METHODOLOGIES FOR IT DOWNSIZING

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Abstract

One year ago, the information services industry was awash with stories and reports on the technological and cost benefits of downsizing. The IS trade press in particular gleefully printed solutions and success stories that placed downsizing on a very high pedestal. One year later, downsizing has become an undervalued IS methodology, synonymous with technological, organizational, economic and political difficulties.

Downsizing itself can be viewed as either a corporate strategy or a tactical approach in the IS department's ongoing struggle to make effective use of information technology. It is this issue that has caused a credibility gap between IS departments and their corporate organizations, who are dubious about if and how downsizing should proceed. This report discusses the background, motivation for and expected benefits of downsizing. It provides an historical framework for fathoming downsizing issues, and describes and analyzes the four management factions that can inhibit or help corporate downsizing efforts.

Downsizing has already proved beneficial for many, but there remain unresolved issues and forthcoming changes that must be considered for downsizing to properly take place. Specifically, IS management and vendors must realize that downsizing is a concerted methodology with definable and desirable goals. It is not necessarily a means of cutting costs. Instead, it is a shift in the management mind-set away from centralized computing and toward the realization that humans must have empowerment through access to information, which will allow them to more effectively contribute to corporate success. To further this assertion, this report gives recommendations for IS managers and vendors on how to proceed in the downsizing market and take advantage of downsizing benefits.

This report contains 82 pages and 14 exhibits.

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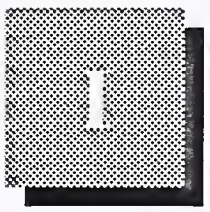
Exhibits



Introduction

As INPUT's research on downsizing has proceeded over the last year, it is clear that the major issue involved is the credibility gap between the IS department and the rest of the organization. From the general euphoria of a year ago, when the trade press was full of solutions and downsizing success stories, INPUT now finds the dirty side of downsizing being reported. Here are some of the problem areas:

- The IS staff and users may resist downsizing.
- New staff and new skills are required.
- It is difficult to align downsizing with corporate goals.
- Few development packages are available for client-server.
- The lack of integrated tools forces the use of many different products.
- Replacing mainframe screens and reports can be long and laborious.
- Building GUIs is slower and harder than building a mainframe application.
- Security, recovery and backup are less mature than on mainframes.
- Coordinating multiple vendors is a major obstacle.
- Failures on PC nodes are much harder to isolate, and some LANs are too slow for the downsized environment.

Downsizing was overrated, but now is undervalued by some of the trade press. This overrating-undervaluing cycle is well established in the computer industry, and is not surprising anyone with its historical perspective.

Making effective use of new information technology has always been more difficult than advertised or admitted by vendors. There is always a lot of dirty work for someone to do, which has usually fallen on the IS department. It is interesting that some resistance to downsizing is reported on the part of the IS staff and end users. It is apparent that at least some of the downsizing dirty work is distributed to users. Hopefully, this will result in a better understanding of the effort required to make effective use of information technology. Also, IS will not have to bear full responsibility when seemingly simple solutions to complex problems do not work as advertised.

INPUT's downsizing research to date has revealed how complex and difficult the effective implementation of downsizing can be in technical, organizational, economic and political terms. This report will examine how various organizations manage their downsizing efforts, and determine the methodologies and tools that are employed during implementation.

A Objectives

This report has the following major objectives:

- To determine whether IS departments see downsizing as a corporate strategy or a tactical approach in the unending struggle to make effective use of information technology.

- To determine how downsizing projects and/or programs will be (or have been) managed, with emphasis upon the following:

  - How systems and data quality will be maintained as downsizing proceeds.

  - How users are involved in the downsizing process.

  - How corporate, user and IS management will share direction, control and responsibility for the downsizing effort.

  - How the downsizing effort will be staffed, and the effects this will have on the IS and user departments during the transition period and after downsizing is completed.

  - The methodologies and tools that will be employed during the downsizing process and the operation of the resulting network and information architecture.

- To identify critical information technology dependencies associated with the business objectives of the organization, especially as they relate to the downsizing and decentralization of corporate functions to operating units of the organization.

- To identify critical changes in the management mind-set necessary to effectively use the information technology required to downsize the numerous levels in the organizational hierarchy.

- To identify preferences for specific platforms, tools and methodologies to implement downsizing.

- To correlate the use of these platforms, tools and methodologies with success or failure of the downsizing effort.

B

Methodology and Scope

1. Methodology

This is the fourth report in INPUT's downsizing program. The research conducted for the first three reports, *Putting Downsizing in Perspective*, *Systems Architectures for Downsizing*, and *Case Studies in Downsizing*, provided a solid foundation for this effort, and enabled INPUT to qualify the additional information sources necessary to support the research program for this study.

- A questionnaire addressing the management, methodologies and tools employed in the downsizing effort was mailed to the same sample used in our original downsizing research. This permitted us to complement and supplement the existing downsizing data base.

- Twenty additional executive interviews, addressing the current management and methodological issues, were conducted by telephone with some of the case study companies included in INPUT's earlier downsizing case study report. Originally, INPUT planned to interview only IS executives, but during the course of the research INPUT determined that it would conduct half of the interviews with users. The emphasis in all of the executive interviews was the strategic importance of downsizing in aligning the information architecture with business objectives.

- A comprehensive computer literature search was conducted to determine trends in the use of downsizing platforms, methodologies and tools over the last two years.

- In addition, INPUT made a thorough review of past research on the effective management of major systems projects, including the selection of tools and methodologies.

2. Scope

The scope of this study provides general guidelines for the organization and management of the downsizing process, including the selection of tools and methodologies. Rough correlations between downsizing success or failure and the platforms, methodologies and tools employed during the transition are also supported within the scope of this study.

The use of, and need for, specific methodologies and tools can be identified, but detailed functional analysis of use and/or requirements was specifically excluded from this study. Therefore, this study supports general market analysis for products and services, but excludes market forecasts.

This study also provides a good foundation for analyzing the organizational and management effects that can be anticipated as innovative information technologies and architectures evolve during the 1990s. Specifically, the changing roles of corporate, user, and IS management have been included in the scope of this study.

C

Report Structure

A brief description of the organization of the report is as follows:

- Chapter II, Executive Overview, provides a brief summary of research findings, analysis, conclusions and recommendations of the report.
- Chapter III, The Importance of Methodology in Downsizing, reviews previous downsizing research that supports the importance of selecting the right methodology in tactical and strategic downsizing efforts.
- Chapter IV, Management Issues in Downsizing, analyzes the need to align the new information architecture with business objectives and to realign management with the new information architecture.
- Chapter V, Technical Issues in Downsizing, provides a framework for understanding the inherent major technical issues in downsizing, and the required methodologies and tools for effective implementation.

- Chapter VI, Strategic Implementation Issues, integrates the selection of methodologies and tools with the goals and objectives of the downsizing effort, with special emphasis upon meeting business objectives.

- Chapter VII, Methodologies and Tools, presents the actual use and/or need for specific methodologies and tools to implement downsizing and achieve the benefits of a new information architecture.

- Chapter VIII, Conclusions and Recommendations, presents specific conclusions and recommendations concerning the alignment of downsizing implementation strategies and tactics with management and business objectives.

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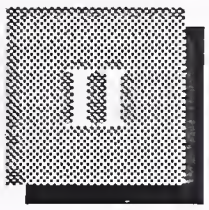


Executive Overview

A
Background and Methodology

This is the fourth in a series of downsizing reports that have been published by INPUT over the last year. The first three, *Putting Downsizing in Perspective*, *Systems Architectures for Downsizing*, and *Case Studies in Downsizing* were published in the first three quarters of 1992. They provide valuable background information for this study.

This study was designed to determine the methodologies being employed in information technology downsizing. The basic research plan was to supplement and complement the research base for the earlier downsizing studies. This involved mailed questionnaires to update and extend the data obtained in 1991 for *Putting Downsizing in Perspective*, and telephone interviews with IS executives in organizations included in *Case Studies in Downsizing*.

In addition, all INPUT research efforts are supported by continuing desk research of pertinent published information. There was an enormous increase in the volume of published information on downsizing during 1992, and much of it contained conflicting opinions.

Then, current research led INPUT to the conclusion that there was no single systematic body of procedures and techniques that characterized downsizing. There were several factions outside the IS department that used different downsizing approaches and methodologies. In order to identify and classify these factions, INPUT conducted interviews with users and IS departments. These interviews provided a fresh perspective on the downsizing research performed with IS departments and vendors.

Finally, one of the big downsizing stories of 1992 was IBM's disastrous 1992 results and subsequent management changes. Convinced that IBM's misfortunes were a direct result of the downsizing revolution, INPUT interviewed several IBM and ex-IBM employees to further supplement trend analysis.

B

Management, Technical and Implementation Issues in Downsizing

1. Management Issues

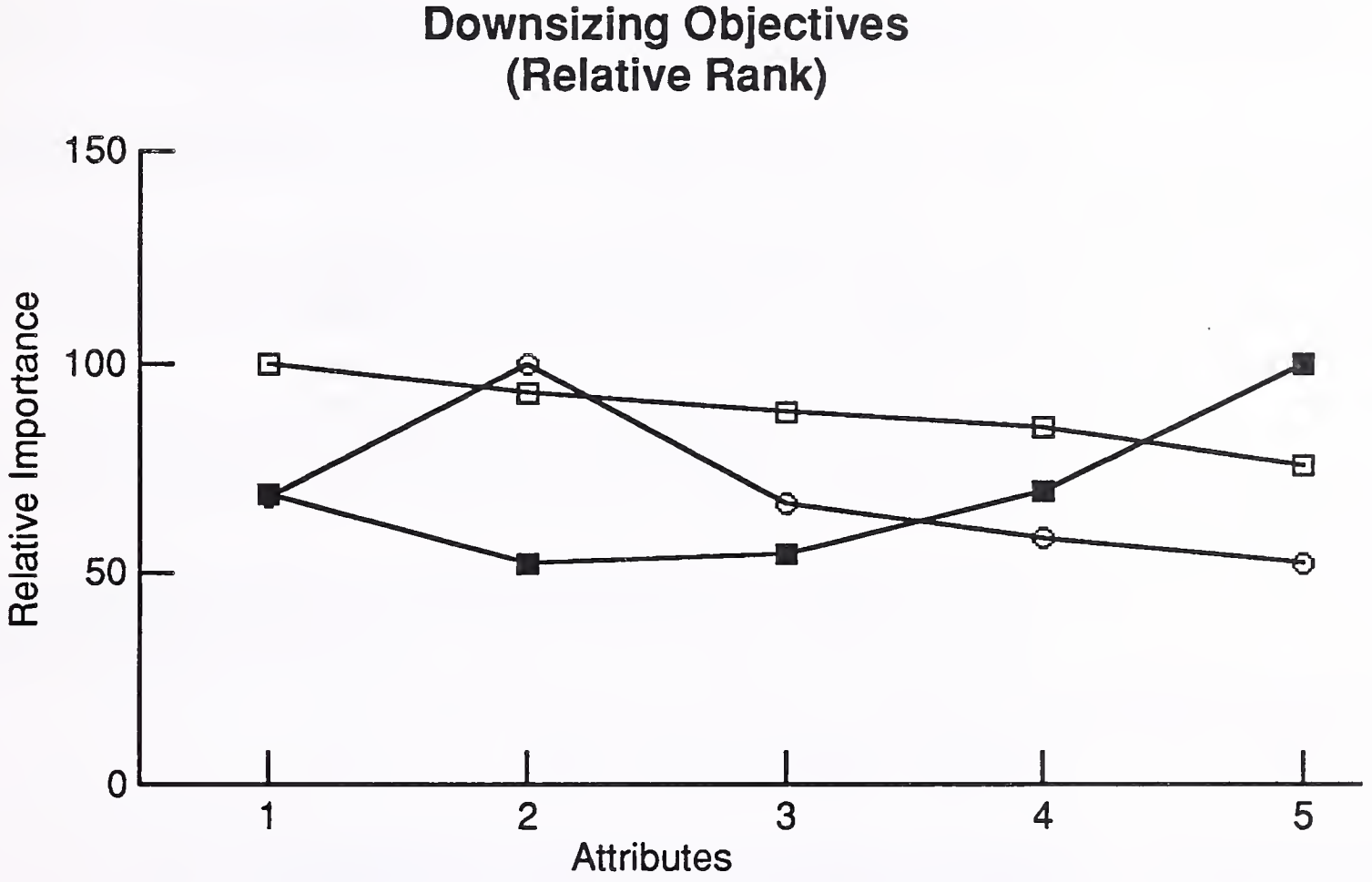
One of the primary management issues in downsizing is that the IS department is being asked to essentially work itself out of a job. Research for this study shows that the funds to implement downsizing flow toward the IS department, but the savings as a result of downsizing are expected to come from the IS department. It is difficult to motivate management or employees to work hard when the end result is the downsizing of their own department.

There are other indications that morale in the IS department may be a problem as downsizing proceeds. INPUT asked respondents to rate corporate management's satisfaction with several aspects of IS department performance, and the results were not encouraging. On a scale of 1 to 5 (where 1 ranks low and 5 high), responses fell within a very narrow range between 2.4 and 3.3.

This indicates a median level of confidence that the IS department is performing to management's satisfaction. More detailed analysis reveals that IS has direct control of the lower-rated factors (such as application development costs, mainframe hardware-software costs, and decision support systems) and less direct control of the higher-rated factors (such as the quality of management reports and auditing).

Another major management issue is the disagreement on downsizing objectives. IS management feels that corporate management is primarily interested in reducing data center costs, and end users are primarily interested in increasing their control of information technology. There is no single methodology for downsizing in most companies, and there is no general agreement on objectives. Exhibit II-1 presents a ranking of downsizing objectives.

EXHIBIT II-1



Key	Attribute	IS	Execs Objectives	Users
1	Better Information	100.0	68.1	68.8
2	Lower Data Center Costs	92.9	100.0	52.8
3	Lower Applications Development Costs	88.2	66.4	54.7
4	Improve Productivity	84.7	58.5	70.1
5	User Control	75.5	52.3	100.0

2. Technical Issues

Content analysis of published information on downsizing indicates that there is no consensus on a number of major technical issues. Based on this analysis, it is possible to generalize and say that easy solutions to technical problems are usually found in vendor-sponsored documents, but professional journals refute these solutions.

Among the downsizing technical issues that remain open are the following:

- There is currently no commonly accepted architecture or tool set for the proper distribution of processing and data over networks.
- There is no reliable methodology for doing a comprehensive cost/benefit analysis of downsizing.
- There is no consensus on the severity of, and solution to, problems of data base synchronization, integrity and security in a distributed downsized environment.
- The reliability, availability and serviceability of PC and RISC hardware-software technologies in client-server networks compared to mainframe-oriented SNA networks is still disputed.
- There are trade-offs between functionality and ease-of-use that complicate the relative merits and advantages of mainframes and downsizing platforms.

3. Strategic Implementation Issues

There are a number of strategic implementation issues that remain open around the methodologies employed for downsizing. These issues were identified by interviews with IS and user management. Among the most important are:

- IBM's reputation as a "safe choice" has gone from being overrated to undervalued in a very short period of time. Before it required additional effort to justify a solution other than IBM, and now the opposite is true.
- Questions of open versus proprietary systems remain, and the relative benefits and advantages are not clear to either IS or user management. However, even the mention of SAA has become politically unacceptable, and everyone is at least considering open systems—even if they are installing proprietary systems.
- The decision to convert versus re-engineering applications when downsizing remains a strategic implementation issue. However, INPUT research reveals that conversion is favored only when mainframes are replaced, and re-engineering is favored when applications are downsized.

- The appropriate use of in-house resources versus outside services when downsizing remains an issue. It appears that IS will go outside only when resources like network installation and management are not available internally. In fact, the expense of outside processing services is used as justification for downsizing to internal systems.

- The methodology employed in downsizing will determine the impact on people and the economy. The information technology being installed is resulting in technological unemployment among all strata of white collar workers. Questions are being raised as to whether any long-term recovery from the recession can occur when it is becoming clear that jobs are still disappearing. How this issue is addressed, and by whom, will affect implementation strategies and anticipated benefits.

C
Methodologies and Tools for Downsizing

However well regarded the IS department is by either corporate management or users, it has been given responsibility for downsizing mainframe applications.

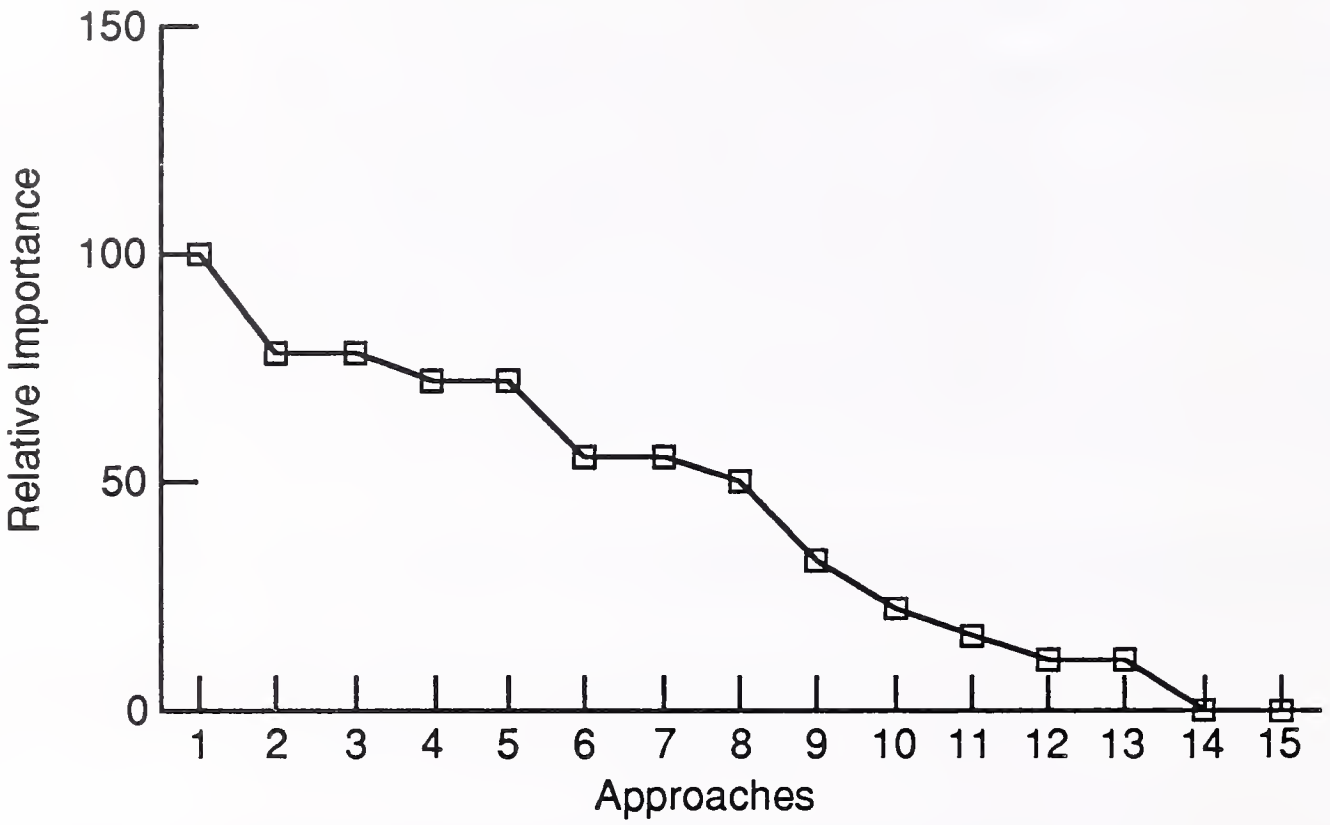
The relative importance assigned by IS management to various downsizing approaches is presented in Exhibit II-2. Clearly, the emphasis is upon:

- Retaining mainframes and central data bases

- Establishing operating and data base standards

- Re-engineering downsized applications to take advantage of more cost-effective processing, while retaining control of distributed data

EXHIBIT II-2

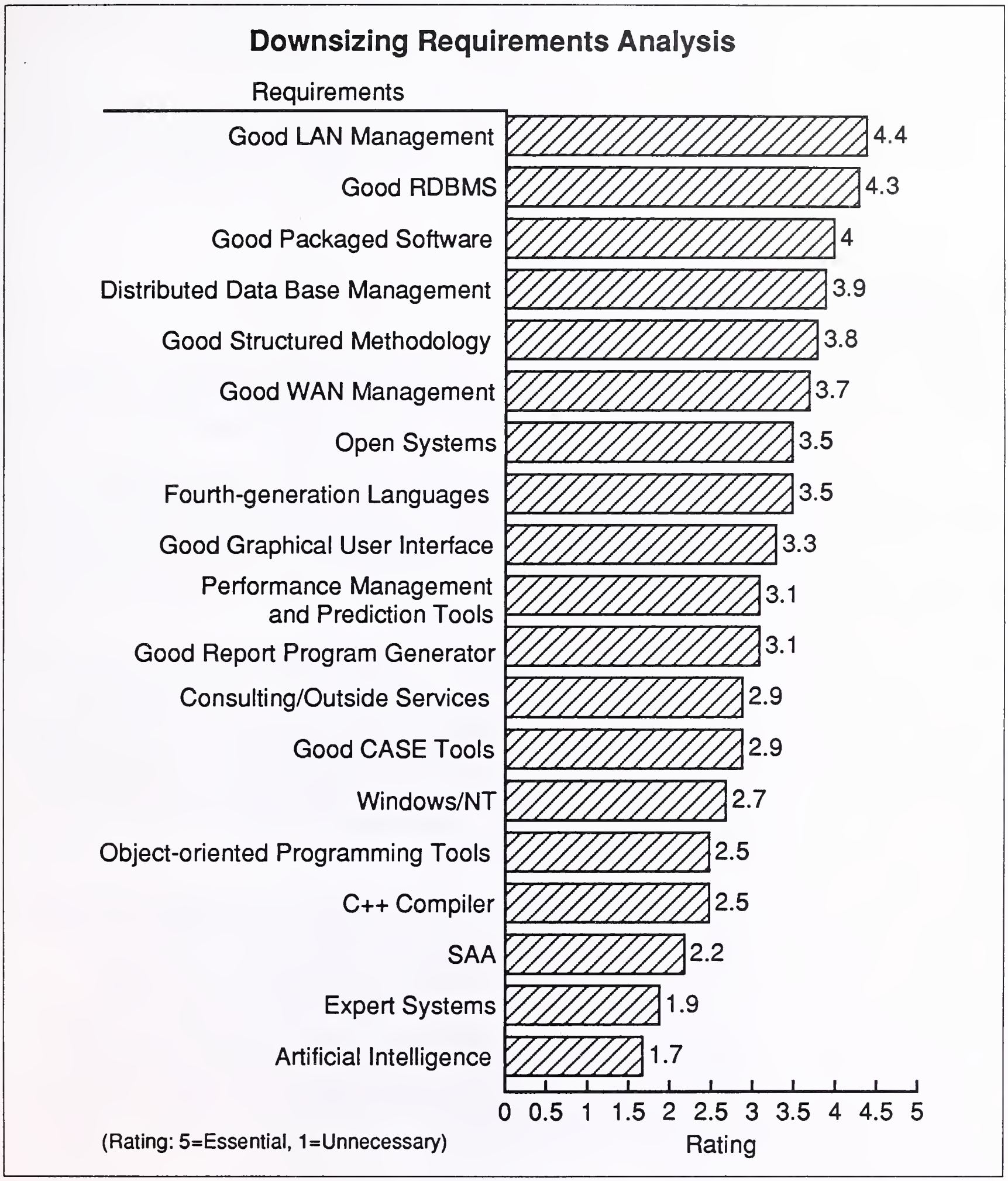


Key	*Approaches*	*Percent*
1	Specific Applications	100.0
2	Re-engineering	77.8
3	OS Standardization	77.8
4	Distribute Process Control Data Bases	72.2
5	DBMS Standard	72.2
6	CASE	55.6
7	Open Systems	55.6
8	LAN User Budgets	50.0
9	LAN User Access & Responsibility	33.3
10	Mainframe Billing Adjustment	22.2
11	Replace Mainframe Platforms	16.7
12	Distribute Data Base Administration to Users	11.1
13	SAA	11.1
14	Quick & Dirty Conversion	0.0
15	Outsourcing	0.0

IS management's ratings of the tools required to implement their approach to downsizing is presented in Exhibit II-3. These ratings reflect the importance of:

- Network management
- Data base management
- A top-down methodology
- The availability of packaged software on downsized platforms

EXHIBIT II-3



In addition, IS management presents a politically correct position by rating open systems as substantially more important than SAA in implementing downsizing. They also feel that expert systems and artificial intelligence are unnecessary when re-engineering downsized applications.

IS has adopted an extremely conservative downsizing methodology that is designed to maintain data base quality and control. While the emphasis on maintaining data base quality is necessary and commendable, this methodology does not support several user factions that are intent upon downsizing.

D

The Four Downsizing Factions

Analysis of all of the research that went into this study (the IS questionnaires, published information on downsizing, and interviews with both IS executive and users) identified four distinct downsizing factions.

- The "Data-Centered Control Faction" is a result of a long-standing coalition between IBM and IS. The downsizing methodology employed by IS, as described above, retains the highly-centralized mainframe orientation that has characterized IBM's networking strategy for the last 20 years. This is as close to business-as-usual as one can get in the downsizing revolution.

- The "Compute Intensive Faction" has had a long-standing battle with the IBM-IS coalition. The availability of RISC workstations settled that battle once and for all. Compute-intensive applications have been (and are being) downsized from IBM mainframes with or without the consent of the IS department. Now this faction wants to replace mainframes for administrative processing. IS feels threatened by this faction, and for good reason, as engineers and scientists understand more about computers than the IS department does.

- The "Knowledge Intensive Faction" consists of management and professionals who have become computer literate enough to recognize that personal computers can be used to assist them in more substantive portions of their work—with decision making and the knowledge-intensive aspects rather than just with personal productivity and accounting. This requires symbol processing and logic in addition to straight arithmetic. Knowledge-based systems are more complex to build, and the Knowledge Intensive Faction needs help. INPUT's user interviews indicate they aren't getting it from IS, and the Data-Centered Control Faction's downsizing methodology isn't going to help them very much.

- The "Empowerment Faction" has found that personal computers and productivity tools aren't of much use unless they have easy access to data; and despite claims to the contrary, they don't have it. In fact, this faction is experiencing great difficulty in just exchanging data among themselves. Their answer is upsizing to a client/server environment, but much of the required server data still has to come from corporate data bases on mainframes. The IS methodology for downsizing is not designed to empower, but rather to control the increasingly chaotic environment that has already been created by downsizing.

Downsizing is all about the effective use of information technology. While the current status of downsizing is quite chaotic, all the factions are pursuing that goal. The IBM-IS coalition, which inhibited the effective use of emerging technologies for so long, has been broken. However, both parties to that coalition still have significant roles to play in bringing together and supporting all four of the downsizing factions. If companies are to survive the downsizing revolution, more effective use must be made of information technology that will require a cooperative effort of all four downsizing factions.

Specific conclusions and recommendations are contained in Section IX of this report.

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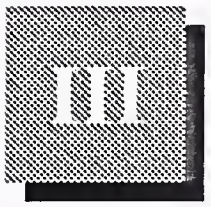


The Importance of Methodology in Downsizing

Downsizing is the breaking wave of the future—the first visible sign of where the information age is taking us. From White Plains to Palo Alto, old hierarchical organizational structures and their paper-pushing bureaucracies are being downsized because they are bottlenecks in the new electronic networks that tie together the global village. Humans are being directly connected to the electronic network because that is the only way they can get to work in the global village. It is apparent that the very nature of work and management will change as downsizing proceeds, but it is not yet clear what this is going to mean to either the individuals or institutions involved.

With downsizing as the medium of change, the message is clear—get more done with less! "Leaner and meaner" is the business and management objective of downsizing, and that objective depends upon information technology.

INPUT research reveals that not many IS executives feel very comfortable with this ideal. They simply don't know how, or whether, the management objectives of downsizing can be accomplished. The technological course of action is far from clear and fraught with danger. However, the approach to downsizing, the methodologies adopted, and the management of the downsizing process will determine the future success or failure of many enterprises.

The following is a brief review of INPUT's earlier downsizing research which leads to this conclusion.

A
Review of Previous Downsizing Research

1. Putting Downsizing in Perspective

INPUT's initial downsizing research revealed that the primary factors prompting the trend toward downsizing were: 1) to cut total information systems costs, 2) to take advantage of the better price-performance of new information technology, and 3) to reduce systems development costs. Because all these factors are under the control of the IS department, the emphasis upon downsizing can be interpreted as a general statement of dissatisfaction with the current information architecture, its costs and the IS department itself.

The original research also revealed that, despite the emphasis upon reduced costs, actual downsizing projects were not expected to achieve these desired benefits. This would obviously only tend to reinforce any negative attitude that previously existed about the IS department, and, the dimensions of the IS department dilemma began to become quite clear. That dilemma may be briefly summarized as follows:

There are two types of downsizing - organizational downsizing and technological downsizing. Organizational downsizing reduces headcount, and depends upon improved white-collar productivity, which in turn depends upon the application of new information technology at the work unit level.

This new technology is more cost-effective and easier to use than installed mainframe technology; also, many software applications are readily available. Therefore, replacing existing mainframe systems will reduce IS costs enough to support the installation of new information technology at the working level of the organization. This will result in the decentralization of many current IS functions to end users. The final product will be the "leaner and meaner" organization necessary to compete in the 1990s. It will be substantially underwritten by transferring IS resources and responsibilities to end users.

The fundamental technical problems that IS management sees in this scenario revolve around distributed data base management, specifically, considerations of data base integrity, synchronization and security.

INPUT concluded that there were two additional problems associated with this downsizing scenario: 1) Motivating IS management to support technological downsizing when it might mean downgrading the role of the IS department; and 2) Changing the management mind-set to adopt and adapt to the new information technology and architecture in their downsized organizations.

2. Systems Architectures for Downsizing

This study concluded that the fundamental network architecture of downsizing is not new. Sixteen years ago, INPUT recommended that standalone computers be replaced with large mainframes in central data centers (upsized). Then, after achieving the benefits of centralization, it was recommended that there be an "orderly distribution of processing" to minicomputers and intelligent workstations. The resulting network was called a "proper hierarchical network." The process by which this would be achieved would now be called "downsizing."

Because little progress was made in developing proper hierarchical networks in the 1970s (primarily because of IBM's System Network Architecture—SNA), the personal computer revolution of the 1980s has long since destroyed the opportunity for the "orderly distribution of processing." The current rush to downsize is merely the final stages of that revolution.

INPUT now recommends that information architectures must be viewed from three perspectives:

- Behind the Screen - in which hardware architectures, network architectures, operating systems, data base management systems, and a variety of applications enabling tools present more choices and demand more decisions than IS management can possibly understand, much less assimilate.

- At the Screen - in which there is a constantly shifting interface at the human-machine interface. The window dressing of the graphics user interface (GUI) is not the most important struggle taking place. It is the fundamental working relationship between humans and computers as computers replace and monitor the performance of knowledgeable workers.

- Beyond the Screen - in which established paper procedures and office organizational structures are in a constant state of flux as traditional mainframe applications are downsized to new information technology.

INPUT concluded the following concerning these architectures:

- IBM's SAA is the most comprehensive architecture that exists behind the screen for downsizing current mainframe applications, but it suffers from a lack of understanding and slow implementation.

- At the screen computer systems must become more "intelligent" and assume more human responsibilities if the management objectives of downsizing are to be achieved.

- Beyond the screen new organizational structures and management concepts are required as machines become more intelligent

It is doubtful that corporate management is aware that downsizing may lead to an environment in which everyone becomes a super data base administrator. However, as more reliance is placed upon information technology, two things are clear: 1) the objectives of decentralization and downsizing make understanding the supporting organizational structures extremely important; and 2) lower investment in information technology may not be a reasonable objective to achieve the most important benefits of downsizing.

Viewing the information architecture at all three levels rather than concentrating exclusively on the technology behind the screen was the most important conclusion of this research.

3. Case Studies in Downsizing

The five strategic case study organizations for this research project were selected for being on the leading edge of downsizing. Four of them find themselves wrestling with the technical, financial and political problems of replacing large mainframes and taking advantage of more cost-effective platforms. These problems are briefly summarized as follows:

- The technical problems are associated with the fact that an economy-of-scale still exists within the IBM mainframe product line. Those that consolidated into large data centers do not have multiple small mainframes installed. What they do have are:
  - Decades of COBOL legacy systems that require maintenance and consume a high percentage of IS resources.
  - Large corporate data bases with unsolved technical problems of distributed data base management and quality control.
  - A highly centralized systems network architecture (SNA).
  - A bewildering array of complex networking solutions to choose from to establish a new information architecture to replace one that already serves.
- The financial problems are at the heart of the problem and the solution.
  - Large mainframe systems have a life of their own and they continue to be upgraded in processing power and DASD.
  - Mainframe systems software is an ongoing source of expense—especially with tiered pricing.

- Downsizing specific applications from large mainframe systems does not immediately result in reduced mainframe costs, which causes an increased cost for remaining users of the central facility.

- Despite the obvious expense of large mainframe systems, IS management is having a difficult time coming up with solid cost justification for downsizing. This is true for many reasons:

  • Increased training expense for systems and user personnel.

  • The problems of running parallel systems during transition.

  • The need for outside consulting help in implementing complex new technologies.

  • The questionable quality of off-the-shelf software that is assumed to be a major benefit of downsizing.

  • The failure of personal computers to improve white-collar productivity during the 1980s leaves open the question of whether users will benefit from the decentralization of IS functions.

• The political problems are associated with the belief that achieving the benefits of downsizing is as simple as ABC:
  - Adopting an open, client-server architecture.
  - Buying cheap, easy-to-use software right off the shelf.
  - Converting a few COBOL procedures using C.

IS management knows from past experience that it just isn't going to be that easy, but when they raise the very real problems they see, they are accused of obstructing progress.

The one strategic case study in which downsizing had been completed (multiple, small mainframes were replaced) revealed the following:

• While adopting a UNIX-based, client-server architecture the customer was locked into a proprietary DBMS.

• Existing applications were converted as rapidly as possible in order to minimize the transition period, but off-the-shelf software was not employed.

• While a 4GL was used for as much of the conversion as possible, it was necessary to convert some applications by using C. This resulted in training and recruitment problems because of the scarcity of experienced C programmers. The final outcome was that IS headcount went down, but the personnel budget went up due to the requirement of more expensive skills .

- The cost savings associated with the downsizing effort are reportedly impressive—especially the savings in IBM systems software. However, IS management admits that their estimates of savings are "rough" and are partly based on what they would have been spending if they hadn't downsized.

B
Identified Implementation Issues

Downsizing is important because changing the information architecture raises major management, technical and strategic issues. There are indications that downsizing is beginning to descend from being overrated to undervalued. This can be extremely dangerous in that a lackadaisical approach will be taken to implement downsizing because its effectiveness is questioned or misunderstood.

INPUT's research found that: cost justification for downsizing can be difficult; cost-benefit analysis is complex; implementation is difficult; management objectives are hard to achieve; and the only reward for IS management might be downgrading of responsibility. However, problems experienced with the implementation of downsizing do not downgrade its importance. When downsizing is put in proper perspective, a number of major issues become apparent:

- Downsizing will determine the future role of information technology and the IS department in the organization.
- Downsizing will determine the competitive strength or weakness of the enterprise.
- Implementing a new information architecture is a complex and long-term project of strategic importance to the very survival of the organization.
- However, the rate of successful completion on large, complex information systems projects is substantially less than 50%, and there is no reason to believe that downsizing will have a higher success rate.
- Management understanding and commitment at all levels (corporate, IS, and end user) is necessary if large downsizing projects are to succeed.

The management methodologies and tools used in crafting a new information architecture will determine the success or failure of downsizing projects. They will also reveal a great deal about the management style of the organization, the role of information technology within that organization, and the perspective of downsizing.

C
The Mainframe Trap and Transition Costs

It is easy to construct theoretical information architectures. In fact, they aren't necessarily too difficult to implement when starting from scratch. Unfortunately, large mainframe users are not starting from scratch. They have an enormous investment in their existing data bases, applications programming, mainframe hardware, existing network architecture, and systems and application programming expertise. Not too many years ago, it was seriously suggested that the expense of building corporate data bases should be capitalized. It now turns out that investment may be one big liability when it comes to downsizing.

IS management that tried to do everything right now finds itself in a mainframe trap, unable to take advantage of new, more cost-effective information technology. Caught by high mainframe hardware-software costs, and saddled with the burden of mainframe data base and applications maintenance, most companies find themselves with limited resources to downsize large central systems.

This problem is compounded by the fact that half measures (like downsizing applications without actually replacing the mainframe) only result in more expense and extended transition period during which the actual and perceived expense of operating the central computer facility becomes more visible and intolerable. Appropriate strategies and tactics for developing an effective downsizing plan vary according to the specific situation, but two guiding principles are the following:

- A way must be found to reduce mainframe expense early in the downsizing process.

- The transition period must be kept as short as possible once the process begins.

There should be a comprehensive downsizing plan before any major downsizing projects are undertaken, and that requires a thorough understanding of the management, technical and strategic issues involved. Otherwise, failure is practically assured regardless of the methodologies or tools employed for implementation. There are no magical ways to escape from the mainframe trap.

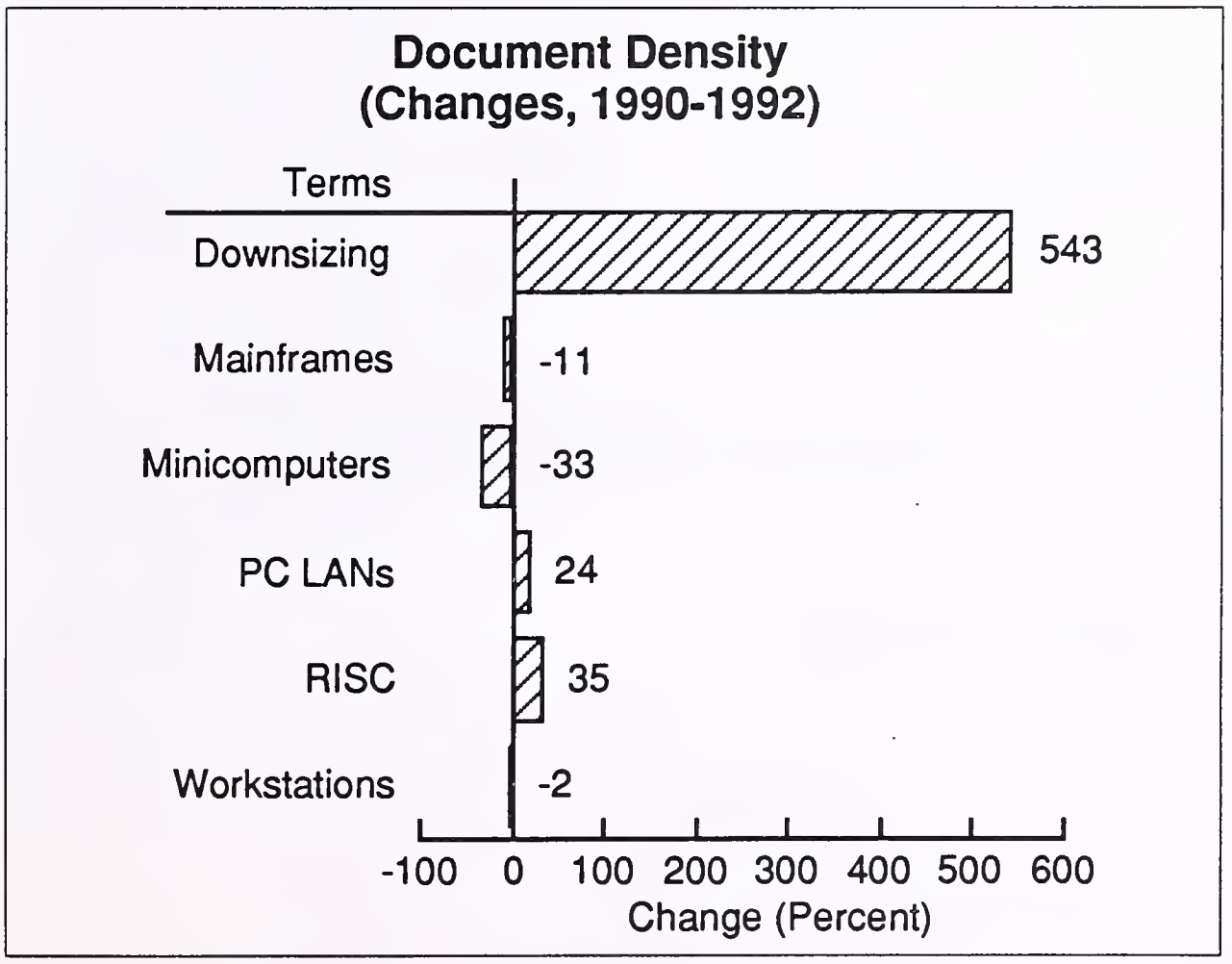
IV

Management Issues in Downsizing

During INPUT's research on the earlier downsizing case study report, some of the interviewees suggested that media coverage was a critical factor underlying the momentum toward downsizing, regardless of the ostensible reasons offered by corporate and IS management. The implication was that basic assumptions about the benefits of downsizing (cost savings, open systems, cheaper development, etc.) were mostly obtained from the press rather than from any detailed analysis or cost justification.

Certainly, the predominant management and technical theme of the 1990s has been downsizing, and this can be quantified by analysis of the frequency with which downsizing is mentioned in the press. For example, in May of 1990, only 110 of 59,579 documents in the ComputerSelect data base contained references to downsizing, but by September of 1992, this had risen to 912 documents. When normalized for an increase in the total number of documents, this still means that "document density" has increased by over 500%, as shown in Exhibit IV-1.

EXHIBIT IV-1



The question raised by IS management is the degree to which the downsizing revolution is being driven by the media rather than by achievable benefits.

A
Corporate Management Issues

Respondents to this study rated corporate management's satisfaction with a number of information technology dependent functions on a scale of 1, for low, to 5, for high. The results are displayed in Exhibit IV-2.

EXHIBIT IV-2

- IS management feels corporate management is least satisfied with costs—applications development costs and mainframe hardware/software costs. This supports our previous research which identified lower IS costs as the primary factor prompting downsizing.

- Decision support systems and the market research and forecasting functions rate slightly less than satisfactory.

- This makes it difficult to understand how corporate management could be "satisfied" with IS responsiveness, the effectiveness of IT investment, and the usefulness of corporate strategic plans.

- Corporate management has been rated as slightly more than satisfied with:

  - The corporate use of PCs and workstations.

  - IS ability to provide ad hoc reports requested, and with the quality of management reports.

- Finally, management is most satisfied with the corporate controller's audit function and the general quality of corporate data bases.

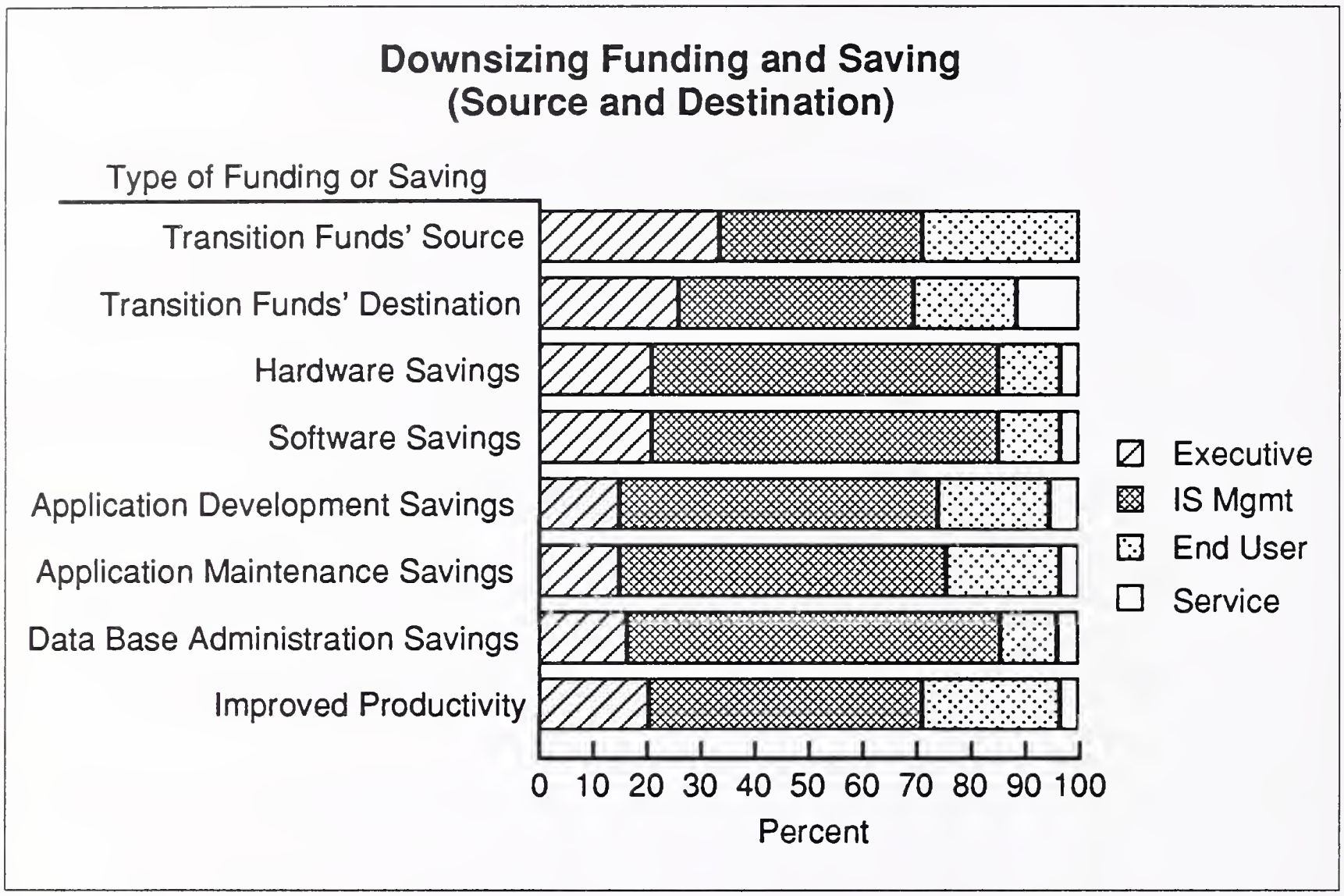
In summary, the mainframe legacy systems are satisfactory for monitoring and controlling corporate operations, but not for providing very much assistance in establishing corporate direction. The issue for corporate management is maintaining corporate control while downsizing central information management functions and technology that are expensive and not effective in maintaining a strong competitive posture in today's global markets.

Because corporate management controls the purse strings in most organizations, a primary issue has to be the source of funding and where the savings will be realized.

1. Funding Downsizing

INPUT's interview sources reported varying answers to where downsizing funds and savings are assigned. Data were used to compute a relative distribution for primary and secondary sources. These values are presented in Exhibit IV-3.

EXHIBIT IV-3



- Responses were divided approximately equally among corporate, IS and end-user budgets (33%, 38% and 29% respectively). Detailed analysis revealed that the designation of primary funding was also equally split among the three sources. This means that equal numbers of companies consider downsizing to be a corporate project, an IS project, and an end-user project.

- The destination of these funds is toward those responsible for actual implementation. INPUT found a shift toward professional systems personnel. The distribution breaks down as follows:

  - Corporate will expend 26% of the downsizing transition funds.

  - IS will receive 44% of the funding.

  - End-user departments will receive 19% of the funds.

  - 11% will go to outside services companies for assistance during the transition period. Outside services includes consulting and software services, not hardware.

- Sixty-four percent of the hardware-software savings anticipated from the downsizing effort will come from the IS department. Most of the remaining hardware-software savings will come from corporate (21%) and end users (11%).

- Application development and maintenance savings anticipated from downsizing are also concentrated primarily within the IS department, approximately 60%, with corporate, end user and outside services being designated as sources by 15%, 20% and 4% respectively.

- Most anticipated savings in data base administration costs will be derived from the IS department (70%). Few respondents (10%) said that end users would have reduced data base administration costs.

Corporate management is directing funds toward the IS department during the downsizing transition period and then expecting most of the savings as a result of the downsizing effort to come from that area. This identifies another major issue: what is the role and responsibility of the IS department during and after downsizing?

The answer to this question depends upon the objectives of the downsizing effort—especially from the perspective of the IS department.

2. The Objectives of Downsizing

IS respondents ranked five downsizing objectives in terms of their importance, with 1 being most important, 2 next, down to 5 for least important. They also ranked the same objectives based on what they believed to be

the objectives of corporate management and end users. From this, IS could compare what was important to corporate management and end users. Exhibit IV-4 presents the results.

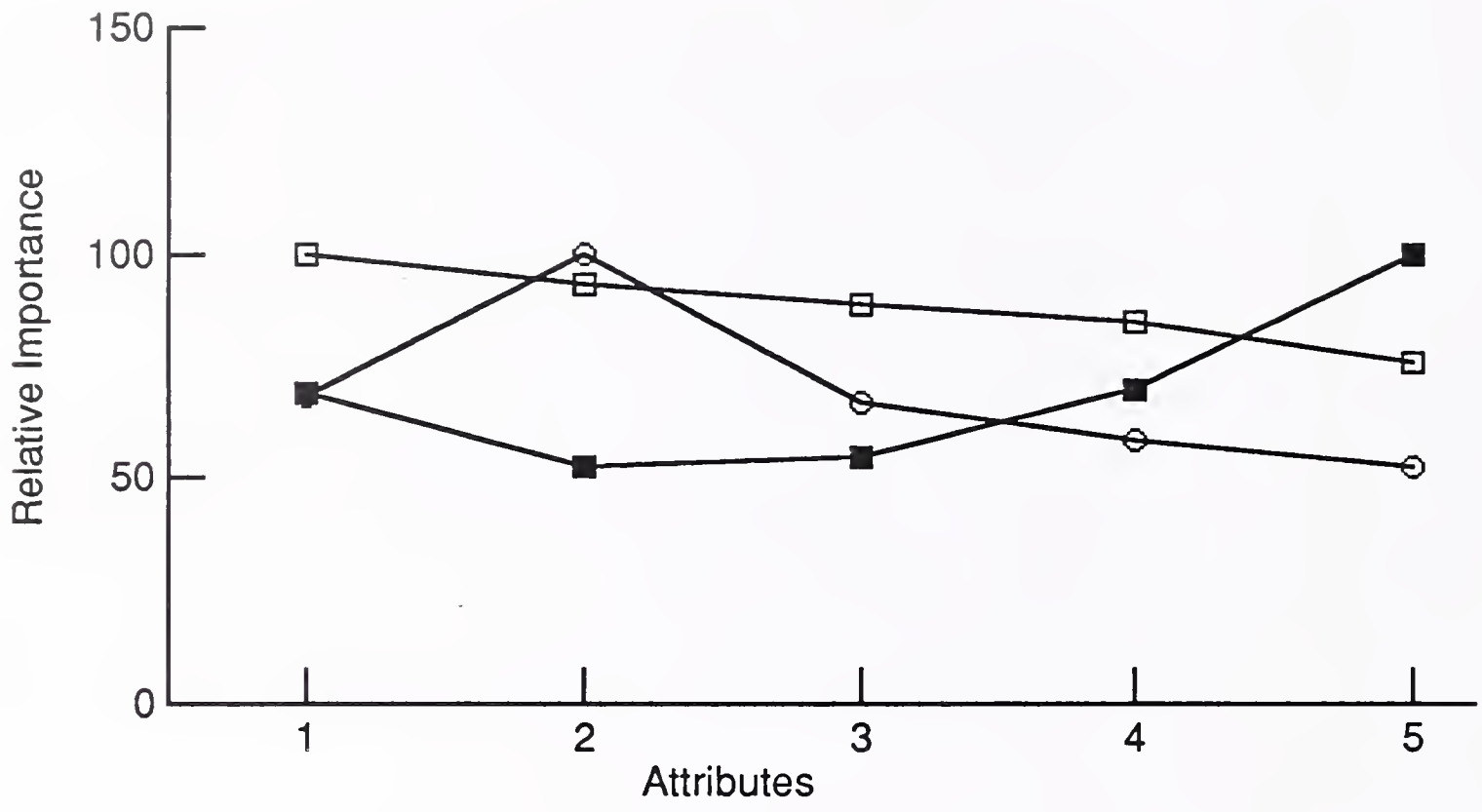
This information prompted INPUT to conduct interviews outside the IS department. IS management holds the following downsizing objectives:

- IS management feels that better management information is the most important objective of downsizing (100), but this is not as important to either corporate management or end users (68 & 69 respectively).

- Corporate management's primary objective is in lower data center costs (100), and the IS department concurs (93). However, for end users, it is the least important of the five objectives (53).

- IS management believes lower application development costs should be an important objective of downsizing (88), but neither corporate management nor end users place that much importance on it (66 & 55 respectively).

EXHIBIT IV-4



Key	Attribute	IS	Execs Objectives	Users
1	Better Information	100.0	68.1	68.8
2	Lower Data Center Costs	92.9	100.0	52.8
3	Lower Application Development Costs	88.2	66.4	54.7
4	Improve Productivity	84.7	58.5	70.1
5	User Control	75.5	52.3	100.0

Note: The lowest score within the set is divided by the score of each objective. The result is multiplied by 100, which results in the lowest score receiving a value of 100. The relative importance of the other objectives is established from this baseline.

- IS management also feels that improved office productivity is more important (85) than either corporate management (59) or end users (70).
- The main thing end users are interested in is increased user control of information technology (100), but corporate management considers that to be the least important of the five objectives (52).

In summary, IS management feels that all five objectives are of considerable importance, but corporate management is only interested in cutting data center costs and end users are only interested in grabbing control of information technology. This attitude will have profound ramifications for the way downsizing is implemented.

The primary issue and challenge to corporate management in the 1990s is the management of the IS function and increasingly pervasive information technology. Not many corporate executives feel comfortable managing either the IS function or the information technology .

B
IS Management Issues

There is one overriding issue that IS management faces—credibility. Credibility with corporate management in terms of making cost-effective use of technology, and credibility with end users in being responsive to business needs.

The IS department in many companies is identified with the following:

- The Corporate Controller's Office
- COBOL
- IBM
- Solutions that:
  - Are complex and expensive
  - Take too long
  - Never materialize

Any one of the above has been enough to destroy credibility with many users who have been dependent on the IS function. As the downsizing revolution has proceeded, there is strong suspicion that IS has fallen behind in their knowledge of advancing technology.

For decades the IS department has devoted approximately 70% of its resources to maintain legacy systems and corporate data bases. Maintaining commercial systems written in COBOL and transaction processing against IMS data bases involves a lot of clerical drudgery. Though there is no disputing the importance of maintaining these systems, it is a significant management challenge to attract or retain good people to do this type of work, and over the years staff quality of most IS departments has tended to degenerate.

IS management has a major challenge in motivating its personnel to downsize themselves out of jobs, especially when end users may be more familiar with the hardware and software employed. In addition, IBM's rapid fall from grace means that IS management has lost a strong ally. Rather than having a solid fall-back position of "you can't go wrong by choosing IBM," IS management may find that it requires additional justification even when IBM may be the right choice.

C
User Management Issues

There is a running battle between IS and engineering departments over control of computers and there doesn't seem to be any question that RISC workstations have proved to be the ultimate weapon in that regard. The IS department just will not stop the flow of compute-intensive processing from mainframes and minicomputers to the more cost-effective platforms—which is no longer an issue for user management.

However, IS management is responsible for implementing downsizing of commercial applications. The only reason end users are interested in downsizing is to increase their control of information technology. This attitude prompted INPUT to conduct some on-site end-user interviews.

One of these interviews was with a medical doctor who is a department chief with one of the nation's largest health care organizations. His experience makes an informative case study of one user's view of the IS department and downsizing:

- Despite decades of attempting to apply computer technology to medical records, they still cannot support even rudimentary research efforts. For example, image processing was tried, but the documents remain unreadable.

- The interviewee received a grant to develop a pilot project for analysis of treatment effectiveness within his department.

- The IS department became involved because professional assistance was needed in defining and integrating the project data with a 10 year program designed to attack the long-standing medical records problem. The cost of this overall program is estimated to be between $300 million and $3 billion per year.

- After working for a year with the IS department to get his project off-the-ground, he found that the IS department had spent the entire amount of the research grant, including the hardware budget, and had not yet even come up with a plan.

- The doctor has now fallen back to his original proposal to collect the data he needs by using scanners and 486-based PCs. In other words, he is downsizing his project by detaching it from an effort to define all the data requirements for the entire organization. That is the only way he can see to get the project completed.

There is no indication that user management has any desire to seize control of information technology in this case. The health care industry is a knowledge-intensive industry, and management has a responsibility for professional staff development. After decades of investing in computer technology, there is a tremendous amount of information being published, but very little computer data to support even relatively simple research activities necessary to improve the treatment effectiveness knowledge base.

The availability of cheap processing power and software tools on the desktop makes user management aware of the potential of information technology to make a substantive contribution to their profession—if only they had data. When users turn to the data base experts they get multi-million (and in this case billion) dollar projects extending over a period of years. Though there may be some uneasiness on the part of user management as to whether they are oversimplifying their little portion of the overall problem, many of them are willing to take the chance and downsize their portions of the overall project.

The issue for user management is whether or not they want to downsize, independent of any IS effort in that direction. INPUT's research with end users indicates that they are seizing the initiative for downsizing regardless of who has primary responsibility for any major project or architectural change. For years, the IS department has been accused of failing to support business objectives. User management risks are accused of the same thing when they initiate independent downsizing efforts.

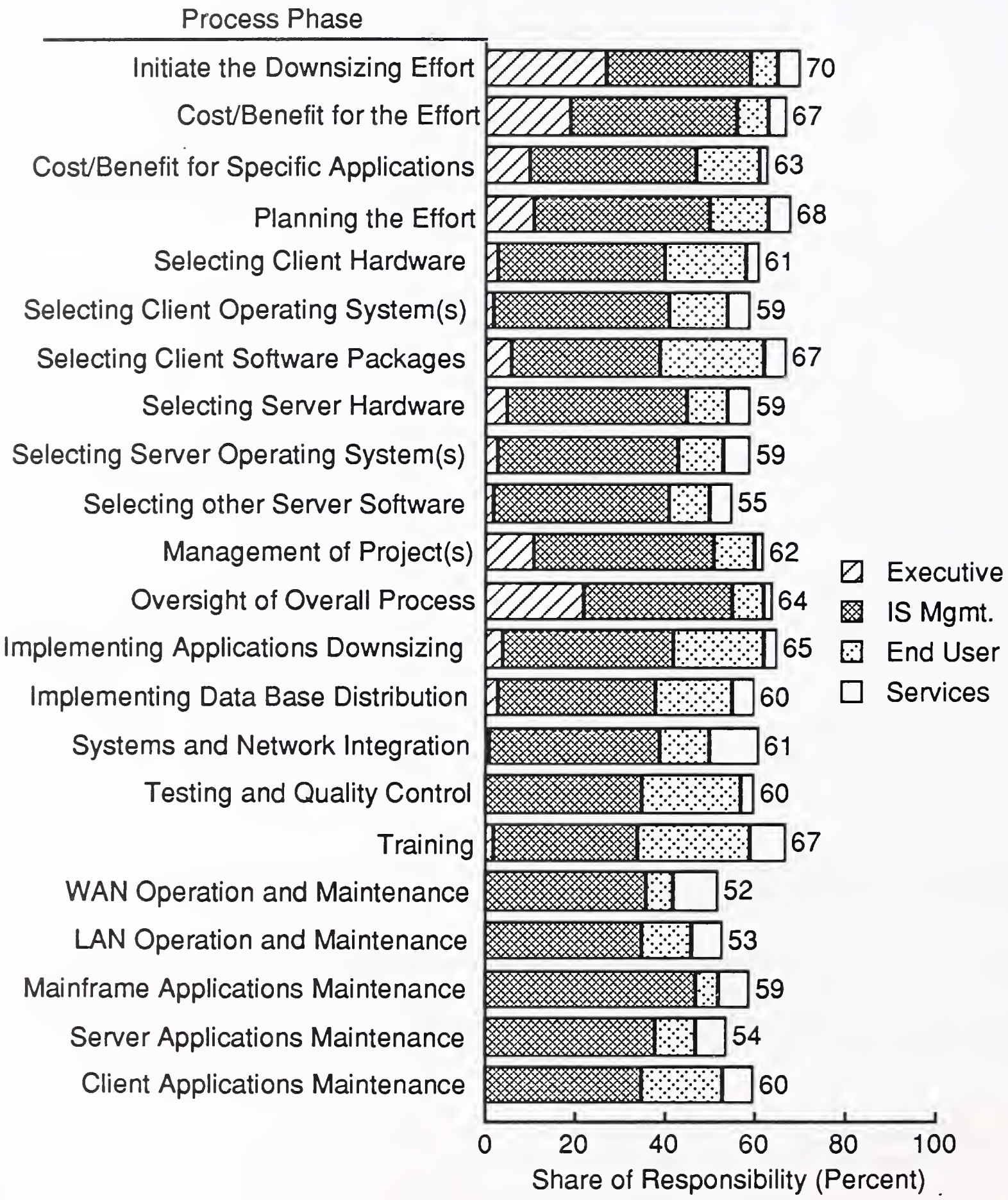
D

Initiating and Managing the Downsizing Effort

Respondents were asked who had responsibility for initiating and implementing the downsizing effort, and who had responsibility for operating and maintaining the downsized systems. The analysis and presentation of results in Exhibit IV-5. are the same as that in Exhibit IV-3.

EXHIBIT IV-5

Management of the Downsizing Process (Relative Responsibility by Phase)



Respondents reported that most downsizing efforts were initiated by either corporate management (39%) or the IS department (46%), but INPUT's research with end users indicates that this may be misleading. Some downsizing projects are done without the knowledge or control of the IS department. End users feel that they initiated downsizing efforts by putting pressure on either corporate or IS management.

- IS management has the most responsibility for cost/benefit analysis of both the overall downsizing effort (55%) and of specific applications (59%), but corporate and user management are involved in the process.

- Planning the overall downsizing effort has IS management in a comparable role with 57% of the responsibility compared to 16% for corporate management and 19% for user management.

- IS department responsibility for client hardware is twice that of user management (61% to 30%), and this increases three times (66% to 22%) for the selection of client operating systems. However, IS management responsibility decreases for the selection of client applications packages (49% to 34%) and this amounts to equal sharing of responsibility between forces in and out of the IS department.

- Not surprisingly, IS responsibility increases at the server level where standards become even more important. The relative responsibility between IS and users there is distributed as follows:

  - Server hardware: IS 68%, and Users 15%
  - Server operating systems: IS 68%, and Users 17%
  - Other server software: IS 71%, and Users 16%

- Corporate management becomes more involved in managing the downsizing project than with selecting hardware and software. Where corporate responsibility had been running less than 10% in those areas it now increases to 18%, but IS still has 65% of the responsibility for project management when implementing downsizing.

- Corporate management has increased responsibility for oversight of the overall downsizing process (34%), but IS still feels that it has the most responsibility (52%) for monitoring the overall process.

- When it comes to actual implementation of downsizing projects, IS shares responsibility with user departments, but retains more responsibility for implementing applications and distributing data bases. This can be viewed as getting users involved in the systems development process that has long been emphasized as a means of improving productivity in the development of applications systems. Here is the involvement anticipated by IS management:

  - Implementing applications downsizing: IS 58%, users 31%
  - Implementing data base distribution: IS 58%, users 28%

- IS doesn't expect as much involvement from users during systems and network integration. There the distribution is IS 62% and users 18%, but IS will compensate by employing outside services vendors (18%).

- The heaviest user involvement in downsizing will be their responsibility for application testing and quality control, and end user training (37% in both areas); but IS still has greater relative responsibility (58% for testing and QC, and 48% for training).

- Just as with systems and network integration, user involvement with WAN and LAN operation and maintenance is restricted, but outside services vendors are employed.

  - IS is responsible for 69% of WAN operation and maintenance, and 66% of LANs.

  - User departments have only 12% for WANs and 21% for LANs.

  - Outside vendors have 19% for WANs and 13% for LANs.

- Applications maintenance by platform reveals that IS doesn't expect packaged software to play much more of a role in a downsized environment than it currently plays in a mainframe environment.

  - Outside vendors have a 12% share of responsibility for mainframe application maintenance, 13% for server applications, and 12% for client applications.

  - IS application maintenance responsibility is 80% for mainframe applications, 70% for server applications, and 58% for client applications.

  - User application maintenance responsibility is 8% for mainframes, 17% for server applications, and 30% for client applications.

The availability of packaged applications software is one of the more attractive advantages attributed to downsizing from mainframes. To the degree that applications packages are available, the software product vendors should have a larger role in maintenance at the server and client levels. This is important because of the high percentage of IS resources committed to maintenance.

The fact that IS respondents did not anticipate more maintenance responsibility is assumed by outside services vendors to be the result of downsizing. This was one of the primary reasons why INPUT expanded the research to include some interviews with end users.

E
Organizing for Downsizing

Interviews concerning organizational changes anticipated as a result of downsizing lead to the conclusion that it will be impossible to solve the age-old, chicken and egg riddle of whether downsizing causes organizational changes or organizational changes cause downsizing. From an organizational point of view, the cycles of centralization and decentralization of IS resources, and the continuing battle for control of information technology, have been going on long before the term "downsizing" was even coined. At any given point in time, it is possible to find an entire range of organizational structures that may or may not be related to downsizing.

However, there are two important facts that resulted from the research conducted for this study.

1. When user departments have previously wrested control of information technology from the IS department, downsizing becomes increasingly attractive. This is true because user departments frequently are not making effective use of information technology in the first place. For example, in a well publicized case study on Motorola, it was pointed out that the personnel department had replaced an IBM 4381 by downsizing. A 4381 in the personnel department is a sitting duck for downsizing, upsizing, rightsizing or retirement for fiscal irresponsibility.

2. IS departments, when responding to questions about downsizing, tend to ignore what is happening with information technology in areas over which they have lost control. This was true in the days when user departments went outside for timesharing services, and it is true even when major organizational segments split off their own computer operations.

A further analysis of the above points is included in Appendix A.

INPUT believes that the IS department's reportedly predominant role in corporate downsizing efforts is really a delusion; much of downsizing has already gone on without the involvement of the central IS function. Though IS may have responsibility for implementing downsizing, it is driven by forces completely beyond its control. The IS department is carried along in the downsizing revolution and not directing it. IS management that supports the revolution may contribute to its success and be rewarded. Those that resist or approach downsizing with mainframe methodologies and mind-set may find themselves downsized out of existence.

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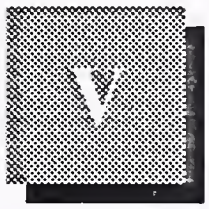

Technical Issues in Downsizing

The central IS department stands accused of making simple problems complicated, and mainframe hardware-software is horribly complex and difficult to use. However, faced with downsizing major applications, the IS department is confronted with an array of technical issues that belie these basic assumptions.

A
Proper Program and Data Placement

The architecture of mainframe applications is quite simple: programs and data reside on a single system, even if it has multiple processors. Downsizing implies that application programs will be split between clients and servers, and data will be distributed, in some fashion, over the network. This issue can be oversimplified by stating that the server handles data manipulation and the client handles the user interface, or can be made as complicated as cooperative processing in IBM's systems application architecture (SAA).

The issue of proper program and data placement raises several specific technical questions, one the most important of which is whether a proper hierarchical network should be two- or three-tiered. Experts are divided on this issue, and it will be analyzed later in this report. Here are some of the technical issues.

B
Comprehensive Cost-Benefit Analysis

Performance measurement of complex mainframe systems has been refined over the years, and with the availability of voluminous historical data on the performance of IBM mainframes, it is now possible to do a reasonably good job of performance measurement. It was also found that queuing network theory provided a valuable tool for predicting operating system performance on mainframe systems, and this turned out to be an available tool for systems software designers and developers.

Interconnected client-server networks raise the measurement and prediction of performance to levels of complexity that are beyond the current state of the art for queuing network theorists. They are still working on the necessary mathematics for LANs and WANs. It is a problem of queues within queues within queues, and it only takes one small bottleneck to bring the network to an unacceptable performance level.

Network and data base design will determine the performance and cost of the downsized applications system. Predicting performance for any but the simplest systems is beyond the current state of the art, and overpowering performance problems with more technology is not always possible in the more complex structures.

Similar problems exist in estimating productivity in the systems development process, and this obviously can impact transition costs. Comprehensive cost-benefit analysis of a major downsizing effort can be expensive.

The effort that should be expended on cost-benefit analysis remains an open issue for IS management, especially because management only wants to save money and users are primarily interested in gaining control of information technology.

C

The Data Quality Problem

If there is one key issue in downsizing, it is data quality. INPUT has defined, refined and redefined the problems of data base integrity, synchronization and security for years. There is growing awareness of this problem, and the split between vendor-sponsored publications (and the trade press) and technical journals is nowhere more clear than on this issue. The distributed data base experts can't agree among themselves as to who is addressing the problem, who is misleading the public, and who just doesn't understand.

However, there is general agreement that distributed data base management presents a problem that DBMS vendors and IS departments will be struggling with for years. The issue for each individual downsizing effort is whether the problem can be avoided by relatively simple file transfer systems.

Decisions on data base distribution and selection of DBMS vendors will determine the success of the downsizing effort and possibly the organization's information architecture for years to come. Data quality is the critical downsizing issue.

D

Reliability, Availability and Serviceability

Mainframe vendors have been talking about reliability, availability and serviceability (RAS) for years. As a matter of fact, it was a theme through several generations of mainframes as more cynical customers asked whether RAS wasn't what the previous generation had promised. Nonetheless, there is no question that mainframe platforms provide a level of RAS that goes well beyond the current downsizing platforms.

The RAS issue may be as much philosophical as it is technical. Those accustomed to pushing the reset button, or reloading an entire data base when something goes wrong, do not seem terribly sensitive to the cost of failing to recognize the importance of RAS.

Take the relatively simple example of backing up files. A study by 3M Corporation found that PC data losses (hardware and software failures) cause a week of lost time for almost 30% of all business users, and estimated that this was equivalent to $4 billion in lost productivity in the nation on an annual basis. The study went on to say that U.S. productivity "is being sapped," and that roughly one-half of all PC business users will face a serious loss of data. In addition, 63% of the study's respondents said that their companies had no formal policy of how (or how often) data should be backed up.

Shifting mission-critical applications to such an environment is a major issue. If downsized applications are expected to exhibit the reliability, availability, and serviceability of mainframes then substantial effort will be required on the part of the IS department (or vendors) in designing the network.

E

Ease of Use versus Functionality

The primary design objective of IBM mainframe operating systems was originally ease of use. Though this may show that ease of use is in the eyes of the beholder, a good case can be made that the complexity of IBM systems software is a direct result of adding functionality.

Downsizing mainframe applications requires improved functionality for the operating systems, DBMSs, languages, spreadsheets and even word processing packages on the downsized platforms.

Years ago, Bell Laboratories warned that open systems, such as UNIX, were "unfit for applications involving classified government information, corporate accounting, records relating to individual privacy, and the like." In addition, it was concluded that to make them "fit" for such applications would mean that they were no longer "open" and easy to use.

The same trade-offs between functionality and ease-of-use applies to all personal computer software as it evolves into being suitable for handling critical mainframe applications. There will be resistance to these changes.

- IBM couldn't get COBOL and Fortran programmers to go to PL/1. How can C, which started as a subset of PL/1, be any more successful as its functionality pluses become ease-of-use minuses?

- Added functionality leads to increased complexity regardless of what kind of GUI is pasted on the surface. Apple tried to convince its loyal Appleworks users that the Mac was easier to use than the Apple II, and all they got was resistance all the way. Many who did convert now find it is easier to lose files and crash the system than it was on Appleworks, and it is much more difficult to figure out what is going on.

- The fact is that any change, even in the interest of ease-of-use, requires users to learn something new. Some of them will resist this change.

The issue for those responsible for major downsizing projects is whether to do a quick and dirty conversion or improve the systems with new functionality.

F

Tools versus Applications

PC software firms have been referring to application development tools as "applications" for so long that some people are beginning to believe them. Underlying this semantic argument is a very real technical issue. As mainframe applications are downsized, is it possible to turn over a spreadsheet package to an end user and say: "Here is your application. The data are on the server. You're on your own"? Even worse, does one permit an end user to go out and buy his own application for the client portion of the application? It is doubtful.

INPUT also doubts whether it is safe to turn mainframe applications that incorporate spreadsheet applications on the client over to the end user for maintenance or use. Spreadsheet applications are too easy to change, too hard to debug, and too prone to data quality problems.

It is important to understand the nature of a real application when downsizing. This can become a problem when people aren't speaking the same language, and there is certainly a communications problem among the personnel involved in the downsizing effort.

G
Summary

The technical issues were identified by an exhaustive literature search designed to determine whether there has been any resolution of these apparent technical problems. It is INPUT's opinion that these issues remain open.

- There is currently no clearly accepted architecture or data base and network management tool set for the "proper" distribution of mainframe applications processing and data over networks.

- There is no viable way to do a comprehensive cost/benefit analysis of the impact of downsizing to determine whether the effort will achieve desired results.

- There is no consensus on the nature, severity and solution of problems of data base synchronization, integrity and security in a distributed (downsized) environment.

- The reliability, availability and serviceability of PC and RISC hardware-software technologies in client-server networks do not yet approach that of mainframe SNA networks.

- Enhancing the functionality of systems software and applications development tools to meet the demands of mission critical applications may result in a level of complexity that compromises the simplicity and ease-of-use that made those systems attractive in the first place.

- There remains serious misunderstandings by many personal computer and workstation hardware-software vendors as to the nature and requirements of mainframe commercial applications as opposed to PC personal productivity and workstation engineering applications.

All of these issues must be understood and resolved by those responsible for downsizing mainframe hardware-software systems. In addition, these technical issues are tightly integrated with a set of strategic issues that may either simplify or complicate the implementation of downsizing.

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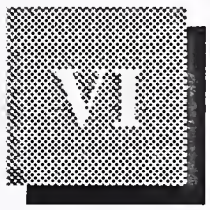


Strategic Implementation Issues

The technical issues were defined by analyzing published information. The strategic implementation issues were identified by telephone and on-site interviews with IS and user management.

A

Overrating and Undervaluing IBM

In the mid-1970s, INPUT warned that not even IBM would be able to control the advance of minicomputer and microprocessor technologies, and the advance toward "proper hierarchical networks." INPUT received criticism from IBM and its customers for "judging too harshly."

In the early 1980s, INPUT interviewed an IBM employee who said: "We have made a lot of money on large mainframes for a long time, and there are those around here who think that it can go on forever." Even the implication that the mainframe cash cow might run dry was not a very popular position to take within IBM, and they continued to milk it for all it was worth. At that time, INPUT took the position that IBM could, in fact, continue to make a lot of money and actually grow to be a $100 billion company by the early 1990s if they embraced new technologies and provided leadership for their customers in the proper distribution of processing and data over hierarchical networks.

The current downsizing frenzy is an indication that IBM no longer controls the release or acceptance of new information technology. Also, they have failed to provide necessary leadership to their customers in the cost-effective distribution of processing and data over networks of systems. This is true, even though IBM developed many of the technologies and tools important for downsizing (relational data bases, floppy disks, RISC technology, etc.). More recently, IBM defined the most comprehensive architecture for the integration of the processing hierarchy (SAA).

The main strategic issue is whether the long-standing marriage between IBM and the IS department can stand the strain of IBM's fall. There has always been the tendency in the IT industry to first overrate new technologies and then undervalue them when they do not meet expectations. However, there are indications that there is something more going on between IBM and its customers. It comes down to a question of trust.

- Even loyal IBM customers feel trapped and exploited by mainframe software pricing, and their primary objective is to free themselves from ever being trapped like this again.

- Some customers expect more from IBM than they do from other vendors. The "wheeling and dealing" that is normal business practice by others raises ethical questions when IBM does the same.

- There is also a feeling that IBM does not want to solve the customers' problems, but to just sell its products. One customer has had a major project delayed by IBM's repeated insistence that DB2 is a workable solution to transaction processing against an enormous data base. The feeling is that IBM does not understand the problem, cannot demonstrate that anyone else has ever successfully employed DB2 in a comparable environment and yet keeps coming back to company executives with the DB2 solution.

- IBM's increasing dependence on business partners is viewed by some customers as an admission that IBM can no longer be trusted to "make things work." Customers get especially nervous when their previous experience with IBM business partners has been less than satisfactory.

- There is a lack of confidence in IBM's ability to support its products to meet the customers requirements.

It is apparent that IBM has irretrievably lost account control in the traditional sense. There is no question that IBM's knowledge of technical issues (data quality and RAS) associated with downsizing of mainframe applications is undervalued at the present time, and so is its solution—SAA.

The challenge for IS departments responsible for downsizing is to neither overrate nor undervalue IBM and SAA. That isn't going to be easy because IBM has demonstrated increased ambivalence about SAA, and IBM's organizational downsizing threatens to destroy the coherence of the architecture.

The degree of trust IS departments still have in IBM will be a major factor in determining the approach taken to downsizing.

B
Open versus Proprietary Systems

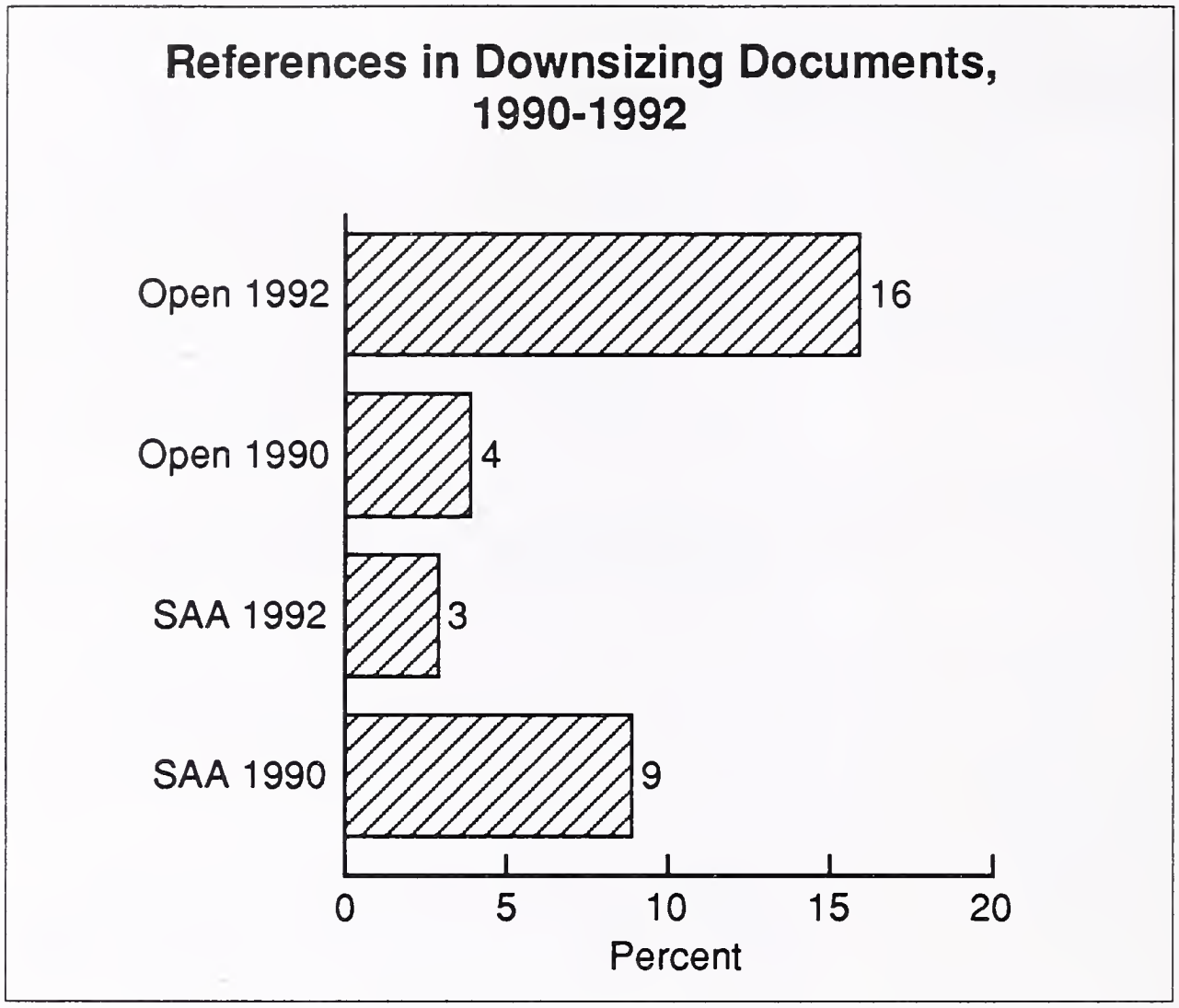
There are those who would have users believe that the choice between open and proprietary systems is between UNIX and SAA. This is a gross oversimplification. There is no consensus among vendors or IS departments as to what constitutes an open system. Any knowledgeable (and honest) systems professional understands that installing a UNIX-based client-server architecture with a proprietary DBMS cancels out most of the purported advantages of open systems right from the start.

Open versus proprietary systems remains an issue because corporate executives and end users don't know whether open systems are really open or not. The attraction of open systems and downsizing is the belief that they can escape the mainframe trap. The mainframe trap for corporate executives is what they view as the ever increasing expense of mainframe data processing, and from the end users perspective, it is the restricted IT choices imposed by the IBM-IS mainframe partnership.

Corporate executives and end users want to believe the volumes that they are hearing about downsizing and open systems. To the degree that SAA represents IBM's solution to downsizing and "open systems" are the alternative, there is no question concerning which is receiving the most press.

Exhibit VI-1 shows a rapid decline in the percentage of downsizing articles that mention SAA (from 9% in 1990 to 3% in 1992), and a corresponding rise in the mention of open systems (from 4% 1990 to 16% in 1992). It would seem that the preferred methodology for downsizing has been decided, at least in the trade press.

EXHIBIT VI-1



However, for the IS department, the open versus proprietary issue remains. It has become a matter of providing additional justification for IBM's SAA solution because it is viewed as a reinforcement of the mainframe trap. SAA is becoming a dirty word that not even IBM or the IS department dares to mention in public.

C

Conversion versus Re-engineering

There are many opinions among IS management on the issue of conversion versus re-engineering applications to be downsized. There are some who feel that downsizing, by definition, implies re-engineering. Others state that existing applications will not be "converted" to downsized platforms until they require re-engineering. Some plan to re-engineer all applications as they downsize, and others plan to have an all-out-effort to convert existing applications as rapidly as possible without re-engineering.

There is some confusion about the terminology, which is reminiscent of past arguments centering around the fine line between maintenance and development. However, there is a general agreement that conversion implies moving the application as quickly and cheaply as possible,

whereas re-engineering implies substantial changes in the application. There is also a general consensus that there are specific applications in which downsizing, by conversion or re-engineering, can not be cost justified.

The strategic issue determines the purpose of downsizing in the first place. If it is to save money by actually replacing a mainframe with a more cost-effective platform, conversion is certainly warranted. If the purpose is to add functionality or improve applications that could not be economically justified with mainframe technology, re-engineering may be warranted based on improved productivity regardless of whether there are hardware-software savings associated with the technological downsizing.

Regardless of the initial approach taken, if downsizing is effective in off-loading substantial processing from mainframes, there comes a time when conversion of the residual mainframe applications must be considered.

D

In-house versus Outside Services

It may be necessary to employ outside services when internal expertise is not available, such as in the integration, operation and maintenance of networks. However, there is a more fundamental issue that determines the roles of in-house and outside resources when implementing downsizing: role of the IS department during and after downsizing.

If the role of the IS department is severely diminished and restricted to the continued maintenance of the old legacy systems (and data bases) in the new environment, it makes sense to contract out for needed services in the more innovative aspects of the new environment. However, if it is anticipated that IS will provide leadership in the effective application of new technologies to business problems, an investment in training internal employees may be warranted. In this case, the operation and maintenance of legacy systems are candidates for outsourcing.

E

The People Problem

Whether technological downsizing or organizational downsizing, it all amounts to the loss of jobs. Robert B. Reich had this to say after the election, but before he was appointed Secretary of Labor:

"Routine manufacturing and data processing jobs, which used to provide high school graduates with good earnings have been vanishing. Meanwhile, the 'knowledge content' of most goods and services is rising—putting a premium on people who are able to recognize and solve problems. These three related trends—automation, globalization and knowledge-intensiveness—are widening the wage gap between the well educated and the poorly educated."

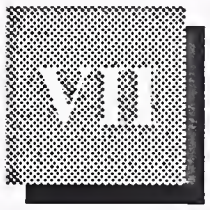
One cannot argue with Dr. Reich's general diagnosis of the long-term infection; however, INPUT's analysis of downsizing indicates that the long-term infection may be more severe than Reich anticipates. Downsizing is not aimed only at clerical employees, it is aimed at educated people who theoretically can "recognize and solve problems"—those in the information systems function, those in corporate planning and control, and those in the middle ranks of management.

This highlights the people problem. The IS function is asked to implement downsizing so that savings can be achieved within IS itself and users are asked to embrace information technology and provide their knowledge so that their ranks can be thinned. This is a tricky management problem.

There is a story of a consultant who asks his clients whether they would like to improve productivity of the IS department by 15%. When they say yes, he tells them how to do it—fire 15% of the IS department and simply make sure it is the right 15%! This sums up the people management problem associated with downsizing—it is possible to cut back on staff, and produce more, but there aren't many managers who have the courage, knowledge or wisdom to make the right cut.

The people issue associated with downsizing is whether the business objective is to empower humans at the working level or to control them. Information technology has the potential to be extremely effective in doing either. However, regardless of the intent and purpose of downsizing, one thing is clear: the interface between humans and computers is changing, and it is seems certain that computers are going to "know" more about what humans are doing than humans know about what computers are doing.

Not very many humans will be comfortable with this changing relationship at the human-machine interface—especially as computers assume more responsibility for knowledge work. This applies to all strata of the work force from entry level to corporate executives. This will have a major impact on the way downsizing is implemented.



Methodologies, Tools and Approaches

The methodologies and tools used (or required) during the implementation of downsizing provide valuable insights into how both the technical and strategic issues are being addressed.

A
Top-Down versus Bottom-Up

One basic principle of structured methodologies is top-down design. In Section IV of this report we saw that the primary impetus for downsizing is coming from corporate and IS management, and that the IS department has the primary responsibility for implementation (see Exhibit IV-5).

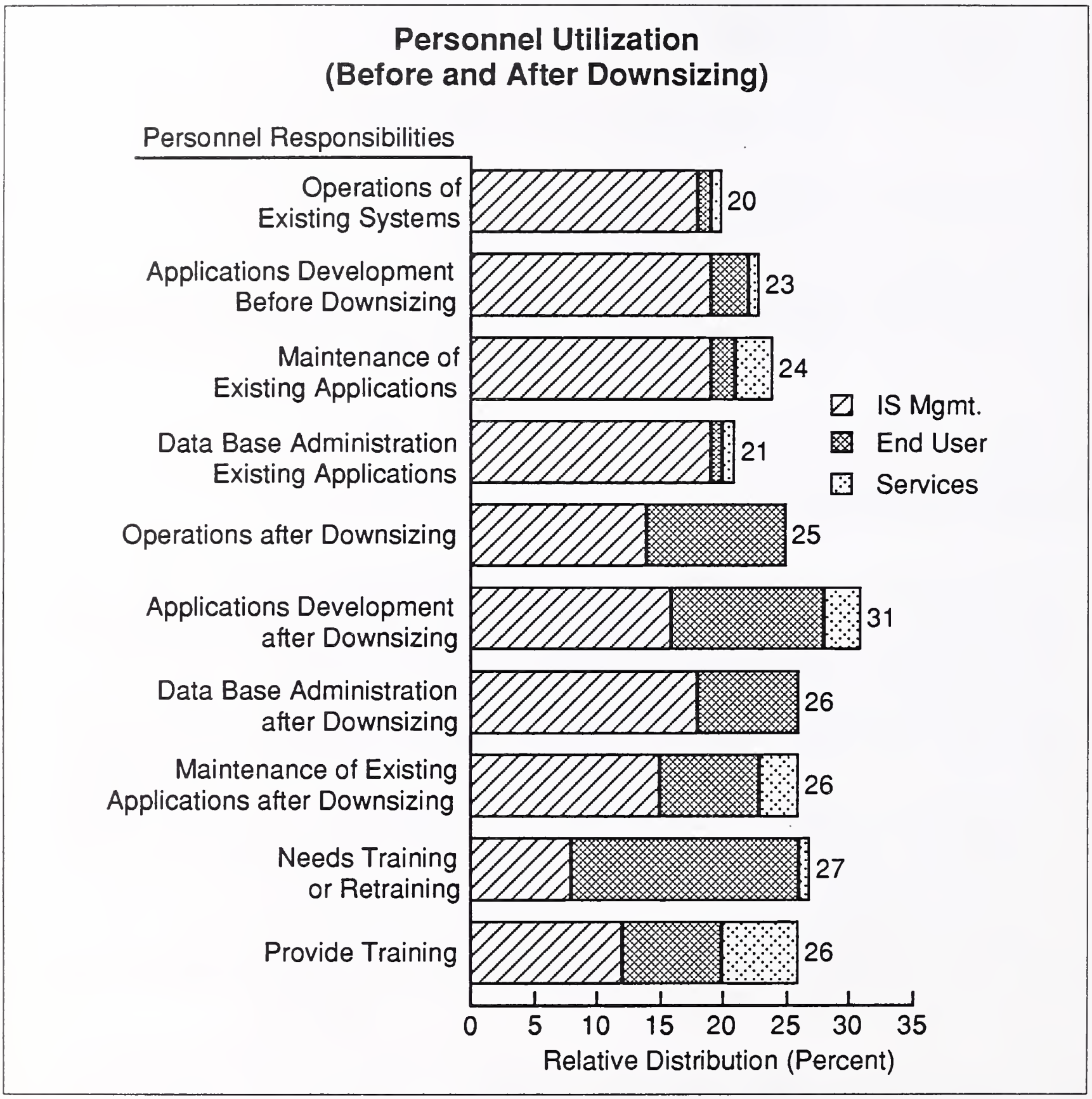
However, INPUT also pointed out that the current downsizing revolution started from the bottom with end users demanding data from corporate data bases. Some current end users still feel it necessary to develop their own systems independent of the IS department. Therefore, the corporate downsizing effort can be viewed as an attempt to bring the downsizing revolution under control, and provide for the orderly distribution of processing power and data to appropriate levels within the organization.

INPUT respondents indicated changes in staffing patterns that would occur as a result of downsizing. Exhibit VII-1 shows a significant shift of responsibility from central IS to the users departments.

- Before downsizing, more than 75% of the IS departments had primary responsibility for the following:

  - Operation of existing systems
  - Implementing new applications
  - Maintenance of existing software
  - Data base management and administration of existing data bases

EXHIBIT VII-1



- After downsizing, a significant number of IS departments planned to pass responsibility to user departments, resulting in the following distribution of primary responsibility:

  - 56% of the downsized systems will still be operated by IS, but 44% will be operated by user departments.

  - 52% of the IS departments will still have responsibility for the development of new applications after downsizing, but 38% of user departments will now have that responsibility. The remaining 10% will be acquired from outside vendors.

  - 69% of IS departments will retain responsibility for data base management and administration of distributed data bases, but 31% of user departments will now have primary responsibility for their data bases.

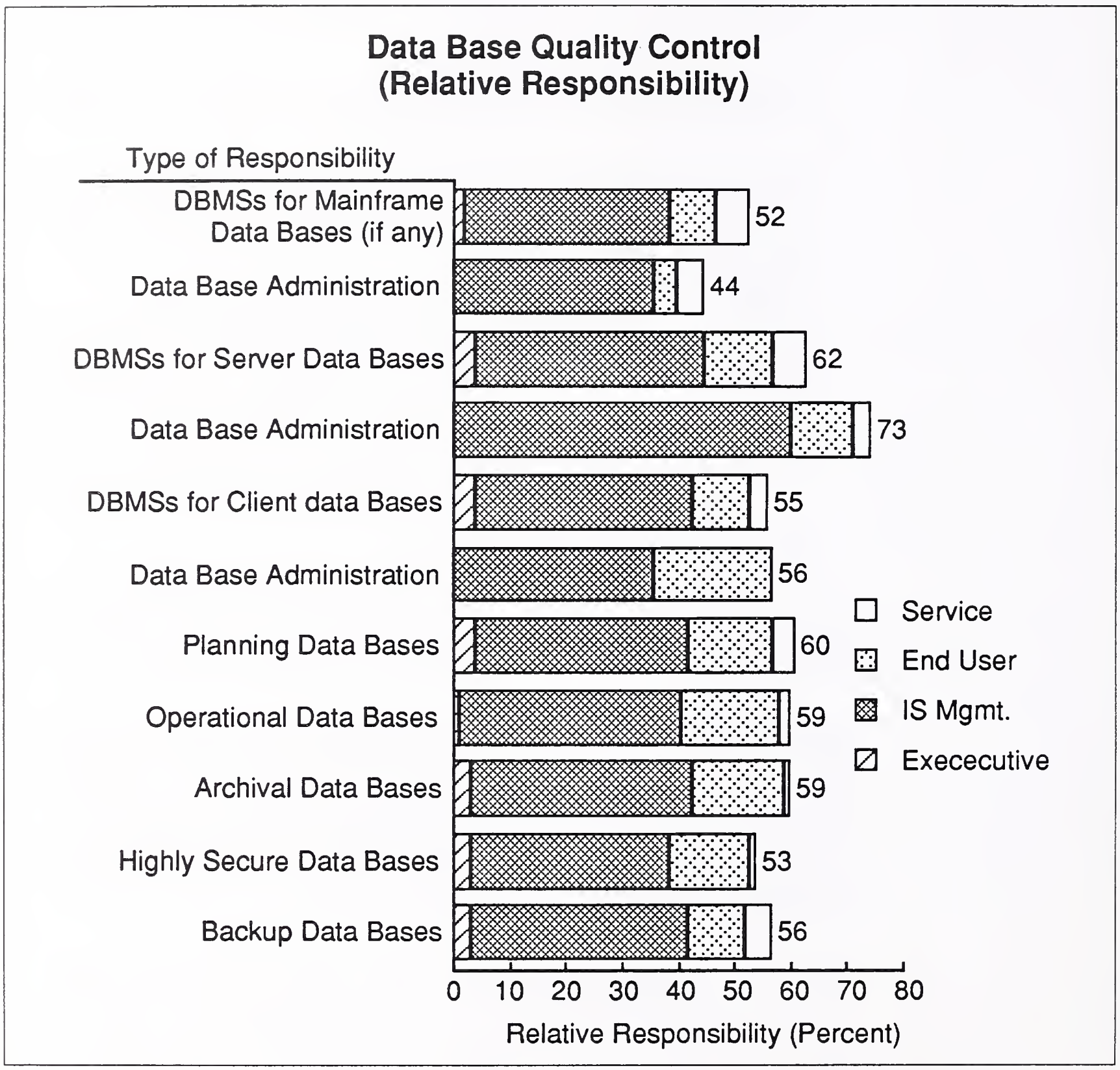
  - 58% of IS departments will retain responsibility for the maintenance of downsized application systems, but 30% of user departments will gain that responsibility. The remaining 12% of applications maintenance will be done by outside vendors.

- User departments will require considerably more training (or retraining) than IS departments—67% for users and 30% for IS. Responsibility for conducting training will be split: IS, 46%; User, 31%; and outside services, 23%.

Though Exhibit VII-1 shows a shift of responsibility away from IS departments, it also gives a hint as to how IS intends to retain control, and how processing and data will be distributed over the network. It is significant that 69% of IS departments intend to maintain control over distributed data bases, which implies control over the server, its software, the applications that will update the distributed data bases and, to a certain degree, over the business process.

In fact, when asked about how responsibility will be shared in selecting DBMSs and quality control of data at various processing levels, and for various types of data bases, IS consistently has at least twice as much responsibility, even down to the client level, as shown in Exhibit VII-2. This effectively gives IS responsibility for essential data flow in the organization.

EXHIBIT VII-2



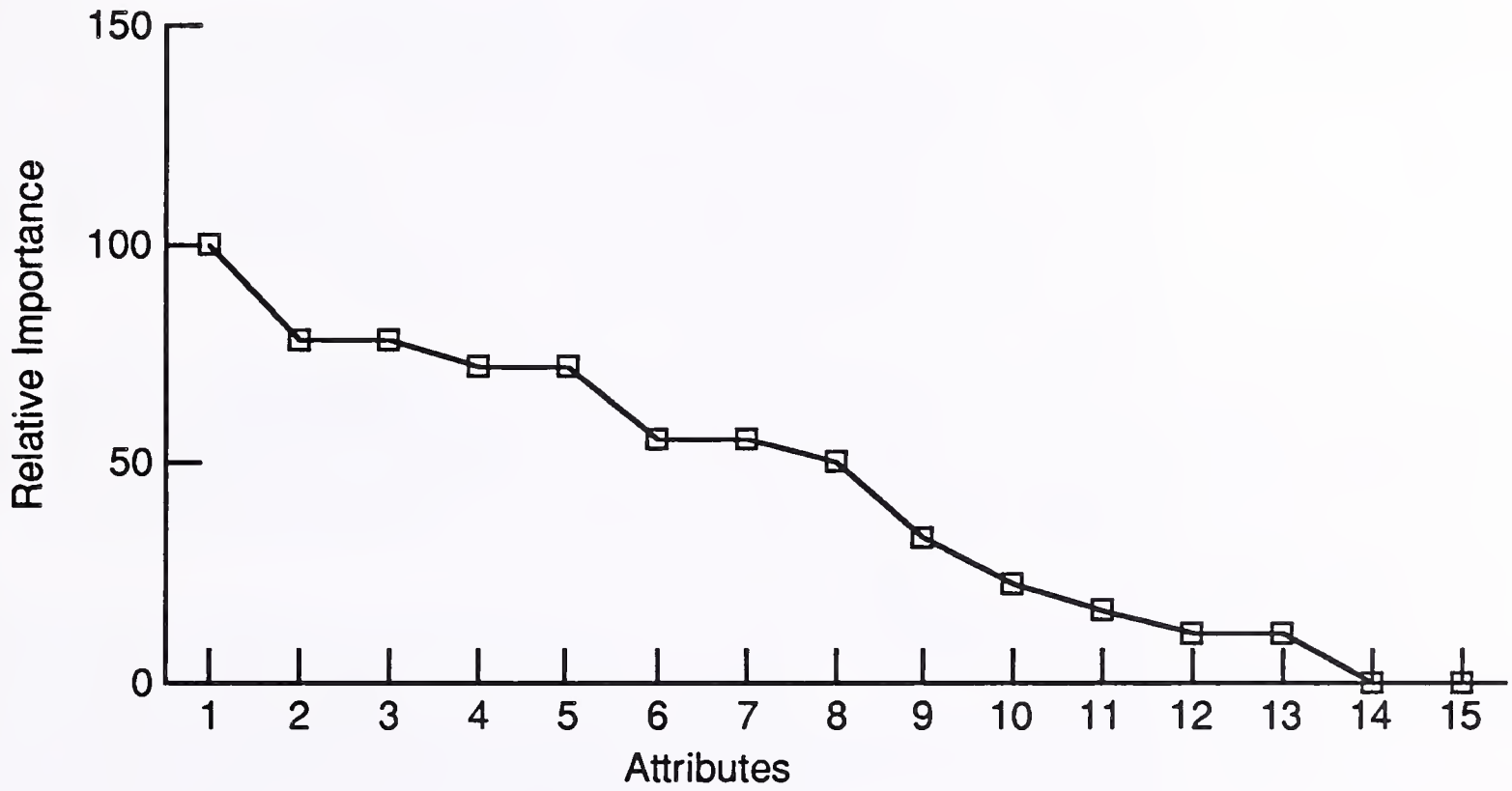
B

Approaches to Downsizing

Respondents were asked to characterize their approach to downsizing. INPUT computed the relative importance of the statements to the most frequently checked statement, which was assigned a value of 100. These values are presented in Exhibit VII-3, which clarifies how the IS department is responding to some of the issues.

EXHIBIT VII-3

Approaches to Downsizing (Relative Importance)



Key	*Attributes*	*Relative Importance*
1	Specific Applications	100.0
2	Re-engineering	77.8
3	OS Standardization	77.8
4	Distribute Process Control Data Bases	72.2
5	DBMS Standard	72.2
6	CASE Tools	55.6
7	Open Systems	55.6
8	LAN User Budgets	50.0
9	LAN User Access & Responsibility	33.3
10	Mainframe Billing Adjustment	22.2
11	Replace Mainframe Platforms	16.7
12	Distribute Data Base Administration to Users	11.1
13	SAA	11.1
14	Quick & Dirty Conversion	0.0
15	Outsourcing	0.0

- Respondents are carefully selecting specific applications for downsizing (100), rather than aggressively trying to replace mainframes (17). This coincides with earlier research, which shows that few mainframes are actually replaced, and those that are replaced are relatively small.

- IS respondents are re-engineering applications as downsizing proceeds (78), rather than doing a quick and dirty conversion. It is clear that most IS departments are attempting to improve their applications as they proceed with downsizing and not rushing to replace mainframes through direct conversion.

- IS respondents said that it is important to standardize on operating systems at each processing level (78), rather than provide data access and turn LAN responsibility over to users (33). Operating systems standards are a means of bringing order out of the user-initiated downsizing chaos, and not very many IS departments are prepared to play a passive role by providing data and leaving LAN responsibility up to users.

- Striking right at the key technical issue of data base quality, IS respondents also find it important to standardize on a DBMS at each processing level (72) as well as to distribute processing and retain central data bases (72), rather than to distribute the data base administration function to users (11).

- The relative rating of 56 for the statement that open systems will be the foundation of downsizing certainly stands out when compared to a relative rating of 11 for the statement that "SAA will play a significant role in downsizing." This represents an important shift because INPUT's earlier research revealed that open systems and SAA were rated approximately equal in relative importance by IS respondents.

- Brief comments on the remaining approaches are as follows:

  - CASE, with a relative rating of 56, may be making a recovery from being badly undervalued when it did not work its promised miracles on improving the system development process.

  - It may be a little premature of the IS department to say that users should budget and pay for hardware and software on LANS (50), when IS departments are also saying that they want to exercise tight control of that hardware and software. This will probably be enough to fuel the continuing feud between IS and users.

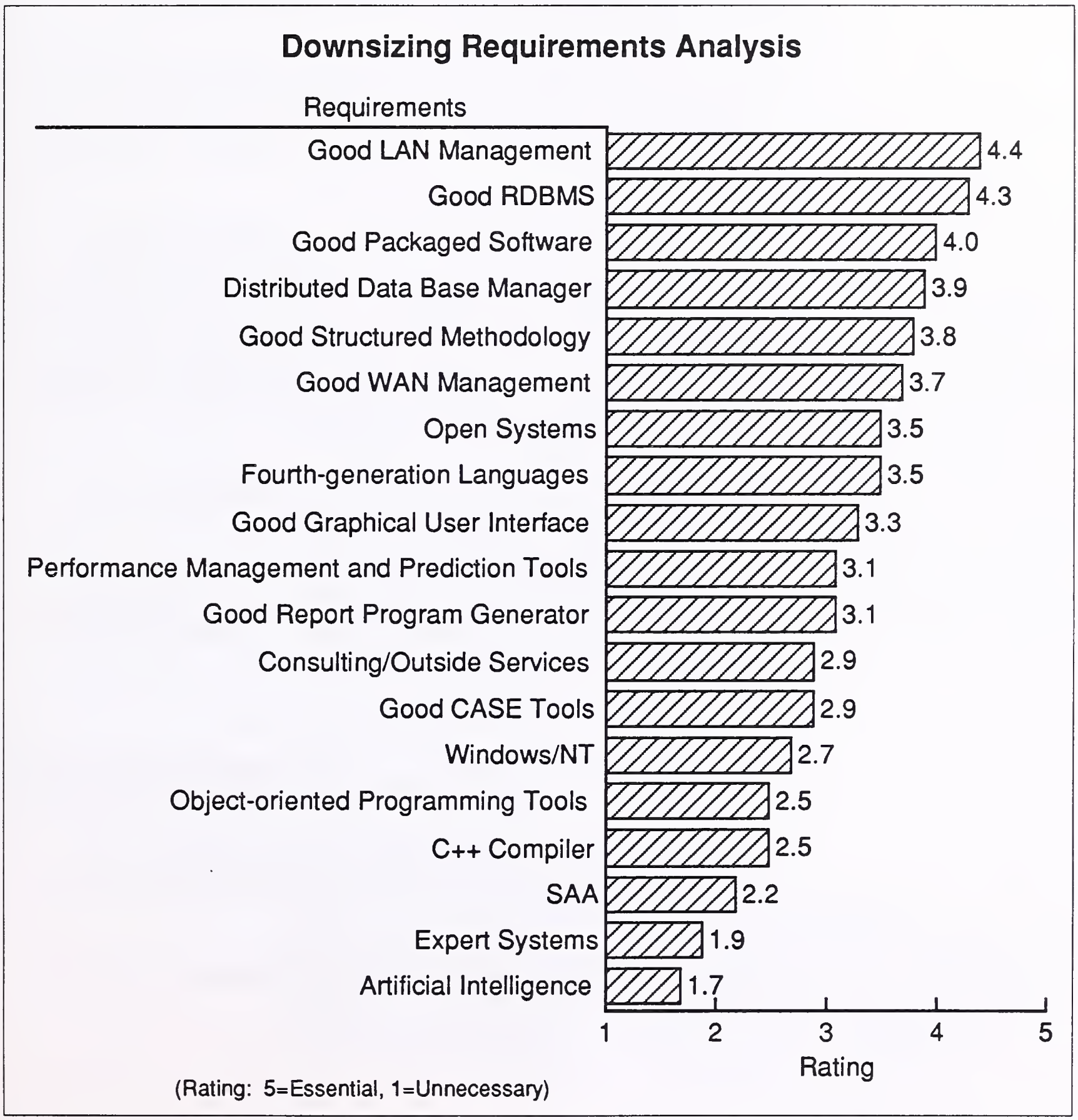
  - In addition, very few IS departments think it is important to adjust mainframe billing to cover decreased use as a result of downsizing (22).

C

Respondents' Downsizing Requirements

INPUT asked IS respondents to rate certain terms based on their importance to the downsizing effort. These terms were rated on a scale of five (5 = essential, 4 = very important, 3 = important, 2 = unimportant, and 1 = unnecessary). The results are depicted in Exhibit VII-4.

EXHIBIT VII-4



- Good network management for LANs is the most essential requirement, with a 4.4 rating. This is very much in line with the issue of how programs and data are to be distributed and controlled on the network. The second most highly rated requirement was a good relational data base management system (4.3). A distributed data base manager came in fourth with a 3.9 rating. The respondents are aware of the key issues of network and data base management. Good packaged software had the third highest rating (4.0).

- In addition to these four requirements topping the list, four others rated between 3.5 and 3.8. Comments that were made are as follows:

  - A structured methodology is considered important because a top-down approach is taken by the IS department and the emphasis is on re-engineering. The employed methodologies vary considerably, but the important fact is there are a variety of tools adapted to support re-engineering to the client-server environment.

  - Because most respondents plan to retain their mainframes, good network management for the WAN is important. SNA still reigns supreme with the mainframe group, and it is difficult to convince those accustomed to using PROFS that every message doesn't have to be routed through a mainframe to be managed. However, IS has already indicated a willingness to seek assistance, and WAN installation and management represents the greatest involvement of outside services companies in the downsizing process.

  - Open systems is at 3.5, but SAA rests at 2.2—implying that SAA really has become a dirty word in the last year.

  - The fact that 4GLs rate as high as they do (3.5) reveals the types of applications being downsized and how they are being re-engineered. Also, the fact that C++ is rated at 2.5 indicates that there aren't that many mission critical applications being downsized.

- Clustered between 3.3 and 2.7 there are the following:

  - GUIs are rated at 3.3, but they have lost some steam in the last year or so.

  - Performance measurement and prediction is considered important with a 3.1 rating. One telephone interviewee explained a performance problem he foresees:

    - We have labored to provide subsecond response time on mainframe terminals.

- We know that users, accustomed to a certain level of response, object to any performance degradation. In fact, any fluctuation in performance and the user will automatically zero-in on the fastest response and expect that all the time.

- We don't know how to predict performance or maintain a consistent level in even a simple client-server environment—much less in a distributed data base environment.

- The one thing that we do know is that an end-user will make a ridiculous query—say requiring a join and select on a large data base—and still expect fast response time.

- Performance is going to be a problem in some downsized applications—even after the operator gets his hunk of the data base on his desktop. Count on it.

- RPGs, which are as old as unit record equipment and as current as the AS/400, are still considered important (3.1).

- Consulting and outside services falls into the important category with a rating of 2.9, right along with CASE tools.

- Microsoft Windows and NT are considered important, but it is probable that Windows carried NT (as yet unavailable). There may be some disagreement between personal computer users and the IS department when RPGs rate slightly higher than Windows NT for downsizing.

- Near the bottom of the ratings (from 2.5 down to 1.7) are object-oriented programming tools (2.5) joining C++ and SAA, which have already been mentioned. Then, at the very bottom, and unimportant to IS as it manages the downsizing effort, INPUT finds expert systems and artificial intelligence.

D

Empowerment, Knowledge and Mind-set

1. Empowerment Doesn't Work

A major international conglomerate in the semiconductor business recently empowered their manufacturing sites through the use of a computer integrated manufacturing (CIM) system. Because of the ready availability of up-to-date data on orders they were able to respond more quickly to their customres demand by scheduling (and rescheduling) their various manufacturing facilities.

This empowerment at the local level enabled the company to eliminate several levels of management until there were eventually only four levels from the president to the shop floor. Unfortunately, they concluded that empowerment didn't work. They found this out when they started having problems with quality control, and found they didn't have anyone left who knew anything about failure analysis.

2. Neural Nets and Mind-sets

Another company is a large international publishing firm that has obtained competitive advantage from information technology by developing the world's most comprehensive and high quality mailing lists. It all started with enormous tape-oriented batch systems years ago, and the data bases grew to be extremely large and complex. Batch jobs updating the data base ran for days, and there was heavy processing for quantitative and qualitative analysis necessary to support market research and forecasting.

It was a natural for a client-server environment using modern data base technology and high-speed workstations. A long-term project was started that is still going. Fortunately, the company is prosperous and can get a lot of outside help. Millions have been spent on outside consulting, tools, methodologies and project control systems. Arguments continue about whether the data base is too big for a relational data base management system or whether VSAM should be used. The IS and user co-builders are not always in synch, but at least they are talking with each other.

There have been problems with having the proposed system aimed at a moving target as new functions are added to the old system by those responsible for maintaining it. People on the IS and user sides are sometimes confused about exactly what is going to be delivered when, but the new system slowly moves forward.

Various expert systems proposals have been reviewed and some qualitative and quantitative capabilities have been built into the system. As the system gets closer to reality, new consultants and new experts review the system and come up with new ideas. One of the latest was a neural net.

It sounded like a great idea until someone said, "O.K., lets assume that we can build it, and even that it works. Is management prepared to run the company that way?" It was concluded that perhaps management's mind-set wasn't quite ready for neural nets, but that raised a more fundamental question: "As long as the company is highly successful using the old system, will anyone trust, or use, the new system?"

It is a good question for those who plan to re-engineer old systems that work.

With or without expert systems and artificial intelligence there are risks in innovation. IS is taking a conservative approach and is adopting a defensive posture as far as downsizing is concerned.

E

The Question of Cost-Benefit Analysis

As long as mainframes remain installed, it is difficult to cost justify downsizing unless one employs creative accounting. One of the objectives of this study was to follow-up on published case studies to determine actual benefits. It revealed some highly questionable cost justification. For example:

- Ignoring transition costs when determining payback from downsizing.
- Determining savings by comparing billings from a central service with hardware costs without considering operating and overhead costs associated with the client-server network.
- Ignoring maintenance and operating costs of the downsized systems.
- Basing downsizing "savings" on projected increased mainframe costs.

In addition, there is a great deal of confusion over methodological cause and effect.

The lack of comprehensive cost-benefit analysis either before or after downsizing has been apparent in all of the research INPUT has conducted, and INPUT has learned to be especially wary when the "cost per MIPS" is mentioned.

There are good reasons for downsizing, and cost savings are possible, but simplistic solutions and buzz words seldom achieve results.

F

The Methods in the Downsizing Madness

1. The Compute Intensive Faction

At one time, IBM had binary computers for scientific and engineering work, and character-based "data processing machines" for commercial work. When it was decided over thirty years ago that there should be only a single product line of compatible computers, IBM came up with the 360/370 complex instruction set computers that are now the mainframes under attack by downsizing.

Not everyone within IBM agreed that there should only be one computer architecture, and the "binary bigots" always knew that cheaper processors could be developed for scientific work. They did not go away, they merely went underground within IBM, and it is not surprising that one of them, John Cocke, emerged many years later as the father of reduced instruction set computers.

However, the IBM 360/370 architecture was a huge success and essentially killed off the "seven dwarves" who had been competing head-to-head with IBM in the commercial market. However, the insistence that commercial work and scientific work could (and should) be done on IBM mainframes never set well with engineers and scientists, and they found other solutions in minicomputers and timesharing services. Anyone who has ever run an IBM mainframe computer center knows that is practically impossible to keep engineers and scientists happy with mainframe computing, and for good reason—the expense and service of mainframe computing adversely impacted their work.

For years the IS department, with aid and assistance from IBM, tried to subjugate engineers to mainframe computing with varying degrees of success. However, the advent of the MIPS-burning workstations triggered the whole downsizing revolution. The price-performance advantages of RISC workstations were too obvious to be ignored.

The methodology employed by the compute-intensive faction of the downsizing revolution is simple because engineering departments have everything going for them.

- They understand computers and networking better than the IS department.
- They do not have problems converting programs because most of them are still written in Fortran, and they have substantially higher aptitude for programming than do the COBOL programmers in the IS department. Also, if they have to employ C++ for any reason it is no big deal.
- Engineering departments already have control over most of their own data.
- They have had experience with work group computing on engineering projects, and client-server architecture comes naturally to them.
- Once they get their engineering applications off-loaded, there is a natural tendency for the administrative work to follow. While IS departments may accuse engineering departments of over-simplifying commercial applications, there is a deep-down, justifiable fear that if the engineers

ever turn their attention to those commercial applications they may, in fact, find them easy to downsize. The complexity of mainframe computing in many cases is in the tools (operating systems, DBMSs, transaction monitors, CASE, etc.) and not in the applications.

2. The Knowledge Intensive Faction

Closely akin to the "compute-intensive faction" is the "knowledge intensive faction." Professionals who have not had very much exposure to computers before, but now have a 486 sitting on their desks know that it can help them with their substantive work (rather than just personal productivity tools), but the IS department has not been very helpful. The professionals frequently surpass the IS department in their use of productivity tools, but anything of a substantive nature seems to become a big project involving complex mainframe systems.

- In the beginning they demanded "micro-mainframe links" to get access to corporate data, and some ad hoc reporting was off-loaded from mainframes.

- Then these corporate data were complemented and supplemented with other data, including some based on the individual professional's knowledge.

- Many of these personal data bases were stored in spreadsheet programs, and data interchange was accomplished via floppy disks.

- The information generated from these personal data bases is in the form of correspondence, reports and other paper documents. In order to speed communications, a hard copy is produced and faxed. Filing is frequently duplicated with a hard and electronic copy being maintained.

- Even simple directory/file management seems to cause individual users problems.

There have been excessive promises and expectations for personal computers, and some computer-knowledgeable end users feel that in order to make more effective use of this remarkable technology, they will have to seize more initiative. However, while "user friendliness" theoretically makes computers easier to use, the systems themselves are becoming complex.

Unlike the compute-intensive environment, knowledge-intensive applications require symbol processing. If human knowledge is to be captured, organized and "managed" by computers in the new human-machine networks that are emerging in downsized organizations, new methodologies and approaches to application development are required.

By new INPUT does not mean that there is a need to invent more tools. Instead, effective use must be made of the technologies already available. Logic must be applied to the information and knowledge-intensive society that is being created by information technology.

Only the end user can supply this logic—that is the main reason for distributing processing power and data to the desk top. The question then becomes one of whether one can expect the user to record this logic using boolean algebra and LISP programming, or whether systems can be built to observe humans as they interact with the system and capture knowledge at its source.

Few individual end users will cope with this increasing complexity when downsizing commercial applications and data bases from mainframes. They expect and deserve help from two sources—from hardware-software vendors and the IS department.

3. The Empowerment Faction

The personal computer industry got started with the revolutionary slogan of "power to the people." As the early day radicals become millionaires, the slogan succumbed to buzz words like empowerment and downsizing. The methodology has been quite simple and effective:

- Sell personal computer hardware
- Make it easy enough for a child to use
- Rename software tools as applications, so that users can immediately become productive until real cross-industry applications appear.
- Demand data from central sources for use with these applications.
- Use file transfer to move data between central data bases and clients and among the clients themselves.
- Trust empowered users with responsibility for selecting and using applications and management of personal data bases.
- Provide for connectivity between empowered users and their application tools.
- Integrate work group activities by upsizing to client-server architecture.
- Replace minicomputers and small mainframes—especially those dedicated to single applications or work groups.
- Downsize work group applications from large mainframes.

- Leave data quality responsibility with the IS department either because the problem is not understood or because it is too difficult to solve.

This has been the bottom-up methodology of the downsizing revolution. It has broken up the long-term marriage between IBM and the IS department, smashed the mainframe glass house, raided the corporate data banks and reorganized the corporate power structure.

Though it remains to be seen how effective the new organizations will be, the empowerment faction believes that anything will be better than the monolithic corporate planning and control functions centered around corporate data bases.

4. The Data-Centered Control Faction

As the research for this study has shown, the IS department still believes that things will get worse unless problems of data base synchronization, integrity and security are understood and addressed before downsizing. As an IBM representative once said about the empowerment faction, "They just don't understand the sanctity of data." This feeling is generally shared by the IS department.

IBM's recommended methodology for preserving the "sanctity of data" in a distributed environment is SAA. Unfortunately, SAA was never understood and/or accepted by IBM's customers or the other factions within the company. The result has been the dramatic decline in SAA as an accepted methodology for downsizing. However, in the case of the IS department, the rejection of SAA is probably a more politically correct reaction than a technological rejection.

The generic description of the data-centered control faction's methodology is as follows:

- Retain central control of data regardless of where is distributed on the network (if the user doesn't need to know where data are stored on the network, some central control is implicit).

- In the interest of preserving data and information quality, programs and applications that process these data must be standardized in terms of their development, maintenance and usage.

- Maintain a central library or repository of data, programs and objects to assure that the quality of active applications systems.

- Maintain a "bonded warehouse" of all corporate data (archival and active) to control and assure proper and authorized usage.

- Distribute these data and processing resources as directed by management, and serve as the corporate conscience for data quality.
- Retain control of LAN and WAN development directly or through vendor selection.
- Maintain control of distributed data bases though selection and standardization of server hardware and software.
- Maintain control of client use of corporate and work group data though selection, standardization and support of client hardware-software and data access.

It is probable that many of these methodological components will be SAA products such as the repository, AS/400, OS/2.2 and SQL. However, few IS departments are committed to being "true blue" in their downsizing efforts. This is due primarily to IBM's failure to establish the AS/400 as the preferred distributed data base server, and APPN as a peer-to-peer networking standard. Whether this was by design, choice, or ignorance INPUT does not know, but it has been extremely costly to IBM.

G

Methodology and Management Mind-Set

In *Systems Architectures for Downsizing*, INPUT described four schools of thought concerning the application of information technology to business problems.

1. Methodology and the Schools of Thought

The schools of thought as described in earlier INPUT research are summarized below.

- The Management Theory School of Thought emphasizes "scientific" management as introduced by Frederick Taylor. It features emphasis on work simplification and cost control that has characterized industrial engineering in the factory. Technological downsizing will facilitate the application of this school of thought to the office environment. This will permit the reduction of staff by increasing productivity of individual workers.
- The Mechanization School of Thought emphasizes the automation of processes using the tools of operations research and industrial engineering. The routing and scheduling of work is automated wherever possible. Downsizing is a major step toward the cost-effective substitution of electronic for paper media in business processes—an innovation of major proportions in the office environment.

- The "Living Systems" School of Thought believes that the empowerment of workers with information will result in increased productivity for products and services. Such empowerment has been a consistent theme since the development of personal computers. Downsizing and improved access to corporate data are viewed as essential to stimulate the untapped creativity and potential of the work force.

- The Intelligent Systems School of Thought is based on Herbert Simon's concept of an "intelligent artifact" capable of performing many functions at, or beyond, the capability of human beings—a highly controversial school of thought since the early days of computers. Downsizing holds the promise of cost-effectively exploring the potential and limitations of artificial intelligence as a substitute for human knowledge and decision making.

a. The Management Theory School

Corporate management is turning over the responsibility for downsizing to the IS department, which strongly feels that the primary reason for downsizing is to cut costs.

The approach taken by IS in implementing downsizing indicates that the mind-set of IS management has also been formed by this school of thought. The function of the corporate systems being downsized is to monitor and control the activities of the operating departments. The data generated by these systems will remain under corporate control.

b. The Mechanization School

The potential to "mechanize" (automate) office operations requires the re-engineering of existing applications to take full advantage of information technology in the workplace. Mechanization is a primary objective of scientific management, and IS states that specific applications will be selected for re-engineering.

Through the use of GUIs, operator tasks at the workstation can be simplified, monitored, measured and controlled. Operator productivity can be improved through mechanization, and management span of control can be increased. The system will supervise the work of individual employees and "report" to higher management.

One of the objectives of SAA is to mechanize data base and network management functions of the IS department. The automation of these functions becomes necessary as systems become more complex and humans are no longer able to operate the networks or respond on a real-time basis.

The Mechanization School of Thought is the logical extension of the Management Theory School. Technological downsizing permits and requires the mechanization of routine white-collar work. Corporate and IS management have graduated from the Management Theory School and are now actively enrolled in the Mechanization School.

c. The "Living Systems" School of Thought

As stated earlier, the empowerment of workers has been a primary objective of the downsizing revolution. It is not clear that either corporate or IS management is prepared to graduate to the "Living Systems" School of Thought. Organizational downsizing and reduced staffing indicates single-minded emphasis upon cost reduction and the maintenance of a hierarchical organization structure.

White collar workers have been empowered in the production of paper information, and they can now produce better looking paper documents. However, there is no indication that the content of these documents has improved, and professional workers now find themselves performing what would previously have been defined as clerical functions.

Whereas the IS executives felt that better management information was the most important objective of downsizing, they did not believe that this was very important from the perspective of either corporate management or users. Interviews for this study indicate that most of them interpret better management information to mean better control and not increased participation in the development of management strategies.

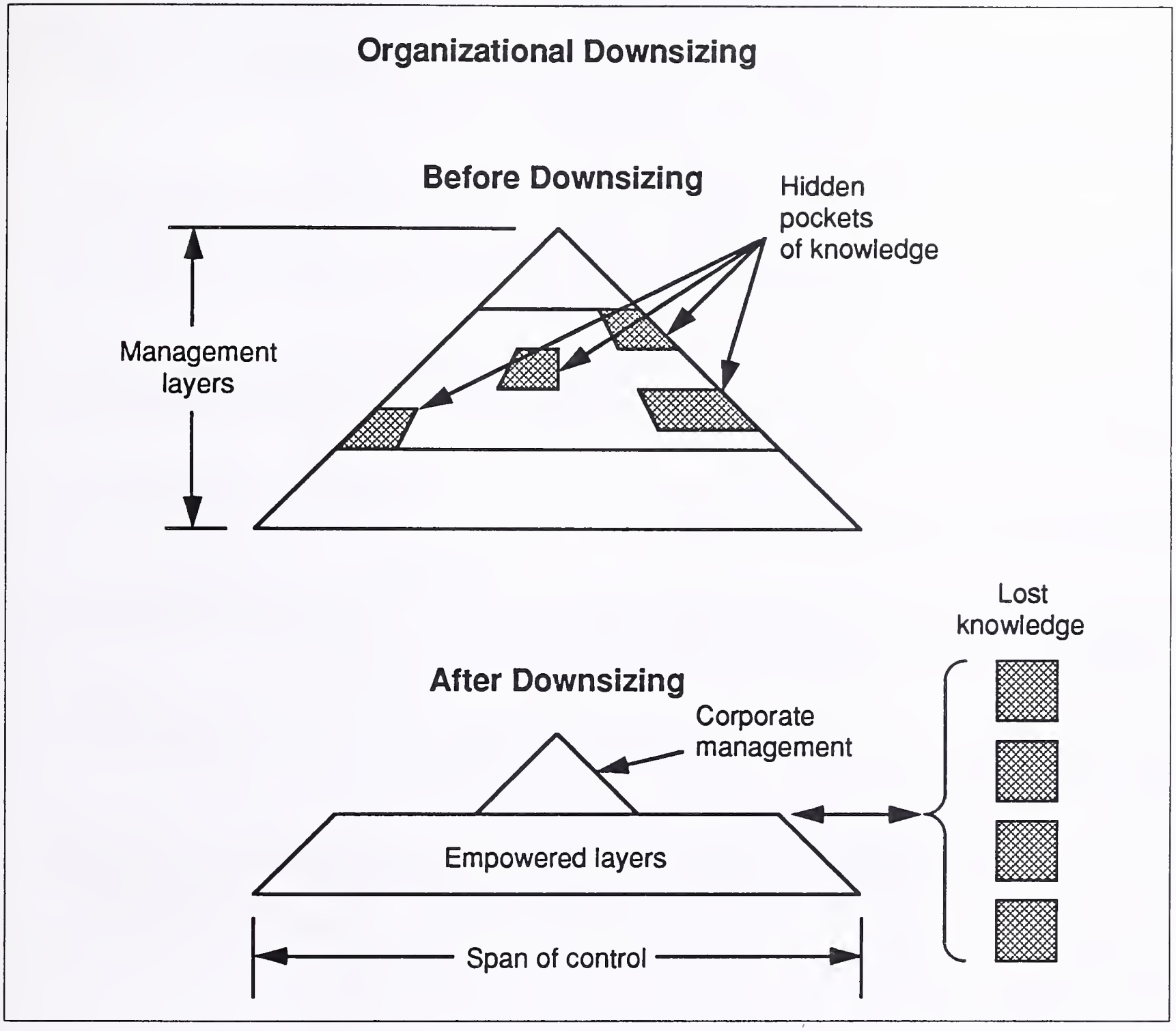
Management strategy is quite simple: if stock prices go up, you keep doing what you have been doing (which essentially means that innovation is slowed), and if stock prices go down, one downsizes and fires people to cut costs. It doesn't matter whether this simplistic approach to management is because of too many MBAs, executive stock options, or information overload—there is a tremendous imbalance between the financial and human sides of management.

d. The Intelligent Systems School

The Intelligent Systems School of Thought is suited for a management mind-set that emphasizes financial numbers over human resources, but IS does not rate either expert systems or AI as very important when re-engineering downsized applications. This may be because precious little progress has been made in substituting computers for knowledge-intensive human work—especially the kind that improves products and services.

The danger in not applying knowledge engineering when downsizing is that essential knowledge will be eliminated as it was in the semiconductor operation cited in the previous section. The problem is depicted graphically in Exhibit VII-5.

EXHIBIT VII-5



- In the classic hierarchical management structure employees, get promoted into supervisory and management positions because they have performed well at the previous level. Knowledge-intensive work means that their experience and knowledge exceeds the layer that they are leaving.

- As organizations grow, additional management layers are added, and this knowledge gets extended along the vertical and horizontal axes of the organization.

- This results in pockets of specialized knowledge (and capability) scattered throughout the organization. Sometimes this is built into the formal organization structure, sometimes it results in an informal organization, sometimes it becomes hidden until a particular problem arises, and when organizational downsizing occurs, these hidden pockets of knowledge are sometimes lost.

- Drastically increased spans of control assures that there will be "blind spots" in management knowledge at the operating levels, and contrary to popular opinion, the quality of information reaching the corporate level for decision support will probably suffer. This is true for the following reasons:

  - Knowledge workers empowered with information technology generate an increased volume of information and noise that is not very well filtered before it is received by decision makers.

  - It is possible to obtain "expert" opinions to support practically any conclusion or decision.

  - This practically assures that corporate management will be forced to manage by the numbers, unless executives have their own informal knowledge network based on their own experience.

  - Unfortunately, the increased span of control makes it less likely for executives to identify the remaining hidden pockets of knowledge—even if they have not been lost during the downsizing process.

Thus, the existing management mind-set that determines the methodology employed when downsizing, is reinforced by the results of downsizing. It also reinforces the opinion that knowledge of a particular company, its products, its people, its customers, and its competitors is not necessary to the effective management of an enterprise.

H

The "Perfect Executive Terminal"

In the 1960s, IBM research scientists at Yorktown Heights, NY, became interested in designing a terminal for executives. They ran into all of human factors problems that continue to keep executives from making effective use information technology. The closest they came to a final product was the IBM 2250 display that featured a light pen for point-and-click, and a Polaroid camera for a hard copy. Only one IBM executive used it as a terminal and that was for demonstration purposes.

However, during that time, one particular research scientist conceived of what he referred to as the "perfect executive terminal."

He stated that the perfect executive terminal was a light bulb that sat on the executives desk and burned continuously as long as everything was going all right by whatever criteria the executive specified to the information system. If the light bulb ever went out, then the executive picked up the telephone and simply asked, "What went wrong"?

Many thought that executives would tolerate this level of interaction with information technology. The inventor also pointed out that the system was fail-safe because even if the light bulb had merely burned out, the executive's response remained exactly the same.

Of course, technology and executives have changed in the last 30 years, but several potentially bad things can happen when the executive picks up the phone:

- He won't know who to call because he doesn't know which business he is running today.
- No one will know what is wrong (or how to fix it) because the organization will have lost essential knowledge through downsizing and empowerment.
- All empowered employees will think they know what is wrong and how to fix it, and the executive will have 14 hours worth of voice mail—none of which is in agreement on either the problem or the solution.
- No one will even answer the phone because the enterprise has been completely mechanized.

As INPUT finished this report, IBM announced its record losses and that its CEO, COO and CFO have resigned. The light bulbs on all three desks have burned out—permanently. It is INPUT's belief that the failure of SAA is directly responsible for the lights burning out. However, before the final burnout, the bulbs flickered many times and corporate management was not picking up the phone, or something went wrong with the management information system.

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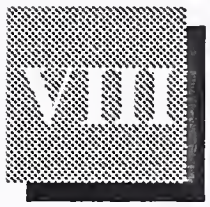


Conclusions and Recommendations

A Conclusions

- Several methodologies are being employed for downsizing, but they all point to one conclusion: the IBM-IS approach of large mainframe-oriented data centers has failed to satisfy end users. INPUT has identified four methodological factions participating in the downsizing revolution. The first three factions are user and/or vendor driven, the fourth is IBM-IS driven.

  - The "compute-intensive faction" has not been satisfied with the IBM-IS approach from the beginning. The benefits of downsizing to this faction have been readily apparent and achievable. The IBM-IS coalition has never controlled this faction primarily because engineers and scientists understand computers and their problems better than the IS department does.

  - The "knowledge intensive faction" has had difficulty dealing with the IS function because of the communications gap between the "computer illiterate" and the jargon-intensive computer "expert." With a smattering of computer literacy, this faction knows that it may be easier to solve their own problems rather than try to explain them to a central IS department laboring under the burden of mainframe complexity.

  - The "empowerment faction" recognizes the unrest of the above factions, and has provided the hardware-software tools to support the downsizing revolution. The revolution has demonstrated the vulnerability of the IS departments hardware-software tools, and now the battle is centered on data—without which the new "solutions" have only limited value.

- The "data-centered control faction" is the IBM-IS coalition, and it has long been under siege from the other factions. When the success of the downsizing revolution became apparent, the coalition put forth a compromise called SAA. This compromise has been rejected and the failure of SAA has put severe strains on the IBM-IS coalition.

- Corporate management is a user of information technology like the operating departments, and it has become just as frustrated with the IBM-IS coalition (and information technology) as have other end users. Corporate frustration with the IBM-IS coalition is based on the following:

  - Failure to produce promised results in terms of competitive advantage, decision support, or improved white-collar productivity.

  - Real and perceived expense of mainframe-based information technology and systems.

  - Counter-productive organizational dissension centering around the use and control of information technology.

  - The inevitable identification of corporate management with the IBM-IS coalition.

  - Unwanted dependency on information technology in order to achieve organizational downsizing objectives.

  - The ever present threat of losing control if operating levels are empowered with information technology and data.

- Corporate management was instrumental in forming the IBM-IS coalition because it had confidence in IBM as a well-run, profitable enterprise—a worthy role model for other companies. However, corporate management seeks to distance itself from the IBM-IS coalition. The "IBM can make it work" attitude has now been replaced with an "IBM is expensive" attitude. The question, "Why not IBM" has been replaced by the question, "Why IBM"?

- IS, as part of corporate management, is well aware of this shift in corporate mind-set. Therefore, IS has sought to separate (and perhaps divorce) itself from IBM. Separation has been relatively easy for IS because IBM has stopped behaving like a true "partner" and has become just another vendor out to make a buck. However, divorce is more difficult because of the legacy of the long-term relationship—those corporate data bases and systems.

- Corporate management recognizes that corporate data represent the only effective means of managing the enterprise. IS management recognizes the technical problems associated with data base quality in a distributed environment. The corporate downsizing plan is designed to retain essential control and maintain data quality while transferring additional power and responsibility to the operating departments.

- Although the motivation for, and implementation of this transfer of power varies tremendously, all but the most radical, or naive, downsizing revolutionary recognizes that it is an extremely complex and risky process. It requires major technological innovations (and even inventions) and changes in management mind-set. Past experience indicates that neither of these come easily and that they must be closely synchronized.

- Simple solutions or methodologies for downsizing can usually be traced to a vendor puff piece in a trade publication. The potential problems associated with downsizing, which were listed in the introduction to this study, are supported by articles in reputable technical journals. INPUT concludes that those planning to downsize should trace their assumptions and expectations back to the sources of information and advice they have received and qualify these sources.

- INPUT also concludes that the primary challenges and opportunities of the downsizing revolution relate to knowledge-based systems in the broadest sense.

  - The challenges are the following:

    - Identify knowledge sources in the enormous volume of published information and within the organization.

    - Implement organizational downsizing without eliminating vital sources of knowledge.

    - Develop systems that capture, maintain and extend the knowledge base necessary to operate and manage the enterprise.

    - Gain acceptance and use of these knowledge-based systems.

    - To foresee and mitigate the potential human and societal impacts of these new applications of information technology.

  - The opportunities are listed below:

    - Fulfill the long-standing promises of information technology to improve knowledge worker productivity, to support the decision making process, and to provide competitive advantage.

  - Open vast new markets for knowledge-based products and services.
  - Provide equal learning and growth potential for individuals.
  - Provide unparalleled growth potential for business enterprises.

- In order to meet these challenges and take advantage of these opportunities, they must be clearly articulated and understood. Obviously, the challenges must be met if the opportunities are to be realized. Pursuing downsizing opportunities without understanding and solving potential technical and organizational problems will seldom achieve desired benefits, and may result in disastrous or catastrophic systems failure.

- The IBM-IS concern for the "sanctity of data" is well-founded. As knowledge is integrated with data, the quality of these data become critical. The challenge of distributed data base management is real, and unless it is met, the potential of downsizing and information technology will never be realized.

- INPUT concluded some time ago that SAA was the most comprehensive plan to meet the challenge of distributed data base management. This position has not changed. INPUT is concerned that SAA has apparently been rejected as a viable (and perhaps necessary) methodology by the data-centered control faction. This concern has increased because of IBM's uncertain future direction under new management.

- Although comprehensive analysis of the potential impact of IBM reorganization on downsizing and SAA is beyond the scope of this study, INPUT has reached the following conclusions concerning SAA:

  - Whether or not the term SAA disappears from the language, the SAA architecture, platforms and concepts will continue to play a significant role in the downsized environment.

  - It is important for the data-centered control faction to understand what SAA is and how its components can be integrated with current and future downsizing plans.

  - It is important for all of the other factions to understand that portions of SAA incorporate de facto standards that will be more prevalent and "open" than competitive alternatives that profess to support the open environment.

  - SAA can serve as a useful model for anyone contemplating downsizing mission critical applications—it is more clearly defined than alternative patchwork solutions.

- Those who cannot understand SAA and its problems will probably have some unpleasant surprises as the downsizing revolution proceeds. This conclusion applies to past, current and future IBM management as well as the IS side of the former IBM-IS coalition.

B
Recommendations

- In order to obtain maximum benefit from this report, it is recommended that the reader be familiar with three previous INPUT reports on downsizing:

  - *Putting Downsizing in Perspective*
  - *Systems Architectures for Downsizing*
  - *Case Studies in Downsizing*

- INPUT recommends that downsizing—technological and organizational—be preceded by an information flow analysis that identifies knowledge sources. This analysis should apply to the business and technological aspects of downsizing. For example:

  - Determine whether the quality of management information is being enhanced with knowledge as it flows through the "filters" at various management levels or is merely picking up noise. Do this before flattening the organization.

  - Determine whether your model for a client-server environment is based on experience and/or analysis of articles in reputable technical journals, or on a piece of unpaid advertising in the trade press. Do this before installing a simple client-server "solution".

- Develop (or update) an installed computer-communications hardware-software inventory for the organization. Then:

  - Isolate the downsizing that has already occurred (or is occurring)—by faction.

  - Overlay the information flow and knowledge source diagram previously developed.

  - Have cost-benefit analyses of these downsizing efforts made.

  - Establish hardware-software standards for platforms that will be supported by the IS function.

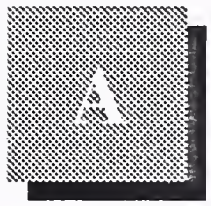
- Before drawing up an overall downsizing plan (much less settling on methodology), make a thorough assessment of the overall organizations information systems resources—the central IS department and within user departments.

- Recognize all four downsizing factions as part of one methodology and resource, and draw on the experience of all four in establishing an overall downsizing plan.

- Allocate human and financial resources accordingly.

- Begin to organize for downsizing and the downsized environment by establishing a management steering committee to coordinate the implementation of the technological downsizing plan and synchronize it with the organizational restructuring inherent in empowerment. One of the primary functions of this steering committee is to stimulate the changes in management mind-set necessary to benefit from increasingly intelligent artificial systems.

- Establish a central knowledge source and learning center for downsizing—technological and organizational. The purpose should be to articulate and analyze the challenges and opportunities outlined earlier. This central knowledge source and learning center will actually be an innovation center—that is what downsizing and management is all about.



Further Case Study Analysis

An intriguing organizational situation was revealed when INPUT attempted to find some examples of end users using packaged software. It was found in the university which was included in INPUT's *Case Studies for Downsizing* report.

As mentioned in *Case Studies for Downsizing*, the central IS function at the university had distributed its systems and programming staff among end user departments even before the term downsizing became popular so that came as no surprise. However, within the university there is a medical school, and in conjunction with the medical school there is a hospital, and within the hospital there is a separate IS function and mainframe computer installation.

Within the medical school the faculty doctors, who practice in and out of the hospital, do not use the computers or IS resources of either the university or the hospital for the substantial business that results from this practice. The attitudes of the various organizations involved are described below:

- The central IS department, when asked about the fact that the hospital has a very large mainframe installed when services could have as easily been provided by the central data processing facility, answered:
  - They think they have special requirements and need their own systems people, and their systems people want their own computer.
  - They are not included in our long-range plan for an information (client-server) architecture.
  - We are just as happy they are going their own way, we have enough problems to deal with without them.
- Hospital IS staff confirms the assessment of the central IS staff by stating:

- We have an entirely different set of problems than those being addressed by the central IS staff. They just don't understand how complex the accounting and payment system for health care is, and what it takes to run a hospital. We need people experienced with hospital systems, and they just don't have them.

- We have our own mainframe because we need a different level of service and reliability than operating out of a central facility. We can't have a bunch of students or hackers from all over the country tied into our computer.

- We are big enough to warrant our own mainframe, and we need the flexibility of making our own hardware decisions.

- We will be ahead of central IS in making use of new architectures (such as client-server) and technologies (such as pen-based computers) because downsizing is necessary in our environment.

- We keep up with the systems developments in other hospitals, and we go outside for technical consulting help. Central IS doesn't have very much to offer us.

• When asked about the fact that faculty doctors had not used either the university or the hospital data centers, but had elected to use first an outside services company, and more recently had installed a DEC VAX, the reply was as follows:

- The faculty doctors have formed a separate corporation for their practice, they require separate accounting and reporting from either the hospital or the university.

- We are not in the computer services business, but we work closely with them on matters of mutual concern and interest. However, clinical systems are different from hospital systems.

- They have a substantial business to run, and they are making their own decisions about the information technology necessary to support that business.

• After going through this complex organizational structure, INPUT finally found an end user who is now spending most of his time dealing with information technology. His focus is on the "business problems" rather than on the technology itself. The discussion of information technology, was related to someone's specific use or experience with technology. Here are some of the things he had to say about the decisions he has had to make:

- It would be out of the question to develop custom software to run on an IBM mainframe. That is the orientation of most IS departments—they make everything complex because they are dealing with such complex systems. We decided to go to a service bureau so we didn't have to deal with an IS department.

- We decided to install our own equipment when the trend was toward outsourcing because our business was growing, and we needed more functionality and capability than the service could provide. Also, there was the possibility of becoming affiliated with other clinics and we couldn't have our information systems dictate our ability to grow.

- We selected the DEC VAX because of the availability of packaged software that met our needs. The software was expensive but not when you consider the alternatives.

- We went VMS rather than UNIX because the software was written for it, and because UNIX just didn't have the systems administration functions we needed—I understand it can't even handle tape labels.

- We signed a long-term maintenance agreement with the software vendor because we obviously can't maintain the system and the vendor is committed to support new DEC systems—including UNIX.

- We are fully satisfied with our hardware-software choice for corporate applications, but workstations and client-server architecture have a lot of appeal for clinical applications. We are currently tracking two systems- one proprietary and one open—both are client-server architecture.

- When we get to client-server architecture, we anticipate that we will have to develop and maintain some of the client applications software. We will need some more people, we might even consider some of the people from IS, but most of them don't seem to fit in too well in our type of environment—they always make things too complicated.

This example shows the subordination of the IS function to the operating organization structure at various levels: by distributing systems personnel to the operating departments; by setting up a separate IS function in the hospital where experience and knowledge of hospital systems requirements are more highly valued than technical expertise; and by having a health care manager assume the responsibility for the effective application of information technology to the business and professional aspects of faculty practice without relying on "professional" IS personnel.

This is a clear picture of the demystification of information technology and the decline of the IS function from a central position of power to a subordinate role in support of the business objectives and professional requirements of the organization.