 1989.

6. Systems Center, Inc., 18000 Alexander Bell Drive, Reston, VA 22091 (703) 264-8000

The Systems Center strategy parallels that of Goal Systems to a significant degree. Starting life as VM Software, the company 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 was changed to 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 over 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 comprising a network. (August 1989)

- 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 Environment, Inc. of Houston (August 1990).

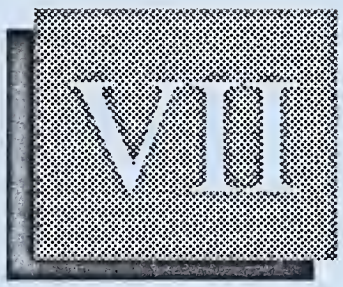
- Acquisition of Unitech Software, Inc. for $43 million of stock. Unitech provides systems utilities and network administration software for UNIX environments.

- 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.

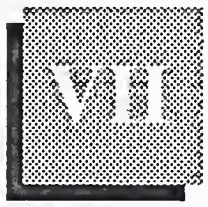
The company recently divested productivity enhancement and utility software products for users of IBM's SQL/DS and DB2 relational data base management systems, selling these products to On-Line Software International.

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.

Systems Center fiscal 1989 revenues were $66.3 million.



Conclusions and Recommendations



Conclusions and Recommendations

A Conclusions

User expenditures on systems software products were $6.3 billion in 1985 and were forecast to reach $16.4 billion in 1990, at a compound annual growth rate of 21% for the last five years. Expenditures are forecasted to reach $31.4 billion in 1995 for a five-year compound annual growth rate of 14%.

This slowed growth is due in large part to the transition to standards and open systems, and to client-server architectures. The marketplace is adopting a wait-and-see stance as systems software companies begin to respond with new products. The user community will need additional support services and training in order to assimilate these new products and to take full advantage of their benefits.

Key trends that point to a market in transition include the following:

- Cooperative processing is still poorly defined and products are just beginning to appear
- Slow migration to standards
- Slow adoption of CASE
- RDBMSs are just beginning to be used effectively at end-user level

The market for operations management tools is the fastest growing submode. It is the smallest to begin with—$3.7 billion in 1990. The transition to standards is eased in that SystemView is already being adopted as a workable de facto standard, mainframe-based products are expected to continue to show relatively strong growth through 1995, and this submode is relatively immune to the trend toward cooperative processing.

Because of the slowed growth and the movement towards integration and standards, industry consolidation continues and partnering and alliances are accelerating.

Only the fittest and most innovative vendors will survive. Vendors are faced with the considerable challenges posed by technology innovation, customers who are experiencing difficulty adjusting to new technology, a continued industrywide consolidation and successful management of myriad alliances over the long term.

B

Recommendations

For long-term viability in the systems software products marketplace, the following approaches are recommended:

- Support operating systems and network standards to increase market reach and flexibility of product offerings.
- Remain cognizant of IBM's priorities and work within the IBM framework. Independent software vendors need to understand what is strategic not only to IBM, but to other major hardware vendors and avoid upsetting the applecart in these areas.
- Being large is not a criterion for success; small vendors, however, must pick niche opportunities that do not represent a large enough market potential to attract powerful competitors.
- In light of the integration trend, product breadth is important. A niche company will have to have strong alliances or risk being acquired.
- Vendors need to ensure that their alliances are strategic in nature. 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.
- Level of integration is a key competitive issue and a differentiator. A systems software products vendor must be aware of its limitations in providing integrated products and not overextend.
- Firms are selling to a confused marketplace. Provide strong education, service and support, or align with a company that has these capabilities.
- Technology is necessary but not sufficient. Understand market needs and focus on the customer. Foster standing as a well rounded, business-savvy vendor rather than a "group of brilliant scientists."
- Systems software products sales forces are now selling to higher levels of management, given the enterprisewide nature of many of the products. Sales forces will have to undergo a transition from a tactical to a strategic sell.

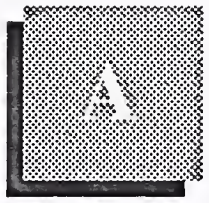
- Consolidation causes temporary chaos and inefficiencies as management teams get used to each other and product lines are merged. Acquire for long-term positioning rather than current market share.

- In light of declining margins on hardware and lackluster 1988-1989 systems software products growth for hardware vendors, be prepared for an increasingly competitive environment as systems vendors become more aggressive. More competition for market share in core systems software products signals new pricing and marketing strategies.

- Investigate systems integrators and facilities management firms as distribution channels.

- Position now as a provider of value-added services; more software products will evolve into commodity-type offerings during the second half of the decade.

Appendixes



Appendix: Definition of Terms

A

Overall Definitions and Analytical Framework

Information Services - 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 (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 responsibility for the development of a custom solution to an information system 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, videotex, 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.

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

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.

- *Functional Application* markets, such as Human Resources, Accounting, etc. These are also called "Cross-Industry" markets.

- *Generic* markets, which are neither industry- nor application-specific, such as the market for systems software.

Specific market sectors used by INPUT are defined in Section D, below.

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 which have a different parent corporation than the user. It is these expenditures which constitute the information services market.

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 B describes the delivery modes and their structure in more detail.

Outsourcing is defined as the contracting of information systems (IS) functions to outside vendors. Outsourcing should be viewed as the opposite of *insourcing*: anything that IS management has considered feasible to do internally (e.g., data center operations, applications development and maintenance, network management, training, etc.) is a potential candidate for outsourcing.

IS has always bought systems software, as it is infeasible for companies to develop it internally. However, all other delivery modes represent functions or products that IS management 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.

B

Industry Structure and Delivery Modes

1. Service Categories

The following exhibit presents the structure of the information services industry. Several of the delivery modes can be grouped into higher-level **Service Categories**, based on the kind of problem the user needs to solve. These categories are:

- **Business Application Solutions (BAS)** - prepackaged or standard solutions to common business applications. These applications can be either industry-specific (e.g., mortgage loan processing for a bank), cross-industry (e.g., payroll processing), or generic (e.g., utility timesharing). In general, BAS services involve minimal customization by the vendor, and allow the user to handle a specific business application without having to develop or acquire a custom system or system resources. The following delivery modes are included under BAS:

  - *Processing Services*
  - *Applications Software Products*
  - *Turnkey Systems*

- **Systems Management Services (SMS)** - services which assist users in developing systems or operating/managing the information systems function. Two key elements of SMS are the customization of the service to each individual user and/or project, and the potential for the vendor to assume significant responsibility for management of at least a portion of the user's information systems function. The following delivery modes are included under SMS:

  - *Systems Operations*
  - *Systems Integration*

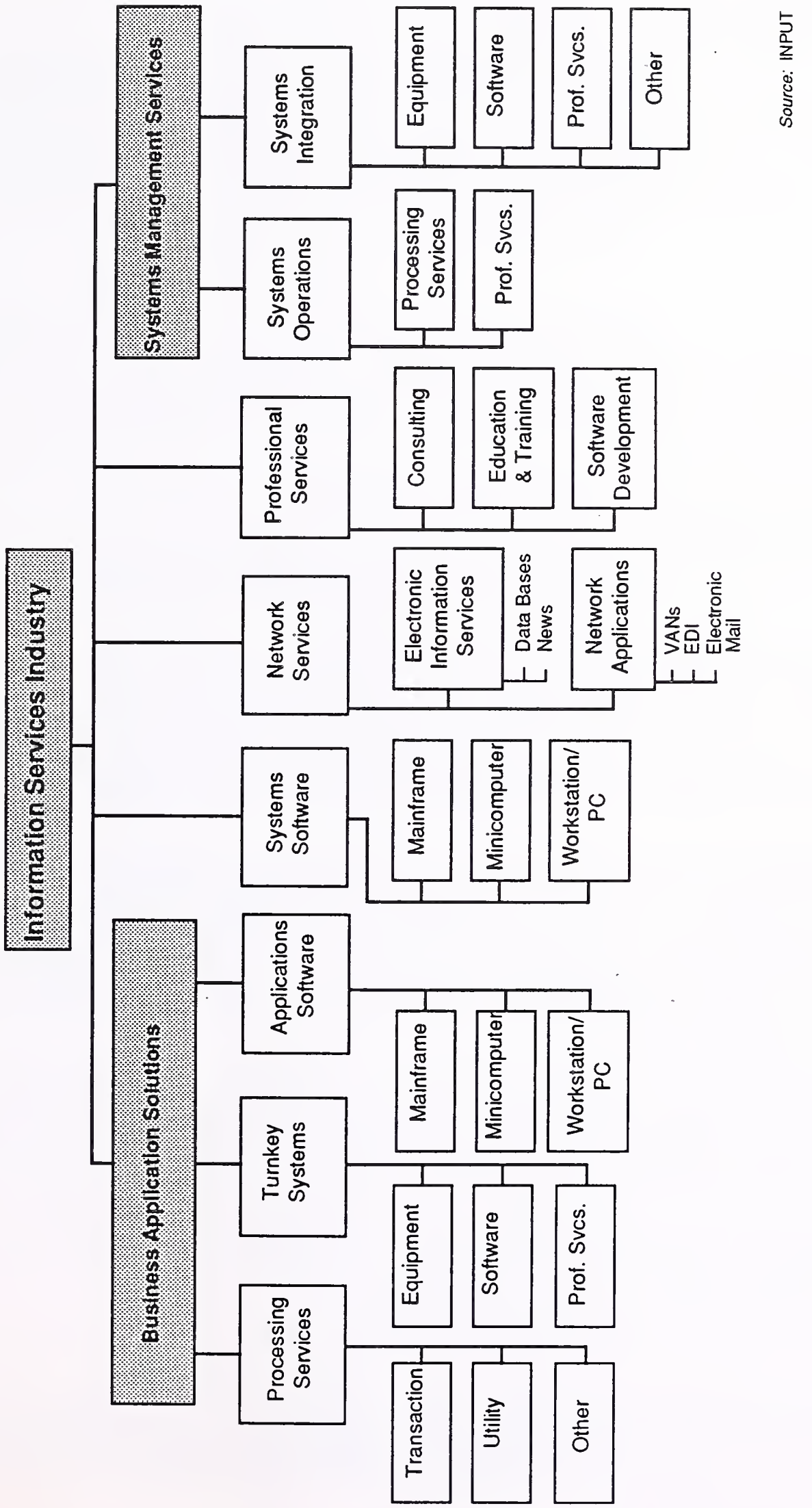
Each of the remaining three delivery modes represents a separate service category:

- *Professional Services*
- *Network Services*
- *System Software Products*

Note: These service categories are a new concept introduced in the 1990 MAP Program. They are purely an aggregation of lower level delivery mode data. They do not change the underlying delivery modes or industry structure.

EXHIBIT A-1

Information Services Industry Structure—1990



Source: INPUT

2. Software Products

There are many similarities between the applications and systems software delivery modes. 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 category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

- **Systems Software Products**

  Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

  - *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.

- **Application Software Products**

  - *Industry-Specific Application Software Products* - Software products that perform functions related to solving business or organizational needs unique to a specific vertical market and sold to that market

only. Examples include demand deposit accounting, MRPII, medical recordkeeping, automobile dealer parts inventory, etc.

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

3. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single system 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.

Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included the appropriate software category.

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 application 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 are divided into two categories.

- *Industry-Specific Systems* - systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical recordkeeping, or discrete manufacturing control systems.

- *Cross-Industry Systems* - systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems.

4. Processing Services

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

- *Transaction Processing:* - Client uses vendor-provided information systems—including hardware, software and/or data networks—at 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 vendor's system.

- *Other Processing Services*: Vendor provides services—usually at 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.

5. Systems Operations

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:

- *Professional Services:* The vendor provides personnel to operate client-supplied equipment. Prior to 1990, this was a submode of the Professional Services delivery mode.

- *Processing Services:* The vendor provides personnel, equipment and (optionally) facilities. Prior to 1990, this was a submode of the Processing Services delivery mode.

In the federal government market the processing services submode is called "COCO" (Contractor-Owned, Contractor-Operated), and the professional services mode is referred to as "GOCO" (Government-Owned, Contractor-Operated).

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."

There are two general levels of systems operations:

- *Platform/network operations* - where the vendor operates the computer system and/or network without taking responsibility for the applications

- *Application operations* - where the vendor takes responsibility for the complete system, including equipment, associated telecommunications networks, and applications software

Note: Systems Operations is a new delivery mode introduced in the 1990 MAP Program. It was created by taking the Systems Operations submode out of both Processing Services and Professional Services. No other change has been made to the delivery mode definitions, and the total forecast expenditures for these three delivery modes are identical to the total forecast expenditures of the two original modes before the breakout of Systems Operations.

6. Systems Integration (SI)

Systems Integration is a business offering 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.

The systems integrator will 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
- Financing

7. Professional Services

This category includes consulting, education and training, and software development.

- *Consulting:* Services include management consulting (related to information systems), information systems consulting, feasibility analysis and cost-effectiveness studies, and project management assistance. Services may be related to any aspect of information systems, 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 implementation of software performed on a custom basis. Conversion and maintenance services are also included.

8. 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. Network services is divided into two major segments: *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.

- *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 communications servers or personal computers. Users typically inquire into and extract information from the data bases. Although users may load extracted 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.

- *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.). Mean-

while, 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.

- *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 capability 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, or 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.

C

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 which 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 significant areas of 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 which 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 which 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.

The following table 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:

Delivery Mode	Vendor Revenue Multiplier
Application 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

D

Sector Definitions and Delivery Mode Reporting

1. Industry Sector Definitions (Vertical Markets)

INPUT has structured the information services market into 16 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 the attached table.

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 (except airline reservation services in 4512)
	46xx	Pipelines, except natural gas
	47xx	Transportation services (except 472x, arrangement of passenger transportation)

EXHIBIT A-2 (Con't)

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	Depositary institutions Nondepositary 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 (Con't)

Industry Sector Definitions

Industry Sector	SIC Code	Description
Business and Technical Services	65xx	Real estate
	73xx	Business services (except hotel reservation services in 7389)
	81xx	Legal services
	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
Personal/Consumer Services	4512x	Airline reservation services
	472x	Arrangement of passenger transportation (travel agencies)
	70xx	Hotels, rooming houses, camps, and other lodging places
	72xx	Personal services
	7389x	Hotel reservation services
	75xx	Automotive repair, services and parking
	76xx	Miscellaneous repair services
	78xx	Motion pictures
	79xx	Amusement and recreation services
	83xx	Social services
	84xx	Museums, art galleries, and botanical/zoological gardens
	86xx	Membership organizations
	88xx	Private households

2. Cross-Industry Sector Definitions (Horizontal Markets)

In addition to these vertical industry sectors, INPUT has also 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:

- *Human Resource Systems*
- *Education and Training*
- *Office Systems*
- *Accounting Systems*
- *Engineering and Scientific Applications*
- *Planning and Analysis Systems*
- *Other Applications (including telemarketing, sales management and electronic publishing)*

3. Delivery Mode Reporting by Sector

The tables below show how market forecasts for individual delivery modes are related to specific market sectors.

Vertical Market Sectors Only

The following delivery modes are reported by industry sector (vertical market) only:

Delivery Mode	Applicable Submodes
• Network Services:	Network Applications
• Systems Operations:	All
• Systems Integration:	All
• Professional Services:	All

This reporting structure is intended to provide expenditures by industry sector. However, it is recognized that many of the services provided are not necessarily specific or unique to any of the individual sectors.

Vertical and Cross-Industry Market Sectors

The following delivery modes are reported by industry sector and cross-industry sector (vertical and horizontal markets):

Delivery Mode	Applicable Submodes
• Processing Services:	Transaction Processing
• Software	Applications
• Turnkey Systems	All

All of these delivery modes represent specific business application solutions.

Vertical and Generic Market Sectors

The following submode is reported both by industry sector (vertical market), and the generic market:

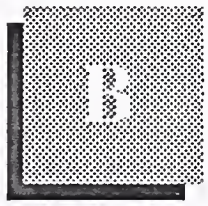
Delivery Mode	Applicable Submodes
• Network Services	Electronic Information Services

While some electronic information is industry-specific (e.g., farm crop reports), much of it is relevant to or may be used by any industry (e.g., data base services such as Dialog).

Generic Market Sector Only

The following delivery modes are so generic that they are not reported by industry or cross-industry sector (vertical or horizontal market):

Delivery Mode	Applicable Submodes
• Processing Services:	Utility Processing Other Processing
• Software	Systems (All)



Appendix: Forecast Data Base

EXHIBIT B-1

Systems Software
User Expenditure Forecast by Submode, 1989-1995
($ Millions)

Delivery Modes	1989 ($M)	Growth 89-90 (%)	1990 ($M)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	CAGR 90-95 (%)
Delivery Mode Total	14,512	13	16,390	18,437	20,944	23,919	27,430	31,487	14
Systems Control Products	5,522	12	6,200	6,863	7,759	8,861	10,112	11,557	13
- Mainframe	2,678	8	2,900	3,103	3,413	3,703	4,000	4,320	8
- Minicomputer	1,795	11	2,000	2,200	2,442	2,759	3,091	3,431	11
- Workstation/PC	1,049	24	1,300	1,560	1,903	2,398	3,022	3,807	24
Operations Management Tools	3,239	14	3,700	4,237	4,875	5,626	6,590	7,700	16
- Mainframe	1,724	16	2,000	2,320	2,691	3,068	3,497	3,917	14
- Minicomputer	1,182	10	1,300	1,417	1,559	1,746	1,955	2,190	11
- Workstation/PC	333	20	400	500	625	813	1,138	1,593	32
Application Development Tools	5,751	13	6,490	7,337	8,310	9,432	10,728	12,230	14
- Mainframe	2,630	10	2,900	3,198	3,527	3,889	4,289	4,730	10
- Minicomputer	1,953	11	2,160	2,388	2,641	2,920	3,229	3,570	11
- Workstation/PC	1,168	22	1,430	1,750	2,143	2,623	3,211	3,930	22

EXHIBIT B-2

Systems Software
User Expenditure Forecast by Platform, 1989-1995
($ Millions)

Delivery Modes	1989 ($M)	Growth 89-90 (%)	1990 ($M)	1991 ($M)	1992 ($M)	1993 ($M)	1994 ($M)	1995 ($M)	CAGR 90-95 (%)
Mainframe	7,032	11	7,800	8,621	9,631	10,661	11,786	12,967	11
- Systems Control Products	2,678	8	2,900	3,103	3,413	3,703	4,000	4,320	8
- Operations Management Tools	1,724	16	2,000	2,320	2,691	3,068	3,497	3,917	14
- Application Development Tools	2,630	10	2,900	3,198	3,527	3,889	4,289	4,730	10
Minicomputer	4,931	11	5,460	6,005	6,642	7,425	8,275	9,190	11
- Systems Control Products	1,795	11	2,000	2,200	2,442	2,759	3,091	3,431	11
- Operations Management Tools	1,182	10	1,300	1,417	1,559	1,746	1,955	2,190	11
- Application Development Tools	1,953	11	2,160	2,388	2,641	2,920	3,229	3,570	11
Workstation/PC	2,550	23	3,130	3,810	4,671	5,833	7,370	9,330	24
- Systems Control Products	1,049	24	1,300	1,560	1,903	2,398	3,022	3,807	24
- Operations Management Tools	333	20	400	500	625	813	1,138	1,593	32
- Application Development Tools	1,168	22	1,430	1,750	2,143	2,623	3,211	3,930	22

Exhibits B-3 and B-4 present the forecast reconciliation for the U.S. systems software products market.

The major variances are:

- 1989 user expenditures for the workstation/PC segment of *systems control products* has been reduced by $152 million or 13%. The reason for this variance is that PC shipments were lower than anticipated, cooperative/distributed processing didn't take hold as rapidly as expected, and OS/2 acceptance has also been slower than expected.

- 1989 user expenditures for the workstation/PC segment of *application development tools* has been reduced by $437 million or 27% for the same reasons stated above for workstation/PC-based systems control products. Additionally, CASE tools and RDBMS products experienced significantly lower growth rates than anticipated.

The variances in the 1989-1994 forecast are explained throughout this report.

EXHIBIT B-3

1990 MAP Data Base Reconciliation Systems Software Products, by Submode ($ Millions)

Delivery Modes	1989 Market				1994 Market				89-94 CAGR per data 89 rpt (%)	89-94 CAGR per data 90 rpt (%)
	1989 Report (Fcst) ($M)	1990 Report (Actual) ($M)	Variance from 1989 Report ($M)	Variance from 1989 Report (%)	1989 Report (Fcst) ($M)	1990 Report (Fcst) ($M)	Variance from 1989 Report ($M)	Variance from 1989 Report (%)		
Total Systems Software Market	14,811	14,512	-299	-2	34,455	27,430	-7,025	-20	18	14
Systems Control Products	5,694	5,522	-172	-3	12,464	10,112	-2,352	-19	17	13
- Mainframe	2,679	2,678	-1	-0	5,157	4,000	-1,158	-22	14	8
- Minicomputer	1,814	1,795	-19	-1	3,493	3,091	-403	-12	14	11
- Workstation/PC	1,201	1,049	-152	-13	3,813	3,022	-791	-21	26	24
Operations Management Tools	3,198	3,239	42	1	7,719	6,590	-1,129	-15	19	15
- Mainframe	1,763	1,724	-39	-2	3,545	3,497	-48	-1	15	15
- Minicomputer	1,092	1,182	90	8	2,394	1,955	-439	-18	17	11
- Workstation/PC	343	333	-10	-3	1,780	1,138	-642	-36	39	28
Application Development Tools	5,920	5,751	-168	-3	14,273	10,728	-3,544	-25	19	13
- Mainframe	2,417	2,630	213	9	4,453	4,289	-164	-4	13	10
- Minicomputer	1,898	1,953	55	3	4,723	3,229	-1,494	-32	20	11
- Workstation/PC	1,605	1,168	-437	-27	5,097	3,211	-1,887	-37	26	22

EXHIBIT B-4

1990 MAP Data Base Reconciliation
Systems Software Products, by Platform
($ Millions)

Delivery Modes	1989 Market				1994 Market				89-94 CAGR per data 89 rpt (%)	89-94 CAGR per data 90 rpt (%)
	1989 Report (Fcst) ($M)	1990 Report (Actual) ($M)	Variance from 1989 Report ($M)	Variance from 1989 Report (%)	1989 Report (Fcst) ($M)	1990 Report (Fcst) ($M)	Variance from 1989 Report ($M)	Variance from 1989 Report (%)		
Mainframe	6,858	7,032	174	3	13,155	11,786	-1,369	-10	14	11
- Systems Control Products	2,679	2,678	-1	-0	5,157	4,000	-1,158	-22	14	8
- Operations Management Tools	1,763	1,724	-39	-2	3,545	3,497	-48	-1	15	15
- Application Development Tools	2,417	2,630	213	9	4,453	4,289	-164	-4	13	10
Minicomputer	4,804	4,931	126	3	10,610	8,275	-2,336	-22	17	11
- Systems Control Products	1,814	1,795	-19	-1	3,493	3,091	-403	-12	14	11
- Operations Management Tools	1,092	1,182	90	8	2,394	1,955	-439	-18	17	11
- Application Development Tools	1,898	1,953	55	3	4,723	3,229	-1,494	-32	20	11
Workstation/PC	3,149	2,550	-599	-19	10,690	7,370	-3,320	-31	28	24
- Systems Control Products	1,201	1,049	-152	-13	3,813	3,022	-791	-21	26	24
- Operations Management Tools	343	333	-10	-3	1,780	1,138	-642	-36	39	28
- Application Development Tools	1,605	1,168	-437	-27	5,097	3,211	-1,887	-37	26	22