FEDERAL SOFTWARE & RELATED SERVICES MKT

1991 - 1996

INPUT

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

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

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

INPUT OFFICES

North America

San Francisco
1280 Villa Street
Mountain View, CA 94041-1194
Tel. (415) 961-3300 Fax (415) 961-3966

New York
Atrium at Glenpointe
400 Frank W. Burr Blvd.
Teaneck, NJ 07666
Tel. (201) 801-0050 Fax (201) 801-0441

Washington, D.C.
INPUT, INC.
1953 Gallows Road, Suite 560
Vienna, VA 22182
Tel. (703) 847-6870 Fax (703) 847-6872

International

London
INPUT LTD.
Piccadilly House
33/37 Regent Street
London SW1Y 4NF, England
Tel. (071) 493-9335 Fax (071) 629-0179

Paris
INPUT SARL
24, avenue du Recteur Poincaré
75016 Paris, France
Tel. (33-1) 46 47 65 65 Fax (33-1) 46 47 69 50

Frankfurt
INPUT LTD.
Sudetenstrasse 9
D-6306 Langgöns-Niederkleen, Germany
Tel. (0) 6447-7229 Fax (0) 6447-7327

Tokyo
INPUT KK
Saida Building, 4-6
Kanda Sakuma-cho, Chiyoda-ku
Tokyo 101, Japan
Tel. (03) 3864-0531 Fax (03) 3864-4114

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1953 Gallows Road, Suite 560, Vienna, Virginia 22182 (703) 847-6870

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Federal Software and Related Services Market, 1991-1996

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Abstract

This report examines the federal market for software and related services. It identifies federal agencies' requirements, plans, and perceptions of the role of software in federal information systems. The leading vendors are identified by market segment and agency.

INPUT expects the federal software market to grow from $2.3 billion in FY 1991 to $3.9 billion in FY 1996, at a compound annual growth rate of 11%. This market is almost evenly split between the software products segment and the software development segment. Within the software products segment, growth in applications software will be half again as large as systems software growth.

This report contains 180 pages, including 76 exhibits.

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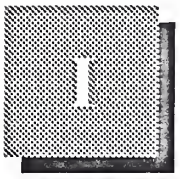


Introduction

Federal Software and Related Services Market, 1991-1996 is a revision of an earlier report issued in 1989. The report has been revised in response to continuing client interest in this segment of the federal market. The report builds on the previous INPUT market analysis, with extensive revisions to reflect government fiscal year 1992 agency budgets, opportunities at agencies, and insight into the factors impacting this market. This report offers guidance to vendors in planning their strategies to compete for federal software products and services.

This report was prepared as part of INPUT's Federal Information Systems and Services Program (FISSP). Reports issued through this program are designed to assist INPUT's U.S. industrial clients in planning how to satisfy future federal government needs for computer-based information systems and services. The report's findings are based on research and analyses of several sources, including:

- INPUT's Procurement Analysis Reports (PARs)
- OMB/GSA/NIST Five-Year Information Technology Plans for 1992-1997
- Interviews with leading software contractors
- Interviews with federal agency officials who manage existing software contracts
- Federal agency FY 1991 and FY 1992 Information Technology Budgets

A
Scope

The period covered in the report is FY 1991 through FY 1996. For the purposes of this study, INPUT defined software and related services as encompassing the following categories of products and services (see Appendix B for detailed explanations of each category):

- Packaged systems software
- Packaged applications software
- Custom systems software
- Custom applications software
- Contract software maintenance

Exhibit B-1 in Appendix B provides a detailed schematic of the types of products and relationships between products covered in this report.

Expenditures for purchase, lease or rental, and maintenance are counted as software products expenditures.

Software development, sometimes called contract programming or programming and analysis, is a subset of professional services.

B
Methodology

The OMB/GSA/NIST Five-Year Plan analysis for the INPUT *Procurement Analysis Report* was reviewed for programs to be initiated during the FY 1991-FY 1996 period. INPUT also researched agency long-range plans for FY 1992-FY 1997 to identify significant budget changes and leading and tagging agencies for software opportunities.

The questionnaire developed for agency officials is included in Appendix F.

The agency questionnaire was designed to acquire information about current experience and plans for future use of software products and services.

Federal agency officials selected for interview included:

- Program managers
- Policy officials

Current versions of the Federal Information Resource Management Regulations, Federal Acquisition Regulations, Defense Acquisition Regulations (changes to FAR), and the Multiple Agreement Schedule policy were investigated to identify changes that will impact software procurements. OMB Federal Contract Reporting Center data for FY 1989 and FY 1990 were reviewed to identify contract vendor market shares. GSA and Ada Joint Program Office sources also were utilized to identify software trends and opportunities.

C
Report Organization

This report consists of five additional chapters:

- Chapter II is an Executive Overview describing the major points and findings in the report.
- Chapter III provides the market forecast and describes the major market issues and trends impacting the industry.
- Chapter IV summarizes federal agencies' requirements for software and related services.
- Chapter V identifies and compares the leading vendors in various agencies and market segments.
- Chapter VI provides a sample of software opportunities presented by programs and initiatives in the federal market.

Several appendixes are also provided:

- Interview Profiles
- Definitions
- Glossary of Federal Acronyms
- Policies, Regulations, and Standards
- Related INPUT Reports
- Questionnaire

Following the appendixes is a description of INPUT and its programs and services.

II

Executive Overview

A
Federal Market Pressures

The federal market for software products and related services is expected to experience continued growth over the next few years. Some of the pressures contributing to this growth are listed in Exhibit II-1. Government information systems require steady improvement in terms of the quality and effectiveness of overall software support.

EXHIBIT II-1

Federal Market Pressures

- Technical staff shortages
- Productivity improvement
- Budget deficit
- Software certification
- Availability and functionality

Agencies continue to place strong emphasis on maintenance and enhancement of existing software systems, as well as on developing new software systems as advances in technology become available. However, staff shortages effectively prevent in-house performance of these software support tasks. Agencies continue to have difficulty competing with the commercial market for technically well-qualified personnel. Many federal employees with less than 15 years of service are leaving the government. Agencies are increasingly forced to contract out most of their software development and support activities.

The Reagan administration encouraged the contracting out of many formerly in-house activities, especially software development and maintenance functions. The growing emphasis on OMB Circular A-76, as well as Executive Order 12615 ("Performance of Commercial Activities") illustrates the government policy toward contracting out. To achieve productivity goals and take advantage of technology, agencies are encouraged to look to contractor services for assistance. Although the Bush administration has backed off somewhat, pressure to contract out remains strong.

The continuing federal budget deficit places increased constraints on agencies while they strive to improve productivity of their information systems. In some cases deficit control measures are decreasing planned improvements to systems, while in other cases are forcing reliance on technology improvements.

Government agencies continue to embrace standardized, certified software to meet common needs. This trend ranges from products supporting open systems, such as GOSIP and POSIX products, to applications products supporting financial, human resources, and travel systems.

The growing availability and functionality of software products has enhanced their appeal to government agencies. Fewer systems require custom software development. Rather, many agencies show a willingness to accept software products either as is or with minimal tailoring.

B
Market Segments

INPUT's updated forecast and analysis focuses on several specific types of commercially acquired software products and services by the federal government.

- Software products, sometimes called software packages, include off-the-shelf applications and systems software products and their maintenance.

- Software development services, also called programming and analysis, can be applied to the modification of applications and systems software, and include custom software development. Maintenance for customized software is also associated with software development services.

INPUT has divided the software products market segments into systems and applications software, as shown in Exhibit II-2. The forecast for these segments includes expenditures based on purchase, lease, or rental of software products.

EXHIBIT II-2

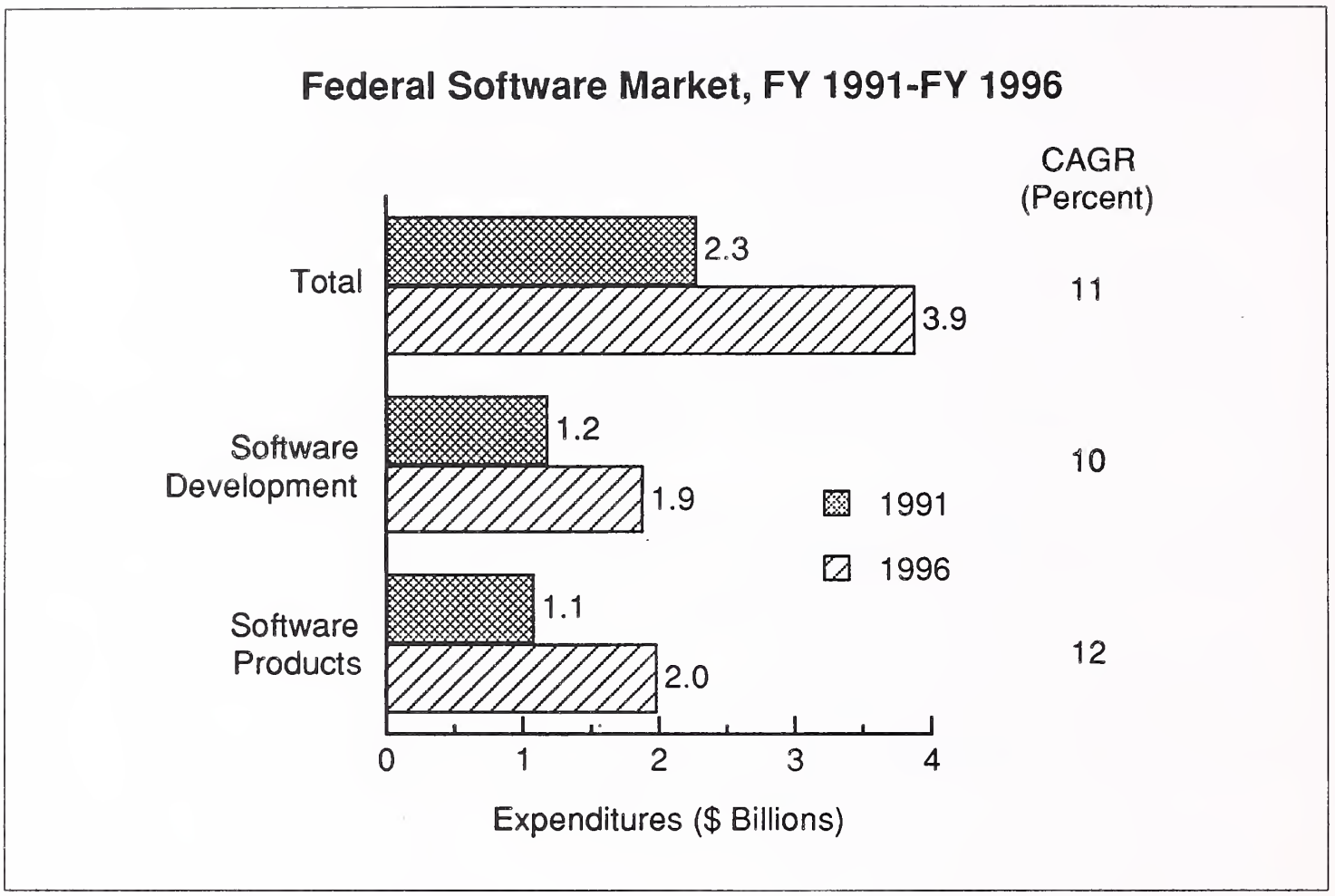
Federal Software and Related Services Market Structure

Means of Acquisition • Type of Acquisition	Type of Software	
	Applications	Systems
Software Products Packages		
• Purchase	X	X
• Lease/Rental	X	X
Maintenance		
• Purchase	X	X
Professional Services		
• Customize Off-the-Shelf Package Purchase	X	X
• Custom Development Purchase	X	X

INPUT estimates that the federal government software and related services market will increase from $2.3 billion in FY 1991 to $3.9 billion in FY 1996, with an overall CAGR of 11%, as shown in Exhibit II-3. This estimate is similar to forecasts of expenditures and CAGRs presented in the prior edition of this report.

The software products market will grow at a slightly higher CAGR (12%) than software development. The software products forecast has declined somewhat from the 17% CAGR that INPUT forecasted two years ago. This is surprising in view of the market pressures identified in Section A. In some cases, agencies are using new systems software products to facilitate more custom software development.

EXHIBIT II-3



C

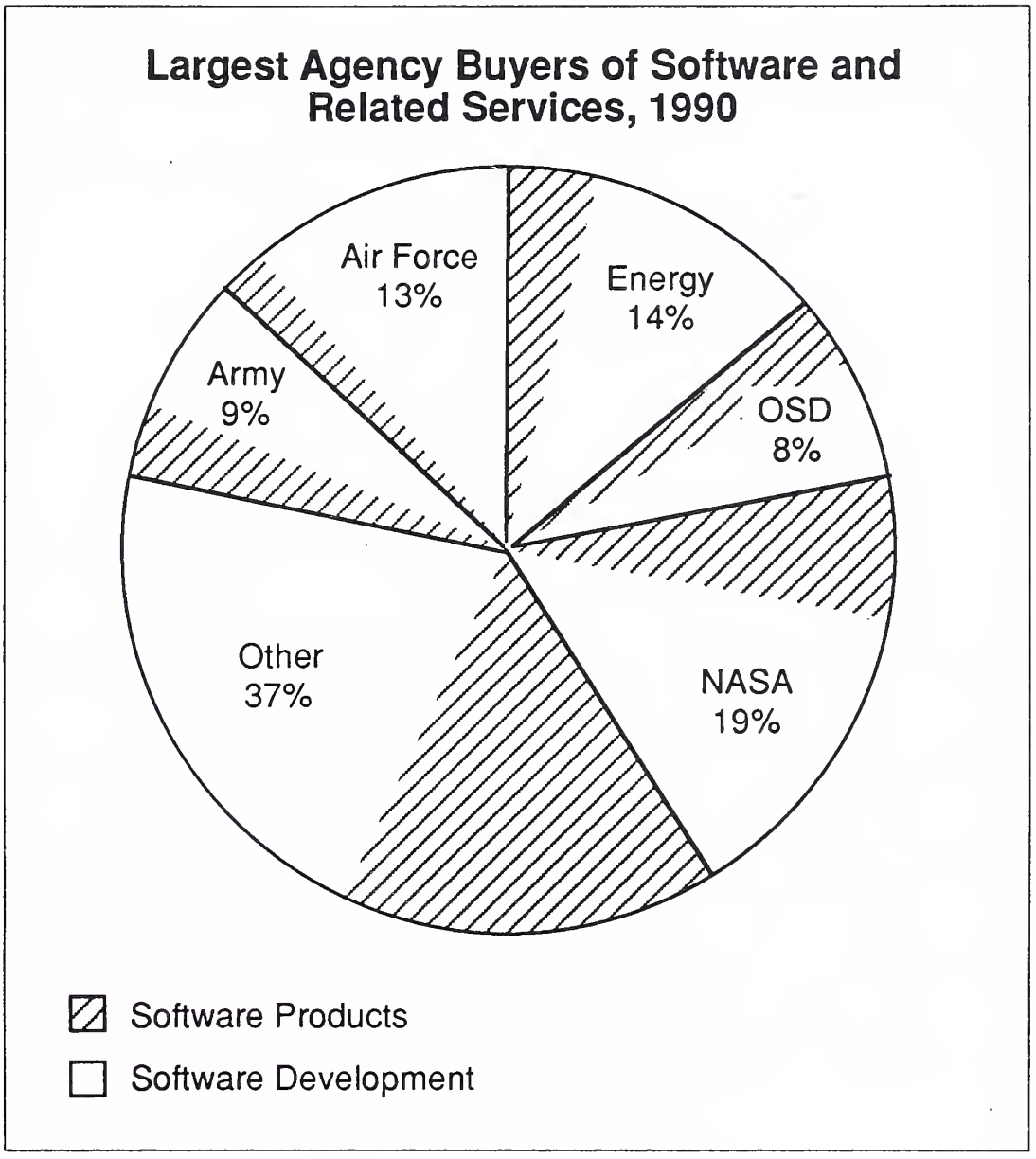
Leading Agency Buyers

Federal agencies fund software and related services acquisitions through portions of several Information Technology Budget categories.

- Capital investments
- Operating costs
  - Lease/rental
  - Supplies
- Commercial services
  - Systems analysis and programming

During FY 1990, five agencies—Air Force, NASA, Army, Energy, and OSD—spent two-thirds of the reported software and related services outlays, as shown in Exhibit II-4. The data verify that software development outlays continued to consume the major portion of federal expenditures for software in 1990.

EXHIBIT II-4

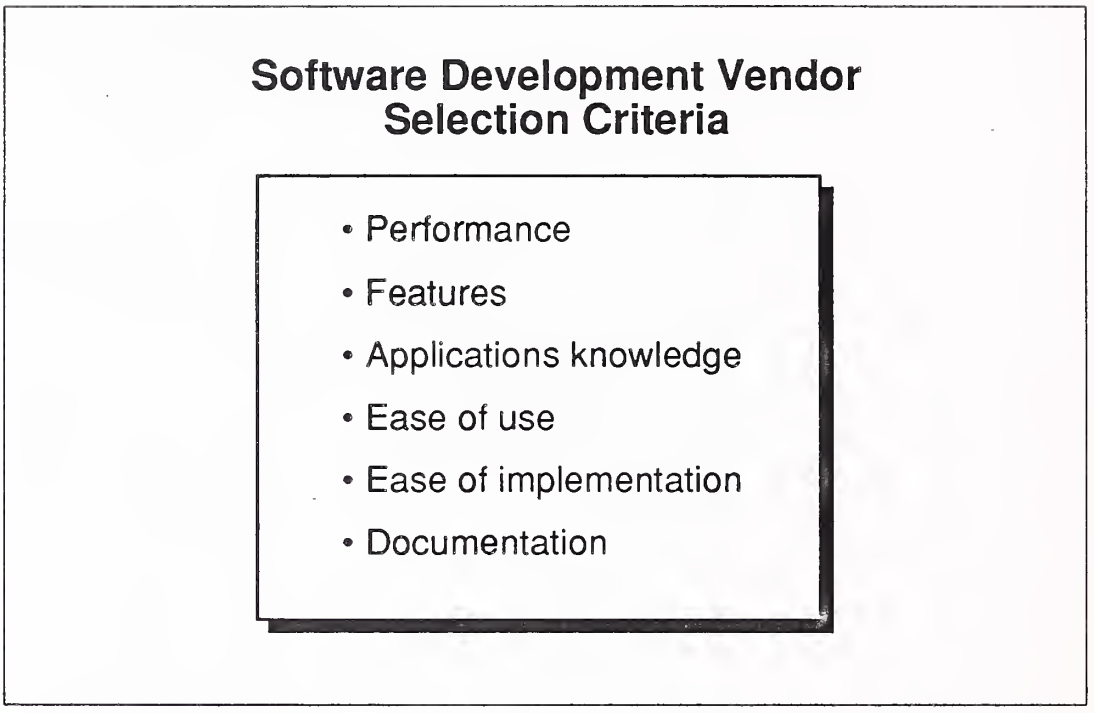


None of the remaining agencies requested a significant portion of the Information Technology Budget, but their collective total was approximately 37% of the line items for this budget category.

D
Custom Software Selection Criteria

Federal agencies place more importance on relevant experience when evaluating vendors for software development efforts, as shown in Exhibit II-5.

EXHIBIT II-5



Vendors' experience with similar development and integration efforts, their applications knowledge, and the software features to be used outweigh other factors such as price, training, or even federal experience.

Both civil and defense agencies rated experience factors as most important. The ratings of other selection criteria differed only slightly between civil and defense agencies.

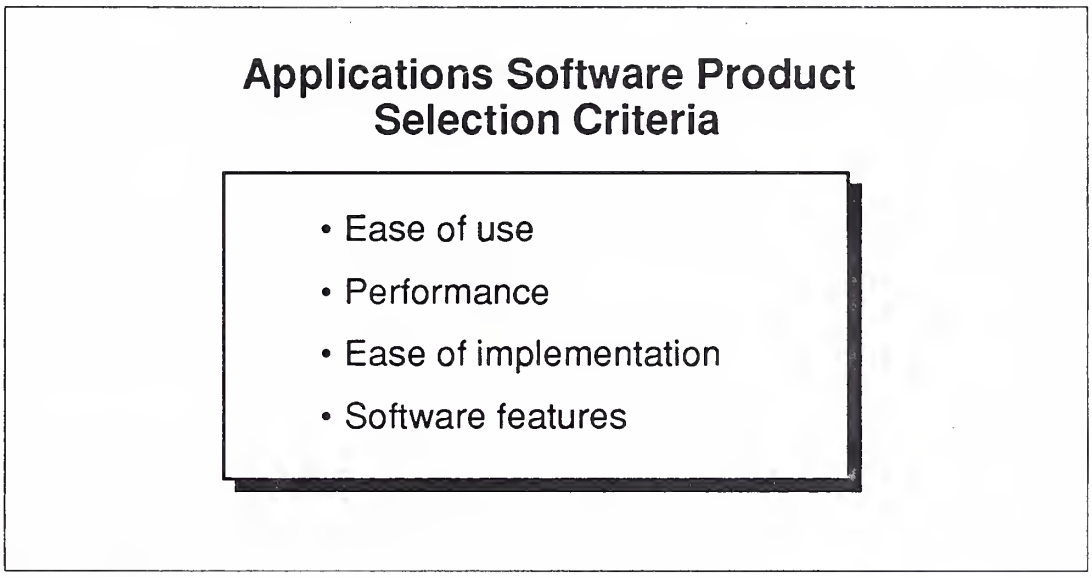
Potential ease of use and ease of implementation were also rated highly. These agencies seek assurance that not only will the vendor be able to develop the system, but also that the system will be readily usable by government personnel.

E

Applications Software Selection Criteria

Federal agency buyers tend to focus on product characteristics rather than vendor reputation and experience in the selection of packaged software products (see Exhibit II-6). Ease of use, performance, ease of implementation and software features consistently rate as the most important selection criteria for packaged applications software products.

EXHIBIT II-6



For software products, agencies rate ease of use even higher than they do for software development. Most respondents view this factor as essential to mission performance. If the software is not easy to use, agencies may misuse it or not use it at all. The same applies to ease of implementation.

On the other hand, agencies also rank performance and software features very highly. If the software does not perform as advertised, the mission may be adversely affected. Further, without the necessary software features, agencies may not effectively utilize the software mission fulfillment.

F

Leading Vendors

The federal government acquires software and related services from a broad range of vendors, including hardware manufacturers, systems integrators, professional services firms, and software product developers. Exhibit II-7 shows the leading vendors for FY 1989-FY 1990, based on the Federal Contracts Award data base.

EXHIBIT II-7

Leading Software and Related Services Vendors FY 1989-FY 1990

Vendor	Software Products ($000)	Related Services ($000)	Total ($000)
IBM	55,114	74,116	129,230
Unisys	41,246	57,366	98,612
CSC	18,330	71,513	89,843
PRC	-	71,568	71,568
Loral	-	67,633	67,633

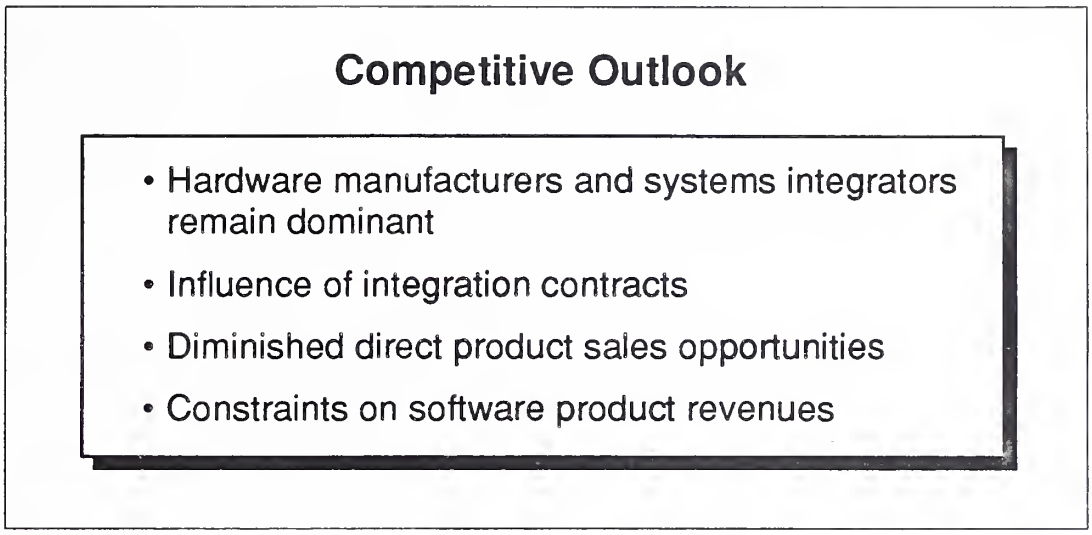
Hardware manufacturers and systems integrators lead the market in terms of revenue. In many cases, related services revenue comes from one or only a handful of contracts at a single agency. Literally dozens of vendors realize millions of dollars in software revenue each year. Instead of being concentrated, software revenues are widely spread among different types of firms that often have differing focuses.

G
Competitive Outlook

The competitive outlook is illustrated in Exhibit II-8. During the forecast period INPUT expects hardware manufacturers and systems integrators to retain their current dominant market presence. Market share, however, will likely change in response to the continuing trend toward systems integration by federal agencies.

Hardware and software products vendors may find fewer direct product sales opportunities, but increased opportunities to place their products through systems integrators. Among the hardware manufacturers, only IBM seems well positioned to gain from growth in systems integration services.

EXHIBIT II-8

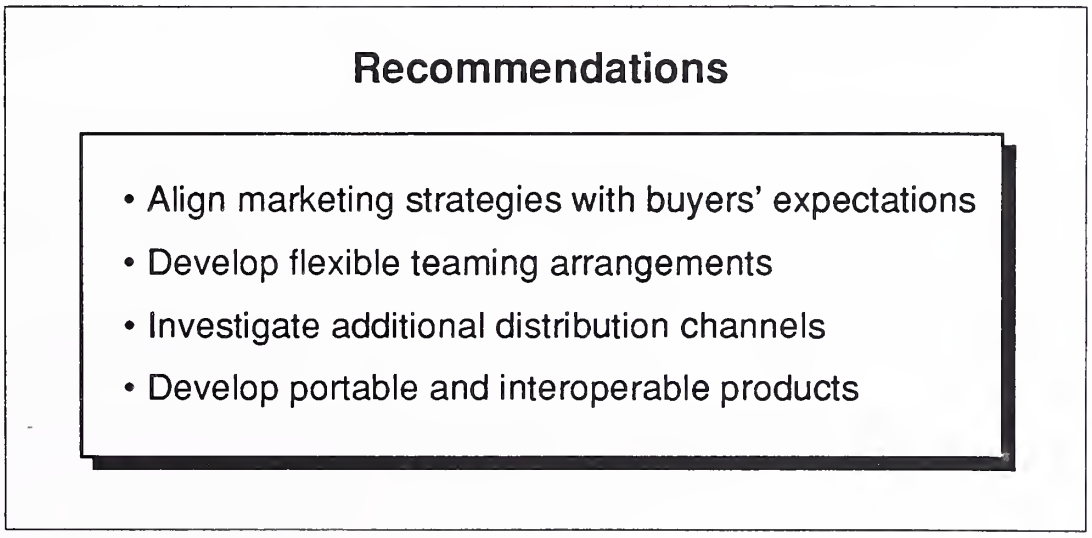


Despite rapid overall expansion in the software products market segment, individual vendors may not experience corresponding revenue growth. Heavy discounting, in many cases up to 50% off commercial pricing, and site-licensing pressures will moderate revenue growth.

H
Recommendations

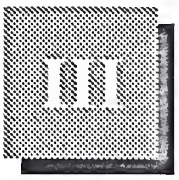
In bidding software products to the federal government, vendors may need to adjust their marketing and product development strategies to align more clearly with buyers' expectations. One key issue is product commitment, where agencies seek concrete assurance that the product acquired today will be supported and enhanced in the years to come. This issue is becoming critically important to agencies, and software products vendors continue to merge and in some cases go out of business. Exhibit II-9 summarizes INPUT's recommendations.

EXHIBIT II-9



Software product vendors need to focus on alternative distribution channels, such as systems integrators, to maximize market share. Revenue from one large-scale, multisite integration contract can easily exceed total annual direct sales from single product copies, as many recent umbrella-type contracts have shown. Software vendors should also increase their teaming relationships with professional services companies that are experienced in federal bidding.

Systems integrators gain a competitive advantage in pricing by building and maintaining long-term relationships with software product suppliers. Reduced development efforts through the use of packaged software modules and lower unit prices accompanying volume purchase contracts hold down costs and improve margins. Vendors can expand their market share by planning products and services to meet agency requirements for portable and interoperable systems. POSIX- and OSI-compatible products are federal standards that agencies increasingly will be required to adhere to as they strive to integrate applications across diverse hardware platforms. In some cases, agency customers may prove to be helpful in interagency marketing efforts.



Market Analysis and Forecast

A
Market Structure

Software products, as a discrete delivery mode, are described in Appendix B of this report, with detail provided in Exhibit B-1. In general, INPUT divides this delivery mode between applications and systems software. Applications software includes typical applications such as accounting, human resources, procurement, and mission-support software. This latter category concerns software that directly supports the mission of the agency. The following examples are typical of applications software supporting mission activities:

- The IRS uses software to assess the auditability of the tax payer's return.
- The DLA uses software to track the movement of supplies at depots and warehouses.
- NASA uses software to evaluate the usability of pictures transmitted from space.

Systems software usually sold with hardware purchases includes operating systems to control the processor, compilers, DBMSs, charge-back and resource accounting systems, and other program development tools.

Software development is a discrete subcategory under the professional services delivery mode (see Exhibit B-1 in Appendix B). These two categories, software products and software development, are combined in this report because:

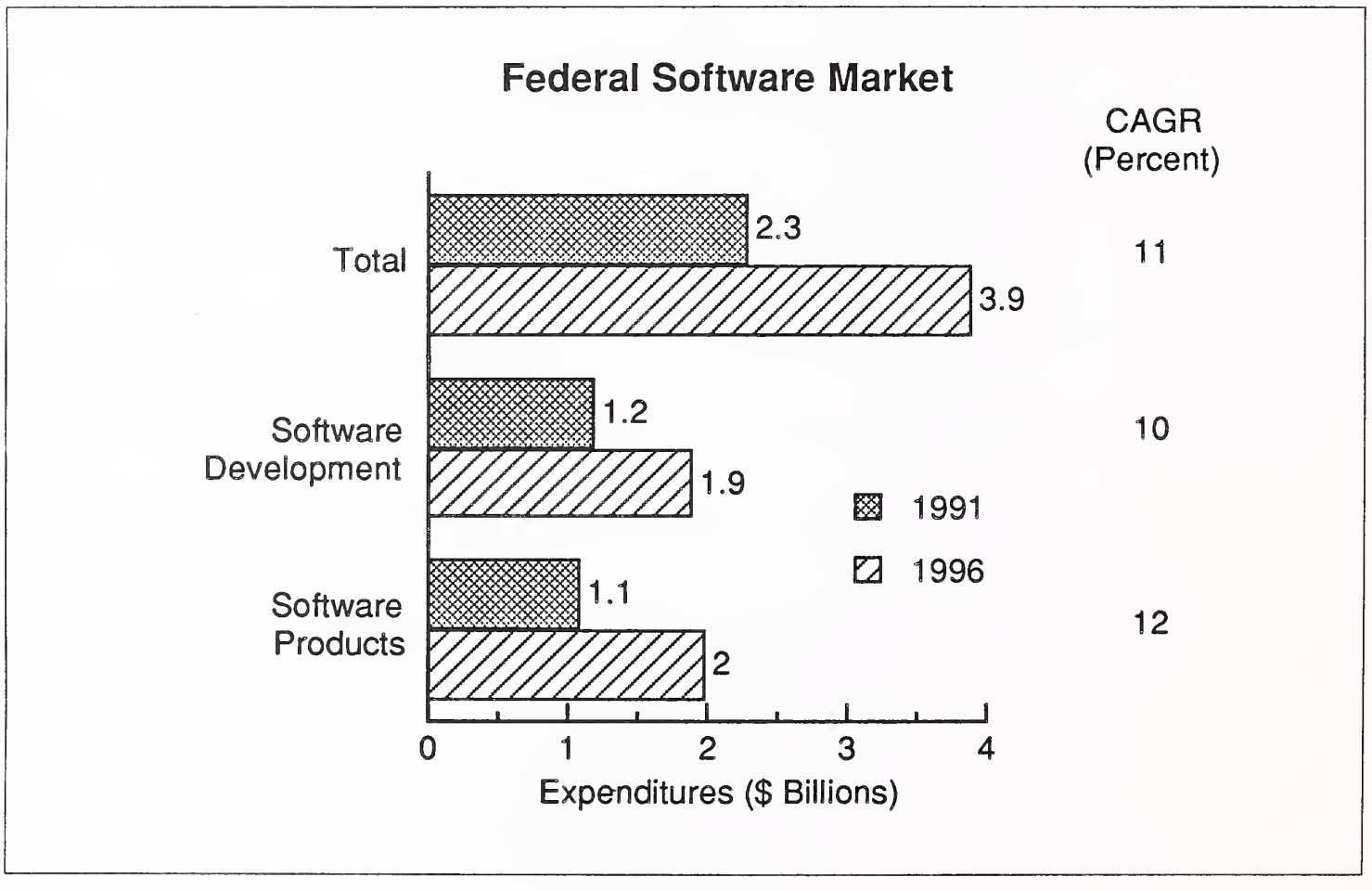
- Together they cover practically all software that vendors supply to the federal government.
- Most companies active in one delivery mode (in the federal market at least) are also active in the other delivery mode.

- Agency decisions to contract in these modes usually arise from the same set of circumstances and reflect the same internal and external pressures.

B
Market Forecast

The federal software market continues to show significant vitality. INPUT expects it to grow from $2.3 billion in FY 1991 to $3.9 billion in FY 1996 at a CAGR of 11%. As illustrated in Exhibit III-1, software products and software development almost evenly split the market. Software products will grow slightly faster, but are starting from a slightly lower base.

EXHIBIT III-1



The overall market equals almost exactly what was predicted in the 1989 version of this report. However, the mix is slightly different, with software products accounting for a somewhat higher share than had been expected.

There are several factors driving the federal software market:

- Federal budget constraints are increasing the appeal of software products because, on a per-unit basis, they cost far less than custom software development.
- OMB has issued various guidelines encouraging agencies to acquire software products instead of software development.
- Various trends toward software certification, especially in the federal financial systems area, are starting to affect software sales.
- Agency users now have a far greater variety of products from which to choose, thanks largely to the greater functionality offered by the vendors.
- Software productivity tools, including 4GLs, CASE tools, Programmers' WorkBench, and Analysts' WorkBench, are facilitating program development by agency personnel.
- New and replacement software development is being driven in part by the (gradually) growing popularity of Ada.
- The growing popularity of requirements contracts for computer equipment, especially microcomputers, has spurred dramatic growth in the software products market.

1. DoD versus Civil Agency Forecasts

Exhibits III-2 and III-3 break out the federal software market into its civil and defense components. As in most federal delivery modes, the civil software market is larger than that of defense, in this case practically twice the defense share. The defense market is growing slightly faster than the civil market. INPUT expects defense spending to remain fairly flat in the early years of the forecast period, and then grow sharply in the later years. The end of the Cold War and the consequent downsizing of defense programs will constrain software growth in the early 1990s. However, INPUT expects that, by mid-decade, DoD will need to catch up with latent demand for software products and software development.

EXHIBIT III-2

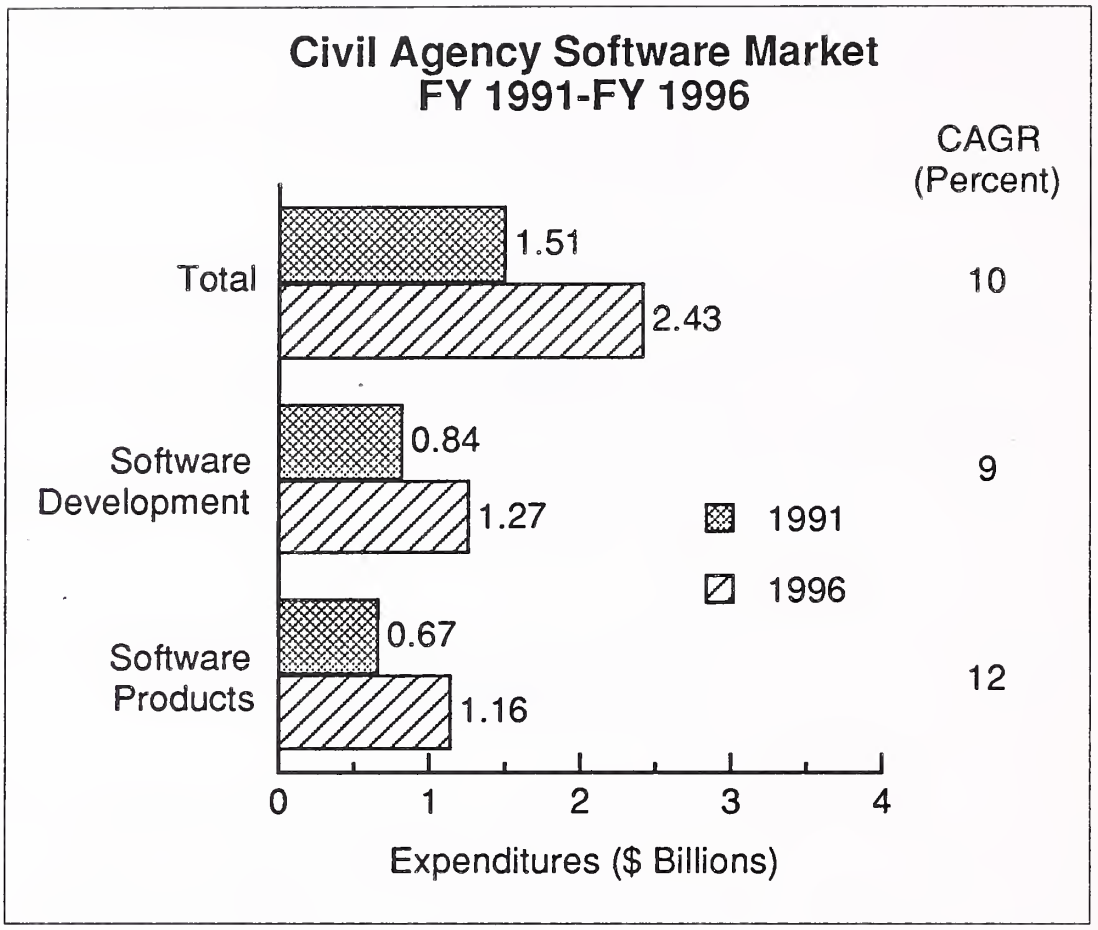


EXHIBIT III-3

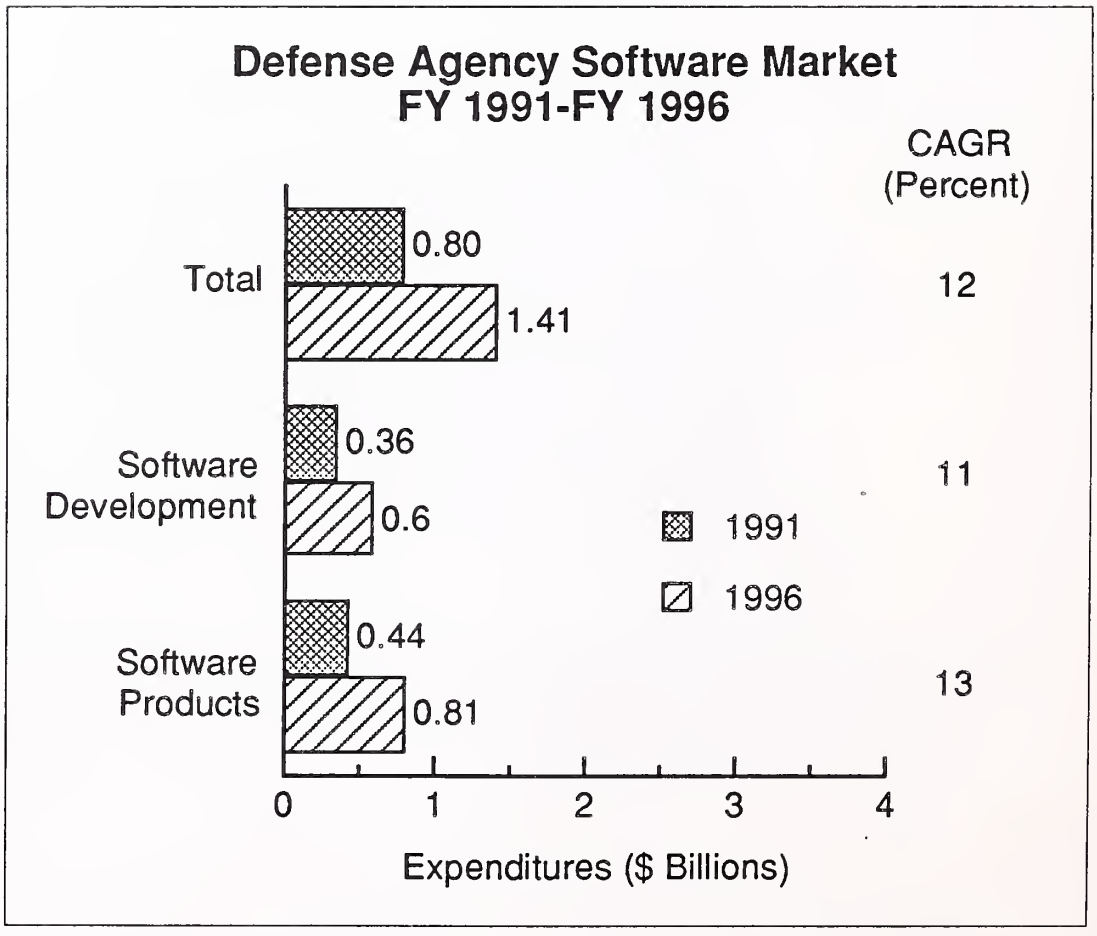
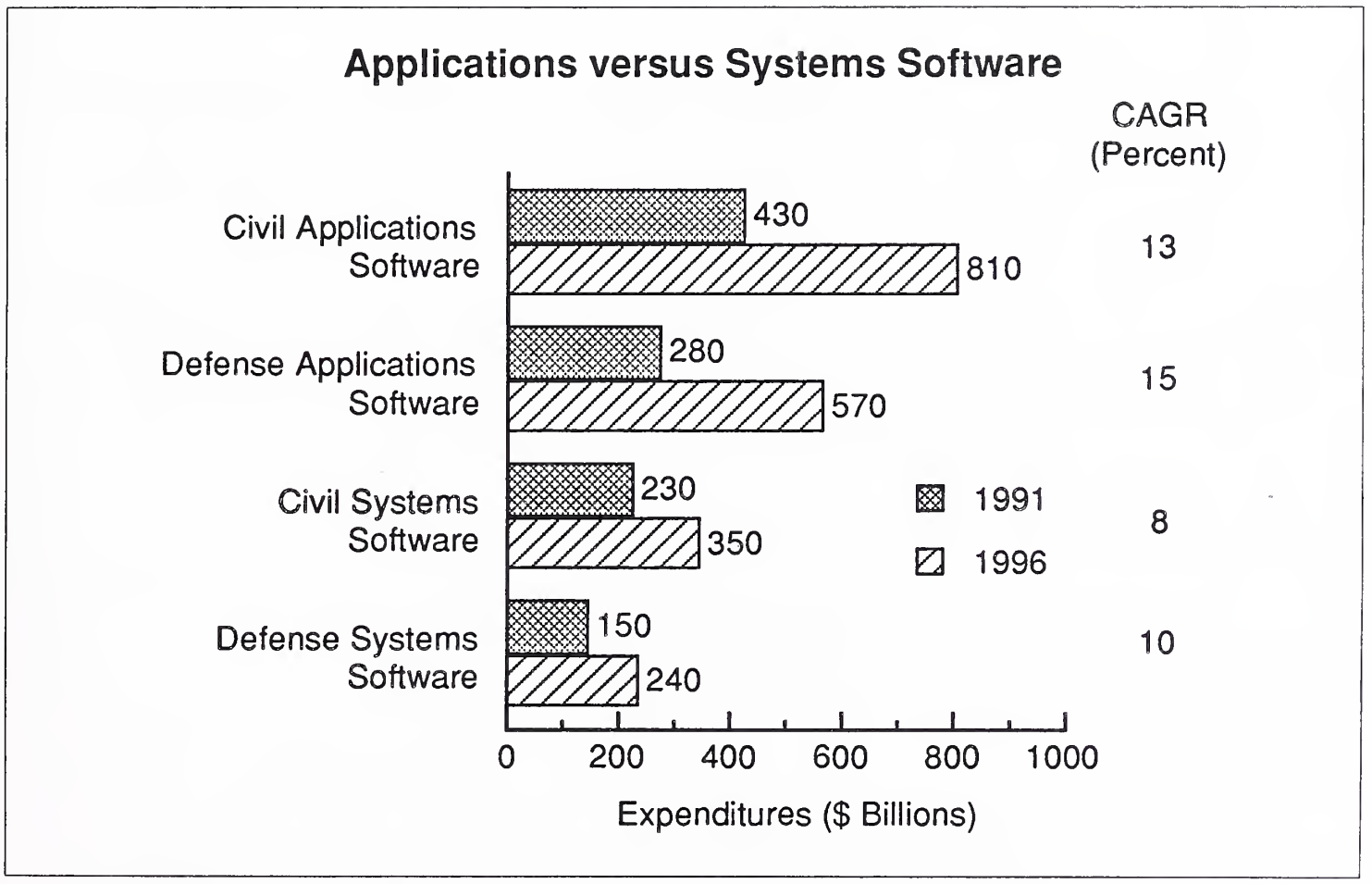


Exhibit III-4 compares spending for applications and systems software. Applications software is growing at a CAGR of 14% versus only 9% for systems software. Again, this growth reflects the increasing availability and functionality of applications software, as well as the need to control costs. Most of the applications software growth is coming at the expense of software development. In most cases, custom software development relates to applications, not systems software. Therefore, as the growth in custom software development slows, applications software products will grow at a faster rate.

EXHIBIT III-4



2. Agency Forecast

Agency software trends are shown in Exhibits III-5 and III-6. Agency FY 1990 to FY 1992 budget requests for the line items "systems analysis and programming" and "software" are similar to INPUT's "software and related services" category of information systems. These agency budget request numbers were developed in the spring of 1991.

Systems analysis and programming budget requests, which include custom software development, are growing at a compound annual growth rate of 11% for defense agencies and 13% for civil agencies. This category of software is growing despite federal pressure on agencies to purchase more packaged software.

Defense's budget request shows a drop in software capital investment between 1990 and 1991, with a subsequent increase in 1992. INPUT does not expect the Congress to allow this to happen. Rather, INPUT believes that software capital investment will remain flat or decline only slightly in the near term, with sharp increases in the mid-1990s. Systems analysis and programming may grow at a slightly lower rate, at least in the near term.

The story is somewhat different among civilian agencies. Systems analysis and programming may, indeed, grow at the high rate indicated, as major efforts at NASA, Treasury and Energy require custom software development. In the out-years, however, this growth rate will likely slow as many major initiatives advance to the implementation stage.

The budget items presented in Exhibits III-5 and III-6 (capital investment for software) are not inclusive of all packaged software acquisitions by federal agencies and do present a misleading view of the market. Software that is acquired through bundled purchases with hardware is not included in capital investment funding for software.

EXHIBIT III-5

Defense Agencies' Software Budget Trends FY 1990-FY 1992

Budget Line Items	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Systems Analysis and Programming	681	679	839	11
Software (Capital Investment)	297	217	257	-7
Total	978	896	1,096	6

EXHIBIT III-6

Civil Agencies' Software Budget Trends FY 1990-FY 1992

Budget Line Items	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Systems Analysis and Programming	1,375	1,617	1,734	12
Software (Capital Investment)	331	404	464	18
Total	1,706	2,021	2,198	13

The overall CAGR for software for defense agencies is 6% for the 1990 to 1992 time period. This represents a 2% increase from the 1988-1990 forecast. Funding requests for civil agencies have increased from 9% to 13%. Despite budget constraints, growth continues.

Specific agency budget changes are presented in Exhibits III-7 and III-8 for software analysis and programming; Exhibits III-9 and III-10 show capital investment trends for software.

Among defense agencies, the Air Force, Navy, and Army all have substantial systems analysis and programming budgets. However, as Exhibit III-7 shows, only the OSD budget is growing. This results from the growing importance of DoD's Corporate Information Management (CIM) Program. The CIM initiative serves to strategically analyze and plan a course for ADP systems acquisitions throughout DoD. It covers a variety of agencywide systems, which are chosen based on standardization potential. At this writing, DoD has established eight functional groups. Their executive agents are listed in parentheses:

- Civilian Payroll (DFAS)
- Distribution Centers (DCA)
- Financial Operations (DFAS)
- Civilian Personnel (Air Force)
- Medical (four separate agents)
- Government-Furnished Material (DFAS)
- Material Management (multiple)
- Contract Payment (DFAS)

EXHIBIT III-7

Systems Analysis and Programming Budget Trends by Defense Agency, FY 1990-FY 1992

Defense Agency	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Air Force	331	256	254	-12
Army	118	153	122	2
Navy	57	48	45	-11
OSD	166	214	412	57
USMC	9	8	6	-18
Total	681	679	839	11

As might be expected for any controversial program, CIM's outlook appears uncertain. The end of the Cold War suggests further budget cuts to come. CIM provides the potential for successfully coping with these cuts. However, as with other overly centralized systems, CIM may not provide the customer service required for mission fulfillment.

At any rate, INPUT expects near-term OSD spending for systems analysis and programming to continue its explosive growth. If CIM prospers, this trend will likely continue, at the expense of individual agency budgets.

Systems analysis and programming budgets for civil agencies are smaller than those for DoD—except for NASA, GSA and Energy—as shown in Exhibit III-8. All of these agencies' CAGRs have continued to rise over the past few years. NASA's growth can most likely be attributed to increased emphasis on the space program. GSA's growth relates primarily to the increasing popularity of its regional and zonal contracts. At first glance, some of the CAGRs for many of the agencies indicate promising opportunities. Vendors should look at the overall dollars requested before assessing their software opportunities at any specific agency. Civil agen-

cies represent better vendor targets for software lease/purchase than defense agencies in terms of total dollars requested in the budget. Outside of CIM, DoD shows no growth. The data indicates that among the civil agencies, NASA and Treasury will be the largest purchasers in 1992.

EXHIBIT III-8

Systems Analysis and Programming Budget Trends by Civil Agency, FY 1990-FY 1992

Civil Agency	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Agriculture	30	56	64	46
Commerce	77	71	122	26
Energy	276	306	309	6
Education	7	12	17	56
EPA	33	33	39	9
GSA	151	224	242	27
HHS	65	66	80	11
HUD	31	45	25	-10
Interior	30	31	41	17
Justice	20	24	23	7
Labor	14	15	19	16
NASA	460	540	578	12
State	35	34	34	-1
Transportation	55	65	14	-50
Treasury	78	78	102	14
Veterans' Affairs	13	17	25	39
Total	1,375	1,617	1,734	12

EXHIBIT III-9

Software (Capital Investment) Budget Trends by Defense Agency, FY 1990-FY 1992

Defense Agency	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Air Force	30	1	1	-82
Army	126	97	140	6
Navy	73	61	62	- 8
OSD	58	48	46	-11
USMC	10	10	8	-10
Total	297	217	257	- 7

EXHIBIT III-10

Software (Capital Investment) Budget Trends by Civil Agency, FY 1990-FY 1992

Civil Agency	$ Millions			CAGR 1990-1992 (Percent)
	1990	1991	1992	
Agriculture	16	21	22	17
Commerce	9	10	11	11
Energy	111	114	120	4
Education	*	*	*	0
EPA	9	6	8	-6
GSA	1	6	5	124
HHS	15	20	21	18
HUD	*	*	*	0
Interior	10	9	15	22
Justice	6	6	7	8
Labor	1	1	1	0
NASA	55	71	100	35
State	3	5	5	29
Transportation	80	114	113	19
Treasury	11	16	34	76
Veterans' Affairs	4	5	2	-29
Total	331	404	464	18

* = less than $1 million

C
Federal Market Issues

During the two most recent administrations, presidential task forces investigated the problems and technological status of the federal government's information processing resources. Findings are shown in Exhibit III-11.

EXHIBIT III-11

Federal Information Processing Weaknesses

- Slow to adopt new technology
- Obsolete ADP inventory
- Ineffective management of ADP resources
- Inadequately trained personnel
- Insufficient information processing for public needs

Agencies find it difficult to adopt new technology, mainly because of the length of program life cycles. This may account for the relatively slow acceptance of new software technologies, such as artificial intelligence, 4GLs, and major information systems initiatives. Technology is changing daily and systems integration projects may take years from the requirements stage to the implementation stage. One way to remedy the problem of evolving technology is to institute engineering change clauses in contracts. These clauses allow contractors to take advantage of new technology, including more effective software, in existing contracts.

Systems obsolescence is also an information processing weakness caused by ever-evolving technology; the slow, complex procurement process; and old equipment and software inventory. In many cases, by the time a system is installed and running, a new technology has been developed that will accomplish the same tasks more efficiently. Also, much of the federal government's current equipment inventory is old and outdated. The average age of federal computer equipment ranges from 8-10 years. In many cases, the software is even older, having been transferred to the "new" equipment via emulation programs.

Ineffective management of IS resources also adds to the government's information processing problems. Each agency manages these resources differently. Some agencies use a central IRM (a popular term in the federal government) function. This IRM function may be involved in system planning or it may only oversee procurement. Some agencies allow individual operating units to plan and develop their own systems. These different approaches to system planning and procurement can lead to inefficient resource management for the agency as a whole.

These findings, along with some fundamental changes in GSA's information systems (IS) management policies, led to gradual changes in IS procurements. These changes support the need for integrated solutions.

Major integration procurements are both fueled and delayed by budget constraints. The constraints tend to enhance prospects for vendor services, as opposed to the government providing services through its own in-house resources. Agencies' requirements for large, integrated systems may also be changed if GSA revises its rules on granting DPAs (Delegations of Procurement Authority) to force adherence to a more modular approach. This will further the prospects of software product sales.

Deficit control measures, such as the Gramm-Rudman-Hollings (GRH) Act, are forcing agencies to cancel programs that do not satisfy tight productivity improvement requirements. Other programs that do not meet urgent or emergency mission requirements are delayed or stretched out over time. At this writing, all agency FY 1992 budgets have been approved by Congress. Despite the GRH Act, budget deficits continue to grow every year. The ongoing recession is aggravating the deficit problem, as entitlement programs expand and tax receipts shrink.

Systems acquisitions in the second half of the 1980s addressed needed improvements in management, administration, human resources, and logistics functions that have not received newer data processing resources in more than a decade. These have been manifested in the focus of systems integration procurements.

1. Federal Policies and Regulations

Agencies and vendors face difficulties in complying with the sheer number of federal policies and regulations while trying to fulfill information processing requirements.

GSA intended that the FIRMR would streamline the information resources acquisition process. GSA recently completed a rewrite of the FIRMRs to reflect significant legal and regulatory changes, as well as to expedite procurements. The FIRMRs now use the acronym FIP to stand for federal information processing resources. Other regulations and policy initiatives that are changing the acquisition procedures include:

- The Competition in Contracting Act (CICA) of 1985 provided for expanded legal powers for ADP protest action via the GSA Board of Contract Appeals (GSBCA) and GAO. It also increased the opportunity to employ negotiated contracts and established seven more restricted categories of exceptions that permit sole-source awards. Agencies view the CICA as allowing vendors to complicate and lengthen the acquisition process. The Act's provisions make it easier for vendors to protest procurement activities and bring temporary halts to procurement schedules. Virtually every major procurement, including those for custom software development, has been protested under the CICA.

- The Paperwork Reduction Reauthorization Act of 1986 expanded the power of the GSBCA, but also retained the Warner Amendment, which provides DoD with mission-critical ADP procurement exemptions to the Brooks Act Coverage, except for application of general-purpose ADPE in noncritical functions such as testing, recalibration, and programmer workbenches.

- At this writing, there are two bills pending that would affect federal information technology. The Federal Information Resources Management Act, also called the Glenn Bill, is competing against the Paperwork Reduction Act, also called the Nunn Bill. OMB's Office of Information and Regulatory Affairs (OIRA) participated in the writing of the Paperwork Reduction Act and is supporting the Nunn Bill. If the Federal Information Resources Management Act passes, it will open OMB's information resources practices up to some scrutiny. Both bills are widely debated and a decision is not expected in the near future. Both bills would reauthorize OIRA. Currently, OIRA is operating without authorization.

Several other issues have arisen that are now being studied. These include software rights, data rights, and second sourcing of some systems. INPUT expects these issues to continue to create problems on some hardware procurements, including systems integration.

As is well known in the vendor community, the CICA has not achieved the expected improvement of competitive opportunities while providing more equitable resolution of protests. The results have been anything but equitable. Most successful protests result from one or more of the following defects:

- Failure to follow stated evaluation plans
- Procurement process inconsistencies
- Improper documentation
- Defective pricing
- Inconsistent information dissemination

GSA's limited procurement review of the past few years has eliminated much of the expert examination of procurement actions. Many vendors now believe that more review is needed. Some have even indicated that, in certain circumstances, losing can be more profitable than winning. Within the past year, the pendulum has shifted back to heavier agency oversight by GSA. In fact, some programs have been singled out for especially comprehensive review, in much the same way that some tax returns are heavily audited. GSA is committed to increasing oversight without unduly delaying agency procurements.

The Procurement Integrity Act also had some negative effects on federal procurements. The Act, which originally went into effect on July 16, 1989, was written to ensure that no bias has infringed upon the procurement process. It required procurement officials to certify that they have complied with the law and that all members of their contracting team also complied with its provisions. The law carried penalties for both government contracting officials and vendors, including fines and imprisonment.

However, in December, 1989, President Bush signed The Ethics in Government Act, popularly referred to as the Congressional Pay Raise. This law suspended the Procurement Integrity Act for one year. The Procurement Integrity Act went back into effect on December 1, 1990. The law caused some discontent and confusion among industry and federal agencies. Industry representatives claim they are aware of the general intent of the law, but they are uncertain what full obedience will involve. Agency officials complain that the law is unclear and that it adds cumbersome paperwork.

2. Budgetary Constraints

Future-year funding of current acquisition programs and approval of funding for the next budget year are always in doubt in the federal government market. The authorization of an agency budget and the requested information sources by the agency oversight committee do not assure the agency or vendors that funds will be provided in the out years. Appropriation Acts for the agencies approve the TOA (Total Obligational Authority) for certain large systems, but not the fiscal year or years in which the funds will be available (called outlays).

Continuing economic and political sensitivity to the large national budget deficit is beginning to affect adversely a number of acquisitions in the less-than-critical defense and civil technology sectors. Major IRM systems already approved are likely to continue in preference to unapproved programs. Furthermore, ongoing production, through operational support contracts, must continue.

INPUT expects budget difficulties to continue to constrain the federal information systems market, particularly on the Defense side. However, if the procurement process is simplified to reduce the protest volume, acquisitions should begin to increase. Many view information systems as key to productivity increases. Therefore, budget constraints sometimes lead to increased opportunities in the information systems market. The greater availability and functionality of software products will enhance this process.

3. Software Integration and Productivity Improvements

Software is the interface medium between machines, applications, and end users. Agencies need strategies and vendor support to implement these integrations. Agency respondents in previous studies noted a growing need for portable software that is readily adaptable to a changing hardware environment. As new hardware technologies are put in place, the next generation of software must accommodate change and communications between incompatible equipment.

Similarly, agencies are increasingly required to merge large applications into a single, transparent software system that fits their end users' needs, rather than the government end users adapting their needs to the capabilities of the software.

To modernize software and effect productivity improvement, agency ADP organizations are seeking greater use of:

- Software engineering technologies, including more efficient software management methods, software development methodologies, and data dictionaries
- Higher-level development tools, including program generators and fourth-generation languages
- Better analytic tools for all sizes of machines—microcomputers, midsize computers, and mainframes—that will provide programmers with development aids such as automatic documentation, cross-referencing, etc. Many agency programs include requirements for these technologies.

One approach—data administration—provides techniques and software tools to arrange large amounts of data. By organizing, indexing, and cross-referencing data according to the business requirements of the organization, agencies are better equipped to plan procedures for the comprehensive development of future systems. Specifications from the American National Standards Institute (ANSI) are now being reviewed by

agencies and vendors. Although a standard data dictionary software specification is some years away, vendors—especially of data base management systems (DBMSs)—need to be cognizant of the pending impact of this trend.

Fourth-generation languages (4GLs) are being employed by agencies to increase productivity in software development and maintenance. Currently, 4GLs are used primarily for end-user computing and reports, along with some decision support. Other applications for 4GLs are being designed and will eventually ease the burden on agency staff; government computer resources experts are concerned with the demand on computing capability of 4GLs and will look for 5GLs with improved efficiencies. Many information systems procurements include requirements for 4GL experience. Advanced hardware designs, including Reduced Instruction Set Computing (RISC), will make (traditional) inefficient 4GLs more feasible. As a result of steadily declining hardware costs and increasingly powerful and faster computers, software inefficiency will matter less than it used to.

4. Artificial Intelligence

In general, the government has been slow to implement AI. Artificial intelligence is a market segment in which vendors are focusing on introduction of new technology to the government, primarily in the areas of software development efforts and decision support. Currently, expert systems (a popular subset of the family of AI capabilities) are being developed by agencies as standalone end-user production systems to automate knowledge-based processing. In meeting federal systems integration needs, vendors must often include AI features as part of their offerings.

The DoD is taking the lead in developing artificial intelligence programs. AI is providing useful training for analysts, and applications are being employed in tactical situations and support functions. Civil agencies are also developing and operating expert systems for large-scale information processing. In a previous report, INPUT reported that decision support systems represent the most common government application of AI. However, AI is also being used in the development of micro security products.

Industry views the current AI opportunities to be in product-oriented services for prototyping systems for the federal agencies. As in other software areas, the government is looking to industry for solutions, not just products. In response to this trend, AI vendors are expected to migrate beyond standalone systems to new products that integrate approaches and solutions. AI is expected to aid in developing closer links to the main flow of an agency's information processing.

Many small AI vendors are focusing their marketing efforts on SI directors and are providing products to facilitate information storage and retrieval, data communication, and other typical management functions. Current federal prototyping efforts are demonstrating AI feasibility in those SI functions as well as other decision support areas. Areas in which federal workers must interview the public seem especially promising for AI. In a previous report, INPUT found that many federal AI applications were being applied to specialized midsize computer systems.

5. Uncertainties and Issues

In their attempts to consolidate disparate IRM systems, federal agencies are bundling their requirements for some information systems into massive contracts. These large projects are causing big problems in the time it takes to implement them, the cost of the system, and the overestimation of the systems' capabilities. Another problem with large-scale projects is the lack of agency staff and managers with the necessary experience, skills, and management authority.

Over the past year there has been rethinking on the issue of "grand design" systems integration projects. In 1988, GSA wrote a report entitled *An Evaluation of the 'Grand Design' Approach to Developing Computer-Based Applications Systems.* The report outlined ten issue areas that have the most effect on grand designs, as shown in Exhibit III-12. The report cites several criticisms of the grand-design approach.

GSA believes that the grand design approach is not easily tailored to many agencies. According to GSA, it demands a high level of cooperation among organizational units, tough priority setting, swift decision making, and mobilization of a large percentage of an agency's top talent.

INPUT believes that the highest potential for software product sales will come from IDIQ contracts, rather than major systems integration efforts. Such contracts as Air Force's Desktop IV, Army's SMC, and Navy's Companion may account for millions of dollars in software sales. Major systems integration projects will, for the most part, result in lower dollar sales for software.

However, these SI projects, to the extent that they succeed, can result in significant and continuing software development revenues. Even after the integrator completes systems installation, the government agency often extends custom software maintenance contracts indefinitely. These extensions allow the vendor to maintain a continuing and decisive presence at the agency.

In April 1991, GSA released a report entitled *Alternatives to Grand Design for System Modernization,* developed in conjunction with American Management Systems, Inc. (AMS).

EXHIBIT III-12

Ten Issue Areas with Most Effect on Grand Designs

- Coordination problems within the agency during the planning phase
- Procurement problems during the procurement phase
- Lack of acquisition skills during the planning and procurement phases
- Placing the program high enough in the organization in the planning phase
- Uncertain funding during the planning phase
- Audits by GAO during the planning and procurement phases
- Problems with contractors during procurement
- Staffing problems during planning, procurement and operations
- Problems with procurement regulations during the procurement phase
- Unrealistic time schedules during the planning phase

Source: Table 2 in Draft Report: *An Evaluation of the 'Grand Design' Approach to Developing Computer-Based Applications Systems*, GSA, Information Resources Management Service, July 1988

The objective of GSA's study is to provide a risk-based approach to the evaluation and selection of system modernization strategies that constitute alternatives to grand design. Specific goals are:

- To define alternative strategies that are more modest in scope than "grand design"
- To identify risk factors to consider when selecting a strategy
- To identify a decision logic for selection of a strategy

GSA hopes this report will deter agencies from using the grand design approach. The report offers four alternative strategies to the grand design method for systems modernization. These strategies are listed in Exhibit III-13.

EXHIBIT III-13

Alternative Strategies to "Grand Design"

- Bounded Grand Design Strategy
- Comprehensive Information Technology Utility Strategy
- Functional/Technical Integration of Program-Specific Plans
- Incremental Investment Strategy

Source: *Alternatives to Grand Design for System Modernization*, GSA, Information Resources Management Service, April 1991

GSA states in this report that a minimum condition for successful systems modernization program is selecting a strategy that is tailored to an agency's programmatic, organizational, budgetary, technical and political environment. GSA examined 29 public and private sector systems modernization programs started in the 1980s. GSA developed the four alternative strategies from analyzing the successes and failures of these 29 programs. All of the strategies listed utilize the downsizing philosophy advocated by GSA.

The report discusses each of the four strategies in great detail. It also describes the most appropriate strategy for certain situations.

The Bounded Grand Design Strategy focuses on implementing a comprehensive technical solution bounded to an agency's highest priorities and reducing risk to manageable levels. This strategy is most likely to be successful when the existing organizational structure supports large-scale, agencywide information technology programs and there is sufficient talent within the agency to plan and execute such a complex program.

The Comprehensive Information Technology Utility Strategy involves establishing a central IRM organization to enforce agencywide standards and methodologies, and requiring functional units to develop and implement their own modernization programs. This strategy seems to work best when there is a well-balanced relationship between a central IRM organization and programmable units, and when the agency's mission places high value on communication and processing capabilities.

Functional/Technical Integration of Program-Specific Plans requires each functional unit to formulate its own modernization plan. A central IRM organization then weaves the plans together and supplies a limited number of common services. This strategy is typically preferred when programmatic and functional units are large, organizationally influential, and have a strong preference for directing their own modernization activities.

The Incremental Investment Strategy focuses on deriving the highest return from relatively limited resources that may be invested in information technology within a short planning horizon. This strategy works well when planning and execution risk is high, significant returns from long-term investments may never be achieved, or there are severe funding limitations.

Great controversy has developed because of GSA's report and a report released by ITAA in June 1991. ITAA's report appears to contradict GSA's unfavorable opinion of the grand design method of system modernization.

The report, entitled *Observations on Successful Federal Systems Integration Programs,* was developed by ITAA to identify large federal systems integration projects, the factors critical to their success, and the criteria by which program managers evaluate program success.

Exhibit III-14 lists the agencies and programs examined by ITAA for its report.

EXHIBIT III-14

Programs Examined by ITAA

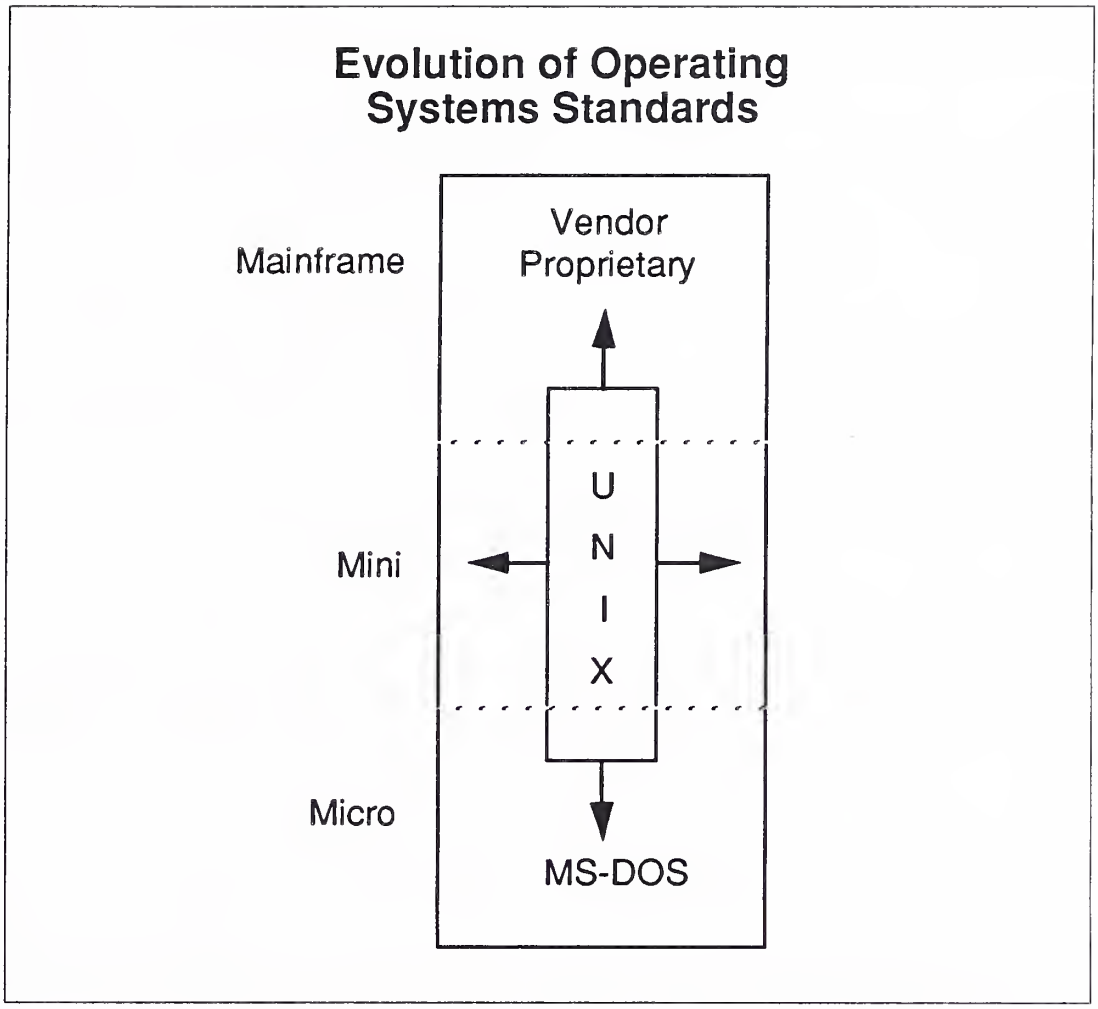
Agency	Program	Systems Integrator	Award Year	Value ($M)
Agriculture	AMPS	EDS	1985	443
Air Force	SC&D	CSC	1988	135
Air Force	HSRP	Grumman	1988	92
Air Force	AFEMS	Martin Marietta	1989	77
Army	FIS	Boeing	1987	42
Army	80X	EDS	1987	343
Army/COE	CEAP	CDC	1989	365
NASA	LIMS	EDS	1987	42
Navy	EDMICS	PRC	1989	150
SEC	EDGAR	BDM	1989	52
Treasury	CDN	CSC	1985	106

Source: *Observations on Successful Federal Systems Integration Programs*, ITAA's Federal Information Systems Committee, June 1991

6. The UNIX/POSIX Solution

An issue of concern to agencies is the interoperability of software across different vendors' hardware. Some agencies believe that UNIX-based products provide a partial solution to this problem. As depicted in Exhibit III-15, UNIX offers a common operating environment for all sizes of hardware, from mainframes to microcomputers.

EXHIBIT III-15



References to a POSIX standard are now seen more frequently, although many authorities doubt the frequently quoted figure that 65% of the upcoming specs will use UNIX.

- The Army's information systems standards include UNIX at the organizational and work-unit levels. These standards are shown in Exhibit III-16.

EXHIBIT III-16

Army Information Systems Standards

Tier I - Regional Processing	
Operating System	- MVS
Data Base Management System	- Any DBMS with SQL interface
Hardware	- No standard defined
Tier II - Installation/Organizational	
Operating System	- UNIX5; or VM able to host CMS/VSE/MVS/UNIX5
Data Base Management System	- Any DBMS with SQL interface
Hardware	- No standard defined
Tier III - User Processing	- UNIX5 or MS-DOS - No standard defined
Operating System	- PC shall be IBM-compatible
Data Base Management System	
Hardware	
Communications: Tiers I and II will be able to use IBM Systems Network Architecture (SNA) or SNA gateway with remote job entry (RJE), 327X emulation, and document interchange/document content architecture (DIA/DCA) and option for DoD protocols.	
Artificial Intelligence (AI): Workstations for AI applications will be able to support "common LISP."	

Source: DAIM-AD
(Department of the Army Information Management)

- The Army's Command and Control Systems (ACCS) will use Uniplex Business Software, which is UNIX-based office systems software.
- The IRS is using a UNIX-based system from Sequent Computer Systems to support its taxpayer services functions.

- NASA's Goddard Space Flight Center is working with a private firm, Century Computing, Inc., to use UNIX in designing application user interfaces.

- In June 1991, the NIST certified the following systems as POSIX compliant:

  - Apple's Macintosh with A/UX
  - IBM's RISC System/6000 with AIX
  - Various systems from Control Data
  - Various systems from Data General

However, differences persist among vendors on various implementations of the POSIX standard, and these differences will retard the interoperability requirements of agency executives.

These issues will not be solved readily and the evolution of a UNIX standard will compete with other approaches to software modernization, including fourth- and fifth-generation languages, data administration technologies and programmer's workbench products.

D
Federal Ada Market

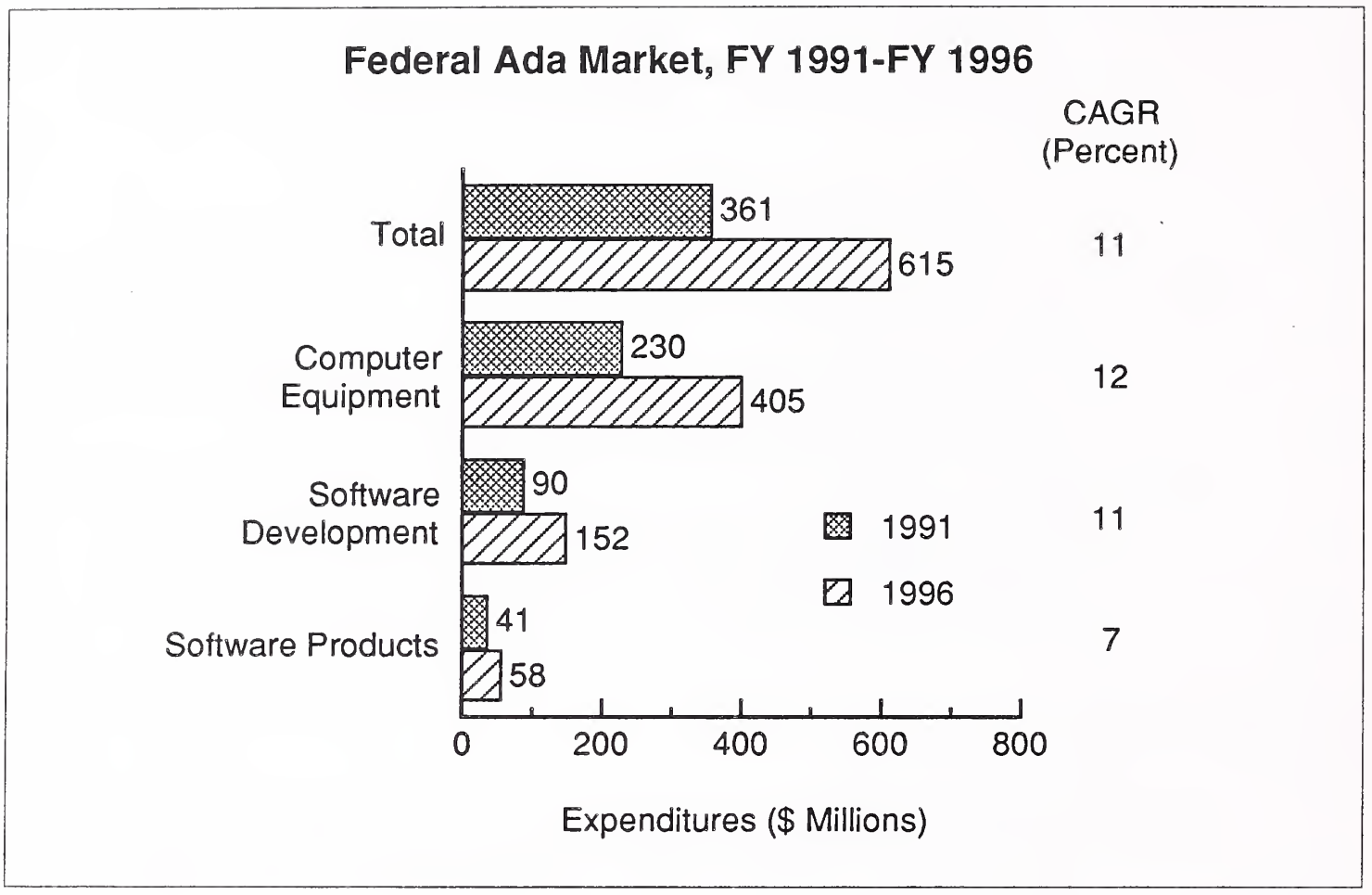
In 1975, the Department of Defense (DoD) began a project to develop a new high-order language, initially intended to support embedded computer systems. Two years later, using a typical try-before-you-buy approach, DoD awarded four contracts to different firms to design, in parallel, this new language. Two of these vendors were chosen to continue their work beyond the preliminary design stage. Finally, in 1979, the DoD awarded a contract to Cii-Honeywell-Bull to develop the new language, subsequently called Ada. The American National Standards Institute approved Ada in 1983, and the International Standards Organization followed with its approval in 1987.

Despite its slow start, Ada is now becoming a major force in the federal information systems market. The Ada market is discussed in this section, and a brief summary on the policy and technical issues as well as highlights of a few applications are provided.

1. Market Forecast

The federal Ada market (covering equipment, software development, and software products) will grow from $361 million in 1991 to $615 million in 1996, at a CAGR of 11%, as seen in Exhibit III-17.

EXHIBIT III-17

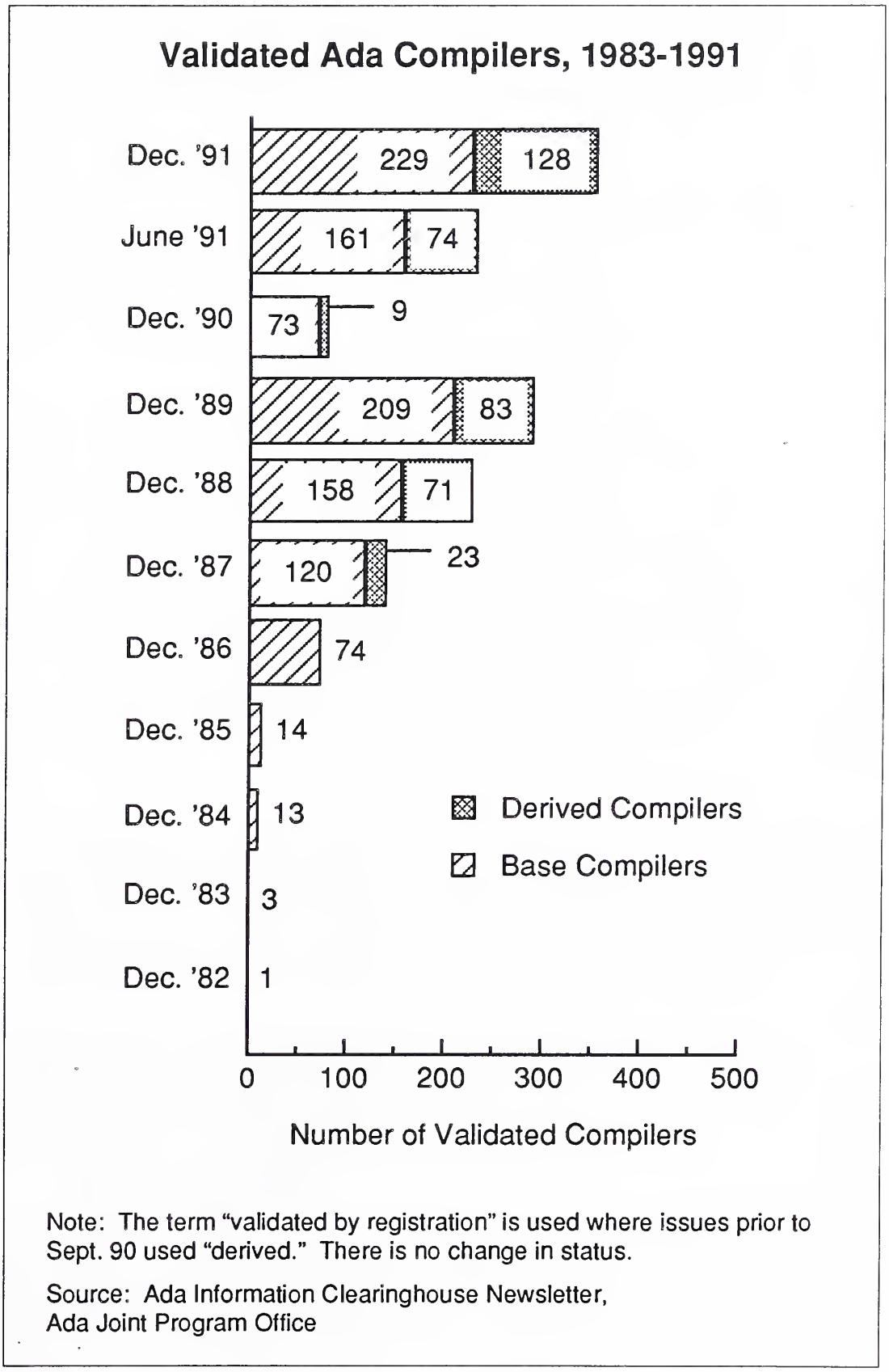


This forecast reflects the growth in federal spending on computer systems using Ada software. Despite the similar growth rates of the three categories, they really reflect three sets of issues:

- The federal computer equipment market, overall, is growing at a CAGR of only 8%. Ada-related equipment is growing half again as fast, reflecting the hundreds of projects in development that require equipment.
- The federal software development market, overall, is growing at a CAGR of only 10%. Ada-related software development is growing slightly faster, reflecting the increasing number of programmers who are trained in Ada and the need to develop new custom solutions on most Ada projects.
- The federal software products market, overall, is growing at a CAGR of 12%. The Ada-related software products market is growing barely half as fast, reflecting the ready availability of compilers, which have so far been put to limited use.

According to the Ada Joint Program Office (AJPO), there are now 357 available Ada compilers (Exhibit III-18). This growth should level off, as most hardware platforms have already developed Ada compilers.

EXHIBIT III-18



Note: The term "validated by registration" is used where issues prior to Sept. 90 used "derived." There is no change in status.

Source: Ada Information Clearinghouse Newsletter,
Ada Joint Program Office

2. Policy Issues

In 1983, the DoD established Ada as the single, common computer language for mission-critical and aviation systems. Subsequently, DoD mandated Ada use for automated weapons and information systems. Dozens of vendors invested internal research and development dollars in Ada compilers and other Ada-related software products to meet the expected demand. It didn't happen.

In 1991, Ada projects still only accounted for a relatively small (but growing) portion of the DoD market for information systems. In fact, some of the more interesting Ada projects such as NASA's Technical and Management Information System (TMIS) and the FAA's National Airspace System are not even in DoD. Reluctance on the part of DoD program managers to use Ada has, in the past, limited the growth of this market.

Defense manages Ada activities through the Ada Joint Program Office (AJPO). Among other things, the AJPO markets the use of Ada throughout the DoD. This includes reversing agencies' attitude that Ada is aimed primarily at mission-critical applications. The AJPO seeks to broaden Ada appeal.

The Defense Advanced Research Project Agency (DARPA) is helping this effort along through a major initiative, the Software Technology for Adaptable Reliable Systems (STARS) program. Through STARS, DARPA is developing and making available a reusable library of Ada code that will assist programmers in using Ada in projects for which it appears appropriate.

It has been reported that most Ada software engineers and program managers believed that Ada had increased their productivity. However, in a recent report, GAO complained that DoD had not designed projects to assess the long-term cost savings and other benefits. This may account, in part, for Ada's slow progress, because budget constraints may inhibit program managers from experimenting with Ada.

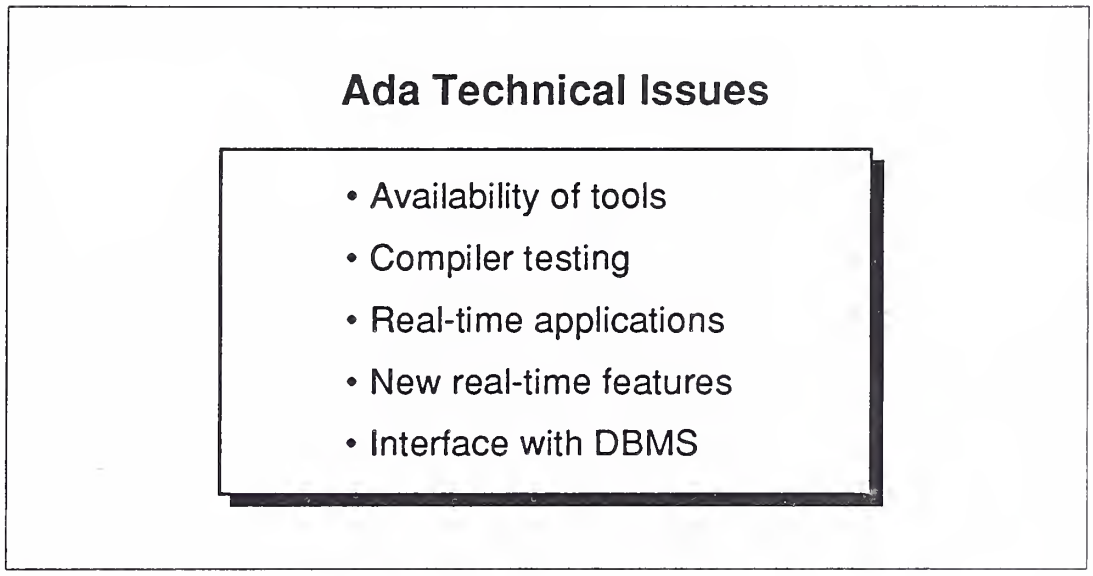
In addition to the AJPO and the STARS programs, Defense has a third initiative aimed at promulgating Ada. The Software Engineering Institute, run by contract at Carnegie-Mellon University in Pittsburgh, is helping to smooth the transition from all new software engineering technology, including Ada, into productive use.

3. Technical Issues

In examining the past and future growth of Ada in the federal government, it is worthwhile to consider some of the key technical issues. In some respects, many Ada products are now tied in with CASE products. Many vendors now offer product packages that include modules from both disciplines. Thus, vendors can offer more comprehensive solutions to agency problems. However, some agencies have been slow to take advantage of these packages because of cuts in training budgets.

In a recent report, the GAO identified five technical issues that have affected or will affect the growth of the federal Ada market. These are summarized in Exhibit III-19.

EXHIBIT III-19



- Availability of Ada software development tools is increasing. Exhibit III-18 showed the growth in compilers. Other tools, including editors, debuggers, and configuration managers, are now generally available. This explains in part why the Ada software products market will grow more slowly than the overall federal software products market.

- Better tests are being developed to determine compiler performance. Although standards conformance is required, compilers need to be measured also in terms of the following:

  - Compile-time efficiency
  - Object code efficiency
  - Compiler services
  - Embedded system requirements support
  - All of these directly affect the suitability of Ada compilers in supporting specific mission needs.

- Many agencies have not yet realized the benefits of Ada for critical real-time applications. In the past, Ada has not performed successfully in applications with severe timing and memory constraints. This problem arises from both the language itself and the compilers implementing the language.

- Some new Ada features will facilitate the use of Ada in real-time distributed systems. Specifically, improvements in Ada's tasking feature can be used to partition and program among various computers, particularly when they are sharing memory. Further, Ada's rendezvous mechanism, with some improvements, handles communications among computers.

- Full Ada benefits cannot be achieved without a uniform approach to using Ada with DBMS. No standard interface currently exists. Four methods have been proposed for a Structured Query Language (SQL) interface to Ada. However, some technical conflicts still need to be resolved.

4. Ada Applications

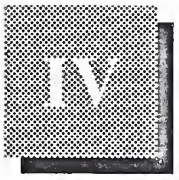
There are literally hundreds of applications either in development or production that use Ada. NASA's Technical and Management Information System (TMIS), mentioned earlier, is an example of a major nondefense initiative using Ada. The FAA systems modernization is another example. TMIS will provide the necessary collection, dissemination, and processing of data to manage the Space Station Program.

As might be expected, most Ada programs are in the Defense Department. They range from the very large—such as the Army Advanced Field Artillery Tactical Data System, with 1.5 million lines of Ada code—to the very small, such as a modified fire control system for the M60 tank, with 3,100 lines of Ada code. The Navy will need 2 million lines of Ada code, along with another million lines of non-Ada code, for its Sea Wolf submarine combat system.

Despite its real-time problems, Ada is being used by the Air Force for a real-time aircrew training system. McDonnell Douglas is using Ada tools to develop a large-scale simulation system for aircrew training. Harris is providing the hardware—40 of its Night Hawk real-time computers—on which the Ada programs will run. The Air Force intends to vary the processing power of the computers, depending on individual site requirements.

Historically, the Army has been the most aggressive in fielding Ada systems, followed by the Air Force and the Navy, respectively. However, the Air Force has shown new interest and commitment to Ada, so the orders of applications may shift in the Air Force's favor. With the exception of a few high-profile projects such as TMIS, civil agencies have

shown little interest in Ada. However, with more compilers and tools available and with the inevitable shifting of personnel among agencies, Ada will probably become more popular on the civil side of the government.



Federal Agency Requirements and Trends

This chapter expands on the areas covered in Chapter III and provides more detailed information on the directions federal agencies are taking in software acquisitions and development.

Material in this section will help the software industry identify ways it can maximize penetration of the federal market. INPUT interviewed policy-making, managerial and technical personnel from a broad range of federal agencies to secure information about their current and intended acquisition of software. Questions designed to probe for agency perceptions and attitudes provided INPUT with additional data for developing a profile of the federal software market.

A
Acquisition Type Selection

The trend among federal agencies is increasingly to purchase software products rather than leasing them from vendors, as was often the custom in the past. In an earlier edition of this report, INPUT asked respondents their preferences on how they acquire software products, through purchase or lease. As shown in Exhibit IV-1, the majority said they prefer to purchase all categories of software products, rather than lease them from vendors. Only for systems control and applications software did a small percentage of respondents indicate that they would acquire these products through lease. A 1988 change in the conditions underlying federal supply offerings required vendors to offer permanent site licenses to government customers who lease products for 18 months. This change discourages agencies from leasing indefinitely and correspondingly reduces federal expenditures for software leasing.

This software trend, in part, matches the trend for buying computer equipment rather than leasing it, except for short-term applications, as earlier directed by Congress. Lower unit purchase prices of many software products are helped along by competitive discounting in the federal market. It suggests increasing agency adherence to OMB policies favoring purchase over lease.

EXHIBIT IV-1

Software Products—Purchase versus Lease

Software Products	Percent of Respondents	
	Purchase	Lease
Systems Control	87	13
Data Center Management	100	0
Data Base Systems	100	0
Program Development and Production Tools	100	0
Applications Software	96	4

B

Expected Changes in Product/Service Acquisition Mix

In speaking with government agencies about their software acquisition plans, INPUT found a continuation of the trend toward the purchase of more packaged software. Nearly two-thirds of the respondents (64%) indicated they intend to acquire more packaged software in the next five years, at the expense of custom developed software (see Exhibit IV-2). The risk and effort of custom software development and maintenance, as compared to the relative ease of purchasing and maintaining packaged software, was the main reason given for these agency plans. Respondents also cited continuing improvement in the quality of packaged software. The trend to more packaged software will benefit vendors who emphasize the high quality, low cost and ease of maintaining their product. Software that readily adapts to agency uses, and is maintained easily and inexpensively, is seen as more desirable than custom development in this stringent funding environment.

Agencies reporting heavy mainframe use are not planning to purchase more packaged software (27%), because of the need for custom development on this size of platform. Custom software developers should be able to count on a continuing captive market in this niche.

EXHIBIT IV-2

Packaged Software versus Custom Software Acquisition

Acquiring More Packaged Software	Percent of Respondents	Reasons Given
Yes	64	Availability Ease of management Cost beneficial Ease of purchase
No	27	Heavy mainframe use requires custom development
Don't Know	9	None given

The responses shown in Exhibit IV-3 show the direction this trend is taking. The majority of agencies surveyed said they expect to increase their acquisition of packaged software, but expect custom software acquisitions to remain about the same. A small number said they expect both packaged applications and systems software acquisitions to decrease during the next five years.

The small number of agencies planning a decrease in packaged software acquisition also reported a decreasing budget for software. Others cited the recent completion of total system upgrades, incorporating new software, as the reason they would not be increasing software purchases in the near future.

The decrease in demand for custom software corresponds with an increase in the installation of local-area networks (LANs). These networks bring more computing power to the end user, decreasing reliance on mainframe platforms for data processing. LANs consist primarily of microcomputers and midsize computers. There is a range of packaged applications available for these systems. Given the demand for cost control, the simplification of purchase procedures and ease of software maintenance, agencies relying more heavily on LANs will also depend more on packaged software.

Increased dependence on in-house maintenance will slow the growth of contract software maintenance. There will be no change in the level of contract software maintenance acquisition for more than half of the agencies in INPUT's survey. The trimming of budget requests historically begins in areas that can be supported in-house, such as software maintenance and other support services. Contract software maintenance will still be sought for functions that will not be supported adequately by agency personnel, e.g., installation of new software and software upgrades.

Budget pressures can be expected to impact software purchases and accelerate the tendency for agencies to acquire more packaged applications. This will occur at the expense of custom development. Also, the simplification of acquisition through umbrella-type contracts through which users may purchase, customize and maintain packaged software will intensify the move to packaged software. Vendors who are able to meet budget limitations while providing software adaptable to diverse agency system needs will continue to thrive in this environment.

INPUT asked about planned operating systems, as well as the applications to be run on them. Agency responses suggest adherence to federal government standards and growing use of interoperable software.

The POSIX standard that facilitates portability and interoperability of software was cited often in this survey. Applications developed for an operating system that is POSIX compliant will be transportable from one vendor's hardware to another's with little or no modification. UNIX-type operating systems meet this requirement. Adherence to the POSIX standard is reflected in the large percentage of agencies planning to use UNIX-type operating systems (Exhibit IV-4).

EXHIBIT IV-3

Projected Changes in Software Product Acquisitions, FY 1991-FY 1996

Software Products	Percent				
	Respondents Expecting Increase	Average Increase Expected	Respondents Expecting Decrease	Average Decrease Expected	Respondents Expecting No Change
Packaged Applications Software	75	42	N/A	5	20
Packaged Systems Software	65	32	N/A	5	30
Custom Applications Software	27	N/A	N/A	17	56
Custom Systems Software	6	50	37	23	71
Contract Software Maintenance	35	47	37	12	53

Note: N/A = Not Available

Rows will not add to 100% due to rounding; note column headings

The trend to LANs and IBM PC-type microcomputers is reflected in the percentage of MS-DOS users. MS-DOS is also the microcomputer operating system standard in many agencies, such as Treasury.

The number of respondents planning to use the MVS operating system indicates the stability of the mainframe environment. These respondents include the heavy mainframe users who will be utilizing custom developed software.

EXHIBIT IV-4

Software Products—Purchase versus Lease

Operating Systems	Percent of Respondents Planning to Use	Percent of Applications
UNIX Types	77.3	53.2
MS-DOS	77.3	30.1
MVS	50.0	39.3
OS/2	31.8	23.3
*Other	18.0	13.3

Note: Columns will not total 100 due to multiple responses

*Includes Macintosh and Wang

Responses show growth in the planned use of OS/2 from earlier editions of this report. However, the number of applications being run on these systems appears to be relatively small. This finding supports INPUT's perception that OS/2 will be used primarily by programmers and power users. Because budget pressures continue to shape the system development and redesign efforts of agencies, new systems should be capable of running old applications. Agencies do not want to begin the migration of applications to a new operating system, such as OS/2, that also requires new, more powerful hardware. The redevelopment of existing applications on a new system would be expensive and time-consuming as well.

An additional restriction in the OS/2 market is the growing movement toward standard operating systems. Respondents from the Treasury Department cited their adherence to the MS-DOS standard for microcomputers in their agency, for instance. Adherence to the MS-DOS standard also facilitates portability and interoperability of applications, which the introduction of the OS/2 operating system would inhibit.

Agencies running applications on systems that do not comply with the POSIX standard will continue to do so as long as there is a related economic benefit. They will be expected to migrate to systems incorporating the standards when new platforms and software are purchased, however.

Industry should note that government requests for software and services will be structured around solutions based on these and other standards. Software solutions must provide users with portable applications, standard data base calls, and compilers that allow users to develop their own solutions based on the standards. "Migration-easing" products will allow applications to be moved from VMS to UNIX, for instance, or will facilitate movement of applications from superminicomputers to workstations. There will be a demand for such software.

Exhibit IV-5 shows that some agencies link hardware buys with packaged software purchases. Exactly half of the agencies INPUT surveyed stated that they expect hardware and software purchases to be linked. INPUT found that these agencies were planning to link almost three-fourths of packaged software purchases to hardware acquisition. This trend suggests that packaged software developers and vendors need to work even more closely with the hardware industry in joint marketing.

EXHIBIT IV-5

Software Purchases Linked to Hardware Buys

Software	Percentage of Software Linked to Hardware Buys
Packaged Systems Software	79
Packaged Applications Software	70

Exhibit IV-6 shows that almost two-thirds (65%) of the respondents do not expect hardware use decisions to determine software purchases. These respondents often cited software functional requirements and the availability of a range of software products as driving hardware use. Respondents reporting hardware use decisions as the determining factor in their software purchases (35%) were often redesigning hardware systems.

EXHIBIT IV-6

Hardware Decisions Affect Software Purchases

Response	Percent of Respondents	Reasons Given
No	65	Software availability Functional needs Standards Requirements
Yes	35	Hardware capability System redesign LAN development

These findings suggest that the software industry should focus on an increased range of software products to meet federal government functional requirements. Agencies commented on the need to justify software decisions by citing users' functional requirements. The allocation of scarce funding resources must be justified by software purchases that support agencies' missions.

Many agencies purchase most of their applications software independently of hardware acquisitions, and when specific requirements demand it. This is most common when a system is acquired for a particular purpose. The software for these systems is often designed around the agency's mission.

Some examples of mission-specific software functions include the following:

- The Federal Highway Administration's use of graphics, CAD systems, and communications software to interface with state highway department engineering systems
- The Internal Revenue Service's funding of the development of an AI application to support public information queries in the Taxpayer Service Division
- The U.S. Courts' use of data base management software that adequately addresses the growing size requirements of their case management system

Respondents, commenting on the added expense of the so-called umbrella-type contracts, noted that there is a trade-off between the ease of making purchases through these contracts and the cost. When it is possible to purchase through another vehicle—e.g., the GSA schedule or a purchase order—many users will do so. INPUT recommends that vendors and developers place their products on the GSA schedule whenever possible, to increase exposure to the market and enable agencies to more easily buy their products.

Agencies use the multiple-award schedules in large amounts, the GSA reports. Annual sales in Information Resources Management Services from the GSA schedules are close to $2 billion.

The availability of new products designed to increase productivity, help systems designers and programmers, and ease user access to data bases was noted by agency respondents. They were asked to rate their expectations of the utility of these products for the next five years. None of the respondents felt that use of these tools would decrease. The expected use of these products is shown in Exhibit IV-7.

The use of fourth- and fifth-generation languages leads in the percent of expected increase (141%), and was cited by 90% of the respondents. It was the second most often mentioned software tool expected to increase in use, just behind SQL-based products at 95%. Both of these products were cited as important to the user community, facilitating access to data base functions and being reasonably easy to use.

The federal adoption of the POSIX standard to increase portability and interoperability of applications is reflected in the 112% average expected increase of UNIX products cited by 64% of the respondents. Because the UNIX operating system functions across a wide range of platform sizes, it is ideal for distributed processing applications. UNIX applications being used include distributed communications and heavy administrative data base management.

Computer-aided software engineering (CASE) tools relieve some of the tedious tasks associated with programming and system design. These tools are also being used to design communications networks and to ease space management problems for some agencies. Fewer than 10% of the respondents said that they are not using these tools, and over 85% expect their use to increase.

Ada compilers were given the lowest expectation of increased use. Sixty-seven percent (67%) of the respondents stated that they do not use them. Twenty-nine percent (29%) said they expected an increase in the use of Ada compilers; these were all DoD agencies that are required to use Ada for all new applications.

EXHIBIT IV-7

Expected Specific Software Products Use

Product	Usage Changes (Percent)				
	Increase Expected	Average Percent Increase	Application Examples	Remain the Same	Do Not Use
SQL-based Products	95	57	Data base interface Application conversion Program management	0	4.7
4th & 5th GLs	90	141	Ad hoc reporting Data base application development	0	10
CASE Tools	86	74	Optimize system design Space management Software development	5	10
UNIX Products	64	112	File server software logistics Administrative DBMSs Distributed communications	9	27
AI/Expert Systems	60	53	User problem solving Error recovery Scientific applications Public information		
Ada Compilers	29	58	Software development logistics	5	67

The number and types of Ada projects have increased over the past two years. However, Ada use is still confined mainly to DoD agencies and some NASA installations. The recent Congressional mandate—that all DoD agencies write their software in Ada—should push development in that direction. Funding constraints, technical issues, and a shortage of Ada programmers continue to prevent a rapid expansion of Ada use. The

Congressional mandate allows projects to be exempted from using Ada if agencies can show that programming in Ada would not be cost-effective, or if a waiver is granted "by an official designated by the Secretary of Defense."

These findings suggest that professional services firms should proceed cautiously in building their Ada expertise. Although more agencies may require this expertise, INPUT does not expect any dramatic increase in Ada requirements, despite the Congressional mandate.

Software products in the system tools market niche are being used and purchased in growing quantities. Agencies' use of these tools demonstrates the federal government's focus on the flexibility of software to meet differing requirements. This sector of the software industry needs to continue to upgrade and enhance the flexibility and ease of use of these tools. Respondents suggested that CASE tools should be made more efficient, and that more CASE products could be made available. Respondents using Ada are looking for CASE tools for Ada program development.

When INPUT asked agencies which new UNIX-based products they would most like to see on the market, they responded with the product types shown in Exhibit IV-8. Their response shows that office automation software is overwhelmingly the first choice for new UNIX products (90%). Product types tying for second choice include systems software tools that would make systems more efficient. SQL and 4GL tools functioning independently of an operating system or DBMS would allow efficient query and data retrieval. Products integrating with other operating systems would comply with the POSIX interoperability requirements. Off-the-shelf software meeting the POSIX and GOSIP standards, though ranked third in the list, would find a ready federal market.

Users of UNIX systems will have access to several MS-DOS applications that are recompiled for use on the UNIX operating system. The XDOS technology of Hunter Systems Inc. of Palo Alto, California, offers interoperability of applications across hardware platforms. Hunter is selling DOS-to-UNIX ports of several MS-DOS-based applications packages. Ashton-Tate's MultiMate and Software Solutions' Brief and DataEase are currently available. Soon, Borland International Inc.'s Quattro spreadsheet and Sprint word processor will be available.

Ashton-Tate will soon begin shipping dBase IV for Sun Microsystems workstations. Beta testing of the product has been completed and a government reseller will soon be named. A version of the software for the UNIX operating systems of Intel Corp. 80386 processors should be ready for release early next year.

EXHIBIT IV-8

UNIX Products Most Often Mentioned

Product Type	Ranking*	Percent of Respondents Identifying
Office automation including graphics and spreadsheets	1	90
SQL and 4GLs independent of OS and DBMS	2	20
Products integrating with other systems and requiring less tailoring	2	20
Off-the-shelf SW meeting POSIX/GOSIP standards	3	10

*Ranked by number of respondents mentioning application

C
Hardware Platforms

A previous edition of this report illustrated the types of software that respondents said would run on the classes of hardware platforms at their agencies—mainframe, midsize and microcomputer. The responses shown in Exhibit IV-9 follow expectations, according to the environments in which these products are most often used. Systems control software may be used on mainframe, midsize, and microcomputer systems, and the data show approximately equal use.

It would also be expected that data center management software would be used primarily for mainframe operations and secondly for midsize systems, as the survey confirms. Because of its uses, data center management software is usually associated with large data center operations that maintain mainframe and midsize systems.

EXHIBIT IV-9

Platforms for Systems Software

Systems Software Type	Percent of Respondents Indicating Hardware Platform		
	Mainframe	Midsize	Micro
Systems Control	40	44	40
Data Center Management	40	32	4
Relational DBMS	44	44	40
Other Data Bases	24	24	36
Data Dictionaries	44	36	28
4GLs	40	52	32
Artificial Intelligence	24	36	52
CASE Tools	24	40	44
Ada Compilers	12	16	12
Other Development and Production Tools	28	36	80

Note: Rows do not add to 100% due to multiple responses

Respondents said that DBMS technology in its various forms will be used fairly consistently across all three platform sizes. There is growing availability of DBMS software designed to cross platform barriers. Distributed processing is increasing in use, requiring the portability and interoperability of DBMS applications.

Software tools appropriate for microcomputer processing (e.g., CASE tools and artificial intelligence) will be used more frequently by federal agencies on microcomputers. There is a strong secondary position for the use of these tools on midsize platforms, however. The future will likely show increasing use of development and production tools on midsize platforms.

A previous survey asked respondents which hardware platforms would be used with certain types of applications software (see Exhibit IV-10). The responses given were similar to those for systems software products. Applications that require central data files and technical management (e.g., accounting and human resources) are being run more frequently on larger systems. Applications primarily associated with end-user functions (e.g., word processing, graphics, and project management) were more often said to be run on small machines.

The results suggest that agencies will be employing a three-tiered architecture to accomplish much of their information processing requirements. Agencies interviewed for a prior edition of this report said that they intended to run most software products across all three computer platforms.

Respondents interviewed said they are installing more local- and wide-area networks, with workstations supporting administrative and other agency work. Personal workstations that can fully support the display capabilities of new software are replacing old standalone units. Connection will often be made between local-area network users and central mainframes.

When asked what type of software their agencies will be purchasing for workstations, respondents identified the product types shown in Exhibit IV-11. The top four choices indicate that users of software on workstations are still largely using office automation products. The importance of data base management is also obvious in this survey. It is tied for first choice with word processing. Data base management is being used increasingly in distributed processing over LANs and WANs.

EXHIBIT IV-10

Platforms for Applications Software

Applications Software Type	Percent of Respondents Indicating Hardware Platform		
	Mainframe	Midsize	Micro
Accounting	40	25	25
Human Resources	32	25	20
Information Analysis	36	32	48
Logistics/Distribution	24	32	28
Word Processing	16	32	84
Graphics	20	40	88
Electronic Mail	28	48	60
Scientific/Engineering	32	40	44
Project Management	20	28	64
Management Systems	36	24	36
Electronic Publishing	12	24	64
Administration	28	32	44
Other Agency-Specific	24	24	40

Note: Rows do not add to 100% due to multiple responses

Spreadsheet and graphics applications have varied uses. Because of the specialized nature of this software, products would easily integrate with word processing and project management to produce many-faceted documents. Many word processing applications are also being used for desktop publishing. This is reflected in the low number of respondents who singled out desktop publishing software.

EXHIBIT IV-11

Types of Software Respondents Will Purchase for Workstations

Product Type	Rank	Percent Identifying
Word Processing	1	79
Data Base Management	1	79
Spreadsheet	2	47
Graphics	3	32
Communications	4	26
System/Development Tools (e.g., CASE, AI, SQL and 4GL)	5	16
LAN Utilities	5	16
Project Management	6	10
Operating System	6	10
Other*	7	N/A

Note: *Includes desktop publishing, utilities, software upgrades

The appearance of communications software and LAN utilities software supports the observation that more agencies are becoming networked. The market is there for vendors of software used in distributed processing and easily adapted to shared applications over networks.

Responses from an earlier survey are summarized by agency type (DoD or civilian) for systems and applications software products in Exhibits IV-12 and IV-13. Some of the differences noted between DoD and civilian agencies are:

- DoD agencies tend to run more systems software (e.g., systems control, data center management, RDBMS, data dictionaries, and 4GLs) on mainframe systems than do civilian agencies.

- Twice as many civilian agencies as DoD agencies use accounting software on mainframes. One-fourth of both agency groups run accounting software on midsize and microcomputer systems.

EXHIBIT IV-12

Agency Hardware Platforms for Systems Software Products—DoD versus Civil

Systems Software Type	Agency Type	Percent of Respondents Indicating Hardware Platform		
		Mainframe	Midsize	Micro
Systems Control	DoD	63	50	63
	Civil	29	41	29
Data Center Management	DoD	63	38	0
	Civil	29	29	6
Relational DBMS	DoD	63	50	50
	Civil	35	41	35
Other Data Bases	DoD	38	25	50
	Civil	18	24	29
Data Dictionaries	DoD	63	38	13
	Civil	35	35	29
4GLs	DoD	75	63	38
	Civil	29	47	29
Artificial Intelligence	DoD	25	38	63
	Civil	24	35	47
CASE Tools	DoD	38	63	63
	Civil	18	35	35
Ada Compilers	DoD	25	25	13
	Civil	6	12	12
Other Program Development and Production Tools	DoD	38	38	75
	Civil	24	35	82

Note: Rows do not add to 100% for each agency category and are based on total samples for each agency category.

EXHIBIT IV-13

Agency Hardware Platforms for Applications Software Products—DoD versus Civil

Applications Software Type	Percent of Respondents Indicating Hardware Platform			
	Agency Type	Mainframe	Midsize	Micro
Accounting	DoD	25	25	25
	Civil	47	24	24
Human Resources	DoD	25	25	25
	Civil	41	24	18
Information Analysis	DoD	38	25	38
	Civil	35	35	53
Logistics/ Distribution	DoD	25	25	25
	Civil	24	35	29
Word Processing	DoD	13	13	88
	Civil	18	41	53
Graphics	DoD	13	38	88
	Civil	24	41	88
Electronic Mail	DoD	25	25	75
	Civil	29	59	53
Scientific/ Engineering	DoD	13	25	25
	Civil	41	47	53
Project Management	DoD	25	25	63
	Civil	18	29	65
Management Systems	DoD	25	13	38
	Civil	41	29	35
Electronic Publishing	DoD	25	13	38
	Civil	6	29	77
Administration	DoD	25	13	38
	Civil	29	41	47
Other Agency-Specific	DoD	50	38	75
	Civil	12	18	24

Note: Rows do not add to 100% for each agency category, and are based on total samples for each agency category.

- DoD agencies most often run electronic mail applications on microcomputers. Civilian agencies tend to run this application with about the same frequency on midsize and micro systems.

- Civilian agencies use more electronic publishing applications overall, running them primarily on microcomputers.

D
Selection Criteria

INPUT asked respondents to rate agency selection criteria for software and software vendors. Eleven criteria were rated in order of importance, on a scale of 1 to 5. The more important a criterion, the higher the rating it was given.

The important factors agencies considered when selecting packaged applications software are shown in Exhibit IV-14. Ease of use of the software application was rated the highest of all criteria. Software performance, ease of implementation and software features were clustered just below. The survey reflects agreement with the rating of price and federal experience from an earlier edition of this report. Agencies continue to look at price and federal experience as the two least important criteria for packaged applications software. Respondents who ranked price as the least important criterion said that software performance and meeting agency requirements were more important. This confirms INPUT findings that show that federal agencies are focusing on packaged software which is able to meet agency functional requirements. Segments of the software industry developing flexible and easily maintained software that meets government standards and agency requirements will continue to be successful in this market.

Some respondents said that training, support reputation, and technical expertise were criteria they did not generally use in evaluating software and vendors. These respondents said vendors would have to meet GSA contract requirements for these criteria, a function the respondents did not fill. INPUT was told that success in meeting these criteria would be reflected in a GSA evaluation of vendors who meet the GSA technical requirements.

EXHIBIT IV-14

Packaged Software and Vendor Selection Criteria Applications Software

Criterion	Average Rating*
Ease of Use	4.0
Performance	3.8
Ease of Implementation	3.7
Software Features	3.7
Documentation	3.6
Application Knowledge/ Technical Expertise	3.5
Support Reputation	3.4
OSI Compliant	3.3
Training	3.3
Product Price	3.1
Federal Experience	2.0

*1 = Not important; 5 = Very important

Agency respondents rating criteria for packaged systems software said performance was the most important (Exhibit IV-15). Ease of implementation and software features followed closely behind. Ease of use and documentation tied for fourth position. Once again, federal experience was in the last position, with price just above it.

EXHIBIT IV-15

Packaged Software and Vendor Selection Criteria—Systems Software

Criterion	Average Rating*
Performance	4.7
Ease of Implementation	4.3
Software Features	4.1
Ease of Use	4.0
Documentation	4.0
Training	3.8
Support Reputation	3.8
Application Knowledge/ Technical Expertise	3.8
OSI Compliant	3.7
Product Price	3.6
Federal Experience	2.3

*1 = Not important; 5 = Very important

The gap between the average rating scores is slightly larger than was the gap in the applications software rating. The highest average rating is 0.7 points above the highest average for packaged applications software. The lowest is 0.2 points above the lowest average for packaged applications. This suggests greater satisfaction with systems software, as well as more interest on the part of respondents.

These data suggest that respondents to the survey rate packaged systems software under a more stringent set of guidelines than they do packaged applications software. Applications software is expected to meet the needs of end users. These will often be non-technical personnel, and ease of use will be an important attribute of software they will want to use. The more technical staff will be using systems software. They do not expect it to be as user friendly as applications software, but performance is extremely important. Ease of implementation and software features for systems software were both rated above 4. The strength of these ratings reflects the technical positions of the respondents. Systems software must be designed to meet high levels of performance and offer ease of implementation and a range of features in order to attract the technical user.

Respondents who rated criteria for custom developed software—applications and systems—were those working in a midsize to mainframe environment. Two-thirds of these respondents were from Department of Defense agencies. This suggests that vendors of custom developed software need to concentrate on marketing to DoD agencies, where custom software is being utilized more consistently. Exhibits IV-16 and IV-17 contain findings from data generated by these responses.

EXHIBIT IV-16

Vendor Selection Criteria
Custom Applications Software

Criterion	Average Rating*
Ease of Use	4.4
Software Features	4.3
Application Knowledge/ Technical Expertise	4.3
Ease of Implementation	4.0
Performance	3.9
Documentation	3.9
Product Price	3.9
OSI Compliant	3.9
Training	3.8
Support Reputation	3.8
Federal Experience	2.6

*1 = Not important; 5 = Very important

Respondents rated the criteria for evaluating custom developed systems and applications software similarly. Although the criteria appear in a slightly different order, the relative values of the ratings show how close in importance the criteria were perceived to be. With the exception of the federal experience of the vendor (rated at 2.6), all these criteria have been rated at 3.8 or higher. As with packaged software, federal experience is the lowest rated criterion for all custom developed software.

EXHIBIT IV-17

Vendor Selection Criteria
Custom Systems Software

Criterion	Average Rating*
Performance	4.3
Software Features	4.3
Application Knowledge/ Technical Expertise	4.3
Ease of Use	4.2
Ease of Implementation	4.1
Documentation	4.0
Support Reputation	3.9
Product Price	3.9
OSI Compliant	3.8
Training	3.8
Federal Experience	2.6

*1 = Not important; 5 = Very important

These findings confirm that agencies are looking for software that meets their functional and performance needs, and are not focusing on the federal experience of the vendor. Federal experience is evaluated by the GSA and contracting specialists, not technical personnel and users. Ratings of other criteria at 3.8 or above show that a vendor's support reputation, software training, software documentation and OSI compliance are important.

INPUT found that the cost of custom developed software, as well as packaged software, is one criterion that is not as important as might be expected. Product price was rated slightly higher for custom developed software than for packaged software, but neither were in the top five criteria. This shows that, while vendors must stay competitive in price, they should also concentrate on the performance and ease of use of their products. Technical competence and software features that will help agencies meet the growing list of government software standards are also necessary.

A recent ruling by the General Services Administration's Board of Contract Appeals (GSBCA) may affect how agencies evaluate the cost effectiveness of custom software. The GSBCA upheld an Air Force decision to award an Ada contract to the higher-priced bidder based on a measure of productivity that lower-priced bidders said was too low. There was a large gap between estimates of time required to write the software for the system, and the number of lines of code required. The winning bid reflected the longer time, lower production rate, and greater number of lines of code. The Air Force said the winner had a superior technical approach. The number of lines of code produced per day is directly related to the complexity and sophistication of the software to be developed, the Air Force said. The price of the award was less important than the ability of the vendor to meet the system requirements.

When INPUT compared civilian and defense agency responses on vendor selection criteria, additional trends were discovered. Exhibit IV-18 illustrates the differences between DoD and civilian agency ratings of custom software criteria. INPUT considers the rating difference significant if the difference is 0.5 or greater.

Responses suggest that a vendor's support reputation is only moderately important to civilian agencies, but more important to defense agencies. The rating difference of 1.3 is significant. Further comparison reveals that vendors' federal experience and application knowledge/technical expertise are more important to DoD agencies purchasing custom software than to civilian agencies. The data suggest that vendors marketing to defense agencies emphasize their capabilities, experience in the federal sector and reputation for supporting software.

The difference in ratings for OSI compliance suggests that, while all agencies are mandated to abide by GOSIP standards for open systems, civilian agencies are slightly more committed to OSI-compliant software than are DoD agencies. Vendors will be expected to provide OSI-compliant software very quickly.

Respondents told INPUT that vendors will be overwhelmed by GSA reliance on federal software standards if the industry is not prepared to meet the requirements of these standards. Software selection will include standards compliance criteria in addition to the usual performance and function criteria.

EXHIBIT IV-18

Vendor Selection Criteria—Custom Software

Criterion	Average Rating*		
	Civilian	Defense	Total Sample
Ease of Use	4.0	4.3	4.2
Ease of Implementation	3.4	4.3	3.8
Performance	4.4	4.2	4.3
Documentation	3.8	4.1	4.0
Training	4.0	3.7	3.8
Support Reputation	3.0	4.3	3.6
Software Features	4.4	4.2	4.3
Application Knowledge/ Technical Expertise	3.8	4.5	4.1
Federal Experience	2.0	2.9	2.4
OSI Compliant	4.25	3.7	4.0

*1 = Not important; 5 = Very important

E
Use of Ada

The U.S. Congress has mandated that all DoD agencies use the Ada programming language, effective June 1, 1991. The mandate has extended mandatory Ada use beyond weapons systems, which were covered by the Deputy Secretary of Defense mandate of March, 1987. Use of Ada for all DoD programming is a major element of the DoD Software Master Plan. DoD agencies will be exempted from using Ada where it can be proven to be not cost effective, or where a special exemption has been granted by an official designated by the Secretary of Defense.

Ada was designed to be useful for increasing productivity and for the development and maintenance of applications using relational data bases. It is the common programming language that DoD planners have chosen for the military. Ada is a modular language; programmers can write, test and compile their code in different pieces and expect their program to run fairly well the first time. As a standard, Ada was also designed to minimize problems in connecting different hardware types and architectures. The portability of applications and the reusability of code makes the language desirable for large projects, such as those undertaken at DoD and NASA. The benefits of Ada are more obvious in projects that have more than 100,000 lines of code.

Ada is a highly structured language, useful for writing reliable, easily maintained systems. But some critics charge that the language has become antiquated and needs revision or rewriting. The current Ada language form is outlined in the Reference Manual for Ada Programming Language MIL-STD-1815A. This manual also incorporates the current standards in Ada design.

Efforts to address the criticism that Ada is an antiquated language are under way. The Ada 9X project has been undertaken by the DoD Ada Joint Programming Office (AJPO) to revise the language. The project goal is to revise Ada to meet essential user needs while maintaining stability in the marketplace, e.g., protecting investments in tools, training programs, and programmers. The Ada 9X office is being run for the AJPO by the Air Force. The cost for Ada 9X has been about $12 million over five calendar years. The AJPO is aiming for a revised standard by 1993.

Three Ada compiler companies have been awarded contracts to test the effect of proposed changes to the Ada language. Each of the contractors will work with at least one additional company that will test how proposed Ada 9X changes affect the contractor's compiler. Congress has doubled the AJPO fiscal 1991 authorization to $22.6 million. This strengthens the perception that Congress is serious about the Ada mandate.

The Army and the Air Force have taken the lead in using Ada in their systems, and the Navy is increasing its use. The Navy's Information Technology Acquisition Center says that the Navy's broad Ada use applies to both mission-critical systems (MCCR) and automated information systems (AIS). In the recent Gulf War, the Air Force Space Command quickly turned an Ada-based strategic missile warning display into a tactical missile warning display. Air Force programmers were able to rewrite the program and ship it overseas within five days. The displays were in place in time to monitor the SCUD missile attacks against Israel.

The Air Force recently announced that Ada is now the single, common, high-order computer programming language for all computer resources used in the Air Force. Air Force system managers are encouraged to move to Ada with any software or hardware upgrade. Projects written in another language and already in place must be reprogrammed in Ada if more than one-third of the existing code is altered at one time. Exceptions will be made for commercial off-the-shelf (COTS) software.

Some applications are being developed in Ada by civilian agencies. Although there is no single mandate to use Ada throughout NASA, NASA presently develops 10% of its software in Ada. The Federal Aviation Administration is writing all software for the National Airspace System Plan in Ada. The FAA considers Ada the best programming language for the job.

NASA has established the Computer Software Management and Information Center (COSMIC) to distribute software developed with NASA funding. It aims to ensure that industry, other government agencies, and academic institutions will have access to NASA's advanced software technology. Although COSMIC has information on more than 1,200 programs, only a relative handful involve Ada. Exhibit IV-19 lists some of these programs.

The Army has been most supportive in promoting the use of Ada as a means of improving software development from a managerial and technological perspective. The "Common Software Concept" is a layered approach being used to develop a variety of Army systems. These include air defense platforms that allow missions to be changed by rebooting new software. The Major Army Command (MACOM) commanders and/or program executive officers are charged with developing their own Ada implementation plans.

EXHIBIT IV-19

Ada Software in COSMIC Collection

Program Name/Source	Development Platform
Flight Dynamics Analysis System NASA Goddard	DEC VAX, VMS 4.3
GATEWAY - Communications Gateway Software, NASA Goddard	DEC VAX, VMS 4.7
Gamma Ray Observatory Dynamics Simulator, NASA Goddard	DEC VAX, VMS 4.0
Ada NAME LIST Package, Jet Propulsion Laboratory	DEC VAX, VMS 4.5
Ada Linear Algebra Package, Jet Propulsion Laboratory	DEC VAX, VMS 4.5
General Purpose Ada Packages	DEC VAX, VMS 4.5
C-Language Integrated Production System Ada Version, Barrios Technology	386-based PC with Alsys 4.3-1 Ada Compiler
Computer Assisted Scheduling System, McDonnell Douglas Corp.	Sun Workstation, Verdix Ada Compiler

Currently there are more than 600 government, education and industry efforts listed in the Ada Information Clearinghouse (AIC) data base of Ada projects. Ada use in programming by government agencies has been expanded to include C3, surveillance and reconnaissance, weapons and avionics systems. Patriot missile upgrades will be done in Ada. Embedded systems and real-time applications are currently using Ada, and agencies are also migrating toward decision support systems that use Ada. The largest potential use for Ada is expected to be in the area of military communications programs throughout the DoD.

DoD reluctance to turn to packaged software to assist in constructing complex systems with Ada is beginning to give way. The recent announcement that the DoD is placing a commercially developed information retrieval and delivery system known as TOPIC at the heart of two major contracts is evidence of this. The successful software company is Verity, Inc. Meanwhile, Rational Technology is providing a commercial software support environment central to major projects at NASA, the FAA and the DoD. When the prime contractor creating the NASA Space Station's Software Support Environment ran into cost and technical difficulties, Rational Technology was brought in. The FAA brought Rational software into the Automated Aviation System contract to create a software support environment (SSE) when NASA attempts to develop the SSE were in trouble. Through these efforts the use of proven, off-the-shelf, commercial Ada environments has begun within the federal sector. Bias and the entrenched conservatism of large organizations may well serve to keep the effort restricted.

The Defense Advanced Research Projects Agency (DARPA) is attempting to develop a standard software environment for the defense community. The program is called Software Technology for Adaptable, Reliable Systems (STARS). The software environment would serve as an integration platform for development and system tools. The success of this program will provide agencies and industry with a common reference for development and integration of efforts.

Some agencies resist the use of Ada because Ada is seen as a high-cost and high-risk option, partially because of the degree of training thought to be needed by programmers before they can be productive. Other reasons given for resisting Ada include: a perception that Ada does not support object-oriented design methodologies; the perception that Ada is big, slow and clumsy; the perception that Ada's tasking model is too slow for real-time systems; and the resistance that large organizations have to making any change.

Critics who have complained of a lack of Ada compilers will soon have no basis for the criticism. In November of 1990, the AIC listed 524 compilers that had passed the test suite and were validated for use. The number dropped in December because a new test suite was instituted. AIC reports that considerable implementation efforts are continuing, and it expects the list of validated compilers to grow from the 143 listed as of February 1, 1991. AIC announced that ACVA 1.11, the official validation test suite, would remain in effect until at least January 1, 1992. Compilers with certificates associated with this test suite will remain current until at least March 1, 1993.

Engineers and designers undertaking Ada research are looking at the use of CASE tools with Ada, the most effective reuse of code, and the use of Ada in object-oriented design. Ada can be used for object-oriented programs, but it does so awkwardly.

INPUT asked all respondents what their reliance on Ada programming will be, and what impact the DoD mandate will have on their agency. Most respondents from DoD agencies said they are using or have plans to use Ada. Respondents from civilian agencies said they have no plans to change their current programming languages. The DoD mandate does not affect civilian agencies.

The effect of the DoD mandate on respondents in defense agencies varies. Most said that they will be implementing the use of Ada. Some indicated that this was difficult and expensive to do. They need and are looking for productivity and development tools to use with Ada. Most indicated that the mandate is being taken seriously. A spokesman for the Navy Information Resources Management office said that meeting the June 1, 1991 switch-over date for Ada would present a major training problem. Most personnel working in the design phase of some Navy activities have no experience with Ada. Sectors of the software industry prepared to provide support and training during the switch-over phase will find opportunities in the DoD.

Agency unfamiliarity with Ada, the different type of technology it represents, and unresolved technical issues have impeded wider federal acceptance. This lack of acceptance is a result of several factors:

- A shortage of trained government personnel and experienced agency staff. If more Ada expertise is developed, there will be more awareness of Ada and its potential as a highly structured language.
- Lack of Ada-specific software development tools
- Unsuitability of Ada for rapid transaction processing and for object-oriented methodologies
- Lack of availability of a standard Ada SQL interface to use with various DBMSs

Funding for program development has been a problem. However, government technology transfer programs can help decrease the initial costs. Through these technology transfer programs, completed software efforts are ready to be shared with industry and other agencies. Existing technology may thus become the basis for new development and cut development costs for industry and other government agencies.

The Computer Software Management and Information Center (COSMIC), sponsored by NASA, is a central office established to distribute software developed with NASA funding. COSMIC is part of the NASA Technology Transfer Network. There are some 1,200 programs in the COSMIC collection. Although the Ada portion of this collection is small, it is growing. The software consists of highly technical programs that are reusable. COSMIC software is free to NASA users, $50 to $5,000 for others. Educational institutions may get COSMIC software for half price. Developers of highly technical software efforts need to investigate this potentially valuable resource.

In a joint effort between government and industry, a small company of software engineers has persuaded two government agencies to develop Ada-based computer systems in tandem. Software Productivity Solutions (SPS) Inc. is developing reusable software systems in Ada on Sun-3 workstations for the Army and NASA. Funding for the work is through two individual $500,000 Phase II Small Business Innovation Research (SBIR) projects. The software developed under the two programs will be interoperable. Each agency will receive an automated reusable software system with performance features called for in its contract, as well as those called for in the other contract. The Army project is the Automated Reusable Components System Reuse Library System; NASA's is the Eli Software Reuse Tools System, a knowledge-based reusable software synthesis system. This is an example of how the Small Business Administration's SBIR program provides research and development opportunities for small businesses looking for work in the federal sector.

F
Software Technology Trends

Software trends that are impacting how agencies accomplish their information processing are listed in Exhibit IV-20. Agency respondents cited government standards most frequently. Although standards are not a technology trend, they are a reflection of the way government is addressing technology procurement. Federal standards were said to be impacting agencies by changing procurements, changing procurement procedures and altering training requirements. In relation to the POSIX standard, a respondent told INPUT that an avalanche is about to happen in government procurement. The pressure from the GSA is going to be overwhelming, INPUT was told. The software industry must be prepared for meeting the POSIX and GOSIP standards in future procurements in order to be competitive in the federal environment.

EXHIBIT IV-20

Software Trends Impacting Agency Information Processing

Trends	Rank*
Standards	1
RDBMSs	2
Networks/Distributed Systems	3
CASE Tools	4
Communications Technology	4
SQL	5
AI	5

*Rank based on frequency of mention by respondents.

Relational data base management systems (RDBMSs) were mentioned almost as frequently as standards. Although the federal market is generally seen to be lagging behind the private sector in adopting new technology, agencies are now embracing this more efficient data base structure for their information systems operations. Agency demands for the integration of available information and the need for systems able to handle large volumes of information are driving this movement.

The National Archives, for instance, is currently building prototypes of the Archival Information System. This system will be built around a combination of an RDBMS and a text information management system. The system will need to describe archived records through all sorts of tracking information. The Archives expects to award a contract in 1992 for the turnkey hardware and software system. It is estimated to cost about $10 million.

When respondents were asked how software trends were impacting their agencies' information systems, their responses indicated they were not prepared to distinguish software trends from other information technology trends. Networks/distributed systems were the third most important trend, based on the frequency of mention by respondents. Growth in distributed processing and networks will provide more end-user processing and access to multiple, geographically distributed data bases. The involvement of end users in information systems was recognized by respondents

as important. Though networks will bring more power to the user, they will also impact the security of systems. Software vendors and developers need to look at the changes that networking is bringing to the federal market. Software for distributed processing, security procedures, integrated and interoperative systems will be needed to support agency functions.

CASE tools and communications technology were mentioned by respondents with the same frequency. Respondents said they appreciate the way CASE tools provide integrated and fully documented applications and increase productivity. Software products that allow systems to use the higher transmission speeds of fiber optics technology were also valued by respondents.

The integration of CASE tools and other new technology into a system was also said to present planning problems for agencies. A large organization trying to deal with the introduction of new technology needs to plan how it will implement the change. It is easier to revert to old systems and old methods, respondents said. The software industry must be aware of the need to ease the planning burden for management attempting to utilize new technology.

Artificial intelligence products and SQL products were both mentioned with the same frequency. AI/expert systems are being utilized by a wide range of civilian and defense agencies. Although use is currently centered in more civilian agencies, the DoD is striving to evaluate and implement this technology. When Ada is fully capable of working with the object-oriented methodology, AI will be used more in the DoD. DARPA has fostered research and studies, and the Army established the Artificial Intelligence Center (AIC).

SQL allows natural language retrieval and query for data base users. Distributed systems with increased networking enhance the value of SQL because the number of users grows. The development of the technology to make it more flexible and less dependent on specific software applications or operating systems will increase the value further.

1. Fourth- and Fifth-Generation Languages

Fourth- and fifth-generation languages (4GLs and 5GLs) are an integral set of functions designed to assist end users with minimum technical knowledge in developing applications. Software products referred to as 4GLs and 5GLs are more accurately described as comprehensive software development tools that are intended to extend the power of third-generation architectures and technologies. Agencies have started to acquire these packages as a means of offloading requests for ADP staff time. Respondents cite the need for efficiency and shortage of staff as reasons for increased use of 4GLs and 5GLs.

The primary issues that are of initial and general concern to potential users are programmer productivity gains (during the development phase and the maintenance cycle), performance and hardware resource considerations, and management issues. Within the government, however, serious consideration must also be given to the future impact of these languages from a conversion standpoint.

Agencies are finding that successful implementation of fourth-generation technology requires careful planning, administration, and management throughout the organization. Items such as policy and procedures, standards, data administration and security, etc. should be carefully established prior to implementation, and monitored and revised as necessary after implementation.

There has been a shift in 4GL and 5GL use within the federal government from that of a few years ago. At present, agencies are taking more advantage of the productivity gains and ease of use promised by this technology. Fourth- and fifth-generation languages are being used for data base and software development purposes, in addition to providing general purpose computing and data base support to users.

The National Institute of Standards and Technology (NIST) published a guide to selection of 4GLs to go along with its 4GL Functional Model. Federal agencies are benefiting from some guidance in this area. Many agencies are looking for cost-justification data, selection criteria, or comparison reports.

Other technical industry trends, however, may lead to a reduction in the use of 4GLs and 5GLs in the federal government. INPUT sees the growing popularity of computer-aided software engineering (CASE) as a partial replacement for 4GLs and 5GLs. In many cases, the close integration of CASE and DBMS products will obviate the need for 4GLs and 5GLs.

CASE tools and methods are categorized by the phases of the software development life cycle they address. They are designed for analysis, design, development and maintenance. The development of CASE tools for languages other than COBOL, e.g., Ada and C, will accelerate the adoption of CASE tools for functions that 4GLs and 5GLs are currently filling.

Some respondents associate 4GLs and 5GLs with SQL, using them for the same purposes. In these cases, they are associated with easing users' interface with data bases for data retrieval or query. Some use them as development tools.

2. Artificial Intelligence

Artificial intelligence (AI) efforts at DoD and civilian agencies are ongoing. DoD has begun several projects, particularly in the intelligence sector. This sector needs to train analysts and incorporate new technologies that provide useful decision aids to improve productivity. Artificial intelligence is ideal for these kinds of applications. The growth of AI and knowledge-based systems management will also continue to be important in providing tools to manage a fully integrated distributed defense information system.

AI is gaining in use in tactical situations, automated planning, and support applications. Research is currently under way exploring its role in unmanned military vehicles. The DARPA Strategic Computing Program has employed AI in its Autonomous Land Vehicle (ALV), Pilot Associate, and Air/Land Battle Management (ALBM) projects. Furthermore, the armed services have been working on prototype projects to assist with the analysis and application of requirements. Many studies and projects have already been completed.

The Congressional mandate for DoD to use Ada for new projects will impact AI research and development. Since Ada does not lend itself readily to use with object-oriented methodologies, AI project managers will either seek waivers or adapt projects to the current limitations of the language. The lack of CASE tools that can be used with Ada, or CASE tools that are object-oriented or support object-oriented development, will also affect AI plans. Object-oriented methods are currently immature, although they can be developed into products to improve quality and productivity in the federal sector.

Large-scale information processing is the principle area of application for AI in civilian agencies automating decision-support and case-processing functions. These systems are mainly end-user production-oriented, and are standalone expert systems. The Internal Revenue Service (IRS) has developed an expert system to provide AI capabilities for taxpayer assistance personnel in its Taxpayer Service Division. The system is intended to improve the accuracy and level of service of the IRS telephone tax information specialists. The pilot program is being reviewed and adapted to national use. The Social Security Administration migrated its examination, processing, and approval of applications for benefits to an expert system. The Department of Education Office of Research and Improvement is using AI for problem solving and getting information to and from educators and schools. The Department of the Interior Office of Surface Mining will use AI for scientific applications in hydrology and geology. It expects its use of AI to increase.

Similar large-scale administrative activities in the federal government that must apply knowledge and regulations/guidelines to specific processing areas are prime candidates for AI systems. These areas include licensing, forms processing, coding and validation, and reference and referral. Although standalone expert systems currently account for most AI development, eventually artificial intelligence will serve to link diverse sources of information to agencies' mainstream data processing.

G

Impacts of Standards and Certification

Federal agency acquisition of software will be guided by the requirements of information systems standards. Procurements are now—or will soon be—delimited by standards that include:

- The Portable Operating System Interface (POSIX) Standard, adopted by the GSA in 1988 and now mandatory. POSIX specifies standard routines for given functions within the UNIX environment. Theoretically, POSIX is independent of any specific operating system; however, it is generally associated with UNIX systems. Agencies have released many RFPs for portable applications based on POSIX since its adoption in 1988. The POSIX standard provides a basis for a universal UNIX interface. POSIX bindings for languages, e.g., FORTRAN and Ada, are being completed by the IEEE to facilitate developing software that is truly portable across vendor platforms.

- The Information Resource Dictionary System (IRDS) Standard (FIPS 156), now mandatory for all federal agencies. The standard specifies a software system that provides facilities for recording, storing and processing descriptions of an organization's data and data processing resources. The federal procurement of data dictionaries or repository systems must comply with FIPS 156.

- The Government Open Systems Interconnection Profile (GOSIP), mandated June 1990 and revised April, 1991. The revision is known as GOSIP2 (FIPS 146-1); federal agencies will be required to include GOSIP2 specifications in requests for proposals and contracts by October 3, 1992. GOSIP is an effort by the government to simplify and ease the assimilation of the Open Systems Interconnection (OSI) technology into federal agencies. OSI was developed to allow disparate computer systems to interoperate in a data communications environment. OMB has mandated the use of OSI-compatible systems throughout the federal government. GOSIP Version 1 is a technical specification that embodies a core set of OSI protocols and services. GOSIP2 expands the current core set to include additional functionality. GOSIP2 will allow greater

flexibility to agencies using multiple networks and foster office document interchange across different systems. Version 2 also incorporates ISDN technology that allows connectivity to telecommunications networks. The GOSIP standard incorporates the TCP/IP standard.

- The ANSI Standard for the "C" programming language (FIPS 160) became effective September 30, 1991 and will be mandatory September 30, 1992. The ANSI C standard joins federal standards for Ada, FORTRAN, COBOL, and Pascal. Because the language is closely associated with UNIX and POSIX, it is used frequently in civilian agencies. The standard is important in facilitating increased portability and compatibility, and reducing development and maintenance efforts.

- Ada was adapted as a Military Standard in 1980 (MIL-STD 1815). It was approved as an ANSI standard in 1983 (MIL-STD 1815A). Ada is a single, common, high-order language mandated for use in DoD agencies by Congress, effective June 1, 1991.

- Structured Query Language (SQL) standards are set forth in FIPS Publication 127. The ANSI standards for SQL are known as ANSI Level 1 and ANSI Level 2. SQL was developed by IBM for creating and querying data bases. SQL is a standard adhered to by agencies because it enables them to develop consistent retrieve and query capabilities for relational data bases. SQL capabilities include defining, manipulating, and controlling data in relational data bases. Most vendors' relational data base products currently support SQL.

Being able to apply these standards to requirements eases the acquisition process for agencies by giving them clearly defined functional specifications. The vendor community also benefits from the consistency of functional requirements when preparing offerings for agencies. The issuance of governmentwide standards helps to aggregate the market and establish consistency with commercial product development. Standards to which everyone must adhere provide a more level playing field. Many of the accomplishments in formulating these standards are attributable to the joint efforts of the National Institutes of Standards and Technology (NIST) and industry. The standards respondents cited as those they are complying with in developing software systems, acquiring applications and specifying requirements are listed in Exhibit IV-21.

Agencies are becoming increasingly aware of the need to adhere to existing standards and to establish additional standards. Ninety percent (90%) of the respondents said they will be complying with the GOSIP standard in their acquisitions. This was the most frequent standard mentioned by respondents. Comparing these responses with those from a previous edition of this report reveals a significant average growth—28%—in agency commitment to standards compliance. Agencies are trying to accommodate the interconnectivity of applications among multiple hard-

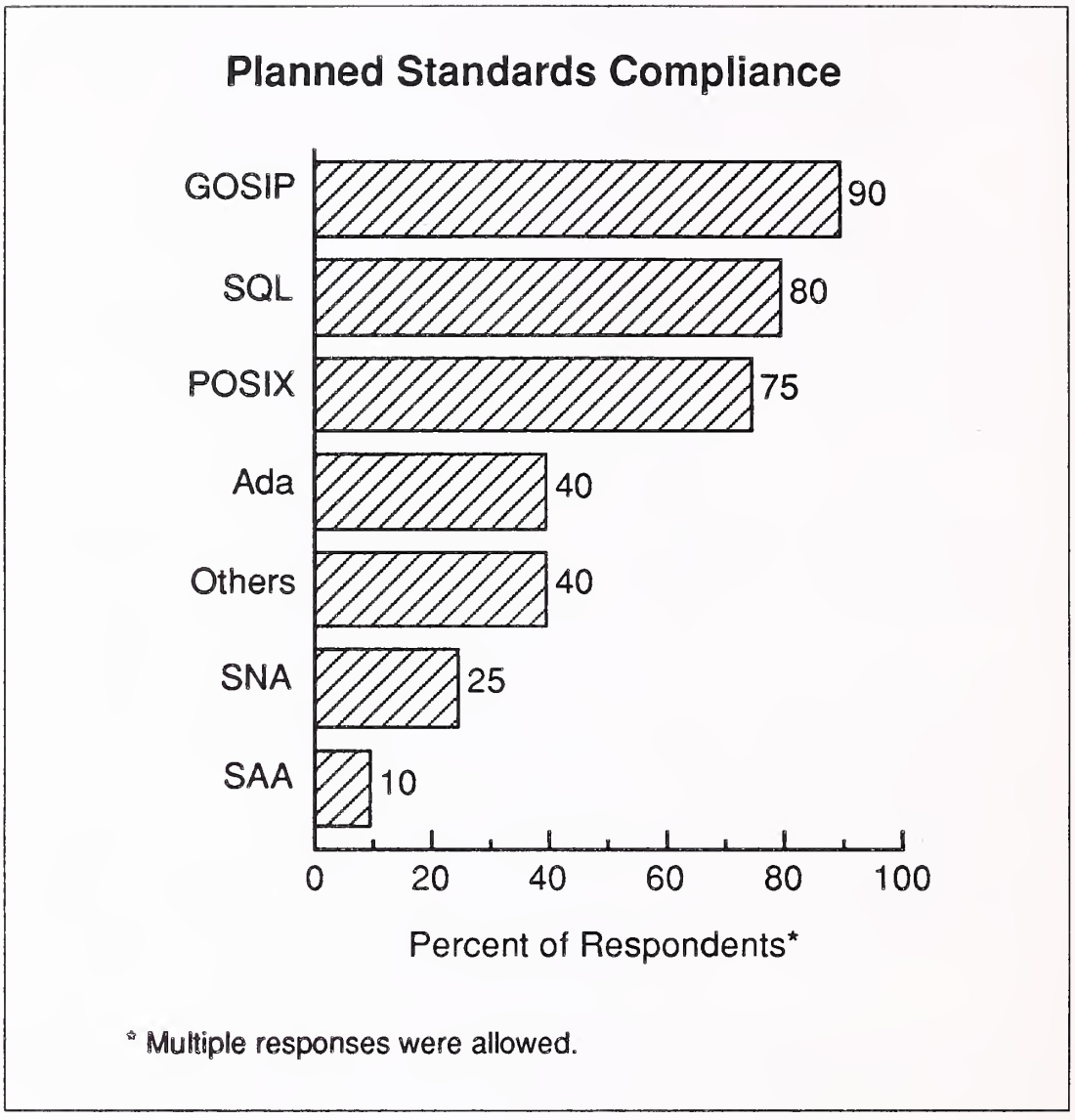
ware systems by adhering more strongly to GOSIP, SQL, POSIX and Ada. Vendors and software developers will find that products that comply with these standards are in demand. System planners are striving for interoperability and interconnection between systems. Applications need to be portable across different platforms. The federal government is rapidly becoming a market that does not contain options.

UNIX continues to gain popularity throughout the federal government as a solution to incompatibility between hardware environments. UNIX will remain of value as a software development system, having become synonymous with "POSIX" in the minds of many. UNIX is particularly associated with superminicomputers and minisupercomputers but has seemed to stall efforts for incorporation into the desktop world. Some attribute this to the overwhelming use of MS-DOS on PCs, and the lack of a good desktop UNIX software product. Critics say the desktop environment is meeting the needs of word processing and spreadsheet users, not more general use of the system as a computer. Also, UNIX needs 12 times the memory of MS-DOS, and is more expensive. Just because an operating system is POSIX compliant does not mean that agencies will justify spending as much as 50% more to acquire it.

The government requirement for open systems has generated responses from vendors of other than UNIX-based systems. POSIX compliance and open systems are not equivalent; the open systems requirement is for interoperability, connectivity and software portability. DEC says that by 1992 VMS will support the POSIX standards, and will be submitted for certification and branding by X/Open. X/Open, an independent consortium of international computer vendors, looks at standard programming interfaces, standard networking protocols and standard user interfaces. The DEC effort will bring a different technology base to the market to interface with the UNIX world.

Government standards activities also are focusing on reduction of software risks. Standardization of government contractors' software development projects has been impacted by DoD Standard 2167 (which directs defense system software development, testing, documentation, and evaluation of requirements) and by the Software Management Assurance Program, its NASA counterpart. These recommendations and standards are an attempt by the government to share risk. They are aimed at installing a specific set of procedures for contracts to promote development of high-quality, reliable software.

EXHIBIT IV-21



H

Acquisition Methods

Regardless of whether software was acquired as a package or through custom development by a professional services firm, the methods of acquisition include competitive bids, GSA Federal Supply schedules, or purchase orders.

As shown in Exhibit IV-22, differences exist in the frequency with which agencies acquire different types of software.

- Competitive bids are more commonly used than other acquisition methods for all types of software products. INPUT found that defense agencies tend to make more frequent use of competitive bids than do civilian agencies.

- GSA schedule purchases are more often used for packaged software than for custom software or contract maintenance.
- GSA schedule orders and direct agency purchase orders, though used less frequently than competitive bids, do provide opportunities for all types of software vendors.

The GSA is reviewing and recommending changes in the multiple-award schedule program. The review will address the timeliness of schedule awards and the amount of paperwork required to do business with the GSA, among other things. Contractors are required to submit large amounts of paperwork when applying for the schedule, and often receive schedules months late.

EXHIBIT IV-22

Agency Acquisition Methods for Software and Related Services

	Average Percent by Method*		
	Competitive Bid	GSA Schedule	Purchase Order
Packaged Systems Software	74	21	5
Packaged Applications Software	68	22	10
Custom Systems Software	95	2	3
Custom Applications Software	89	5	6
Contract Software Maintenance*	92	3	2

*3% of responses use 8(a) firms for contract software maintenance.

The review is scheduled to be a two-year effort. GSA is seeking input from government customers and industry. The initial test beds for the project review are the Federal Supply Service and the Information Resource Management Service. Each averages annual schedule sales of more than $1 billion. Vendors who may enjoy benefits from a revised schedule need to become involved in the review process.

In a previous edition of this report, INPUT asked respondents to rank testing and acceptance procedures for software. The favorite testing and acceptance procedure varied for each category of software products and services, as shown in Exhibit IV-23. For both packaged systems and applications software, respondents indicated they will use trial periods more frequently than other methods to evaluate new software. Agencies will also employ independent verification and validation (IV & V) studies with the same frequency as trial periods to test packaged systems.

Both custom systems software and custom applications software will be evaluated more frequently using IV & V measures. Benchmarking received the same ranking of use as IV & V for custom applications. In an earlier version of this report, the trial period was rated as the most common testing and acceptance procedure for all types of software products. It was generally considered the easiest, least costly process to implement. Agencies are beginning to shift away from using this method exclusively for all types of software. They are now trying to implement the testing procedures that are more appropriate for each software type.

EXHIBIT IV-23

Agency Ranking of Testing and Acceptance Procedures Used for Software

Software Products	Average Rank* of Testing and Acceptance Procedures			
	Trial Period	Bench-mark	Parallel Testing	IV & V
Packaged Systems Software	**1.4**	1.7	2.8	**1.4**
Packaged Applications Software	**1.4**	1.8	2.4	2.7
Custom Systems Software	2.1	1.9	2.2	**1.8**
Custom Applications Software	2.2	**1.8**	2.0	**1.8**

[ ] = Most likely used

* Rank based on likelihood of use.

Benchmarking was the second most frequent testing procedure named for three categories of software products. It is often costly but is sometimes the only appropriate testing procedure. A 1982 GAO study ("Benchmarking: Costly and Difficult, But Often Necessary When Buying Computer Equipment or Services," GAO/AFMD-83-5, 10/22/82, B-208077) of 65 benchmarks indicated that typical benchmark cost (external cost only) ranged between $40,000 to $200,000, but in GAO's opinion was the only appropriate test procedure. Much of the cost, however, usually stemmed from agency errors in benchmark programs, poor documentation, and difficulties in communicating with the agency in resolving technical issues caused by the first problem. GAO recommended that, when appropriate, other evaluation methods be used. In order of increasing cost, these methods include:

- "Paper" or technical evaluation
- Analytical modeling
- Simulation

INPUT reconfirmed this view with GSA. Agencies must, of course, be mindful of GAO's auditing standards. Some agency systems may be subject to GAO audit. These audits are specifically designed to assess the reliability and, therefore, the degree of risk involved in using computer-processed information. Various data reliability tests are performed by auditors on a timely basis to ensure the relevancy, accuracy, and completeness of computer output.

The standards the GSA will apply to the performance of software will become integral to evaluation and testing of software or related services. Vendors and developers need to add testing to the mandatory standards in the design of their testing suite.

Respondents to the current survey were asked what types of vendor support they intended to acquire through 1996. As shown in Exhibit IV-24, agencies intend to rely heavily on vendors for most types of software support. The need for support will be light for modifying off-the-shelf software and for developing custom documentation for systems software. Many agencies are still retaining the necessary in-house technical expertise to perform software applications modifications. INPUT believes that federal demand for contractor assistance for all types of programming services will grow as long as agencies continue to be constricted by inadequate pay scales and benefits that are not competitive with those in the private sector.

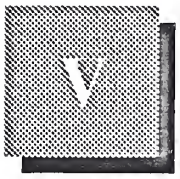
EXHIBIT IV-24

Software Support Needed for Applications and Systems Software

Support Categories	Percent of Respondents	
	Applications	Systems
Install Release Updates	56	44
Install New Software	50	44
Modify Off-the-Shelf Software	17	22
Fix Errors	50	56
Modify Custom Software	28	22
Software Training	50	83
Develop Custom Documentation	50	11

*Rows will not equal 100% due to multiple responses.

The high percentage of respondents who will contract for training is further evidence that the federal government is taking at second look at the training component of systems development. Information has surfaced about reports that say the value of computer resources has often been under-realized because of inadequate attention to training. The federal information systems policy, which stresses the cost/benefit ratio in technical procurements, is placing a higher value on a trained user. Vendors providing training support need to be prepared for growth in this sector of the market.



Competitive Trends

The preceding chapter provided a view of the federal market for software and related services from the agencies' perspectives. This chapter contains representative vendors' opinions for contrast. This comparison will assist readers in developing an understanding of the opportunities and concerns encompassing this market.

First, however, this chapter compares market penetration in four software-related areas. The federal government awards many contracts with sizable software components to systems integrators, weapons manufacturers, and other types of firms. Therefore, some surprising names appear in the following lists. However, software developers can realize significant revenues by subcontracting to the vendors on major federal projects. Therefore, it is useful to review the data and identify the leading software providers.

A
Software Products

Agencies acquire software products through a variety of means:

- GSA schedules
- Open market purchases
- Embedded purchases (where software is bundled, at no additional charge, with equipment)
- Integrated purchases (where unbundled software is included with other products and services)

1. Overall Market

Exhibit V-1 lists the leading software products vendors, as reported by the Federal Procurement Data Center. In analyzing the data, INPUT made certain adjustments based on obvious data entry errors by the reporting agencies.

EXHIBIT V-1

Leading Federal Software Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
IBM	31,218	23,896	55,114
Unisys	22,308	18,938	41,246
Digital	8,231	13,480	21,711
CSC	7,168	11,162	18,330
GTSI	5,174	5,160	10,334
Oracle	3,776	5,545	9,321
Honeywell	4,904	4,402	9,306
Entek	5,401	2,067	7,468
AMS	4,397	2,581	6,978
Data General	6,402	152	6,554

Equipment manufacturers dominate the list, since they provide large numbers of software products with their hardware. This dominance extends beyond the top ten. For example, Zenith Data Systems ranks 18th with $3.8 million in software sales. Most of this total, nearly $3.5 million, occurred in FY 1989. INPUT believes these revenues resulted from residual orders on the Desktop II procurement.

2. Defense Software Sales

Exhibit V-2 lists the leading software vendors in the Defense Department. In comparing Exhibits V-1 and V-2, it is surprising to note that all of CSC's software sales came from defense agencies. On the other hand, while AMS ranks ninth overall, it does not even rank in the top 30 among defense agencies. This suggests that a large share of software sales comes from a relatively small handful of contracts.

EXHIBIT V-2

Leading Defense Software Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Unisys	20,808	16,416	37,224
IBM	19,733	12,129	31,862
Digital	7,427	10,999	18,426
CSC	7,168	11,162	18,330
Honeywell	4,806	4,307	9,113
GTSI	4,538	3,878	8,416
Entek	5,401	2,067	7,468
Oracle	2,594	3,897	6,491
Sterling Software	3,191	2,369	5,560
GM/EDS/Hughes	3,111	2,178	5,289

3. Civilian Software Sales

As pointed out above, AMS, while ranking tenth in overall software sales, failed to make the top 30 in defense. Exhibit V-3, covering software sales at civilian agencies, shows that all of AMS' sales came from civilian agencies. Overall, IBM captured 20% of the civilian software market. As shown in Exhibit V-3, the Department of Energy accounted for nearly one-half of IBM's civilian software sales.

EXHIBIT V-3

Leading Civilian Software Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
IBM	11,485	11,767	23,252
AMS	4,397	2,581	6,978
Data General	6,227	84	6,311
Unisys	1,500	2,522	4,022
Mantech	3,363	0	3,363
Digital	804	2,481	3,285
SAIC	1,341	1,538	2,879
Oracle	1,182	1,648	2,830
Sylvest Mgmt. System	2,406	0	2,406
GTSI	636	1,282	1,918

4. Agency Leaders

When evaluating market penetration, it is sometimes useful to compare the leading vendors in some of the major agencies. Exhibit V-4 presents this information in list form. IBM appears most frequently as the leading software vendor for a particular agency. However, different vendors have penetrated a wide range of agencies, often because of a single contract. As noted earlier, agencies acquire software products through diverse procurement vehicles. By pursuing multiple vehicles such as GSA schedules, open market contracts, and systems integration contracts, vendors can increase their market penetration.

EXHIBIT V-4

Leading Software Vendors by Agency

Agency	Vendor	FY 1989-90 Revenue ($000)
Navy	Advanced Systems Development	4,445
Army	IBM	9,315
Air Force	CSC	18,330
OSD	IBM	3,114
DCA	Unisys	17,840
Agriculture	Data General	6,227
Commerce	IBM	1,897
Energy	IBM	9,105
HHS	Sylvest Mgmt. Systems	1,942
Interior	AMS	5,289
Justice	SAIC	2,793
Transportation	Mantech International	3,363
Treasury	IBM	3,952
NASA	IBM	2,650
EPA	AMS	1,552

5. GSA Schedule Sales

Schedule sales for ADP software are also significant, totalling $51.8 million in FY 1989 and $50.8 million in FY 1990. However, as Exhibit V-5 shows, this market is highly concentrated. In fact, the top five vendors accounted for more than one-half of this market in each fiscal year.

EXHIBIT V-5

Leading Schedule ADP Software Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
IBM	14,844	14,426	29,270
Digital	6,741	4,219	10,960
GTSI	4,085	4,724	8,809
Oracle	3,050	3,877	6,927
Computer Associates	1,811	1,619	3,430
Hewlett-Packard	770	1,165	1,935
Falcon	838	917	1,755
Honeywell	790	632	1,432
Wang	921	277	1,198
Xerox	402	689	1,091

In comparing Exhibit V-5 with Exhibit V-1, it is apparent that schedule sales accounted for the bulk of several vendors' software business. IBM and Digital sold more than one-half of their software through GSA schedules. GTSI's schedule sales accounted for nearly 90% of its software revenue. Oracle's schedule sales were more than 70% of its total. These findings underscore the importance of GSA schedules as a conduit for federal sales.

B
Systems Analysis

Much federal contracting for software support is coded under the category "ADP Systems Analysis Services." This section identifies the leading vendors in this area, categorized in the same way as in the previous section.

1. Overall Market

Exhibit V-6 lists the leading systems analysis vendors in the federal government. Unlike the software products category, equipment vendors do not dominate this category. Rather, professional services firms and specialized defense contractors account for most of the revenue. As shown below in Exhibit V-9, all of Loral's revenues came from NASA. INPUT believes that, as was the case with Grumman in the software category, Loral's revenues were incorrectly coded.

EXHIBIT V-6

Leading Federal Systems Analysis Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Loral	0	67,633	67,633
PRC	16,876	10,291	27,167
Unisys	6,257	4,567	10,824
Viar	5,018	3,142	8,160
Control Data	1,746	3,916	5,662
AMS	3,191	1,770	4,961
Vector Research	3,999	0	3,999
SAIC	2,071	1,819	3,890
Digital Systems Group	0	3,382	3,382
Logicon	1,548	1,757	3,305

2. Defense Systems Analysis Sales

Exhibit V-7 lists the leading vendors in the Defense Department for systems analysis sales. A comparison with the previous exhibit shows that, while all of PRC's sales came from civilian agencies, virtually all of Unisys' sales came from defense agencies. In fact, as Exhibit V-9 will show below, most of these sales, especially in FY 1990, went to the Air Force. Also, all of Logicon's sales went to the Defense Department (also the Air Force). Digital Systems Group, on the other hand, sold only to the Navy. As was the case with software, relatively few contracts may account for the bulk of systems analysis sales.

EXHIBIT V-7

Leading Defense Systems Analysis Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Unisys	6,064	4,471	10,535
Control Data	1,059	3,619	4,678
Vector Research	3,999	0	3,999
Digital Systems Group	0	3,382	3,382
Logicon	1,548	1,757	3,305
EG&G	267	2,748	3,015
Graph-Tech	35	2,855	2,890
Digital	817	1,267	2,084
Graphic Tech	1,648	423	2,071
EER Systems	0	1,852	1,852

Also, the former Advanced Technology, Inc., now a subsidiary of PRC, performs large amounts of program management work at the Navy. Obviously, all of this work is entered under other federal supply codes.

3. Civilian Systems Analysis Sales

EXHIBIT V-8

Leading Civilian Systems Analysis Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Loral	0	67,633	67,633
PRC	16,876	10,291	27,167
Viar	5,018	3,142	8,160
AMS	3,191	1,607	4,798
Applied Technology Associates	0	3,217	3,217
Booz, Allen & Hamilton	1,971	843	2,814
SAIC	1,009	1,682	2,691
Advanced Management	1,737	608	2,345
Orkand	921	1,276	2,197
Information Network Systems	832	1,241	2,073

All of Viar's work comes from the Environmental Protection Agency. Viar is well known for its heavy penetration of EPA. All of AMS' work came from GSA, where it holds a major basic ordering agreement for the National Capital Region. Most, but not all, of Orkand's work came from the Labor Department. All of the business for Information Network Systems came from NASA. Finally, all of the sales for Applied Technology Associates went to GSA. These finding demonstrate how a handful of contracts account for most of the sales volume.

4. Agency Leaders

As was the case with software, it is sometimes useful to compare the leading vendors in some of the major agencies. Most of the work for each major agency comes from a few contractors. Often, only one or two contractors account for the majority of the work.

Exhibit V-9 lists the leading systems analysis vendors in some of the major agencies. Just as most agencies concentrate on one or two vendors, most vendors concentrate on one or two agencies. Most of the companies listed in Exhibit V-9 realized all their systems analysis revenues from a single agency.

EXHIBIT V-9

Leading Systems Analysis Vendors by Agency

Agency	Vendor	FY 1989-90 Revenue ($000)
Navy	Digital Systems Group	3,382
Army	EER Systems	1,852
Air Force	Unisys	9,277
OSD	Vector Research	3,999
Commerce	Ellsworth Associates	1,563
Energy	Proteus Corporation	1,938
Labor	Eastern Computers	2,037
Transportation	Advanced Management	1,545
Treasury	Network Management	1,236
Education	CBIS Corporation	1,141
NASA	Loral Corporation	67,633
EPA	Viar	8,160
GSA	PRC	27,145

5. GSA Schedule Sales

Exhibit V-10 shows the top five vendors for ADP systems analysis. PRC, including its (formerly) Advanced Technology, Inc. subsidiary, captured nearly $20 million in revenues over the two fiscal years. PRC's share represents nearly two-thirds of the total market, which reached $16.9 million in FY 1989 and $15.4 million in FY 1990.

EXHIBIT V-10

Leading Schedule ADP Systems Analysis Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
PRC	11,151	8,615	19,766
AMS	3,191	1,607	4,798
Applied Technology Associates	0	3,217	3,217
Honeywell	631	538	1,169
Digital	488	324	812

This data shows consistency with the previous exhibit, at least as far as PRC is concerned. Since GSA schedule sales were so high, one would expect PRC to be GSA's leading contractor. This is, indeed, the case. In fact, AMS is GSA's second largest systems analysis contractor, and Applied Technology Associates ranks third.

C
Systems Development

As was the case with systems analysis, agencies contract for systems development to help meet their tailored software needs. This section identifies the leading vendors in this category, along with applicable revenues. This section is organized in the same way as the two preceding sections.

1. Overall Market

Exhibit V-11 lists the leading systems development vendors in the federal government. In this case, the list shows a mix of equipment vendors, systems integrators, and professional services firms. Also, unlike the previous categories, the top five vendors obtained significant business from both defense and civilian agencies. Four of the last five realized most or all of their revenues from defense. The fifth, BDM, realized most of its revenues from the Securities and Exchange Commission. This most likely resulted from the Electronic Data Gathering and Retrieval (EDGAR) project.

EXHIBIT V-11

Leading Federal Systems Development Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
IBM	38,692	30,002	68,694
CSC	33,810	34,470	68,280
Unisys	17,087	28,002	45,089
PRC	24,653	19,838	44,491
CDSI	15,793	17,886	33,679
TRW	14,033	18,768	32,801
Martin Marietta	6,161	25,405	31,566
Dynamics Research Corp.	7,471	17,379	24,850
BDM	9,422	13,732	23,154
GTE Corp.	7,164	12,863	20,027

2. Defense Systems Development Sales

Exhibit V-12 lists the leading vendors in the Defense Department for systems development sales. As already indicated, TRW, Martin Marietta, Dynamics Research Corporation, and GTE realized all or practically all systems development revenues from defense agencies. The same is true of CACI (number 11 overall), and Radian Corporation (number 13 overall).

Although not appearing in either exhibit, National Systems and Research Company, an 8(a) firm, ranks fifteenth overall and eleventh in defense with identical totals of nearly $15 million. Further, most of EDS' revenue came from the Defense Department. Of the total sales of $940 million for FY 1989 and FY 1990, defense accounted for $543 million.

EXHIBIT V-12

Leading Defense Systems Development Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
TRW	14,033	18,768	32,801
Unisys	10,077	21,521	31,598
Martin Marietta	6,019	25,405	31,424
IBM	16,022	15,256	31,278
CSC	10,064	20,328	30,392
Dynamics Research Corporation	7,471	17,379	24,850
PRC	13,488	7,584	21,072
GTE	7,164	12,863	20,027
CACI	7,500	10,524	18,024
Radian Corporation	9,657	6,898	16,555

3. Civilian Systems Development Sales

Exhibit V-13 lists the leading vendors among civilian agencies for systems development sales. The first four vendors, along with Unisys (number 6), realized significant sales from both defense and civilian agencies. BDM and Arthur Andersen sold mostly to civilian agencies. The remaining three vendors obtained all their systems development revenue through civilian agencies. The pattern of a few major contracts continues in this category.

EXHIBIT V-13

Leading Civilian Systems Development Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
CSC	23,746	14,142	37,888
IBM	22,670	14,746	37,416
CDSI	9,674	14,468	24,142
PRC	11,165	12,254	23,419
BDM	8,945	13,732	22,677
Unisys	7,010	6,481	13,491
Technology Research	5,760	6,241	12,001
Integrated Systems	8,446	2,354	10,800
Orkand Corporation	5,307	4,791	10,098
Arthur Andersen	9,133	753	9,886

4. Agency Leaders

Exhibit V-14 lists the leading systems development vendors at major agencies. As the exhibit shows, a wide range of vendors participate in this market. Some, like CSC, TRW, and Martin Marietta, are well known. Others, like Integral Systems, Management Assistance Corporation, and Pinkerton Computer Consultants, are hardly known at all outside of a few agencies. In fact, of the categories studied for this report, systems development shows the least concentration.

EXHIBIT V-14

Leading Systems Development Vendors by Agency

Agency	Vendor	FY 1989-90 Revenue ($000)
Navy	CSC	30,392
Army	TRW	32,726
Air Force	Martin Marietta	25,405
OSD	PRC	15,319
DMA	SAIC	1,465
DCA	Wang	1,427
Agriculture	Arthur Andersen	7,220
Commerce	Integral Systems	10,800
Energy	Orkand	9,998
HHS	PROMIS Information Systems	3,367
HUD	Advanced Technology Systems	2,728
Interior	Management Assistance Corp.	4,785
AID	Pinkerton Computer Consultants	4,500
GSA	CDSI	8,179

EXHIBIT V-14 (CONT.)

Leading Systems Development Vendors by Agency

Agency	Vendor	FY 1989-90 Revenue ($000)
FEMA	Systems Research Applications	3,257
EPA	PRC	20,498
NASA	IBM	36,861
Treasury	PRC	20,498
NASA	IBM	36,861
Treasury	PRC	2,700
Transportation	CSC	10,660
State	Metrica	1,728
Labor	CDSI	4,396
Justice	CDSI	11,567
NRC	System Automation Corp.	3,068
SEC	BDM	22,583
CFTC	Systems Research Corp.	1,900

5. GSA Schedule Sales

Exhibit V-15 shows the top five vendors for ADP systems development. CDSI totally dominated this category, probably reflecting its efforts in support of standard financial software packages. The total market for schedule sales in ADP systems development reached $11.3 million in FY 1989 and $3.0 million in FY 1990.

EXHIBIT V-15

Leading Schedule ADP Systems Development Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
CDSI	6,732	1,447	8,179
Atlantic Research	1,981	0	1,981
IBM	595	222	817
Michelson Realty	130	555	685
DP Associates	558	0	558

D
Programming

Agencies assign certain federal supply codes—such as those for systems analysis, systems development and programming—somewhat arbitrarily. Therefore, it is not especially meaningful to break out systems analysis, systems development, and programming. Rather, the reader should consider all three in examining the services market.

This section identifies the leading vendors in the programming category along with associated revenues. As in the two previous cases, agencies contract for programming to help meet their tailored software needs. This section is organized in the same way as the two preceding sections.

1. Overall Market

Exhibit V-16 lists the leading programming vendors in the federal government. Overall, this market is considerably smaller than systems development. In fact, Sterling Federal's revenue of $10.1 million (all from FY 1990), would not have even made the top ten in systems development. Professional services firms dominate the list, with only IBM and Unisys also providing equipment. However, both of these firms provide services to the federal government through subsidiaries.

EXHIBIT V-16

Leading Federal Programming Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Sterling Federal	0	10,129	10,129
CDSI	5,117	3,159	8,276
IBM	2,593	2,829	5,422
CSC	3,233	0	3,233
Software Control	0	2,172	2,172
GM/EDS/Hughes	610	1,388	1,998
EG&G	924	922	1,846
CBIS	0	1,730	1,730
System Automation	1,171	341	1,512
Unisys	1,087	366	1,453

Six of the ten firms listed (IBM, CSC, GM, EG&G, System Automation, and Unisys) derived all of their revenue from the Defense Department. The other four derived nearly all of their revenue from civil agencies. As in the previous categories, many vendors realize programming revenues through one or two agencies. For example, CDSI's revenues came from the General Services Administration. EG&G's revenues came only from the Navy, and IBM's revenues came only from the Air Force. The relatively low numbers for programming also serve to encourage market concentration among the agencies.

2. Defense Programming Sales

Exhibit V-17 lists the leading vendors in the Defense Department for programming sales. As already indicated, six of the top ten in the previous exhibit, also the top six in this exhibit, derived all their revenue from defense. Three of the remaining four in Exhibit V-17 (Engineering Management Concepts, SAIC, and GTE) also received only defense agency business for this category. Only Computer Dynamics split its revenue between defense and civilian agencies.

EXHIBIT V-17

Leading Defense Programming Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
IBM	2,593	2,829	5,422
CSC	3,233	0	3,233
GM/EDS/Hughes	610	1,388	1,998
EG&G	924	922	1,846
System Automation	1,171	341	1,512
Unisys	1,087	366	1,453
Engineering Management Concepts	0	595	595
SAIC	0	712	712
Computer Dynamics	0	479	479
GTE	0	365	365

With the exception of CSC, all the leading vendors derived all of their defense revenues from a single agency. The Army provided CSC with more than 90% of its sales. The remainder came from the Navy. The remaining companies divide as follows:

- Air Force: IBM, GM, Unisys, GTE
- Navy: EG&G, Engineering Management Concepts, Computer Dynamics
- Army: System Automation
- OSD: SAIC

3. Civilian Programming Sales

Exhibit V-18 lists the leading programming vendors among civilian agencies. Only professional services firms appear in this list. Some, such as Sterling Federal and CBIS, are fairly well known throughout the federal IRM community. Others, such as Uipkon and Diversified International Sciences, have virtually no visibility outside their agency customers.

EXHIBIT V-18

Leading Civilian Programming Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
Sterling Federal	0	10,129	10,129
CDSI	5,301	3,159	8,460
Software Control International	0	2,172	2,172
CBIS	0	1,730	1,730
General Sciences Corp.	97	293	390
Uipkon	381	0	381
Computer Dynamics	0	347	347
Management Assistance Corp.	121	210	331
Diversified International Sciences	185	128	313
Core Industries	125	175	300

Each vendor in Exhibit V-18 derives all its revenues from a single agency. The companies divide as follows:

- NASA: Sterling Federal, Diversified International Sciences, Core Industries
- Treasury: CBIS, Uipkon
- HUD: Software Control International
- VA: General Sciences Corporation
- Executive Office of the President: Computer Dynamics
- Agriculture: Management Assistance Corporation

As is evident from this list, civilian agencies provide more diversity in program contracts than do defense agencies. However, sales volumes are also considerably lower.

4. Agency Leaders

Exhibit V-19 lists the leading programming vendors at major agencies. The exhibit covers only agencies that provided more than $500,000 in business (programming) to their leading vendors. The list shows no repeats among the vendors. Rather, each vendor receives all or practically all of its revenue from a single agency.

EXHIBIT V-19

Leading Programming Vendors by Agency

Agency	Vendor	FY 1989-90 Revenue ($000)
Navy	EG&G	5,547
Army	CSC	2,918
Air Force	IBM	5,422
OSD	SAIC	595
HUD	Software Control International	2,172
Treasury	CBIS	1,730
NASA	Sterling Federal	10,129
GSA	CDSI	8,460

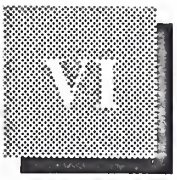
5. GSA Schedule Sales

Exhibit V-20 shows the top four vendors in GSA schedule sales for programming. With the exception of CDSI, this is a very small market which is not worth pursuing. This exhibit is consistent with the previous one, which showed that all of CDSI's revenues come from GSA. CDSI has a series of software products that comply with standards issued by the Joint Financial Management Improvement Program (JFMIP). INPUT believes that programming in connection with the financial product accounted for most of the sales.

EXHIBIT V-20

Leading Schedule Programming Services Vendors

Vendor	FY 1989 ($000)	FY 1990 ($000)	Total ($000)
CDSI	5,301	3,159	8,460
Computer Associates	0	198	198
IBM	0	64	64
Cullinet	0	50	50



Key Opportunities

This section describes specific opportunities in the federal computer equipment market. Lists of programs are provided for future computer equipment acquisitions. The list of opportunities consists of programs that are typical of the federal market and serves as a representative sample.

A
Present and Future Programs

New information technology programs that are larger than $1 million to $2 million are listed in at least one of the following federal government documents:

- OMB/GSA Five-Year Plan, which is developed from agency budget requests submitted in compliance with OMB Circular A-11
- Agency long-range information resource plans developed to meet the reporting requirements of the Paperwork Reduction Act of 1980
- Agency annual operating budget requests submitted to both Congressional oversight and appropriations committees based on the OMB A-11 information
- *Commerce Business Daily* for specific opportunities, for qualifications as a bidder, and to obtain a copy of the RFP or RFQ
- Five-Year Defense Plan, which is not publicly available, and the supporting documentation of the separate military departments and agencies
- Classified programs documentation available to qualified DoD contractors

B

Federal Software Products Opportunities by Agency

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
Air Force			
Integrated Computer-Aided Software Engineering (ICASE)	V-1-145	2QFY92	50,000
Redesign and Implementation of the Cadet Administration MIS	V-1-15		
Army			
Army Tactical Command and Control System	V-2-38		
Installation Support Modules	V-2-45		150,000
Navy			
Navy CALS	V-3-80		
Navy WWMCCS ADP Modernization	V-3-83		55,000
GOSIP Gateways	V-3-123	2QFY92	25,000
Defense			
CALS	V-4E-4		
Joint WWMCCS ADP Modernization	V-4G-2		275,000
Corporate Information Management	V-4G-10		2,000,000

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
Commerce			
Automated Trademark System	VI-6-43	1/92	45,448
HHS			
IMPAC/CRISP Modernization	VIII-8-51	2QFY93	15,000
Interior			
Coal Data MIS	VII-9-12		
GIS Software	VII-9-31	2QFY92	
Computer-Aided Design and Drafting	VII-9-32	1QFY94	5,000
Justice			
Antitrust Office Automation	VII-10-17		12,500
Integrated Automated Fingerprint Identification System	VII-10-29	2QFY92	755,000
Transportation			
Data Link Processor	VII-11-25	4QFY93	
Recruit Information Management System	VII-11-35	FY93	
Personnel MIS/Joint Uniform Military Pay System	VII-11-40	FY93	
Treasury			
Tax Systems Modernization Effort	VII-12-6		8,000,000

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
Education			
National Student Loan Data System	VII-13-14	3QFY92	14,000
Veterans Affairs			
Veterans Benefits Administration Modernization Plan	VIII-16-11	12/91 FY93	220,000
National Archives			
Records Administration Information System	VIII-32-31	FY92	

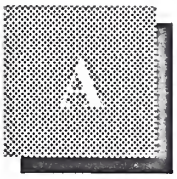
C

Federal Software Development Opportunities by Agency

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
Air Force			
Integrated Computer-Aided Software Engineering (ICASE)	V-1-145	2QFY92	50,000
Redesign and Implementation of the Cadet Administration MIS	V-1-151		
Army			
Army Tactical Command and Control System	V-2-38		
Installation Support Modules	V-2-45		150,000

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
Information System Support Center	V-2-45	FY95	
ADP Systems Services and Installation of Applications System Software	V-2-61	FY92	18,000
ADP Services	V-2-62	12/91	
Multiple Automated Printing Systems	V-2-69	2QFY92	
Navy			
Primary Environment Processing Systems Software System	V-3-46		
Navy WWMCCS ADP Modernization	V-3-83		55,000
ADP Systems Development and Support Services	V-3-118	FY93	
Defense			
CALS	V-4E-4		
Corporate Information Management	V-4G-10		2,000,000
Commerce			
Systems Engineering and Technical Support Services	VI-6-40	12/91	
SARSAT Software Development Recompetition	VI-6-42	1QFY93	16,000
CALS Services	VI-6-45	1/92	

Program	PAR Number	RFP Schedule	Funding FY91-96 ($000)
HHS			
IMPAC/CRISP Modernization	VII-8-51	2QFY93	15,000
Justice			
ADP Support Services	VII-10-34	FY95	
Transportation			
Data Link Processor	VII-11-25	4QFY93	
Recruit Information Management System	VII-11-3	FY93	
Treasury			
Tax Systems Modernization Effort	VII-12-6		8,000,000
Software Development and Operational Support Services Recompetition	VII-12-71	FY93	
Education			
Title IV Program	VII-13-13		130,000
Campus-based Processing Recompetition	VII-13-16	FY94	9,000
NASA			
Software Support Environment Recompetition	VIII-15-106	4QFY92	
EPA			
Data Management Support for Office of Pesticide Programs	VIII-17-16		



Interview Profiles

A

Federal Agency Respondent Profiles

1. Contact Summary

Contacts with agencies were made by telephone and mail. The majority of the agency interviews were conducted at the departmental level, with officials in the office of Information Resources Management who are responsible for computer systems policy and planning.

The distribution of job classifications among individual agency respondents for the analysis is as follows:

	Policy	*Buyers*	*Users*	*Total*
Respondents	6		18	24

2. List of Agencies

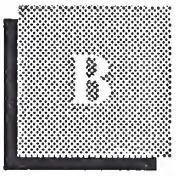
Respondents interviewed represented the agencies listed below, with the number in parentheses indicating the number of different contracts within the agency.

- Department of Defense
  - Air Force (2)
  - Army (4)
  - Navy (2)
  - DLA (1)
  - DISA (1)

- Civilian Agencies

  - Department of Agriculture (1)
  - Department of Transportation (1)
  - Department of Treasury (4)
  - Smithsonian Institution (1)

  - U.S. Courts (1)
  - Department of Education (1)
  - Department of Health and Human Services (1)
  - Department of the Interior (3)
  - Department of Justice (1)



Definition of Terms

A
Introduction

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

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

For 1992 INPUT has incorporated customer services (hardware maintenance) into the information services industry structure. Equipment service becomes the ninth delivery mode used by INPUT to segment and analyze this industry.

In addition, some new areas are being researched during 1992 as part of the outsourcing area and may result in future changes to the industry structure. These areas of research are discussed in Section B 5 of this document.

B
Overall Definitions and Analytical Framework

1. Information Services

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

- Processing of specific applications using vendor-provided systems (called *Processing Services*)
- A combination of hardware, packaged software and associated support services which will meet a specific application processing need (called *Turnkey Systems*)
- Packaged software products, either systems software or applications software products (called *Software Products*)
- People services that support users in developing and operating their own information systems (called *Professional Services*)
- Bundled combinations of products and services where the vendor assumes total responsibility for the development of a custom solution to an information systems problem (called *Systems Integration*)
- Services that provide operation and management of all or a significant part of a user's information systems functions under a long-term contract (called *Systems Operations*)
- Services associated with the delivery of information in electronic form—typically network-oriented services such as value-added networks, electronic mail and document interchange, on-line data bases, on-line news and data feeds, etc. (called *Network Services*)
- Services that support the operation of computer hardware and resident systems software (called *Equipment Services*)

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

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

The analytical framework of the information services industry consists of the following interacting factors: overall and industry-specific business environment (trends, events and issues); technology environment; user information system requirements; size and structure of information services markets; vendors and their products, services and revenues; distribution channels; and competitive issues.

2. Market Forecasts/User Expenditures

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

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

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

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

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

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

3. Delivery Modes

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

Of the nine delivery modes defined by INPUT, six are considered primary products or services:

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

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

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

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

4. Market Sectors

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

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

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

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

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

5. Outsourcing

The changes in the information services area towards longer term client-vendor relationships has created a number of new types of *outsourcing* relationships. In addition to the nine delivery modes, INPUT will be conducting research during 1992 in each of the areas defined below. Based on this research, INPUT will review and may change its information services industry structure for 1992.

- Outsourcing - The contracting of all or a major part of an information systems process to an external vendor on a long-term basis. The vendor takes responsibility for the performance of the process.

- Outsourcing can include any or all of the following elements:

  - Processing Operations - The vendor is responsible for managing and operating the client's computer systems.

  - Network Operations - The vendor assumes full responsibility for the client's data communications systems. This may also include the voice communications of the client.

  - Applications Maintenance - The vendor has full responsibility for maintaining the applications software that the vendor uses as part of its business operations.

  - Applications Management - Not only does the vendor maintain and upgrade the applications software for the client, but also develops and implements new software as the need arises.

  - Desktop Services - The vendor assumes responsibility for the deployment, maintenance and connectivity between the PCs in the client organization. The service may also include performing the help desk function.

C
Delivery Modes and Submodes

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

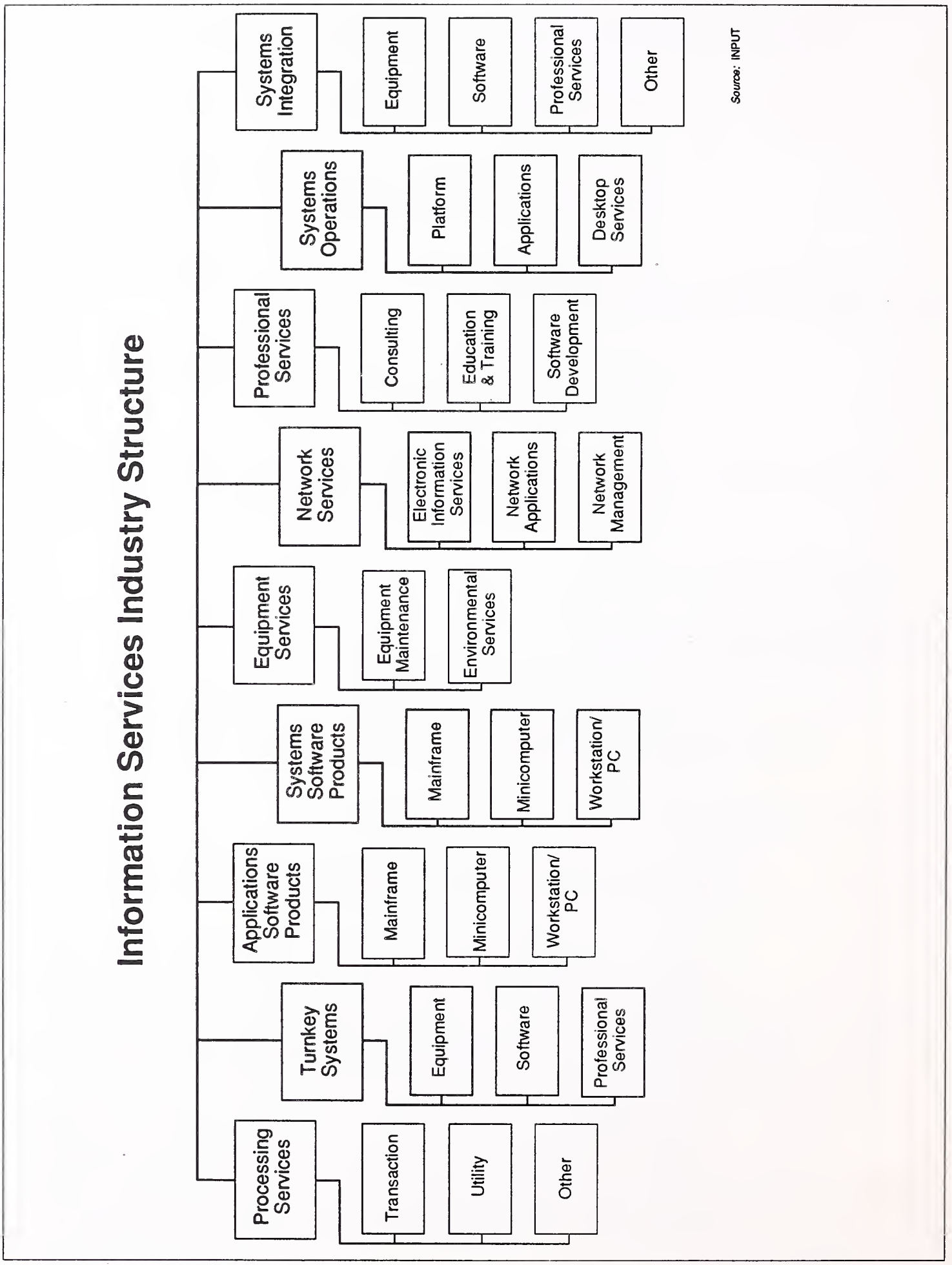
1. Software Products

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

The two delivery modes have many similarities. Both involve user purchases of software packages for in-house computer systems. Included are both lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included here.

Expenditures for work performed by organizations other than the package vendor are counted in the professional services delivery mode. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

EXHIBIT B-1



a. Systems Software Products

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

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

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

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

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

b. Applications Software Products

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

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

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

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

2. Turnkey Systems

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

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

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

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

Turnkey systems have three components:

- Equipment - computer hardware supplied as part of the turnkey system
- Software products - prepackaged systems and applications software products
- Professional services - services to install or customize the system or train the user, provided as part of the turnkey system sale

3. Processing Services

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

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

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

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

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

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

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

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

4. Systems Operations

Systems operations was a new delivery mode introduced in the 1990 Market Analysis and Systems Operations programs. It was created by taking the Systems Operations submode out of both Processing Services and Professional Services. For 1992 the submodes have been defined as follows.

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

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

- *Applications systems operations* - The vendor manages and operates the computer systems, often including telecommunications networks, and is also responsible for maintaining, or developing and maintaining, the user's application systems.

In the federal government market, systems operation services are also defined by equipment ownership with the terms "COCO" (Contractor-Owned, Contractor-Operated), and "GOCO" (Government-Owned, Contractor-Operated).

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

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

5. Systems Integration (SI)

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

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

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

- *Software products* - Prepackaged applications and systems software products.

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

- *Other services* - Most systems integration contracts include other services and product expenditures that are not easily classified elsewhere. This category includes miscellaneous items such as engineering services, automation equipment, computer supplies, business support services and supplies, and other items required for a smooth development effort.

Systems integrators perform, or manage others who perform, most or all of the following functions:

- Program management, including subcontractor management
- Needs analysis
- Specification development
- Conceptual and detailed systems design and architecture
- System component selection, modification, integration and customization
- Custom software design and development
- Custom hardware design and development
- Systems implementation, including testing, conversion and post-implementation evaluation and tuning
- Life cycle support, including
  - System documentation and user training
  - Systems operations during development
  - Systems maintenance

6. Professional Services

This category includes three submodes: consulting, education and 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 the information system, including equipment, software, networks and systems operations.

- *Education and Training:* Products and services related to information systems and services for the professional and end user, including computer-aided instruction, computer-based education, and vendor instruction of user personnel in operations, design, programming, and documentation.

- *Software Development:* Services include user requirements definition, systems design, contract programming, documentation, and implementation of software performed on a custom basis. Conversion and maintenance services are also included.

7. Network Services

Network services typically include a wide variety of network-based functions and operations. Their common thread is that most of these functions could not be performed without network involvement. Network services is divided into two submodes: *Electronic Information Services,* which involve selling information to the user, and *Network Applications,* which involve providing some form of enhanced transport service in support of a user's information processing needs.

a. Electronic Information Services

Electronic information services are data bases that provide specific information via terminal- or computer-based inquiry, including items such as stock prices, legal precedents, economic indicators, periodical literature, medical diagnosis, airline schedules, automobile valuations, etc. The terminals used may be computers themselves, such as 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.

b. Network Applications

Value-Added Network Services (VAN Services) - VAN services are enhanced transport services which involve adding such functions as automatic error detection and correction, protocol conversion, and store-and-forward message switching to the provision of basic network circuits.

While VAN services were originally provided only by specialized VAN carriers (Tymnet, Telenet, etc.), today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers. The following are examples of VAN services.

- *Electronic Data Interchange (EDI)* - Application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. Specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards. This software may be provided as part of the VAN service or may be resident on the organization's own computers.

- *Electronic Information Exchange (EIE)* - Also known as electronic mail (E-mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex, TWX, and other messaging services. This also includes bulletin board services.

- *Other Network Services* - This segment contains videotex and pure network management services. Videotex is actually more a delivery mode than an application. Its prime focus is on the individual as a consumer or in business. These services provide interactive access to data bases and offer the inquirer the ability to send as well as receive information for such purposes as home shopping, home banking, travel reservations, and more.

  Network management services included here must involve the vendor's network and network management systems as well as people. People-only services are included in professional services that involve the management of networks as part of the broader task of managing a user's information processing functions are included in systems operations.

8. Equipment Services

The equipment services delivery mode includes three submodes. All deal with the support and maintenance of computer equipment operations.

- *Equipment Maintenance* - Services provided to repair, diagnose problems and provide preventive maintenance both on-site and off-site. The costs of parts, media and other supplies are excluded. These services are typically provided on a contract basis.

- *Environmental Services* - Composed of equipment- and data center-related special services such as cabling, air conditioning and power supply, equipment relocation and similar services.

D
Sector Definitions

1. Industry Sector Definitions

INPUT has structured the information services market into 15 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 industry sectors are detailed in Exhibit B-2.

EXHIBIT B-2

Industry Sector Definitions

Industry Sector	SIC Code	Description
Discrete Manufacturing	23xx	Apparel and other finished products
	25xx	Furniture and fixtures
	27xx	Printing, publishing and allied industries
	31xx	Leather and leather products
	34xx	Fabricated metal products, except machinery and transportation equipment
	35xx	Industrial and commercial machinery and computer equipment
	36xx	Electronic and other electrical equipment and components, except computer equipment
	37xx	Transportation equipment
	38xx	Instruments; photo/med/optical goods; watches/clocks
	39xx	Miscellaneous manufacturing industry
Process Manufacturing	10xx	Metal mining
	12xx	Coal mining
	13xx	Oil and gas extraction
	14xx	Mining/quarrying nonmetalic minerals
	20xx	Food and kindred products
	21xx	Tobacco products
	22xx	Textile mill products
	24xx	Lumber and wood products, except furniture
	26xx	Paper and allied products
	28xx	Chemicals and allied products
	29xx	Petroleum refining and related industries
	30xx	Rubber and miscellaneous plastic products
	32xx	Stone, clay, glass and concrete products
	33xx	Primary metal industries
Transportation Services	40xx	Railroad transport
	41xx	Public transit/transport
	42xx	Motor freight transport/warehousing
	43xx	U.S. Postal Service
	44xx	Water transportation
	45xx	Air transportation (including airline reservation services in 4512)
	46xx	Pipelines, except natural gas
	47xx	Transportation services (including 472x, arrangement of passenger transportation)

EXHIBIT B-2 (CONT.)

Industry Sector Definitions

Industry Sector	SIC Code	Description
Utilities	49xx	Electric, gas and sanitary services
Telecommunications	48xx	Communications
Retail Distribution	52xx	Building materials
	53xx	General merchandise stores
	54xx	Food stores
	55xx	Automotive dealers, gas stations
	56xx	Apparel and accessory stores
	57xx	Home furniture, furnishings and accessory stores
	58xx	Eating and drinking places
	59xx	Miscellaneous retail
Wholesale Distribution	50xx	Wholesale trade - durable goods
	51xx	Wholesale trade - nondurable goods
Banking and Finance	60xx	Depositary institutions
	61xx	Nondepositary institutions
	62xx	Security and commodity brokers, dealers, exchanges and services
	67xx	Holding and other investment offices
Insurance	63xx	Insurance carriers
	64xx	Insurance agents, brokers and services
Health Services	80xx	Health services
Education	82xx	Educational services

2. Cross-Industry Sector Definitions

In addition to these vertical industry sectors, INPUT has identified seven cross-industry or horizontal market sectors. These sectors or markets involve multi-industry applications such as human resource systems, accounting systems, etc. In order to be included in an industry sector, the service or product delivered must be specific to that sector only. If a service or product is used in more than one industry sector, it is counted as cross-industry. The seven cross-industry markets are:

Accounting - Consists of applications software products and information services that serve such functions as:

- General ledger
- Accounts payable
- Accounts receivable
- Billing/invoicing
- Fixed assets
- International accounting
- Purchasing
- Taxation
- Financial consolidation

• Excluded are accounting products and services directed to a specific industry, such as tax processing services for CPAs and accountants within the business services industry sector.

Human Resources - Consists of application solutions purchased by multiple industry sectors to serve the functions of human resources management and payroll. Examples of specific applications within these two major functions are:

- Employee relations
- Benefits administration
- Government compliance
- Manpower planning
- Compensation administration
- Applicant tracking
- Position control
- Payroll processing

Education and Training - Consists of education and training for information systems professionals and users of information systems, as well as the use of computer-based training tools for the training of any employee on any subject.

- The education and training cross-industry sector only considers education and training offered for a noncaptive market; in other words, this sector does not include educational services provided by information services vendors to their customers for training on their own products.

- Education and training that is provided in a classroom setting, live, is not included in this cross-industry sector. This sector is not to be confused with the education industry-specific sector, the subject of another MAP report, which addresses primary and secondary education as a vertical market for IS services.

Office Systems consists of the following:

- Integrated office systems (IOS)
- Word processing
- Desktop publishing
- Graphics

- IOSs—such as IBM's OfficeVision, HP's NewWave Office and DEC's All-In-1—typically include the following core functions, all of which are accessed from the same desktop: electronic mail, decision support systems, time management and filing systems.

- Office systems graphics include presentation graphics (which represent the bulk of office systems graphics), paint and line art, page description languages, and electronic form programs.

Engineering and Scientific encompasses the following applications:

- Computer-aided design and engineering (CAD and CAE)
- Structural analysis
- Statistics/mathematics/operations research
- Mapping

- Computer-aided manufacturing (CAM) or CAD that is integrated with CAM is excluded from the cross-industry sector as it is specific to the manufacturing industries. CAD or CAE that is dedicated to integrated circuit design is also excluded because it is specific to the semiconductor industry.

Planning and Analysis consists of software products and information services in four application areas:

- Executive Information Systems (EIS)
- Financial modeling or planning systems
- Spreadsheets
- Project management

Other encompasses marketing/sales and electronic publishing application solutions.

- Sales and marketing includes:
  - Sales analysis
  - Marketing management
  - Demographic market planning models

- The fundamental difference between electronic publishing and desktop publishing (within the office systems sector) is that electronic publishing encompasses a method of document management and control from a single point—regardless of how many authors/locations work on a document—whereas desktop publishing is a personal productivity tool and is generally a lower end product residing on a personal computer.

- Electronic or computer publishing systems that are sold strictly and specifically to commercial publishers, printers, and typesetters are excluded from cross-industry consideration and are included in the discrete manufacturing industry.

3. Delivery Mode Reporting by Sector

This section describes how the delivery mode forecasts relate to the market sector forecasts. Exhibit B-3 summarizes the relationships.

- *Processing services* - The transaction processing services submode is forecasted for each industry and cross-industry market sector. The utility and other processing services submodes are not considered industry or cross-industry specific and are only forecasted for the total market.

- *Turnkey systems* - All of the turnkey systems delivery mode is considered either industry or cross-industry specific and is forecasted for the 15 industry and 7 cross-industry sectors. Each component of turnkey systems (equipment, software products and professional services) is forecasted by market sector.

- *Applications software products* - All of the applications software products delivery mode is considered either industry or cross-industry specific and is forecasted for the 15 industry and 7 cross-industry sectors. In addition, each forecast is broken down by platform level: mainframe, minicomputer and workstation/PC.

- *Systems operations* - All of systems operations is considered industry specific. Each of the submodes (platform and applications systems operations) is forecasted for each of the 15 industry sectors.

EXHIBIT B-3

Delivery Mode versus Market Sector Forecast Content

Delivery Mode	Submode	Market Sectors		
		Industry Sectors	Cross-Industry Sectors	Other
Processing Services	Transaction Utility Other	X	X	 X X
Turnkey Systems		X	X	
Applications Software Products		X	X	
Systems Operations	Platform Applications	X X		
Systems Integration		X		
Professional Services		X		
Network Services	Network Applications Electronic Information Services	X X		X
Systems Software Products				X
Equipment Services				X

- *Systems integration* - All of systems integration is considered industry specific. Each of the components of systems integration (equipment, software products, professional services and other services) is forecasted for each of the 15 industry sectors.

- *Professional services* - All of professional services is considered industry specific. Each of the submodes (consulting, education and training, and software development) is forecasted for each of the 15 industry sectors.

- *Network services* - All of the network applications submode of network services is considered industry specific and is forecasted for each of the 15 industry sectors. The electronic information services submode is considered to have both industry-specific and non-specific elements.

The forecast for electronic information systems includes forecasts for the 15 industry sectors as well as an additional forecast component that applies to the market as a whole.

- *Systems software products* - All of the submodes (systems control, operations management, applications development) are considered neither industry- nor cross-industry specific. They are only forecasted in total. In addition, each submode forecast is broken down by platform level: mainframe, minicomputer and workstation/PC.

- Equipment services - All of the submodes are considered neither industry nor cross-industry specific. They are only forecasted in total.

E

Vendor Revenue and User Expenditure Conversion

The size of the information services market may be viewed from two perspectives: vendor (producer) revenues and user expenditures. While the primary data for INPUT's research is vendor interviews, INPUT defines and forecasts the information services market in terms of end-user expenditures. End-user expenditures reflect the markup in producer sales when a product such as software is delivered through indirect distribution channels (such as original equipment manufacturers (OEMs), retailers and distributors). The focus on end-user expenditure also eliminates the double counting of revenues that would occur if sales were tabulated for both producer (e.g., Lotus) and distributor (e.g., BusinessLand).

For most delivery modes, vendor revenues and user expenditures are fairly close. However, there are some areas of significant difference. Many microcomputer software products, for example, are marketed through indirect distribution channels. To capture the valued added through these indirect distribution channels, adjustment factors that incorporate industry discount ratios are used to convert estimated information services vendor revenues to end-user expenditures.

For some delivery modes, including software products, systems integration and turnkey systems, there is a significant volume of intra-industry sales. For example, systems integrators purchase software and subcontract the services of other professional services vendors. And turnkey vendors incorporate purchased software into the systems they sell to end users.

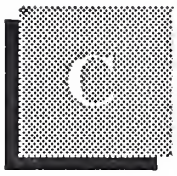
To account for such intra-industry transactions, INPUT uses other conversion ratios to derive the estimate of end-user expenditures.

Exhibit B-4 summarizes the net effect of the various ratios used by INPUT to convert vendor revenues to end-user expenditure (market size) figures for each delivery mode.

EXHIBIT B-4

Vendor Revenue to User Expenditure Conversion

Delivery Mode	Vendor Revenue Multiplier
Applications Software Products	1.18
Systems Software Products	1.10
Systems Operations	1.00
Systems Integration	0.99
Professional Services	0.99
Network Services	0.99
Processing Services	0.99
Turnkey Systems	0.95



Glossary of Federal Acronyms

The federal government's procurement language uses a combination of acronyms, phrases, and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering, and law with new applications and technology.

Acronyms and contract terms that INPUT encountered most often in program documentation and interviews for this report are included here, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency acronyms have been included to the extent they are employed in this report.

A

Federal Acronyms

AAS	Automatic Addressing System.
AATMS	Advanced Air Traffic Management System.
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program).
ACT-1	Advanced Computer Techniques (Air Force).
Ada	DoD High-Order Language.
ADA	Airborne Data Acquisition.
ADL	Authorized Data List.
ADNET	Anti-Drug Network.
ADS	Automatic Digital Switches (DCS).
AFA	Air Force Association.
AFCEA	Armed Forces Communications Electronics Association.
AGE	Aerospace Ground Equipment.
AIP	Array Information Processing.

AIS	Automated Information System.
AMD	Acquisition Management Directorate.
AMPE	Automated Message Processing Equipment.
AMPS	Automated Message Processing System.
AMSL	Acquisition Management Systems List.
ANG	Army National Guard
AP(P)	Advance Procurement Plan.
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch.
APR	Agency Procurement Request.
ARC	Acquisition Review Council.
ARPANET	DARPA network of scientific computers.
ASP	Aggregated Switch Procurement
ATLAS	Abbreviated Test Language for All Systems (for ATE-Automated Test Equipment).
Authorization	In the legislative process programs, staffing, and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget.
AUSA	Association of the U.S. Army.
AUTODIN	AUTOmatic DIgital Network of the Defense Communications System.
AUTOSEVOCOM	AUTOmatic SEcure VOice COMmunications Network
AUTOVON	AUTOmatic VOice Network of the Defense Communications System.
BA	Basic Agreement.
BAFO	Best And Final Offer.
Base level	Procurement, purchasing, and contracting at the military installation level.
BCA	Board of Contract Appeals.
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements.
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder.
BML	Bidders Mailing List—qualified vendor information filed annually with federal agencies to automatically receive RFPs and RFQs in areas of claimed competence.
BOA	Basic Ordering Agreement.
B&P	Bid and Proposal—vendor activities in response to government solicitation/specific overhead allowance.
BPA	Blanked Purchase Agreement.
Budget	Federal Budget, proposed by the President and subject to Congressional review.
C^2	Command and Control.
C^3	Command, Control, and Communications.
C^4	Command, Control, Communications, and Computers.
C^3I	Command, Control, Communications, and Intelligence.
CAB	Contract Adjustment Board or Contract Appeals Board.
CADE	Computer-Aided Design and Engineering.
CADS	Computer-Assisted Display Systems.
CAIS	Computer-Assisted Instruction System.

CALS	Computer-Aided Logistics Support.
CAPS	Command Automation Procurement Systems.
CAS	Contract Administration Services or Cost Accounting Standards.
CASB	Cost Accounting Standards Board.
CASP	Computer-Assisted Search Planning.
CBD	*Commerce Business Daily*—U.S. Department of Commerce publication listing government contract opportunities and awards.
CBO	Congressional Budget Office.
CCEP	Commercial Comsec Endorsement Program
CCDR	Contractor Cost Data Reporting.
CCN	Contract Change Notice.
CCPDS	Command Center Processing and Display Systems.
CCPO	Central Civilian Personnel Office.
CDR	Critical Design Review.
CDRL	Contractor Data Requirement List.
CFE	Contractor-Furnished Equipment.
CFR	Code of Federal Regulations.
CICA	Competition in Contracting Act
CIG	Computerized Interactive Graphics.
CIM	Corporate Information Management or Center for Information Management.
CINCs	Commanders-in-Chief.
CIR	Cost Information Reports.
CM	Configuration Management.
CMI	Computer-Managed Instruction.
CNI	Communications, Navigation, and Identification.
CO	Contracting Office, Contract Offices, or Change Order.
COC	Certificate of Competency (administered by the Small Business Administration).
COCO	Contractor-Owned, Contractor-Operated.
CODSIA	Council of Defense and Space Industry Associations.
COMSTAT	Communications Satellite Corporation.
CONUS	CONtinental United States.
COP	Capability Objective Package.
COTR	Contracting Officer's Technical Representative.
COTS	Commercial Off-the-Shelf (Commodities).
CP	Communications Processor.
CPAF	Cost-Plus-Award-Fee Contract.
CPFF	Cost-Plus-Fixed-Fee Contract.
CPIF	Cost-Plus-Incentive-Fee Contract.
CPR	Cost Performance Reports.
CPSR	Contractor Procurement System Review.
CR	Cost Reimbursement (Cost Plus Contract).
CSA	Combat or Computer Systems Architecture.
CSIF	Communications Services Industrial Fund.
C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec").
CWAS	Contractor Weighted Average Share in Cost Risk.

DAB	Defense Acquisition Board.
DABBS	Defense Acquisition Bulletin Board System.
DAL	Data Accession List.
DAR	Defense Acquisition Regulations.
DARPA	Defense Advanced Research Projects Agency.
DAS	Data Acquisition System.
DBHS	Data Base Handling System.
DBOF	Defense Business Operating Fund.
DCA	Defense Communications Agency (see DISA).
DCAA	Defense Contract Audit Agency.
DCAS	Defense Contract Administration Services.
DCASR	DCAS Region.
DCC	Digital Control Computer.
DCP	Development Concept Paper (DoD).
DCS	Defense Communications System.
DCTN	Defense Commercial Telecommunications Network.
DDA	Dynamic Demand Assessment (Delta Modulation).
DDC	Defense Documentation Center.
DDI	Director of Defense Information.
DDL	Digital Data Link—A segment of a communications network used for data transmission in digital form.
DDN	Defense Data Network.
DDS	Defense Distribution System.
DECCO	DEfense Commercial Communications Office.
DECEO	DEfense Communications Engineering Office.
D&F	Determination and Findings—required documentation for approval of a negotiated procurement.
DFAS	Defense Finance and Accounting Service.
DIA	Defense Intelligence Agency.
DIF	Document Interchange Format, Navy-sponsored word processing standard.
DISA	Defense Information Systems Agency (Formerly DCA).
DHHS	Department of Health and Human Services.
DIDS	Defense Integrated Data Systems.
DISC	Defense Industrial Supply Center.
DLA	Defense Logistics Agency.
DMA	Defense Mapping Agency.
DMR	Defense Management Review.
DMRD	Defense Management Review Decision.
DNA	Defense Nuclear Agency.
DO	Delivery Order.
DOA	Department of Agriculture (also USDA).
DOC	Department of Commerce.
DOE	Department of Energy.
DOI	Department of Interior.
DOJ	Department of Justice.
DOS	Department of State.
DOT	Department of Transportation.
DPA	Delegation of Procurement Authority (granted by GSA under FPRs).

DPC	Defense Procurement Circular.
DQ	Definite Quantity Contract.
DQ/PL	Definite Quantity Price List Contract.
DR	Deficiency Report.
DRFP	Draft Request For Proposal.
DSCS	Defense Satellite Communication System.
DSN	Defense Switched Network.
DSP	Defense Support Program (WWMCCS).
DSS	Defense Supply Service.
DTC	Design-To-Cost.
DTN	Defense Transmission Network.
ECP	Engineering Change Proposal.
ED	Department of Education.
EEO	Equal Employment Opportunity.
8(a) Set-Aside	Agency awards direct to Small Business Administration for direct placement with a socially/economically disadvantaged company.
EMC	Electro-Magnetic Compatibility.
EMCS	Energy Monitoring and Control System.
EO	Executive Order—Order issued by the President.
EOQ	Economic Ordering Quantity.
EPA	Economic Price Adjustment.
EPA	Environmental Protection Agency.
EPMR	Estimated Peak Monthly Requirement.
EPS	Emergency Procurement Service (GSA) or Emergency Power System.
EUC	End User Computing, especially in DoD.
FA	Formal Advertising.
FAC	Facility Contract.
FAR	Federal Acquisition Regulations.
FCA	Functional Configuration Audit.
FCC	Federal Communications Commission.
FCDC	Federal Contract Data Center.
FCRC	Federal Contract Research Center.
FDPC	Federal Data Processing Center.
FEDSIM	Federal (Computer) Simulation Center (GSA).
FEMA	Federal Emergency Management Agency.
FFP	Firm Fixed-Price Contract (also Lump Sum Contract).
FIPR	Federal Information Processing Resource.
FIPS	NBS Federal Information Processing Standard.
FIPS PUBS	FIPS Publications.
FIRMR	Federal Information Resource Management Regulations.
FMS	Foreign Military Sales.
FOC	Final Operating Capability.
FOIA	Freedom of Information Act.
FP	Fixed-Price Contract.
FP-L/H	Fixed-Price—Labor/Hour Contract.
FP-LOE	Fixed-Price—Level-Of-Effort Contract.

FPMR	Federal Property Management Regulations.
FPR	Federal Procurement Regulations.
FSC	Federal Supply Classification.
FSG	Federal Supply Group.
FSN	Federal Supply Number.
FSS	Federal Supply Schedule or Federal Supply Service (GSA).
FSTS	Federal Secure Telecommunications System.
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS 2000 services.
FTSP	Federal Telecommunications Standards Program administered by NCS; Standards are published by GSA.
FTS	Federal Telecommunications System.
FTS 2000	Replacement of the Federal Telecommunications System.
FY	Fiscal Year.
FYDP	Five-Year Defense Plan.
GAO	General Accounting Office.
GFE	Government-Furnished Equipment.
GFM	Government-Furnished Material.
GFY	Government Fiscal Year (October to September).
GIDEP	Government-Industry Data Exchange Program.
GOCO	Government Owned—Contractor Operated.
GOGO	Government Owned—Government Operated.
GOSIP	Government Open Systems Interconnection Profile.
GPO	Government Printing Office.
GPS	Global Positioning System.
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control.
GS	General Schedule.
GSA	General Services Administration.
GSBCA	General Services Administration Board of Contract Appeals.
HCFA	Health Care Financing Administration.
HHS	(Department of) Health and Human Services.
HPA	Head of Procuring Activity.
HSDP	High-Speed Data Processors.
HUD	(Department of) Housing and Urban Development.
I-CASE	Integrated Computer-Aided Software Engineering.
IAR	Senior IRM Official.
ICA	Independent Cost Analysis.
ICAM	Integrated Computer-Aided Manufacturing.
ICE	Independent Cost Estimate.
ICP	Inventory Control Point.
ICST	Institute for Computer Sciences and Technology, National Bureau of Standards, Department of Commerce.
IDAMS	Image Display And Manipulation System.

IDEP	Interservice Data Exchange Program.
IDIQ	Indefinite Delivery-Indefinite Quantity.
IDN	Integrated Data Network.
IFB	Invitation For Bids.
IOC	Initial Operating Capability.
IOI	Internal Operating Instructions.
IPS	Integrated Procurement System.
IQ	Indefinite Quantity Contract.
IR&D	Independent Research & Development.
IRM	Information Resources Management.
IXS	Information Exchange System.
JCS	Joint Chiefs of Staff.
JCALS	Joint Computer-Aided Logistics Support.
JFMIP	Joint Financial Management Improvement Program.
JOCIT	Jovial Compiler Implementation Tool.
JSIPS	Joint Systems Integration Planning Staff.
JSOP	Joint Strategic Objectives Plan.
JSOR	Joint Service Operational Requirement.
JUMPS	Joint Uniform Military Pay System.
JWAM	Joint WWMCCS ADP Modernization (Program).
LC	Letter Contract.
LCC	Life Cycle Costing.
LCMP	Life Cycle Management Procedures (DD7920.1).
LCMS	Life Cycle Management System.
L-H	Labor-Hour Contract.
LOI	Letter of Interest.
LRPE	Long-Range Procurement Estimate.
LRIRP	Long-Range Information Resource Plan.
LTD	Live Test Demonstration.
MAISRC	Major Automated Information Systems Review Council (DoD).
MANTECH	MANufacturing TECHnology.
MAPS	Multiple Address Processing System.
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol.
MASC	Multiple Award Schedule Contract.
MDA	Multiplexed Data Accumulator.
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition).
MILSCAP	Military Standard Contract Administration Procedures.
MIL SPEC	Military Specification.
MIL STD	Military Standard.
MIPR	Military Interdepartmental Purchase Request.
MLS	Multilevel Security.
MNF	Multi-National Force.
MOD	Modification.
MOL	Maximum Ordering Limit (Federal Supply Service).

MPC	Military Procurement Code.
MYP	Multi-Year Procurement.
NARDIC	Navy Research and Development Information Center.
NASA	National Aeronautics and Space Administration.
NBS	National Bureau of Standards.
NCA	National Command Authorities.
NCMA	National Contract Management Association.
NCS	National Communications System (evolving to DISN).
NICRAD	Navy-Industry Cooperative Research and Development.
NIP	Notice of Intent to Purchase.
NMCS	National Military Command System.
NSA	National Security Agency.
NSEP	National Security and Emergency Preparedness.
NSF	National Science Foundation.
NSIA	National Security Industrial Association.
NTIA	National Telecommunications and Information Administration of the Department of Commerce; (replaced the Office of Telecommunications Policy in 1970).
NTIS	National Technical Information Service.
Obligation	"Earmarking" of specific funding for a contract from committed agency funds.
OCS	Office of Contract Settlement.
OFCC	Office of Federal Contract Compliance.
Off-Site	Services to be provided near but not in government facilities.
OFMP	Office of Federal Management Policy (GSA).
OFPP	Office of Federal Procurement Policy.
OIRM	Office of Information Resources Management.
O&M	Operations & Maintenance.
OMB	Office of Management and Budget.
O,M&R	Operations, Maintenance, and Readiness.
On-Site	Services to be performed on a government installation or in a specified building.
OPM	Office of Procurement Management (GSA) or Office of Personnel Management.
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion.
OSADBU	Office of Small and Disadvantaged Businesses.
OSHA	Occupational Safety and Health Act.
OSI	Open System Interconnect.
OSP	Offshore Procurement.
OTA	Office of Technology Assessment (Congress).
Out-Year	Proposed funding for fiscal years beyond the Budget Year (next fiscal year).
P-1	FY Defense Production Budget.
P3I	Pre-Planned Product Improvement (program in DoD).
PAR	Procurement Authorization Request or Procurement Action Report.
PAS	Pre-Award Survey.
PASS	Procurement Automated Source System.
PCO	Procurement Contracting Officer.
PDA	Principal Development Agency.

PDM	Program Decision Memorandum.
PDR	Preliminary Design Review.
PIR	Procurement Information Reporting.
PME	Performance Monitoring Equipment.
PMP	Purchase Management Plan.
PO	Purchase Order or Program Office.
POE	Panel Of Experts.
POM	Program Objective Memorandum.
POSIX	Portable Open System Interconnection Exchange.
POTS	Purchase of Telephone Systems.
PPBS	Planning, Programming, Budgeting System.
PR	Purchase Request or Procurement Requisition.
PRA	Paperwork Reduction Act.
PS	Performance Specification—alternative to a Statement of Work, when work to be performed can be clearly specified.
QA	Quality Assurance.
QAO	Quality Assurance Office.
QMCS	Quality Monitoring and Control System (DoD software).
QMR	Qualitative Material Requirement (Army).
QPL	Qualified Products List.
QRC	Quick Reaction Capability.
QRI	Quick Reaction Inquiry.
R-1	FY Defense RDT&E Budget.
RAM	Reliability, Availability, and Maintainability.
RC	Requirements Contract.
R&D	Research and Development.
RDA	Research, Development, and Acquisition.
RDD	Required Delivery Date.
RD&E	Research, Development, and Engineering.
RDF	Rapid Deployment Force.
RDT&E	Research, Development, Test, and Engineering.
RFI	Request For Information.
RFP	Request For Proposal.
RFQ	Request For Quotation.
RFTP	Request For Technical Proposals (Two-Step).
ROC	Required Operational Capability.
ROI	Return On Investment.
RTAS	Real Time Analysis System.
RTDS	Real Time Display System.
SA	Supplemental Agreement.
SADBU	Small and Disadvantaged Business Utilization.
SBA	Small Business Administration.
SB Set-Aside	Small Business Set-Aside contract opportunities with bidders limited to certified small businesses.
SCA	Service Contract Act (1964 as amended).

SCN	Specification Change Notice.
SDN	Secure Data Network.
SEC	Securities and Exchange Commission.
SE&I	Systems Engineering and Integration.
SETA	Systems Engineering/Technical Assistance.
SETS	Systems Engineering/Technical Support.
SIBAC	Simplified Intragovernmental Billing and Collection System.
SIMP	Systems Integration Master Plan.
SIOP	Single Integrated Operations Plan.
Sole Source	Contract award without competition.
Solicitation	Invitation to submit a bid.
SOR	Specific Operational Requirement.
SOW	Statement of Work.
SSA	Source Selection Authority (DoD).
SSAC	Source Selection Advisory Council.
SSEB	Source Selection Evaluation Board.
SSO	Source Selection Official (NASA).
STINFO	Scientific and Technical INFOrmation Program—Air Force/NASA.
STU	Secure Telephone Unit.
SWO	Stop-Work Order.
Synopsis	Brief Description of contract opportunity in CBD after D&F and before release of solicitation.
TA/AS	Technical Assistance/Analysis Services.
TCP/IP	Transmission Control Protocol/Internet Protocol.
TEMPEST	Studies, inspections, and tests of unintentional electromagnetic radiation from computer, communication, command, and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs.
TILO	Technical and Industrial Liason Office—Qualified Requirement Information Program—Army.
TM	Time and Materials contract.
TOA	Total Obligational Authority (Defense).
TOD	Technical Objective Document.
TQM	Total Quality Management.
TR	Temporary Regulation (added to FPR, FAR).
TRACE	Total Risk Assessing Cost Estimate.
TRCO	Technical Representative of the Contracting Offices.
TREAS	Department of Treasury.
TRP	Technical Resources Plan.
TSP	GSA's Teleprocessing Services Program.
TVA	Tennessee Valley Authority.
UCAS	Uniform Cost Accounting System.
USA	U.S. Army.
USAF	U.S. Air Force.
USCG	U.S. Coast Guard.
USMC	U.S. Marine Corps.

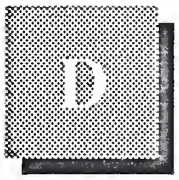
USN	U.S. Navy.
U.S.C.	United States Code.
USPS	United States Postal Service.
USRRB	United States Railroad Retirement Board.
VA	Veterans Affairs Department.
VE	Value Engineering.
VHSIC	Very High Speed Integrated Circuits.
VIABLE	Vertical Installation Automation BaseLine (Army).
VICI	Voice Input Code Identifier.
VTC	Video Teleconferencing.
WAM	WWMCCS ADP Modernization Program.
WBS	Work Breakdown Structure.
WGM	Weighted Guidelines Method.
WIN	WWMCCS Intercomputer Network.
WITS	Washington Interagency Telecommunications System.
WIS	WWMCCS Information Systems.
WS	Work Statement—Offerer's description of the work to be done (proposal or contract).
WWMCCS	World-Wide Military Command and Control System.

B

General and Industry Acronyms

ADAPSO	Association of Data Processing Service Organization, now the Computer Software and Services Industry Association. (See ITAA).
ADP	Automatic Data Processing.
ADPE	Automatic Data Processing Equipment.
ANSI	American National Standards Institute.
BOC	Bell Operating Company.
CAD	Computer-Aided Design.
CAM	Computer-Aided Manufacturing.
CASE	Computer-Aided Software Engineering.
CBEMA	Computer and Business Equipment Manufacturers Association.
CCIA	Computers and Communications Industry Association.
CCITT	Comite Consultatif Internationale de Télégraphique et Téléphonique; Committee of the International Telecommunication Union.
COBOL	COmmon Business-Oriented Language.
COS	Corporation for Open Systems.
CPU	Central Processor Unit.
DMBS	Data Base Management System.
DRAM	Dynamic Random Access Memory.

EIA	Electronic Industries Association.
EPROM	Erasible Programmable Read-Only Memory.
IEEE	Institute of Electrical and Electronics Engineers.
ISDN	Integrated Services Digital Networks.
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT.
ITAA	Information Technology Association of America (Formerly ADAPSO).
ITU	International Telecommunication Union.
LSI	Large-Scale Integration.
MFJ	Modified Final Judgement.
PROM	Programmable Read-Only Memory.
RBOC	Regional Bell Operating Company.
UNIX	AT&T Proprietary Operating System.
UPS	Uninterruptable Power Source.
VAR	Value-Added Reseller.
VLSI	Very Large-Scale Integration.
WORM	Write-Once-Read-Many-Times.



Policies, Regulations, and Standards

A

OMB Circulars

A-11	Preparation and Submission of Budget Estimates.
A-49	Use of Management and Operating Contracts.
A-71	Responsibilities for the Administration and Management of Automatic Data Processing Activities.
A-109	Major Systems Acquisitions.
A-120	Guidelines for the Use of Consulting Services.
A-121	Cost Accounting, Cost Recovery, and Integrated Sharing of Data Processing Facilities.
A-123	Internal Control Systems.
A-127	Financial Management Systems.
A-130	Management of Federal Information Resources.
A-131	Value Engineering.

B

GSA Publications

The FIRMR as published by GSA is the primary regulation for use by federal agencies in the management, acquisition, and use of both ADP and telecommunications information resources.

C

DoD Directives

DD-5000.1	Major System Acquisitions.
DD-5000.2	Major System Acquisition Process.
DD-5000.11	DoD Data Administration (C3I).
DD-5000.31	Interim List of DoD-Approved, High-Order Languages.
DD-5000.35	Defense Acquisition Regulatory Systems.
DD-5200.1	DoD Information Security Program.

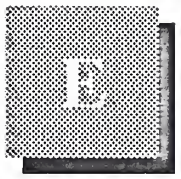
DD-5200.28	Security Requirements for Automatic Data Processing (ADP) Systems.
DD-5200.28-M	Manual of Techniques and Procedures for Implementing, Deactivating, Testing, and Evaluating Secure Resource Sharing ADP Systems.
DD-7920.2	Major Automated Information Systems Approval Process.
DD-7935	Automated Data Systems (ADS) Documentation.
DoDD 3405.1	Computer Programming Language Policy
DoDD 5000.11	DoD Data administration (C31)
DoDI 5000.12	Data Elements and Data Codes Standardization Procedure
DoDI 5000.18	Implementation of Standard Data Elements and Related Features
DoDD 5105.19	Defense Information Systems Agency
DoDD 5110.4	Washington Headquarters Services
DoDD 5118.3	Comptroller of the Department of Defense
DoDD 5137.1	Assistant Secretary of Defense (Command, Control, Communications, and Intelligence)
DoDD 7740.1	DoD Information Resources Management Program
DoD 7740.1-G	DoD ADP Internal Control Guideline
DoDD 7740.2	Automated Information System (AIS) Strategic Planning
DoDI 7740.3	Information Resources Management (IRM) Review Program
DoDD 7750.5	Management and Control of Information Requirements
DoDI 7750.7	DoD Forms Management Program
DoDI 7920.2-M	Automated Information Systems (AIS) Life-Cycle Manual
DoDI 7920.4	Baselining of Automated Information Systems (AISs)
DoDI 7920.5	Management of End User Computing (EUC)
DoDI 7930.1	Information Technology Users Group Program
DoDI 7930.2	ADP Software Exchange and Release
DoDD 7950.1	Automated Data Processing Resources Management
DoD 7950.1-M	Defense Automated Resources Management Manual of Information Requirements

D
Standards

ADCCP	Advanced Data Communications Control Procedures; ANSI Standard X3.66 of 1979; also NIST FIPS 71.
CCITT G.711	International PCM standard.
CCITT T.0	International standard for classification of facsimile apparatus for document transmission over telephone-type circuits.

DEA-1	Proposed ISO standard for data encryption based on the NIST DES.
EIA RS-170	Monochrome video standard.
EIA RS-170A	Color video standard.
EIA RS-464	EIA PBX standards.
EIA RS-465	Standard for Group III facsimile.
EIA RS-466	Facsimile standard; procedures for document transmission in the General Switched Telephone Network.
EIA RS-232-C	EIA DCE to DTE interface standard using a 25-Pin connector; similar to CCITT V-24.
EIA RS-449	New EIA standard DTE to DCE interface which re places RS-232-C.
FED-STD 1000	Proposed Federal Standard for adoption of the full OSI reference model.
FED-STD 1026	Federal Data Encryption Standard (DES) adopted in 1983; also FIPS 46.
FED-STD 1041	Equivalent to FIPS 100.
FED-STD 1061	Group II Facsimile Standard (1981).
FED-STD 1062	Federal standard for Group III facsimile; equivalent to EIA RS-465.
FED-STD 1063	Federal facsimile standard; equivalent to EIA RS-466.
FED-STDs 1005, 1005A-1008	Federal Standards for DCE Coding and Modulation.
FIPS 46	NIST Data Encryption Standard (DES).
FIPS 81	DES Modes of Operation.
FIPS 100	NIST Standard for packet-switched networks; subset of 1980 CCITT X.25.
FIPS 107	NIST Standard for local-area networks, similar to IEEE 802.2 and 802.3.
FIPS 146	Government Open Systems Interconnection (OSI) Profile (GOSIP).
FIPS 151	NIST POSIX (Portable Operating System Interface for UNIX) standard.
IEEE 802.2	OSI-Compatible IEEE standard for data-link control in local-area networks.
IEEE 802.3	Local-area network standard similar to Ethernet.
IEEE 802.4	OSI-compatible standard for token bus local-area networks.
IEEE 802.5	Local-area networks standard for token ring networks.
IEEE P1003.1	POSIX standard, similar to FIPS 151.

MIL-STD-188-114C	Physical interface protocol similar to RS-232 and RS-449.
MIL-STD-1777	IP-Internet Protocol.
MIL-STD-1778	TCP - Transmission Control Protocol.
MIL-STD-1780	File Transfer Protocol.
MIL-STD-1781	Simple Mail Transfer Protocol (electronic mail).
MIL-STD-1782	TELNET - virtual terminal protocol.
MIL-STD-1815A	Ada Programming Language Standard.
SVID	UNIX System Interface Definition.
X.12	ANSI standard for Electronic Data Interchange
X.21	CCITT standard for interface between DTE and DCE for synchronous operation on public data networks.
X.25	CCITT standard for interface between DTE and DCE for terminals operating in the packet mode on public data networks.
X.75	CCITT standard for links that interface different packet networks.
X.400	ISO application-level standard for the electronic transfer of messages (electronic mail).



Related INPUT Reports

Federal Electronic Imaging Markets, 1991-1996

Federal Geographic Information Systems Market, 1991-1996

Federal Computer Equipment Market, 1991-1996

Federal Professional Services Market, 1991-1996

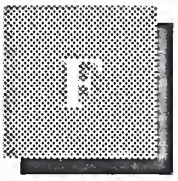
Federal Network Management Market, 1991-1996

Federal Financial Systems Market, 1990-1995

Federal Computer Security Market, 1990-1995

Federal Electronic Commerce Market, 1991-1996

Federal Software and Related Services Market, 1989-1994



INPUT Questionnaire

CONFIDENTIAL

INPUT Questionnaire—Federal Agencies Code: FISR4
Date: _____

Study Title: Federal Software and Related Services Market, FY 1991-FY 1996

Interviewee Type: (check one)		Interview Type: (check one)	
Program Manager	_____	Telephone	_____
Policy Official	_____	FAX	_____
Technical Staff	_____	Mail	_____

Respondent Name: _____

Title: _____

Agency: _____

Address: _____

_____

_____

City, State, Zip: _____

Phone: _____

Comments: _____

_____

Referrals: _____

_____

DEADLINE FOR COMPLETED QUESTIONNAIRES IS _____
PLEASE RETURN BY MAIL OR FAX TO:
INPUT, INC.
1953 GALLOWS RD., SUITE 560
VIENNA, VA 22182
(703) 847-6870
(703) 847-6872 (FAX)

FEDERAL SOFTWARE AND RELATED SERVICES MARKET
AGENCY QUESTIONNAIRE
FY 1991-FY 1996

DEFINITIONS

For the purpose of this study, INPUT has defined software and related services to encompass the following categories:

Software Products - Includes user purchases of applications and systems software packages for in-house computer systems. Software is usually off-the-shelf, or slightly modified. Also included are expenditures for work performed by the vendor to implement or maintain the package at the user's site.

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 for custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software itself. The subcategories of software products are as follows:

- Systems Software

  In general refers to software that enables the computer communications system to perform basic functions and encompasses three basic areas:

  - Systems Control - Includes operating systems, emulators, network control, library control, windowing, access control, and spoolers.

  - Operations Management Tools - Includes performance measurement, job accounting, computer operation scheduling, disk management utilities, and capacity management.

  - Applications Development Tools - Includes 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.

- Applications Software Products

  Refers to software that performs functions directly related to solving user's business or organizational needs. Products fall into two categories: cross-industry products, such as accounting, word processing, and human resources packages, and industry-specific applications.

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. Both applications packages and systems software can be developed on a custom basis.

FEDERAL SOFTWARE AND RELATED SERVICES MARKET
AGENCY QUESTIONNAIRE
FY 1991-FY 1996

CONFIDENTIAL

INPUT, a market research firm, is conducting interviews to examine the federal government's acquisition and use of software and related services. Please refer to the preceding definition page before starting this questionnaire. All responses will be presented in aggregate form and will remain strictly confidential.

1. What percent of your organization's/agency's applications will run under the following operating systems over the next five years? First, let me read the list to you, feel free to estimate your responses. **(Read list and indicate percentages. If respondent cannot estimate percentages, prompt for which operating systems will be used, and check off)**

Operating Systems	Percent (Indicate percent or check mark)
UNIX types	_____
MVS	_____
DOS/VSE	_____
VM	_____
VMS	_____
MS-DOS	_____
OS/2	_____
Other (specify):	_____

2a. For each of the following types of software, indicate if your organization's use is expected to increase, decrease, remain the same, or not use at all through FY 1996. Please try to estimate the percentage use will increase or decrease. **(Read each type of software, check appropriate response, and indicate percentage change)**

	Expected Use				
Software	Increase	Decrease	Percent Change	Remain the Same	Not Use
UNIX-based products	_____	_____	_____	_____	_____
AI/Expert Systems	_____	_____	_____	_____	_____
CASE tools	_____	_____	_____	_____	_____
4 & 5GLs	_____	_____	_____	_____	_____
Ada compilers	_____	_____	_____	_____	_____
SQL-based products	_____	_____	_____	_____	_____

2b. For those products that you expect an increase in usage, could you explain why? **(read only product names that are expected to increase, an record response)**

UNIX-based products _____

AI/Expert Systems _____

CASE tools _____

4 & 5GLs _____

Ada compilers _____

SQL-based products _____

2c. What types of applications will be used for each product your agency intends to use? **(Read each product name that respondent indicated his/her organization will be using in Q2, record response)**

UNIX-based products _____

AI/Expert Systems _____

CASE tools _____

4 & 5GLs _____

Ada compilers _____

SQL-based products _____

3. In your opinion, what UNIX-based products should be available in the marketplace?

_____

_____

4. Which of the following standards will your organization/agency adhere to through 1996? **(Read each item, check if YES)**

GOSIP	_____	SNA	_____
POSIX	_____	SAA	_____
Ada	_____	SQL	_____
Other (specify):	_____		

5a. What is your organization's FY 1991 annual budget for expenditures for software and related services? **(enter dollar amount if known)**

$ _____

5b. Do you expect it to increase for FY 1992? **(check one)**

Yes _____ No _____ Don't know _____

5c. If Yes, by what percent?
(enter percent) _____ %

6. What types of software products will be purchased for use on workstations by your organization?

_____

_____

7a. Would you say that hardware usage decisions are determining your organization's software purchases? (check one)

Yes _____ No _____ Don't know _____

7b. If YES, how?

_____

_____

8. How will your organization's software acquisitions change over the next five years? Do you expect increases, decreases, or no change in acquisitions? Also can you estimate the percent change for each category? **(Read each software category, prompt for increase, decrease, or no change, check if YES, prompt for percent change, and indicate percent)**

	Acquisition Changes			
Software	Increase	Decrease	No Change	Percent Change
Packaged Applications SW	_____	_____	_____	_____
Packaged Systems Software	_____	_____	_____	_____
Custom Applications SW	_____	_____	_____	_____
Custom Systems Software	_____	_____	_____	_____
Contract Software Maintenance	_____	_____	_____	_____

9. How will you acquire software over the next five years? Please estimate the percentages that will be procured through competitive bidding, GSA schedules or Purchase Orders? **(Read each software category, prompt for acquisition method, percentages, and indicate percent)**

Software	Acquisition Method (Indicate Percent) Competitive Bid	GSA Schedule	Purchase Order	Other
Packaged Systems Software	_____	_____	_____	_____
Packaged Applications SW	_____	_____	_____	_____
Custom Systems Software	_____	_____	_____	_____
Custom Applications SW	_____	_____	_____	_____
Contract Software Maintenance	_____	_____	_____	_____

10. Please estimate the percentage of packaged systems and packaged applications software purchases that will be tied to hardware buys over the next five years? **(Read each category, indicate percent)**

	Percent
Packaged Systems Software	_____
Packaged Applications SW	_____

11a. Would you say that your organization's acquisition methods are changing as a result of purchasing more packaged software products in recent years? **(check one)**

Yes _____ No _____ Don't know _____

11b. How has it changed?

_____

_____

12a. Is your organization/agency planning to acquire more packaged software than you used to, at the expense of custom software development efforts? **(check one)**

Yes _____ No _____ Don't know _____

12b. If YES, why? _____

_____

13. How are the new GSA data requirements for vendors impacting your organization's purchase of software and related services?

_____

_____

14. How are federal budget issues impacting how/why your organization purchases software?

_____

_____

15. What types of follow-on support for all types of systems and applications software does your organization/agency intend to acquire from vendors during the next five years? **(Read each category and check if YES)**

Support Category	Software Applications **(check all that apply)**	Software Systems **(check all that apply)**
Install release updates	_____	_____
Install new software	_____	_____
Modify off-the-shelf packages	_____	_____
Fix errors	_____	_____
Modify custom software	_____	_____
Software training	_____	_____
Develop custom documentation	_____	_____

16. Please rate on a 1-5 scale, the importance of each of the following criterion when evaluating packaged applications and packaged systems software. Use a 1-5 scale; where 5 = extremely important and 1= not important at all.

Criteria	Ratings: Packaged Applications Software **(enter 1-5 in each column)**	Ratings: Packaged Systems Software **(enter 1-5 in each column)**
Ease of Use	_____	_____
Ease of Implementation	_____	_____
Performance	_____	_____
Documentation	_____	_____
Training	_____	_____
Support Reputation	_____	_____
Software Features	_____	_____

Application Knowledge/ Technical Expertise	_____	_____
Product Price	_____	_____
Federal Experience	_____	_____
OSI Compliant	_____	_____

17. Also rate on a 1-5 scale, the importance of each of the following criterion when selecting vendors to provide custom systems and applications software. Use a 1-5 scale; where 5 = extremely important and 1 = not important at all.

	Ratings	
Criteria	Custom Applications Software **(enter 1-5 in each column)**	Custom Systems Software
Ease of Use	_____	_____
Ease of Implementation	_____	_____
Performance	_____	_____
Documentation	_____	_____
Training	_____	_____
Support Reputation	_____	_____
Software Features	_____	_____
Application Knowledge/ Technical Expertise	_____	_____
Product Price	_____	_____
Federal Experience	_____	_____
OSI Compliant	_____	_____

18. What trends in software technology are affecting the way your organization/agency accomplishes information processing, and what are their impacts? **(Prompt here with examples if respondent hesitates, i.e., relational DBMS technology)**

Trends	Impact
_____	_____
_____	_____

19. If your organization/agency is part of the DoD, what has been the effect of the new DoD guidelines on mandatory Ada use within your organization?

_____

_____

THANK YOU FOR YOUR COOPERATION

DEADLINE FOR COMPLETED QUESTIONNAIRES IS _____

About INPUT

Company Profile

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

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

Many of INPUT's professional staff have more than 20 years' experience in their areas of specialization. Most have held management positions in large organizations, enabling them to supply practical solutions to complex business problems.

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

Staff Credentials

INPUT's staff have been selected for their broad background in a variety of functions, including planning, marketing, operations, and information processing. Many of INPUT's professional staff have held executive positions in some of the world's leading organizations, both as vendors and users of information services, in areas such as the following:

- Processing Services
- Professional Services
- Turnkey Systems
- Applications Software
- Field (customer) Service
- Banking and Finance
- Insurance
- Process Manufacturing
- Telecommunications
- Federal Government

Educational backgrounds include both technical and business specializations, and many INPUT staff hold advanced degrees.

U.S. and European Advisory Services

INPUT offers the following advisory services on an annual subscription basis.

1. Market Analysis Program—U.S.
The Market Analysis Program provides up-to-date U.S. information services market analyses, five-year forecasts, trend analyses, vertical/cross-industry market reports, an on-site presentation, hotline inquiry service, and sound recommendations for action. It covers software products, turnkey systems, processing and network services, and professional services markets. It is designed to satisfy the planning and marketing requirements of current and potential information services vendors.

2. Market Analysis Program—Europe
This program is designed to help vendors of software and services with their market planning. It examines the issues in the marketplace, from both a user and a vendor viewpoint. It provides detailed five-year market forecasts to help plan for future growth.

3. Vendor Analysis Program—U.S.
A comprehensive reference service covering more than 400 U.S. information services vendor organizations, VAP is often used for competitive analysis and prescreening of acquisition and joint-venture candidates. Profiles on leading vendors are updated regularly, and hotline inquiry service is provided.

4. Vendor Analysis Program—Europe
This is an invaluable service for gaining competitive information and for seeking targets for partnerships or acquisitions. The service provides profiles on some 450 European software and services vendors. A hotline enquiry service provides details on companies not covered by the profiles.

5. Electronic Data Interchange Program
Focusing on what is fast becoming a major computer/communications market opportunity, this program keeps you well informed. Through monthly newsletters, timely news flashes, comprehensive studies, and telephone inquiry privileges, you will be informed and stay informed about the events and issues impacting this burgeoning market.

6. Network Services Program—Europe
Network services is a fast-growing area of the software and services industry. This program is essential to vendors of EDI, electronic information services, and network products and services, keeping clients informed of the latest developments in the European marketplace.

7. Systems Integration Program—U.S.
Focus is on the fast-moving world of systems integration and the provision of complex information systems requiring vendor management and installation of multiple products and services. The program includes an annual market analysis of the U.S. systems integration market, SI vendor profiles and updates, topical market analysis reports, and an annual SI seminar.

8. Systems Operations Program—U.S.
This program focuses on the exciting resurgence of the market for outsourcing systems operations. It includes an annual market analysis report of the systems operations market, SO vendor profiles and updates, topical market analysis reports, and an annual SO seminar.

9. Systems Management Program—Europe
Systems integration and systems operations (facilities management) are key growth areas for the decade. This program examines these two areas and analyzes current market trends, user needs, and vendor offerings.

10. Federal Information Systems and Services Program
This program presents highly specific information on U.S. federal government procurement practices, identifies information services vendor opportunities, and provides guidance from INPUT's experienced Washington professionals to help clients maximize sales effectiveness in the federal government marketplace.

11. State Information Systems and Services Program (proposed)
This program presents extensive information on state government spending, procurement policies, identifies key contacts, opportunities, and provides guidance from INPUT's experienced professionals to help clients maximize sales opportunities in the state government marketplace.

12. Information Systems Program
ISP is designed for executives of large information systems organizations and provides crucial information for planning, procurement, and management decision making. This program is widely used by both user and vendor organizations.

13. Customer Service Program—International
This program provides customer service organization management with data and analyses needed for marketing, technical, financial, and organizational planning. The program pinpoints user perceptions of service received, presents vendor-by-vendor service comparisons, and analyzes and forecasts service markets for large systems, minicomputers, personal computer systems, and third-party maintenance. A monthly newsletter helps clients keep informed of the latest developments in the market.

14. Customer Service Program—Europe
Customer service is an expanding area. Companies are now expanding from hardware service to more software-related maintenance and professional services. This program helps vendors penetrate these new areas and provides guidelines for future market strategy. A monthly newsletter helps clients keep abreast of the latest developments in the market.

15. Worldwide Information Services Market Forecasts
In 1989 INPUT initiated this research study, which provides an international forecast for the information services market.

Customized Advisory Services

In addition to standard continuous-information programs, INPUT will work with you to develop and provide a customized advisory service that meets your unique requirements.

Acquisition Services

INPUT also offers acquisition services that are tailor-made for your requirements. INPUT's years of experience and data base of company information about information systems and services companies have helped many companies in their acquisition processes.

An Effective Combination

INPUT'S Executive Advisory Services are built on an effective combination of research-based studies, client meetings, informative conferences, and continuous client support. Each service is designed to deliver the information you need in the form most useful to you, the client. Executive Advisory Services are composed of *varied combinations of the following products and services:*

Research-Based Studies
Following a proven research methodology, INPUT conducts major research studies throughout each program year. Each year INPUT selects issues of concern to management. Topical reports are prepared and delivered throughout the calendar year.

Information Service Industry Reports
INPUT's Executive Advisory Services address specific issues, competitive environments, and user expenditures relative to:

- Software Products
- Processing Services
- Network Services
- Systems Integration
- Systems Operations
- Professional Services
- Turnkey Systems
- Small-Systems Service
- Third-Party Maintenance
- Large-Systems Service

Industry-Specific Market Reports

Detailed analyses of market trends, forces driving the markets, problems, opportunities, and user expenditures are available for the following sectors:

- Discrete Manufacturing
- Process Manufacturing
- Transportation
- Utilities
- Telecommunications
- Retail Distribution
- Wholesale Distribution
- Banking and Finance
- Insurance
- Medical
- Education
- Business Services
- Consumer Services
- Federal Government
- State and Local Government
- Miscellaneous Industries

Cross-Industry Market Report

A separate analysis covers the following cross-industry application areas:

- Accounting
- Education and Training
- Engineering and Scientific
- Human Resources
- Office Systems
- Planning and Analysis
- Other Cross-Industry Sectors

Hotline: Client Inquiry Services

Inquiries are answered quickly and completely through use of INPUT's Client Hotline. Clients may call any INPUT office (San Francisco, New York, Washington D.C., London, or Paris) during business hours or they may call a voicemail service to place questions after hours. This effective Hotline service is the cornerstone of every INPUT Executive Advisory Service.

The Information Center

One of the largest and most complete collections of information services industry data, the Information Center houses literally thousands of up-to-date files on vendors, industry markets, applications, current/emerging technologies, and more. Clients have complete access to the Information Center. In addition to the information contained in its files, the center maintains an 18-month inventory of over 130 major trade publications, vendor consultant manuals, economic data, government publications, and a variety of important industry documents.

Access to INPUT Professional Staff

Direct access to INPUT's staff, many of whom have more than 20 years of experience in the information industry, provides you with continuous research and planning support. When you buy INPUT, you buy experience and knowledge.

Client Conference

You can attend INPUT's Client Conference. This event addresses the status and future of the information services industry, the competitive environment, important industry trends potentially affecting your business, the impact of new technology and new service offerings, and more.

You will attend with top executives from many of the industry's leading, fastest-growing, and most successful vendor companies—and with top Information Systems (IS) managers from some of the world's most sophisticated user organizations.

On-Site Presentation by INPUT Executives

Many of INPUT's programs offer an informative presentation at your site. Covering the year's research, this session is scheduled at the convenience of the client.

Proprietary Research Service

INPUT conducts proprietary research that meets the unique requirements of an individual client. INPUT's custom research is effectively used:

For Business Planning

Planning for new products, planning for business startups, planning for expansion of an existing business or product line—each plan requires reliable information and analysis to support major decisions. INPUT's dedicated efforts and custom research expertise in business planning ensure comprehensive identification and analysis of the many factors affecting the final decision.

For Acquisition Planning

Successful acquisition and divestiture of information services companies requires reliable information. Through constant contact with information services vendor organizations and continuous tracking of company size, growth, financials, and management "chemistry," INPUT can provide the valuable insight and analysis you need to select the most suitable candidates.

For the Total Acquisition Process

INPUT has the credentials, the data base of company information, and—most importantly—the contacts to assist you with total acquisition and/or partnering relationship processes:

- Due Diligence
- Schedules and Introduction
- Criteria & Definitions
- Retainer and Fee-Based
- Active Search

For Competitive Analysis

Knowing marketing and sales tactics, product capabilities, strategic objectives, competitive postures, and strengths and weaknesses of your competition is as critical as knowing your own. The career experience of INPUT's professionals—coupled with INPUT's collection and maintenance of current financial, strategic, tactical, and operational information about more than 400 active companies—uniquely qualifies INPUT to provide the best competitive information available today.

For Market and Product Analysis

Developing new products and entering new markets involves considerable investment and risk. INPUT regularly conducts research for clients to identify product requirements, market dynamics, and market growth.

More About INPUT...

- More than 5,000 organizations, worldwide, have charted business directions based on INPUT's research and analysis.
- Many clients invest more than $50,000 each year to receive INPUT's recommendations and planning information.
- INPUT regularly conducts proprietary research for some of the largest companies in the world.
- INPUT has developed and maintains one of the most complete information industry libraries in the world (access is granted to all INPUT clients).
- INPUT clients control an estimated 70% of the total information industry market.
- INPUT analyses and forecasts are founded upon years of practical experience, knowledge of historical industry performance, continuous tracking of day-to-day industry events, knowledge of user and vendor plans, and business savvy.
- INPUT analysts accurately predicted the growth of the information services market—at a time when most research organizations deemed it a transient market. INPUT predicted the growth of the microcomputer market in 1980 and accurately forecasted its slowdown in 1984.

For More Information . . .
INPUT offers products and services that can improve productivity, and ultimately profit, in your firm. Please give us a call today. Our representatives will be happy to send you further information on INPUT services or to arrange a formal presentation at your offices.

For details on delivery schedules, client service entitlement, or Hotline support, simply call your nearest INPUT office. Our customer support group will be available to answer your questions.

North America

San Francisco
1280 Villa Street
Mountain View, CA 94041-1194
Tel. (415) 961-3300 Fax (415) 961-3966

New York
Atrium at Glenpointe
400 Frank W. Burr Boulevard
Teaneck, NJ 07666
Tel. (201) 801-0050 Fax (201) 801-0441

Washington, D.C.—INPUT, INC.
1953 Gallows Road, Suite 560
Vienna, VA 22182
Tel. (703) 847-6870 Fax (703) 847-6872

International

London—INPUT LTD.
Piccadilly House
33/37 Regent Street
London SW1Y 4NF, England
Tel. (071) 493-9335 Fax (071) 629-0179

Paris—INPUT SARL
24, avenue du Recteur Poincaré
75016 Paris, France
Tel. (1) 46 47 65 65 Fax (1) 46 47 69 50

Frankfurt—INPUT LTD.
Sudetenstrasse 9
W-6306 Langgöns-Niederkleen, Germany
Tel. 0 6447-7229 Fax 0 6447-7327

Tokyo—INPUT KK
Saida Building, 4-6
Kanda Sakuma-cho, Chiyoda-ku
Tokyo 101, Japan
Tel. (03) 3864-0531 Fax (03) 3864-4114