ISP

End-User Software Requirements

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END-USER SOFTWARE REQUIREMENTS

END-USER SOFTWARE REQUIREMENTS

ABSTRACT

Functions being performed by office workers at every level within organizations can be effective by computer technology. The executives are using computers to build and analyze financial models to arrive at more knowledgeable decisions, and the lower echelons are using computers to help manage their daily affairs and improve overall productivity. The bridge between the end user and the computer technology is software. There are literally hundreds of software packages available, which are aimed at the end user, and end-user software is one of the fastest growing markets in the information services industry.

The report is written for IS management and end-user management and it:

- Examines the future direction of end-user computing software.

- Describes the factors that should be considered in selecting end-user software.

- Identifies strategies for staying abreast of the end-user software market.

This report contains 57 pages, including 15 exhibits.

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END-USER SOFTWARE REQUIREMENTS

CONTENTS

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END-USER SOFTWARE REQUIREMENTS

EXHIBITS

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I INTRODUCTION

A. PURPOSE

- This report is part of INPUT's Information Systems Program (ISP). It identifies issues that the Information Systems (IS) organization must address to ensure the quality and effectiveness of software products selected in support of end-user computing activities.

- The report answers the following questions:

    - Why is it important for IS to be involved in the acquisition process of personal computer software?

    - What is the future direction of end-user computing software?

    - How will end-user computing affect future corporate systems development?

    - Why should IS develop strategic end-user computing plans?

    - What features missing in today's end-user software packages will be required in the future?

    - What factors should be considered in selecting end-user software?

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-       How can IS stay abreast of the fast-growing end-user computing soft-
ware market?

B.   SCOPE

●   This report will focus on the implications of the trends in software directed
primarily at information processing functions performed by workers in an
office environment. It will examine end-user software requirements from the
viewpoints of both the corporate perspective and the individual end user. This
report will outline the action IS should consider to provide an effective level
of support to the end user in evaluating, selecting, and implementing software
products.

●   The following people should find this report pertinent to their tasks and
responsibilities:

-       IS managers.

-       IS planners.

-       IS end-user support staff.

-       End-user managers.

C.   RELATED INPUT REPORTS

●   1984 End-User Planning Report. Identifies strategies for supporting end-user
computing and maximizing its benefits.   It also analyzes new end-user
products and systems.

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- <u>Supporting Personal Computer Software</u>. This report describes the planning and organizational issues of personal computer software support.

- <u>End-User Micro-Mainframe Needs</u>. This report concentrates on the experiences of organizations that use personal-computer-to-mainframe systems. It also identifies systems requirements and projects future effects.

- <u>Future Skills Requirements for Software Development</u>. This report examines many of the latest productivity schemes to determine the impact that new methods are having on the skills mix of IS.

- <u>Organizing the IS Department for End-User Computing</u>. This report analyzes several end-user computing strategies being employed by large firms from a variety of industries.

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II   EXECUTIVE SUMMARY

- This executive summary is given in presentation format to help the busy reader quickly review key research findings.

- It provides an executive presentation, complete with script, to facilitate group communications.

    - The key points of the entire report are summarized in Exhibits II-1 through II-3.

    - On the left-hand page facing each exhibit is a script explaining that exhibit's contents.

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A. END USERS REQUIRE MULTIFACETED SOFTWARE

- Computer technology is moving at a fairly rapid pace toward the workstations of office personnel in almost every business. Functions such as decision making, report preparation, typing, filing, and oral and written communications are all being improved by the use of visual display terminals interacting with computer processors through software.

- End-user software not only entails that which supports standalone personal computers, but encompasses all information processing that is initiated and controlled by end users. Today's office systems provide a wide range of capabilities, from electronic mail and filing to decision support and data processing.

- As end users become more aware of the capabilities of computer technology and more comfortable using the associated software tools, they want to do more comprehensive computing. They want access to corporate data bases and they want to generate unique program instructions in a language that resembles English as closely as possible.

- Eventually, workers will interface with corporate information systems through intelligent workstations, and the supporting software will provide a bidirectional flow of data between workstations and the mainframe applications. Job-specific software for the various functions of an organization will also be available for the intelligent workstations.

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EXHIBIT II-1

END USERS REQUIRE MULTIFACETED SOFTWARE

- **Individual Personal Computing Needs**

- **Software for Office Systems Support**

- **Ability to Share Resources Through LANs**

- **Need to Download Data from Mainframes to Micros for Decision Support**

- **Ability to Generate Programs Through Non-Procedural Languages**

- **Job-Specific Software for End Users**

- **Need to Provide Bidirectional Flow of Data Between Micros and Mainframes for DDP**

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B.   END-USER SOFTWARE HAS MULTIPLE DISTRIBUTION CHANNELS

- In the past, IS normally has had only two sources for the acquisition of main-frame software: the hardware manufacturer or the independent software vendor.   IS has had total control over the selection of mainframe systems software and has been heavily involved in the procurement of mainframe applications software.

- Software written for use by laypersons, or end users, interacting with com-puters through visual display terminals, is available through many channels. A person who wishes to obtain a particular personal computer application package can do so by ordering it through the mail or even by buying it at department stores, such as Sears or Macys.   There are numerous computer retail stores across the nation where anyone can purchase a personal computer and supporting software.

- Because there are so many different software products from which the end user may choose, and because these products are readily available through convenient channels, IS must establish rules and regulations governing the acquisition of end-user software to avoid a hodgepodge of incompatible products that would be impossible to integrate in the future.

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EXHIBIT II-2

END-USER SOFTWARE HAS MULTIPLE DISTRIBUTION CHANNELS
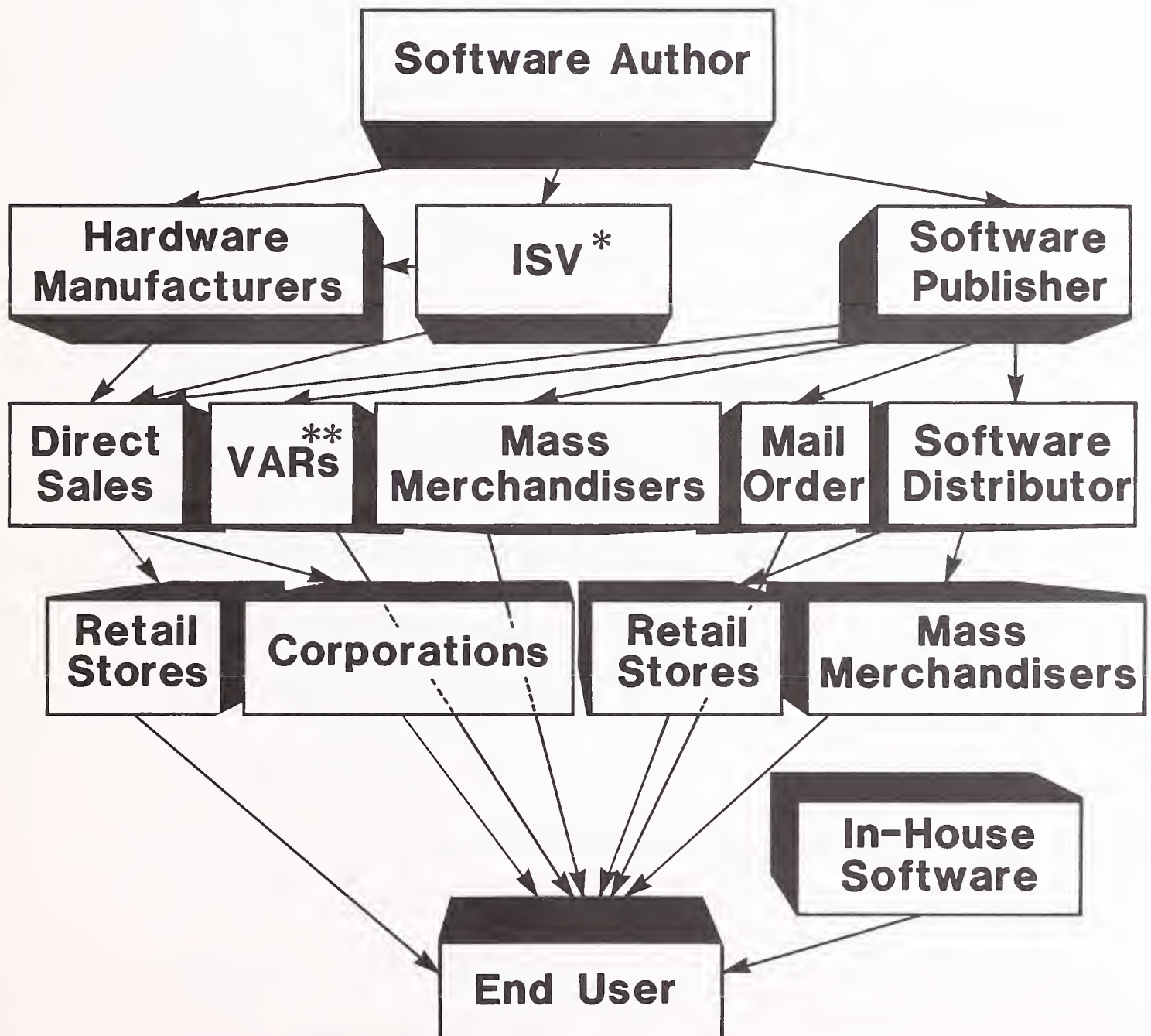
* **Independent Software Vendors**

** **Value Added Resellers**

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C.   I.S. SHOULD LEAD THE END-USER COMPUTING ACTIVITIES

- Although most IS organizations were planning and implementing the information center to support ad hoc reporting needs of the end user, personal computers and office automation were quietly being installed by vendors working directly with the line organizations.

- The time has come when IS must grab hold of all computing activities related to end users to assure an orderly and compatible evolution toward a corporatewide integrated information network. The information center should be expanded to include responsibility for the acquisition and use of all microcomputer products and office automation systems.

- IS should have a master strategic information systems plan that outlines the various stages of end-user computing. The plan would provide the map that directs the end-user software selection process. The software would have to be compatible with the plan before IS would authorize a purchase order.

- The acquisition of end-user software packages should be required to follow a formalized procedure, backed by a policy issued from senior corporate management. Qualifying criteria should be established to screen software suppliers and products. IS should coordinate end-user software purchases to assure quality and compatibility with the strategic plans.

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EXHIBIT II-3

I.S. SHOULD LEAD THE
END-USER COMPUTING ACTIVITIES

- **Establish All End-User Computing Activities Under One IS Manager**

  - **Personal Computers**

  - **Information Center**

  - **Office Systems**

- **Develop Corporatewide End-User Computing Plan**

  - **Departmental Processing Needs**

  - **Personal Computing Needs**

  - **Interface Requirements**

  - **Networking**

- **Establish Corporate Policy Governing End-User Software Aquisitions**

  - **Quality Assurance**

  - **Adherence to Plan**

  - **Vendor/Product Qualifications**

  - **IS Coordination**

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III END-USER SOFTWARE DIRECTIONS

A. BACKGROUND AND DEFINITIONS

- Who is the end user? In the broad sense, anyone who interfaces with computer input or output could be categorized as an end user. For this report, however, the term "end user" will focus on the following categories:

    - Those people using computerized office systems for electronic mail and filing and administrative support.

    - Personal computer users (supporting company business).

    - Information center customers.

- The end users within the established framework use computer hardware and software tools to perform many routine daily functions. The following are descriptions of these functions:

    - Analysis and decision making include research, reading, calculating, forecasting, planning, and scheduling.

    - Document preparation includes outlining, writing, designing exhibits, and proofreading.

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- Typing/data entry includes keying previously prepared documents or data.

- Information handling/storage includes archival data, action data, mail handling, information/document retrieval, filing, and distribution.

- Communications include interchanging data/information between users and scheduling meetings for interpersonal communications.

- When evaluating and selecting software to satisfy the needs of end users, it is important to understand the distribution of office functions by occupational category so that the emphasis will be placed on those functions with the greatest potential payback. In September 1983 INPUT published a report entitled Methods of Cost/Benefit Analysis for Office Systems. The research for that report disclosed the breakdown of the percentages of time devoted to the various functions for the major occupational categories. This survey data is listed in Exhibit III-1. The analysis and decision making function includes reading and performing calculations, which probably accounts for the high percentage of clerical time devoted to this function.

- Many companies have started personal computer purchase programs for their employees. These programs allow the purchase of computer equipment for personal use through a low- or no-interest loan extended over several years. There has been a tremendous response to these personal computer purchase programs, and the employees are generally selecting hardware and software that provide a high degree of computational sophistication. The participating employees are serious about learning how computers can enhance their lives, both at home and at work. This report will not address the software needs and wants of the individuals who have acquired their own personal computers. Rather, it will concentrate on the end-user software requirements to support corporate goals and business objectives.

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EXHIBIT III-1

DISTRIBUTION OF OFFICE WORKERS' FUNCTIONS BY TIMES

OCCUPATIONAL CATEGORY FUNCTION	EXECUTIVE, MANAGERIAL, ADMINISTRATIVE	PROFESSIONAL & TECHNICAL	SALES WORKERS	SECRETARIES, ADMINISTRATIVE ASSISTANTS	TYPISTS, DATA ENTRY	CLERICAL
Analysis & Decision-Making	15.0%	35.0%	7.5%	12.0%	5.0%	25.0%
Report Preparation	23.0	20.0	12.5	12.0	5.0	5.0
Typing/Data Entry	0.0	0.0	0.0	20.0	40.0	10.0
Copying/Information Entry	0.0	0.0	0.0	6.0	12.0	12.0
Information Handling/Storage	12.0	15.0	5.0	15.0	15.0	30.0
Telephone	20.0	10.0	25.0	17.5	10.0	8.0
Interpersonal Communications	30.0	20.0	50.0	17.5	13.0	10.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: INPUT surveys.

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- Exhibit III-2 describes the main types of software packages available for personal computers. Along with the generic software such as word processing, spreadsheets, and graphics, there is also a category called vertical market applications software. Industry-specific applications can be found for medical and dental office management, real estate investment analysis, property management, law firm administration, insurance agents' data bases, and so on. There is another category of software products designed to teach end users how to use the generic software. American Training International, for instance, has introductory courses for PC-DOS, dBASEII, WordStar, VisiCalc, BASIC, SuperCalc, and Multiplan. There are other packages that introduce beginners to computer service in general and personal computers in particular.

- There is software associated with office systems products such as IBM's Professional Office Systems (PROFS), which runs under VM on 43XX and 30XX CPUs; and integrated office systems packages from companies like DEC, Data General, and Wang. These integrated office systems run on those companies' larger minicomputers. (This report will examine the role of the end user in the selection of these types of office systems and will evaluate the need for additional features.)

- There is also a category of mainframe software products that are designed for nonprogrammer users. These products are nonprocedural, nontechnical, relatively easy to learn, and based on simple-syntax English statements that nonprogrammers are able to use to produce computer programs. Fourth-generation languages such as FOCUS, RAMIS II, and NOMAD 2 fall in this category. The report will relate the impact these types of software products are having on end-user computing and will discuss the feasibility of end users developing their own programs.

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EXHIBIT III-2

PERSONAL COMPUTER SOFTWARE DEFINITIONS

SOFTWARE TYPE	DESCRIPTION	EXAMPLES
PC Operating Systems	Controls operation of the hardware, managing the utilization of resources and providing interface between application programs and the hardware.	DOS 2.00, CP/M-86, XENIX, MS-DOS 1.10, OASIS-16
Programming Languages	Interpreters that allow programmers to instruct the computers to perform specific tasks.	BASIC, FORTRAN, COBOL, PASCAL, APL, Assembler, C
Spreadsheets	Grid of rows and columns used to record figures and calculations. Highly interactive allowing the user to build numerical models for "what if" analysis.	VisiCalc, SuperCalc, MultiPlan, CalcStar
Word Processing	Provides document preparation features, such as editing, formatting, global searching, alignment, symbols, fonts, boilerplate text and spelling checkers.	VolksWriter, Multimate, EasyWriter II
Data Management	For collecting, organizing, translating, storing and retrieving related and diverse pieces of information.	dBase II, Knowledge Man, Data Ace
Financial Applications	Portfolio evaluation and investment analysis. Maintains records of purchases, sales, commissions and prepares statements of short- and long-term gains and losses.	N-Squared Stock Analysis, Strategic Planner, Financial Planner
Accounting	Can include general ledger, order processing, inventory control, receivables, payables, and payroll.	Real World General Accounting, Inventory Service, Business Software Series
Business Management	Project scheduling, personnel performance tracking, cost accumulation, and evaluation of resource allocations.	Project Management System, Executive Alert, The Professional, Optimizer
Graphics	Allows user to display or print standard Cartesian plots, pie charts, horizontal and vertical bar charts.	GraphWriter, Chart-Master, BenchMark
Communications	Requires a board with an RS-232C serial port and modem; allows user to dial a remote system, log on, upload or download files, and log off.	Apple-IBM Connection, Passport, Logon, Microgate
Integrated Packages	Combines computer functions into one program: electronic spreadsheet, word processing, data management, business graphics, and telecommunications.	1-2-3, MBA, MetaFile, T/Maker III, PC Data Interface
Product Family	Individual application packages that share common data formats and user interfaces. Each package (spreadsheet, word processing, etc.) may be purchased separately.	VISI Series, Multi Series, Super Series, pfs Series

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B.   END USERS' WISHES VERSUS REALITY

- There is a growing number of end users who would like the flexibility of making selective queries of any mainframe data bases from their personal computers. Ultimately, they would like the mainframe data in a form that their personal computers could use through the microcomputer software. In essence, these end users want to be able to download data from any number of different mainframe data bases to their spreadsheets, word processors, graphics packages, etc.

- The concept of sharing processing capabilities and data between mainframes and micros has been termed "shared functionality" by INPUT. Micro-mainframe applications are expected to grow considerably over the next four years and should affect about a quarter of the installed mainframe applications by that time.

- The big hurdle in achieving micro-mainframe shared functionality is the missing software needed to access the various mainframe data base structures from a microcomputer. There are no set standards that govern the architecture of a data base; structures, inquiry syntax, and data dictionary formats are unique on products such as IMS, IDMS, ADABAS, and TOTAL. Without a standard, it is impossible for microcomputer software vendors to provide an infinite number of integrated micro-mainframe links.

- There are a few ways of tackling this problem of reformatting mainframe data base information for use with microcomputer software. The most common has been to add a synchronous plug-in board with an RS-232C serial port to the personal computers, thus providing IBM 3278 terminal emulation. This allows the personal computers to communicate with a mainframe, but it does not address the data incompatibility problems. This reformatting quandary is usually handled by the internal programming staff, which is capable of handling a few applications; but reformatting could become burdensome as end-user demands increase.

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- Exhibit III-3 identifies the three viable alternatives for coping with the problem of micro-mainframe linkage. The first, which entails an internal programming effort, was discussed above. The second alternative, which appears to be the most feasible, is the establishment of a standard format for which vendors could supply utility programs that would convert input/output formats from their products to a standard format that other vendors' software could read and write. There is such a standard available, called Data Interchange Format (DIF). Several vendors, including ADR, Cincom, and Mathematica, have links from their products to a DIF file.

- The ideal situation, however, is to have the vendors of mainframe data-base-related software provide integrated links to microcomputer applications software products. A few such vendors are providing links to the more popular micro software packages like Lotus 1-2-3 and VisiCalc.

C.   STANDALONE MICRO SOFTWARE NEEDS

- INPUT has been strongly advocating IS control over end-user computing, because INPUT believes that this craze for direct computer support will evolve into a significant aspect of corporate systems development. For this reason INPUT has recommended that IS become the central repository for personal computer software and be included in the acquisition process.

- Unfortunately, some IS managers have taken this recommendation too literally and have implemented compatibility standards that are overly restrictive and provide a very limited array of solutions for the individuals who are trying to improve their productivity through the use of a personal computer or the information center.

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EXHIBIT III-3

APPROACHES TO THE MICRO-MAINFRAME LINK PROBLEM

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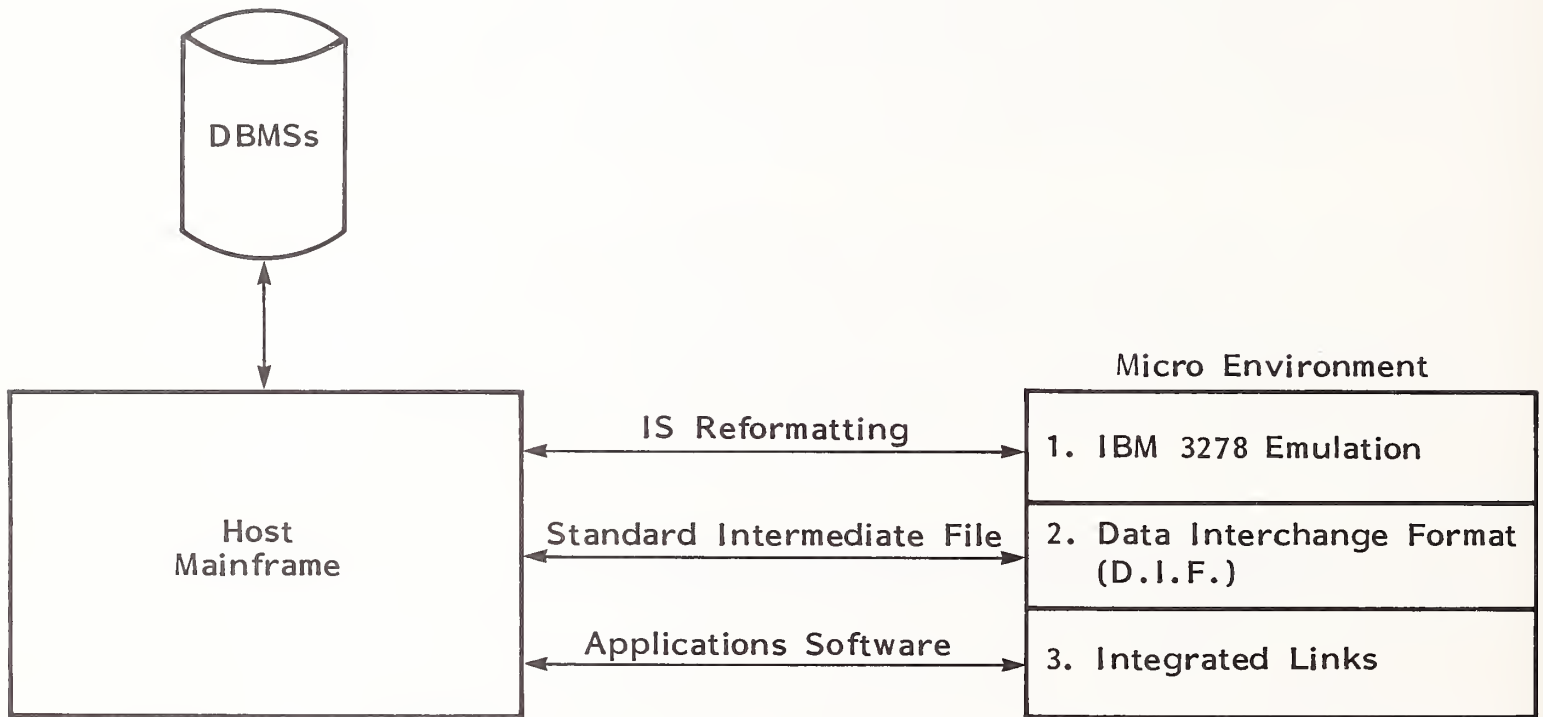
- When evaluating software that will be used by nonprogrammers, the IS technicians must be able to take an empathetic view of the products under consideration. There is a tendency on the part of many IS professionals to automatically select the most expensive and comprehensive software products with the thought that the superfluous features might come in handy at a later date. Offering only the most sophisticated end-user software packages will intimidate beginners and frustrate the seasoned end user who wishes to use only a small portion of the total capabilities.

- When asked to list the attributes of personal computer software in the order of importance, both the vendors and the IS respondents put "ease of learning" and "ease of using" at the top of the list. One vendor pointed out that first and foremost should be the ability of the package to provide an adequate solution for the user's problem, to which INPUT must agree.

- Exhibit III-4 lists the main attributes of microcomputer software in the perceived order of importance from the viewpoints of the vendors of related products and the IS management involved in the acquisition process. Note that the ability to interface with other software packages is next to last. This is primarily due to the fact that most of the present users are performing one specific function on their personal computers and see little need to automatically interface with other software functions.

- As end users learn more about the capabilities of the computer tools and begin to get more involved in developing decision support systems, the need to access corporate data and other systems will become imperative. This need will surely change the ranking of such items as interface ability and security features.

- In order to be an effective facilitator, IS must understand the reason behind the user's request for a particular microcomputer function and then make available products that not only fit the problem but also fit the user's ability to employ them.

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EXHIBIT III-4

STANDALONE MICROCOMPUTER SOFTWARE ATTRIBUTES
IN ORDER OF IMPORTANCE

1. Provide Adequate Solution

2. A Short Learning Curve

3. Easy to Use

4. Thorough Documentation

5. IBM-Compatible

6. Vendor Support and Viability

7. Security Features

8. Resource Efficiency

9. Ability to Interface with Other Software

10. Cost

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- There is more on the selection process of software products for end-user computing in Chapters IV and V.

D.   INTEGRATING THE SOFTWARE TOOLS

- As the neophyte computer user begins to master the capabilities of a separate applications package, there is inevitably the demand to include the capabilities of yet another package. A user might develop a financial model using a spreadsheet program and then wonder how the results can be displayed graphically in a report to management.

- Data format incompatibility between software packages precludes data sharing that necessitates rekeying, cutting, and pasting. Even if the package can send and receive data in the DIF format mentioned earlier, it is a cumbersome task to build a data bridge from one package to another.

- One solution to the data incompatibility problem has been the acquisition of products from vendors that offer a family of application packages, all of which share common data formats and user interfaces. One such family is pfs from Software Publishing. There is a pfs word processing package called Write, a pfs spreadsheet program called Plan, a pfs report generator called Report, a pfs program for data base management called File, a pfs program for proofreading called Proof, and a recent offering--the first in a series of telecommunications products--called Access. VisiCorp also has a series of software packages including VisiCalc, VisiTrend, VisiPlot, and VisiWord. Microsoft has its Multi Series and Sorcim offers Super Series of products.

- These families or series of application packages have been most attractive to the small businesses and the professionals because they allow the individuals to choose the functions needed to improve administrative operations at an

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affordable price. Furthermore, these families of products provide a building-block approach to automation; this is especially attractive to the first-time user who is more comfortable learning how to use the packages one at a time.

- The term "integrated" describes a line of personal computer software that tightly combines several functional applications into a single package. The most widely used integrated package is 1-2-3 from Lotus Development Corporation. It combines electronic spreadsheet, data management, and graphics functions into one program for under $500. The big selling point of 1-2-3 is its superior spreadsheet capabilities. MBA, from Context Management Systems, performs the same functions as 1-2-3 but also includes word processing and asynchronous telecommunications. The latest entrants to the tightly integrated software packages race are Symphony, from Lotus, and Framework, from Ashton-Tate (makers of the powerful dBASEII data-management program). Both of these integrated products include applications software for spreadsheets, word processing, data base, graphics, and a built-in advanced programming language. Symphony also provides some communications capabilities. Both of these integrated packages offer extensive on-screen windowing.

- The IS manager responsible for maintaining a central repository of personal computer software and making package selection recommendations has a difficult task considering the myriad of choices. As mentioned before, INPUT contends that one single integrated software package will probably not suffice when the following factors are taken into consideration:

    - The specific problem being solved.

    - The competence level of the end user.

    - The potential growth of the system.

    - The limitations of the specific hardware.

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- Depending on the size of the organization and the potential number of installed personal computers, IS should consider adding one of the families of software products as well as an all-encompassing, tightly integrated package. Exhibit III-5 illustrates the two approaches.

E.   IBM'S END-USER SOFTWARE STRATEGIES

- IBM's overall strategy has been (and will be, at least during the next decade) to integrate all sources of data and information under the highly centralized, host-oriented, SNA umbrella. This includes traditional data processing applications, office automation, and personal computers. By maintaining control of all information services functions through centralization, IBM hopes to continue to lead the hardware and systems software markets.

- INPUT believes that as PCs turn into intelligent terminals and the use of office systems expands to every level of worker, the tasks being performed by the host under MVS/XA, VM, TSO, IMS, DB2, etc., and the demand for tens of gigabytes of DASD and tens of megabytes of RAM will create an insurmountable bottleneck. There is no indication that IBM intends to change its current 308X, VM/MVS/XA-oriented architecture in either the Sierra or Summit series of host mainframes. The differentiations of functions through small business systems, minicomputers, and disparate office automation products--as depicted in Exhibit III-6--will become increasingly necessary. For more on this subject refer to the INPUT study entitled Large-Scale Systems Directions--Large IBM and Software-Compatible Mainframes.

- IBM understands that to maintain control of its market position it must not only control the hardware and systems software but also provide application solutions for personal computer users. In its quest for control, IBM recently announced a simple-to-learn, easy-to-use PC operating environment product

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EXHIBIT III-5

APPROACHES TO DATA COMPATIBILITY

Family of Products
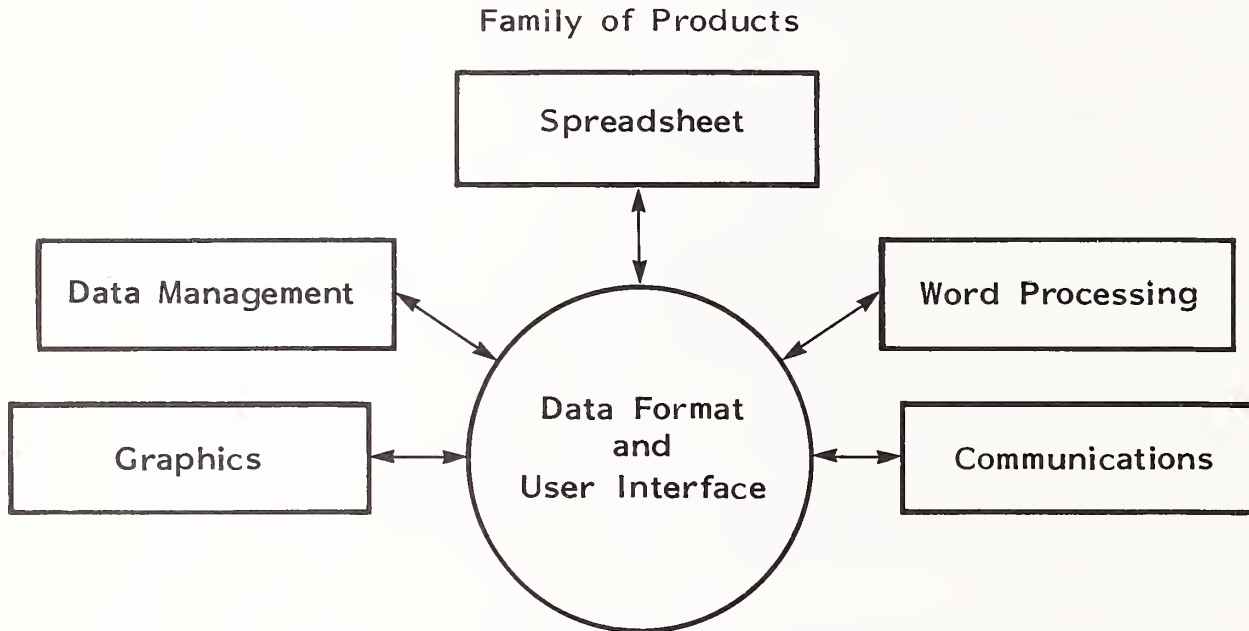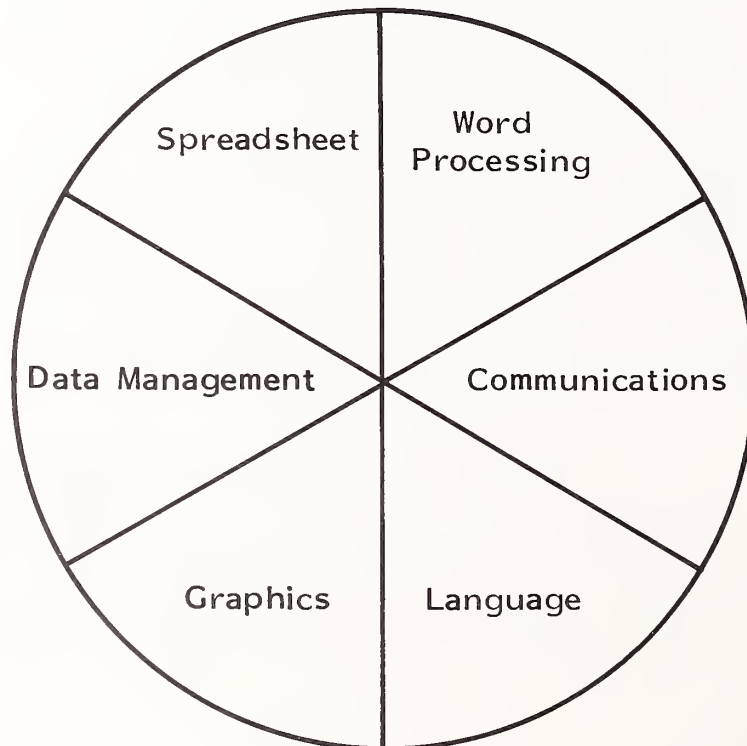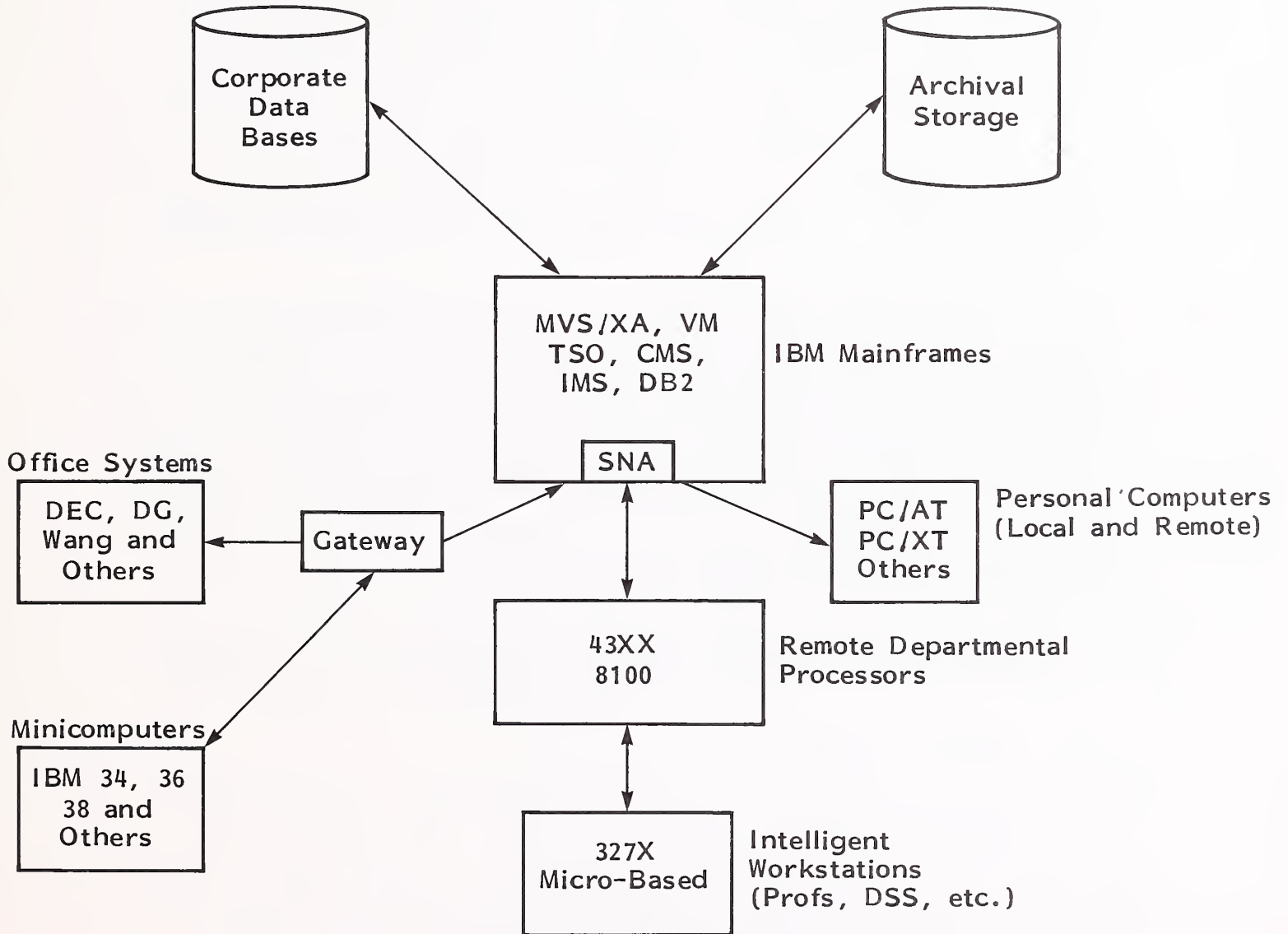

versus

Integrated Applications

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EXHIBIT III-6

IBM CENTRALIZATION AND DIFFERENTIATION
OF FUNCTIONS

called TopView. It provides data transfer, multitasking, and windowing capabilities for software packages that recognize TopView's existence. This, of course, means that software vendors such as Lotus and Ashton-Tate will have to take TopView into consideration in future products.

- IBM has also become aggressive in the PC application software arena by offering its family of products known as the Assistant Series, developed by Software Publishing Company. File management, report generation, business graphics, and spreadsheet calculations are individually packaged under the Assistant Series. The earlier Displaywrite Series, which offers the PC user many of the word processing capabilities of IBM's Displaywriter, is another indication that IBM is willing to compete in the fast-growing microcomputer software market.

- IBM must be concerned with its niche in the integrated office systems market, because its Professional Office Systems (PROFS) product requires a mainframe and the VM operating system. These requirements limit its potential distribution. The major minicomputer suppliers market their own versions of integrated office systems and provide additional features in areas of decision support, communications, and data processing functions. The better known products from the minicomputer vendors are:

  - Comprehensive Electronic Office Systems (CEO), from Data General.

  - All-in-1, from DEC.

  - Office, from Wang.

- TopView appears to be one of IBM's first steps toward the control over the direction of end-user computing. IBM's approach has always been to gain control of markets by way of products that tend to dictate policy and set industry standards. In developing strategic plans for the use of microcomputers in information systems, IBM's intentions must be taken into consideration.

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- The move toward shared functionality has created a greater demand for the systems' ability to handle multiple tasks. The mini/micro operating systems with the best features for handling multiusers and multiprogramming is UNIX. IBM recognizes the popularity of UNIX and is starting to announce products that are UNIX derivatives. One example is the PC/IX, developed for IBM by Interactive Systems. IBM's latest entrant to the PC market is the PC/AT, which can support up to three concurrent users and runs under the IBM PC XENIX operating system, which is Microsoft Corporation's version of UNIX.

F.   OFFICE SYSTEMS SOFTWARE AND THE FUTURE

- Rudimentary word processing and messaging systems have been available for more than ten years. The word processing vendors started out directing their sales efforts almost entirely to the office staffs. Even IBM tended to work directly with end users for sales of office systems.

- Minicomputer vendors have, for the most part, aimed their products at engineers, scientists, and manufacturing functions. In the past, corporate IS wouldn't have been too concerned or involved with the acquisition of a special-purpose minicomputer system.

- As minicomputer vendors started adding an array of office systems software to their product lines, the minicomputer user recognized the need to communicate with the IS-controlled host systems. Digital Equipment Corporation, for instance, has expanded its network, DECnet, to IBM SNA network link for both VAX and MicroVax. Cullinet is offering IDB, a micro-mainframe link for IBM 43XX and up that will allow VAX users access to IBM mainframe data. DISOSS, which is IBM's distributed office support system, provides the bidirectional capabilities between DECnet and SNA.

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- INPUT envisions future office systems as including software tailored more specifically to a functional area within a corporation. The sales force has different informational needs than the accounting department, and business planning requires knowledge beyond either of the other two functions. The software and software/hardware vendors will make available "total solution" turnkey systems that will be built around natural languages that will enable end users to "talk" to the computers in standard, everyday English.

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IV   I.S. END-USER SOFTWARE STRATEGIES

A.   BUILDING A COMPUTER NETWORK

- The future information systems networks will become the heart of corpora-
  tions. The ability to interchange general information across a wide variety of
  computer-based products from multiple vendors will become imperative. The
  ability to move data, text, images, graphics, and voice from one workstation
  to another--regardless of the distance between them--will become an absolute
  requirement if companies intend to remain competitive.

- In selecting products for end-user computing, assume that there will be a
  future need for those products to interface with other similar local products
  and with the corporate data center facilities. Be certain that local networks
  provide gateways to an IBM SNA environment and public data networks.

- As end users graduate from word processing and simple spreadsheet calcula-
  tions, the need to access data in a mainframe data base becomes a pressing
  issue. There is software available that provides interfaces between a personal
  computer application and mainframe data. Some of this software resides on
  the mainframe only and some resides on the microcomputer only. Yet a third
  group of micro-mainframe link software, such as McCormack & Dodge's
  PC/LINK, resides on both the micro and the mainframe. When evaluating
  applications packages, look beyond the immediate need of the end user to
  determine the likelihood of a mainframe link requirement.

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- Investigate the benefits in SNA and SNA-compatible network environments, of employing IBM's Document Interchange Architecture (DIA), which handles the protocols and data structures being transmitted among diversified nodes. DIA provides basically three types of document interchange services:

    - Library services. End users can store and retrieve documents in a central library.

    - Distribution services. End users can send documents or information to one or more locations on the network.

    - Application processing services. End users can invoke document transform routines and execute programs on the host mainframe.

- IBM's Document Content Architectures (DCA) supports the DIA functions in the SNA environment by defining the format of the data, text, images, graphics, or voice being transmitted.

- Exhibit IV-I depicts a possible integrated communications network configuration that might be installed in a large corporation with regional and branch offices.

B.   MEETING THE END USERS' SOFTWARE NEEDS

- Personal computer software has been, for the most part, looked upon as a "throw away" item. The criteria for selecting a piece of software to be used by end users has been very limited and has usually encompassed:

    - Ease of implementation.

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EXHIBIT IV-1

INTEGRATED COMMUNICATIONS NETWORK
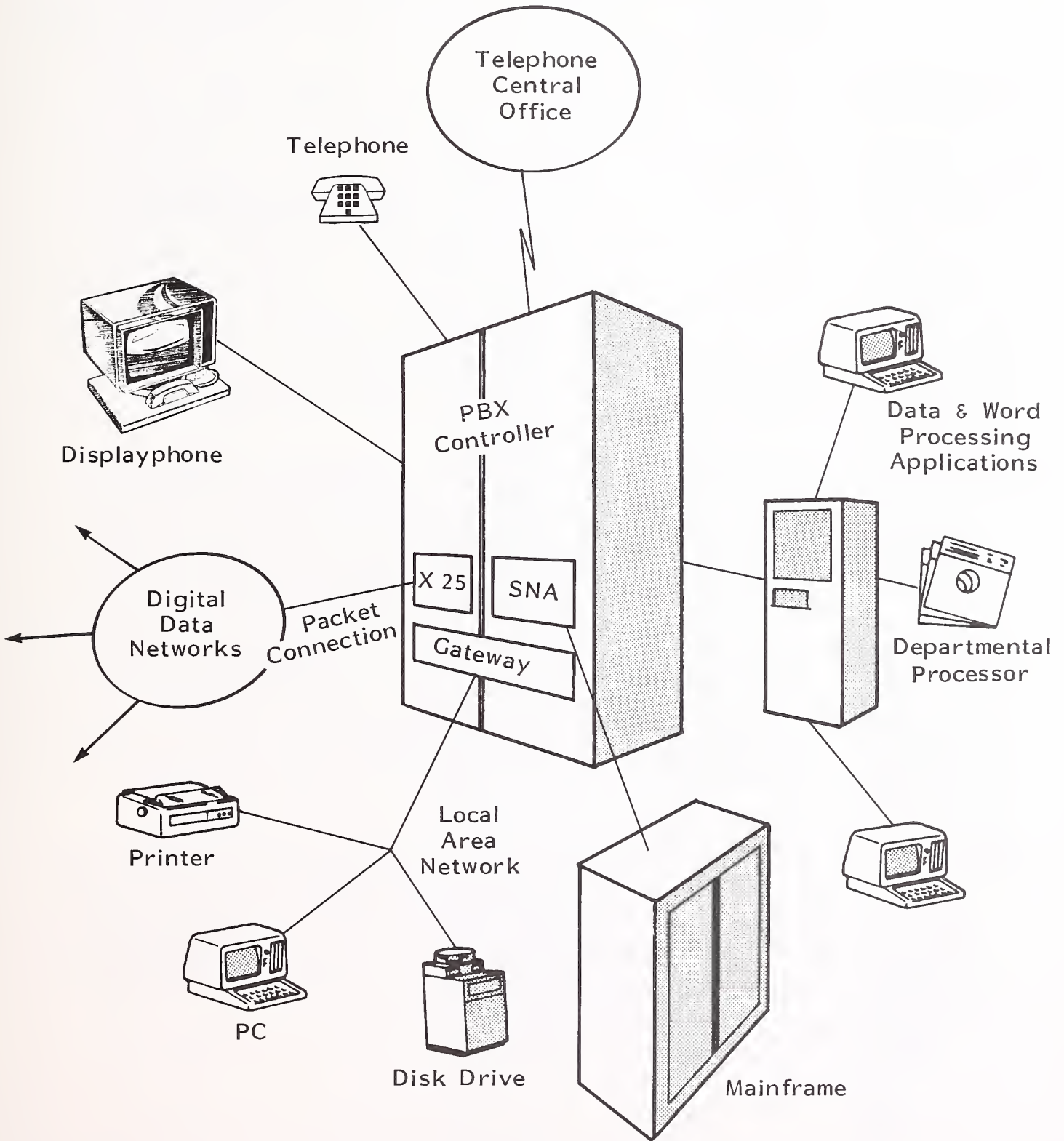
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- Ease of use.

- Features and functionality.

- During 1983 INPUT surveyed software product vendors and large IS organizations for its Market Analysis and Planning Service (MAPS) and asked them to rank 17 decision factors for the acquisition of software. The vendor ranked the factors in order of importance from the perceived view of the customers. The software categori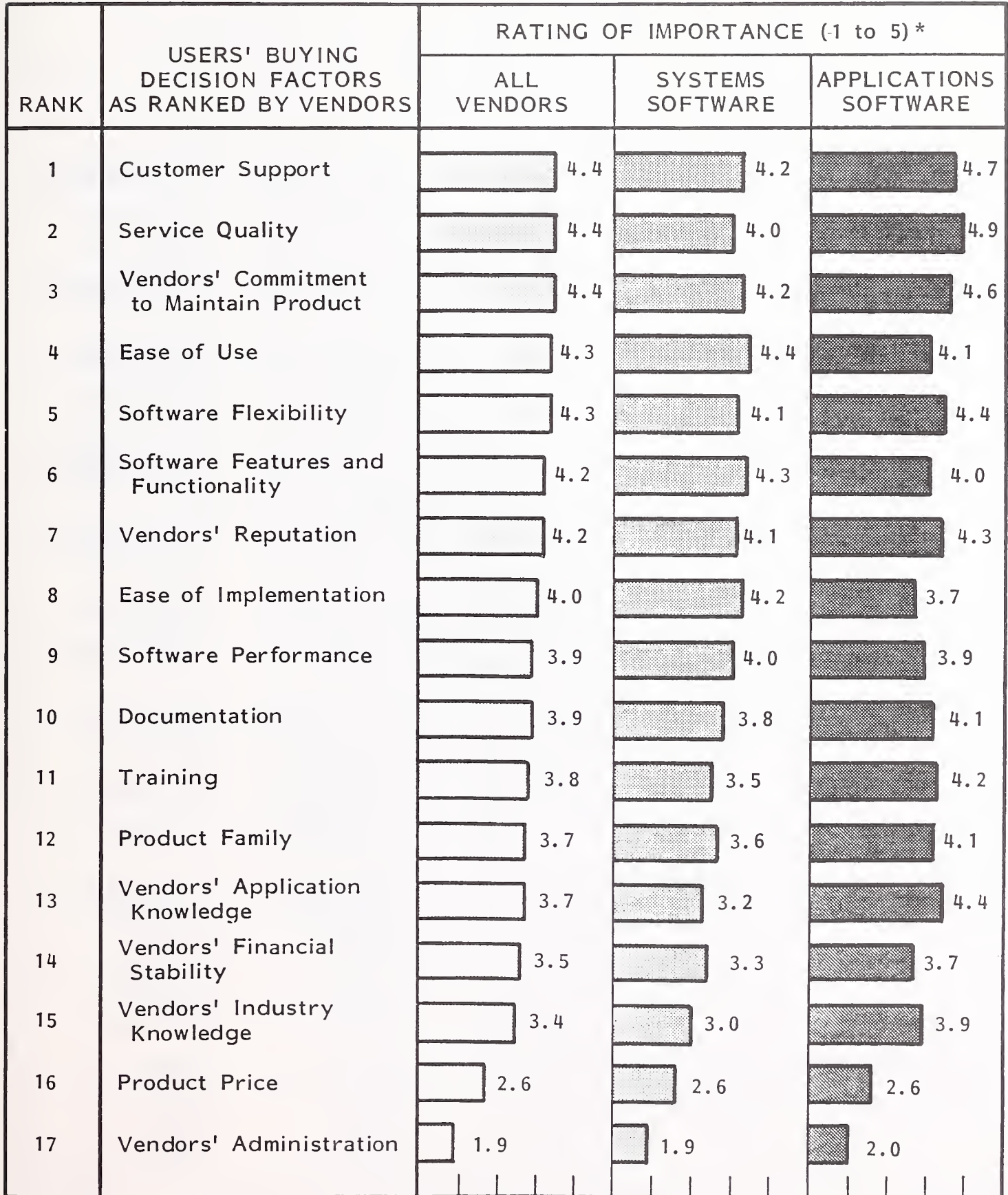es were divided between systems software and applications software; there was no distinction between mainframe-based software and micro-based software. Exhibit IV-2 lists the decision factors in order of importance from the vendors' standpoints. Note that, according to the vendors, customers consider customer support to be the top selection factor and ease of use to be a fourth consideration. Exhibit IV-3, which is the IS ranking of the factors, puts ease of use in first place and customer support in third.

- From a corporate standpoint, the same care that goes into selecting mainframe-oriented systems and applications software should be extended to software products that will directly support end-user computing. Vendors' commitment to maintain the products scored fairly high on both the vendors' and IS organizations' lists of decision factors for buying general software. This factor is not normally considered, however, when buying a word processing software package for a PC. Service quality and vendors' reputation are two other factors that should play a part in choosing end-user software packages.

- IS should have the responsibility to make certain that the selected software package not only meets the immediate needs of an end user but would also score favorably against the ranking of factors in Exhibit IV-3. The software's ability to link to mainframes or to other end-user applications is represented in the factor listed as software features and functionality.

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EXHIBIT IV-2

RESPONDENT SOFTWARE PRODUCT VENDORS' RATINGS OF
THE FACTORS CONSIDERED MOST IMPORTANT BY CUSTOMERS

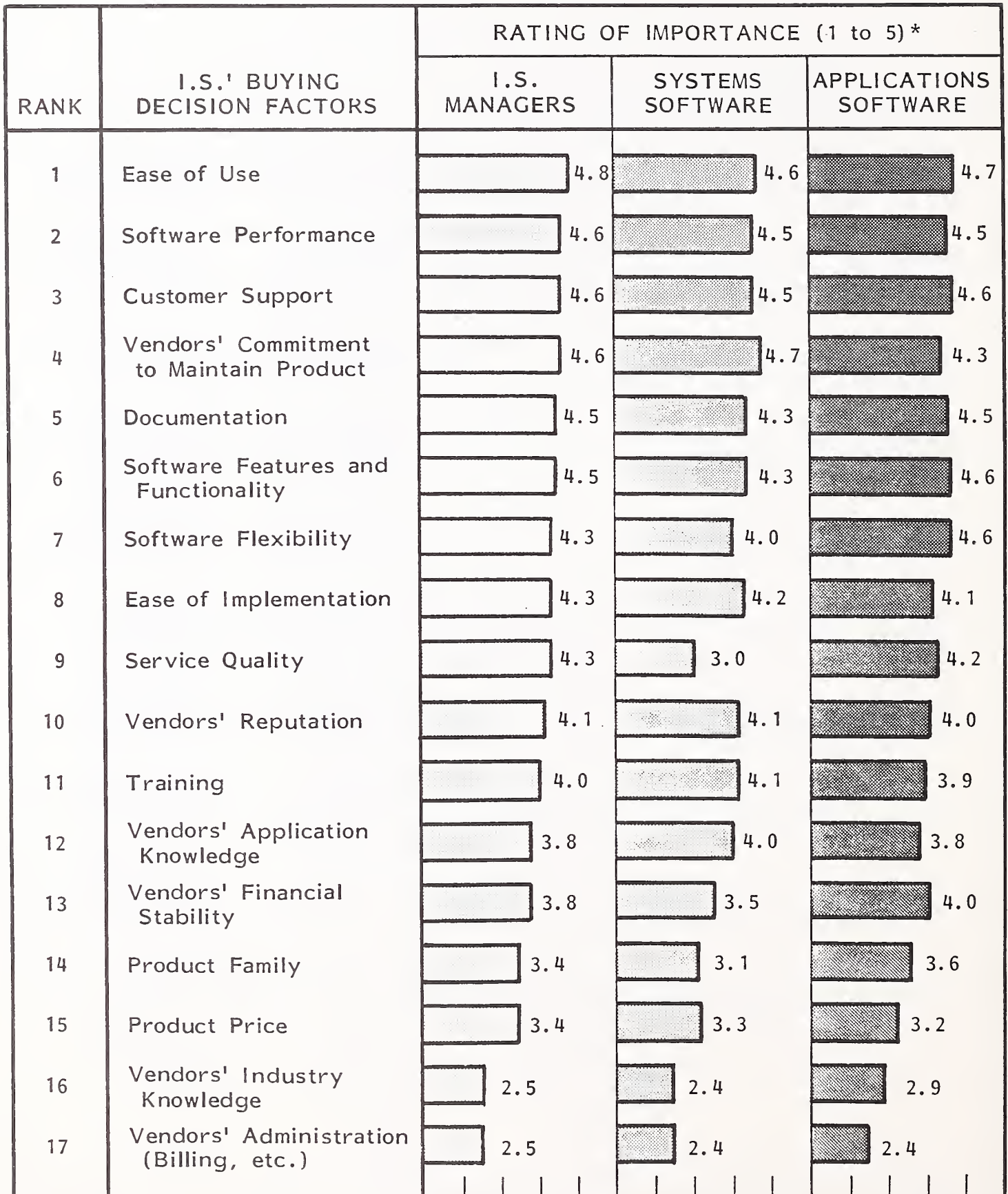| RANK	USERS' BUYING DECISION FACTORS AS RANKED BY VENDORS	RATING OF IMPORTANCE (1 to 5)*		
		ALL VENDORS	SYSTEMS SOFTWARE	APPLICATIONS SOFTWARE
1	Customer Support	4.4	4.2	4.7
2	Service Quality	4.4	4.0	4.9
3	Vendors' Commitment to Maintain Product	4.4	4.2	4.6
4	Ease of Use	4.3	4.4	4.1
5	Software Flexibility	4.3	4.1	4.4
6	Software Features and Functionality	4.2	4.3	4.0
7	Vendors' Reputation	4.2	4.1	4.3
8	Ease of Implementation	4.0	4.2	3.7
9	Software Performance	3.9	4.0	3.9
10	Documentation	3.9	3.8	4.1
11	Training	3.8	3.5	4.2
12	Product Family	3.7	3.6	4.1
13	Vendors' Application Knowledge	3.7	3.2	4.4
14	Vendors' Financial Stability	3.5	3.3	3.7
15	Vendors' Industry Knowledge	3.4	3.0	3.9
16	Product Price	2.6	2.6	2.6
17	Vendors' Administration	1.9	1.9	2.0

* Rating: 1 = Low, 5 = High

1 2 3 4 5   1 2 3 4 5   1 2 3 4 5

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EXHIBIT IV-3

I.S. MANAGERS' RATINGS OF THE FACTORS
CONSIDERED MOST IMPORTANT IN BUYING SOFTWARE

RANK	I.S.' BUYING DECISION FACTORS	RATING OF IMPORTANCE (1 to 5)*		
		I.S. MANAGERS	SYSTEMS SOFTWARE	APPLICATIONS SOFTWARE
1	Ease of Use	4.8	4.6	4.7
2	Software Performance	4.6	4.5	4.5
3	Customer Support	4.6	4.5	4.6
4	Vendors' Commitment to Maintain Product	4.6	4.7	4.3
5	Documentation	4.5	4.3	4.5
6	Software Features and Functionality	4.5	4.3	4.6
7	Software Flexibility	4.3	4.0	4.6
8	Ease of Implementation	4.3	4.2	4.1
9	Service Quality	4.3	3.0	4.2
10	Vendors' Reputation	4.1	4.1	4.0
11	Training	4.0	4.1	3.9
12	Vendors' Application Knowledge	3.8	4.0	3.8
13	Vendors' Financial Stability	3.8	3.5	4.0
14	Product Family	3.4	3.1	3.6
15	Product Price	3.4	3.3	3.2
16	Vendors' Industry Knowledge	2.5	2.4	2.9
17	Vendors' Administration (Billing, etc.)	2.5	2.4	2.4

* Rating: 1 = Low, 5 = High

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- Exhibit III-4 in Chapter III lists the standalone microcomputer software attributes (or factors) in order of importance from the views of the vendors and users surveyed for this study. In the survey for specifically end-user software, the most crucial factor proved to be "providing an adequate solution" (that is, meeting the end users' needs), followed closely by "ease of learning and using."

- "Easy-to-use", or "user-friendly" are marketing phrases that are used so often in end-user software product literature that they are becoming meaningless (and irritating) phrases. Basically, the experienced user wants the option of bypassing "nested" menu schemes that can be time-consuming and frustrating. Users want to be prompted and to be able to ask for help when needed, but they don't want to be guided through software products. Complex syntax commands that seasoned programmers can easily understand and use should be avoided, if possible, when selecting end-user software.

C. SUPPORTING THE SOFTWARE PRODUCTS

- End-user computing has advanced to a point where software vendors and using companies agree that the internal IS organizations should provide at least technical advice in the acquisition of end-user software. They also agree that IS should be involved in the actual negotiations with the suppliers. There are mixed feelings, however, over the question of whether IS should have the authority for final approval.

- INPUT contends that IS must play a leading role in the selection and acquisition of software products that will be used directly by the end users, because IS should be working from a strategic plan and following an information systems map.

- End-user computing is in the first stages of evolution, which finds individuals working on isolated problems in a standalone environment. IS must provide

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the direction through subsequent evolutionary stages to ensure compatibility with corporate goals and objectives.

- In order to lead and direct the end-user computing activities, IS must provide the proper level of support to the user community. Most IS organizations that are faced with the dilemma of determining what constitutes a "proper" or "adequate" level of support for end users have placed all end-user computing activities under the responsibility of one manager. The activities could include:

    - Microcomputer hardware and software selection and implementation.

    - Office systems selection and implementation.

    - The information center.

    - Applications development consultation.

    - End-user training and education.

    - Communications network planning.

    - End-user computing standards and guidelines.

- INPUT's surveys indicate that 6% of the IS professional staff is being allocated to supporting end-user computing. There doesn't appear to be a standard method in arriving at a service ratio of support staff to the number of users. The number of variables makes it difficult to fix a recommended ratio like 50 to one. The variables could include, but are not limited to, the following:

    - Number of software products to be supported.

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- Complexity of the supported software products.

- Competence level of the end users.

- Level of end-user communications activities.

- Level of sophistication of end-user applications.

- Level of support from the hardware and software suppliers of end-user products.

- Degree of micro-mainframe link requirements.

D.   DATA/INFORMATION/KNOWLEDGE AND THE END USER

- Artificial intelligence (AI) concepts from research conducted for many years at institutions such as Stanford University, M.I.T., and Carnegie-Mellon University are emerging in the commercial world as expert systems. INPUT believes there is a definite move from data storage and information retrieval to the development of knowledge bases.

- Expert systems are composed of knowledge bases of rules and facts about particular subjects and an inference engine, which is a program that interprets the knowledge to deduce conclusions and make judgments. There are several hurdles to clear before expert systems will be in common use.

    - Expert knowledge is not easily codified.

    - The logic requires tremendous memory and processing speed.

    - There is a scarcity of qualified AI specialists.

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- There are several expert systems products on the market, and more are expected to be available in the near future. Inference Corporation is developing an expert system package for DEC's VAX-11 called Automated Reasoning Tool, which will be used by the programming staff to develop knowledge-base applications.

- The progress in the field of expert systems should be carefully watched by the IS end-user support staff to maintain a level of awareness about the available tools. If a decision is reached to acquire an expert system, a pilot system should be installed in a controlled environment to assess the capabilities of the system and its impact on available resources. IS should understand the concepts and theories behind expert systems to avoid products that are allegedly based on artificial intelligence but are nothing more than data management systems.

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V   END-USER SOFTWARE ISSUES

A.   SOFTWARE PLANNING IS A JOINT EFFORT

- There are several different approaches being employed by companies across the nation regarding the acquisition and dissemination of personal computer software, including:

    -     A central IS repository or library.

    -     The personal computer store concept.

    -     Direct retail store purchases without IS support.

    -     Direct retail store purchases with IS assistance.

    -     Acquisition in conjunction with major systems projects.

- The central repository or software library approach is probably the most common. Users that have a software need request assistance from the IS end-user support group. The support group assesses the user's requirements and then attempts to locate a suitable solution from the available packages in the library. The library contains information on personal computer software that has previously been approved by IS and is in use somewhere in the corporation. If no existing packages fit the user's needs, then IS aids in the procurement of a new package.

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- Some of the Fortune 500 companies have departments within IS that resemble retail computer stores. The "store" will contain a copy of all of the hardware and software that is approved and supported by IS. End users can browse through the store and receive demonstrations on the various products from the "salespeople" (consultants). End users can discuss their needs with the consultant and jointly they can put together an appropriate hardware and software configuration. Again, if the store doesn't have all the necessary pieces, the IS consultant can be responsible for identifying viable vendors that can supply the missing capability. Either the IS store can "rent" the personal computer products to the end users or the end users can purchase the products from an outside source with the approval of IS.

- INPUT does not recommend allowing end users to deal directly with software vendors or retail computer product stores without the assistance of IS. This practice will breed incompatibility, which will come to haunt IS in the future when it tries to integrate all the fragmented information system pieces. Not only that, most end users are not experienced enough to evaluate the factors that should be considered in selecting a software package as outlined in Chapter IV.

- In INPUT's opinion, there is no doubt that micro-based multifunctional workstations will become part of the systems requirement definition of future corporate systems development activities. With this in mind, systems teams will be required to identify software packages for these intelligent workstations that will be complementary and compatible with the architecture of internally designed systems and will offload some of the host mainframe processing to the local micro-based processors.

- Just as teams have been formed of representatives from IS and line functions to guide and coordinate major information systems development projects, teams composed of experts in technology and professionals from the business side of the company should be formed to plan and coordinate the implementa-

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tion of integrated electronic office systems. As mentioned earlier, the communications infrastructure will become a very important factor in the success of integrated office and data processing systems. Planning the stages and mapping the implementation steps would be the primary responsibility of the electronic office team. The team could report progress to, and receive direction from, the IS Steering Committee.

B.   STAYING ABREAST OF THE SOFTWARE MARKET

- INPUT's 1984 projections of the personal computer applications software markets indicated an average annual growth rate of 42% between 1984 and 1989. As shown in Exhibit V-1, the software market will grow during those years, from $1 billion to over $6 billion.

- If there is a direct correlation between market revenues and the number of products being marketed, then the 1,500 personal computer applications programs reviewed by PC World magazine in their winter 1985 issue will grow to nearly 9,000 programs by 1989.

- The numbers are already staggering to the IS group responsible for recommending personal computer software to be used throughout the corporation. The choices are so numerous, it's no wonder that many companies rely solely on IBM to furnish a solution to a particular personal computer applications problem. Unfortunately, IBM does not have all the personal computer software solutions, nor does it necessarily have the most advanced office automation products.

- In the October 1984 report entitled Organizing the IS Department for End-User Computing, INPUT recommends the establishment of an internal end-user computing users' group fashioned after the IBM users' groups, Guide and Share. IS would act as advisor and would participate in the meetings, but end

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EXHIBIT V-1

PERSONAL COMPUTER APPLICATIONS SOFTWARE MARKETS
1984-1989

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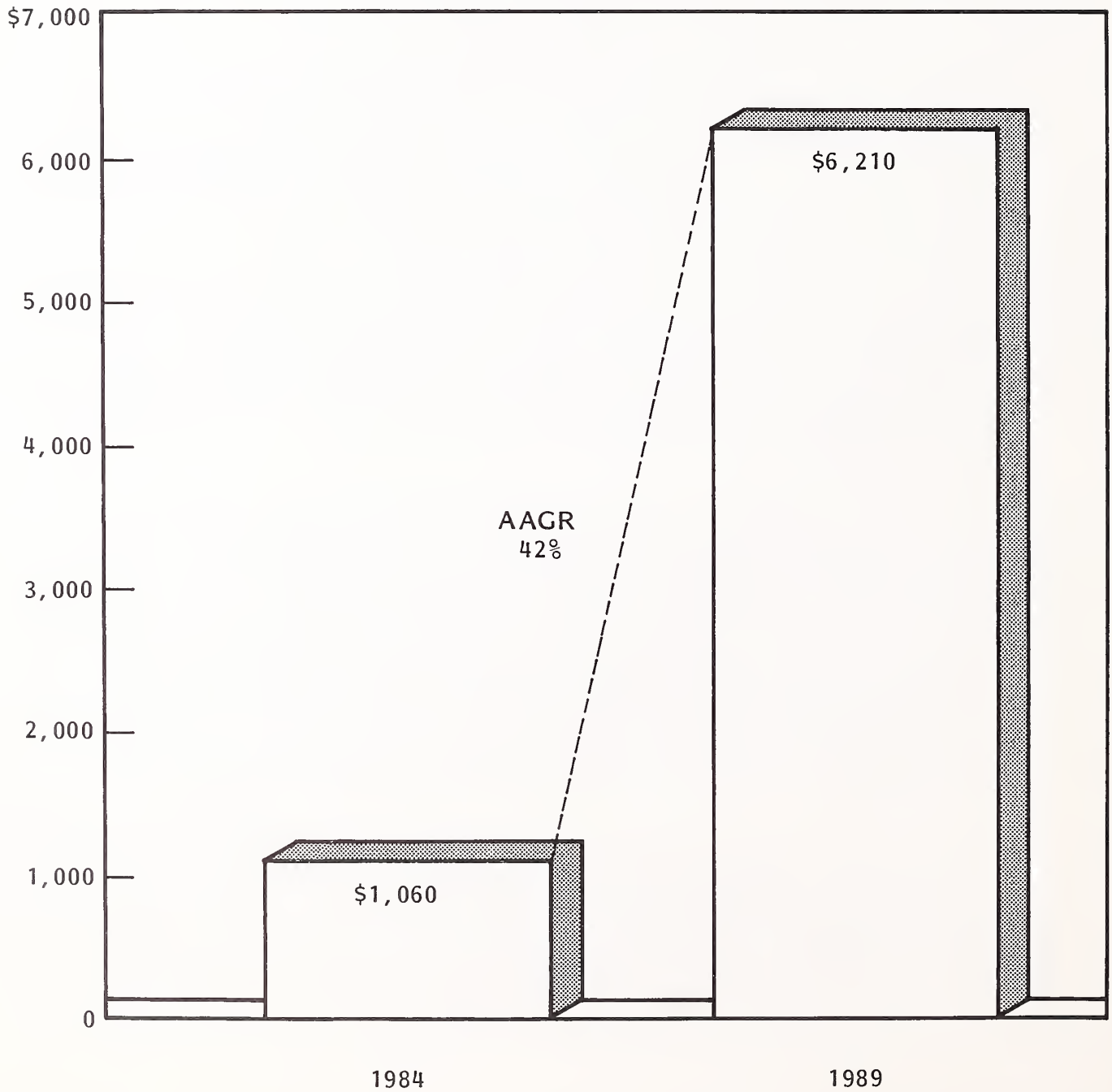
users would manage the overall affairs of the group. Just as Guide and Share have special interest subgroups, so could the end-user computing users' group. One or more special-interest subgroups could be set up to focus on software packages. Vendors could be asked to make presentations and stage demonstrations to these special-interest subgroups, which in turn could present their evaluations to the main body and IS management. Representatives from IS could be assigned to these special-interest subgroups to provide a balance of technical expertise.

- INPUT believes that those companies classified as independent software vendors will be required to provide value-added features to their products in the areas of support and maintenance in order to stay in the software market. One of the first steps in building a knowledge base on end-user software products is to eliminate products that are irrelevant to the industry or environment being serviced. Another important step is to eliminate vendors that don't meet certain qualifying criteria. The criteria could include, but not necessarily be limited to, the following:

  - Vendors should be established multiproduct companies as opposed to ones that rely solely on single "hit" products.

  - Vendors should have a direct sales policy for corporate accounts as well as retail distribution.

  - New products should interface with the existing product line within homogeneous applications.

  - Vendors should have a proven ability to respond to changes in technology (e.g., new hardware designs and new operating environments).

  - Plans should be established to upgrade installed products (e.g., new releases and feature add-ons).

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- There should be a maintenance guarantee with each product released.

- Vendors should supply hot line support.

- Stability of the executives and depth of skills and experience of the professional staff are other important factors to consider in qualifying the viability of software vendors.

- INPUT maintains files (including financial statements, press releases, and product literature) on over 4,000 information services vendors and maintains detailed profiles on approximately 70 of the top independent software vendors. INPUT can be a tremendous source of information for identifying viable products and vendors.

- Exhibit V-2 provides a summary example of criteria for identifying independent software vendors that should be included on an approved list for procuring corporate end-user software products.

- Some microcomputer product retailers, such as ComputerLand of Atlanta, maintain direct sales forces that call on corporate prospects. This could be an acceptable method for procuring micro-based software that is otherwise unavailable. Another retailer--Corporate Software of Waltham, Massachusetts--provides technical support, training, and attractive discounts for corporate customers.

C.   MATCHING THE SOLUTIONS WITH THE PROBLEMS

- Information systems professionals have the reputation of being somewhat enthralled with the latest computer gadgetry at the expense of users who are seeking appropriate solutions to their business systems problems. Sometimes a product is selected for its technological prowess rather than its ability to get the job done. The adage that computer people have solutions and are

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EXHIBIT V-2

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EXAMPLE OF CRITERIA FOR SELECTING
INDEPENDENT SOFTWARE VENDORS

- Established Multi-Product Company

- Direct Corporate Sales Capabilities

- User Interface Between Products

- Responsiveness to Technological Changes

- Product Life Cycle Planning

- Product Maintenance Guarantees

- Hot Line Support

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looking for problems can apply to end-user computing as well as to mainframe applications.

- Throughout 1984, in the studies related to end-user computing, INPUT has been stressing the need for IS to take the reins of the runaway trend toward end users' direct involvement in computer technology. Systems for end users must be viewed from the perspective of the corporation's overall information needs, and IS is in the best position to ensure that software purchased for end-user computing will benefit the corporation.

- Decision support systems (DSSs), with two and three dimensional worksheets for financial modeling and statistical analysis can cost a few hundred dollars for PCs and up to a hundred thousand dollars plus for mainframe DSS packages. Some of these packages have self-contained graphics and report writers and simple, English-like commands. Before a company makes a commitment to acquire one of these advanced systems several questions should be answered.

  - What knowledge and analytical capabilities are required for decision making within the various occupational categories?

  - At each office worker level, how are analysis and decision making accomplished?

  - What degree of experience and judgment are required for business decisions and planning?

  - How can decision support software aid in the decision-making process?

  - What are the potential benefits of a DSS to each of the occupational categories?

  - What is the likelihood of a particular DSS being properly utilized?

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-   How will the DSS package be supported by IS (programming, consulting, implementation, maintenance)?

-   Will the selected DSS package be able to handle future decision-making needs?

-   What is the risk of not implementing a DSS?

-   What level of expertise is required to use the product?

●   When end users request the acquisition of particular software packages, IS should have the responsibility to make certain the packages:

    -   Offer the best price/performance available.

    -   Are capable of satisfying users' needs.

    -   Are suitable for similar corporate situations.

    -   Keep within the general IS qualifying guidelines (e.g, security, documentation, and vendors' reputation).

    -   Function within the established hardware environment standards (models, capacity, response times, storage, etc.).

D.   TECHNOLOGY ISSUES

●   Vendors and IS professionals alike agree that nonprogrammers or end users will probably not look favorably on software products that require arcane commands or programming languages. Nonprocedural data base management

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systems emerged in the late 70s to aid professional programmers. The nonprocedural features of such products as FOCUS, RAMIS, and NOMAD helped lay the groundwork for subsequent products designed for end-user use through the information center and microcomputers.

- When asked about the policy regarding end users developing their own programs from scratch, most survey respondents said they either discouraged the practice or prohibited it. The programming languages in question were the high-level procedural types such as COBOL, BASIC, APL, or FORTRAN. They claimed the practice was too time-consuming and prone to errors.

- INPUT believes that corporations will be attracted to end-user software packages that provide a total solution to a particular problem or type of problems. IFPS (Interactive Financial Planning System) from Execucom in Austin, Texas is an example of the total solution approach. IFPS supplies a comprehensive, nonprocedural, descriptive modeling language for end users, but it also has a command language that the IS staff can use to build direct links between IFPS and relational or hierarchical data base systems and other products.

- Planning and decision-making systems (like IFPS) that offer modeling, interrogation, data handling, consolidations, graphics, and reporting for both the mainframe and personal computers are the type of systems that corporations will be seeking. They will have built-in procedural languages that IS can use to customize the system for a unique environment but will interact with users in a natural language that understands individual lexicons.

- The need for networking micros and handling multiusers and multitasking environments will result in a greater acceptance of UNIX-based operating systems. The Personal Computer Interactive Executive (PC/IX) operating system from IBM is an indication of this trend. XENIX is a UNIX derivative that IBM has selected for use on its high-end multitasking AT.

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- In order to penetrate the Fortune 1000 accounts, software companies will join forces through mergers and acquisitions to combine the capabilities of individual products into packages aimed at specific corporate information systems problems. Targeted sales will be achieved through national direct sales and follow-on support (maintenance and enhancements). There will also be greater activity in the area of joint projects between software and hardware companies. Microcomputer-based turnkey systems for vertical markets will increase. IS organizations might consider entering into a joint venture with a vendor in the development of an industry-specific product.

- INPUT projects that by 1990 the relative processing power will increase 160 times from that of 1970, with the majority of this growth attributed to the distributed processing of end-user decision-support-related applications. Exhibit V-3 shows how the computing focus will change between now and 1990. Notice that the emphasis will shift from transaction-driven mainframe applications to distributed decision support systems. This survey data was collected from the respondents to INPUT's 1984 End-User Planning Report.

- The impact of end-user computing has just started to ripple across the nation's industries. Positive results from this revolution will be obtained through the careful selection of software. Within an enterprise, IS is the only organization that has the expertise to evaluate end-user software requirements relative to the global corporate information systems goals and objectives. Not only is IS's involvement in the direction of end-user computing recommended, but it is essential to the future success of information systems endeavors.

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EXHIBIT V-3

CHANGES IN COMPUTING FOCUS
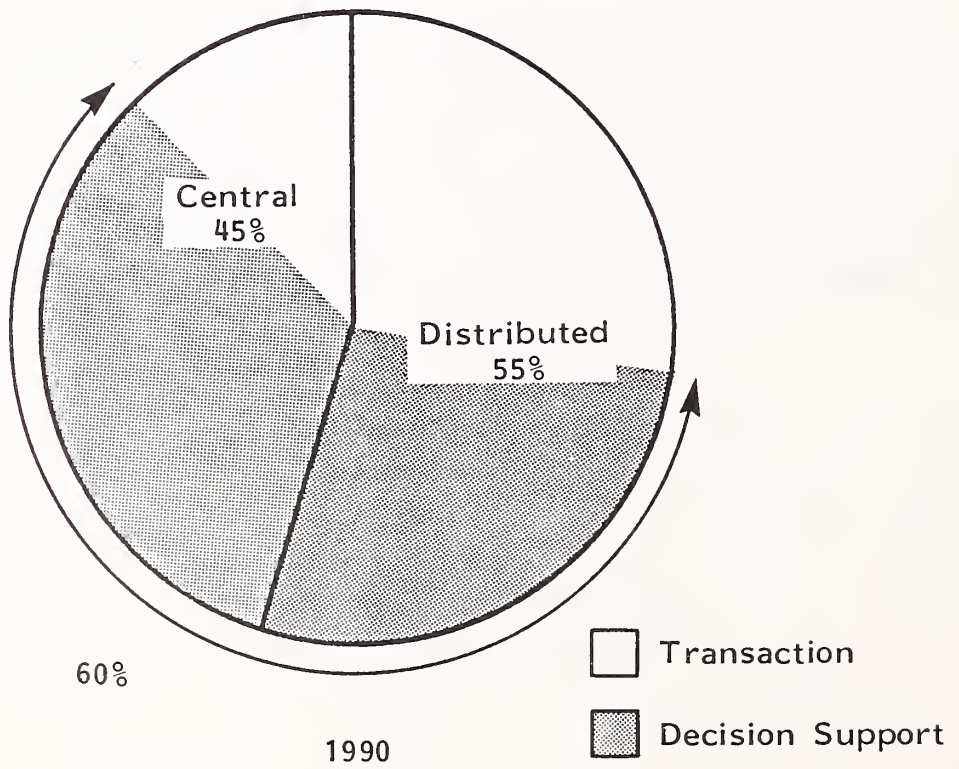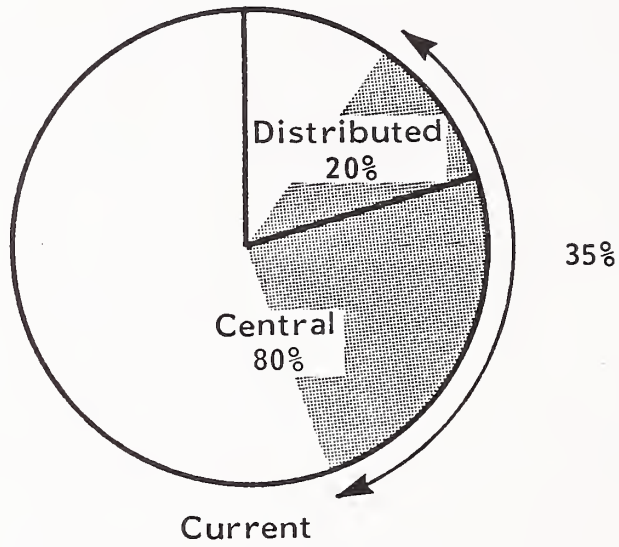
VI CONCLUSIONS AND RECOMMENDATIONS

- There is a tendency to view end-user software as PC products acquired from local computer retail stores or mail order vendors. It is true that individual PC users are looking for graphics and spreadsheet capabilities to add on to their word processing programs, but the total software requirements to support end-user computing extend far beyond a few PC packages.

- Office systems are finally gaining wide acceptance, which can be attributed to the "me too" phenomenon: a majority of companies will not be the first to install new technology, but they also don't want to be the last to install it. Ten years ago it was nearly impossible to sell the concept of electronic mail and filing to a corporate executive. Today, corporate executives are pushing for office systems that exceed those being used by the competition.

- The concept of the information center has had a tremendous influence on the growth of end-user computing, which in turn has expanded the scope of end-user software products. End users are demanding software that is flexible, is easy to use, and interfaces readily with other applications. Effective decision support software, for instance, should provide:

  - Automatic reformatting of data downloaded from a corporate data base to a micro.

  - A nonprocedural, optional menu-driven interactive language.

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- Integrated data management, spreadsheet, graphics, word processor, and report generator.

- Interfaces to other applications software.

- INPUT predicts a surge in the installation of processors at the departmental level in the form of superminis or small mainframes, to support office systems and decision-support systems within a functional unit of an organization. These local systems will have gateways to SNA to provide interfaces with data bases maintained by the corporate host mainframe. They will also be used for transaction processing and data collection for corporate systems processing and integration.

- Software and hardware vendors will team up to generate "total" solution products aimed at specific corporate functions or vertical markets. These turnkey systems will be sold directly to the corporate buyers through national marketing representatives. This concept has already taken hold with products such as Data General's Comprehensive Electronic Office Systems (CEO), which purportedly offers integrated word processing, electronic mail and filing, administrative and decision support, and distributed data processing. DEC's All-in-1 system is another example of the total solution approach.

- Even though products such as CEO contain rather generic applications software, they are targeted at a specific market--the managerial, professional, and clerical personnel in a business office environment. Job-specific software for personal computers is growing for the small businesses and professionals (doctors, lawyers, architects, etc.). Soon there will be packages aimed at corporate functions like personnel, purchasing, inventory, and accounting.

- Total solution software will have built-in micro-mainframe links, providing bidirectional interfaces with mainframe data bases. The local needs of the workers within a particular business unit of a corporation will be satisfied by job-specific hardware/software systems that are capable of interacting with the host mainframes for corporate integration and reporting.

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- If end-user computing will become an integral part of future corporate systems design and development (which INPUT believes will happen), then IS cannot afford to view it apathetically. IS must lead the revolution of end-user computing down a logical path directed at the overall goals and objectives of the organization. In order for IS to do this effectively, it must take an active role in the evaluation, selection, and acquisition of software designed for the end user. IS must also offer consultation and programming support that would include building interfaces to corporate data bases and systems as required.

- Many IS activities involve a balancing of several factors, and end-user software acquisition is no exception. The main factors include:

  - Responsiveness to users' needs.

  - Adequate solution for the problem at hand.

  - Price/performance.

  - The product's ability to expand with growing needs.

  - Versatility of the product.

- IS must first build an environment that is conducive to supporting end users in their search for computer-based solutions to their individual functional problems. INPUT recommends expanding the information center's scope of responsibilities to include:

  - Microcomputer support and training.

  - Micro software procurement.

  - End-user software library maintenance.

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- End-user software programming support.

- End-user applications consultation.

- Office systems planning and support.

- Micro-mainframe support.

- LAN/PBX planning.

- End-user and corporate systems integration coordination.

- If the personal computer market will grow from $1 billion in 1984 to $6 billion in 1989, as predicted by INPUT, then IS will be faced with the monumental task of sifting through the never-ending product announcements to identify those that might be applicable.

- Qualifying criteria should be established for suppliers of end-user-related software products to help reduce the number of choices. Packages themselves should be required to meet certain standards before being considered. The standards should cover areas such as documentation, vendor support and maintenance, interfaces, and hardware and systems software requirements. If a software package does not meet IS's standards, it should no longer be a contender.

- The establishment of an internal end-user computing users group can be an excellent way of screening products and determining exact requirements of users throughout the organization. The users' group concept fosters communication among the line functions and with IS on subjects pertaining to information resource requirements.

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- IS should develop strategic end-user computing plans that map out stages leading to an integrated distributed data processing environment that involves departmental processors, intelligent workstations, and communication networks that tie all information resources together at a corporate level. With such a phased plan approach, IS will be in a much better position to assess the applicability of new announcements in end-user software markets.

- One of the biggest challenges facing IS with regard to end-user computing is hurdling the interface barriers between end-user applications and corporate systems. Some commercial software provides the necessary links between end-user applications and corporate systems. But the vast majority of interfaces will require special programs written by IS.

- If end-user computing is going to make a significant contribution to a corporation's profitability and competitiveness, it will do so through the implementation of the most effective supporting software. IS expertise is needed to ensure that appropriate software products are acquired for end users.

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