Micro-Mainframe End-User Experiences

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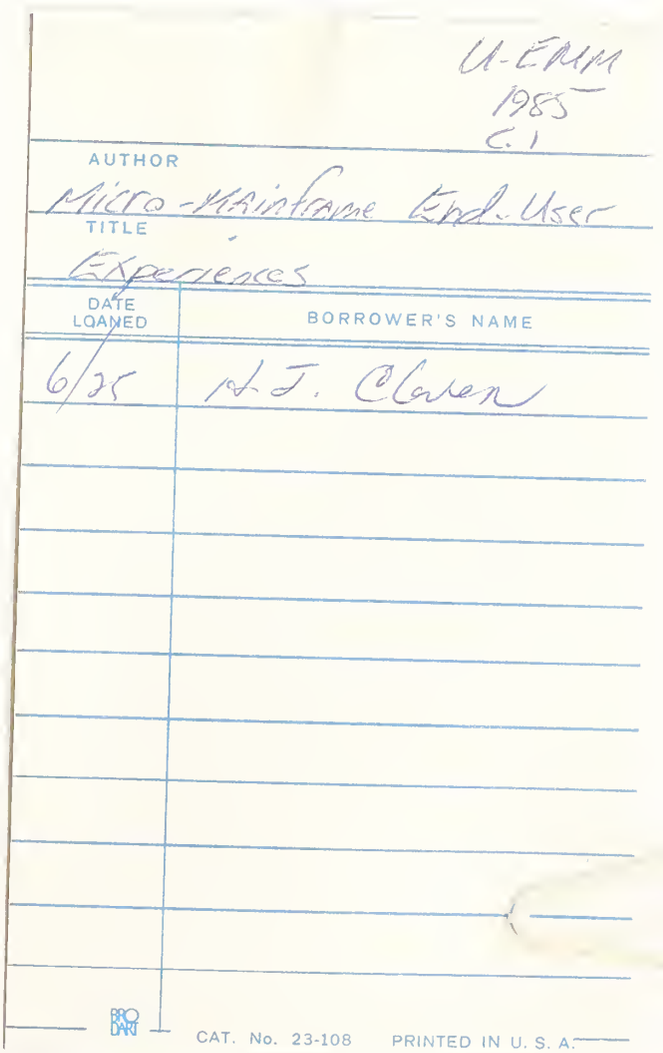
MICRO-MAINFRAME
END-USER EXPERIENCES



MICRO-MAINFRAME END-USER EXPERIENCES

CONTENTS

EXHIBITS

I INTRODUCTION

A. BACKGROUND

- The micro-mainframe (M-M) issue consistently scores high in INPUT's client polls. In 1985, interest continued to climb, assisted by a barrage of vendor announcements which have made it difficult to identify and understand key issues, and difficult to determine which, if any, micro-mainframe path to take.

- The growing proliferation of corporate-based microcomputers is fueling end-user demand for access to large company computers, and there is growing appreciation of the productivity made possible by this connection. However recognition and understanding of the potential problems these linkages can cause is only beginning.

- INPUT believes M-M is the first logical step in distributing mainframe information to end users and as such, becomes more than a question of, for example, terminal emulation or screen versus file transfer.

  - The additional issues emerging involve ease-of-use, security, and maintaining central data base concurrency.

  - Also, timing issues need to be addressed: should M-M be implemented now, or should IS wait for new products?

- This study generally assumes that the micro-mainframe world is an IBM or IBM-compatible world.

  - INPUT acknowledges that the assumption remains somewhat debatable; Apple's plans to place Macintoshs in corporate America, AT&T's continuing computer efforts and other vendor participation may provide a basis for corporate M-M strategies. However, two key points need to be made:

    . IBM's current interconnect strategy provides an underlying environment for Information Systems (IS), end users and vendors.

    . Equally important are the views held by IS. IS management expects the non-IBM-compatible share of corporate micros to be very low compared to IBM and compatibles, as shown in Exhibit I-1.

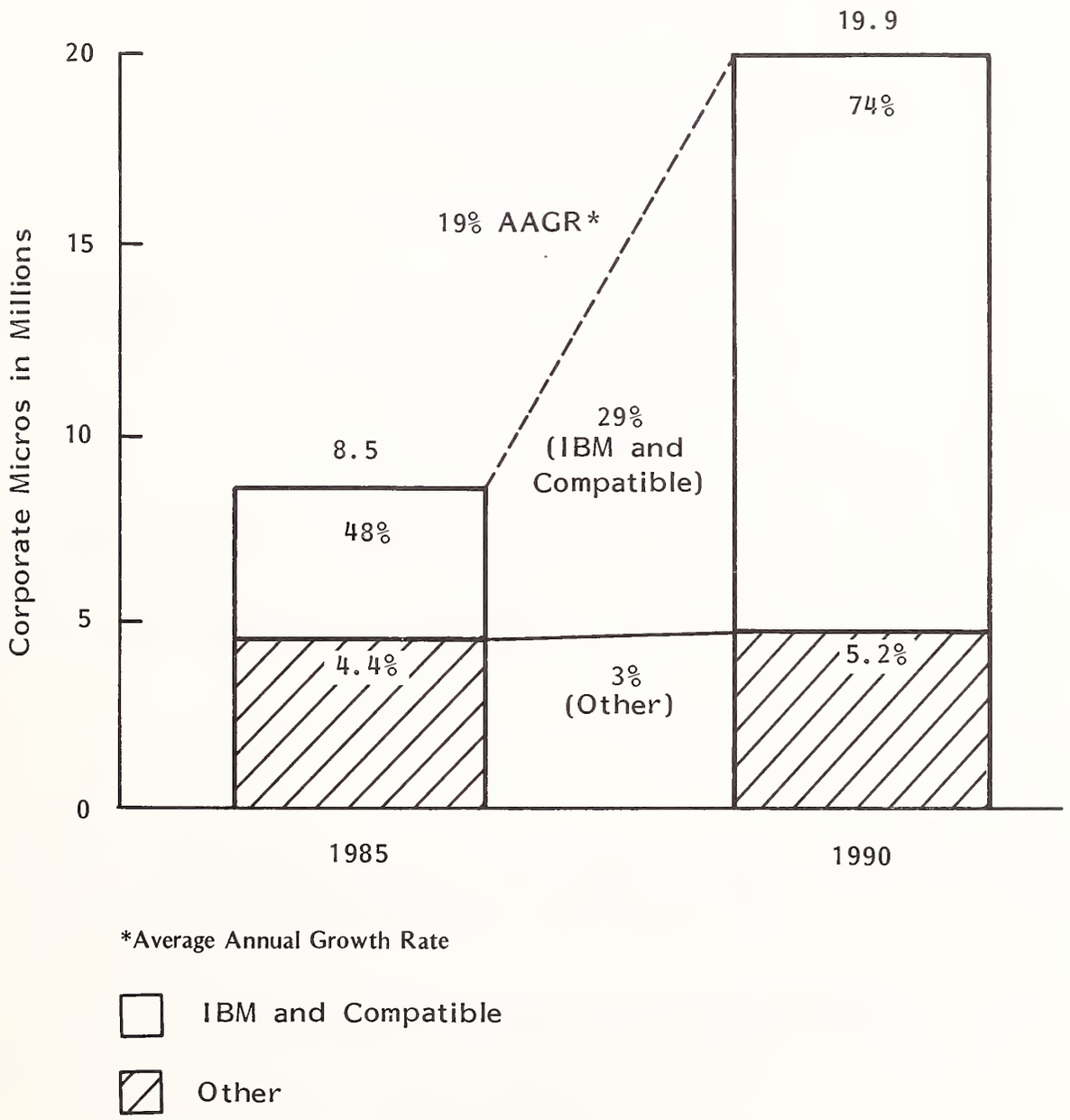
  - This does not mean there is no place for innovative micro hardware in Fortune 1000 corporations, but from the M-M standpoint, such devices must generally be transparent to IBM networks for easy use and acceptance.

B. METHODOLOGY

- The report research was conducted in parallel with that for four other related reports (see section D below). The research consisted of:

EXHIBIT I-1

CORPORATE MICRO GROWTH, 1985-1990



*Average Annual Growth Rate

IBM and Compatible

Other

- Client interviews.

  . INPUT sampled clients to determine areas of special interest and to learn of their experiences, problems, and needs.

- Corporate interviews.

  . Approximately 130 structured interviews were conducted with IS managers at large corporations in March 1985.

    - The questionnaire used is in Appendix A.

    - Appendix C shows company sizes and industries.

  . In addition, INPUT had the opportunity to review 20 companies in depth, with some of their experiences described in the report while other information was used to form our analysis and recommendations.

  . In the past two years, INPUT has conducted a number of consulting studies bearing on M-M issues. While no proprietary information is revealed, the knowledge gained is represented here.

- Vendor interviews.

  . Structured interviews were conducted with vendor personnel from 25 companies. The questionnaire used is in Appendix B.

- Product and service analysis.

  . INPUT collected and analyzed information on over a hundred M-M products and services.

- Of course, the continuing change represented by new products means that this report risks obsolescence upon publication. Some announced products may never be brought to market. Product introductions will continue, with offerings expected from LAN vendors and various software companies.

- Vendors are even promoting modems and communications software as M-M products, causing further confusion over just what micro-mainframe really is.

- Nevertheless, the issues discussed here remain valid despite the dynamic forces at work in the industry.

C. SCOPE

- This report is one of a series of continuing studies analyzing micro-mainframe, designed to help the understanding of end-user's needs and of the issues which can arise as M-M is approached and implemented.

- It addresses the following topics:

  - End-User experiences with micro-mainframe implementation (Chapter III).

  - The types of M-M linkages, end-user planning, knowledge levels and other micro-mainframe issues (Chapter IV).

  - The functions which remain to be addressed by vendors, market trends, IBM's directions, cost/benefit analysis and anticipated technological developments. (Chapter V).

- Implementation recommendations for building relationships between IS, end users and corporate management to generate a fuller understanding of the issues, capabilities and limitations of M-M applications (Chapter VI).

D. RELATED REPORTS

- Interested readers are referred to the following INPUT reports:

  - Micro-Mainframe Connectivity (1985) analyzes various microcomputer communications methods, their advantages and limitations, and projects changes in these modes as they relate to micro-mainframe.

  - Micro-Mainframe: Software (1985) categorizes the massive number of M-M software products necessary to accommodate M-M access, with special attention to security and data integrity requirements. The report recommends a software development/acquisition strategy.

  - Micro-Mainframe: Corporate Impact (1985) describes the organizational and technological effects of M-M in the corporation, in light of the growing demand for end-user access to corporate data bases. The impact of M-M products on the current inventory of standalone micro and mainframe software is also analyzed.

  - Micro-Mainframe Market Analysis (1985) segments the market, provides projections for terminal emulation and intelligent packages, and analyzes issues, events and trends in the marketplace.

- These reports update a similar series published by INPUT in 1984. Other relevant studies are:

  - Destiny of the Information Center (IC) (1985) examines the impact of the microcomputer and end-user computing on the future of the IC.

  - Integrating Voice and Data Communications (1985) analyzes changing telecommunications technologies, integration benefits and costs, and the evolution of LAN, CBX and other devices. It also provides guidelines to what makes data-only networks most appropriate.

  - LAN/CBX Trends: Decision Processes for Users (1984) describes current and future product trends and presents a planning process for managers to ensure successful implementation of a strategy meeting corporate needs.

  - LAN/CBX: Planning for Change (1985) reports current experiences with these data and data/voice communications technologies and looks at the future of office-oriented communications devices.

  - Office Videotex (1985) examines corporate, in-house applications for this user-friendly technology which has thus far failed to make an impact as a new consumer-oriented media.

II EXECUTIVE SUMMARY

- This executive summary is designed in presentation format to help the reader quickly review key research findings and recommendations. 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-5. On the left-hand page facing each exhibit is a script explaining that exhibit's contents.

A. CONFLICTING VIEWS ON MICRO-MAINFRAME LINKAGE

- End-user demands for mainframe access are driving the movement to M-M, which stems directly from the growth of corporate microcomputing.

- While uneducated views may suggest that micros and mainframes should easily communicate, Information Systems (IS) managers and vendors are just beginning to address the complex issues involved. New products are starting to attain the advanced capabilities seen as needed now and in the future.

- History is repeating itself. End users see the microcomputer-mainframe link as a breakthrough allowing them to take charge of many data processing needs and allowing them access to critical information which otherwise would require intermediaries who are often bogged down in backlogs. These views were also held when the first micros appeared on the corporate scene.

- End users also want to expand the utility of M-M links from purely analytical work, to include the ability to upload revised data to the mainframe.

- As with micros, IS is working to control M-M linkages because of the importance of maintaining undisrupted operations, and because of security concerns and data currency needs:

  - Having more users increases security risks.

  - Central data base integrity needs to be maintained.

  - Multiple data bases need to be synchronized.

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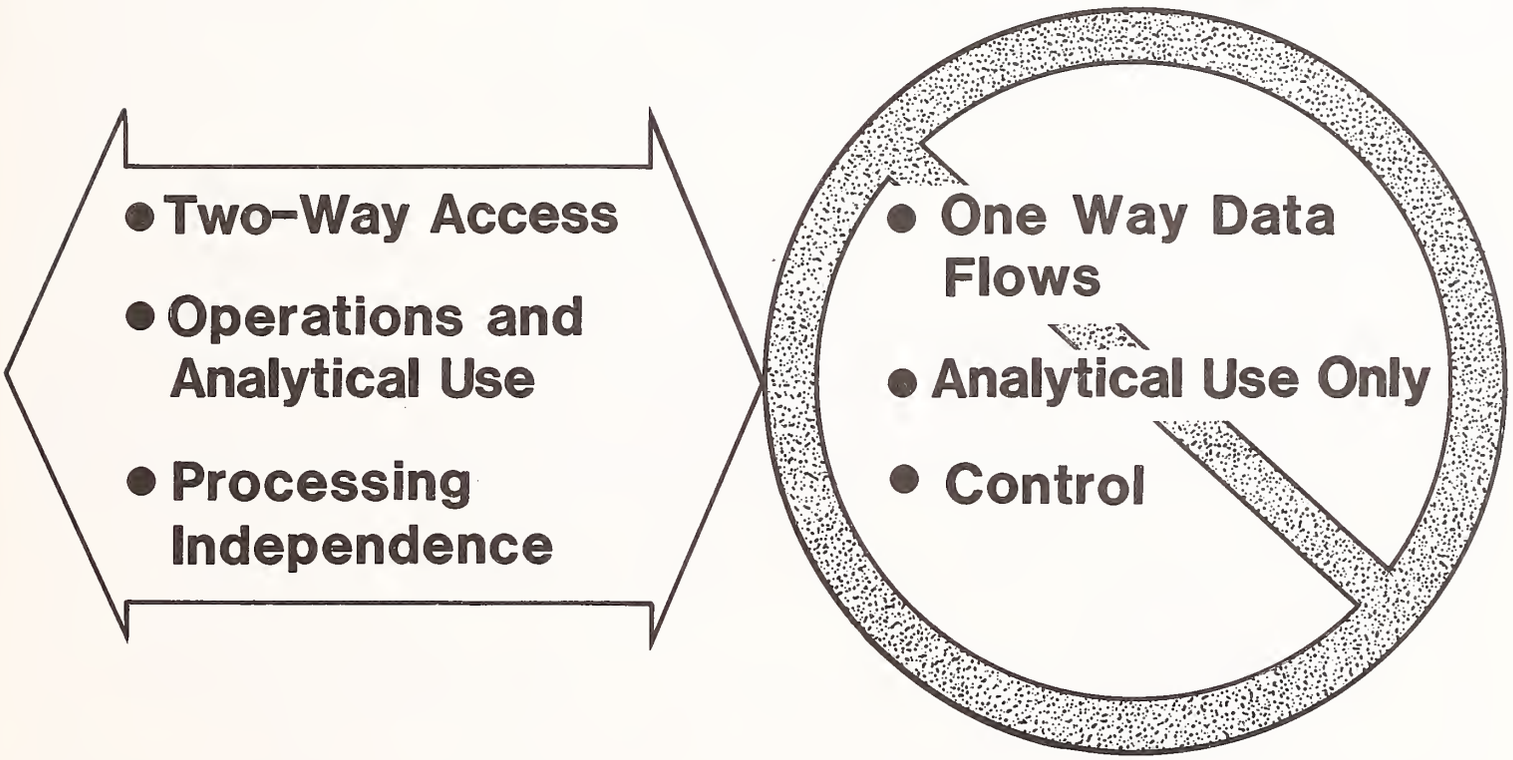
CONFLICTING VIEWS OF MICRO-MAINFRAME



B. MICRO-MAINFRAME CAPABILITIES IN TRANSITION

- Micro-to-mainframe technologies are in a period of transition between simple terminal emulation and evolving intelligent links offering sophisticated, customized capabilities to both end users and IS.

- The ideal universal solution gives end users the power to easily locate, format, convert, and manipulate mainframe data stored on any machine to any of the increasingly capable and available microcomputers. This ideal remains several years from full actualization. In the interim, demands for micro-mainframe continue to be heard, and available products may adequately serve current needs.

- Micro-mainframe is also poised between the response to end-user demands for improved personal productivity and management recognition that M-M can be an important tool used company-wide to meet information management needs.

- However, IS is also concerned about a number of issues which need to be considered and addressed, including decentralization, security, training needs and building better relationships between IS and end users.

- IS needs to address these issues in its implementation planning to avoid potential problems and achieve the productivity benefits M-M makes possible.

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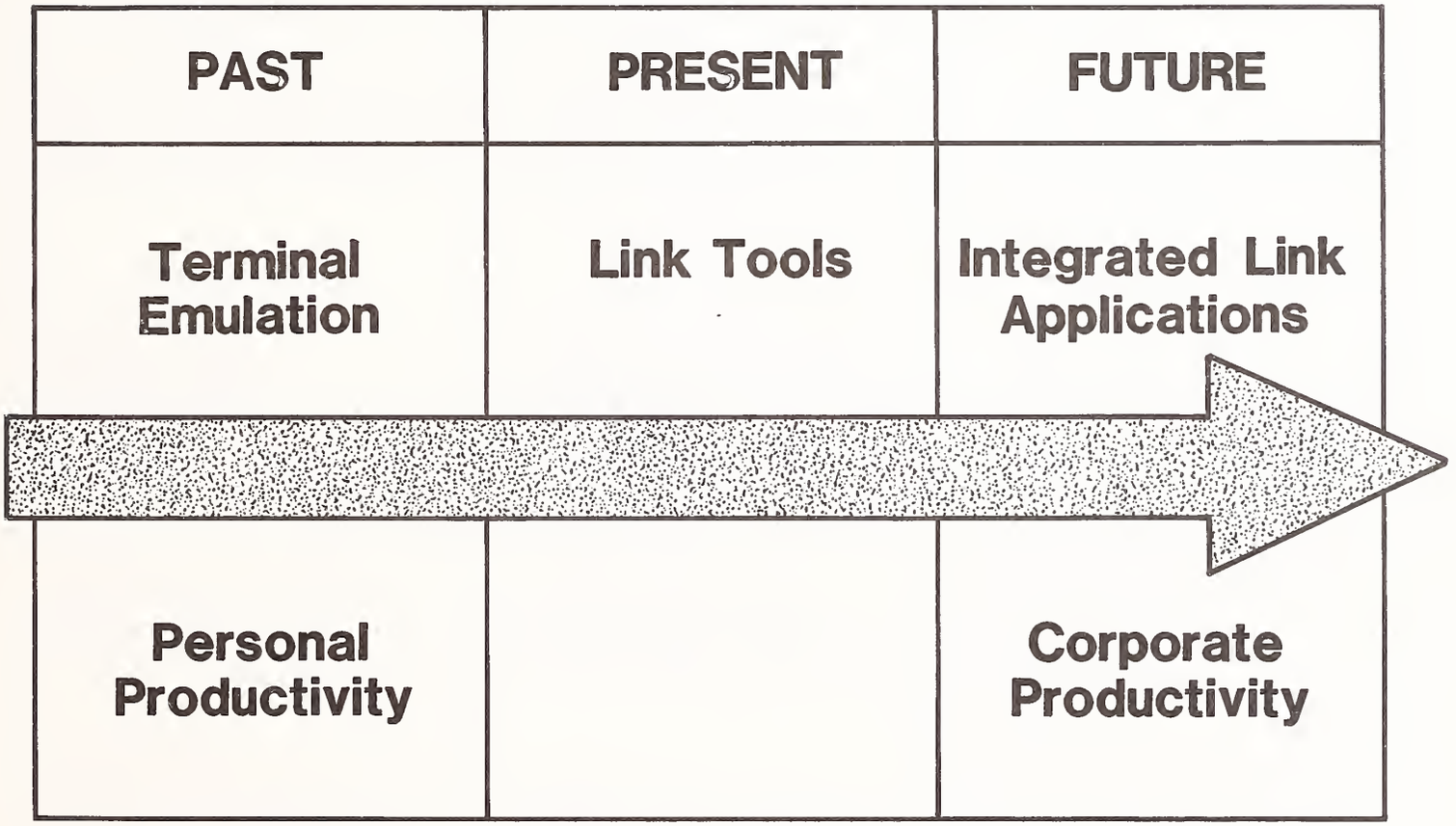
MICRO-MAINFRAME CAPABILITIES IN TRANSITION



C. MICRO-MAINFRAME DANGERS

- Solutions fully meeting user needs have not yet matured to the point where IS can guarantee success. IS needs to inform users of current technological limits to prevent being seen as attempting to maintain its authority and control over corporate computing.

- Security becomes a more critical issue when increasing numbers of end users can not only access corporate files, but can upload new data to those files. M-M applications magnify the risks of erronous information and the problems of data synchronization. IS must establish security and control procedures for M-M, similar to those used at other computing levels.

- Microcomputers are noted for their flexibility, but by connecting to hosts, they often must give up some of that flexibility; successful M-M implementation should minimize micro functionality loss.

- With no coordination, there is no control. This can lead to disastrous problems and difficult interpersonal relationships when end users and IS have different priorities, or have not learned to understand each other and work together. IS needs to build good relationships with end users to avoid these problems.

- Because micro-mainframe is still evolving, there is the danger that currently available methods will become obsolete. New technologies also cause uncertainty and meanwhile, the pressures to implement continue to mount, and the needs are current. IS must develop forecasting skills to help cut the number of rapidly outdated solutions.

MICRO-MAINFRAME DANGERS

DANGER	CAUSE	REMEDY
No Guarantees, Obsolescence	Technology Still Evolving	Inform Users of Current Limits. Develop Fore casting Skills
Lack of Security	More Users: Risk of Errors, Data Synchron-ization Needs.	Establish Secur-ity Policies for All Computing
Loss of Micro Flexibility	Mainframe Connection	Balance M-M and Micro-Specific Use
User versus IS Control	No Coordination	Build Good Relationships

D. ACTIONS TO BE TAKEN

- IS must resist the tendency to become inactive while waiting for new and better technologies. Productivity can be improved now, and IS can learn about user needs in the interim.

- M-M justification can often rest on intuitive, qualitative factors such as the value of timely information, improved analysis and better decision support. If required, quantitative cost/benefit justification can be based on prototype systems, or the experience of similar user organizations.

- M-M cost analysis is approximately based on projected individual end-user expense rather than the entire implementation budget. This cost is easier to understand, allows analysis based on the value of each worker's effort, and provides a basis for charging costs to end users.

- Since M-M is usually carried out in response to user demands, the user community shares justification responsibility and implementation risks. IS needs to inform users of these risks and work with management on setting up security controls.

- Putting M-M in place at the right time requires finding the balance point where M-M solves more problems than it creates. Premature implementation with inadequate tools for the job is a risk, but IS must take risks, working to identify the appropriate time for action.

ACTIONS TO BE TAKEN

RISK	ACTION	PAYOFF
Inaction	Pilot Projects	Identify Potential Productivity Gains
High Cost	Justify Costs on per User Basis	Provides Basis for Charging Costs to End-Users
Justification	Leverage Pilot Productivity Gains	Avoids Costly, Difficult Quantitative Justification. Users Share Justification Responsibility
IS Solely Responsible	Share Risks with Users and Management	Better Work Relationships, More Coordination and Better Controls

E. ANTICIPATE CHANGE

- Users should be informed on IS technology and issues, and a general confidence building strategy is needed. This includes educational programs on M-M capabilities and limits, and expansion of the IS Microcomputer Support Group.

- IS should initiate low-risk micro-mainframe projects as a learning tool, and proceed on fuller implementation in carefully planned stages.

- IS needs to understand corporate and departmental goals, motives, and problems and recognize that the current response to end-user M-M demands is reactive. Managing corporate information requires corporate planning.

- IS should also anticipate developments impacting company information processes.

- M-M initiatives may accelerate IS decentralization. If unplanned, this can harm organizational effectiveness. Decentralization issues should be forthrightly addressed rather than consciously or unconsciously obstructed.

- Because of technical implementation difficulty, IS should join with vendors to find solutions.

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ANTICIPATE CHANGE

- Build Better User-IS Relationships
- Recognize Need for Corporate Information Management Planning
- Plan Low-Risk Initiatives
- Anticipate Technical Developments
- Plan for Decentralization
- Experiment with Vendors

III END-USER CONTINUING DIRECTIONS

A. INTRODUCTION

- Much attention has been focused on downloading data for spreadsheets and other microcomputer applications. Dozens of such products have been released and many more have been announced or are in beta testing.

  - Many of these products are valuable tools, especially since the prior method was to manually rekey data from mainframe reports. This manual method is probably the most prevalent (and error prone) form of the micro-mainframe interface.

  - However, it became clear in the course of INPUT's research that end users have their sights raised higher than using mainframe data extracts in spreadsheet programs.

- INPUT developed case studies describing how companies are pushing micro-mainframe (M-M) communications to the edge of the feasible.

B. CASE STUDY STATUS

- Case study status has changed little since these cases were described in 1984, because companies are still evaluating the technological options new vendor offerings present.

  - Only the salient points are being discussed here. Interested readers are referred to INPUT's 1984 report End-User Micro-Mainframe Needs for a more detailed description.

- INPUT expects many companies to move ahead with M-M implementations in the 1985-1986 time frame due to continuing end-user demand and the availability of new products.

1. A BANK'S ABORTED PLAN

- A bank installed minicomputers to provide data base information to loan teams, and had planned micro access to the central loan data base through a custom package which could have been sold to other banks.

  - But product development stopped after the bank realized that the complexity involved would decrease security and render the software design difficult.

- Today, a planning group is investigating ways of implementing micro-mainframe solutions throughout the bank, but progress is slow due to the growing recognition of the problems it would create, and the desire to achieve the best possible solution.

2. A RETAIL ESTABLISHMENT PROTECTS ITS CENTRAL DATA BASE

- At this company, the merchandising department wanted more timely reports, and independently purchased an IBM-XT for analysis and operations, while often neglecting to update mainframe files.

- Today, a microcomputer manager has been assigned to address the needs of all end users and maintain orderly planning. The current IS stance is that M-M be used only as a data base gateway.

- This company and others are particularly concerned with preventing impurities from entering the central data base while giving users the ability to update those files.

  - This could be resolved by authorizing designated end users to handle this function under policies and procedures developed by IS.

  - However, IS has not had time to implement an M-M solution incorporating these procedures. Simple solutions are not practical because the central data base structure was internally developed, requiring adaptation by in-house staff, consultants or the vendor of any M-M software purchased.

  - IS has not yet realized that if IS proceeds with implementation, M-M applications can be made available to end users while IS addresses concerns about central data base concurrency.

3. THE COMPLEXITIES OF AN ORDER ENTRY SYSTEM

- The third case focused on order entry and the problems created when complex systems feed to other corporate financial systems, and a company uses a complicated discount schedule.

- IS had called for a study of micro-mainframe issues but end users wanted solutions "now" and believed IS actions only flanked the IS domain.

- This company has hired a Director of Research who has gained the respect of both IS and end users and is smoothing relationships. M-M implementation is proceeding.

4. UNIX

- Although not uniquely a M-M issue, this case shows how people can become enamored with new technology, and how technical enthusiasts can lead the uninitiated astray.

- An energy firm upgraded information center services to download data to micros, and particularly into spreadsheets. This whetted user appetites for more micro-mainframe applications.

- Because of some IS staffer's enthusiasm, and due to growing trade press attention, users came to believe that UNIX was the answer to getting timely information.

- IS, however, viewed UNIX as only one of a number of esoteric or experimental approaches to be investigated, and began a limited pilot program with little indication that UNIX would become the centrally used language.

- There could have been much wasted time and effort due to misunderstanding UNIX.

- The UNIX pilot project has defused the UNIX timebomb and the push to UNIX as a panacea has ebbed at this company--at least for now. Meanwhile, M-M is being limited to data base access.

C. SUMMARY

- These case studies, and trends examined by INPUT at other companies, reveal that micro-mainframe links are evolving, and are not yet optimized at many locations.

  - In many regards, M-M is a symptom of the larger problem of giving users access to the information they need and as such, only solves this problem in the interim.

  - Exhibit III-1 summarizes the cases, the issues involved, and their status.

- Since last year's look at these and several other companies, more planning and coordination has been put in place, and, characteristically, M-M implementation is in an evaluation period, with limits placed on how M-M is currently used.

- INPUT expects these firms, and others like them, to move forward cautiously to address the larger organizational needs.

- One common thread is that micro users often have a simplistic view of micro-mainframe: "I have a PC. I want to use it to get into the mainframe." Clearly user understanding and commitment is necessary for the micro part of the micro-mainframe relationship to work. Users are recognizing the problems while IS attempts to maintain control to protect, not only IS, but the corporate resources in its charge.

- Another factor is that products are maturing, and addressing needs identified by the market.

EXHIBIT III-1

END-USER CASE STUDY SUMMARY

CASE	USER SATISFACTION WITH I.S.	M-M INITIATIVE FROM	END-USER TECHNICAL UNDER-STANDING	CURRENT STATUS
Bank	High	IS	Medium	On Hold
Retail	Low/Medium	Users	Low/Medium	M-M Seen as Data Base Gateway
Order Entry	Low	Users	Low	M-M Proceeding
UNIX	Medium	IS	Low	UNIX Pilot Project. M-M Limited to Data Access Only

- It is noteworthy, and to be expected, particularly in light of historic poor relationships between IS and users, that initiatives often come from users. The micro-based systems users want are centrally important to their operations.

  - M-M applications complement data processing and relate to the micro mystique.

  - They also symbolize user frustration with conventional data processing. IS is often unable, in the short run, to relieve these frustrations.

- Unique data base structures requiring specialized M-M approaches, and the expertise of in-house programmers or outside consultants, exacerbate M-M set-up in many installations.

  - An applications backlog often preempts timely internal development of M-M software. Current vendor products are configured for a limited range of specific mainframe systems, and "universal" solutions are difficult to develop.

  - Also, IS may be unwilling to use outside consultants when it is paying internal staff. Budgetary justification may be a political as well as a financial problem.

- However, IS must recognize that using M-M applications can reduce the backlog by making it possible for end users to run their own sessions.

  - IS needs to get out from under the backlog long enough to implement these tools, committing the resources to have them developed, or alternately, waiting for the products fitting their specific needs to be available.

D. APPLICATIONS

- INPUT's survey of IS departments asked users for the applications most suitable for micro-mainframe links.

- For each application named, IS was asked to categorize their stage of implementation.

- Accounting, financial analysis and management, decision support, office automation, sales and marketing, statistical analysis, and personnel applications, such as payroll led the list of functions users deemed most appropriate for micro-mainframe linkage.

- On average, these applications tended to be in the developmental stage at the respondent's location, indicating that IS is moving forward on M-M implementations for these needs.

- Exhibit III-2 shows the relative frequency of responses.

E. VENDOR ASSISTANCE

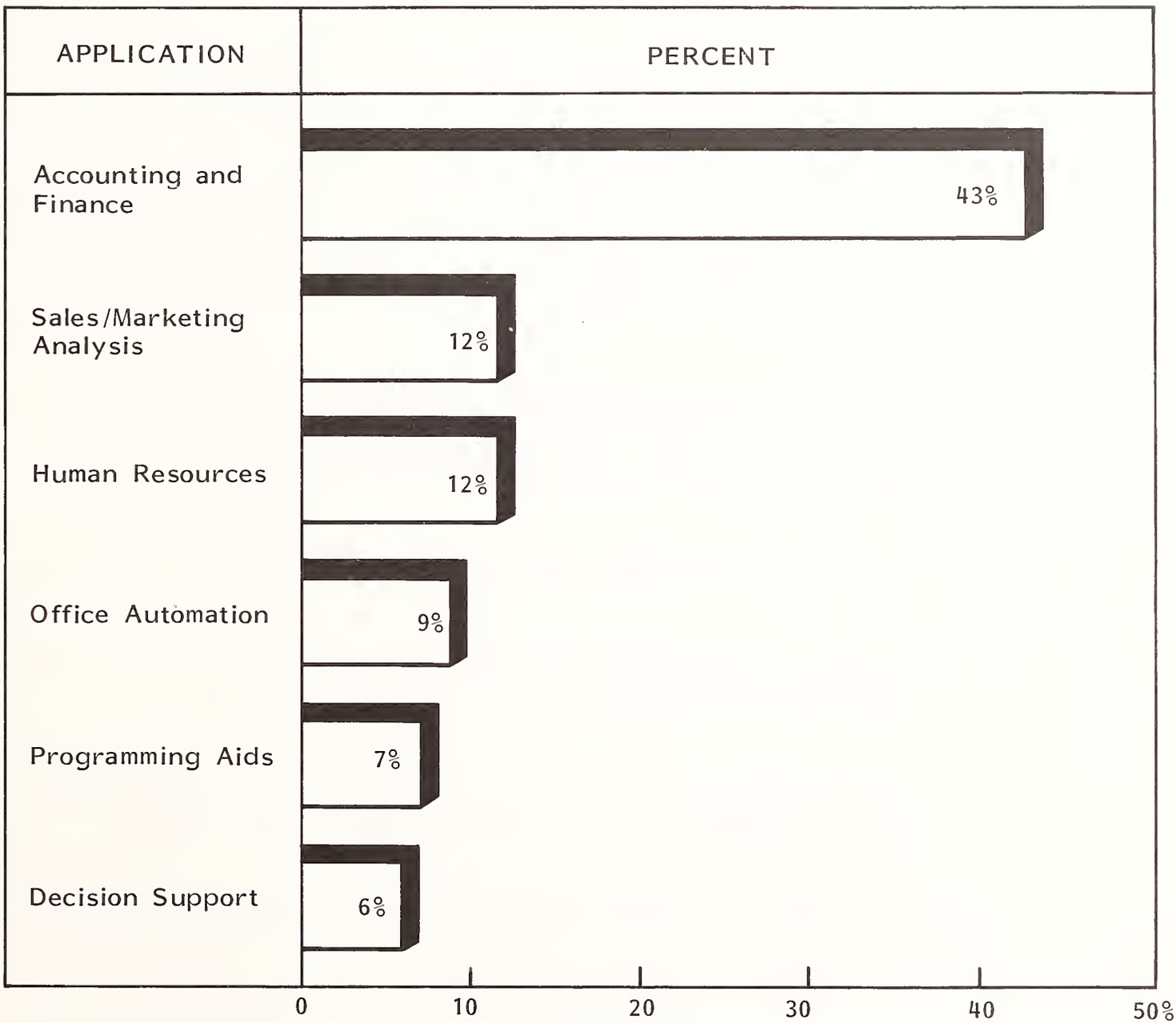
- Respondents were asked to rate the level of assistance expected from vendors in helping them to plan and implement M-M applications.

  - A majority of the sample indicated low expectations from vendors generically.

  - IBM fared a bit better.

EXHIBIT III-2

MICRO-MAINFRAME APPLICATIONS
(Percent of Respondent Mentions)



- Microcomputer hardware and software vendors were also low rated, but mainframe software vendors rated a bit higher.

- Remote processing services and turnkey systems vendors received the lowest scores.

- Exhibit III-3 shows the relative ranking of vendors.

- Perhaps more telling is how user organizations plan to construct their M-M applications. The findings show a high level of self-sufficiency.

  - Of three approaches given (modification of existing applications, writing new applications using existing files, and writing both new applications using new files), users indicate they expect to do their own development.

  - Vendors developing applications alone rated decidedly lower, while joint development by both IS and vendors rated somewhere between the two.

- The conclusions drawn from these findings are:

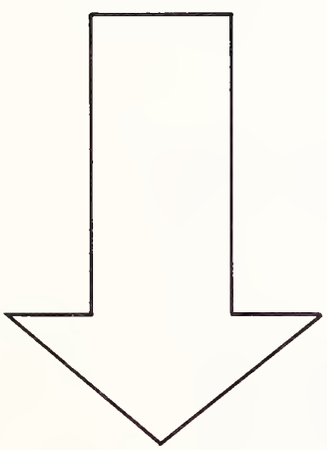
  - IS expects to be centrally responsible for developing M-M linkages, and does not have high expectations from vendors working alone.

  - The fairly high rating given joint development indicates that IS expects to buy a package and modify it for the company's specific needs.

- Exhibit III-4 shows the average scores against the various types of implementation.

EXHIBIT III-3

USERS EXPECTATIONS FROM VENDORS FOR PLANNING AND IMPLEMENTING MICRO-MAINFRAME APPLICATIONS

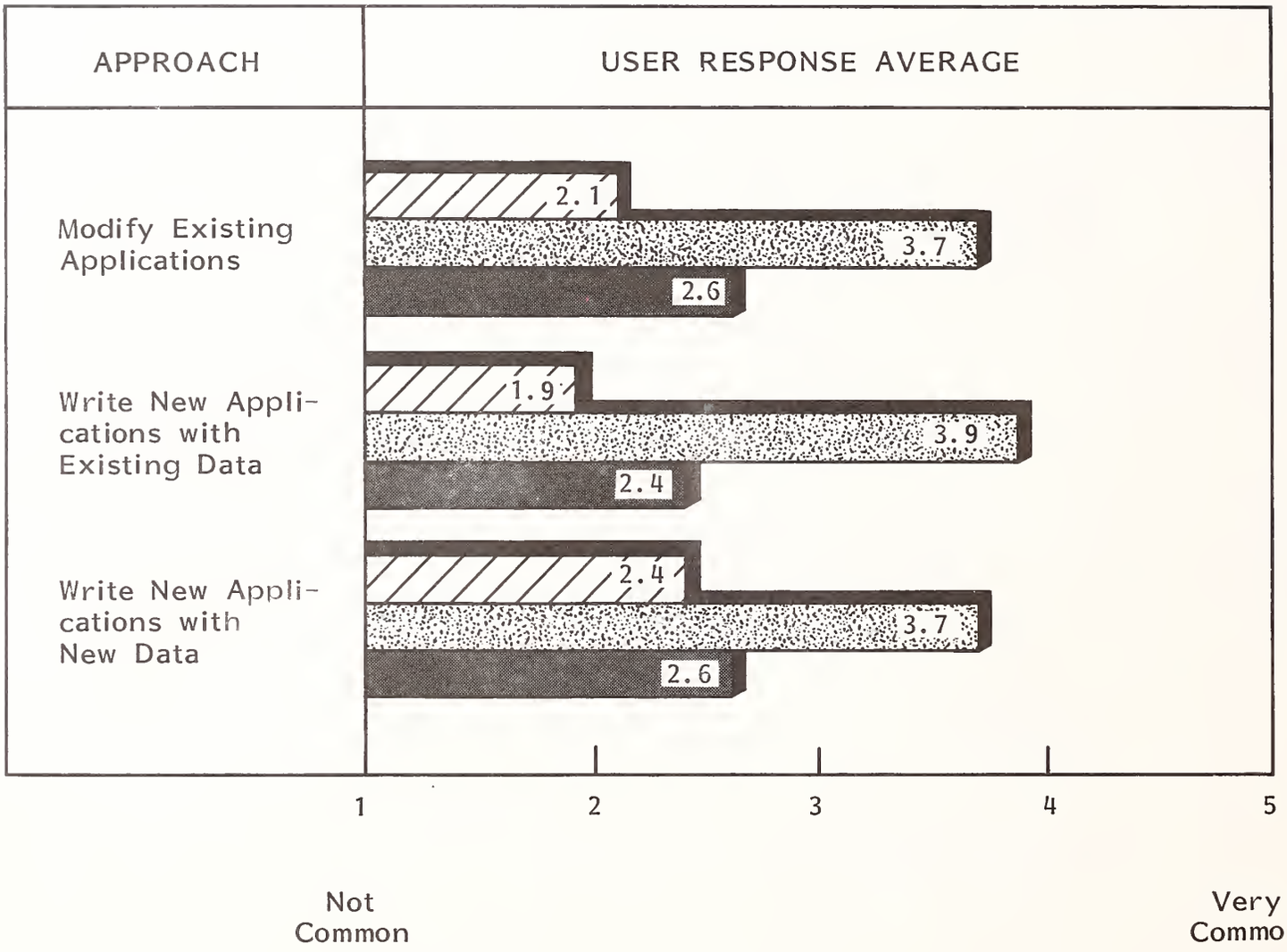


- IBM
- Mainframe Software Vendors
- Micro Software Vendors
- Consultants
- Micro Hardware Vendors
- Turnkey System Vendors
- Remote Processing Vendors

* Based on Average Rating

EXHIBIT III-4

USER EXPECTATIONS OF VENDOR ASSISTANCE BY APPROACH



F. THE MAINFRAME UPDATING PROBLEM

- There is IS resistance to allowing mainframe data to be updated by end users on a wholesale basis.

  - Most IS departments are fairly comfortable allowing mainframe data to be accessed on a read-only basis, although even limited access may require IS training and other support and place demands on central processors.

  - IS departments may even feel comfortable with the next step of allowing data downloading for end-user microcomputer manipulation, assuming security and access issues are properly addressed.

  - Problems arise, however, when end users want to upload revised data to the mainframe, which may pollute the central data base with inaccuracies or improper formats.

- These and other issues are analyzed in the next chapter.

IV END-USER MICRO-MAINFRAME ISSUES

A. SHARED FUNCTIONALITY

- INPUT coined the term "shared functionality" to describe a key characteristic of M-M applications.
  - Shared functionality is the sharing of processing and data between mainframe and micro.
  - It is allied with, but distinct from, older views of distributed data processing (DDP).
    - DDP was usually seen as centrally controlled. Shared functionality is based more on equality and peer-peer relationships.
    - A key DDP motivator was IS efficiency. Shared functionality is motivated by meeting end-user needs.
- The concept of shared functionality is accepted by the majority of respondents, but as illustrated in the cases, some think M-M is, or should be, limited to suitably protected mainframe to micro data flows.

- Respondents were asked if they felt that within five years, most applications now host-based will have a considerable amount of functionality taken over by host-linked personal computers.

  - Seventy-four percent said they agreed.

- Some typical comments offered by respondents disagreeing with the shared functionality concept were:

  - "We need controls which you don't have with micros."

  - "Micros are only suitable for lighter jobs. There are too many applications where they aren't very helpful. They will never have sufficient power and storage to take over mainframe tasks."

- However, these comments may indicate a conceptual misunderstanding. Shared functionality does not mean a take-over of mainframe tasks. Representative comments from those agreeing with the statement show a better understanding.

  - "Micros and mainframes will work in tandem."

  - "There is a tendency toward user self-sufficiency. Micros will eventually become like telephones. They will be used, but less intensively than the way mainframes are now processing virtually all the time."

  - "The variety of software now available makes micros a viable, cheaper substitution for mainframe processing. They will take over a larger part of functionality, but not all. There are problems with large volumes of data which still require mainframe processing."

- The findings were consistent with a majority of the respondents reporting planning or implementation of M-M applications. Although many of these

M-M applications might be called primitive in that the provide only terminal emulation, they do represent experiences which are paving the way for further development.

B. DECENTRALIZATION

- Shared functionality implies decentralization. Respondents were asked to rate the impact of micro-to-mainframe applications on moving their companies toward more decentralized information system functions.

  - With one representing "no impact" of M-M on decentralization and five representing "great impact," respondents averaged nearly a three rating.

  - This compares with an average rating describing current decentralization status of slightly over two.

  - The shift toward decentralization caused by M-M is shown in Exhibit IV-1.

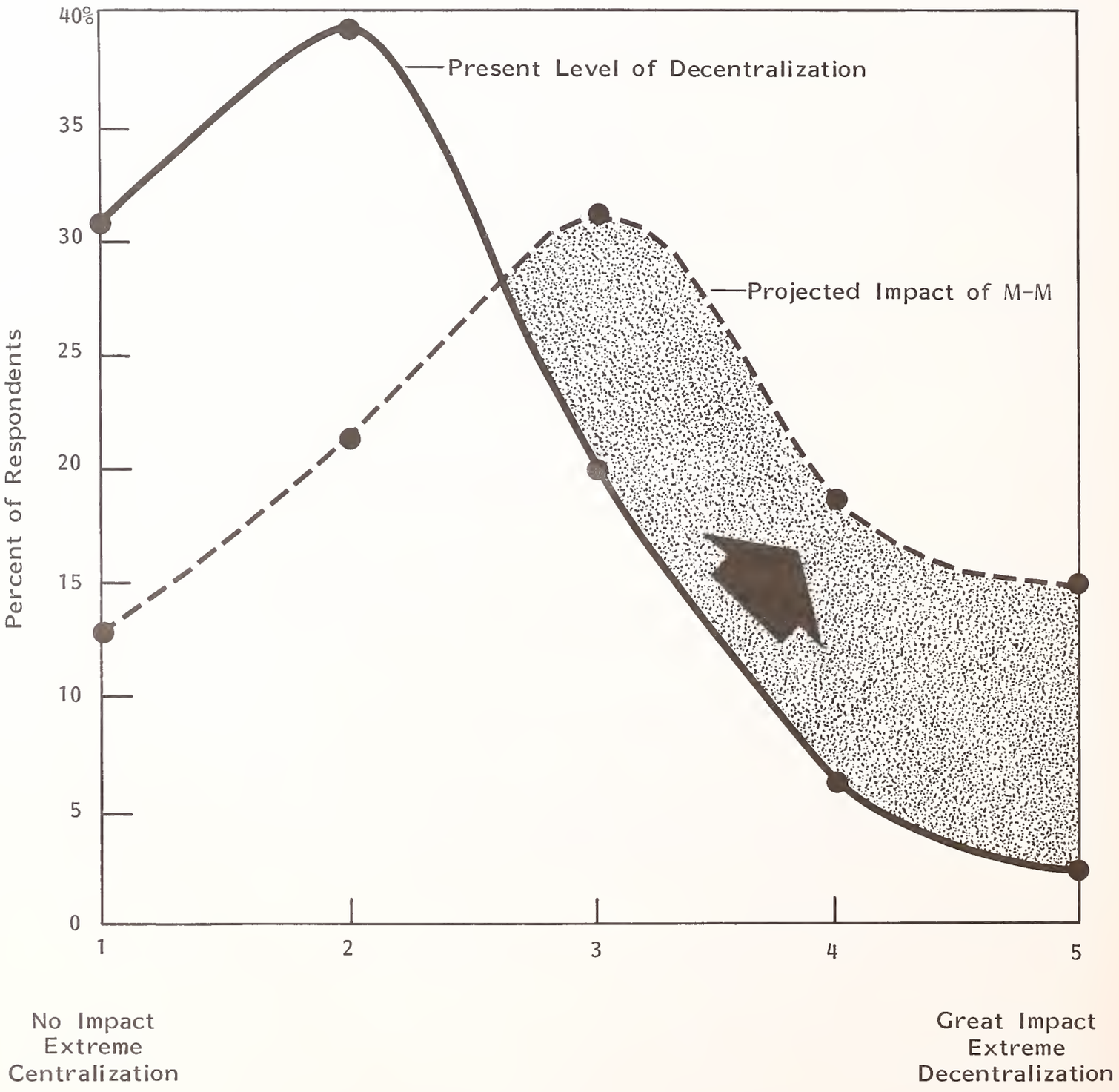
- Typical respondent comments may be even more revealing than the statistical demonstration that M-M leads to decentralization.

- Those reporting no impact at all typically said.

  - "We are a highly centralized company with a central management. We don't want to decentralize IS. I'm not sure we even want micros. They're limited and they won't replace the mainframe. They're just popular."

EXHIBIT IV-1

M-M IS SHIFTING I.S. TOWARDS DECENTRALIZATION



- "We were planning to decentralize but the economies of scale just weren't there. It's just not economically feasible."

- Typical comments from those indicating that M-M would have a significant impact on decentralization were:

  - "Applications are increasingly being decentralized. We have 20 researchers who are now using micros to do analysis. Before, IS had to babysit their demands."

  - "Most of our minicomputer applications will be standalone. The availability of computing power in micros has further helped to decentralize us, and more can be done."

  - "Micro use has crept up due to a lack of service available from the mainframe. A large backlog of demand can be released to the local level."

  - "Users are coming to appreciate the types of systems which can be under their control. The micro is definitely a vehicle for decentralization."

- These findings are significant in that a company's movement toward IS decentralization impacts the very structure of IS and its reporting roles in the organization.

  - How a company can move toward decentralization is described in Chapter VI, Section C-3.

C. TYPES OF MICRO-MAINFRAME LINKAGES

- One of the problems which surfaces with M-M (or any complex topic) is recognizing the gradients of the technology: the levels at which it operates, its capabilities, limits, and physical pieces.

1. LEVELS OF CONNECTIVITY

- Conceptually, M-M connectivity ranges from manual entry of data to fully interactive, real-time programs, as shown in Exhibit IV-2. The goal of shared functionality implies reaching the range of 4-5 shown on the exhibit.

- There are three basic micro-mainframe linking methods.

  - Terminal emulation is a low cost method using plug-in boards and software to allow microcomputers to be used on-line by appearing as terminals to the mainframe.

  - Terminal emulation with data transfer adds the ability to up- and download information, usually a file or a screen at a time, but sometimes select data is extracted.

    . This requires knowledge of mainframe commands, and files may not be in the most usable formats, or be too large for micro storage.

  - Intelligent links integrate with mainframe application programs such as query and report writers, and often create central storage areas which appear to the micro as floppy disks.

    . Information can be selectively located using micro-based commands which are automatically translated into commands recognized by the mainframe.

EXHIBIT IV-2

HIERARCHY OF MICRO-MAINFRAME CONNECTIVITY

5. Integrated, Intelligent Applications Programs (Coordinated Processing Between Mainframe and Micro) Using the Virtual Floppy Method
   - Batch and Interactive

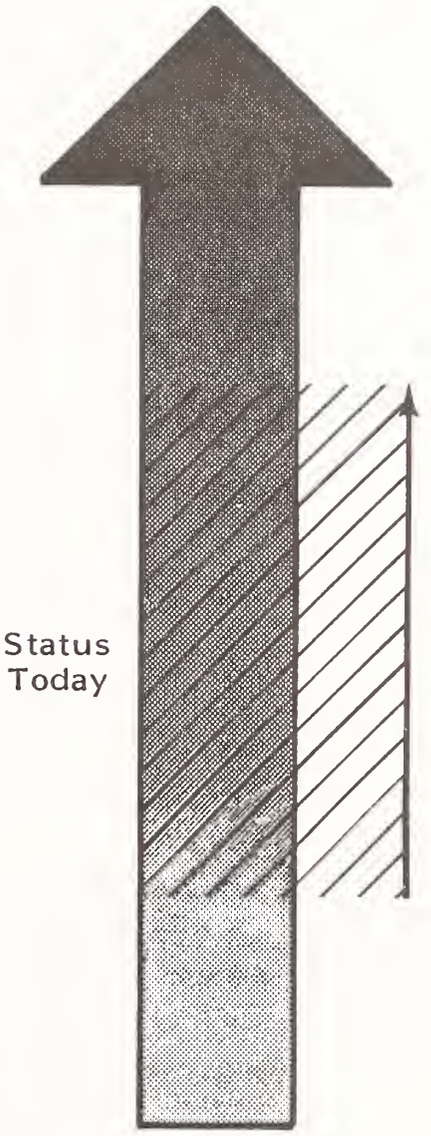
4. Logical Data Bases Covering
   - Multiple Hardware and Software Environments

3. File Exchanges (Bidirectional)
   - Low or High Speed, Proprietary or Generalized Structure

2. Downloading - Low Speed
   - Extracts and Operational Files

1. Manual
   - New and Rekeyed Data

Key: Darker Shades Indicate More Complex Issues/Unresolved Implementations



- Data can be manipulated in spreadsheet, data base, word processing, graphics, or integrated programs, and then uploaded to mainframe or intermediate files as revised.

- Products can be "general," designed to allow micro access to a variety of common mainframe file structures, (called "open architecture" by vendors) or "proprietary," working only with certain mainframe software.

- Further, some proprietary products will only download into specific vendor micro software or a limited number of popular packages such as Visicalc, Lotus 1-2-3 or dBASE II.

- The characteristics, benefits and limits of these types of linkages are shown in Exhibit IV-3.

- Truly universal links, supporting a wide variety of both micro and mainframe software, are not yet available. This is causing IS delay in implementation since there is understandable reluctance to be locked into specific software on either end of the M-M link, and since there is a tendency to wait for needed applications rather than accept limited products.

- INPUT's report Micro-Mainframe Software Issues offers a more detailed look at the levels of M-M linkage.

2. THE PHYSICAL LINKS

- The physical linkages may include plug-in boards, controllers, twisted pair, coaxial cable, local area networks, intermediate processors serving as file servers, protocol converters, modems or line drivers, data switches or CBX equipment, and at each end, the appropriate interfaces (i.e., RS-232-C or coaxial interfaces).

EXHIBIT IV-3

TYPES OF MICRO-MAINFRAME LINKAGES

	CHARACTERISTICS	BENEFITS	LIMITATIONS
Terminal Emulation	Modems and Plug-in Boards.	Micros Connect to Mainframe, Extending Utility.	Micro Becomes Dumb Terminal. Only Views Data. Local Processing Not Possible During Emulation.
File Transfer	Mainframe Files Bulk Transferred to Micro.	Mainframe Data can be Used by Micro.	Customized Programming Required on Both Mainframe and Micro. Slow, as Only Entire Files Are Downloaded. Requires Large Micro Storage Capacity.
Intelligent Links	Integrate with Mainframe Applications. Central Storage Areas Often Appear as Floppies to Users.	Data Extracts from Several Files Available for Integration into Micro Applications. Can Sometimes Upload Revised Files to Mainframe. Higher Speed Access by Micro.	Only Accesses Specific Applications or File Structure.

- Exhibit IV-4 shows the variety of telecommunications links and the physical pieces in the M-M relationship.

3. THE SOFTWARE CONNECTION

- Software for M-M is usually loaded on both the micro and the mainframe, unless the micro is serving as purely a terminal emulation device.

- INPUT's reports titled Micro-Mainframe Connectivity and Micro-Mainframe: Software Issues describe the functions of these elements in greater detail, and provide analysis of the issues they involve.

D. KNOWLEDGE LEVEL OF USERS

- When INPUT studied micro-mainframe in 1984, it appeared that end users had a simplistic perception of the issues involved.

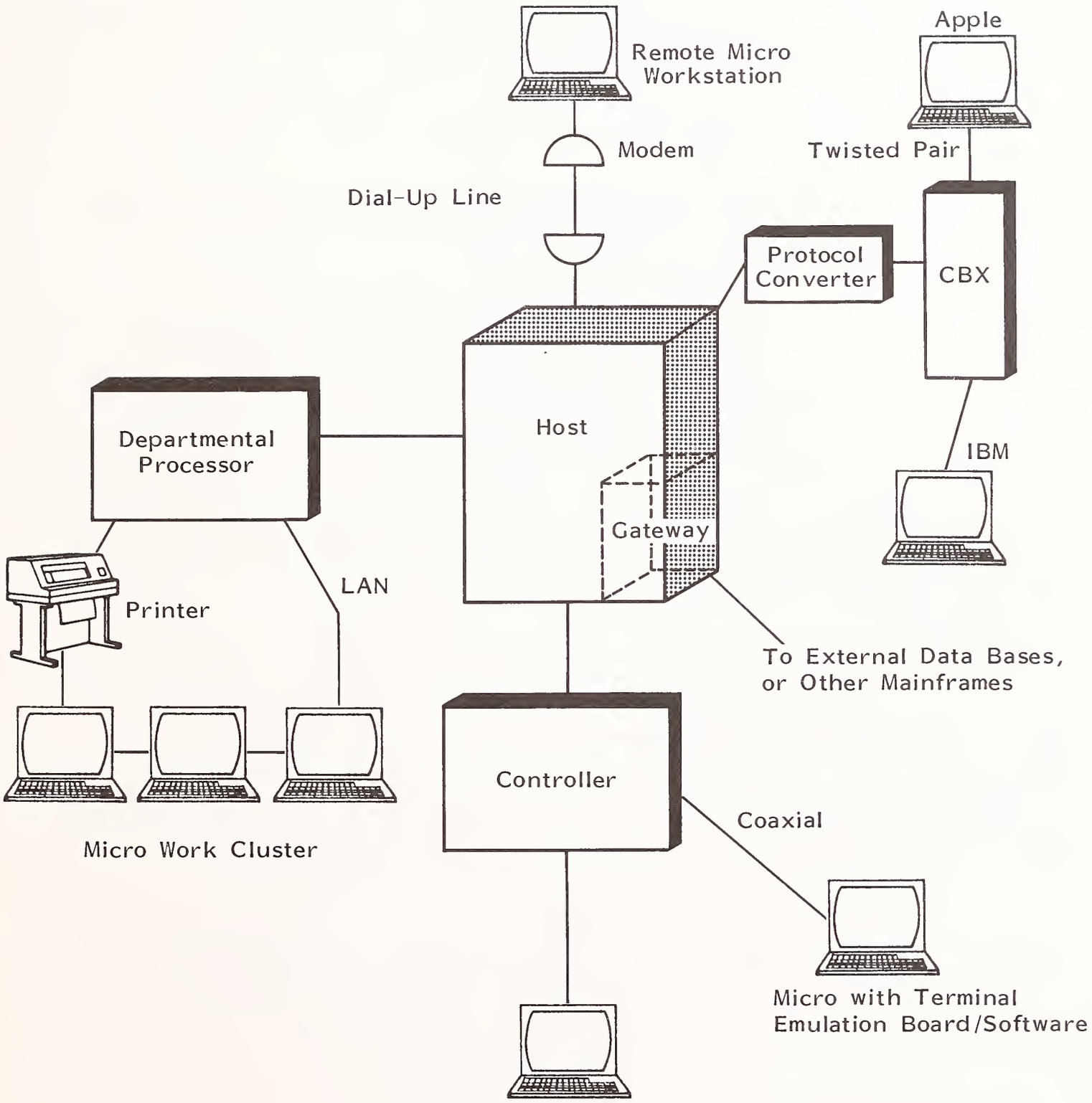
- Since then, the number of computer literate workers has grown, correlating with the increasing microcomputer population in corporate America. The growth of corporate sponsored and third-party microcomputer educational programs gives testimony to the increasing sophistication of end users.

- This increasing number of end users are instigating consideration of M-M links to improve productivity. Fortunately, with growing microcomputing familiarity comes increasing appreciation of the problems which need to be addressed when implementing M-M.

- INPUT also found IS managers and their staffs well-informed about the status of M-M and surrounding issues. This is to be expected; IS professionals are staying abreast of their field.

EXHIBIT IV-4

A VARIETY OF LINKAGES ARE POSSIBLE



- What generally emerged in the 1985 survey is a picture of growing awareness, but still some uncertainty over directions to take.

  - Some IS departments are taking a cautious approach, preferring to let time temper the tide of growing end-user enthusiasm and advocacy for M-M, and permitting analysis of what types of M-M links are truly needed by users individually and as classes.

  - INPUT feels this caution represents two things:

    . Awareness of an emotional factor behind M-M demands as part of the end-user revolution.

    . The capabilities and limitations of existing M-M products. IS managers need more time to evaluate options and to be convinced that the M-M solutions offered by vendors fit their immediate and future needs.

- However, a cautious approach can back-fire and create relationship problems for IS and users. Users may feel IS is "dragging its feet" to protect its technocracy.

  - This makes it particularly important for IS to sponsor training programs to properly represent the state of the technology and the underlying reasons for exercising caution.

  - It is also a signal to IS to become conversant, not only with developments in traditional data processing, but with microcomputing.

- IS is responding with the appointment of end-user microcomputing managers. Ideally, this liaison acts in a positive, supporting role rather than a punitive, controlling one.

E. PLANNING ISSUES

1. GRANTING ACCESS

- The IS manager must determine which requests for mainframe access to grant. End users may have acquired microcomputers without IS coordination, but justifing mainframe access is a different, more critical issue which cannot bypass IS.

- IS may want to formally poll microcomputer users on their needs as a pre-emptive action to maintain orderly development of M-M. As users become more familiar with spreadsheet packages such as Lotus 1-2-3, the re-entry of data becomes an obstacle and they look to M-M to automate the process.

- IS must understand what specific information end users need and how critical the timeliness of that information is to the user's function.

- The polling process should be designed to minimize unrealistic expectations. Accordingly, it should be coupled to a familiarization program on the state of the technology, benefits, and potential problems. This initiative can be politically important to IS.

- While the move to connect previously standalone microcomputers to the network is growing, upon analysis, some users will only require shared resources (e.g., printers), or limited office automation applications (e.g., electronic mail) which can be accomplished on a departmental basis or with limited mainframe access.

- There may be strategic reasons for planning and initiating M-M capability while not yet fully implementing it. These reasons include:

- It is feasible to build the physical links, but IS has not determined how the software connection will be handled.

- The company may be installing LANs or a voice/data CBX and it is an opportune time to plan for future M-M connectivity, even though the entire plan has not been finalized.

2. NEED FOR CORPORATE PLANNING

- M-M demand is coming from end users, wanting to improve their growing personal computer output with mainframe data.

  - This improves the individual performance and extends the utility of the micro--positive accomplishments.

  - End-user initiatives, freely carried out with the proper tools, will usually succeed because users are highly motivated.

- This is an individual perspective, albeit one which has corporate benefits. Missing is recognition that M-M improves the management of corporate information--a corporate perspective.

- End-user M-M demand generally comes from managers and analysts familiar with microcomputing capabilities. Production systems may also benefit from M-M, but they may not have such motivated champions.

- In order for M-M benefits to penetrate other appropriate levels of the corporation, "bottom-up" demands must be matched with "top-down" planning to apply the technology to corporate as well as to individual needs.

- INPUT recommends an entry-level, departmental implementation. This is designed to give IS low-risk experience with operational micro-mainframe links to evaluate products and to evaluate internal factors in anticipation of M-M expansion.

- This careful approach is required because M-M technologies are relatively new.

- Also, care is needed to identify all requirements, evaluate benefits and costs, and deal with interdepartmental politics.

- With success behind it, IS will be better positioned to implement M-M for other applications in response to continuing end-user demands and corporate mandates. Most important, success will enable IS to take the initiative in improving corporate information management.

- In this way, IS becomes proactive, rather than reactive.

- IS also has better control of implementation, and may therefore prevent time consuming, costly mistakes.

- Currently, INPUT sees M-M as one potential solution to information management, which is in transition between meeting end-user demands and solving the broader information management problems of the company. Demand is currently bottom up, but planning needs to become top-down.

- This parallels the technological view which sees M-M emerging from simple terminal emulation to approach intelligent, integrated links with confidence.

3. SECURITY

- Security and data integrity issues were rated as the most critical problems created by M-M.

  - Twenty-nine percent rated security as the primary problem and almost 12% placed the issue second.

- Data integrity was placed first by nearly 8% of the respondents, and 14% placed it second.

- Security issues surface at three levels: backing-up data, preventing unauthorized access (e.g., "hackers" or industrial spies), and maintaining the "purity" of the central data base. This latter concern surfaces when users are given the capability to upload revised data to the mainframe.

a. Back-ups

- Backing up mainframe data to prevent catastrophic loss is a standard IS procedure; M-M does not change this requirement. Even the virtual floppy method of M-M could presumedly build in an automatic back-up mechanism.

- Information downloaded and manipulated in end user's micros should also be locally duplicated to prevent loss. This information can be stored in the user's designated mainframe workspace or stored by making additional copies clearly labelled "back-ups."

- Back-up procedures are key, but often overlooked, elements in end-user training. Experience shows that one loss is usually sufficient to drive home the lesson.

b. Access

- Generally, M-M packages integrate with standard password protections supported by mainframe systems. In this regard, there is no difference between terminal and micro access.

- The ability of end users to download mainframe data which may include confidential corporate data is also a concern; however, while M-M may increase opportunities for unauthorized distribution of strategic corporate information, this problem is not unique to M-M.

- Managers who now request reports from IS could also be responsible for allowing printouts to "leak" to unfriendly parties.

- The "owner" of the data base, be it accounting, marketing, finance or another department, is ultimately responsible for its security, using IS provided guidelines and procedures.

  . This sharing of security responsibilities and risks implies corporate approval of security measures and policies.

- The problem must be handled in a manner similar to those traditionally used: passwords, authorization levels and audit trails. Some M-M packages build in audit trails automatically based on identifiers embedded in software or chips on the add-on boards installed in micros.

c. Updating

- Updating the mainframe data base with revised end-user information depends on specific application and corporate needs.

  - Many M-M software packages create "shadow" files separate from the "real" mainframe data base. These shadow files can be verified by IS before being passed in batch form to the core data base.

    . Of course this can affect the currency of the central data base and may prove unpopular with users needing "up-to-the-minute" real-time information.

    . Users requiring only "timely" data (i.e., daily rather than immediate updates) may not find this objectionable.

- Other M-M packages permit real-time updating with varying levels of IS supervision through password authorization.

- There is an industry debate about micros being used to perform updates.

  - Some say intermediate steps make micros no more capable than dumb terminals, and waste resources.

  - Others are concerned about increased opportunities for breaches of security; however, this may be a smokescreen to avoid the changes M-M brings to IS. Security protections can be established just like they are for terminals.

- In practice, it depends on need, and IS should be cautious but not inflexible.

  - Since security measures can authorize access and updating to certain files and even fields within files, it is a matter of determining who has what level of authority.

  - Variations from standard procedures can be flagged, adding another level of security and helping to develop effective, realistic, policy.

4. FUNCTIONALITY VERSUS EASE OF USE

- While advanced, highly capable products are becoming available, many users, not generally familiar with mainframe commands, are finding that these products perform clumsily.

  - Easier packages are often limited in their capabilities.

  - Newer packages are combining functionality with ease of use by a "fill-in-the-blanks" user interface and optional command-level abilities for more advanced users.

5. CAPACITY

- Users interviewed think M-M applications will increase main CPU processing loads by an average of 17%, but this may not be what actually occurs.

  - Over 30% of the sample expects increases averaging from 20-30% in mainframe processing as a result of M-M, while 18% saw no increase at all.

  - The general view is that micros do not offload processing from the mainframe, but indeed require increasing capacity.

  - Predicting end users' need is difficult. Structuring the time and nature of transactions may be required to prevent response time deterioration.

6. STORAGE

- Users surveyed expect microcomputer usage to increase mainframe storage requirements by an average of 18% by 1987.

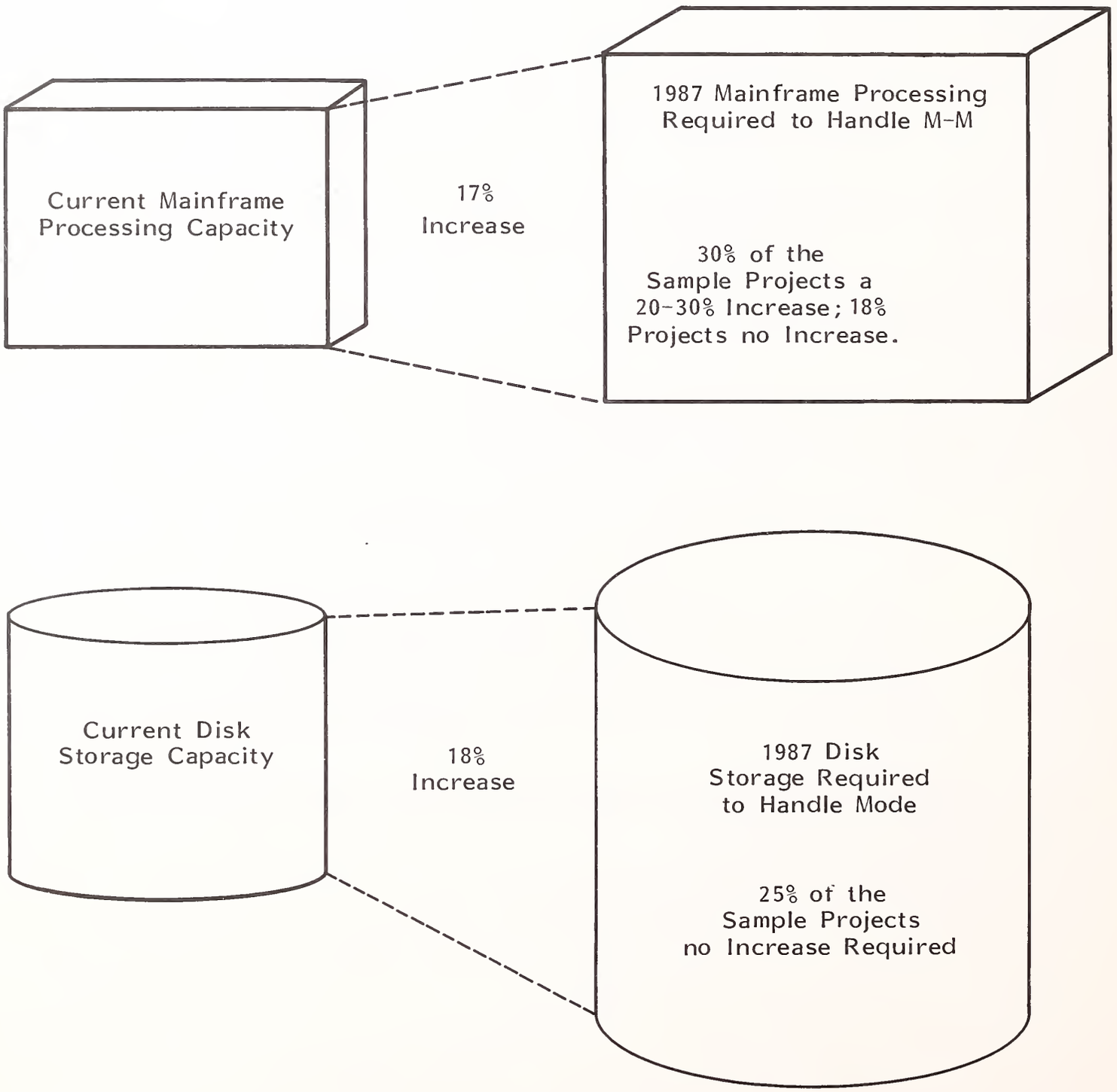
  - One fourth of those responding saw no increase needed.

  - M-M and other increasing demands on storage and processing may cumulatively lead to procurement of faster, higher capacity central processors, ways of off-loading functioning to intermediate processors, (as is happening with M-M and DDP) and greater file capacity.

- Exhibit IV-5 shows how users see M-M creating demands for additional computer resources.

EXHIBIT IV-5

AVERAGE PROJECTED IMPACT OF M-M APPLICATIONS
ON MAINFRAME PROCESSING AND DISK STORAGE DEMANDS



7. TRAINING

- Approximately 10% of those interviewed identified end-user training and support as either the first or second problem most frequently created by M-M.

- IS personnel are trained to use mainframe software which requires knowledge of an often complex command structure. These methods are generally not "user-friendly" and are unsuitable for most end users.

  - It is for this reason that pure terminal emulation is often an unsatisfactory M-M method. It requires knowing and understanding job control languages and data base commands.

  - M-M packages usually offer a menu driven user interface, and some vendors offer on-line training modules with their packages.

- The future will undoubtedly bring natural language capabilities to M-M, however, user needs cannot wait for these products to be available.

- IS needs to consider required end-user training for M-M applications and should favorably rate those packages which offer ease of use, tutorials, and after sale vendor support, assuming other features are satisfactory.

- Training is also required to educate end users on the limitations dictated by the current state of the technology and by company policy.

  - For example, discussing the reasons for limiting M-M access, or locking individual files and fields from end-user manipulation, will help create better human relationships by clarifying restrictions which might otherwise be misinterpreted.

- Users are becoming more computer literate. Indeed, computer literacy is one reason for M-M demands. However, the adage "a little knowledge can be a

dangerous thing" applies. It is better for users and IS to have a mutual understanding of their needs and concerns and deal with them cooperatively.

8. EVALUATING VENDORS

- Interview respondents were asked how they planned to implement the micro-mainframe applications described in Chapter III, Section E.

- These findings show a high expectation of self-sufficiency.

- When planning to work jointly with a vendor, or relying solely on a vendor's product, IS should determine the vendor's future plans and abilities to design upgrades meeting the organization's future needs. This often means bypassing enthusiastic salespeople to question technical and development staff.

- Ways of implementing M-M are recommended in Chapter VI of this report. Chapter V examines future M-M trends which need to be considered prior to implementation.

V FUTURE DIRECTIONS--MEETING UNMET NEEDS

- Products serving M-M needs are still evolving with new introductions virtually every week. Many products are being pre-announced, and it's likely some of these will fail to reach market.

- Regardless of individual product failure or success, the technology advances and the market churns, making choices more difficult. Goethe wrote "Coming events cast their shadow before." With a little future gazing, developments can be anticipated, thus informing decisions.

A. VENDOR ALLIANCES

- The recent history of M-M product development shows vendors joining forces to solve problems.

  - Existing mainframe and minicomputer data structures are being opened to specific micro-based products to permit downloading directly into microcomputer data base or spreadsheet applications.

  - This trend will continue as software vendors seek to extend their principal products' utility.

- Since micro-mainframe is now implemented as separate pieces, typically software mounted on both sides of the link, the formation of alliances simplifies the purchasing process and creates operational ease.

- Vendor alliances should lead to the same commands for both micro and mainframe applications and insure that data, formatted one way on the mainframe, is transformed for easy micro use, where it's formatted differently.

B. THE IDEAL

- The best M-M implementation is the one which works best for the individual need. Simple data base access can be done through terminal emulation, although this has the effect of reducing an intelligent microcomputer to a dumb terminal, albeit sometimes with downloading capabilities.

- A generic ideal M-M implementation automates tasks which otherwise require knowledge of the mainframe's command structure.

  - This means simplified log-on procedures, menus, on-line help facilities and a micro-based data dictionary, essentially a directory to the various data bases, applications, and services accessible through the system.

- Distributed data processing advocates see the ideal consisting of many network nodes each with resident data. The end user's node locates requested information anywhere on the network and converts it to micro format.

  - The process is transparent. Users are not required to know data addresses, and node intelligence can even handle conversion and communications between the dissimiliar systems.

- This ideal system has a simple, consistent user interface requiring little IS involvement.

  - "Fill-in the blanks" screens help users build queries, and eventually, natural languages (non-computer specific commands), voice command or artificial intelligence will provide assistance in appropriate settings for those willing to pay the price.

- Exhibit V-1 summarizes these capabilities.

- The technology is fast approaching these capabilities. But most current M-M products are not universal solutions. They are usually limited in the types, and brand names, of applications they service. Generic solutions are just emerging.

C. MICRO CAPACITY

- The memory storage and processing capacity of micros are increasing. Some feel that micros will eventually have as much functionality as today's mainframes, both individually and through shared resources on local area networks.

  - Laser disks, eventually with economical read and write capabilities, promise increased local storage capacity. This means that each micro can have a copy of at least some of the data bases which are normally stored on the mainframe.

  - Advances in integrated circuits and the expected 1986 availability of "megachips," capable of storing over one million rapidly accessible bits, promise to bring much of the processing and storage power of mainframes to desk-top units.

EXHIBIT V-1

THE IDEAL MICRO-MAINFRAME LINK

- Automated
- Simple Log on
- On-Line Help
- "Fill-in-the-Blanks" Query
- Natural Language Interface
- Micro-based Data Dictionary
- Transparent Conversions

- The implication for IS is clear:

  - Distributed data base management will emerge as a key IS task. For example, IS must insure central data base concurrency when massive local storage becomes available to end users.

- This is not an easy issue to face, but fortunately it is not an immediate concern. While technology may provide increased capabilities, it does not mandate an end-user need for these capabilities.

- IS does need to monitor developments in order to inform its long range planning, estimate the time frames in which these, or any, advances will become cost effective, and plan today's systems and methods so that new technologies can be easily incorporated when available.

D. VIDEOTEX AS MICRO-MAINFRAME

- Many think of videotex as a new media consumer service. Office videotex, which internally serves corporate information workers, will probably find greater success than consumer videotex.

  - IBM, DEC, AT&T, Honeywell, Sperry, and other computer manufacturers are aggressively pursuing office videotex markets. On-line data base services such as Dialog are adding new subscribers daily.

- Videotex is a very easily used micro-mainframe data base application. The videotex (front end) processor, located between the end user and the data base, extracts and formats data for display on special terminals or micros equipped with decoder software or boards. Micros can store downloaded information for later review or processing.

- Although videotex "pages" may need to be composed on frame creation systems, videotex can also present pre-existing mainframe data. Videotex usually implies color graphics, but ASCII-only systems with easy user interfaces are also available.

- For occasional data base queries by unsophisticated (in a computer literate sense) users, videotex offers attractive benefits. These are described in INPUT's 1985 report Office Videotex.

E. LOCAL AREA NETWORKS

- In the aggregate, respondents claim an average of slightly over one LAN now, with a projected average of seven by 1987, meaning an estimated seven-fold sample increase in LANs.

- The data also shows an equivalent increase in LAN connections to mainframes and minis, with an over eight-fold increase in the number of micros used in LANs when compared to the current configurations. Not all of these LAN connected micros will access larger processors through the LANs, however.

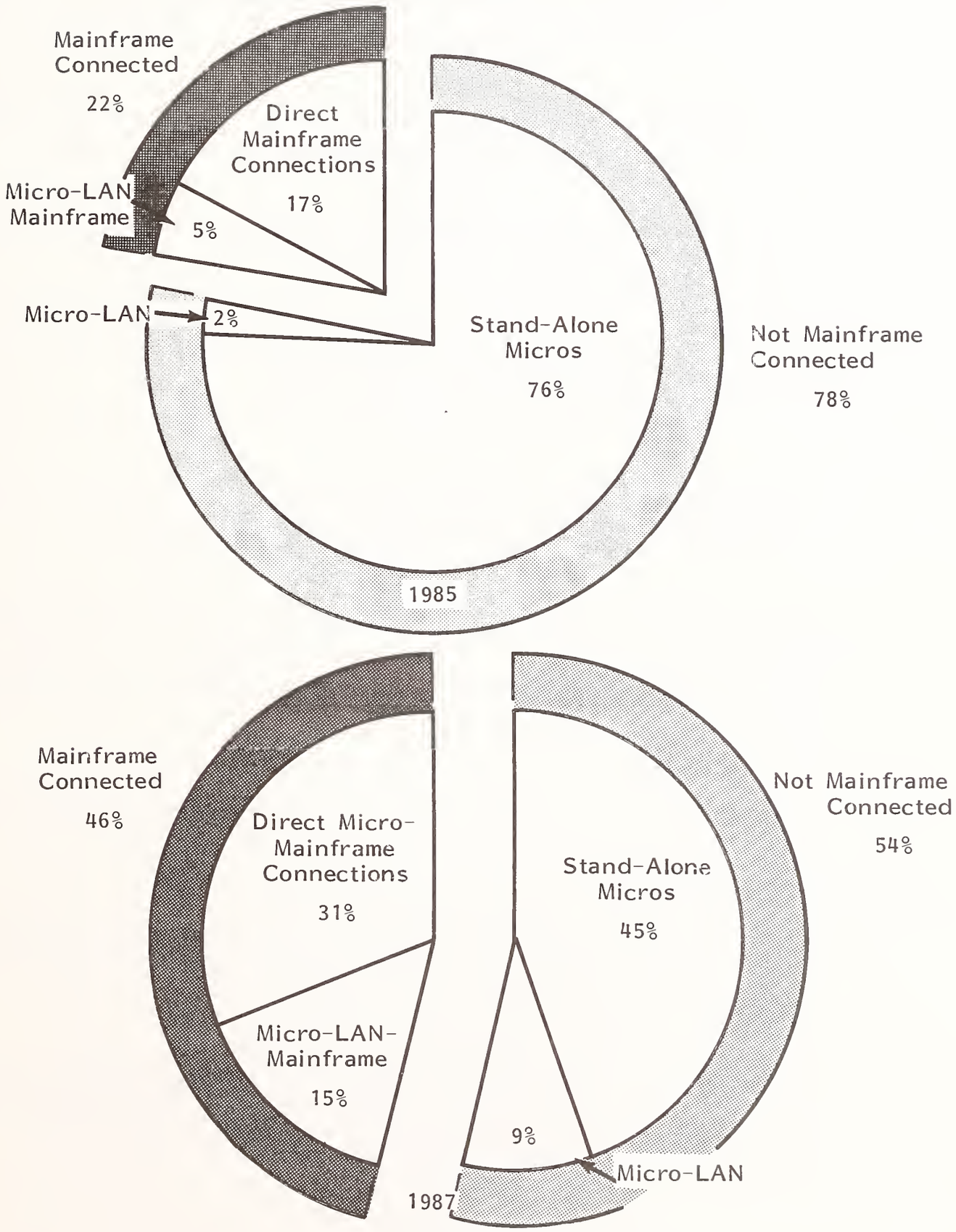
- Also, respondents project an over four-fold increase in the number of micros not used in LANs which will be directly connected to mainframes or minis by 1987.

- Exhibit V-2 shows these findings as a percentage of the total number of micros now and in 1987.

- It appears that LANs will increasingly be used for M-M linkages, as well as to share data and peripherals in work groups, and that growth is expected in the number of micros which will directly connect to larger processors and data bases, although at a lower rate than LAN-mainframe linkages.

EXHIBIT V-2

M-M CONNECTIVITY BY PERCENT OF TOTAL MICROS
SURVEY RESULTS



- Vendors are starting to take the M-M tack in their marketing efforts, with LAN communications servers (LAN processors handling linkage and conversion tasks) offering an alternative to individual M-M linkages and the use of intermediate processors.

- Technological improvements driven by VLSI technology and software development will add flexibility to LANs while lowering prices.

- INPUT's 1985 report, Micro-Mainframe: Connectivity, further discusses the importance of these findings.

F. THE "FOURTH GENERATION" VOICE/DATA PBX

- Compounding any view of future M-M linkages is the so-called "Fourth Generation PBX," or computerized private branch exchange (CBX).

- These voice/data switches are distributed processors which integrate LANs by design and form the core for corporate office automation and telecommunications. There are political and organizational implications since CBXs involve telecommunications as well as the data side of IS.

- As the installed base of earlier generation switches becomes obsolete, CBXs will become more common, bringing with them M-M capabilities.

- IS needs to be aware of this approach to merging voice and data functions in order to gather resources in one integrated system which forms the central nervous system of corporate information management.

- CBX issues are analyzed in INPUT's 1984 report LAN/CBX Trends: Decision Processes for End Users, and in the 1985 report LAN/CBX: Planning for Change.

G. CONSIDERING UNIX

- Respondents to INPUT's 1984 and 1985 user surveys were asked to rate the importance of UNIX-based systems to their organizational plans.

- With five being "high importance" the mean rating in both years was the same (below two), meaning UNIX is not viewed favorably by IS.

- This does not necessarily mean that UNIX will fail. Given these results it is clear there is a general respondent lack of familiarity with the language despite its developmental history and AT&T's reported expenditure of $3.5 million on awareness advertising over the past year.

- Some typical comments from those rating UNIX low were:

  - "We have no priority on UNIX, and we have no people who have been trained in it. We just don't see any need to change from what we have."

  - "There is uncertainty about its future acceptance by the industry, and I can't see any use for UNIX-based applications here."

  - "We're just learning about UNIX and as far as I'm concerned, the jury is still out."

  - "We are driven by the availability of software, and in the banking industry, we use MS DOS, not UNIX. It's an ugly language to the end user. You have to put "shells" around it....."

  - "It requires a skilled professional. We think it's unnecessary to add new operating systems here, especially that one. It requires too much memory and it's expensive. We have no need for the functions it provides. Besides, it's hard to implement in an IBM world."

- "We've tried it and we're throwing it out. It's terrible! So expensive, and the overhead! It really chews up memory and cycles. It doesn't perform to our satisfaction and it's not user friendly. It really requires a professional user."

- Many negative respondents commented that they rated UNIX low because they are strictly IBM shops (even though IBM has introduced its own version of UNIX).

- Typical comments from the minority who rated UNIX highly are:

  - "We will use it only in our multiuser systems. Others have led us to believe it will be important."

  - "We see it as a fill-in for IBM's inadequacies. We will be experimenting with it soon."

  - "UNIX is the only one that can use multiple mainframes. I think it will become important, especially for multitasking and for the power it offers."

- Clearly AT&T's continuing efforts behind UNIX, and the support of other computer vendors (including IBM) means that minimally, the operating system must be considered for multiuser, multitasking, networked applications. UNIX is generally transportable, and micro versions of mainframe applications are relatively easy to configure.

- Users remain unfamiliar with UNIX. For it to succeed, vendors need to continue their awareness programs and overcome the objections reported here.

H. IBM DIRECTIONS

- Since M-M is largely an IBM world, and since the IBM Personal Computer is the de facto industry standard, understanding IBM's intentions and directions is important in planning M-M implementations.

- IBM has identified the general development of communications software as a top priority, but it needs to overcome the past piecemeal development and enhancements made to its family of products.

  - The company has increased its programming staff, and will work to enhance Systems Network Architecture (SNA) to serve decentralized needs.

- The success of the PC underscores the strategic importance of M-M communications software. PC users have often had to look to other solutions in the absence of fully integrated products from IBM.

- To support micro-mainframe, IBM does offer a range of products:

  - The Personal Decision Series (PDS) of productivity tools links with "Attachment" products to IBM's "Business Management Series" on System/36 and System/370 with access to microcomputer DOS files and DIF file conversions.

    . They give users virtual disk sharing options, with conversion between EBCDIC and ASCII, as well as security functions.

- In the future, IBM will need to provide versions of these products that link to other IBM mainframes.

- On the hardware side, IBM offers:

  - The 3270 PC which allows windowed multiple host access with simultaneous personal computing abilities.

    . Data can be transferred between windows.

    . The 3270 PC communicates with any System 370, 308X or 43XX through a 3274 controller.

  - The PC XT/370 and the faster PC AT/370, as the names imply, work as micros, as System/370 VM/CMS workstations, or as 3277 display terminals.

    . Switching between modes is done with a few keystrokes. Data can be downloaded for manipulation, reporting and program development, and then uploaded back to the host.

- IBM also plans to link the PC network to a future token-ring LAN. While its cabling standard has been announced, the introduction of this LAN has been delayed by software development.

- IBM has been promoting a set of extensions to SNA, including Advanced Program-to-Program Communications (APPC) and Logical Unit (LU) 6.2 protocols to be used in host-host links, and for pass through to non-compatible devices in the IBM environment.

  - Logical Units form the basis for terminal and application communications.

  - By referencing VTAM tables, an LU application determines how to communicate with a terminal.

- LU 6.2 protocols permit document transfer and central control between distributed nodes in the SNA network, in many cases bypassing the host.

- LU 6.2 permits micros and minis to work intelligently in a peer-peer, rather than master-slave relationship. The mainframe views the PC as a network resource.

- In this relationship, applications are working with other applications, hence the APPC label.

- Currently, LU 6.2 is only supported on CICS/VS mainframe software.

- Document Content Architecture and Document Interchange Architecture (DCA/DIA) software also belongs in this family of SNA extensions.

  - DIA defines how documents are transported through SNA.

  - DCA describes document formatting.

  - DIA/DCA will become a de facto protocol standard, and other vendors are developing ways to attach non-IBM equipment.

- Other vendors are expected to support these protocols in the future.

- Additional links, particularly between the Distributed Office Support System (DISOSS--a mainframe program supervising large, shared, document files), the Professional Office System (PROFs), and, perhaps most importantly, PCs are still needed to effectively integrate office automating and data processing functions.

- Further development of M-M software by IBM is expected, and will be introduced over the next few years, but this delay is undoubtedly causing cautious IS approaches to M-M.

I. OTHER VENDOR DIRECTIONS

- Other vendors are not oblivious to the growing demand for M-M.

  - Digital Equipment Corporation's stated strategy is to support the multivendor, open systems interconnect (OSI) model. The company says it will continue to introduce networking products for the VAX/VMS computer family, to increase functionality in new and existing VAX/IBM interconnect products.

    . For example, DEC offers integrated terminal emulation, file transfer and Ethernet communications capabilities on the MicroVAX I personal computer, which operates under modified versions of VMS and UNIX.

    . Central to DEC's strategy is the DECnet/SNA Gateway to support transparent communications between the two network environments.

  - Data General has a similar philosophy.

    . DG's product line includes micros with integrated communications capabilities operating under its own operating systems. These can emulate both their own and IBM terminals.

    . IBM PCs and compatibles can be connected to DG's MV series of minicomputers.

  - While AT&T does not offer mainframes, it is firmly behind UNIX, which is designed to facilitate communications between diverse computer brands and sizes. UNIX is seen as an alternative to IBM's multiple, and incompatible, operating systems.

- While AT&T has endorsed Amdahl's UNIX-based mainframe, it is focusing its own efforts on smaller, multiuser systems.

J. MICRO-MAINFRAME EVOLUTIONARY TRENDS

- M-M currently requires a piecemeal implementation approach. While vendor alliances and product refinements are making M-M easier to establish, the final resolution to the problem may well be the integration of M-M capability to the point where it is no longer a separately identified issue.

  - New mainframe software products will "build in" M-M capabilities. Microcomputer hardware may also incorporate the functions required (such as protocol conversion) to effect transparent links, eliminating the need for micro application software, add-on boards, or standalone converters.

  - Intermediate processors (minicomputers) with resident software aiding end-user navigation through mainframe data will offer another alternative. These processors download and transform information into the formats needed by the micro. To a certain extent, this is already occuring.

  - Also, more micro versions of mainframe software will become available, along the lines of Information Builder's PC Focus. These adaptations ease accessibility to mainframe data.

- These trends towards integration support the view that current M-M methods are intermediate tools used for distributing mainframe information structured in various ways to users. More comprehensive, and more economical, solutions to this complex problem will eventually become available. The key questions are "when?" and "can IS or users wait for them?"

- Exhibit V-3 summarizes M-M's future directions.

K. FUTURE ECONOMICS

- IS should resist the tendency to become immobilized while waiting for future developments to offer better solutions. Productivity gained with today's tools can be substantial.

- IS can seize this time for learning about M-M and its user requirements and for thoroughly evaluating M-M products, implementing the available tools which will most likely fit current needs.

  - These methods may serve for several years, or they may be modified later to take advantage of technological improvements.

1. JUSTIFICATION

- While cost justifying M-M links was ranked the key problem by only 3% of the sample, it is INPUT's experience that significant investments in new systems require some form of cost/benefit analysis.

  - The low rating may reflect the largely experimental status of M-M and its primary use of terminal emulation methods built on low cost, add-on boards.

  - It may also mean that IS management is as yet unaware of the expense involved in M-M implementation.

  - Senior management will start evaluating M-M costs when it emerges beyond terminal emulation, board-based implementations.

EXHIBIT V-3

FUTURE DIRECTIONS

- Vendor Alliances
- Increased Micro Memory/Processing Capacity
- Micro-LAN-Mainframe Links
- Micro-CBX-Mainframe Links
- IBM Developments
  - 3270 PC
  - XT and AT/370
  - APPC, LU 6.2
  - DIA/DCA
  - Countinuing M-M Product Development
- Micro Versions of Mainframe Software
- M-M Capabilities Integrated Into Micros and Mainframe Software

- With the high prices of advanced M-M links, and with IS time and effort required to customize these links to specific environments, justification will often be a task required of IS by most management structures.

- Justification can be based on the estimated savings gained by IS when end users develop and run their own applications, although these costs are shifting from IS to users rather than being replaced. Nevertheless, it can be assumed there are efficiencies because end users are closer to their own needs than is IS.

- The organizational value of timely information can also help justify M-M.

a. Justification Based On Productivity

- Justifying any computerized system is appropriately based on increased productivity, but IS managers have difficulty in quantifying these increases.

- INPUT's 1983 report, Impact of Office Systems on Productivity, identified interpersonal communications as the largest time/cost factor in the office, with analysis and decision making second. Micro-mainframe applications serve these functions well.

- The IS manager may attempt to demonstrate M-M productivity improvements by prototyping systems and by evaluating the experience of other companies. Such analysis is often time consuming and difficult.

- The INPUT report concludes: "Lacking precise tools for measurement of the performance of office systems, relatively simple, intuitive measures will have to be used. Our assumptions are that decreased paper volume, transfer of time spent communicating to time spent in analysis and decision making, and the acceptance of new office systems can be used as measures of productivity improvement. Unfortunately such measures are difficult to use as cost justification for the installation of new office systems."

- Increasingly, IS uses intangible benefits (increased effectiveness, quality of work, productivity) to justify office system implementation. Sometimes, however, conservative managers require "bottom line" tangible justification (cost displacement, reduced personnel costs, reduced backlog). They require that new system expenses more than displace old system costs.

- Because of the need to justify new systems, INPUT issued a companion study, Methods of Cost/Benefit Analysis for Office Systems.

  - This study recommended awareness of management types in order for justification to be consistent with their requirements. While conservative managers require hard figures, more progressive managers are interested in business opportunities and in soft dollar and intangible projections.

  - The most commonly cited intangibles were productivity-linked, value-added benefits.

- Interested readers requiring tangible justification methods are referred to this report, which cautions that the overriding weakness of such techniques is that too much time and money can be spent on the process.

b. Competitive and Corporate Culture Justifications

- Companies may wish show clients their participation in the information age, and awareness of information management as a powerful competitive tool, by implementing M-M.

- The company can also demonstrate to employees its commitment to staff productivity by bringing M-M tools into use.

c. IS and Justification

- By implementing M-M, IS is usually responding to user demands. Accordingly, the IS role in justifying M-M is shared with end users, and this is politically wise.

  - Users must live with the system and the reasons for installation.

  - Users will often try to transfer responsibility for unattained benefits to the justifier.

  - However, IS has a responsibility to educate users on the limits of the technology, and on any controls which must be implemented, such as security measures, which may prevent optimization of M-M links, at least in the users' eyes.

2. PRICING

- Pricing is also related to timing, and is a more practical matter to consider.

  - Currently, M-M products offering substantially similar capabilities range in price from a thousand dollars to over one hundred thousand dollars, with the main differences appearing to be functionality and bundled products/services.

  - With time, the effects of competition will undoubtedly smooth out these vast differences, making possible comparisons based on functionality rather than price.

- M-M implementation pricing should be stated in terms of individual user costs rather than as the total package price. Not only is this lower price easier to comprehend, but it allows evaluation based on the value of each worker's effort and provides a basis for charging costs to end users.

3. TIMING AND RISK ANALYSIS

- Proper timing requires finding the window of opportunity for methods which solve more problems than they create.

- IS runs a risk of implementing M-M too soon with tools which are inadequate for the job at hand.

  - IS must become as skilled at prognosticating as it is at understanding technical issues.

  - IS must meet its professional responsibilities to management by making available productivity tools.

  - IS is also required to use people skills to balance end-user demands with the technologically possible and to make management and users aware of the potential risks, thus sharing those risks.

- The next chapter discusses recommendations for implementation, and offers conclusions on the status of micro-mainframe issues.

VI CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. MICRO-MAINFRAME IS STILL EVOLVING

- M-M products are maturing, but they are often limited to linking with specific existing mainframe software and data bases.
  - This does not present a problem for users of these applications, but for others, M-M implementation often requires customized solutions based on vendor provided tools, or a large-scale revision of entire existing systems.
- Most solutions now available are far from universal. They require programming by IS, vendors, or consultants, to adapt packages to specific environments.
- Universal solutions are elusive because of the various structures, protocols and formats developed over many years which now exist on mainframes.

2. BENEFITS AND PROBLEMS

- M-M benefits to an organization can be substantial.

- The applications development backlog is filled with end-user requests.

- End-user computing, mated to micro-mainframe applications, can effectively reduce this backlog by giving end users the power to build models, extract data, and manipulate information into the form desired.

- This will give IS more productive time and deliver more timely information to corporate users.

- M-M implementation can bring problems caused by misunderstandings, and by the need to plan for the effects of M-M usage on processing, communications, and memory storage.

- M-M does not raise insurmountable problems.

  - Security, for example, can be addressed in IS terms, with passwords, intermediate files where the accuracy of new information can be verified, audit trails, and, if necessary, encryption.

  - Capacity planning can be assisted by implementing in stages while considering each application's demand on resources and planning accordingly.

- For production systems, M-M linkage can mean more timely data reflecting the corporation's true status, regardless of the geographical distribution of data or users.

- For less regular users, such as managers requiring data for occasional reports, M-M offers an effective way of reducing the float between the time information is created and the time it can be used.

3. THE ROLE OF CORPORATE CULTURE

- When setting up M-M, it is important to understand company philosophy.
  - Many firms insist on being on technology's "leading edge," but other firms make no such claims.
  - IS should recognize where a company stands technologically and match this with an understanding of what can be technologically done, and with a recognition of end-user community maturity.
  - From this set of understandings, specific strategies can be developed.
- Exhibit VI-1 summarizes these conclusions.

B. TECHNICAL APPROACHES TO IMPLEMENTATION

- The general steps recommended in planning implementation are:
  - Studying requirements.
  - Considering other alternatives, such as file servers, or Remote Computer Services (RCS) as a interim step.
    - RCS timesharing bureaus offer software to link to their mainframes, permitting data downloading for end-user manipulation.
    - This can provide M-M experience prior to in-house implementation, and time to evaluate internal needs and available options.
  - Evaluating costs.

EXHIBIT VI-1

CONCLUSIONS

- M-M Is Still Evolving
  - Limited Solutions Now Available
- M-M Offers Benefits
  - Reduces Backlog
  - Provides Timely Data
- M-M Problems Are Not Insurmountable
- Strategy Development Involves Corporate Culture Considerations

- Proceeding slowly on implementation.

I. A BEGINNING, DEPARTMENTAL LEVEL APPROACH

- IS should select an important, but technically unambitious user area that:
  - Uses a significant number of standalone micros.
  - Currently rekeys corporate data.
  - Uses data from a software product that has proprietary downloading.
- IS should verify that the department is interested and committed to downloading data, and then should:
  - Analyze the data needed.
  - Provide extract files of needed data.
  - Set up inquiry and/or scheduled downloading, possibly through the Information Center or staff assigned this function. (See below for discussion of the IS role.)
- Throughout the implementation process, IS should carefully explain what is not currently possible using this approach.
- The approach gives M-M development a good start in a controlled environment. With successes behind it, any caution that IS shows toward more ambitious and technically demanding M-M projects will be better accepted.

2. STANDARDS

- Ironically, premature standard setting could be risky since it could lock IS into obsolescent technology.

- Since there are no obvious product winners and since the next generation of products will soon be available, standard setting should be limited.

  - Only a few M-M link products should be used.

  - Where there is significant investment in proprietary software (e.g., from MSA, Cullinet, McCormack & Dodge) that vendor's link package should be used.

  - Implementation should be relatively inexpensive and reversible. The more bound an application is to a current vendor technology and user application, the more difficult it will be to change direction. This, of course, is the vendor's objective.

3. THE INFORMATION CENTER AS A CONNECTIVITY TOOL

- In many minds, the Information Center (IC) has gone into a decline due to microcomputer advances. It may be further eclipsed by M-M linkages.

- As an interim step, the IC has a role to play as a staging area for extract files to be downloaded. Later in M-M implementation, the IC will be bypassed when production data files are used.

- INPUT's report Destiny of the Information Center (1985) examines the IC in detail.

4. AN ON-LINE BATCH STRATEGY--IMPLEMENTING PRODUCTION SYSTEMS

- On-line batch systems are those where micros perform processing, with the micro and mainframe occasionally exchanging data.

- IS departments developing on-line batch systems for production environments must steer a carefully developed course.

  - Micros must be sufficiently isolated from the host so input and output can be viewed essentially as file transfers. This is true even for short, frequent data transfers, such as transactions.

  - However, if micros are too isolated, central control and coordination can be weakened.

  - Exhibit VI-2 shows a conceptual micro applications post-processor interposed between the micro application, the extract data base and the central data base.

  - This closes the gap between microprocessing which is recognized as host transactions, and other data base changes which are not normally host system transactions.

- Exhibit VI-3 shows the key micro-mainframe planning steps.

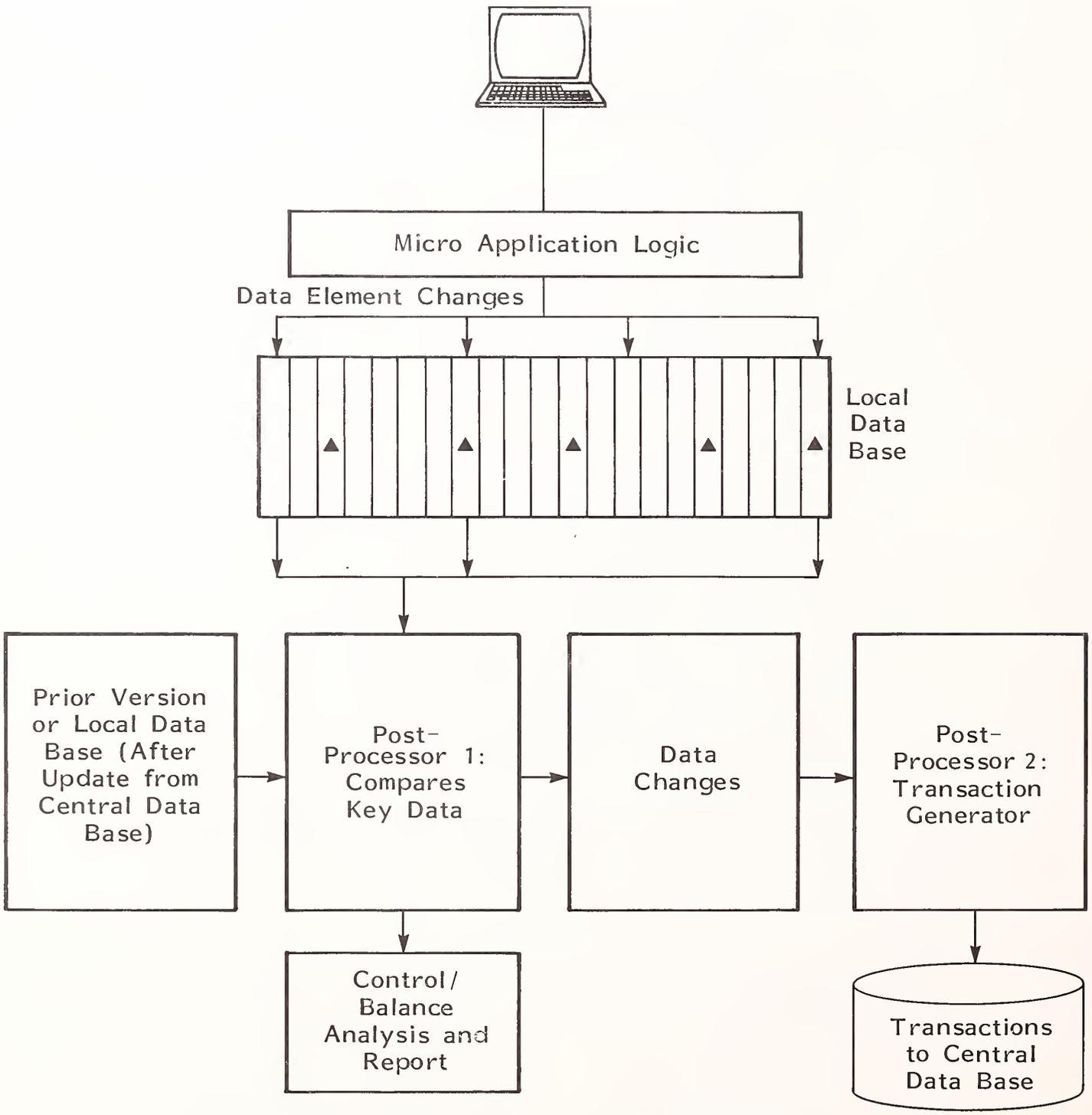
5. IMPLEMENTING INTERACTIVE APPLICATIONS

- Interactive applications are the riskiest to implement because of their complexity, demands on processing and communications, and the measures needed to insure accuracy.

- Interactive applications are feasible, at least experimentally, although it will probably be some time before they are routinely employed.

EXHIBIT VI-2

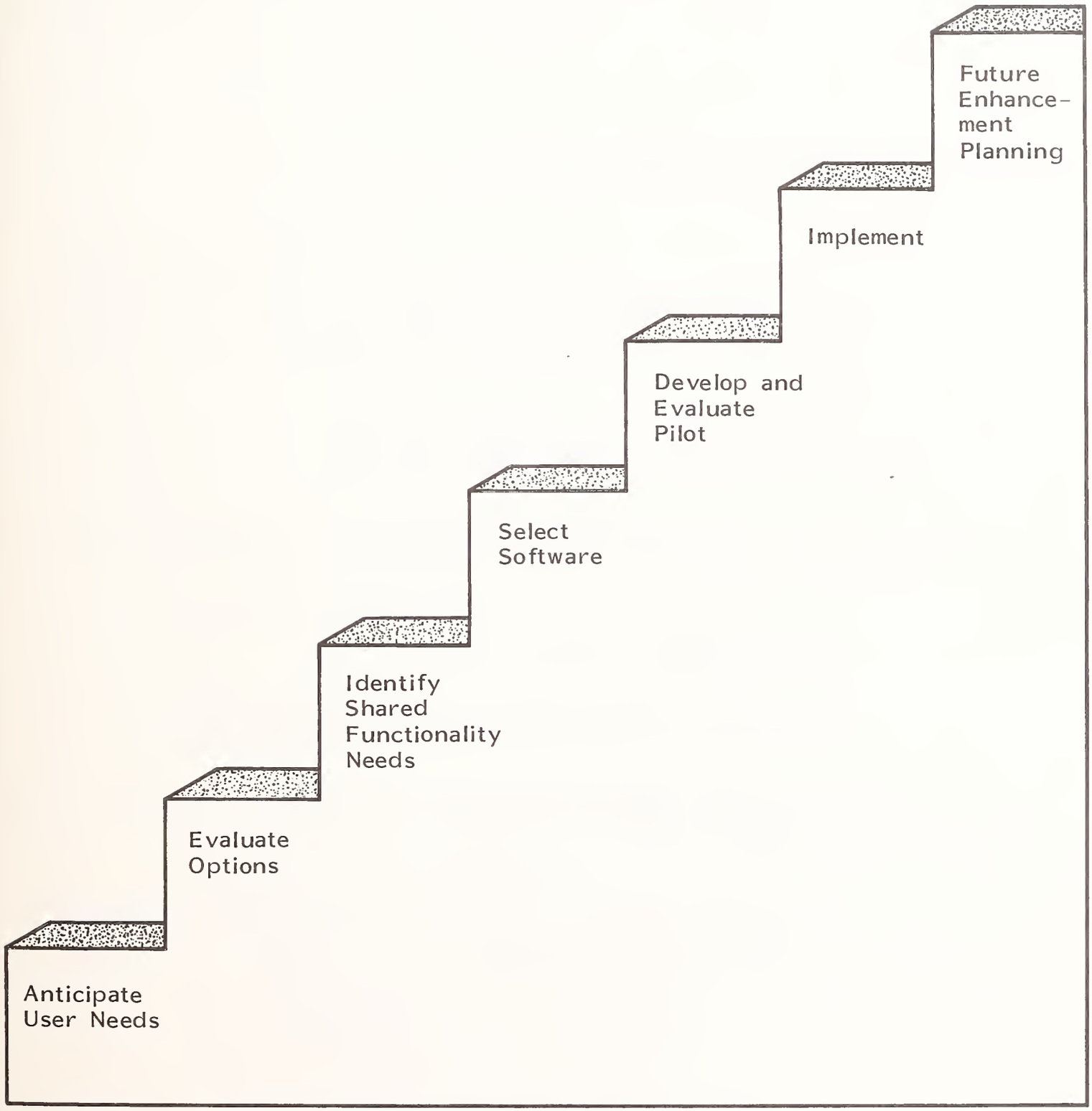
DATA BASE POSTPROCESSOR: LIMITS EXCESSIVE MICRO INDEPENDENCE



▲ = Data Elements Common to Host and Local Data Bases (Key Data Elements)

EXHIBIT VI-3

MICRO-MAINFRAME PLANNING STEPS



- IS should diplomatically question end-user assumptions about M-M need at the highest level and carefully evaluate requests for interactive applications.

- Section D of this chapter describes strategies for working with vendors to reduce risk and allow for implementation of interactive applications in the short term.

C. END-USER RELATIONSHIP BUILDING

- Because of the nature of M-M applications, much of the activity takes place at user, rather than IS locations. This makes the quality of end-user/IS relationships important. Executive-level relationships will generally be even more important.

1. GENERAL IS-USER RELATIONSHIP IMPROVEMENTS

- End users must have confidence in the good intentions and knowledge of IS when IS provides M-M advice. Ways to aid this process include:

  - Regular meetings with key user staff.

  - Frankness on issues and problems, avoiding unnecessary jargon.

  - Semi-technical briefings on IS issues in general and M-M issues in particular.

  - A "marketing" approach to IS services (complete with IS "marketing reps" if resources are available).

- Maintaining documentation on key operational units to understand motives behind system requirements. While written business plans are important, personal contact is even more useful.

2. MICROCOMPUTER SERVICE IMPROVEMENTS

- Microcomputer support has become more important, particularly in light of M-M developments.

  - The more that users (and IS) learn about the micro's true capabilities, the less likely they are to pursue impossible and/or dangerous M-M applications.

  - The micro support manager, reporting to IS, can provide an excellent early warning system on users' M-M intentions.

    . IS can work with users to construct M-M systems acceptable to all.

    . IS has more time to head off poorly considered initiatives.

3. IS ORGANIZATIONAL CHANGES/IMPROVEMENTS

- Many IS organizations are implementing partial or full decentralization of their application-related functions.

  - Corporations may wish to experiment with decentralization approaches to determine which is best; i.e., should the structure be skewed more to the micro or the mainframe?

  - Experimentation enables companies to ease into decentralization. Decentralization can create dangerous organizational upheaval if improperly planned.

- Exact arrangements depend on corporate culture, IS/user relationships, system technical complexity, decentralized unit size, amount of department application independence, and department willingness and/or ability to manage technical functions.

- Exhibit VI-4 shows how IS responsibilities can be assigned in a decentralized environment.

D. VENDOR PARTNERSHIPS

- The adequacy of M-M technical arrangements largely determines success.

- Vendors want to satisfy users. Therefore vendors are willing to work with large IS organizations to find M-M solutions that work in real organizations. Complex projects, such as interactive situations, make vendor involvement particularly important.

- In cooperative arrangements, IS contributes a test facility, machine time, business and systems analysts, and technical support, while vendors contribute technical expertise, advice on alternatives, and product prototypes.

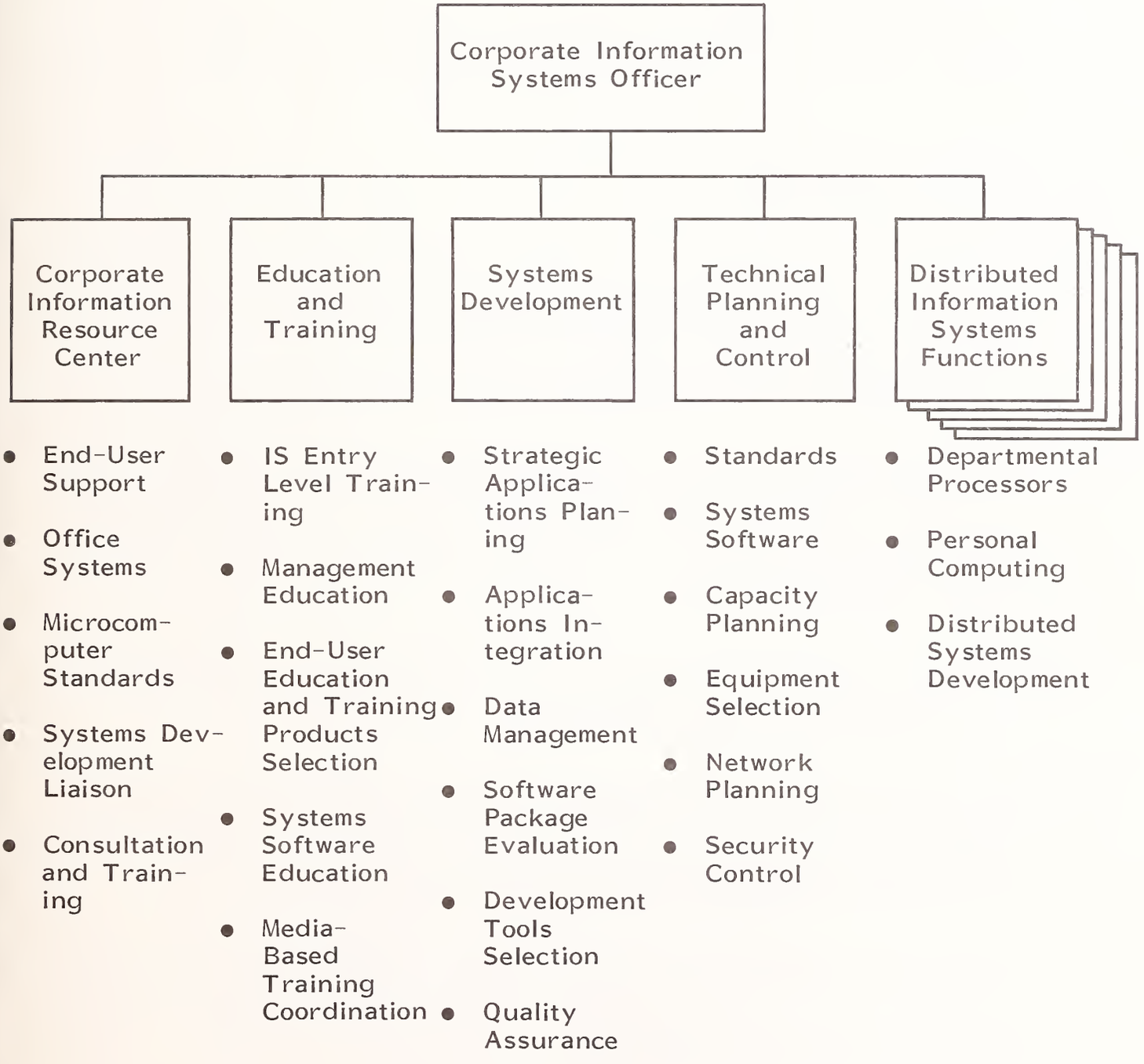
- In this way, corporations can stay on technology's leading edge while solving current business problems. Some limits are often needed.

  - For example, vendors may require nondisclosure agreements on what, after all, could be a valuable product, and both partners may agree not to "raid" each other's personnel.

  - Large vendors have more products and there may be a pre-existing relationship upon which to build. Small vendors may be more innova-

EXHIBIT VI-4

CORPORATE INFORMATION SYSTEMS RESPONSIBILITIES IN A DISTRIBUTED I.S. ENVIRONMENT



tive but also may be more paranoid about secrecy and protecting new product developments.

- Research partnerships that work well can result in permanent business arrangements, with IS active in product development and with the company as a whole possibly becoming an investor in promising vendors.

- Exhibit VI-5 summarizes INPUT's implementation recommendations.

E. FOCUS ON THE GOAL

- IS needs to evaluate requests for M-M applications carefully, and question the assumption that advanced, two-way data flows to and from the mainframe, without the safety of intermediate processors, are really necessary.

- INPUT believes that current attention on micro-mainframe technologies and issues really focuses on an intermediate step, and that many existing products are likewise interim solutions to the problem of making information available to those who need it.

  - Interim solutions, including those developed in house, may be needed in the absence of satisfactory products.

- The current bottom-up end-user demand for M-M which benefits personal processing directly, and corporate information management indirectly, needs to be validated by top-down corporate planning.

- IS should not lose sight of its central goal of meeting current and future information demands, for the productive and competitive benefits to, and perhaps survival of, the corporation.

EXHIBIT VI-5

IMPLEMENTATION RECOMMENDATIONS

- Study Requirements
- Consider Alternatives
  - File Servers
  - RCS as an Interim Step
- Proceed Slowly
- Low Risk Implementation on a Departmental Basis
- Approach Risky Interactive Applications Carefully
- Improve Relationships
- Consider Organizational Changes
- Form Vendor Partnerships

APPENDIX A

MICRO - MAINFRAME USER QUESTIONNAIRE

1. With 1 representing "disagreement" and 5 representing "agreement", to what extent do you agree that "within five years most applications that are now host-based will have a considerable amount of funtionality taken over by personal computers that are linked to the host."? Why?

   _____

   _____

2. INPUT is defining "on-line batch" micro-to-mainframe linkages as those linkages where the micro performs processing on a standalone basis and, periodically, the micro and the host exchange data. The host may then futher process the data received.

   Given this definition, do you believe that links between host computers and micros will be predominately interactive, predominately on-line batch, or about the same?

   _____ Predominately interactive

   _____ Predominately on-line batch

   _____ About the same

   Why? _____

   _____

3. a. With 1 representing extreme centralization and 5 representing extreme decentralization, how would you rate your information systems function?

      _____

   b. With 1 representing "no impact" and 5 representing "great impact", how would you rate the impact of micro-to-mainframe applications on moving a company like yours toward a more decentralized information systems function?

      _____

      Why? _____

      _____

4. a. With 1 representing "no assistance" and 5 representing "much assistance", how much assistance do you expect to be able to get from vendors in helping to plan and implement your organization's critical micro-to-mainframe applications? _____

b. More specifically, how would you rate: (1-5 with 5 good)

VENDOR TYPE	RATING
IBM	_____
Microcomputer hardware vendors	_____
Software vendors who primarily offer mainframe software	_____
Software vendor who primarily offer micro software	_____
Remote processing (timesharing) vendors (e.g., McAuto, Boeing)	_____
Turnkey systems vendors	_____
Professional services and consulting firms	_____

Next, I am going to describe several approaches for contructing micro-to mainframe applications and I would like you to rate each on a 1 to 5 scale with 1 representing "not common" and 5 representing "very common".

5. The first approach I would like you to rate concerns . . .

a. . . .modifications of existing applications systems.

1.) How common do you think modifications of this type will be done solely by the vendor? _____

2.) How common do you think modifications of this type will be done solely by in-house information systems staff _____

3.) How common do you think modifications of this type will be done jointly by vendors and in-house information systems staff _____

b. . . . writing new applications that use existing and data base(s):

1.) How common do you think modifications of this type will be done solely by the vendor? _____

2.) How common do you think modifications of this type will be done solely by in-house information systems staff? _____

3.) How common do you think modifications of this type will be done jointly be vendors and in-house information systems staff? _____

5. Finally, I would like you to rate the approach that concerns. . .

   c. . . .writing new applications that use new files and data base(s):

      1.) How common do you think modifications of this type will be done solely by the vendor? _____

      2.) How common do you think modifications of this type will be done solely by in-house information systems staff? _____

      3.) How common do you think modifications of this type will be done jointly by vendors and in-house information systems staff? _____

6. a. For your own organization, what specific applications do you see as being the most suitable as micro-to-mainframe applications? (They need not be computerized applications now.) (Use work space below.)

   b. Are these applications planned and if so, at what stage are you implementing them? (Planning stages: no concrete plans, planning, applications being developed, applications already implemented.)

   c. Do you expect to develop these applications in-house, purchase an existing package from an outside vendor, or modify in-house an existing package?

			STAGE:			SOURCE:		
CODE	APPLICATION NAME	NONE	PLAN	DEVL.	IMPL.	IN-HOUSE	VENDOR	BOTH
_____	1. _____	____	_____	____	_____	_____	_____	_____
_____	2. _____	____	_____	____	_____	_____	_____	_____
_____	3. _____	____	_____	____	_____	_____	_____	_____
_____	4. _____	____	_____	____	_____	_____	_____	_____
_____	5. _____	____	_____	____	_____	_____	_____	_____

Comments:

1. _____
2. _____
3. _____
4. _____
5. _____

7. a. In order of importance, with the first being the most important, what do you consider to be the top three problems solved or alleviated by micro-to-mainframe systems?

CODE

1. _____ _____

2. _____ _____

3. _____ _____

b. In order of importance, with 1 being the most important, what do you consider to be the top three problems caused by micro-to-mainfram systems?

1. _____ _____

2. _____ _____

3. _____ _____

c. What can your organization do to solve each of these problems?

1. _____ _____

2. _____ _____

3. _____ _____

d. What can vendors do to solve each of these problems?

1. _____ _____

2. _____ _____

3. _____ _____

On a scale of 1 to 5, with 1 = low importance and 5 = high importance, How important will it be for . . .

8. a. . . . your company's micros to be connected with mainframes within your company? _____. Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Dial up

_____ Leased Lines _____ Public Data Network _____ WATS

_____ Other _____

8. b. . . . the same micro to link to more than one brand of mainframe at different times? _____. Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Dial up

_____ Leased Lines _____ Public Data Network _____ WATS

_____ Other _____

How important will it be for . . .

c. . . . your company's micros to be connected with micros in other departments? _____. Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Dial up

_____ Leased Lines _____ Public Data Network _____ WATS

_____ Other _____

d. . . . your company's micros to be connected with mainframes in other companies? (e.g., subsidiaries', suppliers', or customers') _____.

Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Dial up

_____ Leased Lines _____ Public Data Network _____ WATS

_____ Other _____

e. How important will it be for your company's mainframe to be connected with micros outside of your company? _____. Why this Rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network _____ Dial up

_____ Leased Lines _____ Public Data Network _____ WATS

9. a. What telecommunications operating system(s) do you have?

_____ TSO _____ CMS _____ CICS _____ IMS DC

Others: _____

b. Which of these will require micro links by 1987?

_____ TSO _____ CMS _____ CICS _____ IMS DC

Others: _____

10. a. What data base management systems do you have?

_____ IMS _____ IDMS _____ ADABAS _____ TOTAL

Others: _____

b. Which of these will require micro links by 1987?

_____ IMS _____ IDMS _____ ADABAS _____ TOTAL

Others: _____

11. a. Do you expect microcomputer use in your company to accelerate the use of mainframe-based relational data base management systems in your company? _____ YES _____ NO (If NO, skip to next number)

b. Which one(s)? _____ DB2 _____ MDBS III _____ BASIS

Others: _____

12. a. Do you expect microcomputer use in your company to _____ Increase _____ have no effect on _____ Deacrease your mainframe processing requirement by 1987?

As a percentage of your current mainframe processing capacity, what percentage change do you expect in mainframe processing demand to result from microcomputer use by 1987? _____%

b. Do you expect microcomputer use in your company to _____ Increase _____ Have no effect on _____ Decrease your mainframe disk storage requirement by 1987?

As a percentage of your current mainframe disk storage capacity, what percentage change do you expect in mainframe disk storage demand to result from microcomputer use by 1987? _____%

(For Number 13, 13a. should equal the sum of 13b, 13c, and 13d)

		NUMBER INSTALLED NOW	NUMBER BY 1987
13. a.	How many micros do you have total in your company now? 1987?	_____	_____
b.	How many of these are used as standalone units now? 1987?	_____	_____
1)	How many Local Area Networks do you have now? 1987?	_____	_____
2)	How many of these LANs have communication links to a mainframe or minicomputer now? 1987?	_____	_____
c.	How many of your micros are used in Local Area Networks now? 1987?	_____	_____
d.	Excluding those micros used in LANs, how many of your micros are connected to a mainframe or minicomputer now? 1987?	_____	_____

14. Of all your micros which are connected to the mainframe, about what percent are used solely for terminal emulation now? 1987?

_____% Now _____% 1987

15. Of all your micros, about what eprcent are in use by computer professionals versus "end-users"?

    I.S. Professionals _____% + End Users _____% = 100%

16. a. Do you have any multiuser microcomputer systems? _____ YES _____ NO (if no ask for 1987)

    b. How many multiuser microcomputer systems (e.g., AT, Altos) do you now have installed? How many do you expect to have installed by 1987?

    Now _____ 1987 _____

    c. How many multiuser microcomputer systems have communications links to a mainframe or minicomputer? How do you expect will have links by 1987?

    Now _____ 1987 _____

17. On a scale of 1 to 5 with 1 = "Low importance" and 5 = "High importance", how important do you see UNIX-based systems being to your organization's plans? _____ Why? _____

    _____

    _____

THANK YOU

Interviewer: (Rate the interviewww's disposition as a source for additional information on the topic of micro-to-mainframe)

_____ Very informative

_____ Informative

_____ Not very informative

APPENDIX B

MICRO - MAINFRAME VENDOR QUESTIONNAIRE

Name: _____

Company: _____

Address: _____

Title: _____

1. How would you define the micro-mainframe market? _____

_____

2. How large is it? 1984 dollar growth rate? _____

_____

WHERE DO YOU FIT?

3. What micro-mainframe products do you currently offer? _____

_____

4. What are their prices? _____

5. Future products? _____

_____

6. What was your total company revenue in 1984? _____

7. What was your revenue from micro-mainframe products? _____

8. How many units of _____ did you ship? _____

9. What percent of your micro-mainframe sales are direct versus through retail or other channels? Will this change, if so how? _____

_____

COMPETITION

10. Who are your top three competitors in the micro-mainframe market?

11. Can you estimate 1984 market share? Units or expenditure installed base?

12. Who will be most successful in the near future? Why?

STRATEGIC ISSUES

13. Key issues and trends in the micro-mainframe market?

14. Is support an issue? Why?

15. Has your company developed alliances with other firms to develop or market micro-mainframe software? Who? In the future?

16. Will data interchange standards emerge? If so, how will they impact the micro-mainframe market?

17. What will IBM do in the micro-mainframe market? Will they be a threat to you?

_____

_____

18. Bundling links as part of standard mainframe or micro package? _____

_____

19. Generic links versus specialized mainframe data base vendor link?

_____

_____

20. Any new opportunities you see in the market? _____

_____

Comments: _____

_____

_____

Name of someone in product technical support? _____

_____

THANK YOU

APPENDIX C: CORPORATE RESPONDENT PROFILE

- The 129 corporate respondents were in the following industrial sectors:
  - Discrete manufacturing - 9.
  - Processing manufacturing - 15.
  - Transportation - 7.
  - Medical - 4.
  - Services - 8.
  - Distribution - 16.
  - Utilities - 3.
  - Banking - 28.
  - Insurance - 4.
  - Federal government - 7.

- State and local government - 23.

- Other - 5.

- Small corporations (revenues under $250 million) accounted for 42 of the respondents.

- Mid-sized companies (revenues between $250 million and $1 billion) accounted for 31 of the respondents.

- Large companies (revenues over $1 billion) accounted for 42 of the respondents.

- The balance (14) were unrecorded.

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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