

DECISION SUPPORT SYSTEMS

EXPERIENCE AND OUTLOOK

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DECISION SUPPORT SYSTEMS:  
EXPERIENCE AND OUTLOOK

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## DECISION SUPPORT SYSTEMS: EXPERIENCE AND OUTLOOK

### ABSTRACT

Decision support systems (DSS) in many forms are becoming commonplace in virtually all business organizations. Although the technology is maturing and gaining wide acceptance, decision support remains a somewhat flexible term as a result of both new DSS applications and technological advances. This report provides the DSS user with information and analyses of trends in the areas of products, applications, and services. It also provides background on decisionmaking concepts and user perspectives, highlights the leading software currently available for mainframe, mini, and microcomputer processors, and analyzes the current DSS market, as well as forecasting user expenditures through 1990 and making recommendations for dealing effectively with a rapidly changing DSS environment.

This report contains 91 pages, including 24 exhibits.



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EXPERIENCE AND OUTLOOK**

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## I INTRODUCTION





## I INTRODUCTION

- Decision support systems are quickly becoming commonplace in virtually every business organization. Although decision support systems are maturing as they find wide acceptance, the definition of DSS is again being clouded by vendors repositioning their products and by new thrusts into artificial intelligence.

### A. OBJECTIVES AND SCOPE

- This report, a part of the Software Planning Segment of the Information Services Program (ISP), provides the corporate DSS user with information and analyses of trends in the areas of products, applications, and services for internal acquisition and planning purposes.
- This report provides background on DSS concepts, user perspectives, and the leading current software available on mainframe, mini, and microcomputers. It also examines trends in applications and among DSS software vendors and examines the impact artificial intelligence (AI) will have on practical decision support.

- Among the many questions this report answers are the following:
  - Are the current DSS products and services matching the users' ability to cope with them?
  - What are the current predominant decision support applications? Are there nonfinancial DSS applications on the horizon?
  - What impact is the information center (IC) having on users of DSS?
  - Who are the users of DSS in an organization? Are DSS vendors addressing the needs of potential users such as executives?
  - To what degree is artificial intelligence technology finding its way into decision support tools?
  - How can organizations prepare to bring large numbers of PC DSS users into a more productive organizational DSS environment?
  - Will today's user, faced with a variety of DSS tools available, be able to make the proper selection?
- This study will also provide estimates of the overall growth of the decision support products and services for the period 1985 through 1990.

## B. METHODOLOGY

- The information for this report was obtained from a number of sources.
  - Interviews conducted with six of the leading DSS software vendors.

- A review of current trade publications and vendor literature.
- A review of theoretical and academic literature on the subject.
- Dialogues with DSS observers and senior INPUT staff.
- Previous INPUT studies were also reviewed and relevant information extracted. A listing of these related INPUT reports is contained in Appendix B.

### C. REPORT ORGANIZATION

- The remainder of this report is organized as follows:
  - Chapter II is an Executive Summary formatted as a presentation for group discussion.
  - Chapter III examines the nature of DSS and users.
  - Chapter IV reviews current DSS applications and leading products.
  - Chapter V assesses DSS software and industry directions and trends.
  - Chapter VI examines leading DSS vendors.
  - Chapter VII summarizes the conclusions and recommendations.





## II EXECUTIVE SUMMARY



## II EXECUTIVE SUMMARY

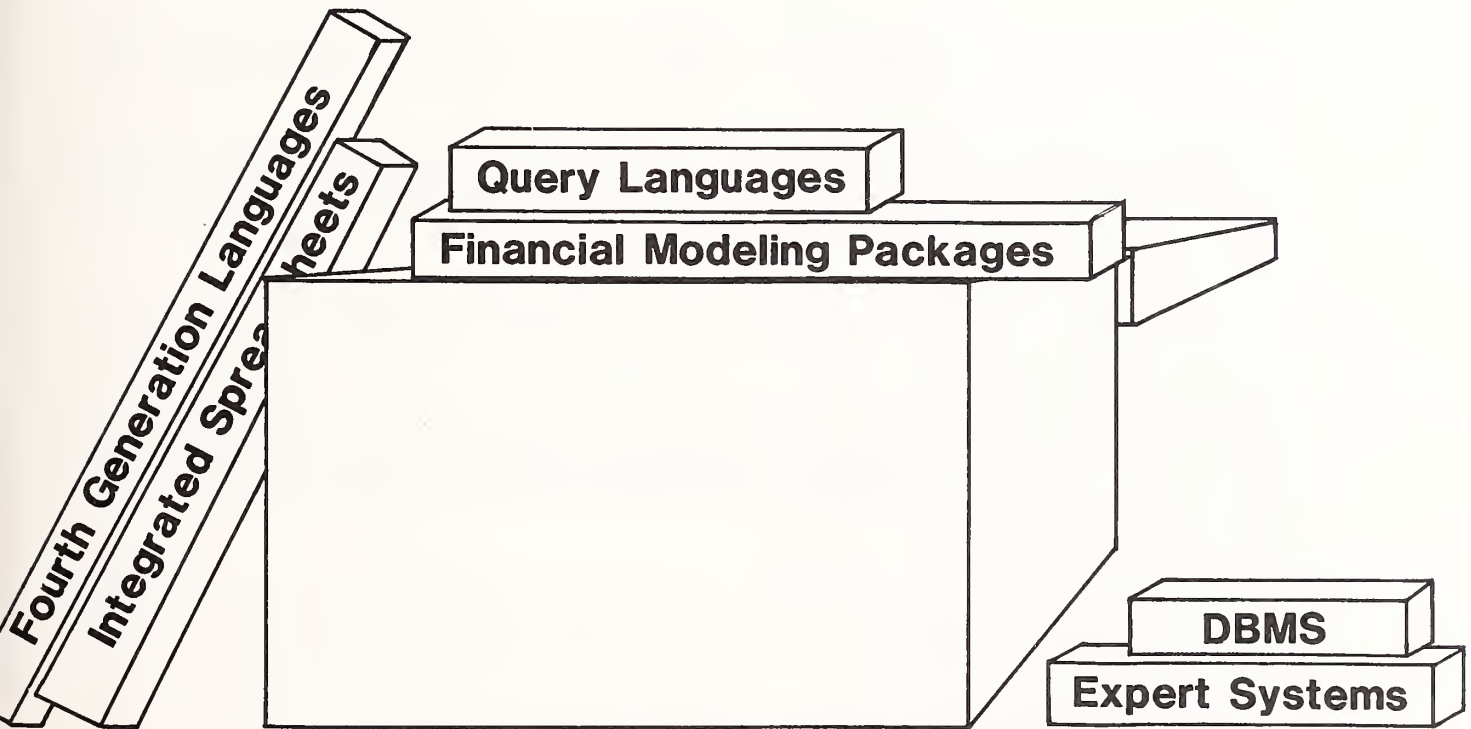
- This chapter summarizes key issues and trends that are discussed in more detail in the remainder of the report.
- This Executive Summary is prepared in a presentation format. The exhibits are formatted for ease of use with an overhead projector and the accompanying script for each is contained on the left-hand page facing the exhibit.

## A. DSS TOOL BOX GETTING CROWDED

- The definition of what constitutes a decision support tool, already elusive, is being further clouded as traditional DBMS, fourth generation languages, and spreadsheets join the already crowded DSS toolbox.
- This broadening of what is being accepted and considered DSS has been brought on by at least two major trends:
  - An ever-increasing focus on data acquisition and integration issues related to DSS. This plays directly into the hands of traditional DBMS vendors.
  - DBMS, spreadsheet, and fourth generation language vendors, eager to gain an increasing share of possibly new applications, are positioning themselves as DSS vendors.



## DSS TOOL BOX GETTING CROWDED



## B. DSS SOFTWARE TRENDS

- There are several key trends which are indicative of the direction decision support systems software is taking. Mainframe and minicomputer vendors, influenced by the lessons of personal computer spreadsheets and anxious to attract more organizational users, are adding visual functions, built-in help facilities, and even natural language interfaces. Users view this as aiding in productivity and promoting self-supporting DSS computing.
- Concentration on data issues is probably the single most important factor driving DSS software today. This has manifested itself in a variety of product offerings and modifications, including micro-mainframe links, an emphasis on data management features, and modeling and analysis packages integrated with true DBMS products.
- Micro-mainframe links are currently being offered by most of the leading DSS vendors either in connection with current PC or mainframe software or as an add-on. They range in function from terminal emulation and communications to intelligent data transfer facilities.
- DSS vendors are integrating their products, formally and informally, with other applications in order to open new markets and to ease the data compatibility objections. Vendors are also "tailoring" their tools into functional and industry-specific versions.
- Although there is a great deal of discussion, promotion, and technical progress on general tools, traditional DSS vendors are taking a cautious approach to artificial intelligence technology, primarily due to unclear concepts; the relative infancy of technology; high risk, high potential investment; and unproven practical user benefits. There is some activity in the natural language technology, primarily in user interfaces to DSS.
- Most of the leading mainframe/mini DSS vendors are developing and marketing fully-functional PC versions, limited only in processing power.

## **DSS SOFTWARE TRENDS**

- **Improvements in User Interface**
  - **Vendors Recognizing Importance of Data**
  - **Micro-Mainframe Links Becoming “Me Too”**
  - **Integration with Applications**
  - **Cautious Approach to Artificial Intelligence**
  - **Limited Mainframe Functionality Now Available on Micros**
-

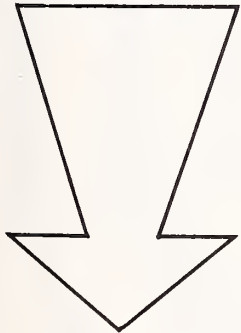
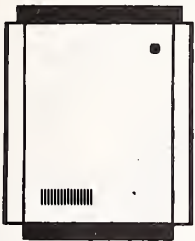
## C. DSS VENDORS BATTLING FOR EACH OTHER'S TURF

- An interesting battle is shaping up between mainframe and microcomputer-based decision support tools vendors.
- Mainframe and minicomputer vendors are "downsizing" their products to operate on more powerful PCs in an attempt to:
  - Get serious spreadsheet users to convert to their products when spreadsheets have difficulty handling complex applications.
  - Familiarize corporate users with the product on a PC and move them up to mainframe and mini versions.
  - Show that they offer a consistent range of products over a wide hardware mix.
- The spreadsheet and integrated micro packages are:
  - Adding functions such as DBMS, goal-seeking, and consolidation capabilities to become feature competitive with mainframe packages.
  - Entering into partnerships with mainframe applications software vendors.
  - Porting spreadsheets directly to mini and mainframe hardware.
- The prizes in this battle may be both the much sought-after sophisticated spreadsheet user-in-transition and the possibility of being chosen as the mainframe DSS solution.

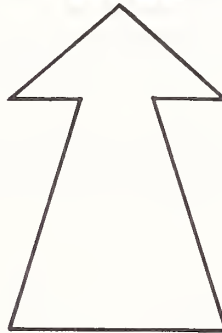


# DSS VENDORS BATTLING FOR EACH OTHER'S TURF

## Mainframe DSS Vendors



**Downsizing  
Products**  
  
**Making Them  
Friendlier**



**Adding Functionality**  
  
**Linking with Main-  
frame Applications**  
  
**Spreadsheets for  
Mainframes**



## PC Spreadsheet Vendors

## Micro Based Versions

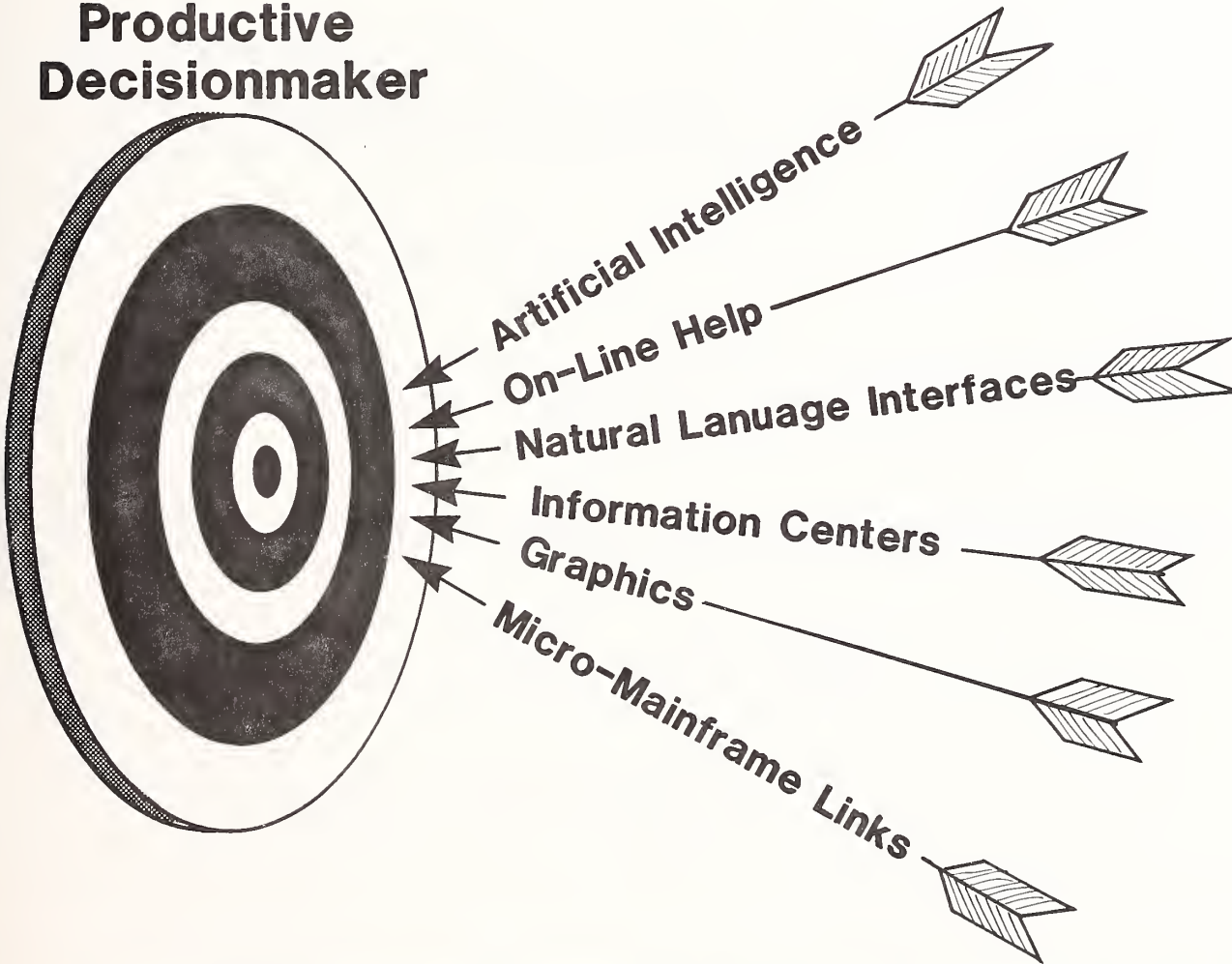


#### D. THE ELUSIVE DSS TARGET

- The ultimate objective of decision support should be to provide reliable and consistent support across the organization and along a wide spectrum of problems. Vendors and IS departments alike are currently directing their resources at widening the use of DSS at middle level management faced with "tactical" decisions.
- Despite this, there remain serious questions about DSS use in strategic decisionmaking and whether or not the executive will ever adapt and accept decision support systems for personal direct use. Historically, executives have not used computers but have depended on others for computer analysis.

## THE ELUSIVE DSS TARGET

**Productive  
Decisionmaker**



## E. THE NEW I.S. CONSULTANT ROLE

- The traditional role of information services (IS) as a DSS onlooker or keeper of computing resources must change if decision support systems are to provide widespread productivity gains at the middle and potentially upper management levels.
- IS should change its focus to that of a consultant and promoter of DSS throughout an organization. This role includes a broad range of planning, training, and support activities which hopefully will bring it closer to the DSS user community.

## **THE NEW I.S. CONSULTANT ROLE**

- **Partner, Not Onlooker**
  - **Planning DSS**
  - **Acquiring Tools, Evaluating Software**
  - **Providing Insight on Integration Issues**
  - **Internal Promoter of DSS**
  - **Training and Support**
-



### III DSS EVOLUTION





### III DSS EVOLUTION

#### A. NATURE OF DSS ENVIRONMENT

- Since the term decision support system was introduced in the mid 1970s, there has been an attempt to label practically any information processing system as DSS. Although by its very nature DSS is open to a rather wide interpretation, identifying some unique characteristics provides an understanding for what constitutes computer-based DSS:
  - A computer system to support unstructured or semi-structured decisionmaking.
  - Orientation to the future based on historical trends or parameters.
  - Used on an ad hoc or unscheduled basis.
  - Unique by application and traditionally financial in nature.
  - Often controlled by the end user (decisionmaker).
  - Usually include capabilities to support data gathering.

- Typically, decision support systems are comprised of three basic components:
  - Language facility or user-command processor.
  - Relevant knowledge base or data base.
  - Problem processor which provides the solution support.
  
- DSS products and services available today address these components, their nature, and their capabilities, varying by the relative emphasis placed on each component.
  
- It is important to understand the nature of business decisionmaking and its relation to an organization's make-up. Decision support system and services do not currently provide solutions to all types of decisions and levels of an organization equally. Three basic types of decisions are typically made within organizations:
  - Operational.
  - Tactical.
  - Strategic.
  
- Exhibit III-1 contrasts decision types, their relationship to the organization, and relative timeframes.
  
- Operational decisions are usually focused on day-to-day management of an organization's activities, usually at a relatively low, front-line management level. Timeframes are short and data obsolescence is rapid. Decisions and problems tend to be fixed or semi-structured in nature.

EXHIBIT III-1

NATURE OF BUSINESS DECISIONMAKING

DECISION TYPES	TIMEFRAMES	ORGANIZATION LEVELS/ CHARACTERISTICS	DECISION SUPPORT APPLICATION AREAS
Operational	Day-to-Day	<ul style="list-style-type: none"> <li>● First Line Management</li> <li>● Usually Confined to Organizational or Departmental Lines</li> </ul>	<ul style="list-style-type: none"> <li>● Logistics, Material Distribution, Vehicle Dispatching, Production Scheduling</li> </ul>
Tactical	Short to Medium	<ul style="list-style-type: none"> <li>● Middle Management</li> <li>● May Cross Organizational Lines</li> </ul>	<ul style="list-style-type: none"> <li>● Financial and Budgetary Management, Inventory Management, Asset Acquisition, Personnel Administration</li> </ul>
Strategic	Medium to Long Range	<ul style="list-style-type: none"> <li>● Top Management</li> <li>● Consistently Crosses all Organizational Lines</li> </ul>	<ul style="list-style-type: none"> <li>● New Market Entry, New Product Offerings, Corporate Reorganizations, Facility Relocation, Mergers, Acquisitions</li> </ul>

- Tactical decisions are usually concerned with longer timeframes and associated with reaching established corporate plans and objectives. These decisions tend to cross organizational lines and deal with a higher level of uncertainty than operational decisionmaking. Tactical decision support relies on less precise or detailed data, dealing instead in trends, percentages, and averages.
  
- Strategic decisions span long timeframes and deal with broad organizational issues and plotting of corporate direction. This is typically the realm of top management and usually involves issues and decisions that:
  - Are less quantifiable.
  - Are highly uncertain.
  - Rely on data from a wide variety of sources, often nonfinancial.
  - Often are most influenced by management experience, insight, and intuition.
  - Are highly unstructured.
  
- Strategic decisionmaking offers the greatest potential for decision support systems and also the greatest challenges and risks for DSS product and service vendors. Factors listed above, plus historical executive reluctance to directly accept computers, will make the growth of DSS slow at the top levels. However, the potential productivity and organizational gains are large and should continue to encourage their eventual implementation and acceptance.

## B. DSS USER PERSPECTIVES

- This section will examine the DSS user, basic needs, the role of traditional information services, and the impact on users of microcomputers in DSS.
- Previous INPUT surveys have shown a widespread use of decision support tools at all organizational levels. Since many managers make operational, tactical, and strategic decisions, a direct correlation between organization level and type of decision cannot be completely justified. It can be stated, however, that the most widely accepted DSS use has occurred at the middle-management level in support of tactical decisions, in quantitative and analytical applications.
- Although a high percentage of respondents to recent INPUT surveys have reported to be end users of decision support, there is evidence to suggest that a significant number of these may not be decisionmakers, but rather "knowledge workers." The true decisionmaker relies on this function (financial analyst or system expert) to provide technical or application expertise and to provide digested data for support of decisionmaking.
- It is useful to review some of the basic user needs in relation to decision support systems. A recent INPUT survey reported that data acquisition and data base management are becoming the most important user needs. As larger numbers of users become more experienced with DSS and its complexities, issues such as data acquisition, corporate data bases, and timeliness of data take on added importance. Other DSS user needs in order of importance are:
  - Forecasting capability.
  - Modeling language.

- Spreadsheets.
  - Report generation.
  - Graphics.
  - Financial functions.
  - Statistical functions.
  - Telecommunications.
- Growth of decision support systems within organizations can be categorized by stages of user and technical sophistication. These stages are:
    - Initial DSS user.
    - Maturing DSS user.
    - Advanced DSS user.
- Individuals and corporations exhibit patterns associated with a growing experience and sophistication. Exhibit III-2 details these traits in the following areas:
    - Numbers and types of users.
    - Sophistication level of applications.
    - Delivery methods.
    - Data acquisition methods.



EXHIBIT III-2

DSS USER GROWTH CHARACTERISTICS

	INITIAL DSS USER	MATURING DSS USER	ADVANCED DSS USER
Nature of Applications	Financially Oriented Applications, Single-Purpose Budgeting Analysis	Largely Financial, Wider Variety of Applications	Largely Financial, May Include Novel Applications or Artificial Intelligence
Support	End User Usually Technically Competent (Supports Self)	End Users Less Technically Competent	End User and Technical Support Divergence Well Established
Sources of Data	Standalone Systems, Data Manually Entered	Some Data Available from Other Sources	More Data Sharing, May include Micro-Mainframe Connections, Corporate Data Bases
Organizational Factor	Departmentally or Functionally Confined	Cross-Organization Applications Developing	Formal Cross-Organizational Applications
Personal Computer	Moderate Level of PC Spreadsheet Use  Usually no Mainframe/Mini DSS Tools	High Level of PC Applications  May Have Mainframe/Mini Application Tools	Large Numbers of PCs Throughout Organization  Mainframe/Mini DSS Tools
Impact of Remote Computing Services	DSS May Be Delivered By Remote Computing Service	RCS Beginning to Migrate In-House	Little RCS Used
Scope of DSS Tools	Limited Base of DSS Tools	Base of Tools Widens, May Include Mainframe DSS	Wide Variety of DSS Tools Available

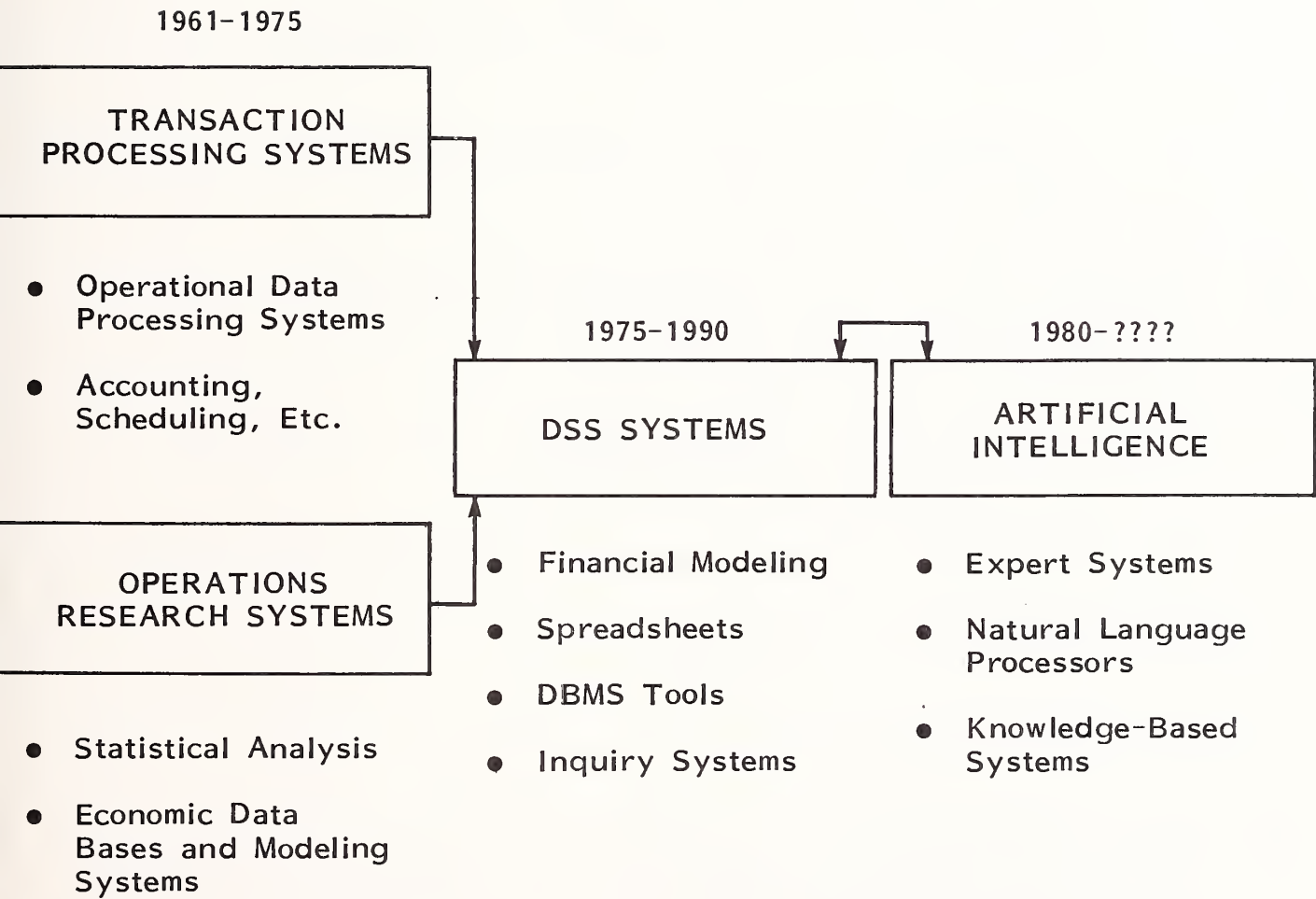
- Number and sophistication level of DSS tools.
- Organizational factors.
- The evolution of the relationship between DSS and traditional data processing is worth examining. It provides a background for understanding the evolution of DSS software tools and services as well as the challenges ahead for fully exploiting "organizational DSS."
- Decision support systems grew out of user needs traditional DP did not provide. These unfulfilled needs were based on quick response requirements and lack of access to information to guide the user through uncertainty. DP, it seems, was more concerned with efficiency, cost control, large structured long-term products, and centralized computer resource allocation.

### C. EVOLUTION OF DSS SOFTWARE

- Decision support software evolved from a combination of existing data processing applications and unmet user need for dealing with future business uncertainty. From its origins in operating research, DSS tended to be complex, mathematical, and developed/maintained by "gurus."
- DSS also has roots in extensions of traditional business operational and transaction systems such as accounting and scheduling. A need developed for manipulating current and past financial experience into modeling future financial conditions. Exhibit III-3 depicts this evolution.
- As stated before, decision support tools and systems have, in large part, evolved directly out of user needs which have affected:
  - The basic nature of the software.
  - The methods of its delivery to the user.

EXHIBIT III-3

DSS SOFTWARE EVOLUTION

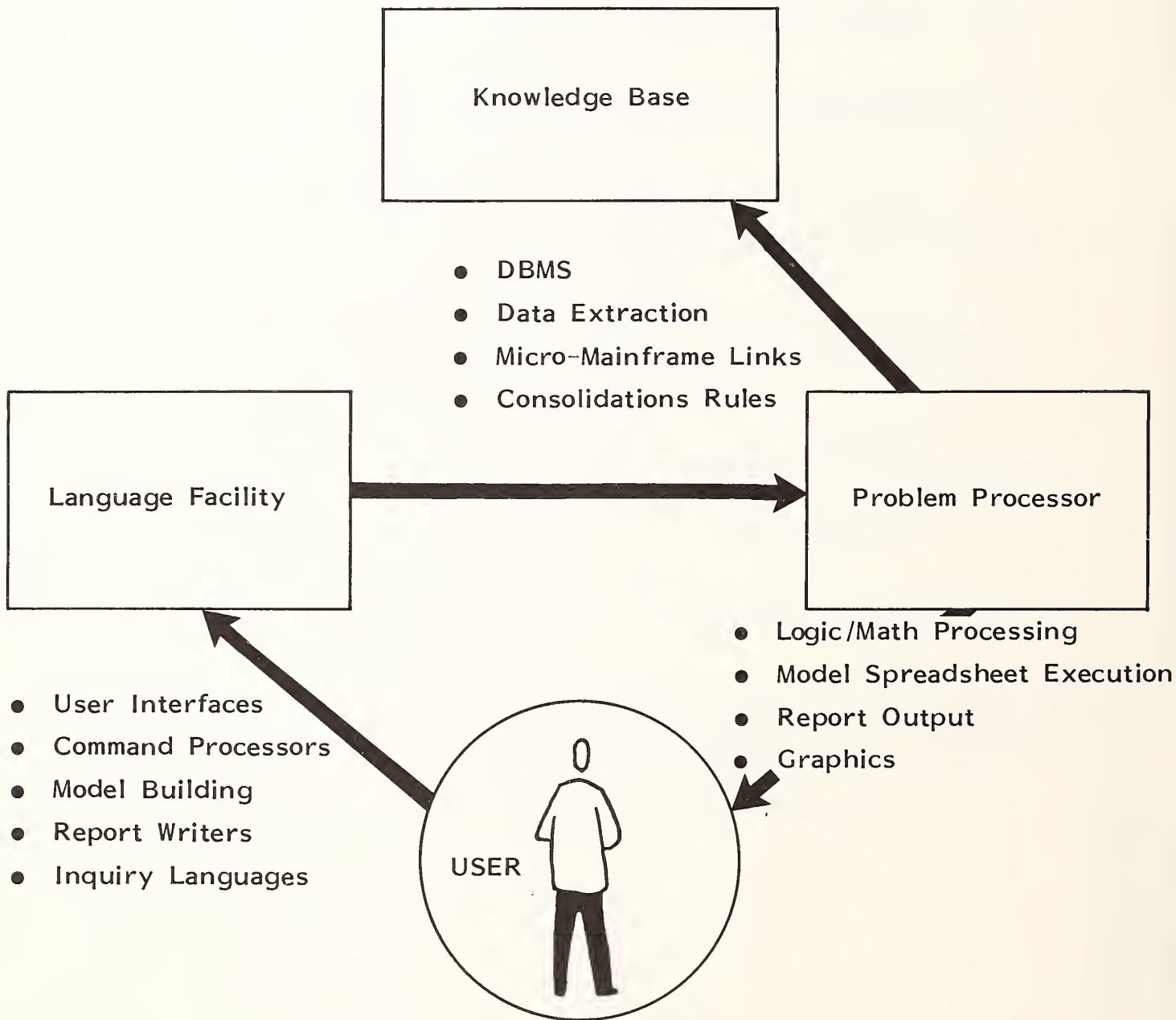


- This caused users to look elsewhere for solutions and led to an even wider gap between end users of DSS and IS groups. Some of this led to:
  - Users acquiring DSS through remote computing services (RCS) and external consulting.
  - DSS software vendors selling directly to end users.
  - Users acquiring PCs and spreadsheet packages on their own, in great numbers.
  - DSS software containing a high degree of built in help facilities to offset a lack of IS support.
  
- In the last few years, there has been pressure for DSS users and IS groups to work more closely together due to:
  - Rapidly changing hardware technology.
  - Increasing complexity and more DSS tools for users to choose from.
  - Sophistication of applications.
  - DSS' increasing appetite for corporate data.
  
- Typical DSS software, both microcomputer and mainframe, contains functions and characteristics which reflect the assumption that many end users provide their own support. General characteristics of DSS software are:
  - Responsive, highly interactive.
  - Usually visual.

- Contains a high degree of self help.
- Often includes relatively good error handling.
- Includes facilities for acquiring data easily.
- The history of the methods employed for delivery reflect the independence of the end user in acquiring decision support solutions. DSS has:
  - Often been supplied by RCS vendors.
  - Been acquired without the "blessing" or control of IS.
  - Probably more driven by the acquisition of more PCs (through spreadsheets) than any other application.
- In our earlier academic definition of decision support systems, it was stated that DSS was comprised of three principal elements:
  - Knowledge base.
  - Language facility.
  - Problem processor.
- Currently available DSS software functions can be roughly grouped into these major components, as shown in Exhibit III-4.

EXHIBIT III-4

DSS MAJOR COMPONENTS AND FUNCTIONS





## IV CURRENT DSS SOFTWARE ENVIRONMENT





## IV CURRENT DSS SOFTWARE ENVIRONMENT

### A. TYPICAL APPLICATIONS

- Decision support applications can be broken into two general types:
  - Financial and statistical analysis applications.
  - Management or decision aids.
  
- Characteristics of financial and statistical analysis applications:
  - Heavy accounting or budgeting orientation.
  - Mathematical, "number crunching."
  - Special functional (capital acquisition) as well as organizational (corporate budgeting) applications.
  - An abundance of tools on micro, mini, and mainframe computers.
  
- Characteristics of current decision-aid software include:
  - Some degree of expertise in a specific functional area such as project management or employee performance.

- Typically focused on individual decisions.
- May include artificial intelligence technology.
- General, cross-industry, financial applications currently account for approximately one-third of total DSS user expenditures. Exhibit IV-1 shows the variety of these applications. They represent, historically, the primary DSS uses, and, in INPUT's view, will continue to experience significant growth.
- Financial applications are primarily used in the tactical decision area, usually by either middle managers or professionals. It is worth noting, however, that a small but increasing number of top managers are users of DSS. This use is usually limited to PC-based spreadsheets or a specific, focused application.
- Industry-specific applications tend to fall into the softer, nonfinancial decision aid category. In addition, service, transportation, and some manufacturing DSS applications are heavily nonfinancial and are often used at the operational or front-line level.
- Exhibit IV-2 shows industry-specific applications.
- In the manufacturing segment, DSS applications integrated with manufacturing resource planning are beginning to appear and offer promise for productivity gains, inventory control, and scheduling. They are, however, complex applications and rely on a large volume of data.
- The nature of the distribution industry with high volume, price sensitivity, and complex transportation components provides a fertile DSS application environment. This has led to specific-function, custom, in-house DSS solutions.

## EXHIBIT IV-1

### CROSS-INDUSTRY DSS APPLICATIONS

- Departmental Budgeting
- Financial Forecasting
- Capital Budgeting
- Mergers and Acquisition Analysis
- Lease versus Purchase Decision
- New Venture Evaluation
- Tax Planning/Modeling
- Foreign Currency Analysis
- Pro Forma Financial Statements

EXHIBIT IV-2

INDUSTRY-SPECIFIC DSS APPLICATIONS

BANKING AND FINANCE	MANUFACTURING	SERVICE
<ul style="list-style-type: none"><li>● Asset and Liability Management</li><li>● Credit Analysis</li><li>● Interest Rate Analysis</li><li>● Portfolio Analysis</li></ul>	<ul style="list-style-type: none"><li>● Production Scheduling</li><li>● Inventory Planning/Management</li><li>● Product/Job Cost Planning and Analysis</li><li>● Factory Simulations</li><li>● Integrated Production and Financial Forecasting</li></ul>	<ul style="list-style-type: none"><li>● Project Management</li><li>● Special Service Segment Applications</li><li>● Construction Scheduling</li></ul>

TRANSPORTATION	UTILITIES
<ul style="list-style-type: none"><li>● Fleet Repair Analysis</li><li>● Logistics Modeling</li><li>● Scheduling Analysis</li><li>● Tariff Filing</li></ul>	<ul style="list-style-type: none"><li>● Load Forecasting</li><li>● Rate Planning/Analysis</li></ul>

## B. CURRENT DSS PRODUCTS

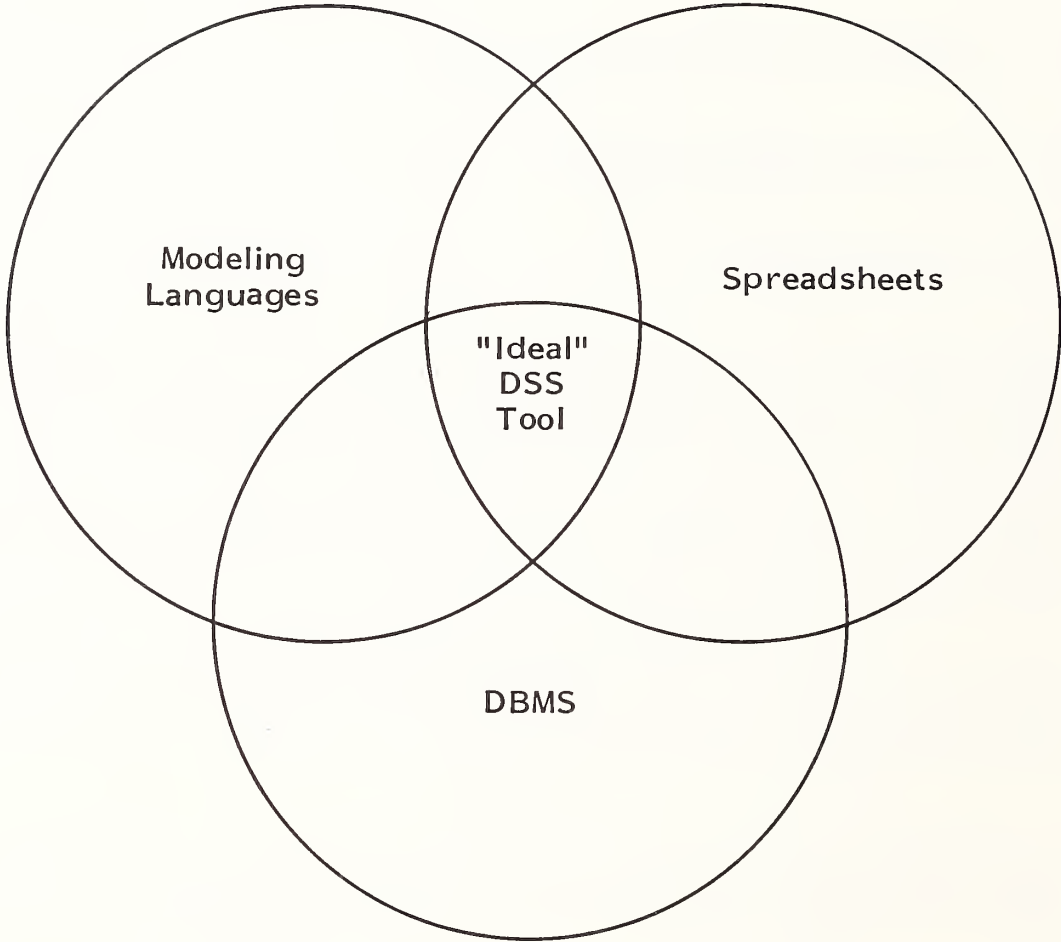
### I. ANALYSIS OF AVAILABLE TOOLS

- Current computer-based decision support systems software can be segregated into three broad categories:
  - DBMS, fourth generation languages.
  - Financial modeling products.
  - Spreadsheets.
- Many products promote themselves in all areas, but due to their particular original user and design orientation, few cover all three areas.
- Again, part of the problem of identifying "true" decision support products lies in the inability of DSS to be clearly defined.
- Exhibit IV-3 depicts the three categories of DSS tools and the "ideal DSS tool" at the intersection of the three categories.
- It is useful to examine the sum of the characteristics of products in each group and to identify any potential strengths or weakness to the DSS user.
- Current leading financial modeling languages (mainframe-based) usually provide:
  - Model building facility.
  - Some data organizing facility.



EXHIBIT IV-3

PROFILE OF EXISTING DSS TOOLS



- Three-dimensional data capability.
- Financial and statistical functions.
- Graphics capability.
- A microcomputer version and/or link.
- Some consolidation capability.
- Capability for multidimensional applications (like departmental budgeting, forecasting, consolidations).
- Some potential drawbacks in modeling languages include:
  - Inability to deal with high volume or detail-level data.
  - Usually inadequate inquiry functions.
  - Awkward in multidimensional data applications.
- Currently available spreadsheets (micro-based) used in a decision support environment usually provide:
  - Simplicity, ease of use.
  - Single problem, application orientation.
  - Local decision support.
  - Highly visual user interface.

- Potential limitations to spreadsheets as a full DSS tool include:
  - Basic orientation that forces all decision support into two-dimensional worksheets.
  - Restricted to unstructured and relatively small amounts of data.
  - Limited consolidation or data manipulation capability.
  
- DBMS tools offer a somewhat different DSS orientation and associated set of capabilities:
  - Good data organizers.
  - Detail, transactional orientation.
  - Usually include query function.
  - "Roots" based in operational systems development.
  - Sometimes viewed as applications productivity tool rather than DSS.
  
- Potential drawbacks of DBMS tools when applied to a DSS:
  - May have limitations in summarizing or transforming data to a usable form for modeling.
  - Typically have no facility for "what if" manipulation.
  - Non-matrix orientation makes worksheet concepts difficult to apply.
  - Conceptually difficult for novice DSS user or spreadsheet user.

- Exhibit IV-4 organizes leading software products by their primary orientation.

## 2. MAINFRAME AND MINICOMPUTER-BASED PRODUCTS

- A list of some of the leading mainframe and minicomputer financial modeling software is included as Exhibit IV-5.
- For consistency and clarity in identifying the proper DSS tools, data base-oriented DSS tools are listed and included as Exhibit IV-6.

## 3. MICROCOMPUTER-BASED DSS PRODUCTS


- Because of the rapid growth of personal computers and the wide acceptance by corporations of products such as Lotus 1-2-3, a large percentage view DSS as a PC spreadsheet function.
  - Although it is highly unlikely that large numbers of users will abandon personal DSS on microcomputers, users find that as they move through learning stages and gain expertise in individual applications, certain limitations previously mentioned become apparent.
  - Microcomputer DSS, and in particular spreadsheets, are contrasted with their perceived traditional mainframe counterparts in Exhibit IV-7.
  - For corporate-wide DSS to be successful, it is important to understand these differences. For IS, it is critical that they provide users with the information necessary to make logical choices of tools to accomplish the DSS objective.
  - Microcomputer DSS software can be roughly separated into two major groups for the purpose of this discussion.
- Spreadsheets and integrated software.
  - Downsized versions of mainframe DSS products.

EXHIBIT IV-4

LEADING DSS PRODUCTS BY MAJOR CLASSIFICATIONS

MODELING LANGUAGES
Cuffs
EIS
Empire
Express
FCS-EPS
IFPS
MAPS/Model
Model
System W
XSIM

INTEGRATED SOFTWARE AND SPREADSHEETS
Framework
Lotus 1-2-3
Multiplan
SuperCalc
Symphony

DBMS
dBase III
Focus
R Base 5000
Inquire
Natural

EXHIBIT IV-5

LEADING MAINFRAME/MINI FINANCIAL MODELING PRODUCTS

PRODUCT	VENDOR	PRODUCT LICENSE FEE	ORIENTATION/ CAPABILITIES	HARDWARE REQUIRED
Cuffs-88	Cuffs Planning and Models Ltd.	\$30,000-42,000	Reporting, Modeling Forecasting, Data Handling	IBM Mainframes, Plug-Compatibles, DEC VAX, Apollo, Ridge, Sun
EIS	Boeing Computer Services	\$55,000-160,000	Reporting, Modeling, Graphics, Forecasting, Data Base Management, Statistics	IBM Mainframes, Plug-Compatibles,
Empire	Applied Data Research (ADR)	\$45,000-60,000	Data Handling, Reporting, Modeling, Graphics, Statistics	IBM Mainframes, Plug-Compatibles DEC VAX
Express	Management Decision Systems (MDS)	\$50,000	Modeling, Forecasting, Reporting	IBM Mainframes, Prime 2250 and up.
FCS-EPS	EPS	\$40,000-120,000	Planning, Forecasting, Graphics, Data Management, Reporting	IBM Mainframes, Plug-Compatibles System 134, DG, HP 3000, Univac, Wang VS
IFPS	Execucom Systems Corp.	\$40,000-60,000	Modeling, Reporting Data Base Management, Graphics, Statistics	IBM Mainframes, Plug Compatibles, Burroughs, CDC, DEC Mainframes, VAX, Harris, Honeywell, Data General, HP 3000



EXHIBIT IV-5 (Cont.)

LEADING MAINFRAME/MINI FINANCIAL MODELING PRODUCTS

PRODUCT	VENDOR	PRODUCT LICENSE FEE	ORIENTATION / CAPABILITIES	HARDWARE REQUIRED
MAPS/Model	Ross Systems Incorporated	\$23,000-30,000	Financial Modeling, Reporting, Data Management, Spreadsheets	DEC VAX
Model	Lloyd Bush & Associates	\$ 9,000-100,000	Reporting, Modeling, Planning	Prime, DEC VAX, HP 3000, Honeywell, IBM (CMS, TSO)
System W System W Plus System W Distributed	Comshare	\$65,000 100,000	Forecasting, Graphics, Statistics	IBM Mainframes (CMS, TSO)
CPL TACTIX	Segra International	\$85,000	Financial Analysis, Modeling, Spreadsheets, Relational Data Base, Graphics	IBM 43XX/MVS/TSO, VM/CMS
XSIM	Chase Decision Systems	\$50,000	Data Management, Reporting, Graphics, Financial Modeling, Modeling, Econometrics, Statistical Analysis	IBM Mainframes, Plug-Compatibles



EXHIBIT IV-6

LEADING DATA BASE LANGUAGE-ORIENTED DSS PACKAGES

PRODUCT	VENDOR	PRICE	CAPABILITIES
dBase III	Ashton-Tate	\$ 695	Relational Data Base Mgt.
Focus	Information Builders	\$ 40,000- 120,000	DBMS, Query Language, Application Builder
Natural	Software AG	\$ 7,900- 32,000	Statistical Analysis, Data Management, Graphics, Reporting, Modeling
R:Base 5000	Microrim	\$ 495	Relational Data Base Mgt.

EXHIBIT IV-7

CONTRASTING SPREADSHEETS WITH MAINFRAME DSS

PC SPREADSHEETS	TRADITIONAL MAINFRAME DSS
<ul style="list-style-type: none"><li>● Data and Logic Reside Together</li><li>● Crude Data Management</li><li>● Awkward Consolidations</li><li>● Visual, Worksheet Orientation</li><li>● Typically Geographical Reference to Worksheet Cells</li><li>● Very Easy to Use</li><li>● Simultaneous Relationship Solutions Seldom Available</li></ul>	<ul style="list-style-type: none"><li>● Data and Formulas Stored Separately</li><li>● Sophisticated Data Management</li><li>● Consolidations Easily Accomplished</li><li>● Command Language, Less Visual</li><li>● Usually Meaningful Neumonic References</li><li>● Sophistication Makes Learning Sometimes Difficult</li><li>● Goal Seeking, Tarteting Usually Available</li></ul>

- Exhibit IV-8 shows a partial list of the most popular personal computer spreadsheets and integrated software available currently.
- Leading mainframe software vendors, feeling pressure to offer PC software, have introduced micro-based versions of mainframe DSS software. These products in general include similar functionality to their mainframe namesakes, although typically are restricted in either the data management or processing speed areas. These products are summarized in Exhibit IV-9.

#### 4. MICRO-MAINFRAME LINKS

- Much has been written and discussed about micro-mainframe links, one of the latest computer concepts still remaining to be defined and practically implemented.
- Recent INPUT user studies have confirmed an overwhelming interest in micro-mainframe links, but have also uncovered a vagueness concerning the specific user expectations and practical application of such concepts by vendors. Vendor confusion and their apparent inability to communicate specifics to the market have only fueled this confusion.
- Micro-mainframe links are, however, the necessary means to:
  - Build distributed DSS applications.
  - Allow sharing of historical data with large numbers of PC DSS users.
  - Allow organizational DSS to evolve.
- The primary advantages of micro-mainframe links with respect to DSS can be summarized as follows:
  - Ready access to central data by PC DSS users.

## EXHIBIT IV-8

LEADING MICRO-BASED SPREADSHEETS  
AND INTEGRATED SOFTWARE

PRODUCT	VENDOR	PRICE	ORIENTATION CAPABILITIES
Framework	Ashton-Tate	\$695	Spreadsheet, Graphics, Data Base, Word Processing, Telecommunications
Lotus 1-2-3	Lotus Development Corporation	495	Spreadsheet, Graphics, Data Management
Multplan	Microsoft	195	Spreadsheet
SuperCalc 3	Sorcim/IUS	395	Spreadsheet, Graphics, Data Management
Symphony	Lotus Development Corporation	695	Spreadsheet, Graphics, Data Base, Word Processing, Telecommunications
Encore!	Xerox Micro Systems	895	Mainframe-like Modeling and DSS

EXHIBIT IV-9

MICROCOMPUTER VERSIONS OF MAINFRAME/MINI PRODUCTS

PRODUCT	VENDOR	PRICE
CIS Workstation	Boeing Computer Services	\$300
PC Empire	ADR	600
Express Mate	MDS	450
Micro FCS	EPS	N/A
IFPS/Personal	Execucom Systems	600
MAPS/Pro Model	Ross Systems	1,295
Model PC	Lloyd Bush & Assoc.	595-995
Micro W	Comshare	200
CPL TACTIX	Segra International	2,000

- Productivity and data quality gains, largely from the elimination of manual data input and data duplication.
  - Mainframe offloading (although users report conflicting results).
  - A mechanism for organizing, collecting, and consolidating DSS information from largely independent PC users, a real advantage in budgeting and forecasting applications.
- Despite the hysteria and promise of micro-mainframe links, two realities remain:
    - Manual re-keying of data is by far the most widely used DSS micro-mainframe link.
    - Several major challenges remain before these links are widely implemented.
  - These challenges can be summarized as follows:
    - Micro-mainframe links are technically complex due to data base consistency, severity, and data integrity issues.
    - Relatively unsophisticated PC DSS users are probably not yet ready to embrace more complex technology.
    - DSS applications built around these links are dependent on individual organizational factors, requiring traditional systems approaches and longer implementations.
  - Exhibit IV-10 shows current representative DSS micro/mainframe link software products. Many of the mainframe/mini vendors include a micro/mainframe product as part of their PC-based DSS products.

EXHIBIT IV-10

REPRESENTATIVE MICRO-MAINFRAME LINKS

PRODUCT	VENDOR	DSS LINK ORIENTATION
ADR/Data Query	Applied Data Research	Data Management
Natural/Connection	Software AG	Data Management
PC Focus	Information Builders	Data Management
IFPS/Personal	Execucom	Financial Planning and Analysis
Micro FCS	EPS, Inc.	Financial Planning and Analysis
Maps/Microlink	Ross Systems	Financial Planning and Analysis
System W	Comshare	Financial Planning and Analysis
Smart Link	GE Software International	Application-Specific
Interactive PC Link	McCormack & Dodge	Financial Planning and Analysis
Expert Link	MSA	Financial Planning and Analysis





V DSS OUTLOOK



## V DSS OUTLOOK

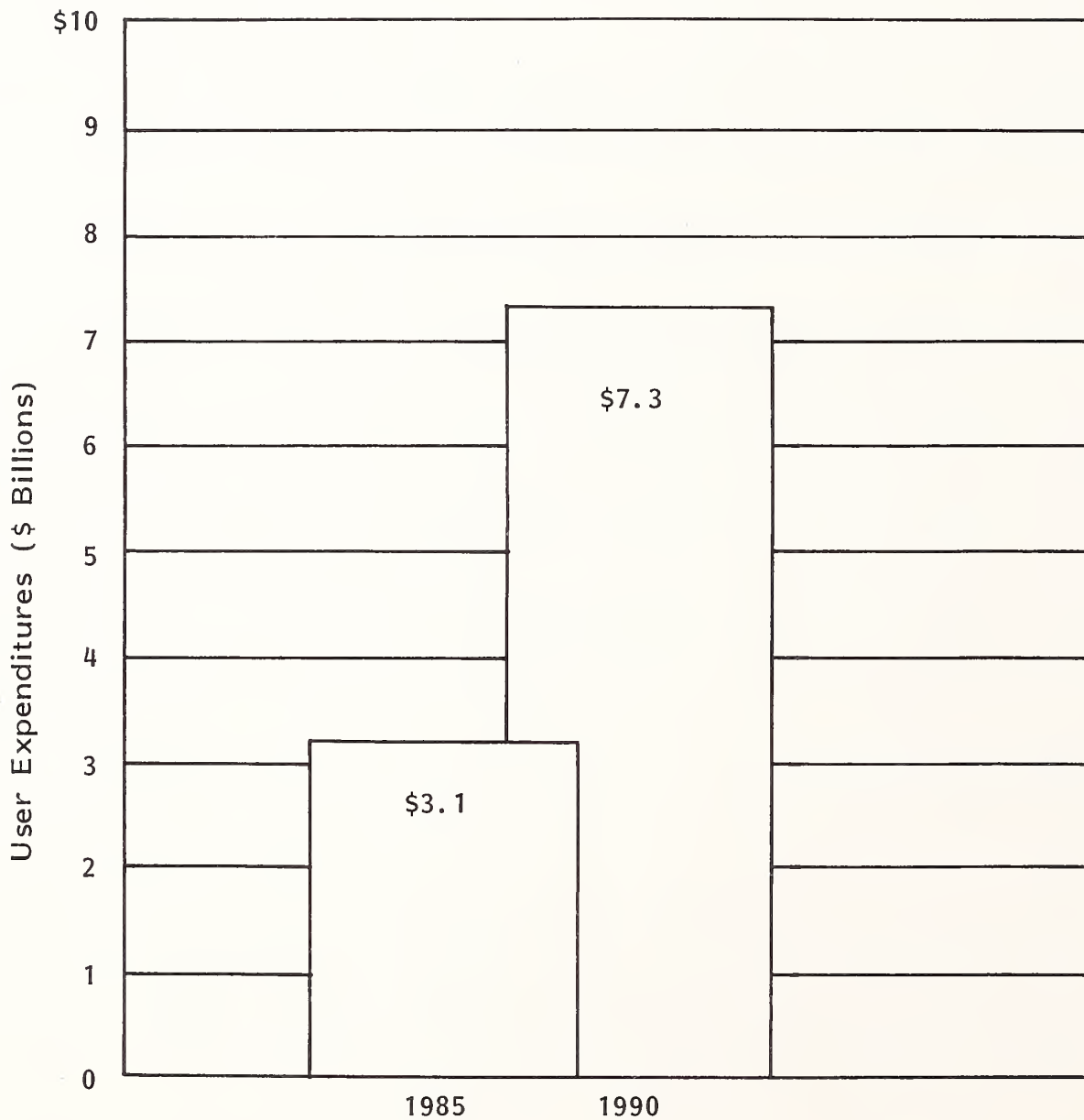
- Many factors will affect the evolution of decision support systems. This section will discuss these factors and also:
  - Forecast user expenditures for DSS products and services.
  - Identify DSS application growth areas.
  - Provide an analysis of product trends.
  - Predict the impact of artificial intelligence.
  - Present an outlook for support of DSS.

### A. INDUSTRY TRENDS

- INPUT forecasts show DSS to be one of the fastest growing cross-industry segments. Exhibit V-1 shows that an average annual growth rate of 17% through 1990 is forecast for DSS applications, including budgeting, financial planning, forecasting, and modeling.
- User expenditures will be stimulated by the continued growth of micro-computers which serve to both introduce new users to the benefits of DSS ✓

EXHIBIT V-1

DSS USER EXPEDITURE FORECAST, 1985-1990



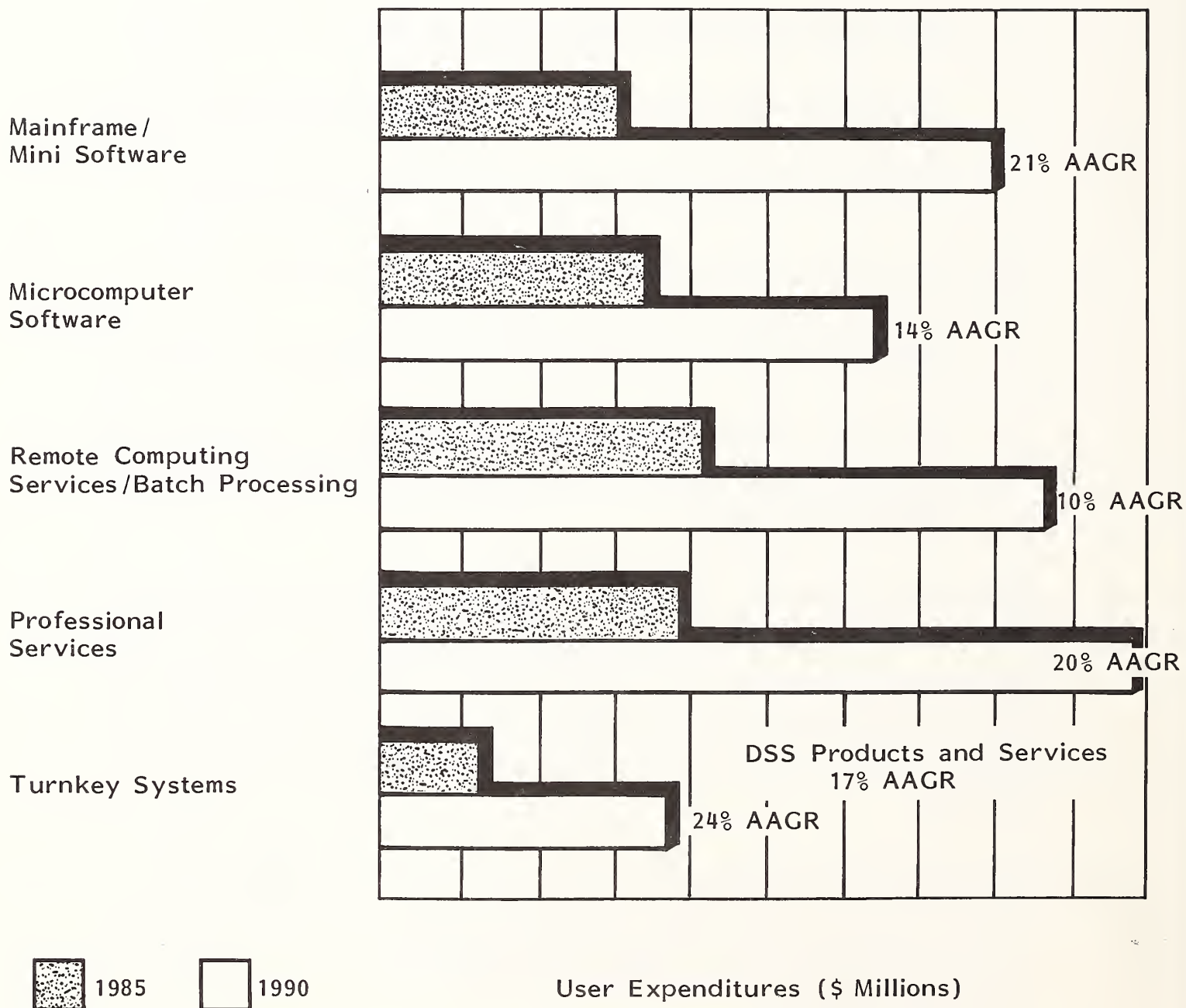
Average Annual Growth Rate = 17%

(usually via spreadsheets) and create a desire for more power beyond existing systems.

- Positive factors influencing this growth:
  - More powerful microcomputer hardware.
  - Better micro-mainframe links to large data bases.
  - Integration of DSS with operational and transaction processing systems.
  - Addition of artificial intelligence to traditional DSS applications.
- There are also some negative factors influencing user expenditures:
  - The end user's ability to assimilate advancing, complex DSS products.
  - Backlog of unimplemented facilities from existing decision support systems resulting from the user's inability to keep pace with the advances of the tools.
- Exhibit V-2 presents DSS forecasts by delivery mode. Mainframe/mini applications software products continue to lead all other delivery modes in terms of size and growth rate. The increasing development of complex distributed data processing networks is stimulating the growth of mainframe/mini-based decision support systems that are designed to have strong links to microcomputers.
- Microcomputer-based applications software will grow 14% annually for the next five years to reach nearly \$1.3 billion by 1990. This mode's growth is somewhat less dramatic than mainframe/mini growth due to price erosion and applications saturation.

EXHIBIT V-2

DSS USER EXPENDITURES BY MODE OF DELIVERY





- Remote computing services and batch processing will continue to lose ground to in-house solutions. However, market opportunities will still exist for processing of very large data bases with their attendant retrieval and analysis requirements.
- Professional services will grow a hefty 20% annually through 1990. Custom solutions as well as education, training, and consulting activities will be in significant demand as users seek to adapt DSS to their unique requirements.
- Turnkey systems will also enjoy healthy growth as more software vendors expand their markets by becoming value-added resellers, thus simplifying the buying decision for users.

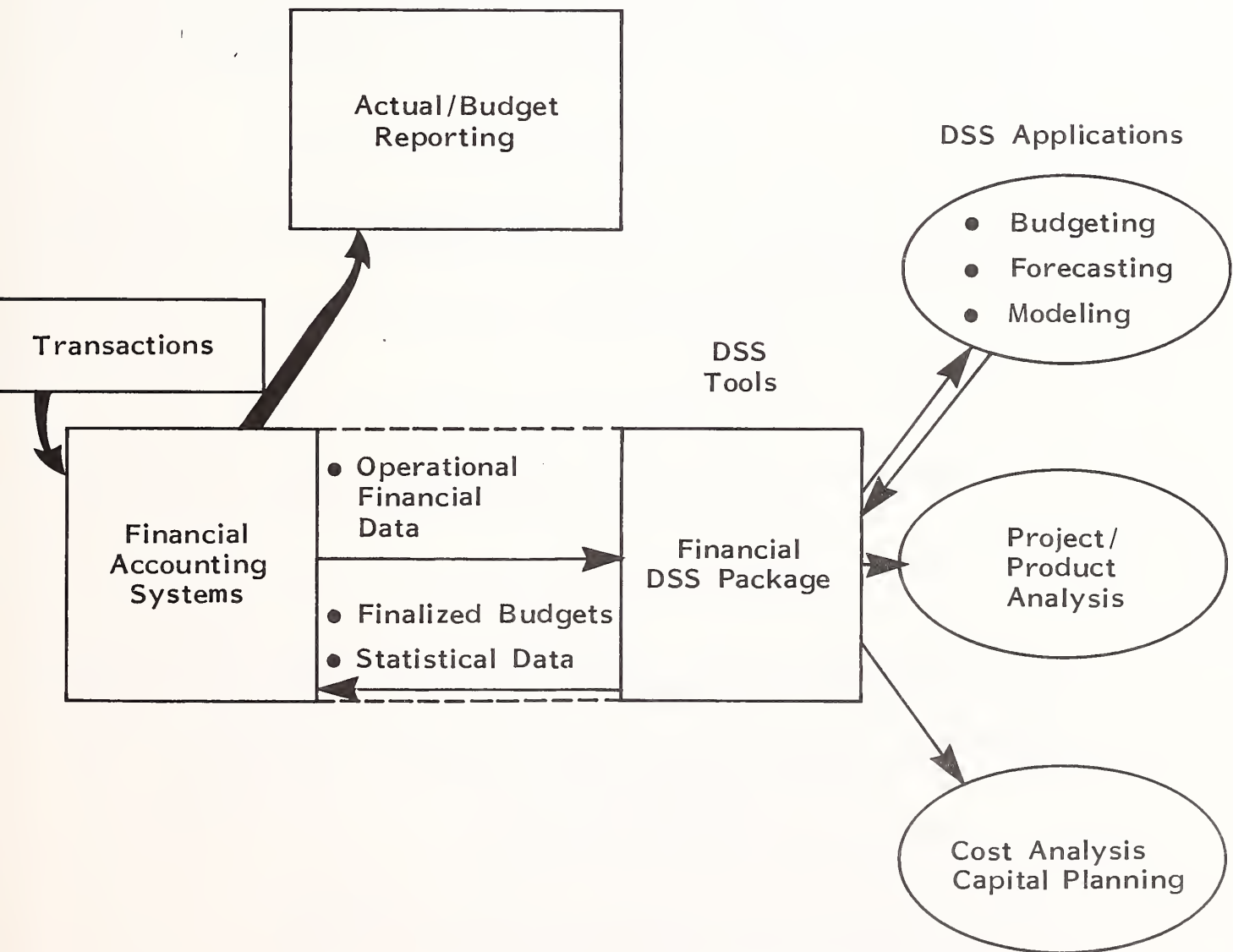
## **B. DSS APPLICATIONS GROWTH**

- Trends suggest growth in already established applications such as planning and analysis which will further evolve as the user base matures in sophistication, as well as new industry and function specific applications stimulated by vendor partnerships and artificial intelligence technology. In addition, communications and micro-mainframe advances should further stimulate growth of larger scale, organization-wide DSS applications.
- Cross-industry decision support systems are forecasted to continue their present growth patterns, although the base should broaden to include other less well-developed applications. In general, the traditional financial planning and analysis group will remain strong, but other cross-industry applications likely to see rapid growth are:
  - DSS applications integrated directly with other cross-industry operational and transactional software.

- Integrated DSS and office systems software such as electronic mail and communications.
- Broadening DSS applications, from a vendor's perspective, is most easily achieved by the integration of DSS software into other operational applications. Financial and transactional systems offer the most realistic and practical potential. Several factors will drive this.
  - Traditional DSS dependence on actual financial (accounting) data.
  - Increasing frequency of planning and its related comparison with actual results.
  - Relatively well-defined, large applications that exist today.
  - The ability of DSS software vendors to develop partnerships with other vendors with relatively little investment of resources.
  - Productivity benefits of data sharing, which are easily perceived by users familiar with manual data input.
- Probably the best practical example of integrated transactional DSS application is depicted in Exhibit V-3.
- In this example, corporate accounting systems are maintained by a standard financial accounting package which typically includes transaction processing, reporting, and possibly budget reporting (but not budget development capability).
- Because the nature of accounting systems is well defined and structured, the task of integration with DSS modeling tools is confined to a relatively few issues of data compression/explosion. Once the data gateway is described in generalized interfaces (which is beginning to be addressed by a few software

EXHIBIT V-3

EXAMPLE OF INTEGRATED FINANCIAL DSS APPLICATION



vendors), the environment exists for rapid development and implementation of integrated financial DSS applications.

- The perceived benefits, from a user's perspective, in this example would be:
  - Relatively well-defined applications development environment.
  - Immediate productivity and data quality gains.
- With decreased regulation of the banking/financial services industry, this segment should experience growth in applications that focus on profitability and alternative analysis as well as branch performance. Moderating growth of vertical software will be the availability of a number of currently available generic tools.
- ✓ ● Manufacturing systems will provide a great deal of potential for DSS applications growth, especially in integration of analysis tools within specific existing software processing functions such as:
  - Inventory management.
  - Financial functions (accounts receivable, sales analysis, forecasting).
  - Plant simulation.
- The service industry, with its diverse business categories and sizes, will see attention given to it by software vendors already addressing a particular segment with products other than DSS. These segments include:
  - Engineering firms for project management.
  - Accounting firms for auditing and statement analysis.

- Medical diagnosis systems.
- Hospital capacity planning and analysis.
- Construction companies for project planning and forecasting.

### C. MAINFRAME AND MINI-BASED PRODUCT OUTLOOK

- Several key decision support trends are developing which will have a significant impact on the direction and nature of DSS products on mainframes and minicomputers: ✓
  - Ongoing quest for friendlier software.
  - Micro-mainframe links.
  - Focus on data acquisition, management.
  - Integration with other applications.
  - Traditional DBMS products moving into DSS.
  - Continued expansion to other hardware.
  - Cautious approach to artificial intelligence technology.
- These trends will be discussed in detail throughout this section, but in summary, they are a result of several factors.
  - A focus on user needs.



- Recognition that data is going to play an ever-increasing critical role in DSS.
  - An effort to reach the executive decisionmaker.
  - A realization that micros and PC DSS are here to stay.
  - Significant vendor investment in existing software.
- User-friendly may be the most overused term when referring to decision support software. Like decision support itself, it is difficult to define. DSS product vendors typically view the user interface as a primary factor in software selection. This is likely based on the following assumptions that:
    - If a product is not easy to learn, it will not be widely accepted.
    - There is a generation of PC spreadsheet users ready for more DSS power, but with expectation levels based on user-oriented PC software.
    - "Friendly" software sells into organizations more easily.
- Micro-mainframe links are currently being widely offered in conjunction with PC versions of mainframe/mini software or as separate add-ons. They range in function from simple terminal emulation and communications to well-thought-out, intelligent data transfer mechanisms. Although highly promoted, there is little hard evidence of their success or widespread implementation. It appears that most software vendors, although realizing the importance of links to the future of organizational acceptance of DSS, are as unclear as the rest of the world as to how it should actually happen.
- Data management and acquisition will be an important factor in determining the direction of DSS products. Although this issue transcends products and has much to do with organizational and end-user factors, DSS vendors have been quick to react to what they believe are the needs:

- Micro-mainframe links.
  - Heavy promotion of data management capabilities.
  - Adding data handling functionality.
  - DBMS vendors taking a more aggressive DSS posture.
- As discussed in a previous section, there is a distinct trend for DSS tools to be more closely aligned with specific applications. Several DSS vendors have announced agreements with applications software vendors.
  - This is being accomplished in three ways:
    - By having application products include specific DSS functions.
    - By DSS vendors partnering with or making their products compatible with widely used applications or DBMS systems.
    - By offering traditional DSS products in industry or functional "template" versions.
  - This trend may be a reaction to the confusion by users as to what constitutes DSS. The user community to a great extent views DSS through applications, and vendors find their products sell more easily when driven by specific applications users can relate to.
  - Although not thought of as DSS in a classic sense, traditional DBMS vendors are taking a broader definition of DSS and actively marketing their products under that umbrella. With user needs now focusing on the importance of data organization, data acquisition, and integration capabilities, vendors make up for their general lack of specific DSS functions. DBMS vendors are taking



advantage of most DSS products' inherent weaknesses in the data management area. They tend to view spreadsheets as the modeling and analysis tool and their products as the overall mechanism for integrating systems and providing data as well as linking micro and mainframe users.

- Demand is increasing for solutions which allow the implementation of a single product across mixed vendor hardware and across different combinations of mainframe, mini, and micro-based processors. Larger organizations recognize the need to standardize systems across departments and business units and the support costs of maintaining multiple DSS products on different hardware.
  
- Although AI is seen by many as one of the most important long-range decision support product trends, few traditional mainframe and minicomputer DSS software vendors are racing to apply artificial intelligence to their products on a large scale. AI applications will take time to develop due to some very high risk factors that few DSS vendors are likely to take a chance on all at once:
  - Unknown benefit.
  - User commitment, acceptance unclear.
  - High investment required.
  - Applications somewhat limited.
  - Relative infancy of technology.
  - Long development lead times.
  
- Most of the current product development in DSS with respect to artificial intelligence is taking place in the user interface area with natural language front-end processors, particularly in ad hoc data retrieval applications.

- While AI and DSS are developing slowly on the mainframe/mini environment, personal computer-based AI or knowledge-based tools, particularly single-function applications, are beginning to appear widely. This will be explored in succeeding sections.

#### D. MICROCOMPUTER DSS TRENDS

- There are many developing trends in microcomputer DSS products; in some ways, they parallel or mirror trends evolving in the mainframe and mini environment. Several of the most significant decision support product trends are summarized below and explained more fully throughout this section.
  - Full-function PC versions of leading mainframe/mini DSS packages are becoming more significant.
  - Spreadsheets are moving toward "mainframe" functionality.
  - Applications and DSS "templates" are finding acceptance.
  - There are greater offerings of AI-related DSS tools.
- Factors that have and will continue to influence the direction of micro-computer decision support products include:
  - More powerful processors with greater storage capacities.
  - A rapidly growing user base.
  - Increasing user sophistication and capability.

- User view of DSS as a specific application.
  - Need for access to a wide variety of data sources.
  - Vendors (as opposed to users) providing much of the direction for products.
- Many of the leading maintenance/mini DSS products are, or will be, offered on the personal computer largely intact. This may be due not as much to the potential exploitation of the PC base as to the establishment of a foothold for accomplishing longer-term objectives. This trend should continue as vendors attempt to:
    - Offer a product to sophisticated spreadsheet users with nowhere to go.
    - Integrate their product line all types of processors.
    - Gain exposure and acceptance for future mainframe/mini sales.
  - Packages such as IFPS/Personal and PC Empire (refer to Exhibit IV-9) typically provide functionality very close to that available on the mainframe, but by their very nature do not have the easy-to-learn/use orientation inherent in spreadsheets.
  - Spreadsheet and integrated microcomputer software vendors recognize that users are becoming more proficient with their products and that there is an upper limit to the capabilities of spreadsheets in dealing with advanced DSS functional requirements and multidimensional or multi-source data.
  - PC software vendors are very aware of the potential of mainframe/mini vendors to attract these sophisticated and possibly frustrated users. To address this, spreadsheets/integrated packages are evolving into areas that rival the functionality of mainframe DSS counterparts:

- Increased data management capabilities.
- Additional functionality such as goal seeking, regression, and statistical analysis.
- New, intermediate level, micro-only packages such as Reflex and Javelin have also been introduced and targeted at the advanced DSS PC user.
- There is an emerging trend of third-party vendors offering DSS application templates or "baseline" systems built using popular software tools such as Lotus 1-2-3, Symphony, and Framework. These have been developed to take advantage of:
  - A preponderance of similar applications such as budgeting, statements, and forecasting.
  - The early users' attraction to DSS applications rather than unstructured tools.
- Two current vendors of these templates are Optionware and DSS Development.
- The increasing power and sophistication of DSS and DBMS software will continue to stimulate functional and industry-specific applications product versions, thus paralleling a trend evident in the mainframe/mini DSS environment.
- From a practical DSS user's standpoint, there is significantly more artificial intelligence related software available as compared to the mainframe and mini environments. These packages are typically not traditional general analysis and modeling-oriented software, but are closer to decision aid or expert systems.

- The micro-based artificial intelligence software suffers under the same set of evolutionary constraints as found on larger systems when thought of in terms of traditional DSS applications.
- Recent partnerings of PC-based DSS software vendors such as that announced between Lotus Development Corporation and McCormack & Dodge highlight a trend also worth watching. In an effort to be included in organizational DSS solutions, PC software vendors are being motivated to integrate directly to mainframe applications products rather than cooperating with their new, mainframe-rooted, DSS competitors.

#### E. DSS AND ARTIFICIAL INTELLIGENCE

- This section takes a closer look at artificial intelligence, its relation to and impact on decision support systems, and the outlook for practical implementations of AI technology in DSS.
- For the purposes of this report, we will limit the discussions to those applications which have the closest relationship to commercial applications of artificial intelligence technology. These fall into the categories of:
  - Natural language interfaces.
  - Expert or knowledge-based systems.
- Natural language interfaces usually have the capability to understand conversational English, to consistently respond to differently worded questions, and to resolve ambiguities in requests. They can serve as both front-ends to DBMS applications such as corporate data bases and an easily learned interface for ad hoc data retrieval requests.



- Expert or knowledge-based systems are computer-based systems which operate, typically without decision structure, to formulate conclusions based on learned rules. The current practical business implementations are primarily in narrowing defined expertise areas such as:
  - Problem diagnosis.
  - Scheduling and assignment.
  - Management decision aid.
  
- It is useful to compare traditional DSS systems with expert systems. Traditional decision support system characteristics are as follows:
  - User must draw own conclusion from DSS results.
  - Solution sought is usually specific.
  - Assumptions are usually mathematical.
  - System cannot "learn" from experience.
  
- Expert systems, on the other hand, display a different set of attributes.
  - System draws conclusions, interprets results.
  - The system starts with little knowledge, builds with later decisions.
  - Nature of solution sought may be unknown or very general.
  - Assumptions and data may be unstructured and incomplete.

- Natural language and knowledge-based systems both share similar broad objectives in their organizational use; that is, to make management more efficient and productive in decisionmaking. The outlook for these artificial intelligence tools to provide these gains is unclear, but some conclusions can be drawn.
  - One important conclusion is that natural language user interfaces may be the next step in the evolution of "friendly" DSS software, providing front-ends for DBMS languages and possibly assisting in defining assumptions and algorithms in modeling-oriented languages. Whether or not they reach a new target of managerial users rests in large part on the organizational effort made in marketing it to new users. A more in-depth discussion of this is found in supporting decision support systems.
- Several software companies have developed natural language query systems either separate from or in conjunction with DBMS products.
- One recent offering, Reveal, claims to have combined expert system technology with standard DSS tools by providing facilities for interpreting English-like subjective data and transforming it into broad policy guidelines and models.
- A listing of currently available natural language systems is included as Exhibit V-4.
- Use of artificial intelligence in strategic decisionmaking will experience a longer range evolution due to a combination of technological and organizational factors.
  - The kinds of support required for these types of decisions are beyond the proven core of AI technology.



EXHIBIT V-4

ARTIFICIAL INTELLIGENCE DECISION AND DSS PRODUCTS

PRODUCT	VENDOR	PRICE	ORIENTATION
Intellect	Artificial Intelligence Corp.	\$ 49,500- 69,500	Natural Language Query System
Easy Talk	Intellegent Business Systems	55,000- 150,000	Accounting Oriented Natural Language Query System
Themis	Frey Associates	24,000	Natural Language Query System
Sales Edge, Management Edge	Human Edge Software	250	Decision and Management Analysis
Clout	Microrim	195	Natural Language Query System

EXHIBIT V-4 (Cont.)

ARTIFICIAL INTELLIGENCE DECISION AND DSS PRODUCTS

PRODUCT	VENDOR	PRICE	ORIENTATION
OZ	Fox and Geller	\$ 495	Management Control
Reveal	Infotym	25,000- 50,000	DSS Tools, Modeling, Re- porting, Analysis, Natural Language Model Building
Light Year	Light Year Inc.	495	Management Decision Aid
Trigger	Alamo Learning Systems	250	Decision Control and Monitor
HAL	GNP Development Corp.	Not Yet Determined	Natural Language Lotus 1-2-3 Interface

- Computer processing power requirements are relatively high.
- There is a high degree of reliance on high volume, variable, and sometimes unrelated data.
- Resource requirements to develop these systems to aid in specific decisions may outweigh their value.

## F. SUPPORTING DECISION SUPPORT SYSTEMS

- With the rapid advances in the ability and complexity of tools and the changes in how the organization views DSS, it is helpful to examine what mechanisms will be needed to support decision support systems in the coming years.
- Two primary topics will be discussed. The first is the traditional IS role in DSS and how that must change for DSS to experience its next stage of growth. The second is the information center and its potential impact on the user and decisionmaking.
- In the evolution of DSS, traditional information services (IS) during the 1970s and early 1980s began to focus on:
  - Large-scale projects.
  - Operational and transactional systems.
  - Systems that improved productivity of front-line workers.
  - The IS role of data and computer resource "custodian."

- As DSS users gained confidence and independence, they viewed IS as unresponsive and insensitive to end-user needs, which led to an even wider polarization.
- Several forces are now acting to modify the IS role in support of decision support systems.
  - DSS's increased appetite for corporation data.
  - Training needs brought on by complex new DSS tools.
  - Need for applications which are systematically defined and structurally consistent.
  - User's need for an "advisor" to deal with changing technology and confusing alternatives.
- The evolving role of information services ideally will be that of a partner and promoter of DSS tools and applications. IS has the potential to serve many areas by this new role, including:
  - Providing consulting services and recommending DSS products and services.
  - Setting of standards for products, data, and underlying systems architecture to ease the data sharing barriers.
  - Playing a lead role in building knowledge-based and expert systems.
  - Taking an active role of marketing tools and applications throughout the organization. This will tend to strengthen management commitment to DSS, encourage new manager/users, and give IS improved visibility within the organization.

- Providing organizational tools and concepts such as information centers as a decision resource.
- Training and end user support of more complex applications.
- There are also forces which will continue to work to the disadvantage of this partnership.
  - Continuing IS backlog and workload.
  - Past distrust and mistrust on both sides.
  - Reluctance of end users to part with any measure of independence.
- The information center (IC) has the potential to provide the manager or "knowledge worker" with resources and tools to make decisions more effectively and productively. It serves as a facilitator for communicating to DSS users what the organization knows about its own business information.
- The information center concept has grown because by their very nature DSS systems are not well defined and do not lend themselves to the traditional IS applications development process. The IC can be thought of as a mechanism that provides:
  - A directory of information resources and data about an organizational business.
  - DSS tools to manipulate this data and provide support.
- The information directory can provide the manager/user with a wide variety of company-oriented resources.
  - Business subjects.

- Business and organizational processes.
  - Sources for detail data.
  - Data elements and technical terminology.
  - Assistance in accessing data.
- A DSS tools directory can provide a listing of DSS tools and applications and assistance in selecting the proper alternative for use in analysis.
  - Information centers offer the advantage of giving users a common view of the business and more efficient methods of acquiring and manipulating this data.

**VI DSS VENDOR ANALYSIS**





## VI DSS VENDOR ANALYSIS

- This section is intended to give the user a better understanding of the DSS software market and the various companies offering products.
- This information can then be combined with the characteristics of the user's environment to determine which vendors and products match.

### A. NATURE OF THE MARKETPLACE

- The market for DSS software, as previously mentioned, can be categorized into three general areas. Vendors of these products tend to follow these categories as well.
  - Modeling languages.
  - DBMS-oriented products.
  - Spreadsheets and integrated packages.
- Traditionally, the leading vendors have been from dedicated vendors, such as Execucom, EPS, Lloyd Bush & Associates, and Management Decision Systems.

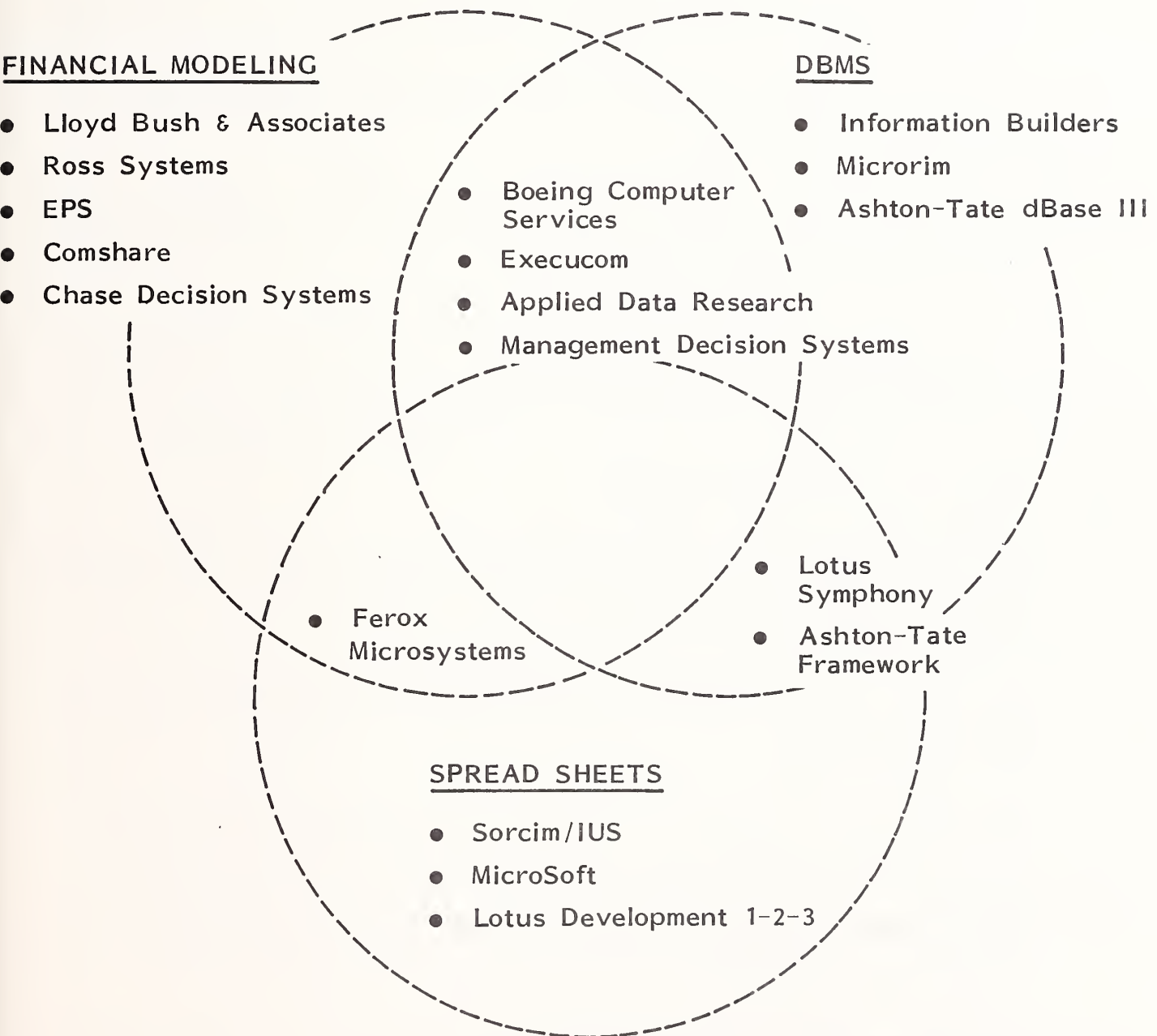
- Many of the recently active DSS vendors are firms with products in other segments. Examples include Comshare, Applied Data Research, Boeing Computer Services, Chase Decision Systems, and Management Science of America. This is a result of traditional DBMS vendors repositioning their products as DSS and applications vendors such as MSA developing closely coupled DSS as an integrated portion of their offering.
- As the product trends described in Section V continue, there will be more merging of these categories.
- Although there is currently little overlap between spreadsheet and the financial modeling-oriented firms, user demands for common solutions which include mainframes, minicomputers, and microcomputers will force movement by both groups to develop interfaces and products, thereby gaining position on each other's "home ground."
- Because the very definition of decision support continues to defy both vendors and users alike, it is impossible to exactly categorize vendors and their associated products. However, Exhibit VI-1 shows a rough estimation of leading vendors' orientation with respect to the three categories mentioned above.

## B. VENDOR PROFILES

- The following sections profile representative vendors of DSS software and services.
- I. EXECUCOM
- Founded in 1975, Execucom ranks number one in product sales of financial modeling-oriented planning and analysis systems on mainframe processors.

EXHIBIT VI-1

DSS VENDOR ORIENTATION



- Sales for 1985 are approximately \$22 million.
- Execucom was acquired in 1984 by Continental Telephone, the nation's third largest telephone company.
- Execucom's IFPS product has achieved ICP's \$100 million lifetime sales award.
- Execucom is introducing versions of IFPS that address both functional and industry-specific applications.
- Its strategies include addressing a wide hardware mix as well as encompassing organizational DSS with a variety of tools.
- Execucom's strengths lie in its large installed user base (1,400 installments in over 750 organizations) and the financial strength of its parent.

## 2. APPLIED DATA RESEARCH (ADR)

- ADR is one of the oldest and largest systems software vendors in the nation with total revenues of \$128 million.
- The primary source of ADR's product revenue is from an IBM mainframe DBMS, Datacom/DB.
- ADR's DSS product, Empire, accounts for approximately \$5 million annually.
- ADR has begun packaging Empire with some of its other systems products to stimulate sales.
- ADR's strengths are in the robustness of its Empire product, its diversified product line, and the installed base of its DBMS and systems software.

- Management expects significant growth opportunities as open architecture comes of age and it takes advantage of its DBMS strength in DSS.

### 3. MANAGEMENT DECISION SYSTEMS (MDS)

- MDS was founded in 1967 primarily as a management consulting firm.
- MDS was acquired by Information Resources, Inc., a management information company.
- Express is MDS's primary product and is a financial modeling-oriented language.
- Express is installed in over 300 locations.
- Express Mate and Express Link are MDS's PC offering and micro-mainframe link software, respectively.
- MDS will combine its expertise in modeling and analysis with IRI's marketing data capability to target sales and marketing DSS applications.
- MDS announced in 1983 an agreement with Lotus Development Corporation to integrate Lotus 1-2-3 into Express.

### 4. COMSHARE

- Founded in 1966, Comshare was one of the first companies to offer commercial timesharing services. Processing services is still a major part of its total business, with 1984 revenues in the \$76 million range.
- Comshare is a relative newcomer to the decision support systems software products business, although most of its processing services revenue is derived from its DSS-oriented applications.



- Over the past five years Comshare has reportedly invested over \$26 million in research and development of new products, and it plans to spend over \$15 million on developing and marketing of DSS product in the next few years.
- Comshare entered into a complimentary marketing agreement with IBM in 1984. This allows IBM and Comshare to make joint sales calls and places Comshare's DSS product, System W, in IBM information centers across the country.
- A primary Comshare strategy involves migrating computing services companies in-house by providing DSS products on a wide hardware mix, internal support training, and implementation consulting services.

#### 5. LLOYD BUSCH & ASSOCIATES

- Lloyd Busch & Associates was founded in 1971 as a consulting services firm specializing in software and services primarily for the financial community.
- Its main DSS product, Model, is a financial modeling-oriented language with features that have made it appropriate for commercial and investment banking applications.
- Lloyd Busch and Associates has entered into marketing relationships with hardware vendors such as Prime in order to stimulate sales.

#### 6. LOTUS DEVELOPMENT CORPORATION

- Lotus was founded in 1981, and its initial product, Lotus 1-2-3, has an installed base of over one million units.
- Lotus is the second largest independent software products company (Cullinet is number one).



- An agreement has been made with McCormack & Dodge, a leading mainframe accounting software maker, for interfacing Lotus 1-2-3 with its financial packages.
- Lotus plans to acquire GNP Development Corporation, a maker of a natural language interface for Lotus 1-2-3.
- Symphony, Lotus' more fully featured and expanded version of 1-2-3, was introduced in 1984 and has sold over 200,000 copies to date.
- Although sales continue to rise rapidly, overall financial performance has not kept pace with the past due to poorer than expected sales of Symphony, Jazz (for Apple MacIntosh), and Signal, an innovative securities analysis program.

## 7. INFORMATION BUILDERS

- Information Builders was formed in 1975 and markets Focus, a nonprocedural report preparation, data analysis, and comprehensive data management system.
- Focus has been installed in over 700 computer sites worldwide and has been offered over the Tymshare Tymnet network in the U.S. and overseas.
- Information Builders also offers PC/Focus, a minicomputer version of Focus.
- An interface between Focus and Execucom's IFPS (Interactive Financial Planning System) is currently being offered.

## 8. EPS, INC.

- EPS is one of the top two or three software vendors providing mainframe financial modeling-oriented DSS tools.

- EPS's primary product, FCS-EPS, is reported to be installed in over 700 corporations worldwide.
- EPS is currently emphasizing its distributed processing capabilities provided by Micro FCS, introduced in 1983.
- Leading EPS strengths are considered to be:
  - Marketing--both domestic and international.
  - Products somewhat more powerful than its competition.
  - Full screen product capabilities.
  - Wide-range of compatible hardware.
- Potential weaknesses include:
  - Products require large amounts of core memory.
  - Older technology.
  - Programmer rather than user orientation.

## 9. BOEING COMPUTER SERVICES (BCS)

- BCS was formed as a wholly-owned subsidiary of the Boeing Company in 1970. In 1978, BCS became a division of Boeing.
- EIS (Executive Information Service) is an interactive planning, modeling, analysis, and reporting language.

- Software product sales contribute approximately 10% of BCS's external revenues. EIS, along with several other commercial software products, contributes to that revenue.
- Total revenues for 1984 were reported to be approximately \$300 million (which included a significant proportion of internally billed or captive revenue).
- BCS is making a focused effort to enter the office information systems market by offering a local office network, TOP (Technical Office Protocol), that it hopes will evolve into a standard for office applications. EIS will be available under this office network.

#### 10. SAS INSTITUTE INC.

- SAS Institute Inc. was incorporated in 1976 to further develop and promote its base product, SAS (Statistical Analysis System), a package which originated at North Carolina State University.
- SAS Institute now markets a series of software products in addition to, and based on, SAS.
- Packaged software accounts for over 80% of SAS's revenues.
- SAS is considered to be a programming language that can be tailored for use in a number of applications, including decision support.
- SAS products are available on remote computing networks such as BCS, GEISCO, Informatics, Martin Marietta Data Systems, and McAUTO.

- Other DSS related products from SAS include:
  - SAS/GRAPH--a color graphics package.
  - SAS/ETS--a forecasting, planning, and financial tool.
  - SAS/OR--a product management tool.

## VII CONCLUSIONS AND RECOMMENDATIONS



## VII CONCLUSIONS AND RECOMMENDATIONS

### A. MATCH PROPER DSS TOOL TO PROBLEM

- With the continual onslaught of technology and the seemingly unending stream of new DSS software products and services, the user continually risks acquiring and applying the wrong tool to solve DSS problems. This risk increases as organizations move toward more of an organizational view of DSS and often buy tools and technology first and decide what to do with them later.
- Several areas need careful consideration before committing to major DSS expenditures.
- Assess organizational decision support objectives. Are business goals, objectives, and strategies being set and committed to at a level of management that can benefit from decision support systems? Is planning and analysis an integral part of the organization's "corporate culture"?
- Determine if the organization is at a stage of DSS maturity that can handle and productively apply tools. The following require evaluation:
  - Potential training and support requirements from IS.
  - The availability of data necessary to fully utilize tools.



- Level of technical expertise available to implement ambitious DSS solutions.
- IS must play a certain role in providing advice when choosing decision support products and services.
  - The increasing complexity of the products leaves users in a technological gap.
  - The data acquisition issues will quickly overwhelm unwary, inexperienced DSS planners.
  - Organizational DSS will require experience in traditional systems planning, integration, and implementation.
- DSS planners need to look beyond generic tools as vendors move toward offering closely integrated products and specific applications.
  - "Tailored" or integrated tools can shorten DSS implementation at a lower cost.
  - Specific industry or functional application tools can provide a semblance of expertise possibly not found within the organization.
  - Decision support integrated with applications such as accounting, transactional, or operational systems can drastically reduce the data sharing complexities.

## B. I.S. NEEDS TO CHANGE ITS TRADITIONAL ROLE

- The traditional role of information services (IS) as a DSS onlooker or keeper of computing resources must change if decision support systems are to provide widespread productivity gains at the middle and upper management levels.
- IS should modify its focus to that of a consultant and promoter of DSS throughout an organization. This role should include a broad range of activities which reinforce this partnership.
  - Participation in the process of organizational goal setting, planning, and measurement of results.
  - Involvement in planning and acquiring DSS products and services.
  - Providing insight from experience in data and systems integration.
  - Playing a new role as internal promoter of DSS tools and applications.
  - Providing support and training.
- IS should also consider the potential value of implementing an information center, evaluating it in relation to the maturity level of the organization and the commitment of management.
- IS must pay particular attention to technological advancements, especially in areas where end users do not have sufficient capabilities to make knowledgeable evaluations. Artificial intelligence, micro-mainframe links, and new, unique DSS applications are to be promoted heavily by vendors. IS must be willing to guide selections around promotion and "hype."

- DSS vendor developments in the area of "strategic partnering" need to be monitored closely. Software makers are increasingly developing relationships that integrate applications with DSS as well as provide industry or functional "templates." Potential resource gains and lower implementation risk are the payoffs.
- Achieving these objectives and realizing this new role will be present challenges during the coming years, as current views project continuing backlogs which will work against IS assuming new duties.

### C. BE PREPARED FOR ORGANIZATIONAL DECISION SUPPORT

- As users, tools, and DSS techniques mature and become more sophisticated, companies must be increasingly prepared to embrace an integrated, organizational decision support approach in order to realize promised decision productivity and quality gains.
- "Organizational" means more than linking spreadsheets or integrating software.
- Recognition of decision support systems as a key part of the management function is an important characteristic of organizational DSS.
- Individual DSS users must share the same common view of the business and its knowledge base so that managers can focus productivity on coordinated decisions consistent with business objectives. To accomplish this requires:
  - Well-planned core operational and transactional systems to provide sound, useful data and an easy access route.
  - Well-planned and implemented DSS.

- A recognition that personal DSS applications are heavily reliant on corporate data.

DSS applications designed within organizational boundaries and oriented to end-user requirements for ongoing use.

- Management policies that encourage decision support systems and their use in decisionmaking.

#### D. SUPPORT FOR STRATEGIC DECISIONMAKING EVOLVING SLOWLY

- The outlook for practical support systems for perhaps the most critical level of decisions, strategic, is that they will evolve gradually rather than explode.
- Although artificial intelligence, knowledge-based, and expert systems technology is advancing rapidly, its practical application to strategic decisionmaking faces several key barriers.
  - The technology and tools for building effective expert systems are embryonic.
  - The data required for such systems is highly unrelated, coming from a wide variety of sources.
  - Strategic and upper level decisionmaking is not yet well enough understood to build reliable rules.
  - The computer resources required are high.

- In addition to the technical forces influencing strategic decision support systems, there is uncertainty as to whether the strategic decisionmaker will adopt these tools.
  - Although much is heard of stories of a president of an organization with a PC on his desk, this level of management has traditionally resisted the direct use of computers.
  - Strategic decision support systems must rapidly build a high confidence factor if executives are to rely on them for critical decisions.
  - These systems will require much of an executive's time during implementation to "learn" about an organization, decision criteria and patterns, and complex judgements. The payback may not be readily apparent.
  
- Finally, vendors are only cautiously reacting to the potential of strategic decision support.
  - They are largely talking about AI in terms of natural language interfaces and narrowly focused expert systems which, in fact, may make existing support systems "friendler" and easier to use.
  - Vendors are concentrating on less risky exploitation of traditional operational and tactical decision support systems where they have large investments and significant expertise.

**APPENDIX A: DEFINITION OF TERMS**





## APPENDIX A: DEFINITION OF TERMS

- ARTIFICIAL INTELLIGENCE - Multidisciplinary attempts to simulate intellectual activity using computers. Still in its infancy, AI includes the use of robots, expert- and knowledge-based systems, natural language query systems, expert-system generators, and the like.
- DATA BASE MANAGEMENT SYSTEM - A generalized computer program that handles the mechanics of storing, updating, and accessing data for multiple applications. This definition does not include file management systems that are designed primarily for single applications.
- DECISION SUPPORT SYSTEMS - Computer-based programs used for the collection, synthesis, analysis, and reporting of information in such a way that more informed decisions are rendered by the decisionmaker more efficiently. The system is usually comprised of an inquiry or language facility, a knowledge or data base, and a problem processor.
- EXPERT SYSTEMS - Computer-based programs that make original judgements based on general facts about a situation, typically requiring intensive interactions with an expert knowledgeable in a given field. Can handle problems with no algorithmic solution.
- FINANCIAL MANAGEMENT AND PLANNING SYSTEM - Software package used to model all or part of a company's financial planning. This system is used to create end-user solutions to financial planning problems, either

directly or through the generation of end-user computer programs that, in turn, are executed to forecast the desired financial or planning data.

- FOURTH-GENERATION LANGUAGE (FGL) - A software tool, used for coding computer instructions, that is nonprocedural (i.e., focuses on the result, rather than the process of obtaining the result). Unlike its closest programming language predecessor, COBOL, FGL is Englishlike, nontechnical, flexible, and easy to start to use and has numerous built-in functions.
- GOAL SEEKING - Ability to set a specific target or goal and view the net effect on other equation variables.
- KNOWLEDGE-BASED SYSTEM - See Expert Systems.
- NATURAL LANGUAGE QUERY SYSTEMS - Possess abilities to understand conversational English, respond to similar questions worded in a variety of ways, resolve request ambiguities, and function without regard to data structure formats.

**APPENDIX B: RELATED INPUT REPORTS**



## APPENDIX B: RELATED INPUT REPORTS

- End-User Micro Mainframe Needs, 1984.
  - Describes experiences of organizations that use micro-mainframe linkages and systems. This report also identifies systems requirements and projects future effects of the micro-mainframe phenomenon.
  
- Decision Support Systems and Beyond, 1984.
  - Describes and examines the rapidly changing field of DSS from a corporate perspective over the next five years.
  
- Integrating Systems and Corporate Planning, 1984.
  - Describes approaches for producing an integrated information systems and corporate business plan and achieving full benefits from information technology.







# About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs.

Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 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 in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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