OPEN SYSTEMS OPPORTUNITIES

INPUT

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Abstract

This report addresses one of the technological trends in which both users and vendors have expressed a high level of interest—the use of "open systems." In the report, INPUT focuses upon the concept and practice of open systems from the viewpoint of ultimate users and examines whether open systems is just another name for UNIX. Drawing on in-depth interviews with users and vendors, the report presents the rationale for open systems from the standpoint of both customers and vendors and analyzes the types of open systems that are possible.

In this report, INPUT analyzes the role of standards in open systems, identifies attributes that users look for in these systems and presents user ratings of open system alternatives. The report highlights the potential benefits of open systems and barriers to their potential use as reported by users. The strategies of vendors in regard to proprietary systems are also examined and comparisons of open systems and other operating environments are developed.

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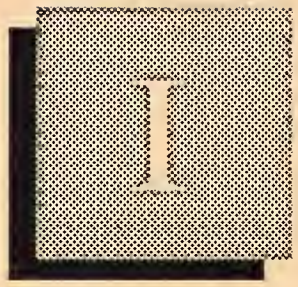
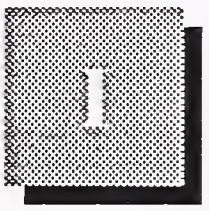
Exhibits (Continued)



Introduction



Introduction

Is "open systems" just another phrase for UNIX? There has been a great deal of confusion over the meaning of open systems and their potential impact. This report seeks to address this confusion.

A
Objectives

The purpose of this report is to examine the concept and practice of open systems. This will be largely from the standpoint of the ultimate user, based on primary research by INPUT.

The report addresses these issues:

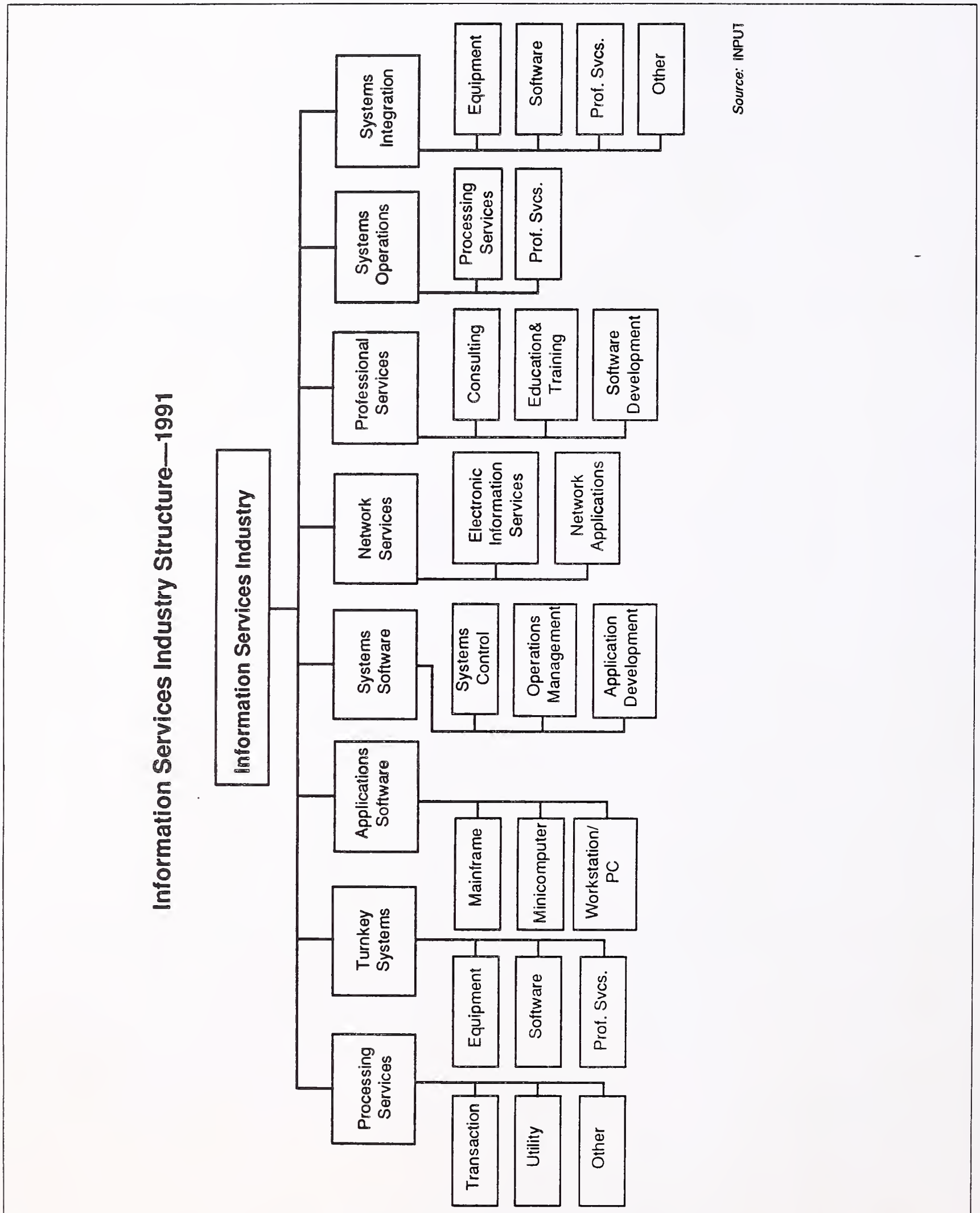
- How do users define "open systems"?
- What roles—positive and negative—do standards play in making open systems a reality?
- How closely do different operating systems meet user needs?
- What benefit do users see in open systems?
- What are the barriers to successful open systems?
- What are the strengths and weaknesses of proprietary operating environments versus open systems environments?
- How are vendors positioning themselves for open systems?

B
Scope and Methodology

1. Scope

Exhibit I-1 shows the structure of the information services industry as defined by INPUT in its market analyses and forecasts.

EXHIBIT I-1



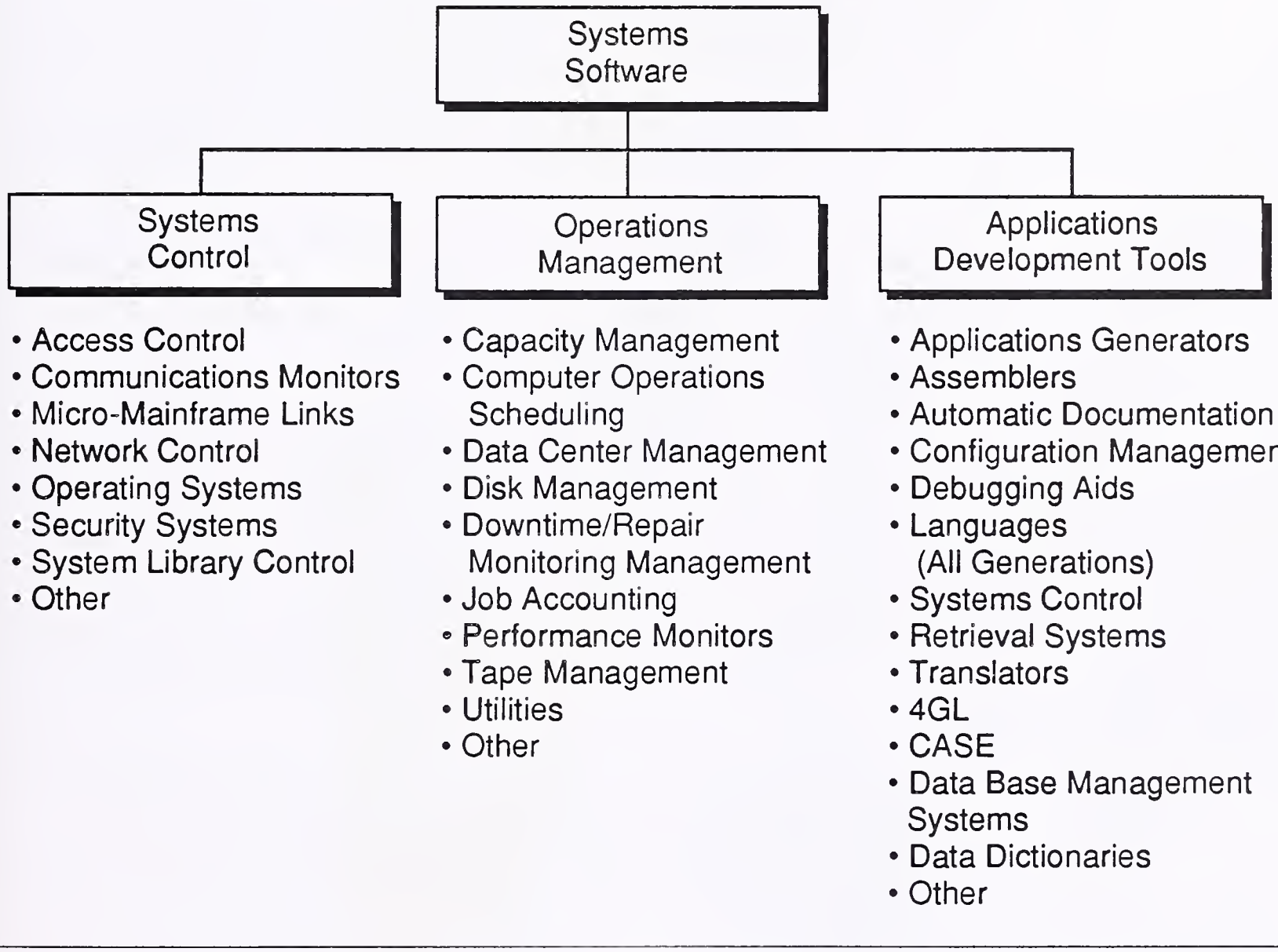
The market consists of eight delivery modes, each of which contains a number of submodes.

a. Systems Software Products

Exhibit I-2 shows the three main product types within the systems software delivery mode.

EXHIBIT I-2

Systems Software Market Structure—1991



The three systems software submodes are defined as follows:

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

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

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

Systems software involves user purchases of software packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support for operating and using the package, if bundled in the software pricing, is also included here.

b. Applications Software Products

Applications software is prepackaged or standard solutions to common business applications. These applications can be either industry-specific (e.g., a turnkey system for a law office) or cross-industry (e.g., human resources software). In general, application solutions services involve minimal customization by the vendor, and allow the user to handle a specific business application without having to develop or acquire a custom system or system resources. Exhibit I-3 is a diagram of the market structure for application solutions, including applications software products and turnkey systems.

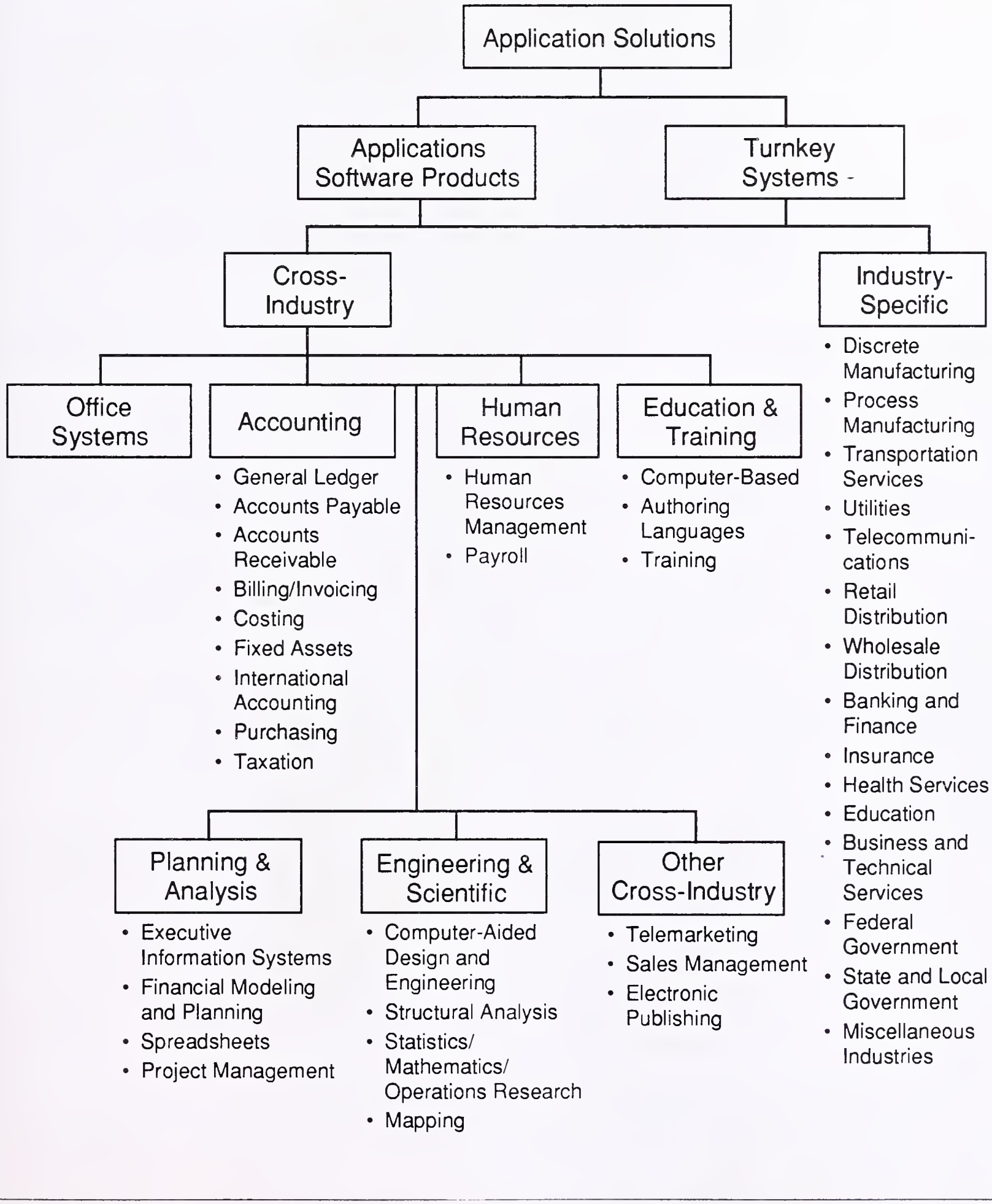
- Applications software is packaged software purchased for in-house computer systems.

  - Industry-specific applications software products perform functions related to fulfilling business or organizational needs unique to a specific vertical market and sold to that market only. Examples include demand deposit accounting, MRPII, medical record keeping, and automobile dealer parts inventory.

  - Cross-industry applications software products perform a specific function that is applicable to a wide range of industry sectors. Applications include payroll and human resource systems, accounting systems, word processing and graphics systems.

EXHIBIT I-3

Application Solutions Market Structure, 1991



2. Methodology

This report draws on in-depth telephone interviews with end-user organizations as well as interviews with vendors that are or will be key open systems participants.

- Twenty-one telephone interviews were conducted with the IS management of end-user organizations that represent a cross-section of vertical industries and company sizes. The interviews were in depth, lasting 30 minutes or more. They explored issues and questions of both a quantitative and qualitative nature. The user questionnaire is in Appendix A.
- INPUT staff participated in over 15 meetings with key vendor product and service representatives to understand vendor open system strategies and offerings.

C
Report Structure

This report is organized as follows:

- Chapter II, Executive Overview, providing a summary of the research findings, analysis, and conclusions and recommendations.
- Chapter III, Background, gives the rationale for open systems from the standpoint of customers and vendors, and examines the levels and types of open systems that are possible.
- Chapter IV, User Requirements, reports the findings of primary research to show how users define open systems, how the role of standards is perceived by users, and the attributes that users look for in open systems. The chapter also provides user ratings of specific operating systems.
- Chapter V, Open Systems Benefits and Barriers, examines the potential benefits of open systems as reported by users. The chapter also reviews the barriers to successful open systems as seen by users, accompanied by INPUT analysis.
- Chapter VI, Vendor and Product Positioning, examines the overall attributes and strategies of proprietary operating environments and then analyzes the strategies of specific vendors. The remainder of the chapter compares UNIX and proprietary environments.
- Chapter VII, Conclusions and Recommendations, summarizes the report's conclusions about open systems and gives recommendations for vendors and users.
- Appendix A is a copy of the questionnaire that was used.

D
Related INPUT Reports

Recent INPUT reports of direct relevance to this study include:

- *Western European UNIX Market Opportunities, 1991-1996*
- *U.S. Market for UNIX, 1991-1996*

Other related reports of interest are:

- *U.S. Systems Software Products, 1991-1996*
- *Western European Market for Systems Software, 1991-1996*
- *U.S. Application Solutions Market, 1991-1996*
- *The Future of CASE, 1991-1996*
- *Downsizing of Information Systems*

INPUT has also conducted studies and engaged in other activities involving open systems, including:

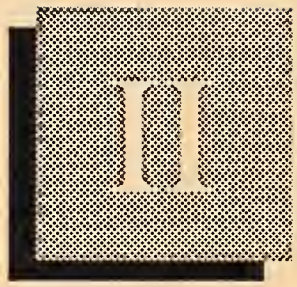
- Assessing the market for UNIX-based applications and related services in the financial services sector

- Advising an aerospace company with considerable open systems expertise on opportunities in the civilian government market as well as commercial markets

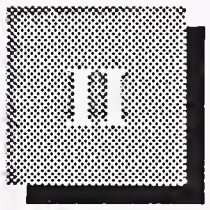
- Consulting for two major hardware manufacturers on key software planning issues for UNIX-based platforms

- Analyzing the NCR/AT&T merger, focusing on UNIX and open systems issues

- Studying client/server support needs



Executive Overview



Executive Overview

Is there a single "open system" subscribed to by both users and vendors? INPUT's research and analysis indicates that there is a very complex set of issues not easily resolved by a single product or standard.

A
The Open Systems Environment

The traditional computing environment is made up of a mixture of proprietary and third-party hardware and software.

The current direction, exemplified by the phrase "open system," is to separate some of the components of the traditional model (Exhibit II-1). The components would not only be separate, but it would also be possible to exchange components. At the most simplistic, not only would the operating system be separate, it could also be moved from one processor family to another.

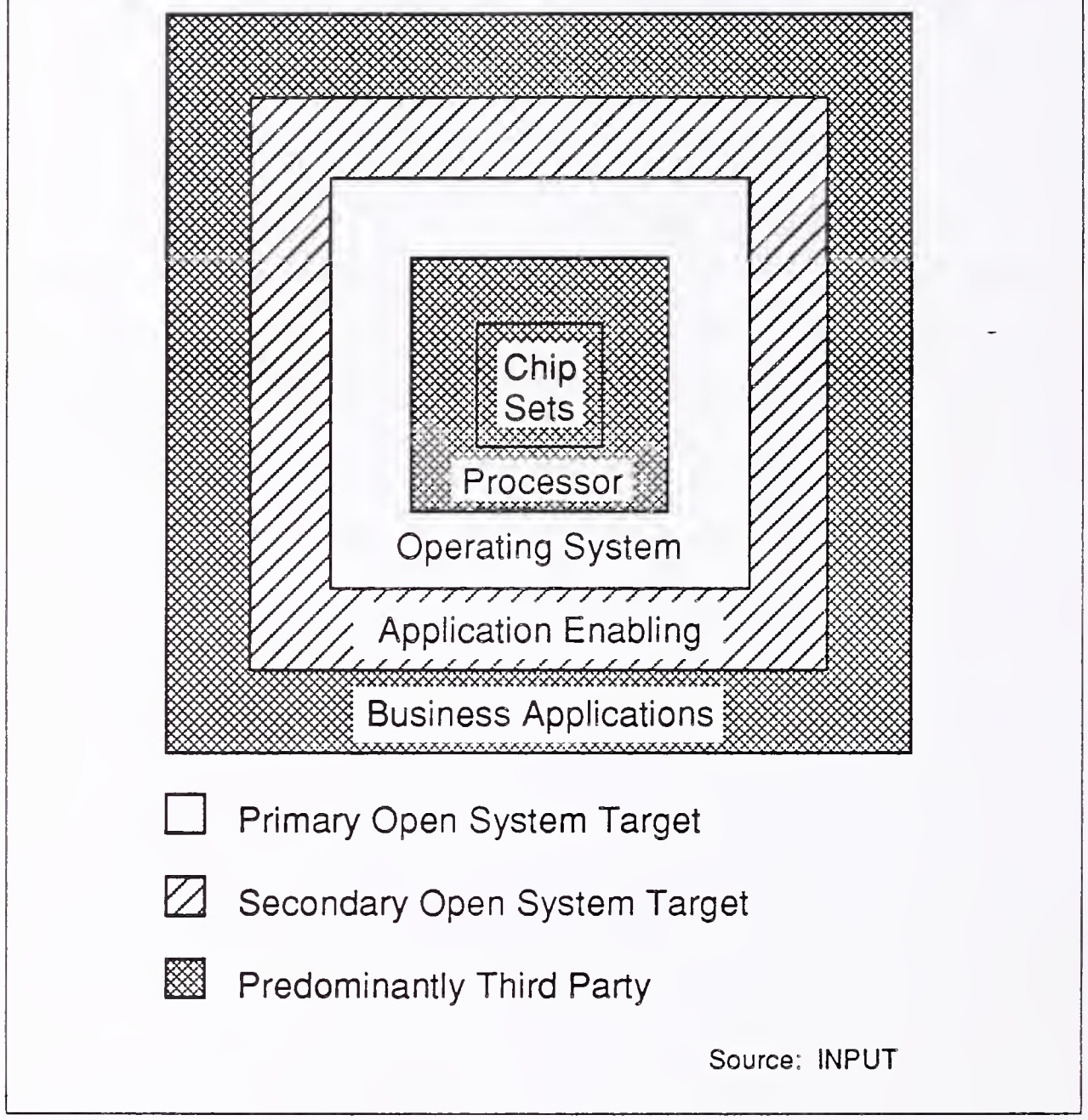
The three principal characteristics of open systems are:

- Portability: Data bases or applications programs can be moved from one operating environment to another with little or no modification. This could go a long way toward preventing premature obsolescence and improving efficiency.

- Interoperability: This is related to portability in the sense that if data and applications can be moved from one environment to another, the applications can also interact with each other.

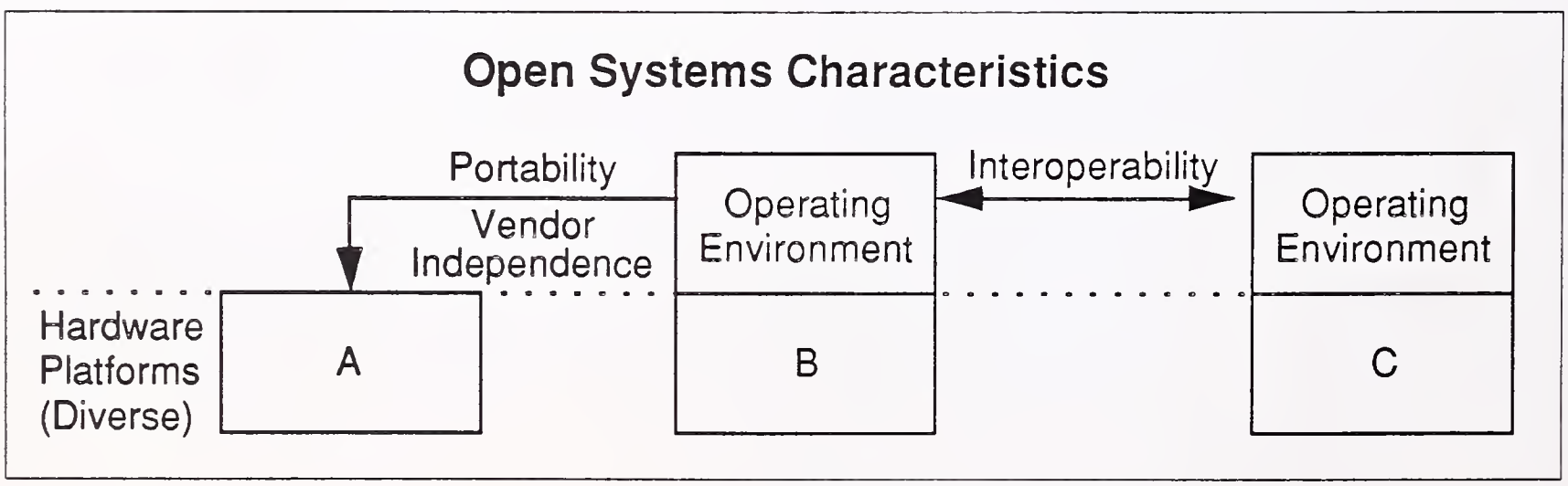
- Vendor Independence: If applications are portable, they can be ported from one vendor's environment to another. This not only gives customers increased flexibility in picking and choosing suppliers, but also gives customers much greater leverage over suppliers.

EXHIBIT II-1



These principles are illustrated in Exhibit II-2.

EXHIBIT II-2



It is important to understand that users and vendors do not necessarily see eye to eye on open systems objectives.

Portability, interoperability and hardware independence certainly represent user objectives, as Exhibit II-3 shows.

EXHIBIT II-3

Open Systems Objectives by Group

Group	Open Systems Components		
	Portability	Interoperability	Hardware Vendor Independence
Users	X	X	X
Hardware Vendors		X	
Operating System Vendors	X	X	X
Software Product Vendors	X	X	
Professional Services/ SI Firms	X	X	
Systems Operations/ Outsourcing Vendors			
Governments	X		X

X = Primary Objective

- Most vendors support interoperability.
- Hardware vendors feel at best ambivalent about portability and are generally opposed to vendor hardware independence.
- Government influence is a special factor in open systems. Governments see open systems as an opportunity to level the playing field, either for government procurements or, especially in Europe, in the computer industry generally.

B

Open Systems: User Definitions

There have been a number of definitions of "open systems" advanced by academics, analysts and vendors. INPUT took a somewhat different tack and provided potential definitions of open systems to a sampling of users knowledgeable about open systems.

- The vast majority agreed that open systems meant products based on vendor-independent standards (Exhibit II-4).

- Far fewer agreed that UNIX represented open systems (Exhibit II-5).

- A somewhat higher proportion went so far as to award openness to an operating system like MS-DOS that has support from multiple vendors, even if controlled by a single vendor (Exhibit II-6).

- These last two points are especially important since these findings go against much of the writing and commentary commonly found in the trade press. Two important factors contributing to these attitudes are:

  - Conflicting standards
  - Adding value to standards, i.e., extensions to standards

EXHIBIT II-4

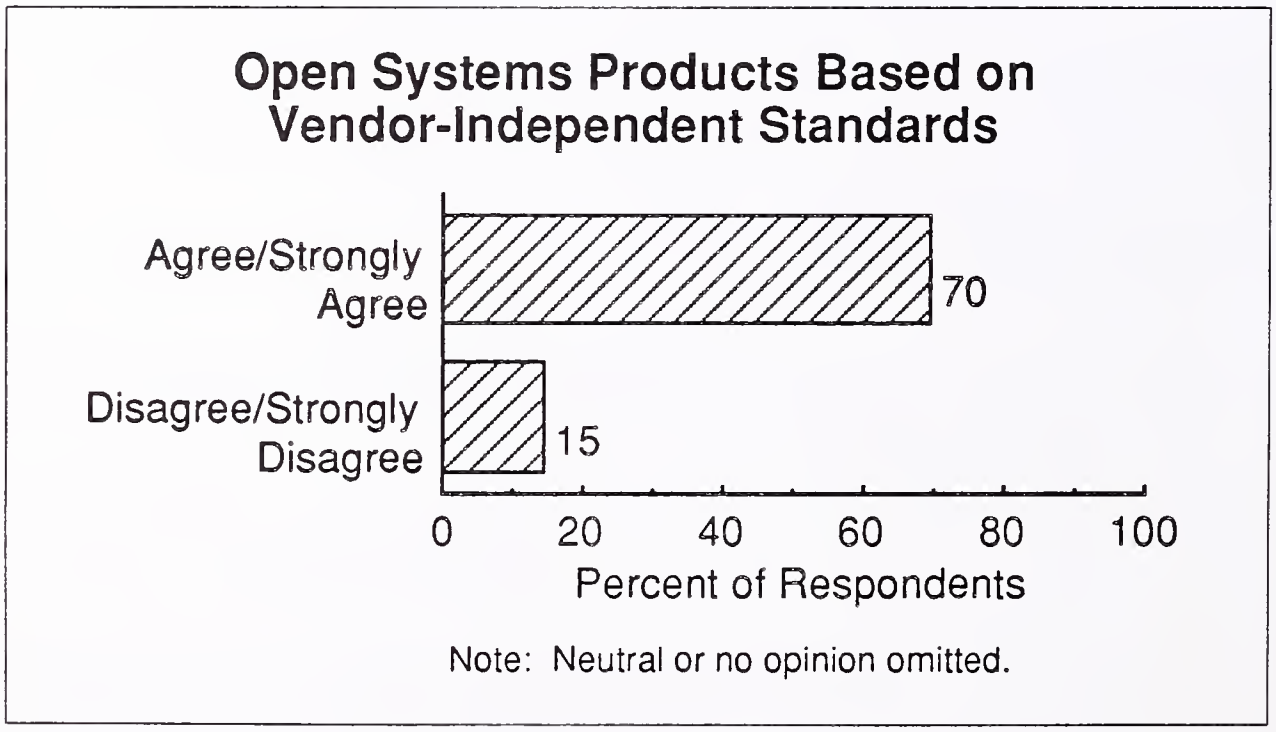


EXHIBIT II-5

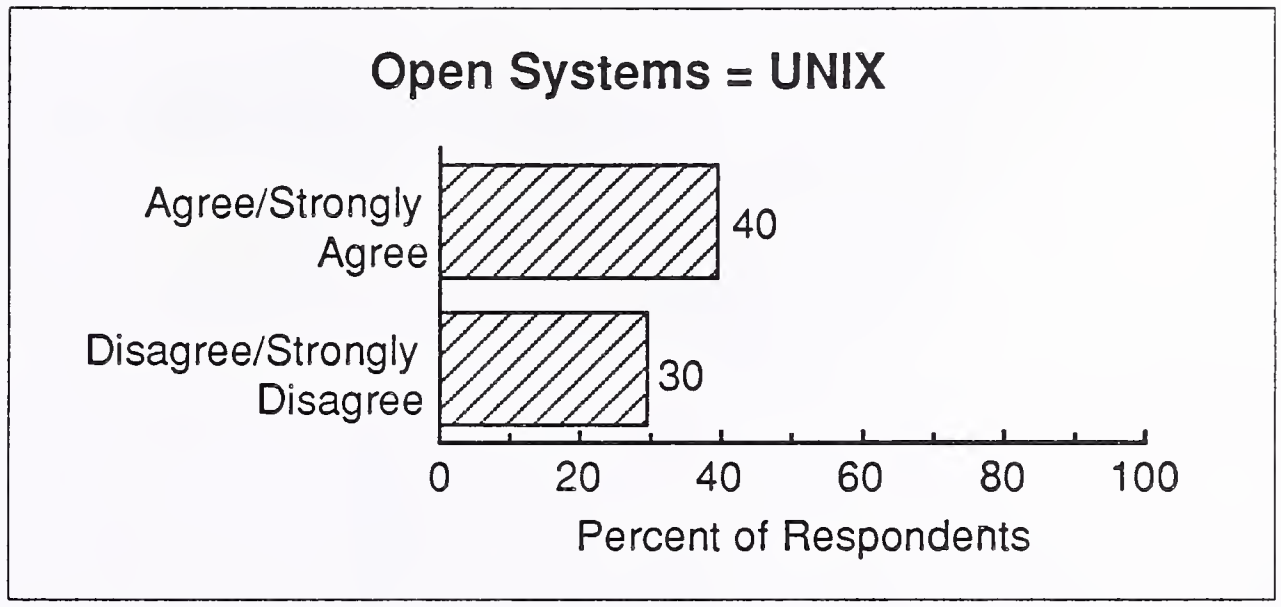
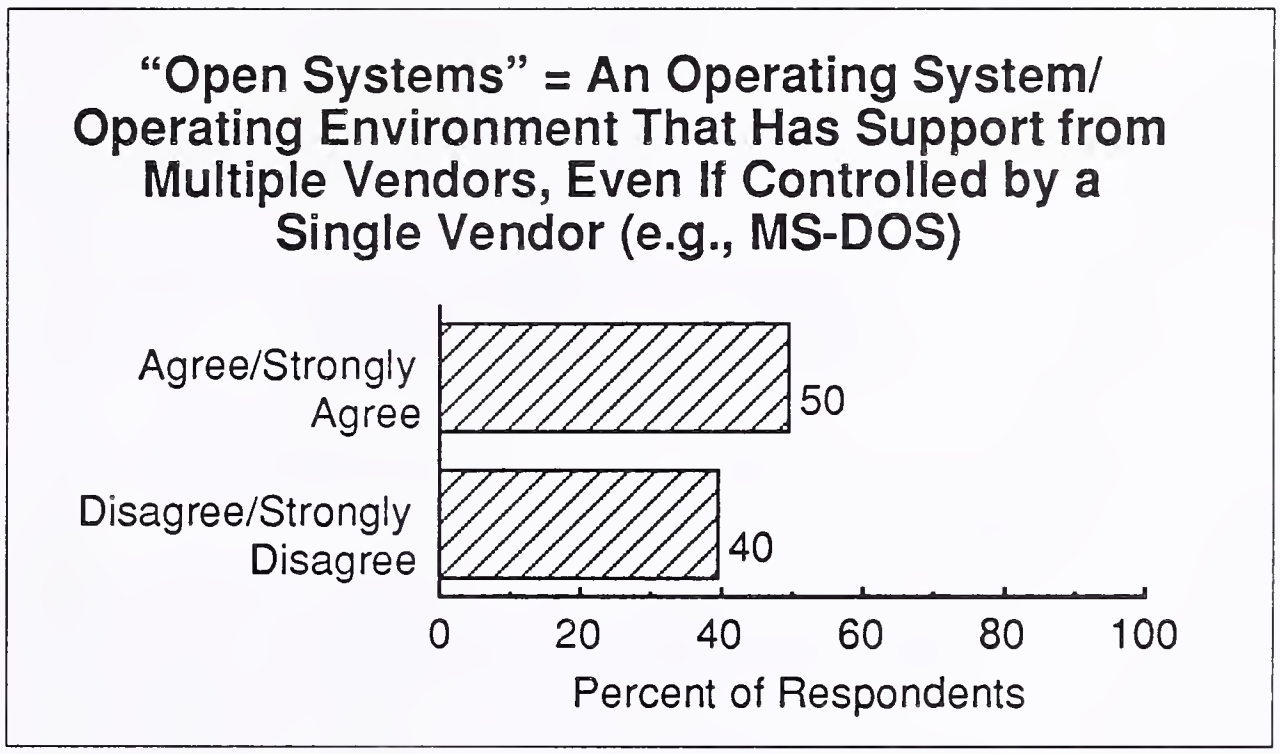


EXHIBIT II-6

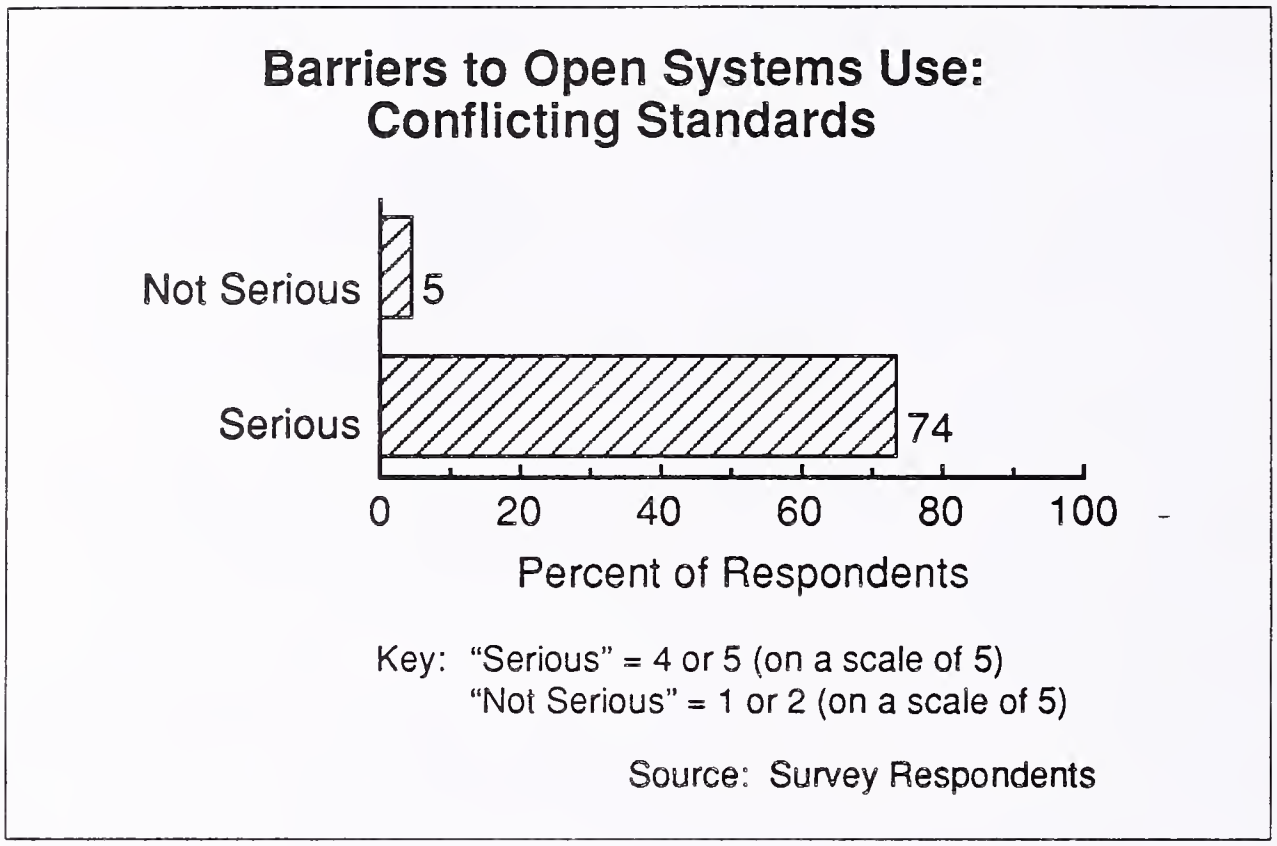


C

Conflicting Standards

If UNIX has a single problem it is that this "standard" operating environment comes in so many different "flavors." INPUT's user respondents cited the issue of conflicting standards as the single most important barrier to open systems (Exhibit II-7).

EXHIBIT II-7



Users are often willing to trade the risk of a single vendor's dominance for the certainty of a stable environment.

D

Standards Extensions

Users evaluated a number of potential problems associated with open systems (Exhibit II-8). By far the most serious and likely of these was vendors providing unique product extensions (Exhibit II-9). This could take the conceptual form shown in Exhibit II-10.

EXHIBIT II-8

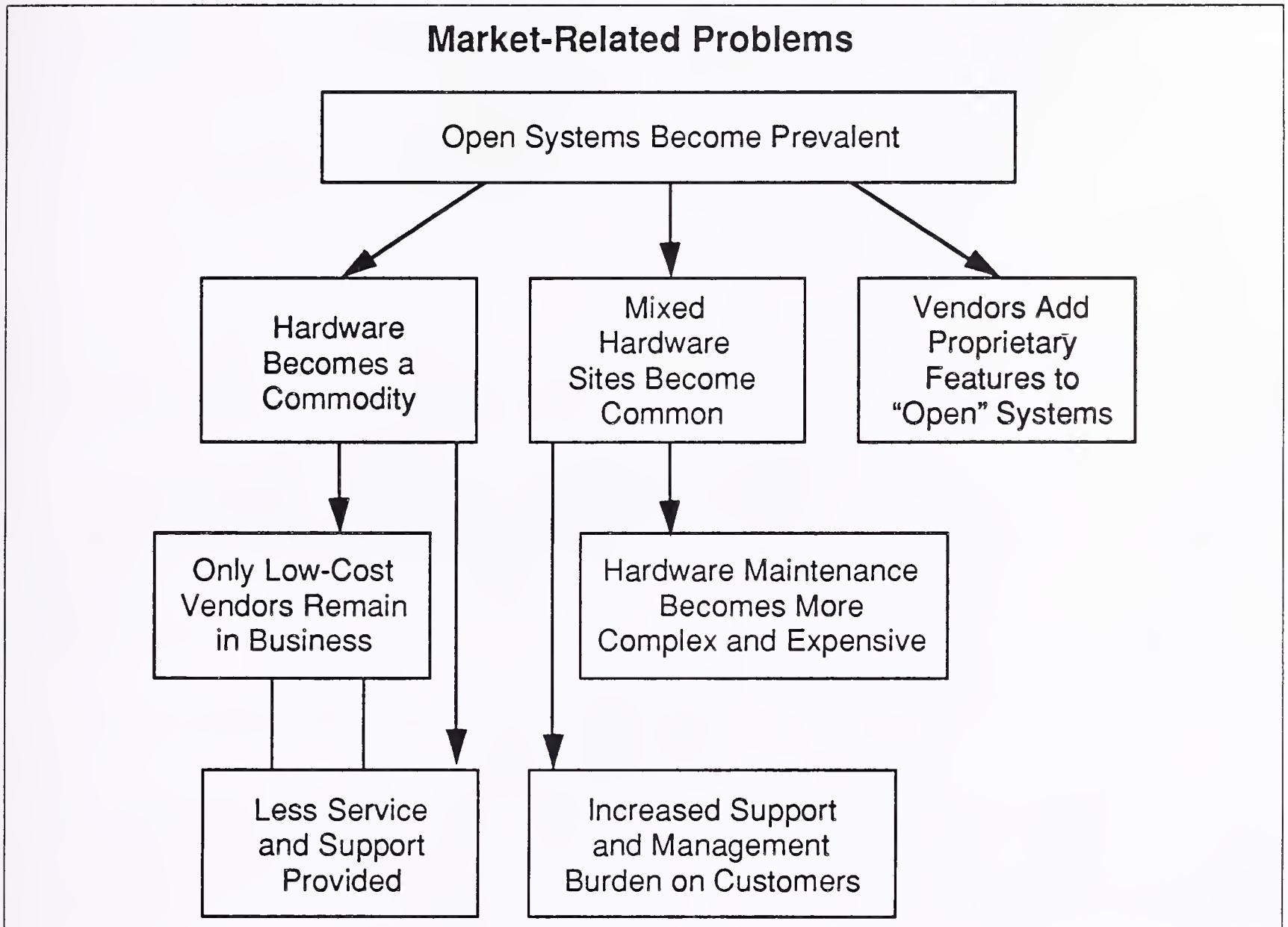


EXHIBIT II-9

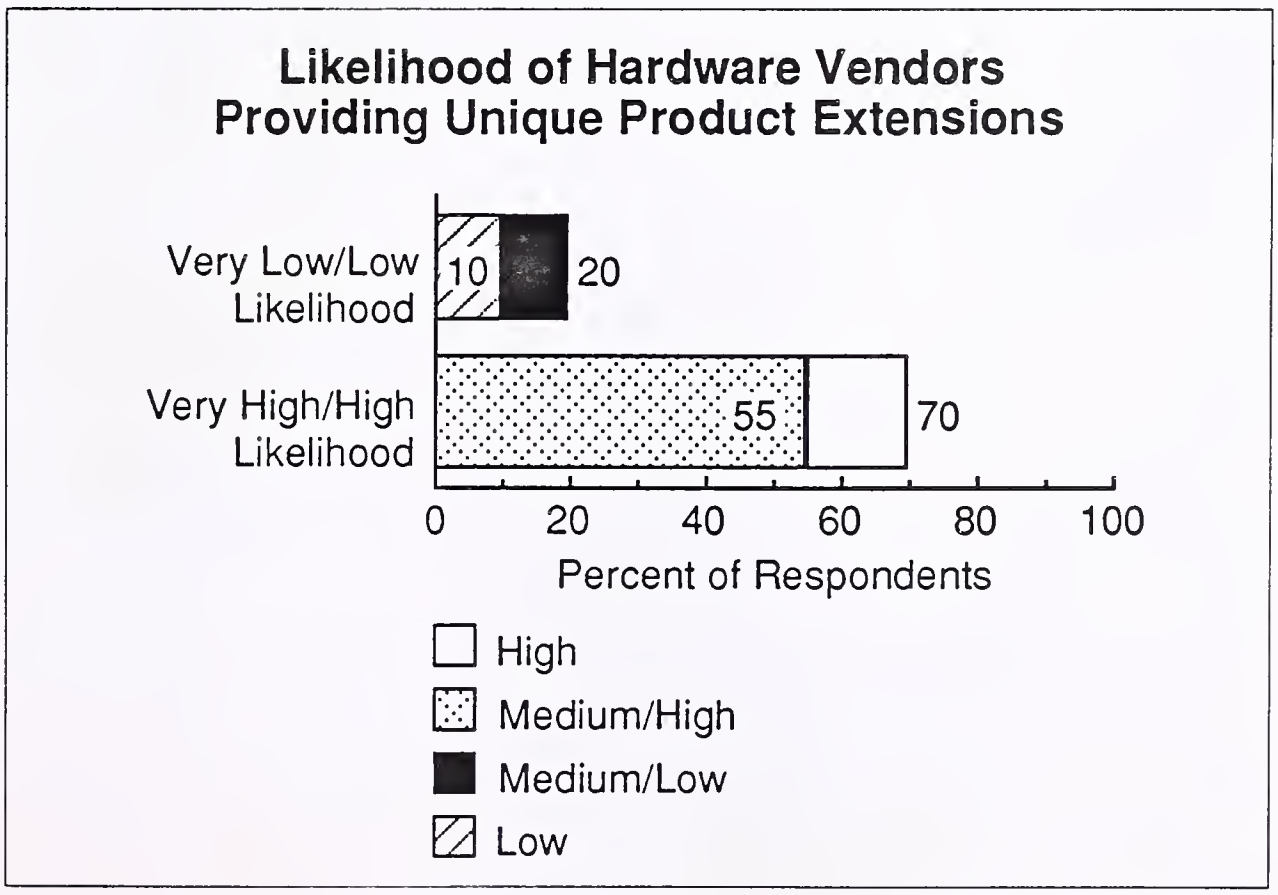
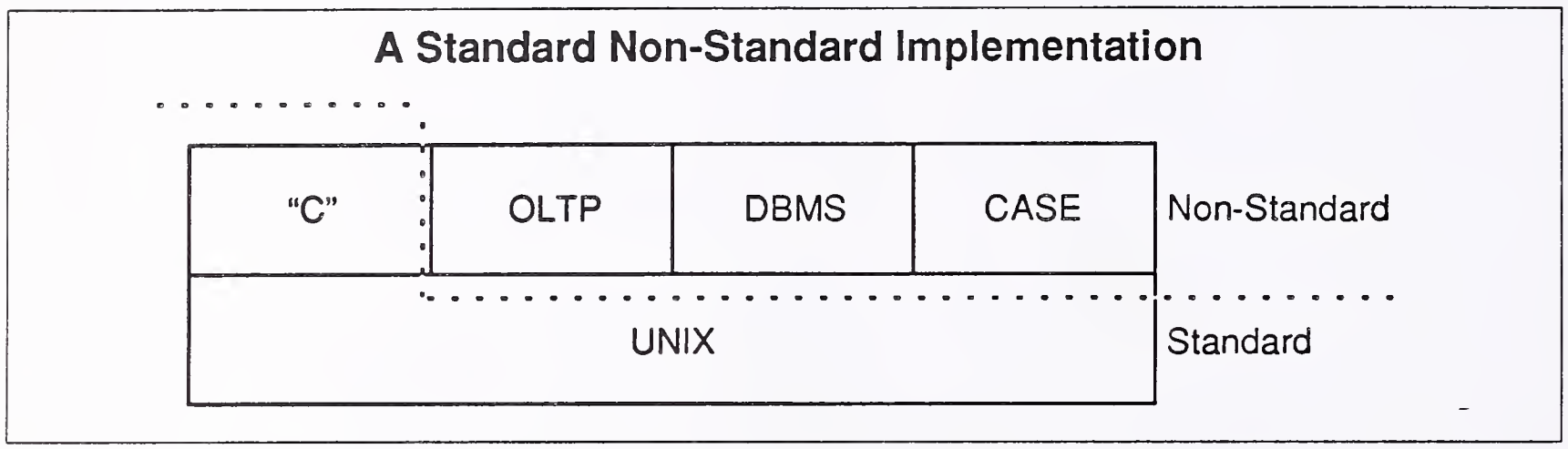


EXHIBIT II-10



This is more than a concept. NCR, for example, in its new UNIX-based 3000 series, has added operating system and applications enabling enhancements that effectively remove much of the series' openness (Exhibit II-11). It is reasonable to say that any large, complex application that is written to take full advantage of NCR's processor architecture and promised price/performance will be tied as tightly to the NCR 3000 as an MVS-based application would be to IBM mainframes.

EXHIBIT II-11

Emerging Environment: NCR

Component	Standard Components	NCR Value Added
Chip sets/processor	• Intel microprocessors	• Software architecture • Application-specific integrated circuits (ASIC)
Operating system	• UNIX • OSI • MS/DOS • OS/2	• Processor coupling • Transaction processing "extensions" • Improved communication and file handling
Applications enabling	• Third-party DBMSs • KnowledgeWare • Communications management	• DBMS enhancements • "Cooperation" • C++ applications development process
Business	• UNIX-targeted • Third-party DBMS-targeted	• Document management • Retail and financial industry expertise

Source: INPUT

Essentially, if UNIX is enhanced for performance, it loses some of the advantages accruing to a cross-platform standard.

OS/2 could well be a successful coming-from-behind entrant in the open systems stakes:

- Building on MS-DOS and Windows provides acceptability.
- The Intel family provides second sourcing and competition (even if the best performance is reserved for PS/2 environments).

E

Open Systems Options

Much of the focus on open systems alternatives has been—and will continue to be—at the operating systems level. Exhibit II-12 assesses four operating environments from the standpoint of meeting user needs.

EXHIBIT II-12

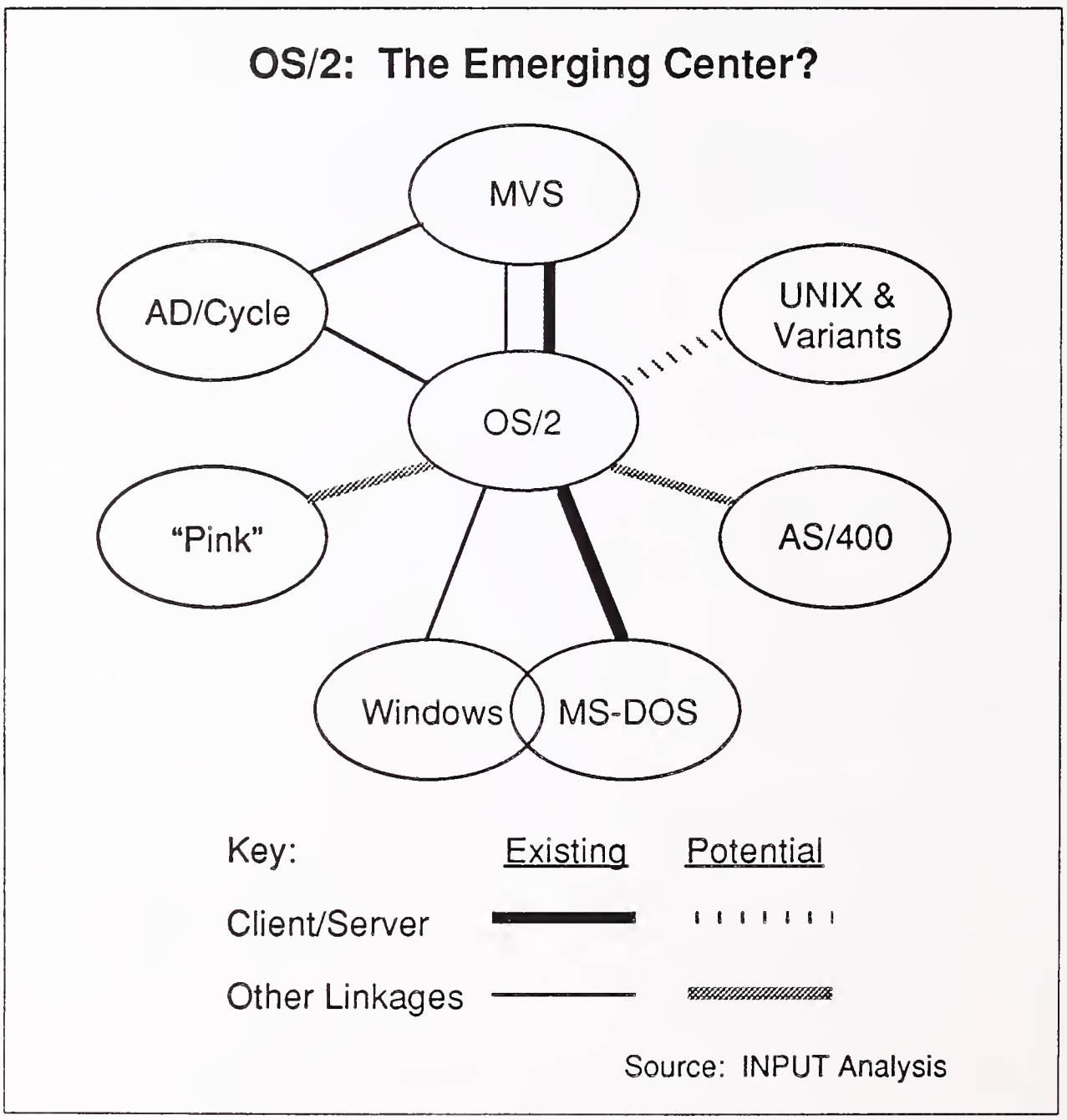
Key User Needs Met by Selected Operating Environments

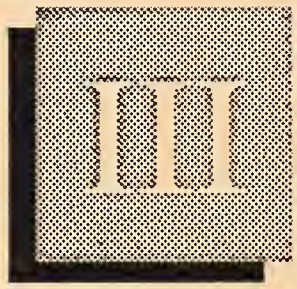
Key User Needs	Standard UNIX	Enhanced UNIX*	MVS	OS/2
Hardware Platform Price/Performance	B	A	B(?)	C
Second Sourcing: Hardware	A	C	B	C
High Performance Support Operating Environment	C	A	?	B
Reliable and Secure Operating Environment	C (Future = B?)	B+	B	B+
Compatibility with Other Operating Environments	B (Other UNIX)	C (Other UNIX)	A- (MS-DOS Windows MVS)	C (Guests)
Availability of Third-Party Software	B-	C	A	A

*Value added by a vendor

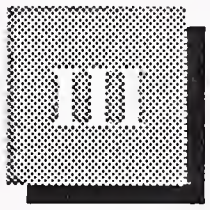
- Standard UNIX (to the degree that it may exist in the future)
- Enhanced or extended UNIX (e.g., on the NCR 3000 series)
- OS/2 (Release 2 and subsequent)
- MVS (for comparison)
- Most importantly, from the standpoint of the IBM customer base, OS/2 can potentially link together the current disparate environments as shown per Exhibit II-13.

EXHIBIT II-13





Background



Background

This chapter provides an overview of open systems. This consists of examining the technical aspects of open systems and the rationale for open systems from the standpoint of users and vendors.

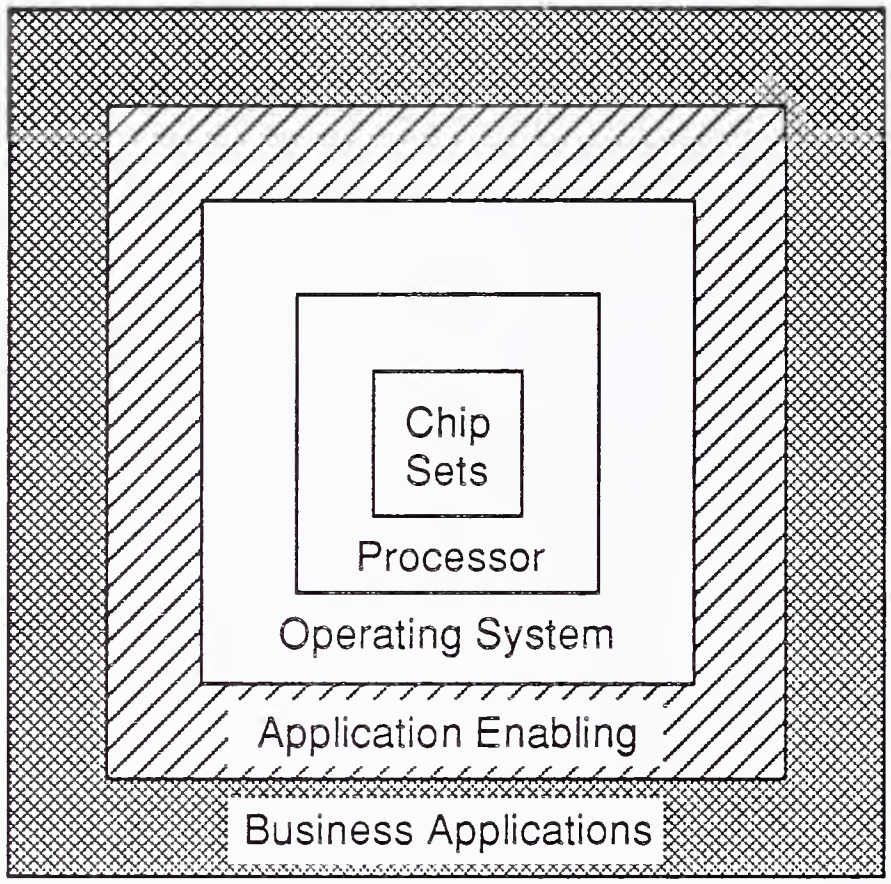
A
Technical Aspects of Open Systems

The traditional computing environment (Exhibit III-1) is made up of a mixture of proprietary and third-party hardware and software. There have been occasional proposals to more tightly integrate these functions in the proprietary environment. For example, in the early 1980s IBM was moving toward pulling more of its operating system into hardware functions and no longer being hospitable to third-party DBMSs. This has, of course, changed.

The current direction, as exemplified by the phrase "open systems" is to separate some of the components of the traditional model. The components would not only be separated, but it would also be possible to exchange components. At the most simplistic, not only would the operating system be separate, but it could also be moved from one processor family to another (Exhibit III-2).

EXHIBIT III-1

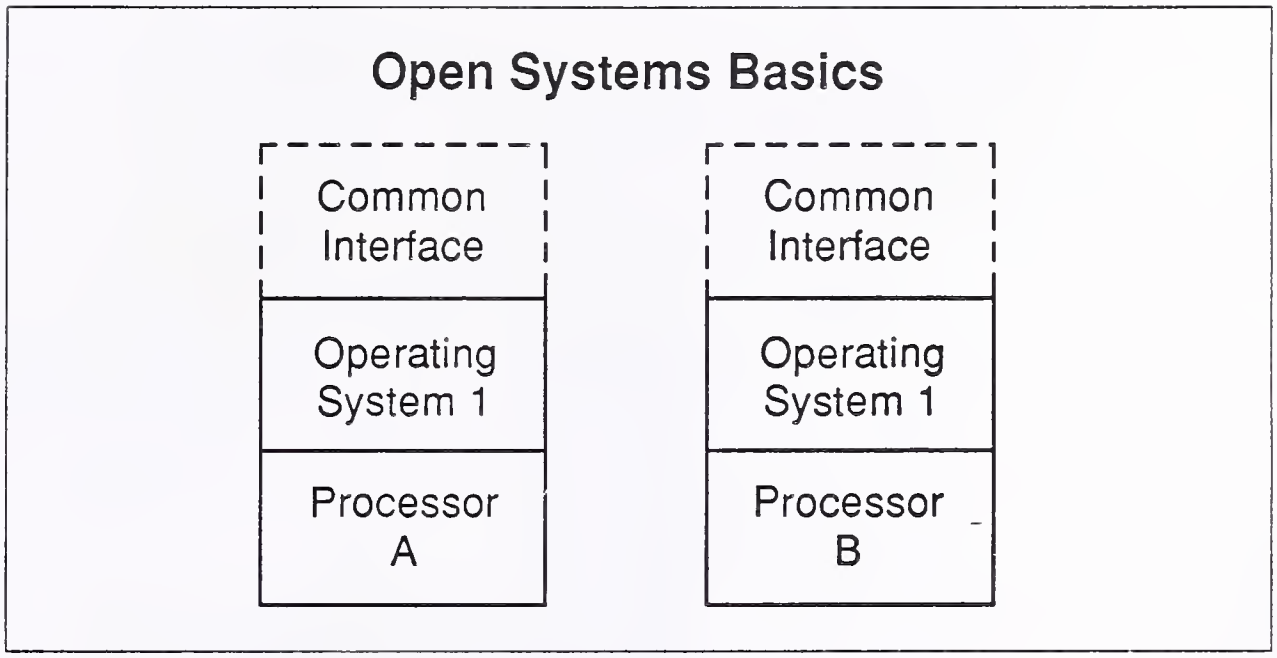
Traditional Computing Environment



- Proprietary
- Mixed: Proprietary and Third Party
- Predominantly Third Party

Source: INPUT

EXHIBIT III-2



The three principal characteristics of open systems are:

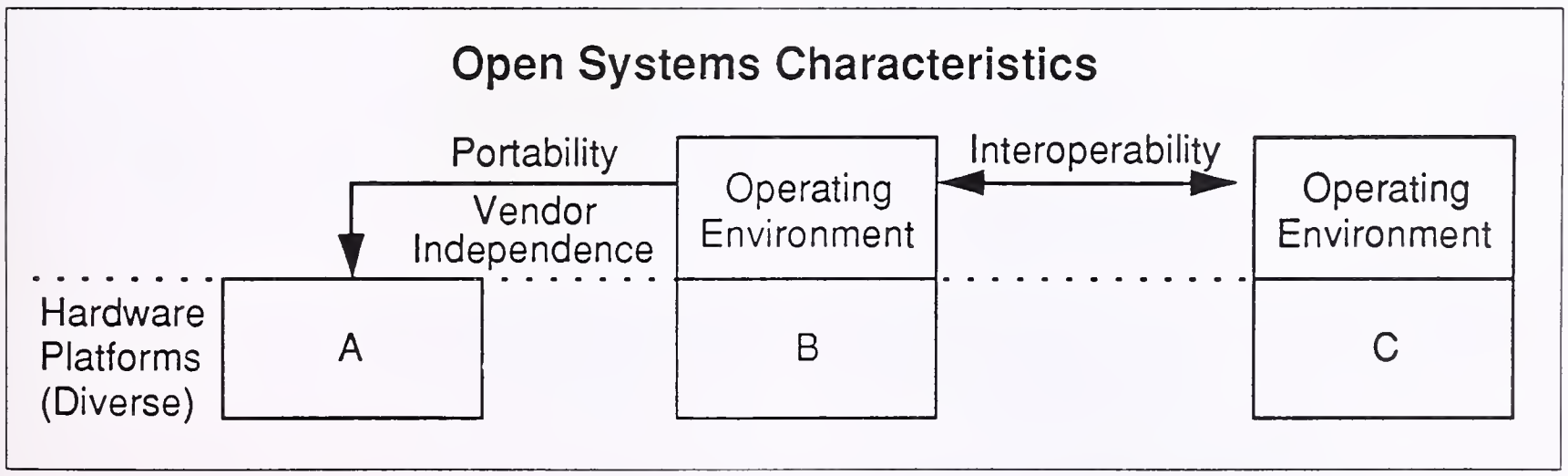
- Portability: Data bases or applications programs can be moved from one operating environment to another with little or no modification. This could go a long way toward preventing premature obsolescence and improving efficiency.

- Interoperability: This is related to portability in the sense that if data and applications can be moved from one environment to another, the applications can also interact with each other.

- Vendor Independence: If applications are portable, they can be ported from one vendor's environment to another. This not only gives customers increased flexibility in picking and choosing suppliers, but also gives customers much greater leverage over suppliers.

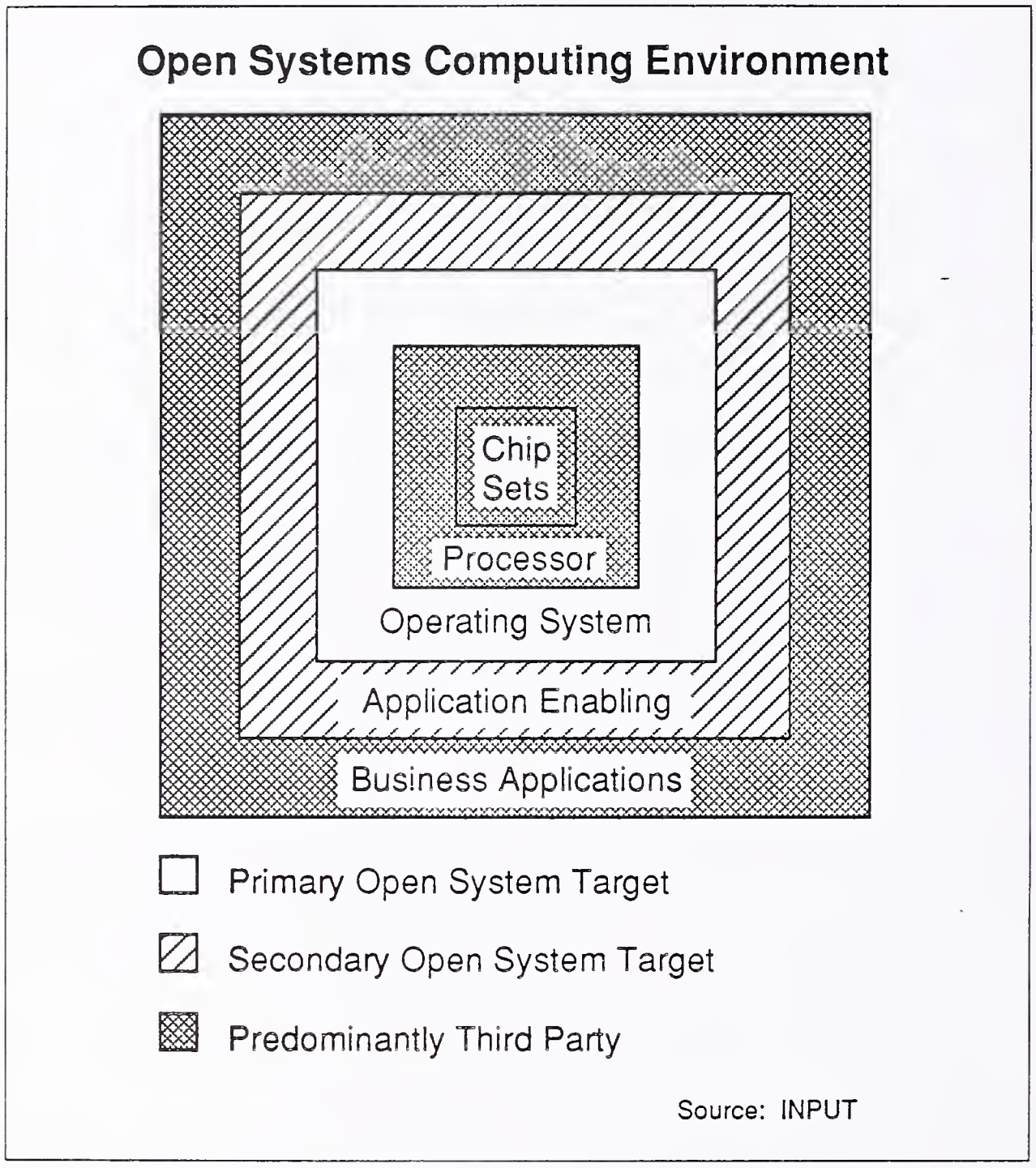
These principles are illustrated in Exhibit III-3.

EXHIBIT III-3



The operating system has been the main focus of openness. In principle, this openness could also be accomplished at the application enabling level (see Exhibit III-4).

EXHIBIT III-4



Operating system openness has been the focus of much of the activity and analysis regarding open systems. However, there are other candidates for providing an open platform: DBMS and CASE tools. SQL and even COBOL have also been cited as possessing some of the attributes of openness.

However, no single environment now fulfills all of the requirements for an open system (Exhibit III-5).

EXHIBIT III-5

Degrees of "Openness" in Selected Environments (Summary)

"Open" Environment Candidate	Open Attributes		
	Portability	Interoperability	Vendor Independence
COBOL	Partial	Limited	Partial
SQL	Partial	Yes (Core Functions)	No
Multiple-Platform DBMS	Yes	Yes (Using Same DBMS)	Yes (Hardware & Operating Sys.)
Intel Processors	No	Yes	Limited
MS-DOS	Yes (Intel Platforms)	Yes (Intel Platforms)	Yes
UNIX	Partial (Potentially: Full)	Yes	Partial (Potentially: Full)

- UNIX may have the most potential; however, it is currently not completely open.
- MS-DOS in some ways comes closest to being an open system, but only on a single type of processor platform.

B
Rationale for Open Systems

The rationale for open systems exist on several levels, for both users and vendors. This section will provide an overview of what open systems mean from the customer viewpoint, from the viewpoints of several types of vendors, and from the standpoint of other groups.

The next chapter will provide the results of primary research that, among other things, reports on how customers define and perceive open systems.

1. Open Systems As Seen by Users

Users see the entire cluster of characteristics that compose open systems: portability, interoperability and vendor independence (as shown in Exhibit III-3).

The operational benefits that accrue to a user of open systems if the preceding functional benefits are achieved include:

- Longer lived applications
- Fewer modifications for technical/environmental reasons (as opposed to applications-specific reasons)
- Reduced training costs for teaching users or developers how to interact with specific systems environments
- Lower technical development risks in selecting a technical platform (since platforms can be easily replaced if they are not adequate)

INPUT will assess these benefits in the next chapter. There are also barriers to successful open systems development, which are assessed in the next chapter.

2. Vendor Objectives

As a group, vendors generally see the functional components in the same way as do users (as shown in Exhibit III-3). However, vendors see open systems from a different perspective; they have business objectives as well for open systems. Different types of vendors view open systems differently, depending on whether they primarily market services, software products or hardware systems.

a. Hardware Vendors

If given a choice and adequate resources, an established hardware vendor would not want to give up the advantages of a proprietary operating environment. However, the situation during the 1980s changed for all but the largest computer hardware manufacturers:

- The overhead in supporting and expanding proprietary hardware and software platforms became higher as the pace of technology change increased.

- The growth in the installed base slowed and, in some cases, reversed as customers looked to alternate platforms with a perceived critical mass.
  - Early in the 1980s the alternative platforms were generally IBM and DEC. These had the additional attractiveness of having a robust group of third-party software developers.
  - Later in the 1980s, users turned increasingly to smaller, newer platforms, often MS-DOS-based.
  - Now, of course, both IBM and DEC have begun to experience similar conditions themselves.
- The "second tier" manufacturers see open systems (which they tend to define as UNIX-based environments) as a means of re-establishing themselves:
  - Offering open systems allows them to, in principle, compete for new business outside of their installed base.
  - It also allows them to create a pathway for their own users over which they have more control.

Consequently, hardware vendor objectives are mixed:

- They see the benefits of vendor independence as it relates to obtaining new customers.
- However, they are also seeking ways to limit the independence of their own customers.

b. Software Products Vendors

Operating system suppliers are, of course, the key component of current open system initiatives. Besides supplying the core operating system itself, they are increasingly surrounding the operating system with other systems software tools to provide systems and data management.

Other software product vendors are strong supporters of portability. These firms constantly face the decision of which hardware/software environments to port their products to.

For example, Informix has created 200 different versions of its DBMS product, reflecting different hardware and software permutations. Having to maintain these versions as the underlying platforms change creates significant overhead; this situation is especially ironic given that Informix's target market is the UNIX environment—which is supposed to greatly alleviate this kind of problem.

DBMS and CASE product vendors can also be viewed as providing the foundation for open systems. However, with partial exceptions (e.g., Oracle), DBMS firms have not positioned themselves as open systems suppliers. CASE technology has the theoretical ability to provide some open systems-like capabilities, but CASE is currently too immature to be offering these kinds of services.

Software vendors feel ambivalence similar to that of the hardware vendors. Software products often must sacrifice a portion of their performance by having to depend on a standard operating system and not being able to take full advantage of the underlying hardware's characteristics. There will always be a temptation, for at least the major hardware platforms, to bypass some of the standard software interfaces to take advantage of processor strengths.

c. Professional Services/Systems Integration Vendors

The long-term benefits of open systems for services vendors are very similar to those obtainable by users in general: the ability to function in a more standard software environment, leading to a greater focus of knowledge and more efficiency. In the short term, of course, an open system is just one more environment that a services vendor has to master.

d. Systems Operations/Outsourcing Vendors

Open systems will probably only have meaning to this group of vendors in the very long run. The core of their business now consists of taking over large-scale, long-established computer operations. It is possible that they could begin to develop a business to operate downsized computer operations that would often be based on open systems. However, it would be some time before this part of their business became important in and of itself.

3. Other Groups

Computer-based products and services are primarily of interest to vendors and users. Open systems represent something of an exception in that government and political groups see open systems as a way to interfere with market forces or to obtain a national or regional advantage.

- A decade ago, the de facto standard of IBM mainframes was perceived in Europe and, to some extent, in the U.S. as being against the national interest. This gave rise to attempts to directly (via antitrust actions) and indirectly (via support of open systems) open the market to other competitors.

- UNIX and its derivatives, for example, have become important in U.S. government procurements as a method of instilling stability in computer environments without giving IBM an automatic advantage.

- Much of the standards activity in Europe can be traced back to similar motives. As "national" computer manufacturers become less viable, the attention in Europe has shifted to forming European standards that will provide all suppliers with a more level playing field.

4. Summary of Objectives

Exhibit III-6 provides an overview of the objectives of the different groups concerned with open systems.

EXHIBIT III-6

Open Systems Objectives by Group

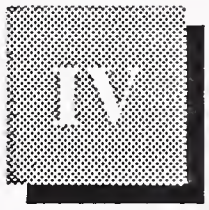
Group	Open Systems Components		
	Portability	Interoperability	Hardware Vendor Independence
Users	X	X	X
Hardware Vendors		X	
Operating System Vendors	X	X	X
Software Product Vendors	X	X	
Professional Services/ SI Firms	X	X	
Systems Operations/ Outsourcing Vendors			
Governments	X		X

X = Primary Objective

- Only users have as primary objectives all three of the components of open systems.
- At this time, systems operations/outsourcing firms have relatively little interest in the open systems phenomenon.

- Hardware vendors can enthusiastically subscribe to interoperability as an objective.
- Software and professional services/SI firms like the concept, but may not see much of an impact on their own business for some time to come.

User Requirements



User Requirements

This chapter reports the results of user research on open systems. The chapter is divided as follows:

- Definitions and expectations of open systems from the user perspective
- User views on the role of standards
- User assessments of the relative importance of operating system attributes and their ratings of selected operating systems

A

Open Systems Definitions and Expectations

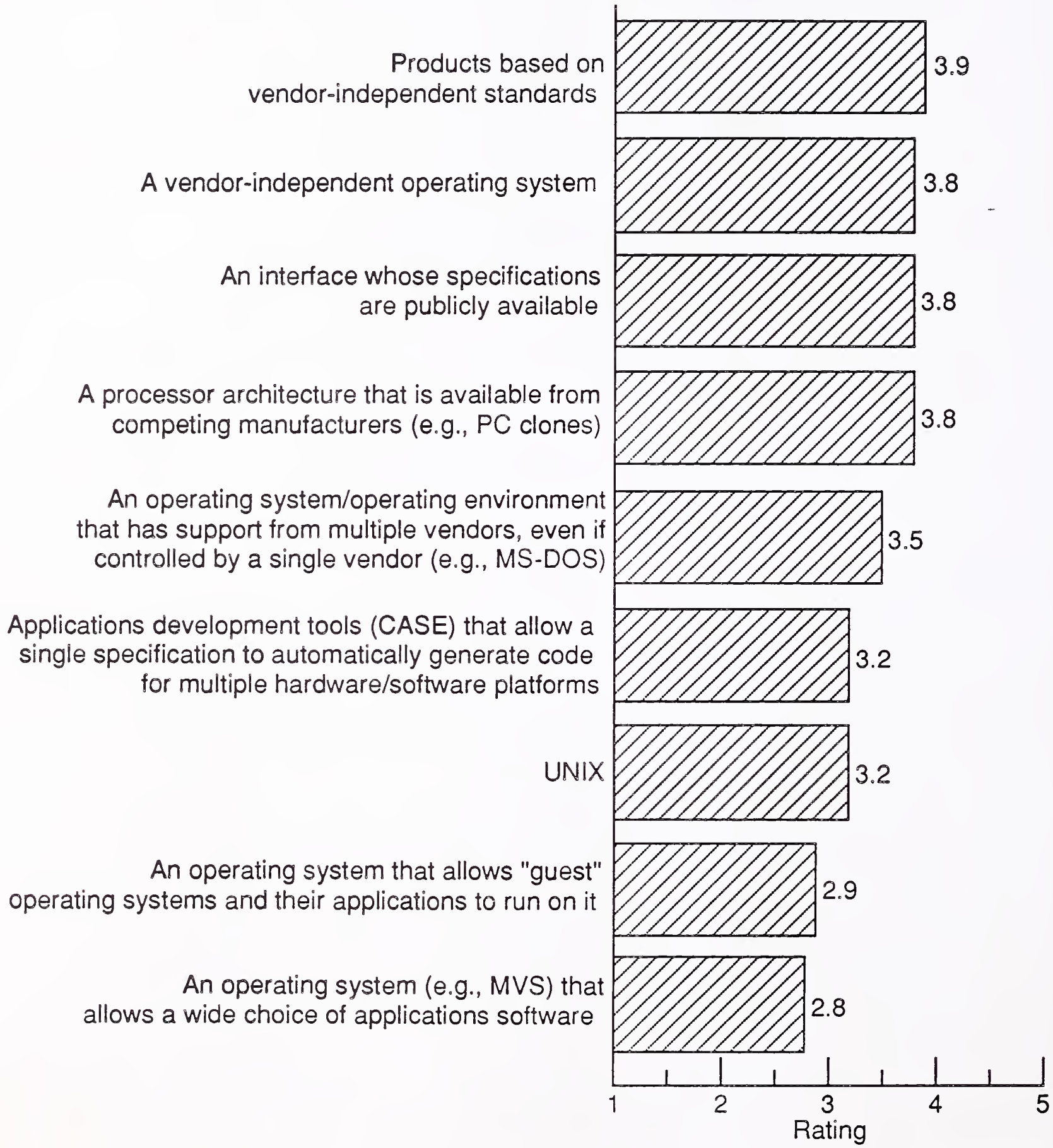
Analysts and vendors have provided various definitions of open systems. INPUT asked users to rate how close each of a variety of definitions came to their own understanding of open systems. (The ratings are on a five-point scale; 1 = strong disagreement with the proposed definition and 5 = strong agreement.)

Exhibit IV-1 summarizes the overall findings. Each definition will be analyzed separately below; however, several general observations can be made:

- No single definition is viewed as *the* definition for open systems.
- Quite a few definitions received relatively strong support, i.e., a rating of 3.5 or greater.
- Many respondents gave high ratings to several definitions, including some that might appear to be somewhat in conflict (e.g., a vendor-independent operating system and MS-DOS).
- UNIX, which many commentators identify principally with open systems, received relatively little support.

EXHIBIT IV-1

User Definitions of "Open Systems": Summary



Rating: 1 = Strongly Disagree, 5 = Strongly Agree

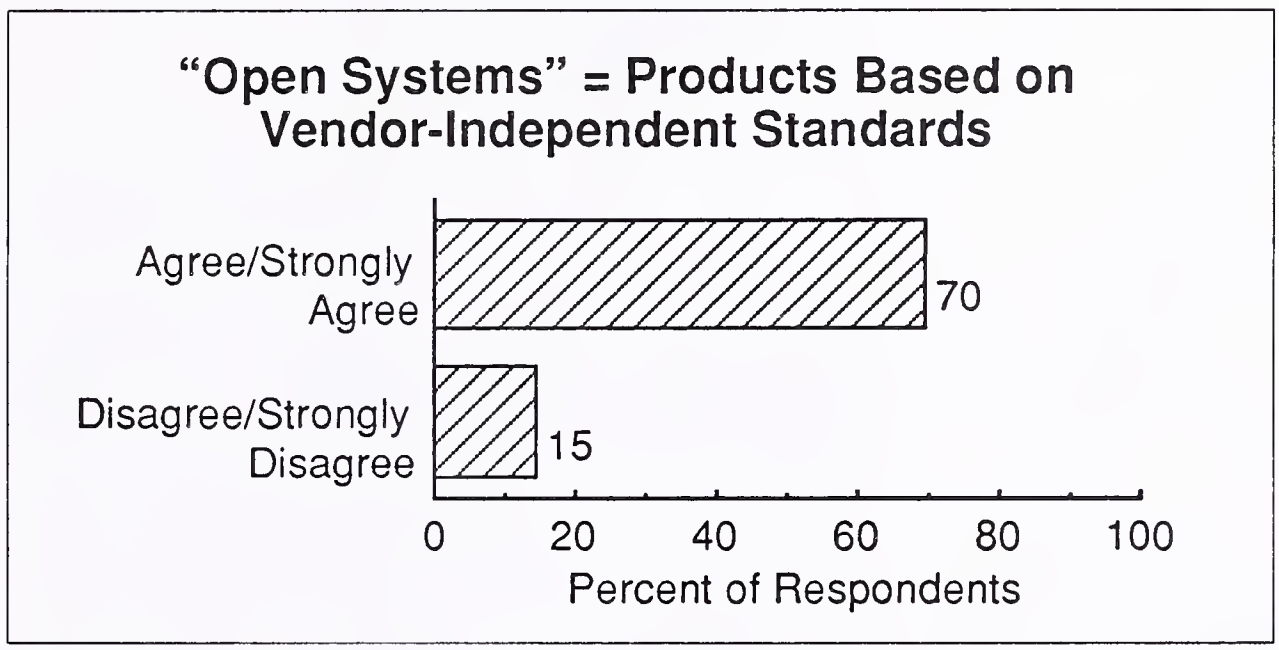
Source: Survey Respondent Ratings

These research findings are somewhat counter to much of what appears in the trade press, as well as some vendor positions. This situation makes understanding these issues critical.

In order to delve more deeply into these issues of user self-definition, INPUT analyzed the data by comparing the percentage of respondents who agreed or disagreed with each definition (omitting those who were neutral on a particular definition).

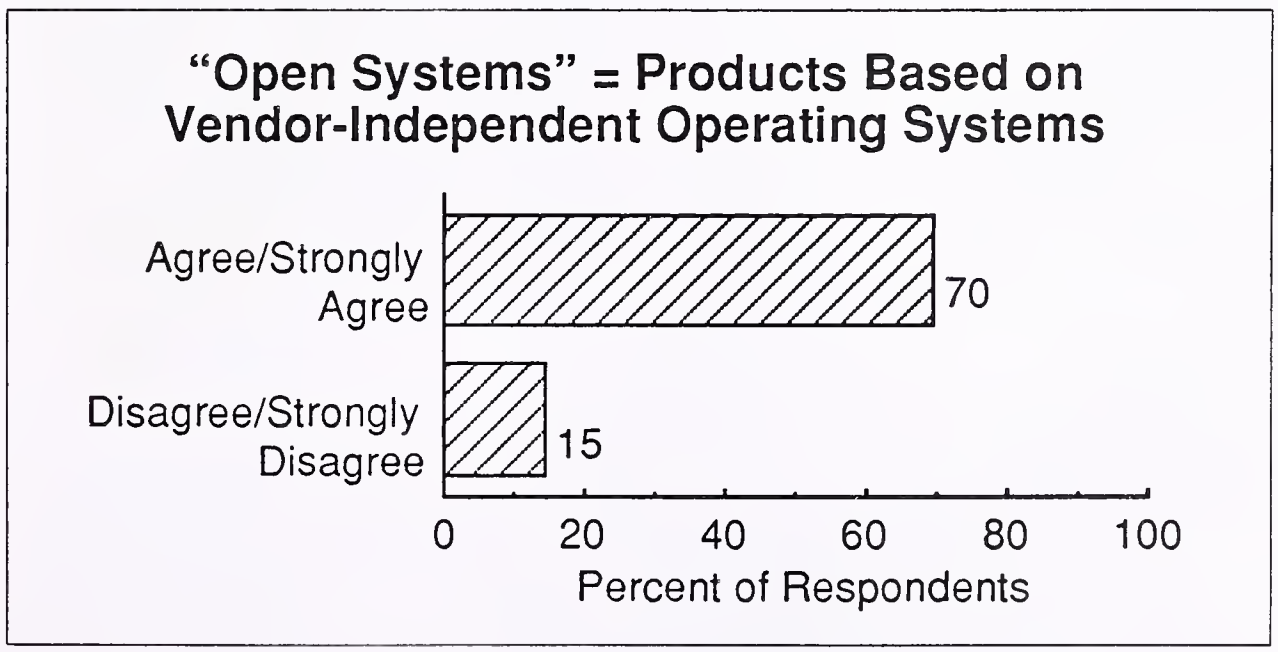
Vendor-Independent Standards: The strongest agreement (and least disagreement) was on the definition of open systems being based on vendor-independent product standards in general (Exhibit IV-2).

EXHIBIT IV-2



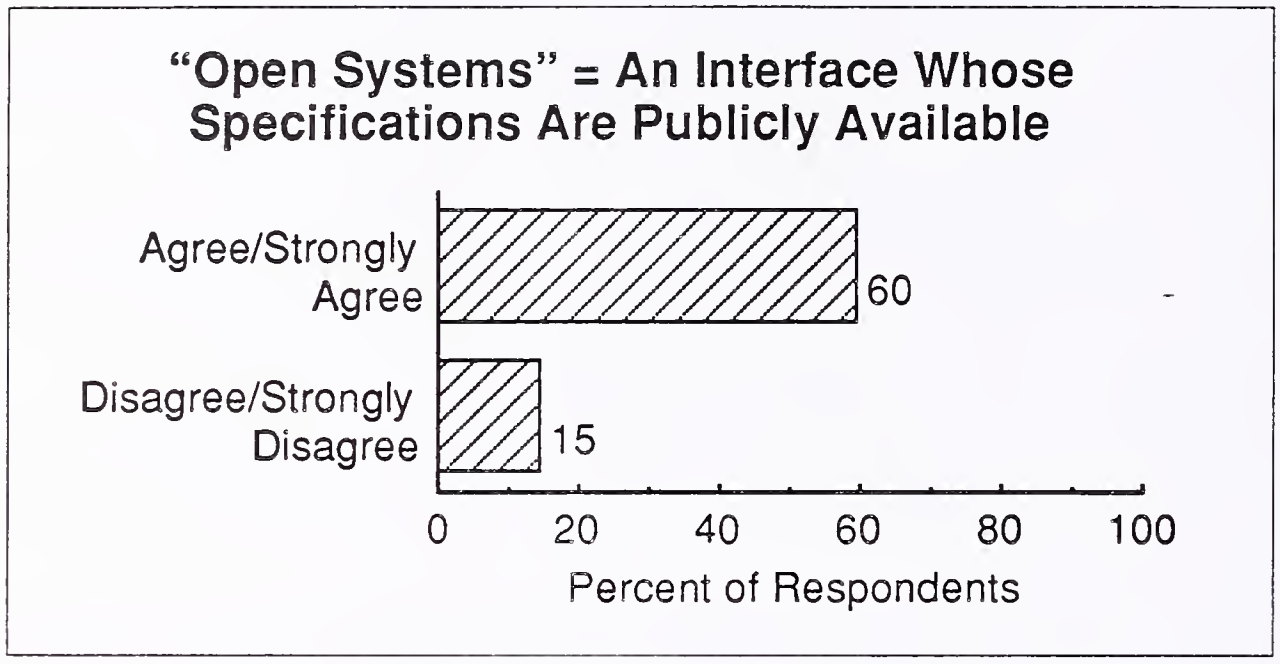
Vendor-Independent Operating System: This is obviously closely related to the prior definition, but excludes the hardware or processor element; it received marks as high as the preceding definition (Exhibit IV-3).

EXHIBIT IV-3



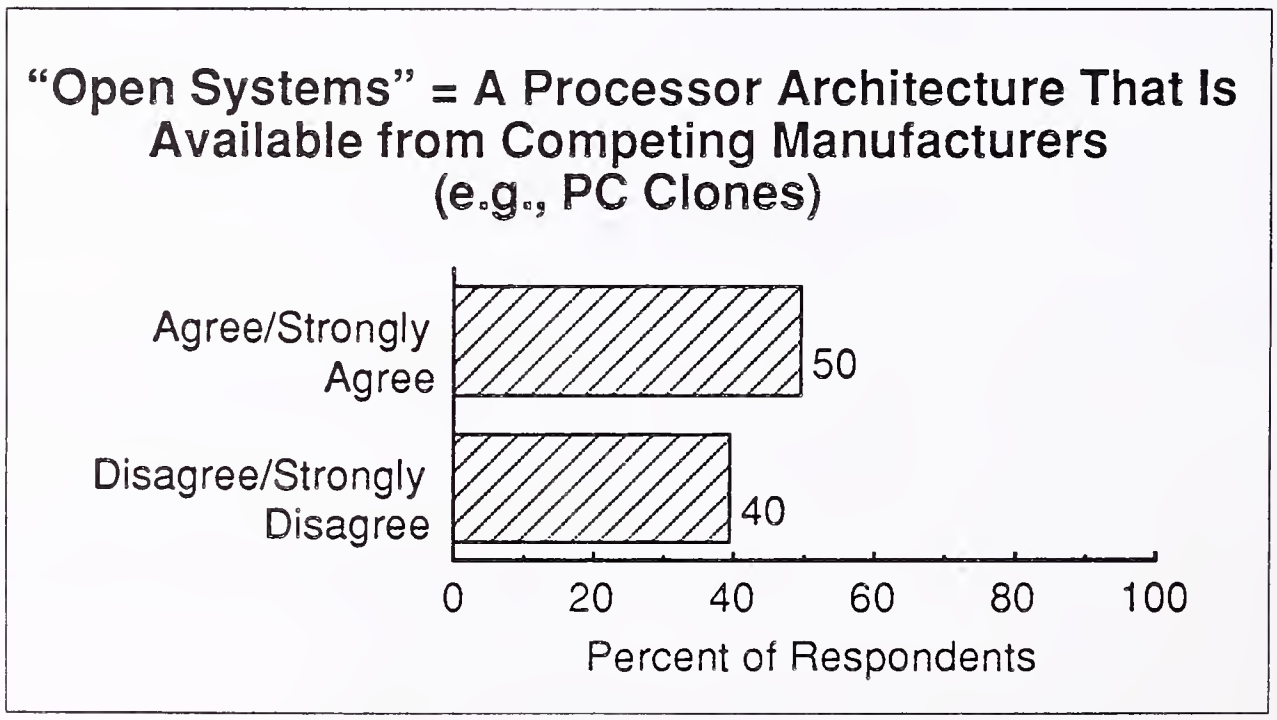
Publicly Available Interface Specifications: This definition received a surprisingly high rating, since these specifications may or may not be established by an independent organization (e.g., POSIX versus SAA); see Exhibit IV-4.

EXHIBIT IV-4



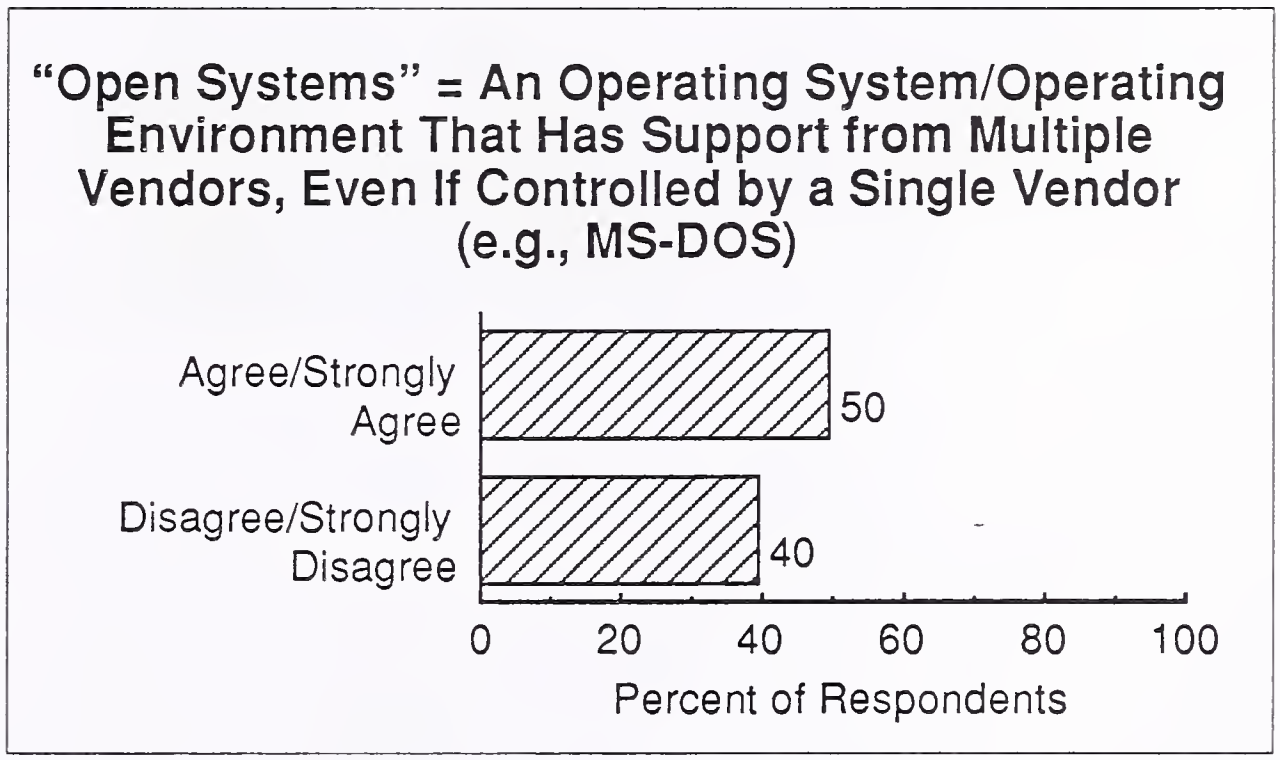
A Processor Architecture Available from Competing Manufacturers: The example given in INPUT's question was PC clone hardware. Consequently, there was no doubt that the product in question did not have specifications set by an independent body. However, a majority of respondents still agreed that this represented an open system (Exhibit IV-5).

EXHIBIT IV-5



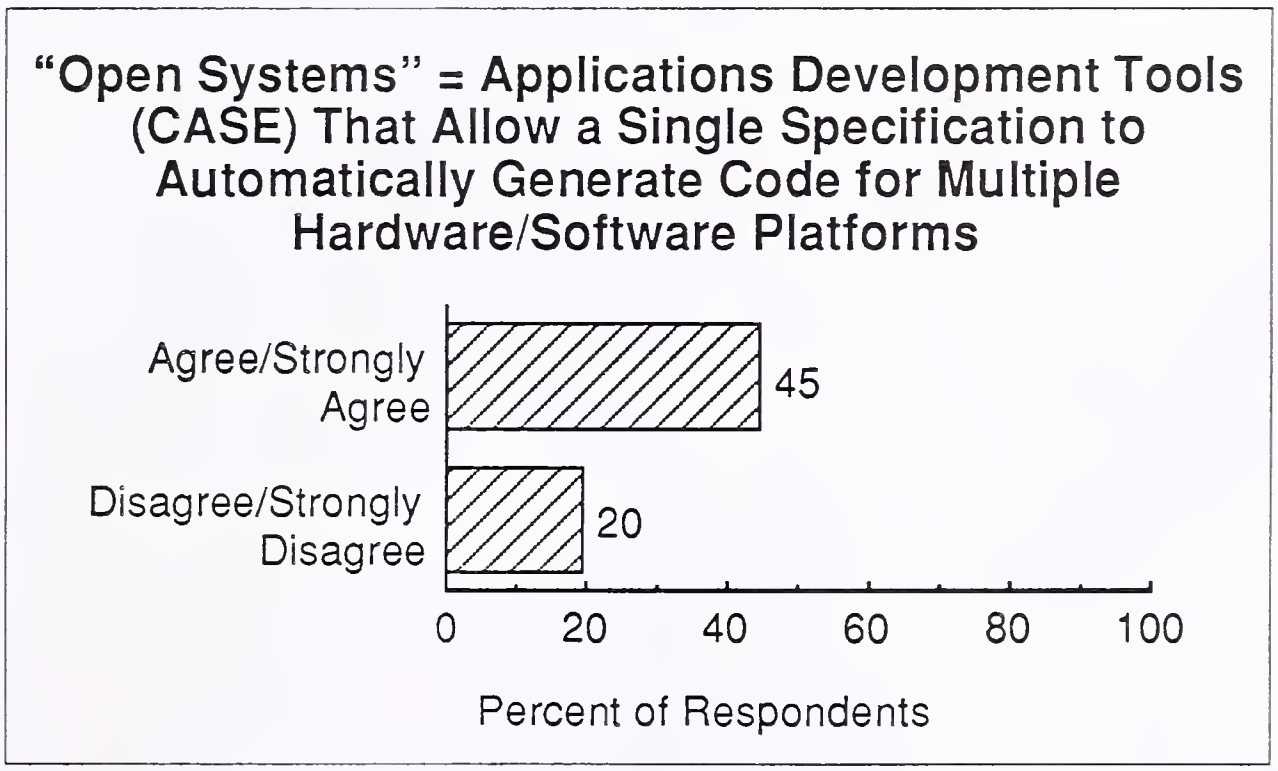
An Operating System Supported by Multiple Vendors: This is the software analogue to the preceding definition; the definition offered specifically gave the example of MS-DOS, i.e., where a single vendor controlled the specifications and direction of the product. This definition also received the support of a majority of those interviewed (Exhibit IV-6).

EXHIBIT IV-6



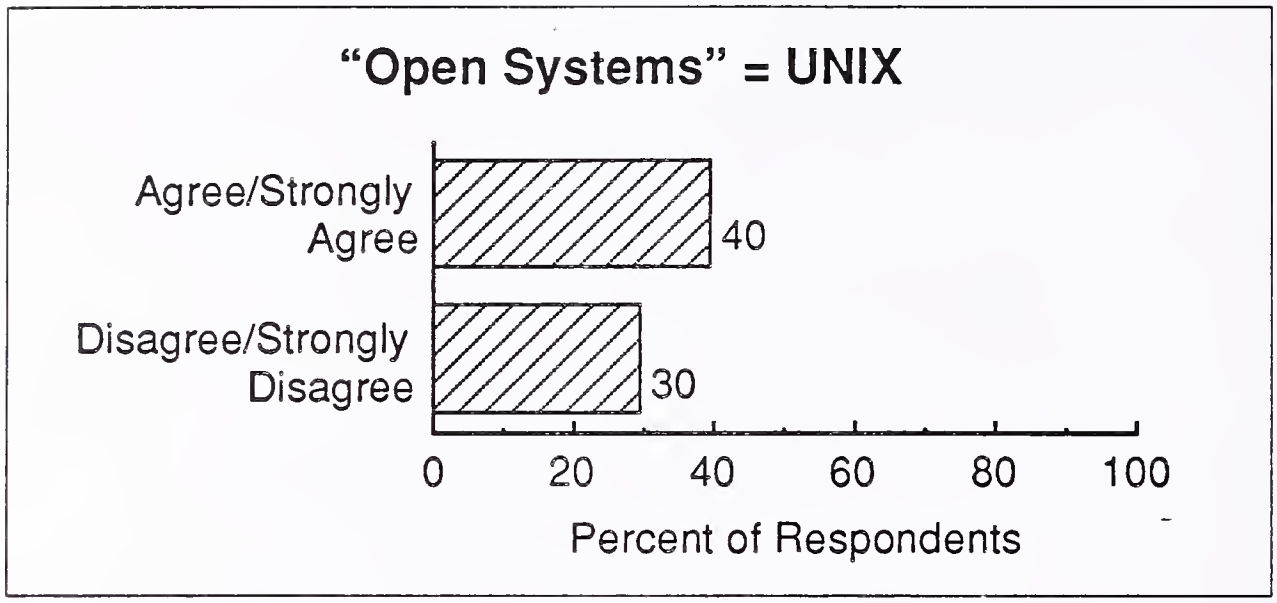
A CASE Generator for Multiple Target Platforms: This is a definition that has not commonly been associated with open systems. However, it received the support of almost half the respondents (Exhibit IV-7); only a small number disagreed. This was an area in which a substantial number of users had not considered the issues enough to have an opinion.

EXHIBIT IV-7



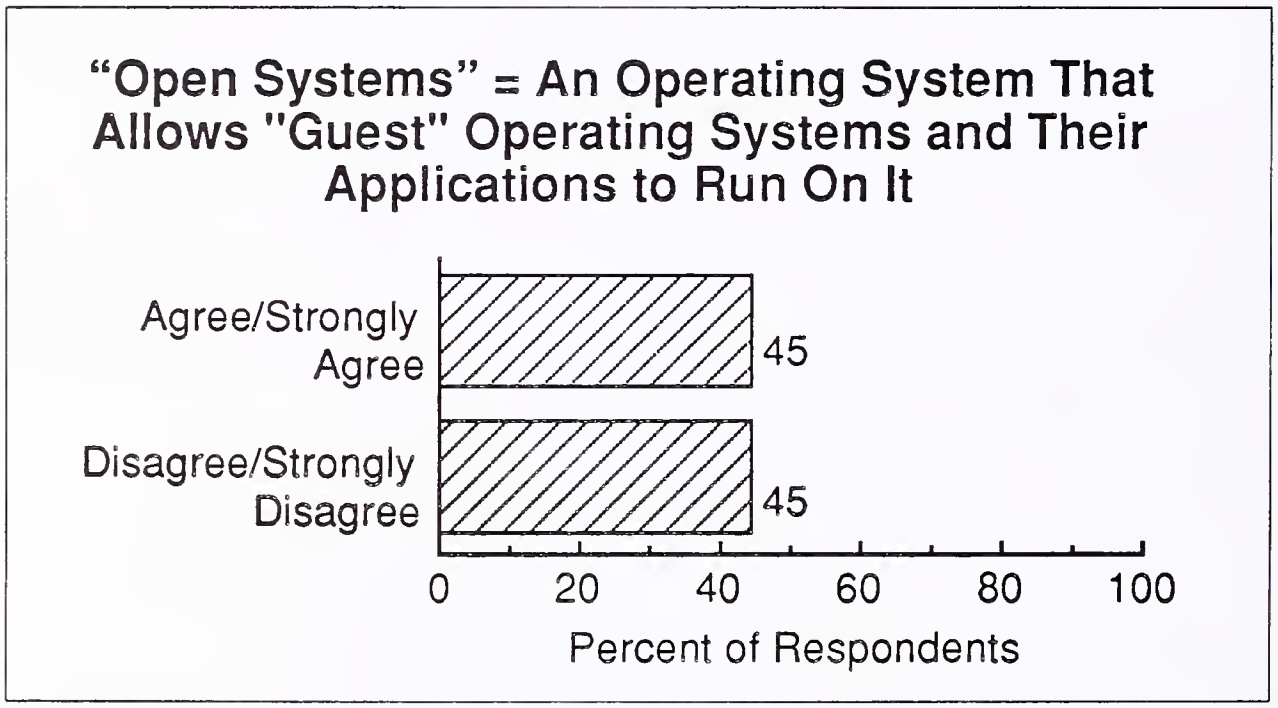
UNIX: The single most surprising finding in the research was the relatively low level of support given to UNIX as representing "open systems" (Exhibit IV-8). This finding is especially unexpected given the close identity between UNIX and open systems in the trade press as well as by many vendors; after all, one of the principal UNIX standards-setting groups is called the Open Systems Foundation. INPUT considers this to be a key issue, and UNIX will be discussed at several points in the remainder of this report.

EXHIBIT IV-8



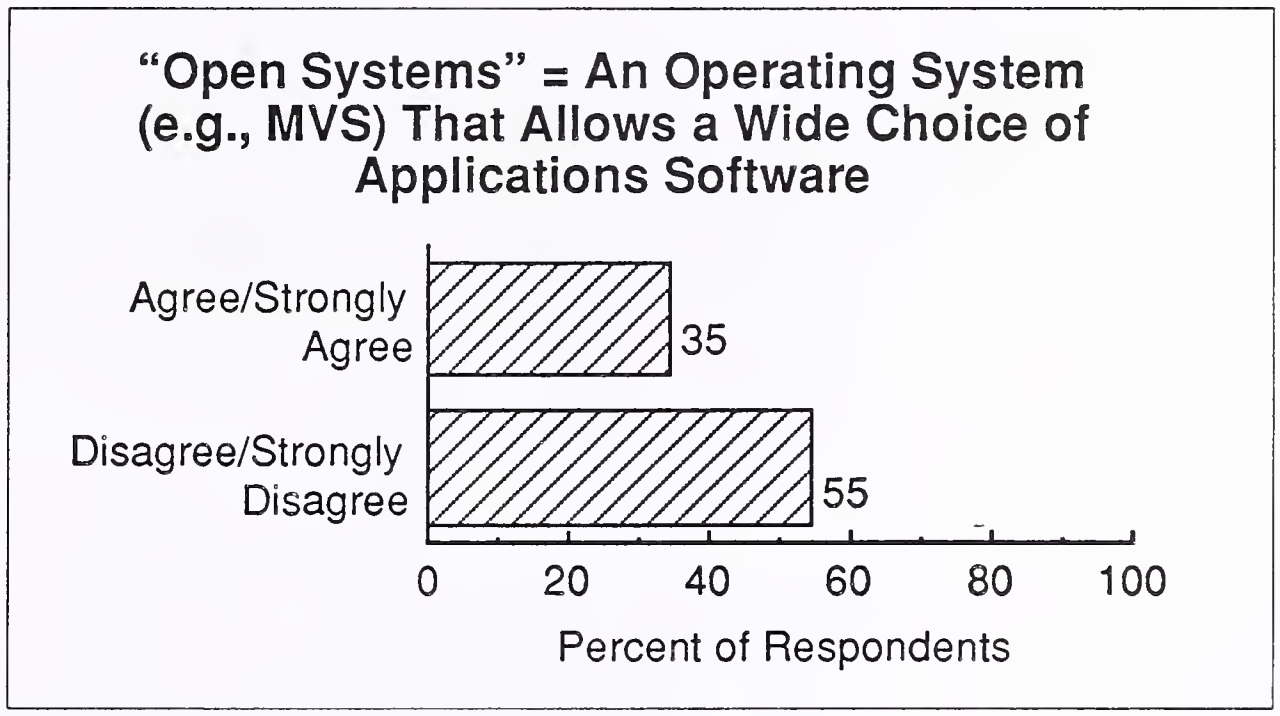
An Operating System That Allows "Guests": Respondents were equally split as to whether an operating system that allowed guest operating systems to be run under it qualified as an open system (Exhibit IV-9). The "guest" concept is not normally one associated with open systems, so the amount of support this definition gathered is very interesting.

EXHIBIT IV-9



An Operating System That Supports a Wide Choice of Applications Software: This definition was offered to test the extent to which choice defines user attitudes toward open systems. This was the one definition upon which a majority of respondents did not agree that it was a viable open systems option (Exhibit IV-10). The reason for this may have been that INPUT, somewhat provocatively, offered MVS as an example of such an operating system.

EXHIBIT IV-10



The preliminary conclusion that can be formed is that users are pragmatic and have a high degree of interest in products that exist in the marketplace. However, standards are important also and are discussed in the next section.

B

Standards and Open Systems

In the preceding section, definitions involving standards received the highest levels of agreement (Exhibits IV-2 to IV-4, which for convenience are duplicated below as Exhibits IV-11 to IV-13).

As either a cause or effect of this level of interest, there are at least ten major standards-setting organizations focusing on computer hardware or software (Exhibit IV-14).

In spite of or because of the large number of standards organizations, a majority of INPUT respondents still see a lack of standards as a serious barrier to open systems use (Exhibit IV-15).

EXHIBIT IV-11

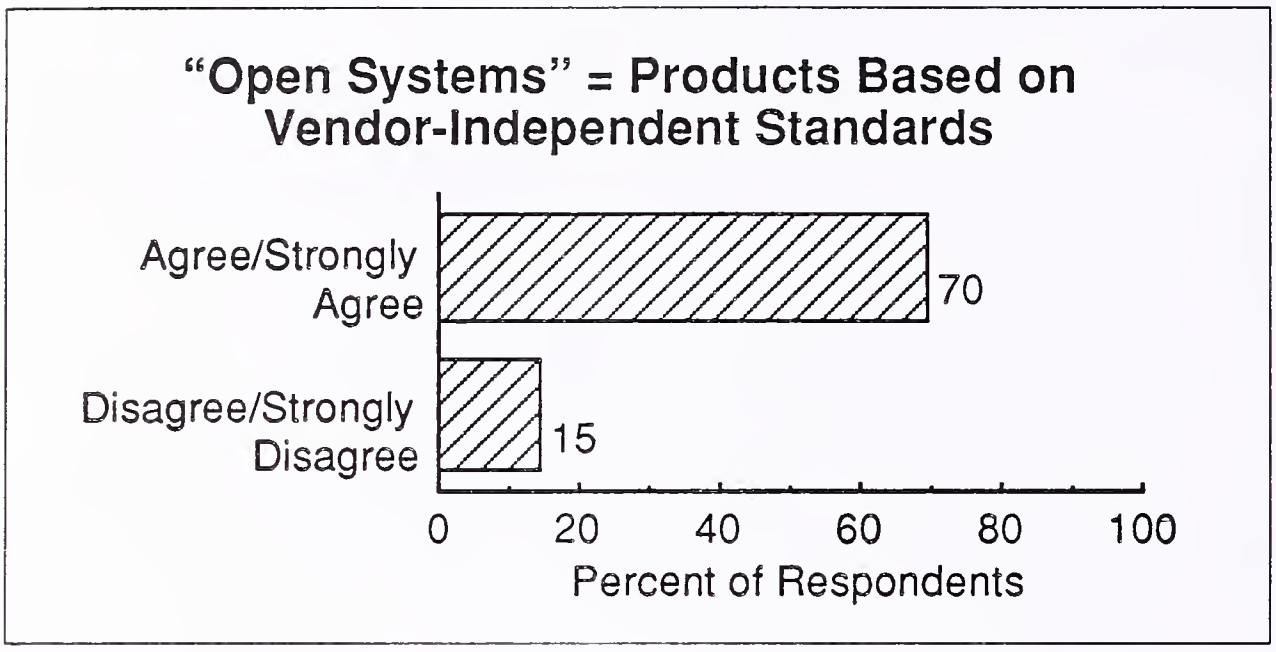


EXHIBIT IV-12

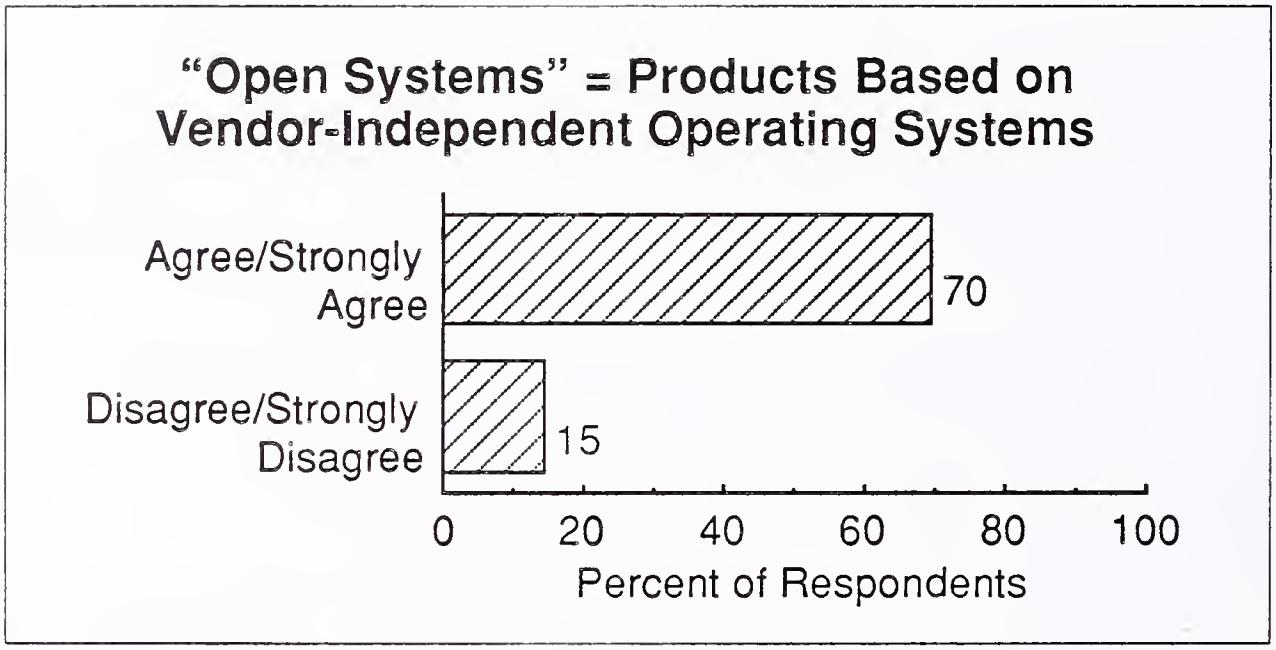


EXHIBIT IV-13

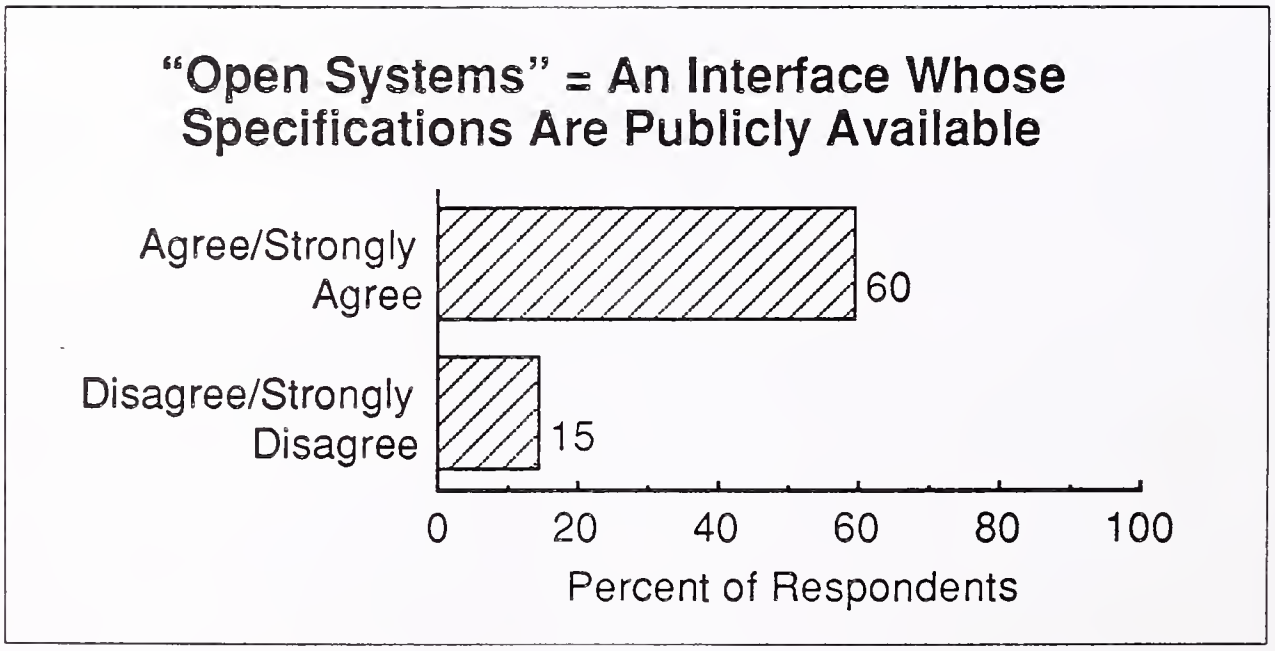
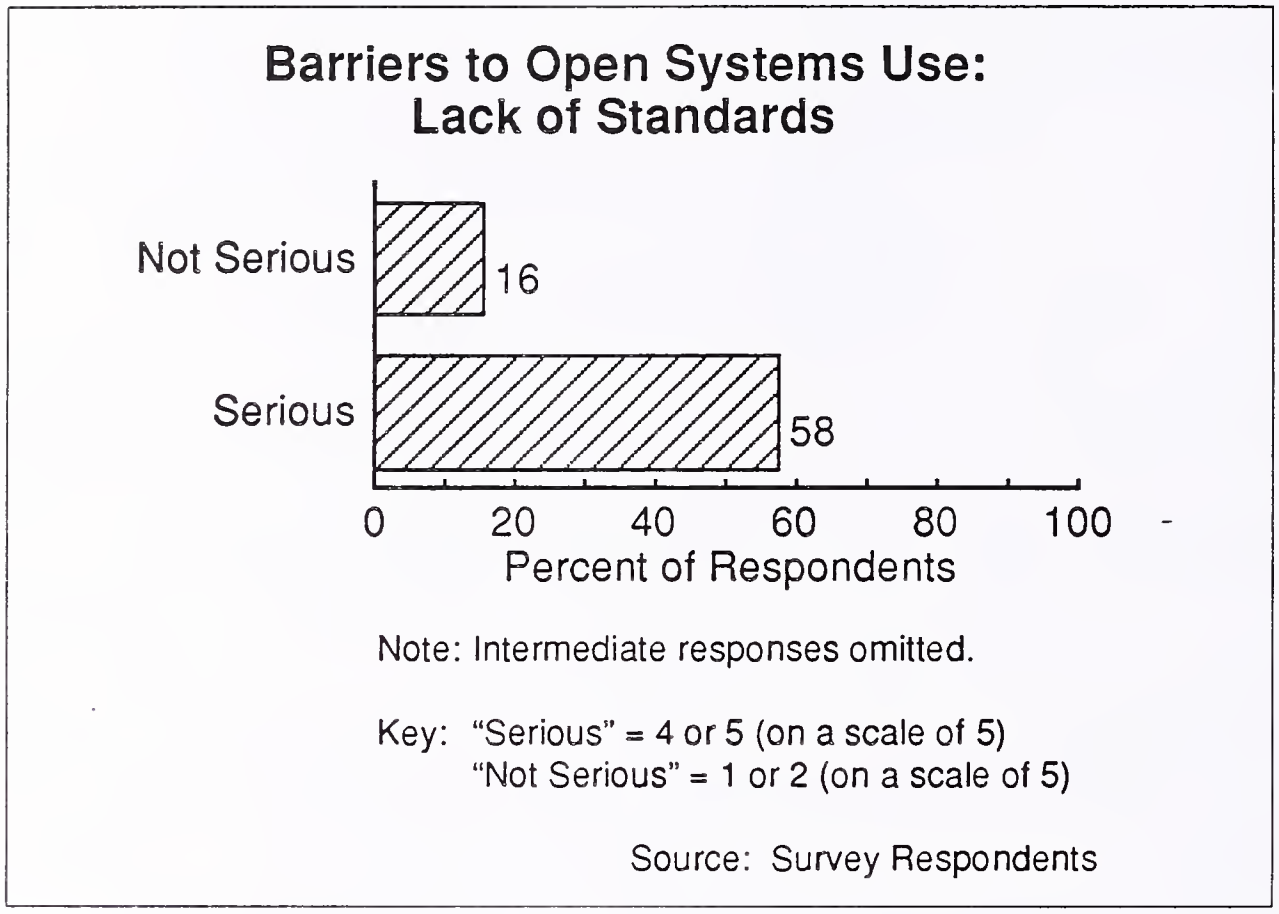


EXHIBIT IV-14

Selected Standards Organizations

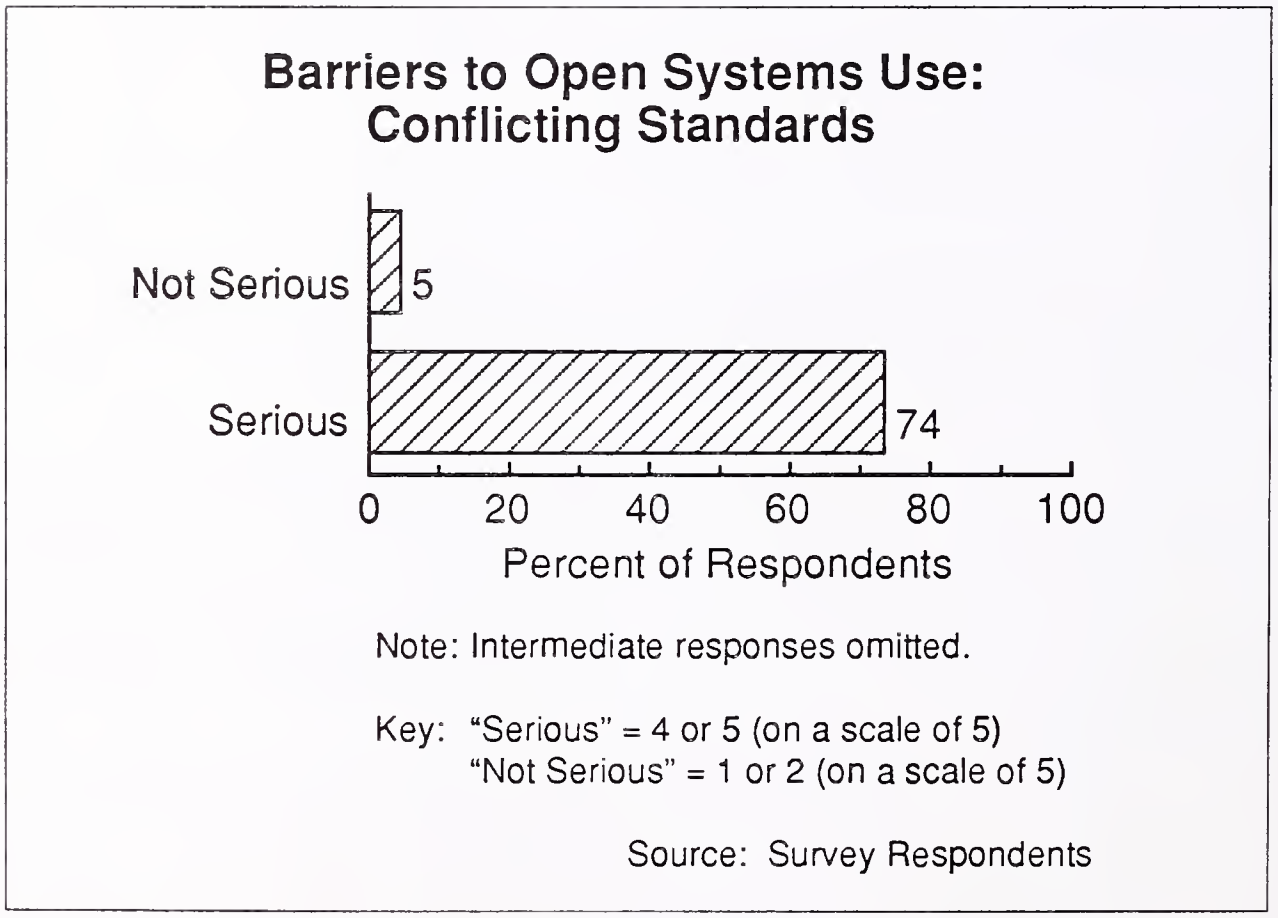
Name	Date Formed	Location	Membership	Focus
Open Software Foundation	1988	Cambridge, MA	Vendors, users, non-profit	Vendor-neutral specifier of UNIX software & supporting environment
UNIX International	1988	Piscataway, NJ	Vendors, users non-profit	Formed by AT&T to market market UNIX System V. Now semi-independent.
Corporation for Open Systems	1985	McLean, VA	Vendors, users, non-profit	Supports OSI, MAP/TOP activities
IEEE Computer Society Technical	1980	Piscataway, NJ	Subcommittee on operating systems standards	POSIX standards
Object Management Group	1989	Framingham, MA	Vendors, users	Object management on varied hardware and software platforms
X Consortium	1988	Cambridge, MA	Vendors	X Windows standards and support
X/Open	1988	Reading, U.K.	Vendors, users	International specifier of open systems requirements
Office Document Architecture Consortium	1991	Brussels, Belgium	Vendors	Document interchange standards
European Workshop on Open Systems	1987	Brussels, Belgium	Vendors, users (European)	Develop European OSI profiles
Multivendor Integration Architecture Consortium	1988	Tokyo, Japan	Vendors (Japanese)	Develop standards for Japanese procurements

EXHIBIT IV-15



However, the problem of conflicting standards is considered even more serious (Exhibit IV-16).

EXHIBIT IV-16



In this case, the UNIX issue probably does play an important open systems role. However, the role is largely a negative one:

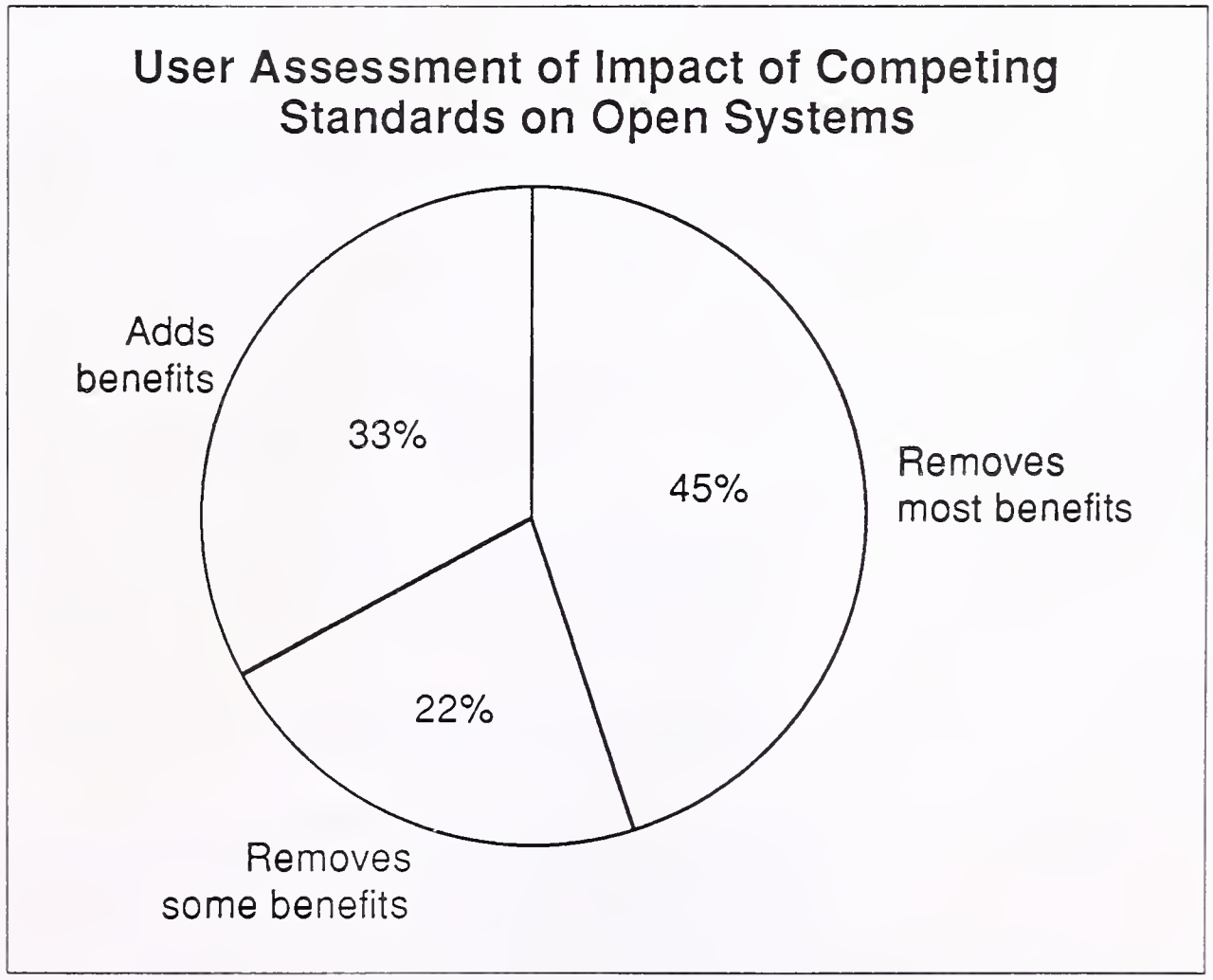
- The UNIX heritage of many non-standard implementations is not advantageous.

- There are two opposed UNIX standards groups: UNIX International and the Open Systems Foundation. There is no sign that these two groups' efforts will be converging any time soon. (For more information and analysis on UNIX issues specifically, see INPUT's report, *U.S. UNIX Market, 1991-1996*.)

- One of the standards organizations, UNIX International, is still closely identified with AT&T, which raises questions in some customers' minds about the organization's independence.

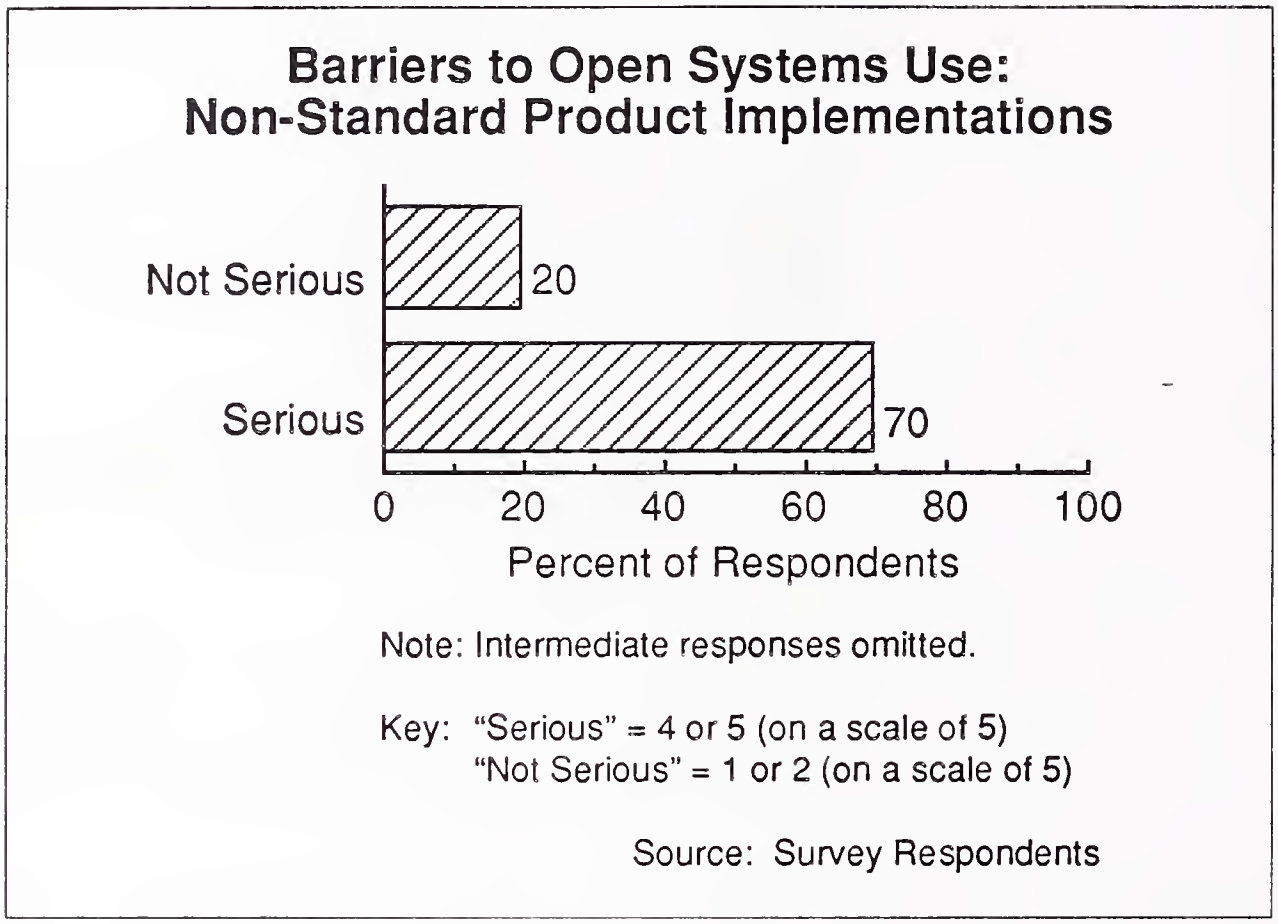
There is a counterargument that competing standards groups can add more value than is lost, as in many competitive situations. However, only a third of INPUT respondents subscribe to that view (Exhibit IV-17). Almost half, in fact, believe that competing standards remove most of the benefits that would otherwise be associated with standards.

EXHIBIT IV-17



From the user viewpoint, even an agreed-upon standard does not provide value if its implementation by vendors is not standard (Exhibit IV-18).

EXHIBIT IV-18



This issue will be addressed in more detail in the next chapter, in which the positions of specific vendors are examined. However, several broad points can be made here:

- Standards themselves may be inadequate:
  - They may be incomplete
  - They may only address the lowest common denominator of need
  - A vendor may, in good faith, believe that a standard (or more commonly, part of a standard) is technically deficient
  - Most commonly, the standards process may produce standards that lag behind the needs of the market
- Vendors, of course, believe strongly in differentiation. If all vendors implemented standards exactly as written, the scope for competition would be greatly narrowed—to, essentially, price and ancillary services. Without product differentiation, many vendors would not be able to remain in business.

C
Operating Systems Attributes for Open Systems

As part of the open systems research, users were asked to discuss their operating systems requirements and rate particular operating system environments. This is an important issue, since operating systems are the chief battleground over which the open systems wars are being fought.

As shown in Exhibit IV-19, operating systems are judged on a number of attributes, most of which are considered by users to be quite important.

EXHIBIT IV-19

Importance of Operating System Attributes

Attribute	Importance
Reliability	High
Power	Medium/High
Cost	Medium/High
Availability of Systems Software	Medium/High
Availability of Cross-Industry Applications Software	Medium/High
Availability of Vertical Applications Software	Medium

Source: Survey respondents' rating on a scale of low to high importance.

- Reliability is the most important attribute.
- The availability of specific packaged vertical applications software products is somewhat less important.

Users were then asked to rate specific operating systems against each of these attributes. Respondents were asked to rate UNIX, MS-DOS and OS/2, since each of these has some claim to being an open system in terms of

the definitions given in Section A of this chapter. In addition, the assessment of MVS was also asked for as a "control" case: MVS is the core of most large organizations' IS operations, but most users do not consider MVS an open system.

Before proceeding to the individual assessments, there are some very important caveats readers should keep in mind. These caveats will affect some of the overall conclusions of this report:

- These findings are very time-dependent, based on user experiences as of late 1991.

- At this time, for example, the direct experience of most users with OS/2 was rather limited. Most opinions on current and future performance were based on the trade press and analysts' opinions—which have been, on balance, negative. INPUT believes that both the performance and the image of OS/2 will be considerably different (i.e., more positive) in mid-1992.

- A sizable number of respondents were relatively unconcerned and/or uninformed about mainframe—i.e., MVS—issues. This was explicitly stated in some cases and was obvious in other instances by the respondents' inability to make a rating. This tended to lower the overall ratings of MVS. This relative ignorance is an important negative finding in itself: To the extent to which there is competition between established host-based operating systems and newer "open" operating systems, those making or influencing decisions may already have closed their minds toward traditional proprietary operating systems.

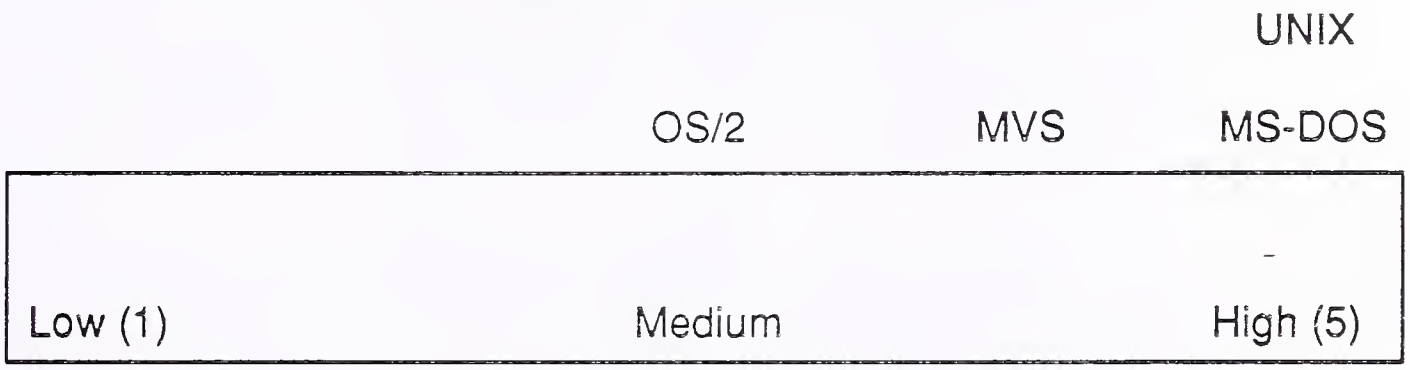
- More generally, INPUT has found that users who are not in special non-disclosure or beta test groups find it difficult to provide a good sense of direction for future developments, even for products they are currently using.

However, with these caveats in mind, the following data is quite illuminating as to what a sampling of users believes to be the current and future situation.

Reliability: UNIX and MS-DOS are seen as highly reliable, even more so than MVS (Exhibit IV-20). For those with in-depth knowledge of MVS, this might not be objectively the case. However, until now people with in-depth knowledge of MVS have usually not become involved with open systems questions. For example, in a skills inventory taken in a large IS organization, the knowledge of nontraditional hardware and software platforms was very small. The rating of OS/2 reflects its lack of market penetration as well as the capabilities of Release 1.

EXHIBIT IV-20

Assessment of the Reliability of Selected Operating Systems

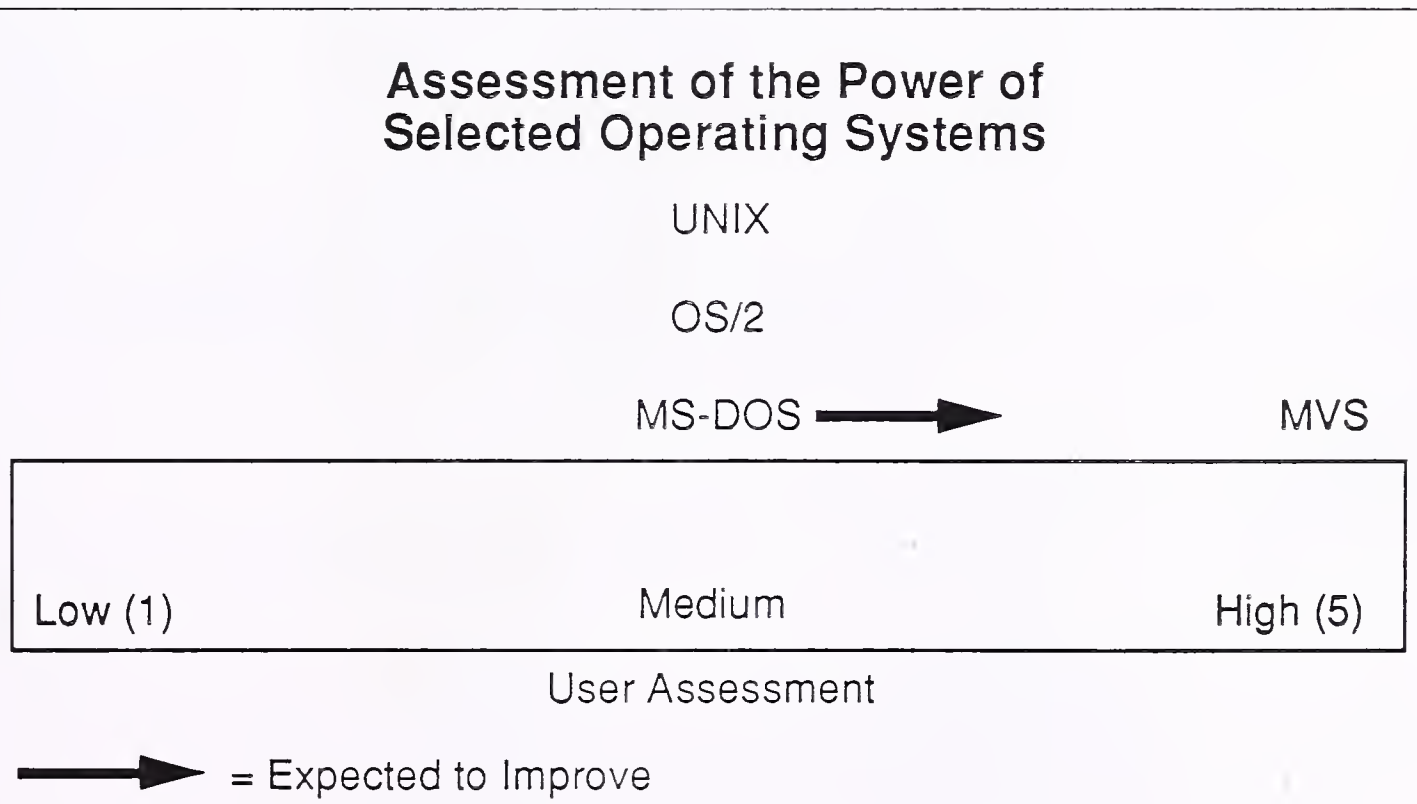


Source: Survey Respondents

Power: Not surprisingly, MVS is the unambiguous winner for power (Exhibit IV-21). In contrast to reliability, where actual knowledge is required to make a precise assessment, the power of MVS is much more obvious.

EXHIBIT IV-21

Assessment of the Power of Selected Operating Systems



Source: Survey Respondents

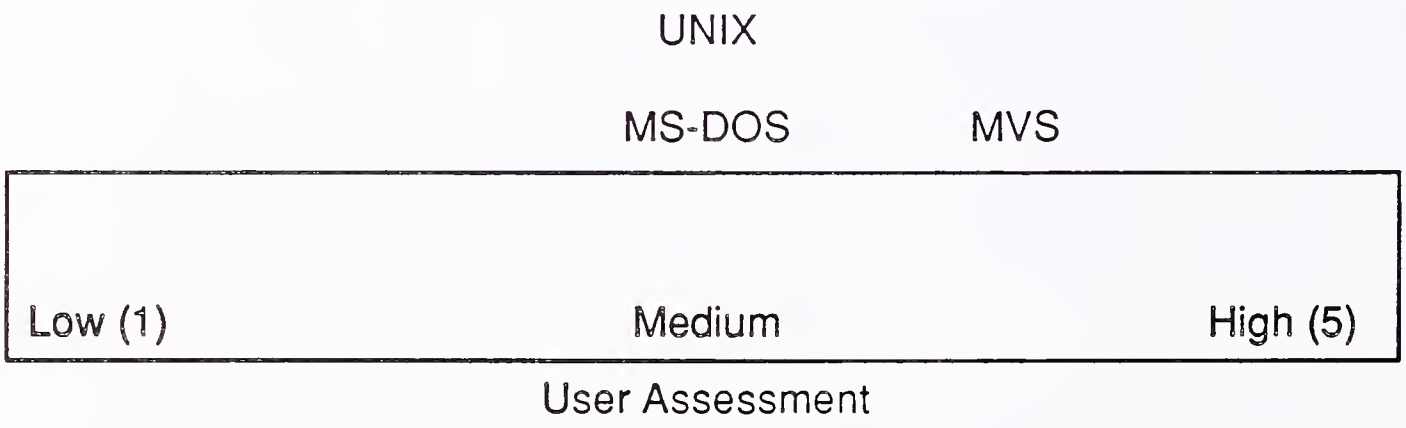
More surprisingly, only MS-DOS is expected to make appreciable improvements compared to UNIX and OS/2. Operating systems experts would probably make the exact opposite assessment—i.e., more improvements should be expected from UNIX and OS/2 than from MS-DOS. Arguably, MS-DOS has reached a performance and development plateau and will soon be a maintenance mode for the long term.

Cost: Cost in this case is not just the cost of the operating system itself, but the overall cost of doing business in a particular operating environment.

MVS is considered the most expensive computing option, but only marginally so (Exhibit IV-22). Again, for better or for worse, the high cost of MVS has entered the folklore of computing. Cost judgments are tempered somewhat by the knowledge that there are still many large-scale tasks for which MVS is uniquely suited, making cost comparisons difficult. Respondents could not provide reliable assessments for OS/2 at this stage of its development.

EXHIBIT IV-22

Assessment of the Cost of Selected Operating Systems

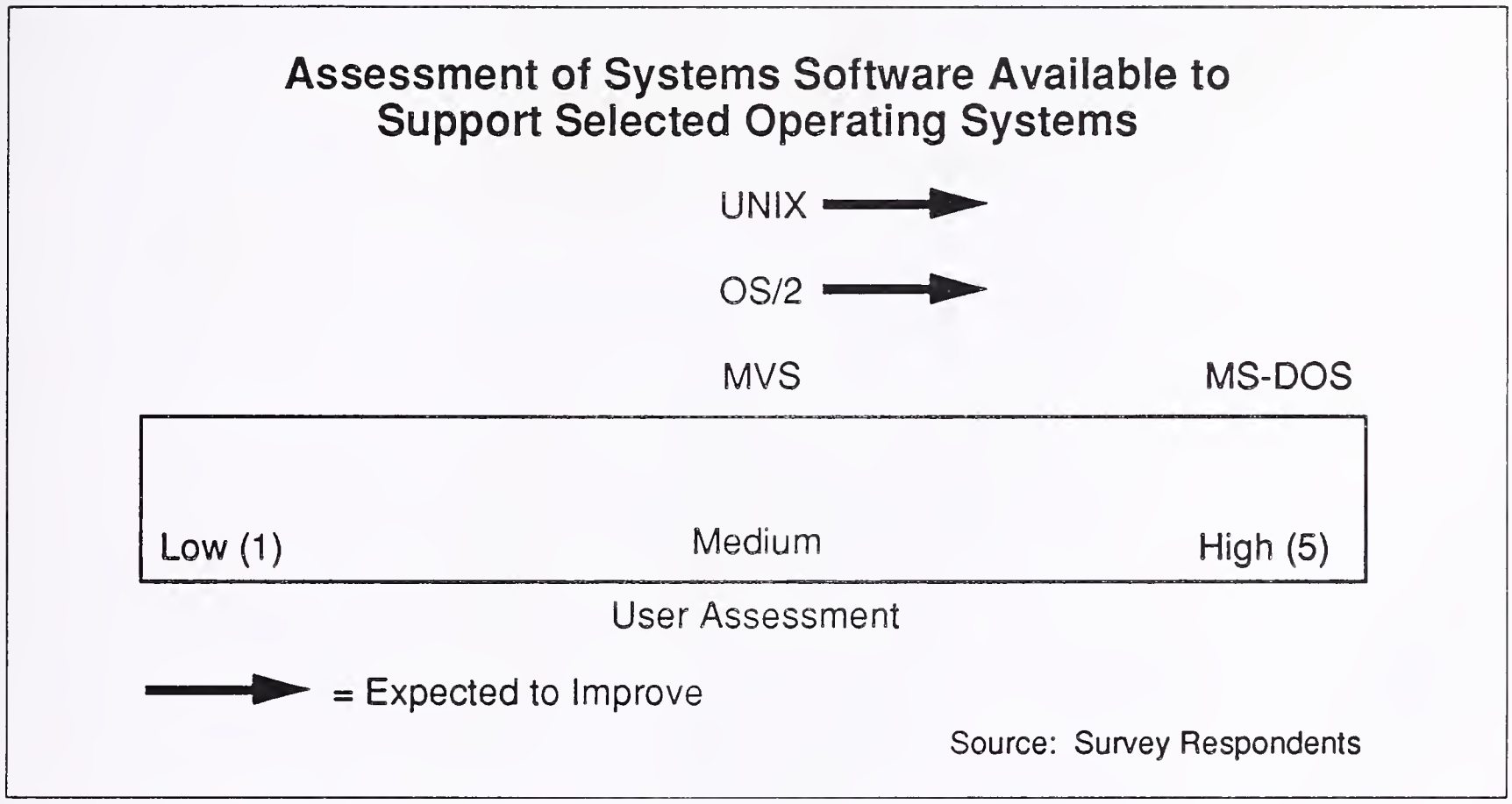


Note: Respondents could not assess OS/2.

Source: Survey Respondents

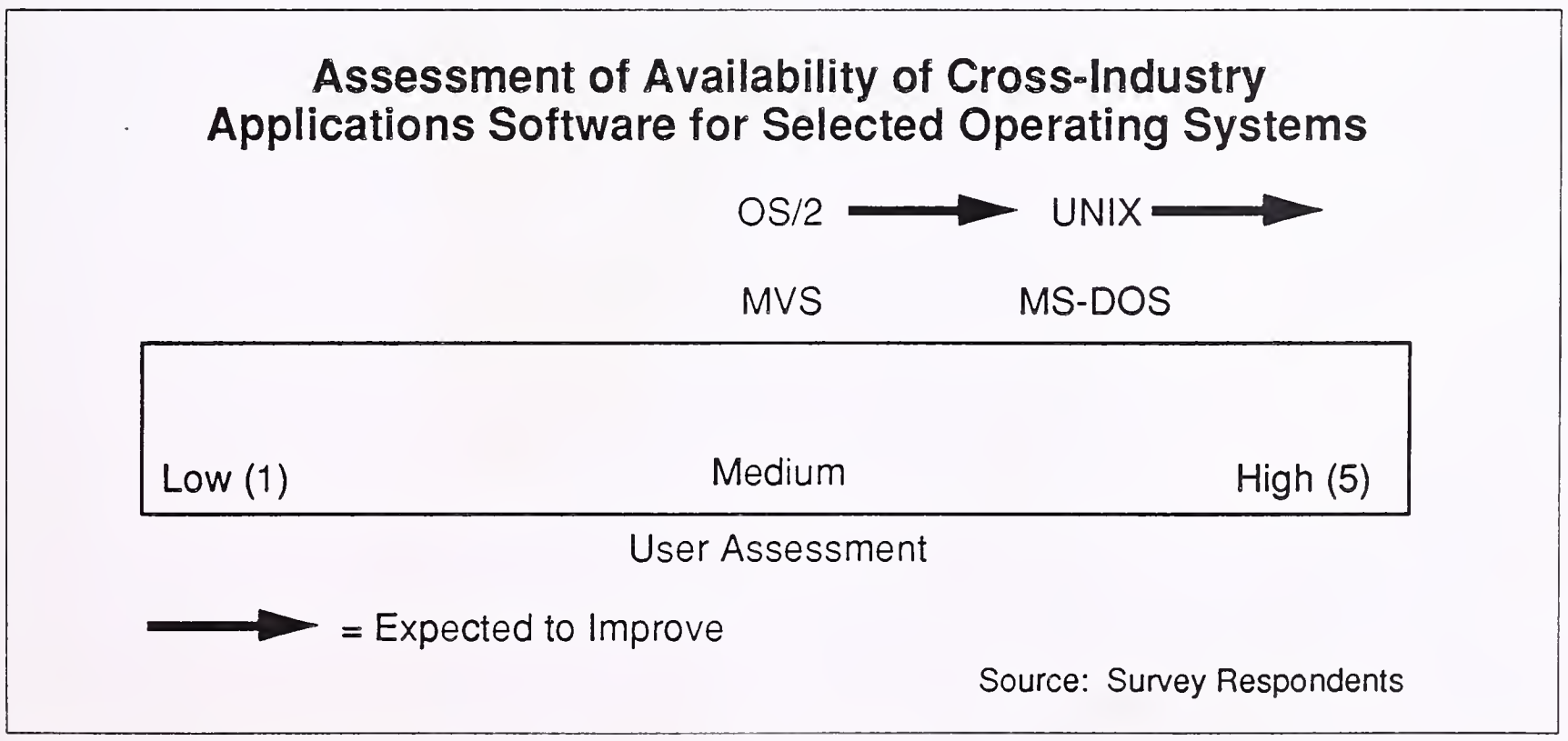
Systems Software Availability: Respondents were obviously influenced by the number of software products available and secondarily by the richness of its functionality in giving MS-DOS the highest marks (Exhibit IV-23). UNIX was probably held back somewhat by relatively slow progress by UNIX standards organizations in approving or developing systems software support suites for the UNIX core. The fact that both UNIX and OS/2 are widely perceived to be in a growth phase fuels expectations for improvement.

EXHIBIT IV-23



Cross-Industry Software Availability: Both UNIX and MS-DOS have thousands of cross-industry applications packages available (Exhibit IV-24). OS/2 benefits from this as well, being able to support MS-DOS applications as well as packages that run in the native OS/2 mode.

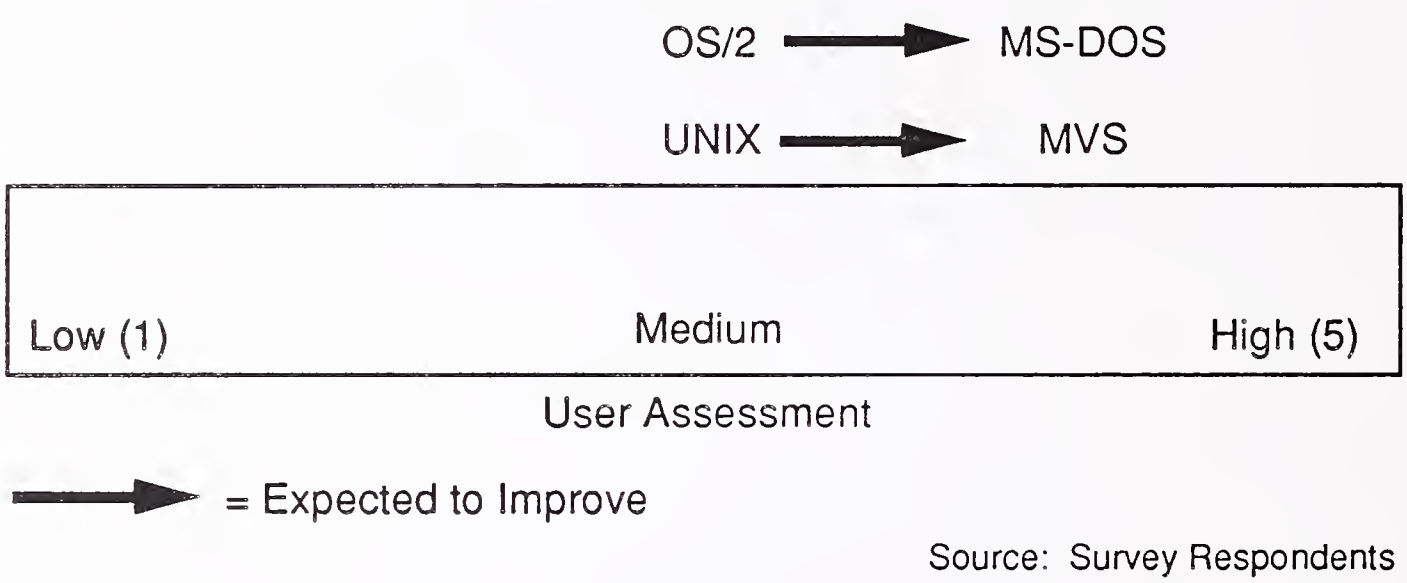
EXHIBIT IV-24



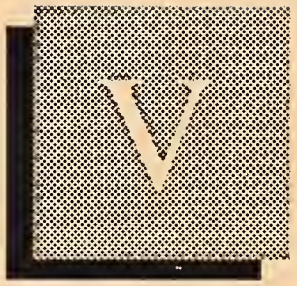
Vertical Industry Software Availability: The situation here is similar to the cross-industry category, with the exception that MVS is recognized as supporting many key software products aimed at particular industry applications (Exhibit IV-25).

EXHIBIT IV-25

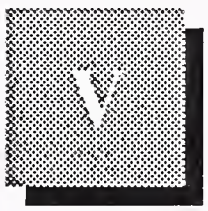
Assessment of Availability of Vertical Applications Software for Selected Operating Systems



Source: Survey Respondents



Open Systems Benefits and Barriers



Open Systems Benefits and Barriers

This chapter examines the benefits of and barriers to the use of open systems. This chapter is based on the results of user research as well as INPUT's analysis of the market environment.

A
Open Systems Benefits

There are two principal benefits of open systems as seen by users:

- Increased choice for selecting and using different hardware platforms
- The ability to run applications on different hardware platforms

Exhibit V-1 shows the relative importance of subcategories within the general categories.

In general, the goal of users is not to be tied to a particular operating environment, whether the operating environment is a hardware or software platform (see Exhibit V-2 for a graphic representation of user preference). Specific observations on these user preferences include:

- Being able to switch hardware vendors easily is a desire founded upon the experiences of users throughout the 1980s, where
  - Large or small variations in equipment specifications have subsequently made it difficult to network equipment or applications. This is obvious in the case of proprietary environments; more subtle differences in supposedly more standard platforms (e.g., those based on Intel chips) have only made the problems more frustrating.
  - At different times, different vendors or processing architectures may be ahead or behind on the price/performance curve. Users would like the freedom to be able to switch from one vendor to another at these times.

- If a vendor runs into financial difficulty, users would like to be able to have the option of switching, even if the price and performance is satisfactory.

EXHIBIT V-1

Importance of Open System Benefits

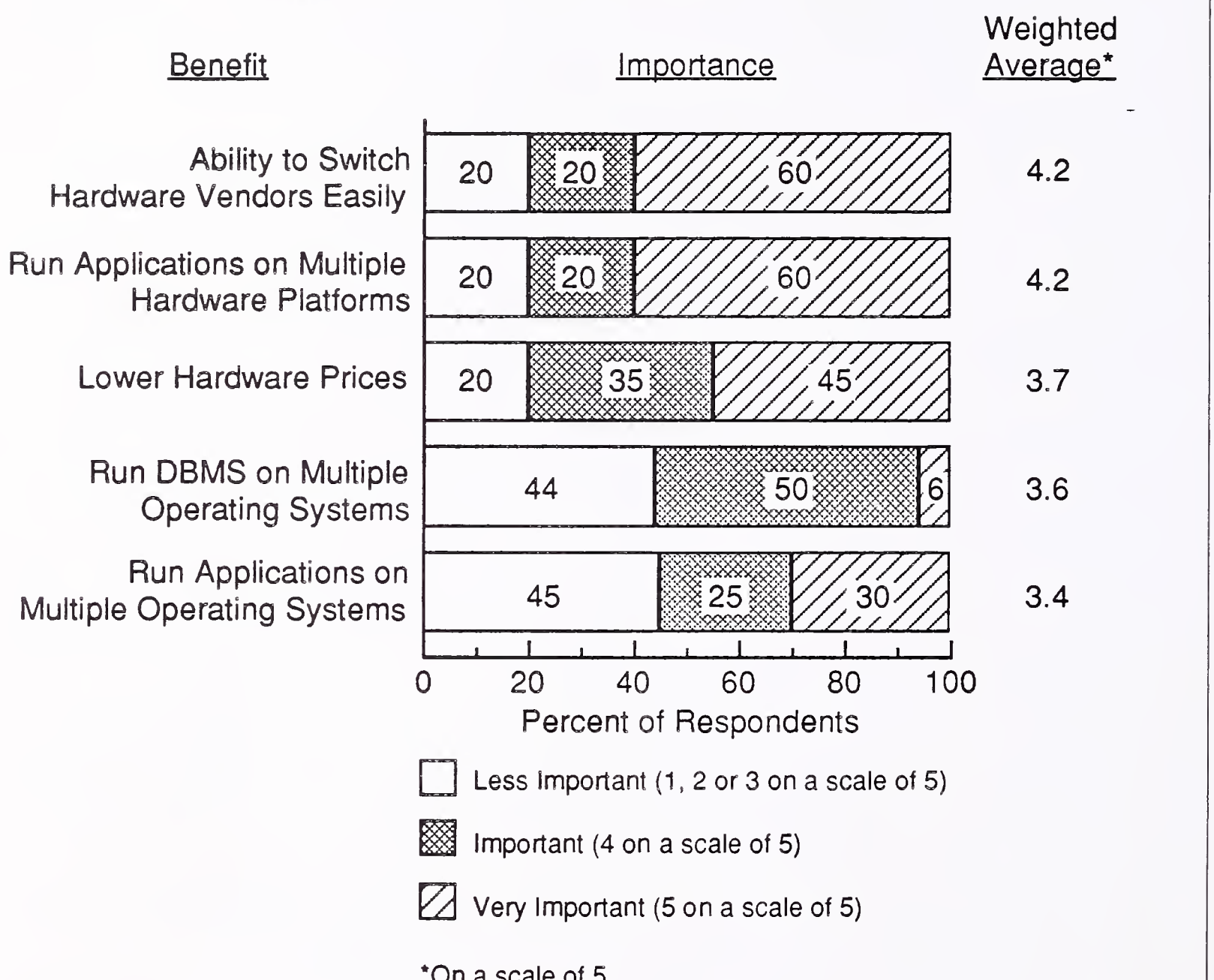
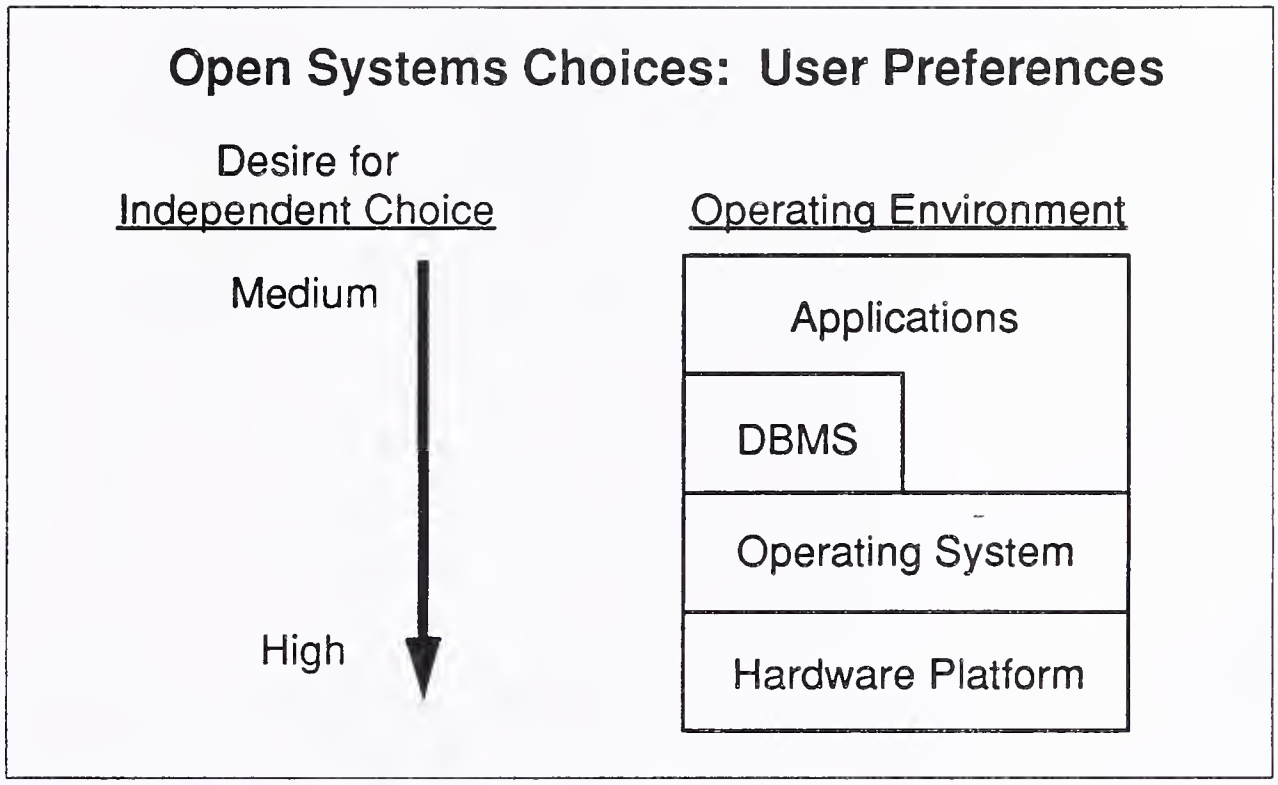


EXHIBIT V-2



There are attractions to being able to standardize at the applications or DBMS level. However, to most users, this benefit is not as important as hardware standardization:

- Most users have had far less experience in this kind of standardization. So far, their objective need to move applications (or DBMS-based applications) between different operating systems has been fairly low.

- This kind of software portability is at least as complex as hardware platform portability, with these additional problems:

  - With the exception of work in the SQL area, there is little agreement on what the standards issues are, let alone attempts to address them.

  - The responsibility for applications portability is on individual vendors (e.g., Oracle or Lotus). A vendor may change direction at any time, with obvious effects on the user.

  - In any event, much more of the responsibility for software portability and compatibility will be on the user organization than is the case for hardware portability.

These potential benefits will not happen automatically. There are significant barriers to successfully using open systems. The next section looks at these barriers from the standpoint of users.

B
Barriers to Open Systems

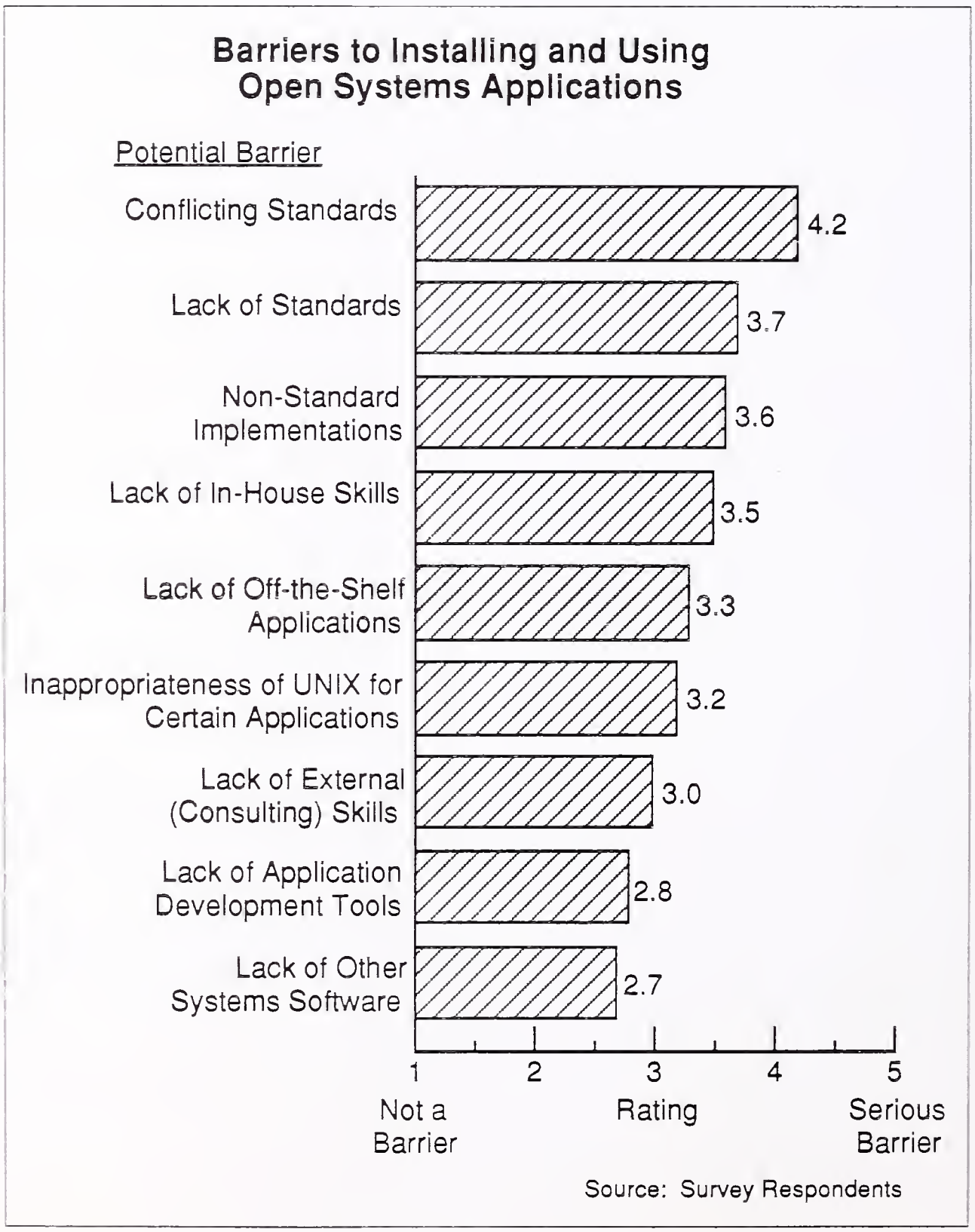
There are two types of potential barriers to open systems:

- Technical barriers
- Market-related barriers

1. Technical Barriers

Exhibit V-3 summarizes the barriers that are essentially technical in - nature.

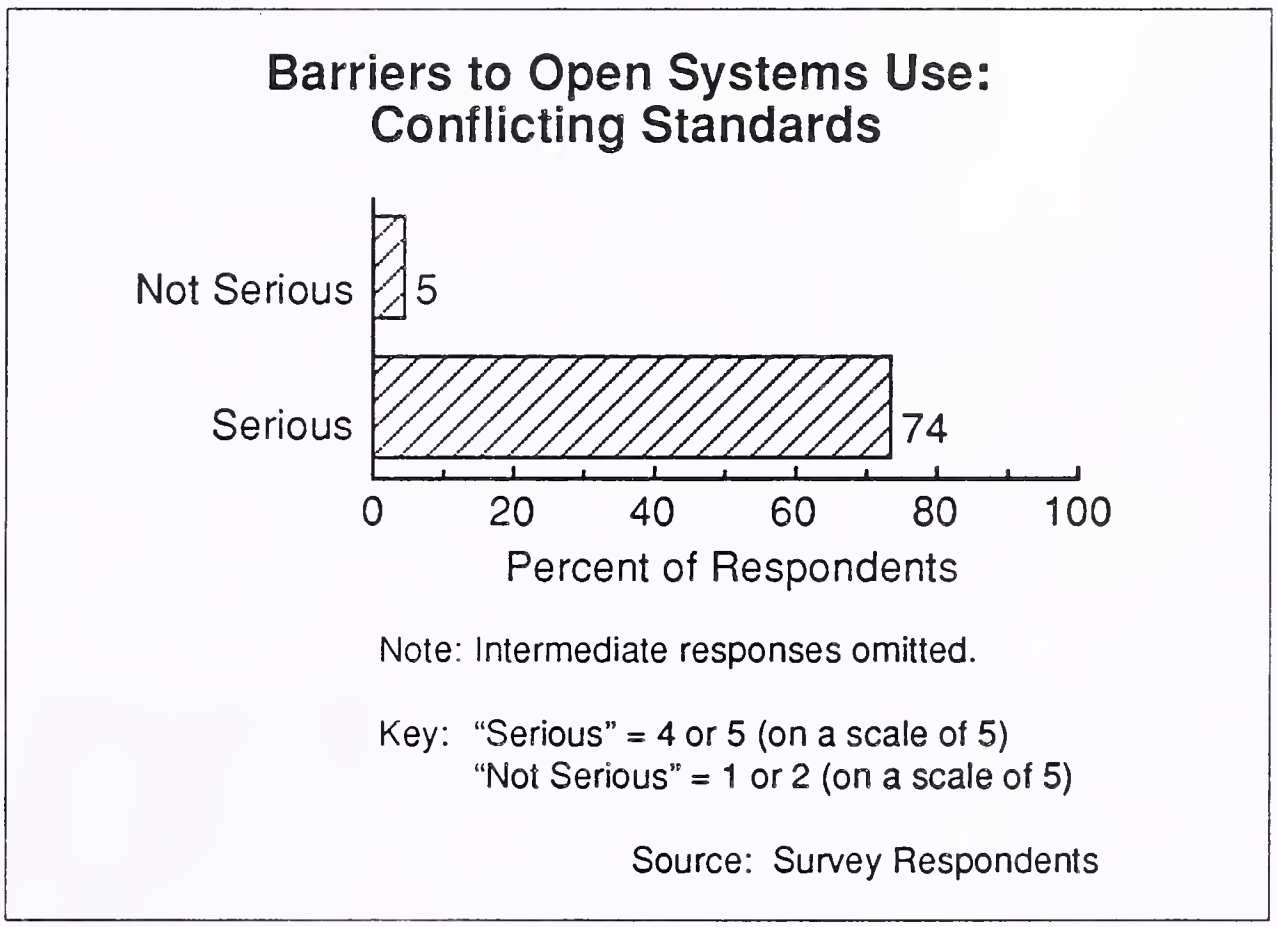
EXHIBIT V-3



These fall into the general categories of standards issues, skills, and software products/tools. These are discussed individually below. The exhibits below further analyze the average values provided in Exhibit V-3 to show the balance between views of a particular problem as serious or not serious (respondents with weaker—or no—views have been omitted).

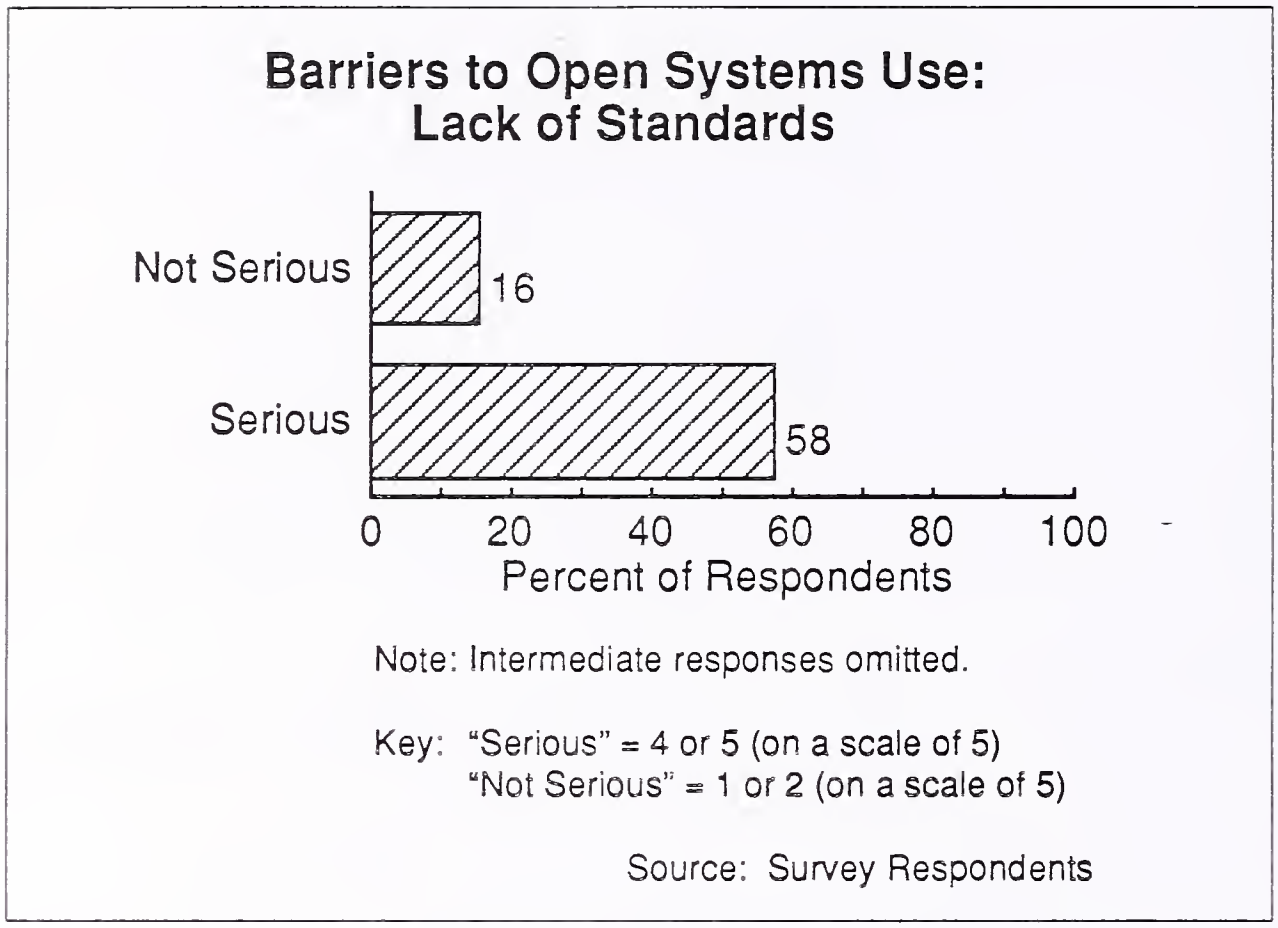
Conflicting Standards: This and the other standards-related issue are seen as the most serious barriers to successful open systems use (Exhibit V-4; note that this and the following exhibit were also used in the Standards section of Chapter IV as Exhibits IV-15 and IV-16; they are repeated here for convenience). INPUT believes that the sheer bulk of standards efforts interferes with the ability of even sophisticated user organizations to absorb their meaning and take advantage of the standards.

EXHIBIT V-4



Lack of Standards: This problem (Exhibit V-5) includes instances in which a standard area has not been addressed or has not yet been resolved. For example, there may be several dozen systems software support products or functions that should exist or be defined before a computer environment is complete. Standards organizations are years away from defining and specifying complete suites of functionality. There is no assurance that when they are finished the process will not have to start over again as requirements and technology change further.

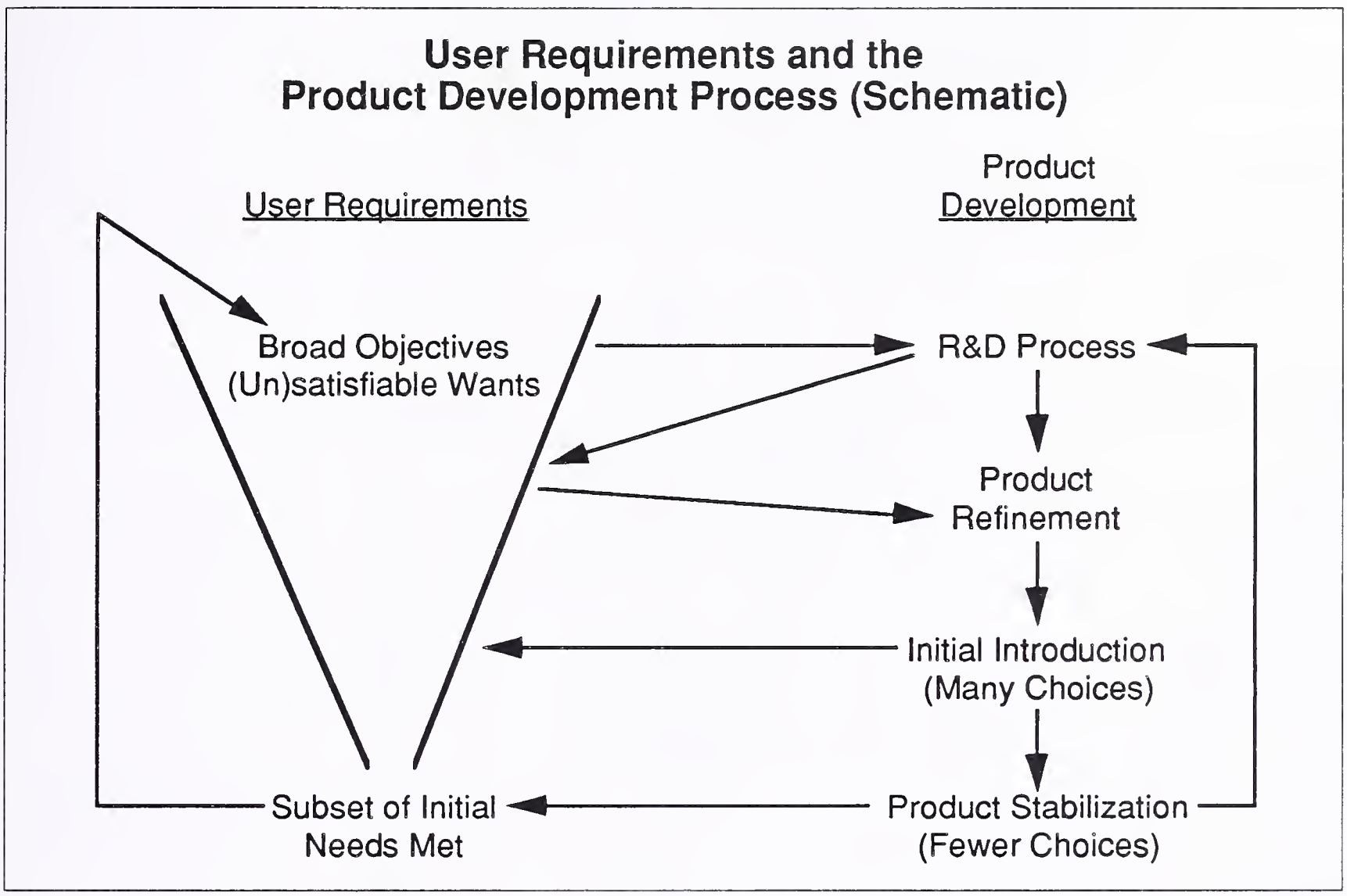
EXHIBIT V-5



These issues are illustrated in Exhibit V-6, which shows the general relationships between user requirements and the product development process:

- There is always a wide selection of user wants and objectives. Some may be satisfiable; some may never be.
  - There is interaction between the R & D process—and, later, the product refinement process—and user needs.
  - Ultimately, one or more kinds of products are produced (from one or more vendors). As the product(s) is refined and then introduced, fewer and fewer of the original needs are met—and the process begins again.
  - This process is extremely dynamic; the timing involved is difficult. If the standard is put into place too soon, desirable product options may be foreclosed (or the standard will be a dead letter); too late, and there will be much less opportunity for vendors to observe the standard.

EXHIBIT V-6



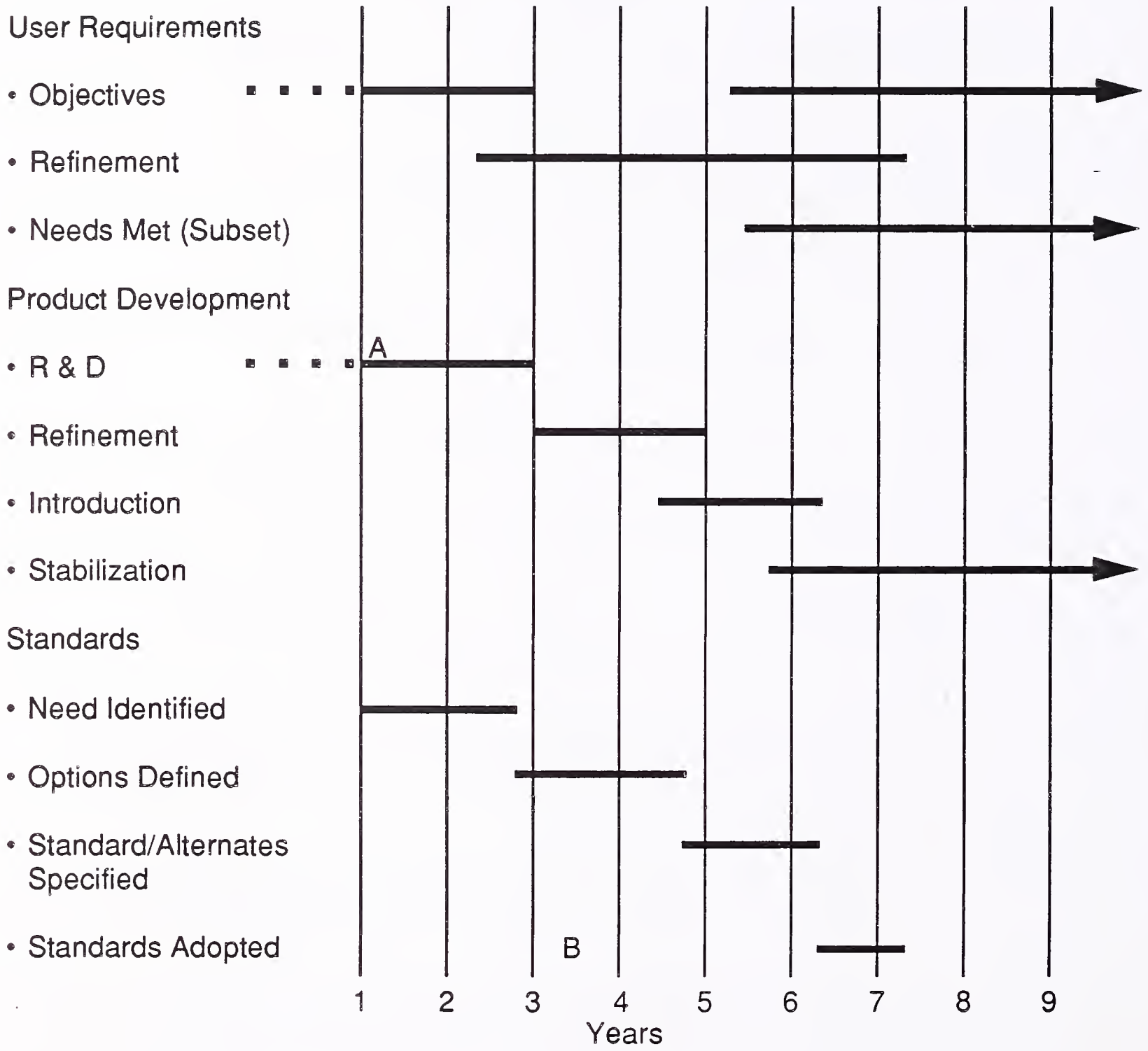
Typically, the problem is not that the standard is introduced too soon, but that the standard lags behind reality. Exhibit V-7 shows some realistic requirement and product development timelines along with reasonable standard timelines:

- Vendors (and customers) need to know what the appropriate standards will be soon after the completion of the R & D process and while the product is being refined. (See point "B" on Exhibit V-7.)

- However, standards groups cannot move that fast. Standards groups are faced with the unfortunate task of either ratifying a de facto standard or trying to make the market move in a different direction than its natural movement.

EXHIBIT V-7

User Requirements, Product Development and Standards (Schematic)



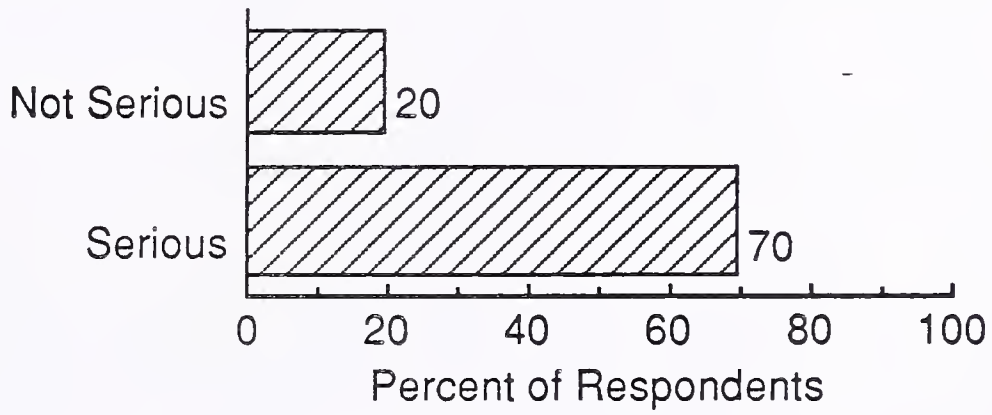
A: Announced and/or widely known

B: Standard needed

Non-Standard Implementations: This is one of the largest areas of long-term conflict between users and vendors. Users are very concerned over non-standard implementations (Exhibit V-8). However, vendors must often produce non-standard products, even if they may prefer not to (as shown in Exhibit V-7).

EXHIBIT V-8

Barriers to Open Systems Use: Non-Standard Product Implementations



Note: Intermediate responses omitted.

Key: "Serious" = 4 or 5 (on a scale of 5)
"Not Serious" = 1 or 2 (on a scale of 5)

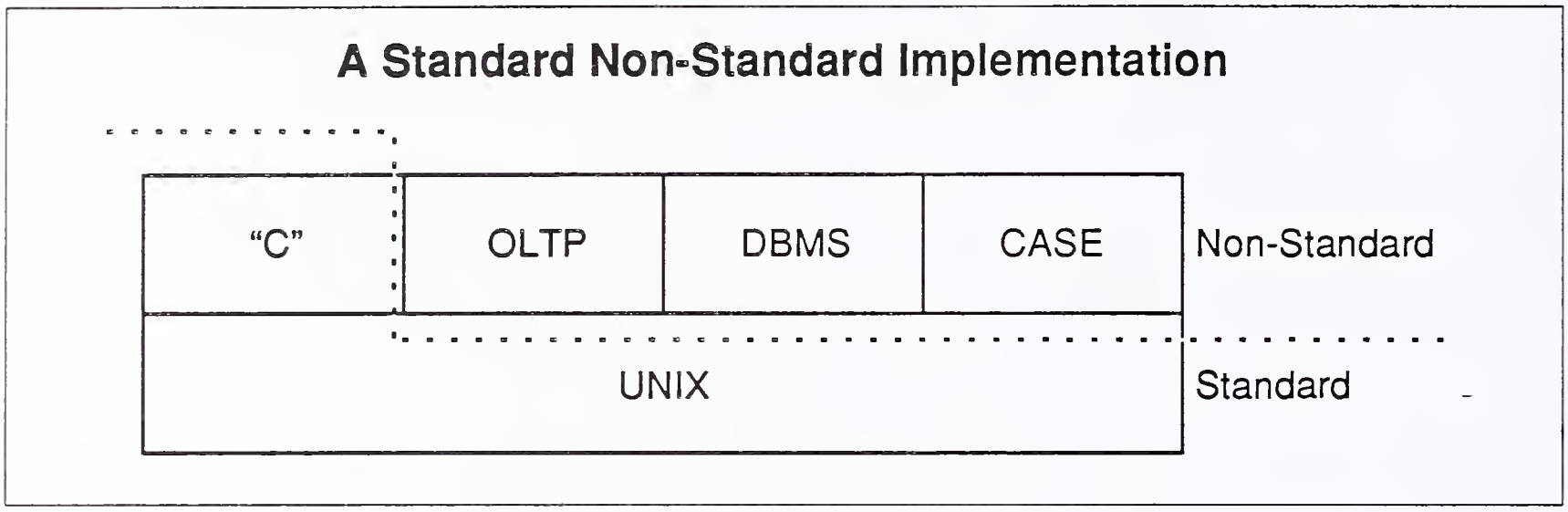
Source: Survey Respondents

- Standards (or a choice of standards) exist for UNIX and C, for example. These can readily be offered in a plain vanilla version.

- However, there is no current direction on what a vendor should offer for high-performance on-line transaction processing, DBMS or CASE. A vendor will offer tailored, optimized products to meet market needs (see Exhibit V-9).

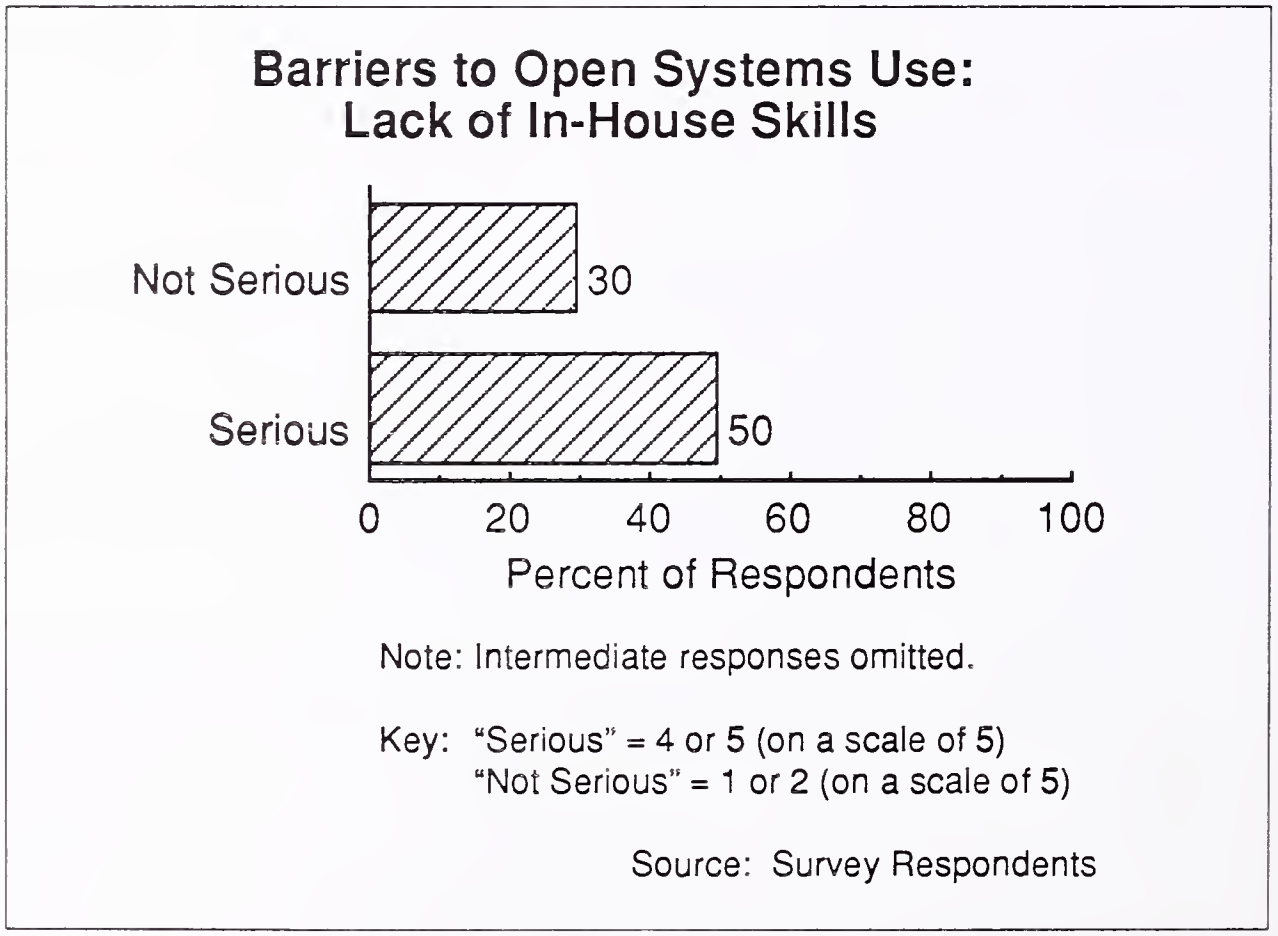
- Users will discover that the more successful the vendor has been in meeting their needs, the more locked in they are to a customized computing environment, even if much of it has been constructed from "standard" components.

EXHIBIT V-9



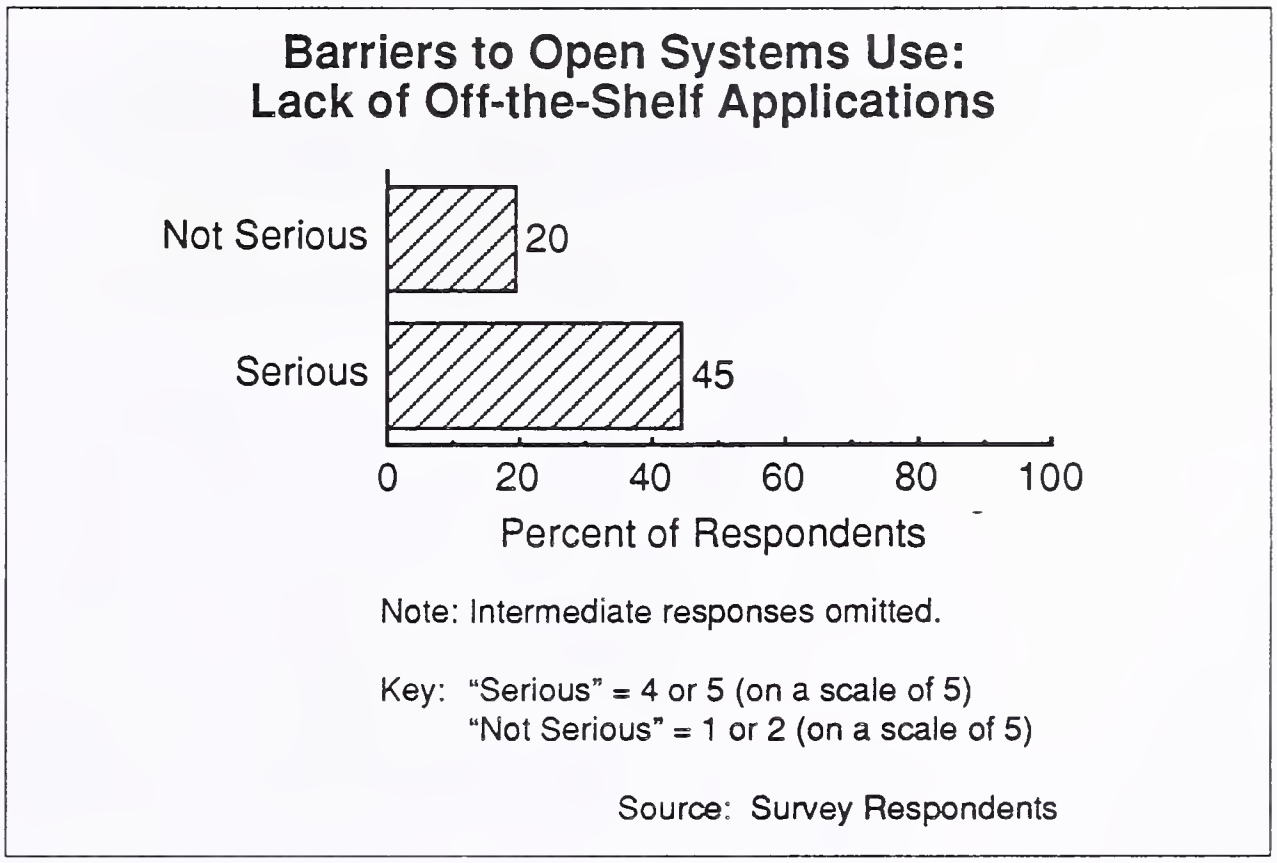
Lack of In-House Skills: This is perceived as a serious problem by half of the respondents (Exhibit V-10). As noted earlier, traditional IS organizations have largely traditional proprietary platform skills. Decentralized or downsized units outside of the central IS organization often have a broader range of skills, but these are often scattered over many hardware and software products and specialties, and vary widely in competence.

EXHIBIT V-10



Lack of Off-The-Shelf Applications: This is viewed by respondents as the second most serious of the non-standards-related barriers (Exhibit V-11). At first glance this might appear to be an inappropriate complaint since, for example, UNIX and MS-DOS each have well over 10,000 software packages available.

EXHIBIT V-11



However, on closer analysis there is a problem in comparing packages aimed at the proprietary and non-proprietary platforms; in this case, UNIX and MS-DOS will be defined as non-proprietary platforms. The proprietary platforms analyzed were MVS, VAX/VMS, HP and the AS/400.

INPUT analyzed the characteristics of both the products and the vendors offering packaged software products for the most popular vertical industry (MRPII) and the largest cross-industry sector (integrated accounting).

- From a qualitative standpoint, it should not be surprising that the packages offered for proprietary platforms had far more features and had the power of the platform behind them.

- Far more vendors offered products for UNIX and MS-DOS than for the proprietary platforms (see Exhibits V-12 and V-13).

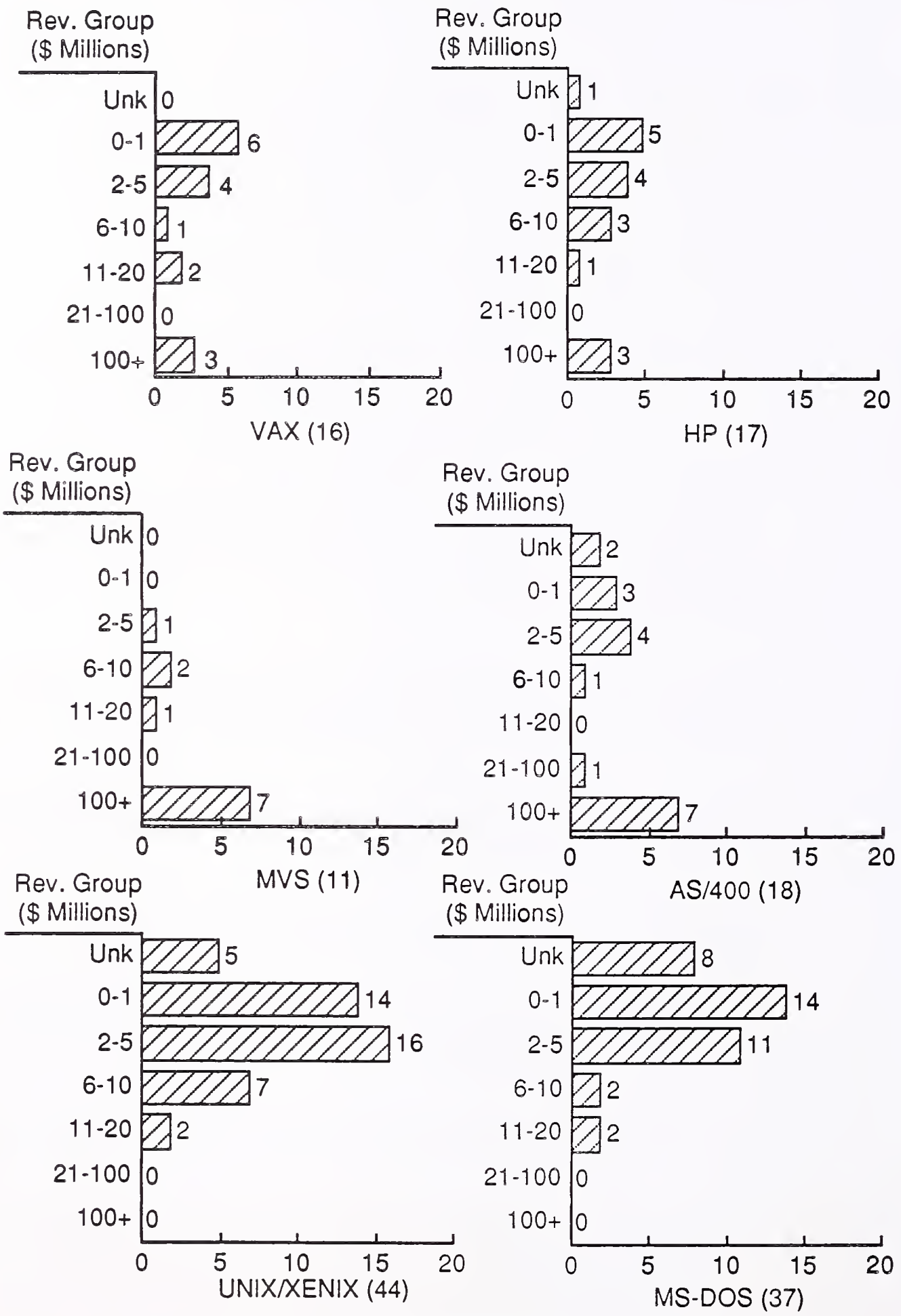
  - However, the profile of the underlying strength of the vendors, as expressed in total vendor revenues, was noticeably different for the vendors offering UNIX or MS-DOS products.

  - No UNIX vendor had revenues over $20 million. Of the 152 MS-DOS accounting vendors, only five had revenues over $20 million.

  - Perhaps an even larger problem is the sheer "clutter" of vendors offering UNIX and MS-DOS applications. There are far too many vendors for very many to be able to build up to critical mass. This not only creates confusion in the marketplace, but leaves the very real fear in customers that a vendor selected this year might be out of business next year.

EXHIBITS V-12

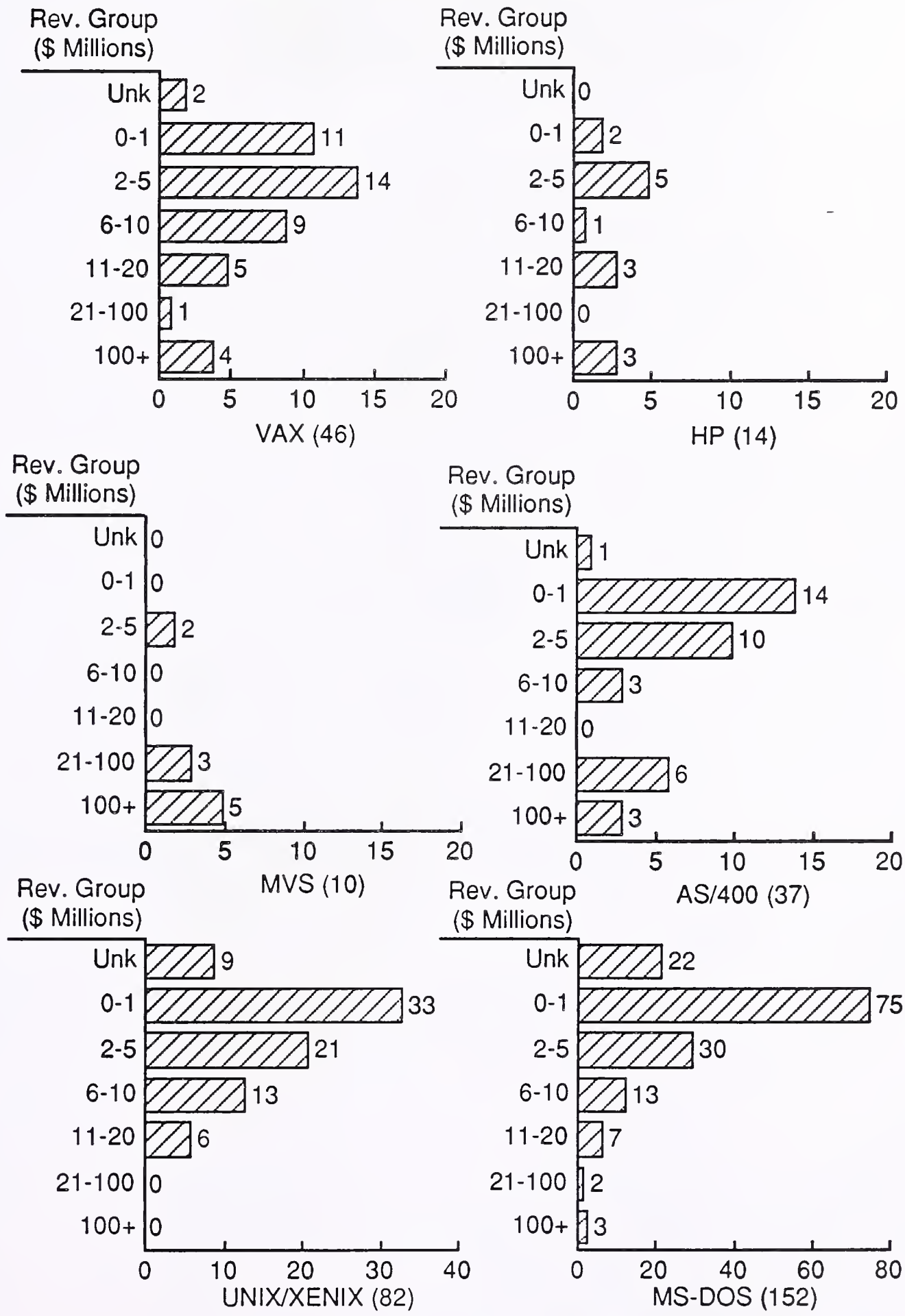
Number of MRPII Vendors by Platform and Vendor Revenue Size



Source: INPUT analysis. Total number of vendors in parentheses; vendor products may be on more than one platform.

EXHIBITS V-13

Number of Integrated Accounting Vendors by Platform and Vendor Revenue Size



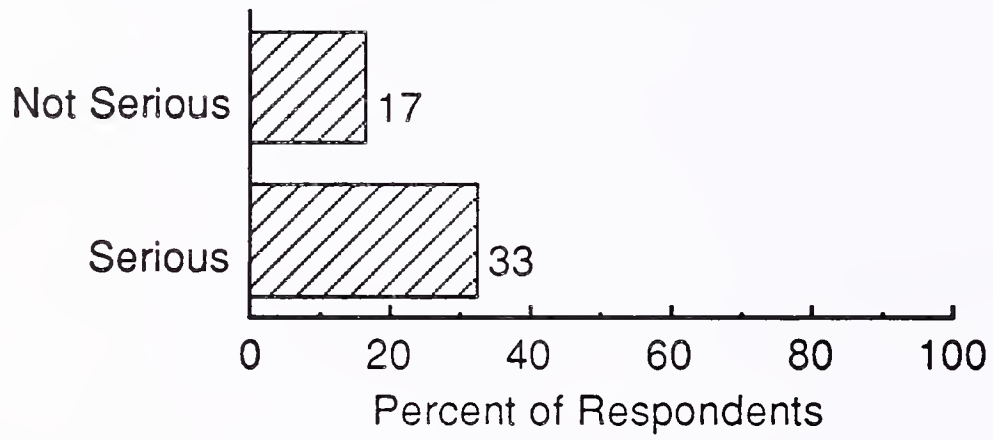
Source: INPUT analysis. Total number of vendors in parentheses; vendor products may be on more than one platform.

Inappropriateness of UNIX: A third of respondents see this as a serious barrier (Exhibit V-14). Note, however, that only half the respondents had an opinion on this issue; twice as many saw this as a serious problem as did not see it as a problem. There are two factors contributing to this situation, both of which have been discussed previously:

- Non-standard implementations of UNIX
- The lack of adequate packaged software for some requirements

EXHIBITS V-14

Barriers to Open Systems Use: Inappropriateness of UNIX for Certain Applications



Note: Intermediate responses omitted.

Key: "Serious" = 4 or 5 (on a scale of 5)
"Not Serious" = 1 or 2 (on a scale of 5)

Source: Survey Respondents

Lack of Access to External Consulting Skills: Somewhat more respondents see this as a problem than not a problem (Exhibit V-15). The lack of in-house skills is viewed as a more serious problem (see Exhibit V-10, above).

Lack of Application Development Tools: This is viewed as not being a serious problem by 40% of respondents (Exhibit V-16).

EXHIBIT V-15

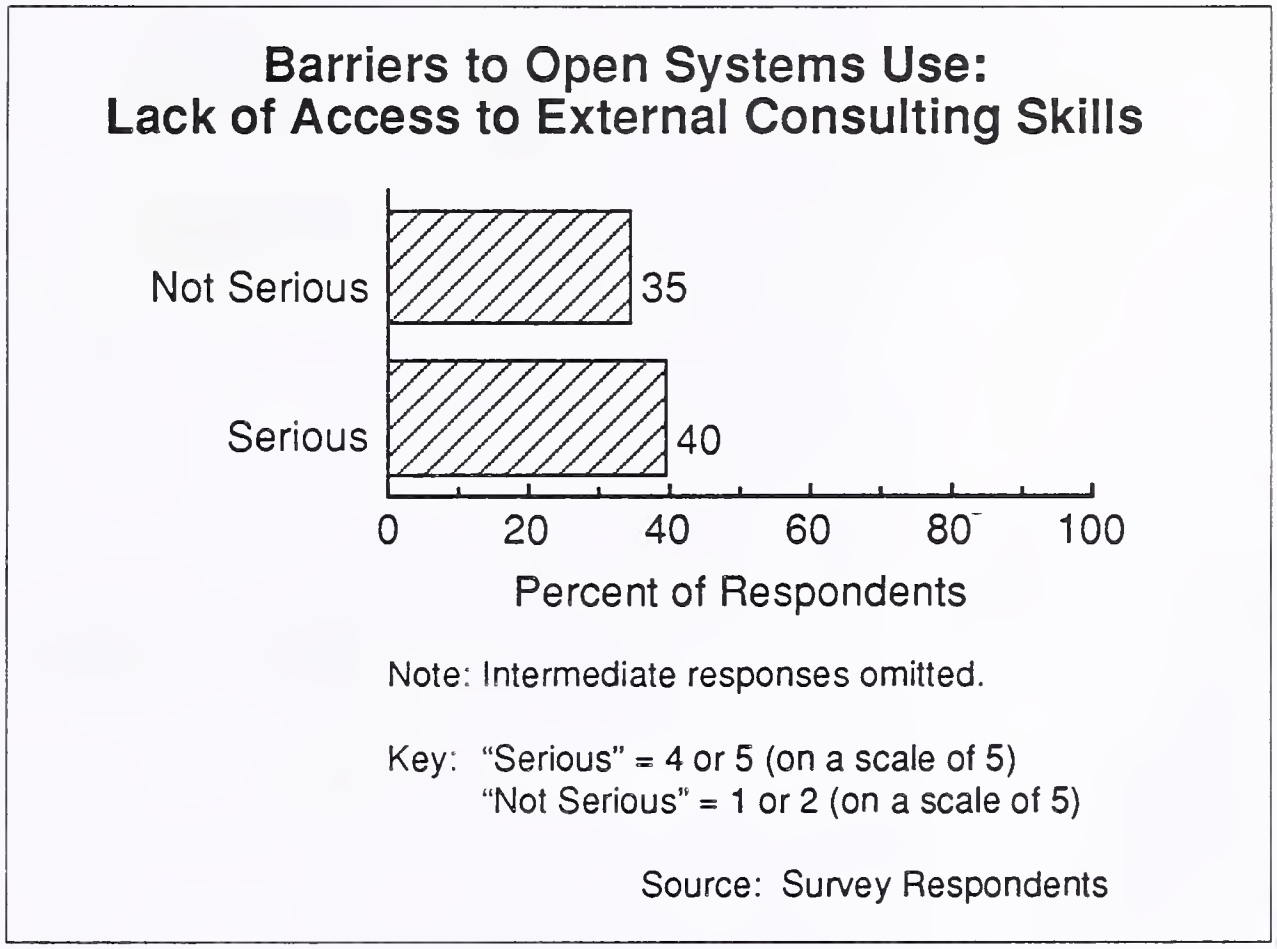
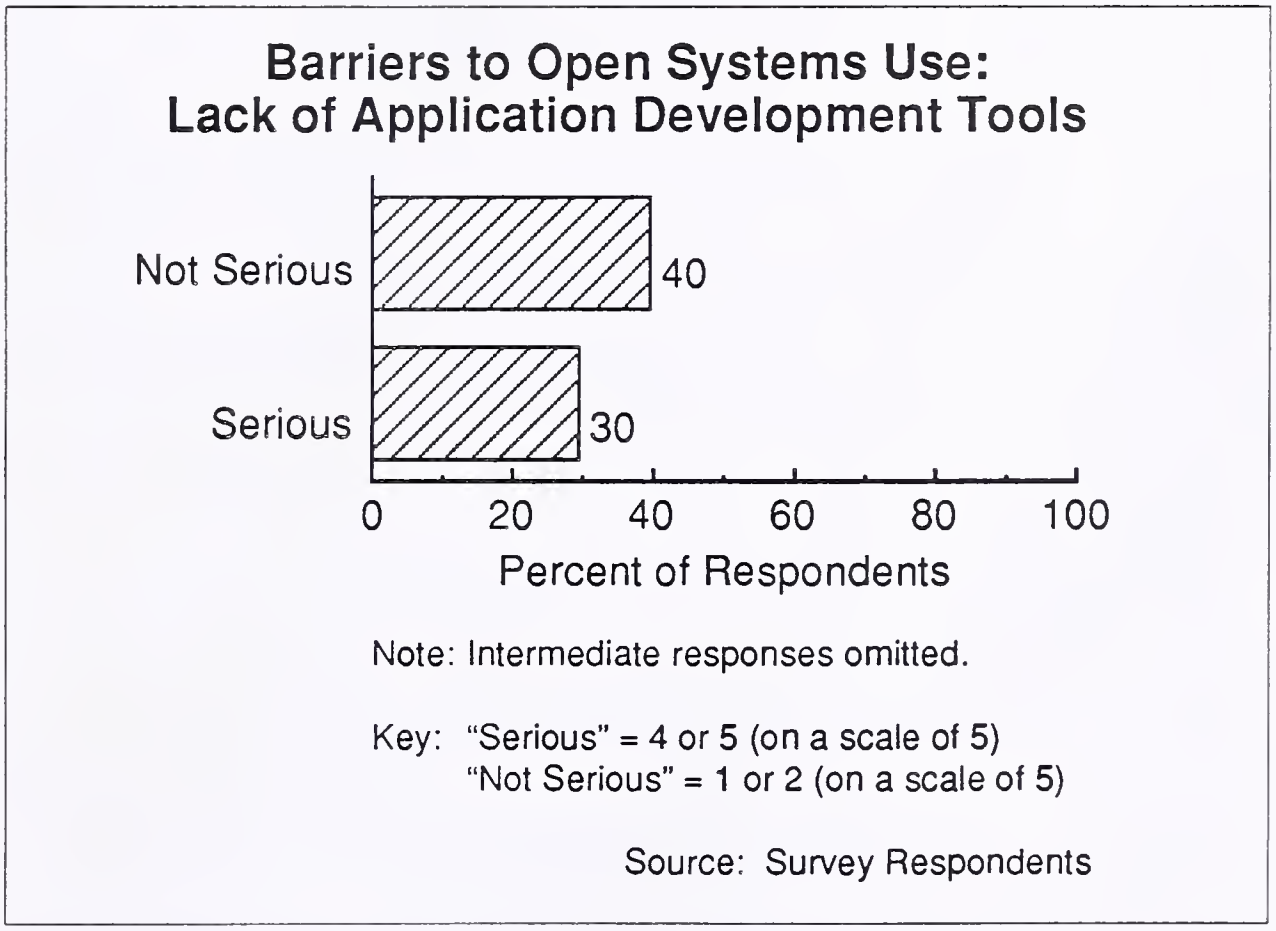


EXHIBIT V-16



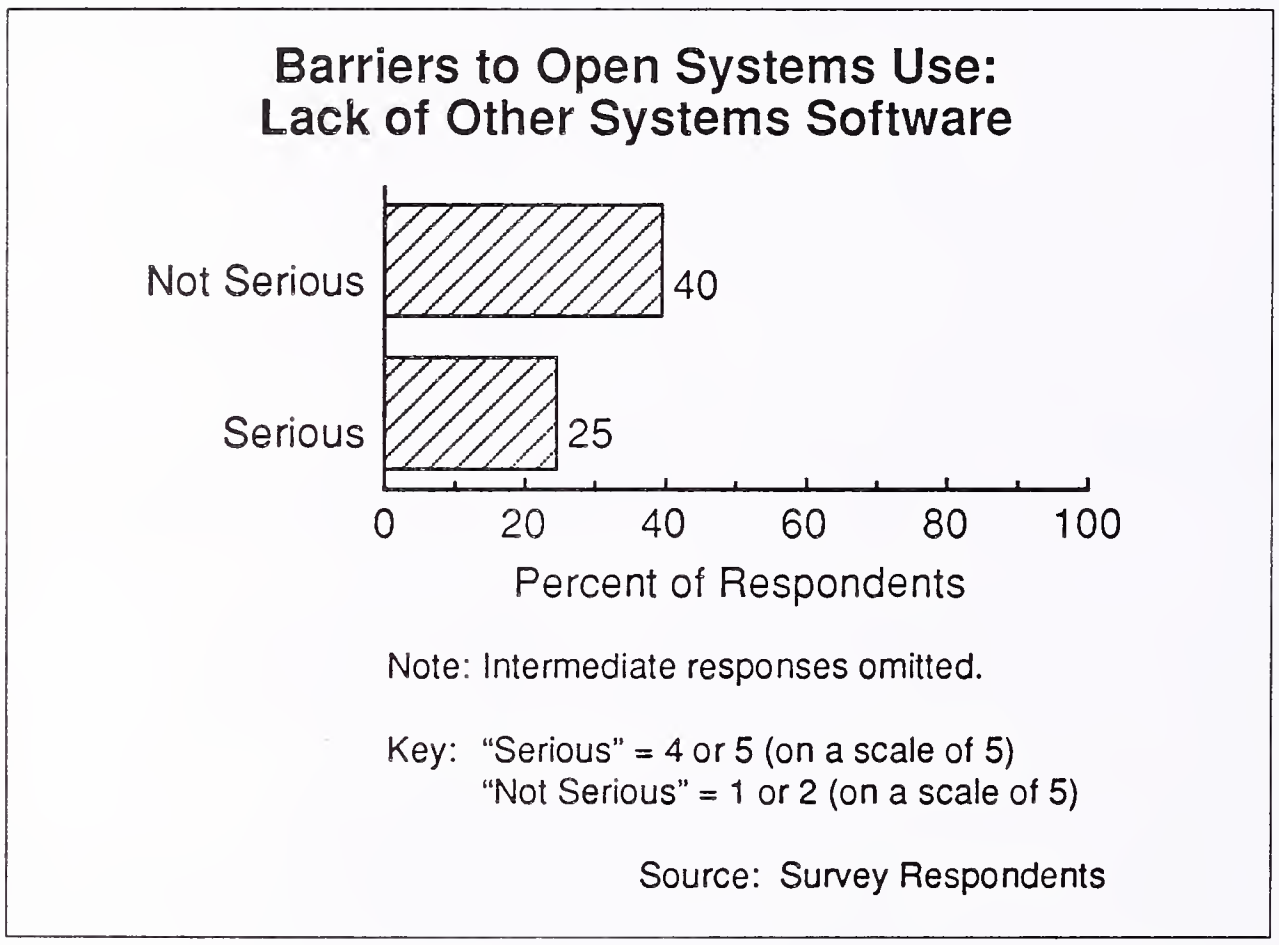
INPUT believes that this attitude reflects the relatively immature state of development of many UNIX and MS-DOS environments:

- In the case of UNIX, many environments are specific forms of UNIX matched to a specific hardware platform—sophisticated development tools are not a realistic option. Many of these early adopters have not been tool users.

- At the other extreme, many MS-DOS environments have done little in the way of custom development.

Lack of Other Systems Support Software: This is generally not viewed as a serious problem (Exhibit V-17). In INPUT's view, lack of other systems support software primarily represents the immaturity of many current installations.

EXHIBIT V-17

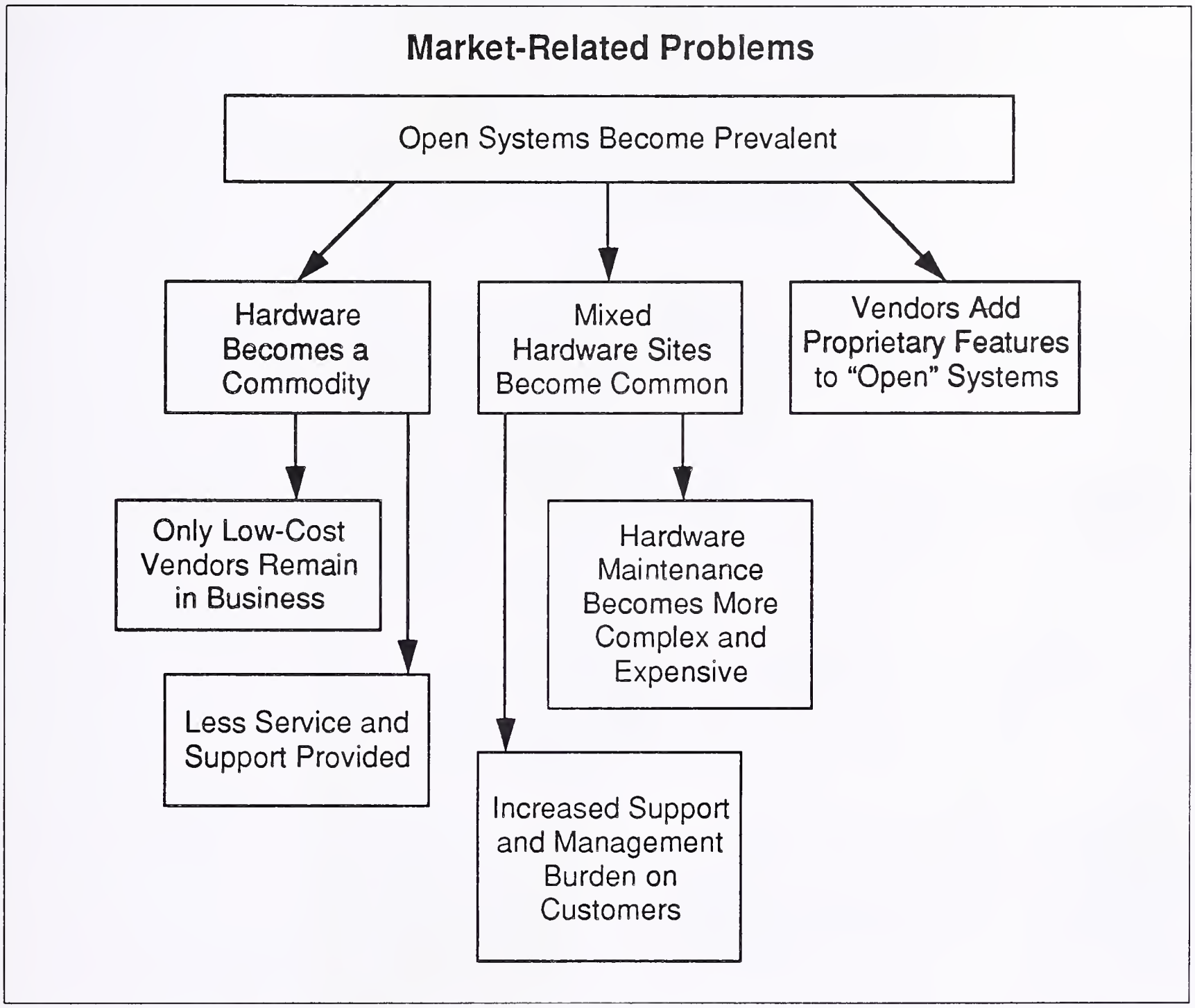


2. Market-Related Barriers

The previous section examined barriers that are primarily technical in nature. This section examines barriers that are more market-related. The issue here is the kind of impact that open systems might have on vendors and, subsequently, on users.

Exhibit V-18 illustrates some of the events that could occur if open systems succeed.

EXHIBIT V-18



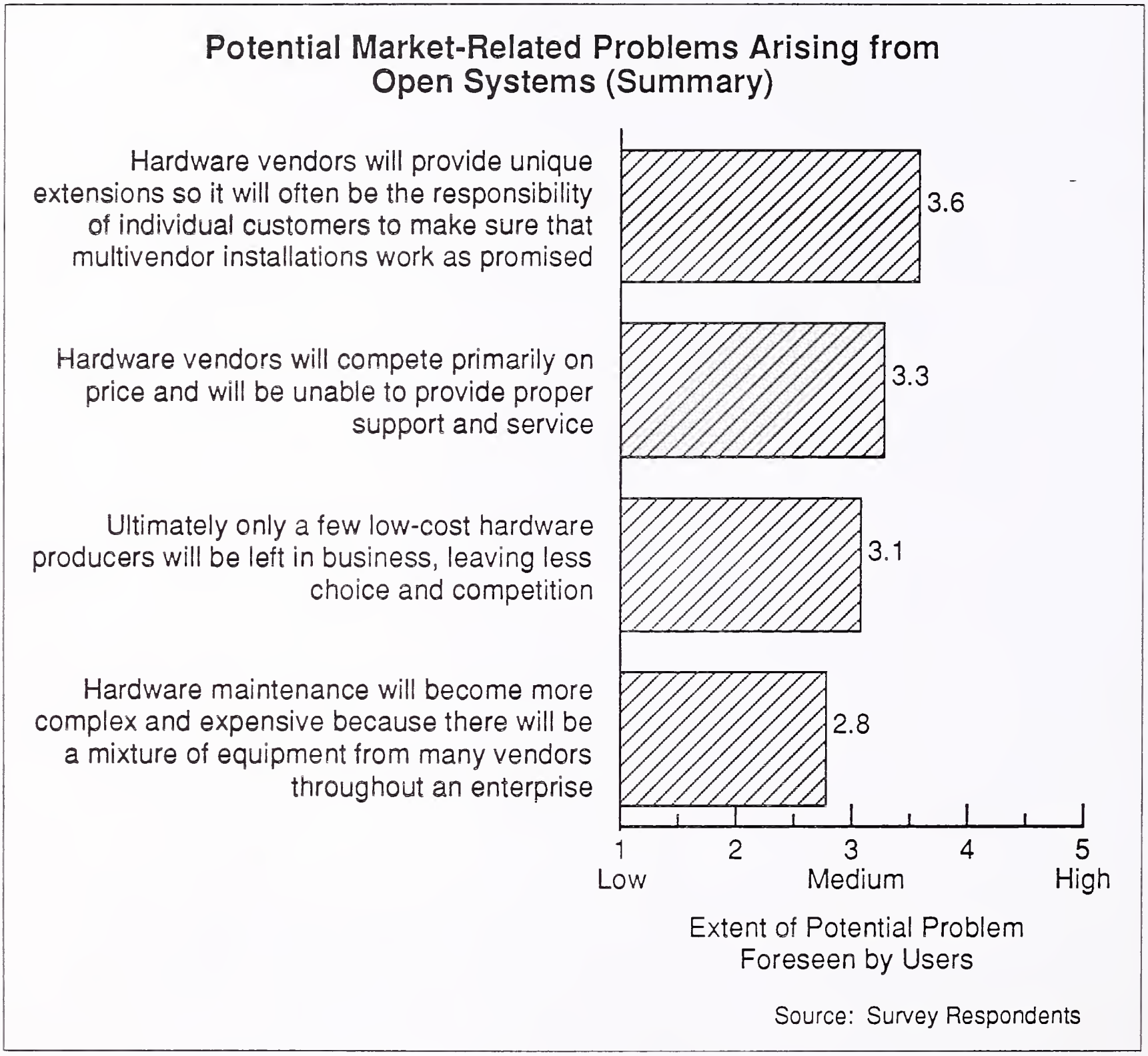
- Not all of these events will take place. For example, to the extent that vendors are successful in adding value by adding proprietary features, it is less likely that hardware will become a commodity. (The technical implications of this were shown in Exhibit V-9 in the preceding section.)

- It is also quite possible that if hardware were to become more commodity-like that at least some systems vendors would seek to add value by providing (and separately charging for) additional support and services.

- Similarly, some customer service vendors are already specializing in providing hardware maintenance services in mixed-vendor environments. Open systems could accelerate this trend.

How do users evaluate these kinds of possibilities? Exhibit V-19 summarizes the results of user interviews on this subject. On the whole, users are not overly concerned about these issues.

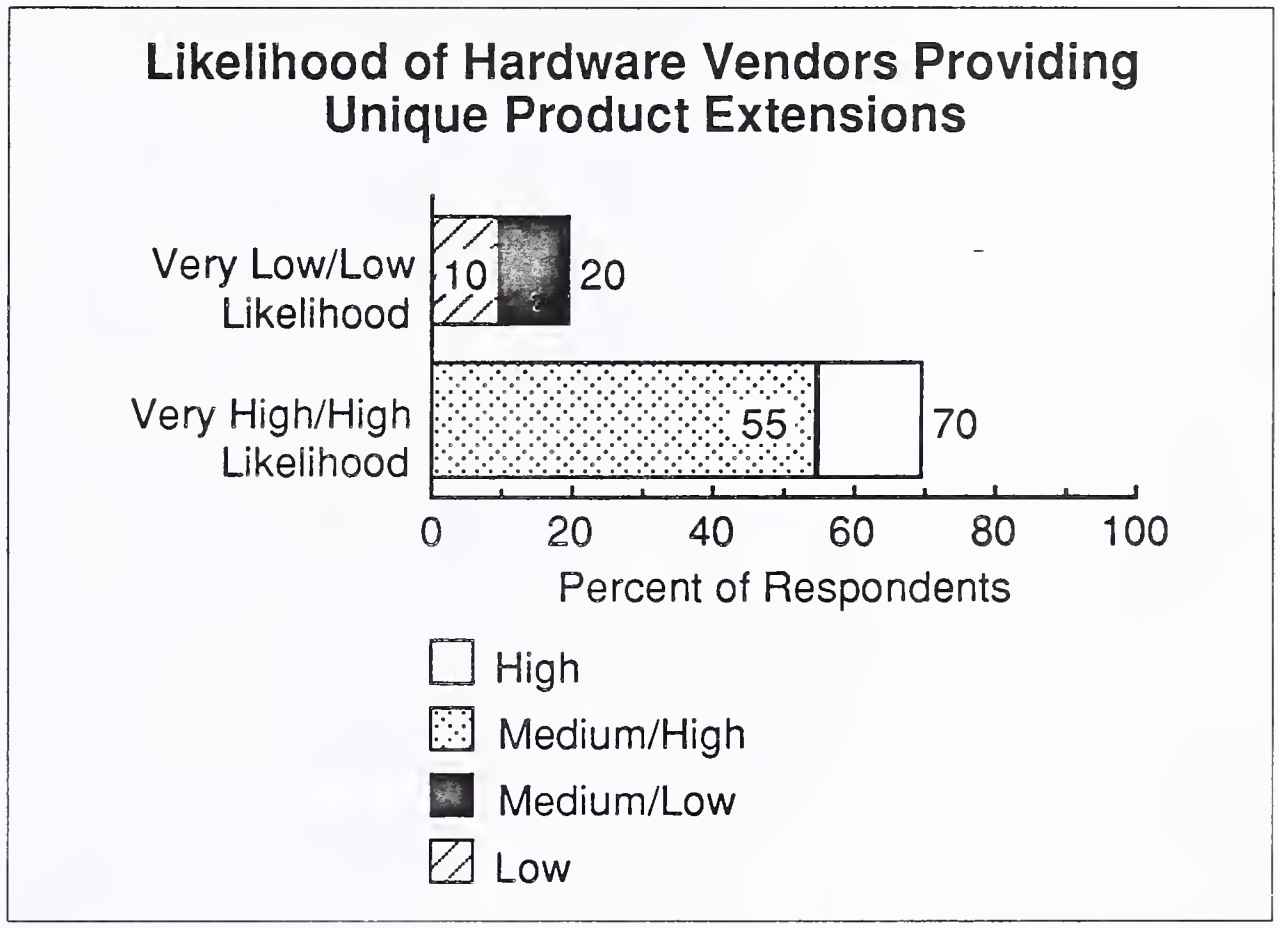
EXHIBIT V-19



However, disaggregating the answers to specific questions indicates that there are areas of user concern already. These may very well grow as the implications of widespread open systems are realized.

Likelihood of Hardware Vendors Providing Unique Product Extensions: Exhibit V-20 omits the neutral respondents and shows only those who see a higher or lower likelihood of vendors providing product extensions. Already, a large majority of respondents see this as highly likely. In a sense, users are preparing themselves for "pseudo-open systems."

EXHIBIT V-20



Likelihood of Price Competition Reducing Service: Fewer than half of respondents see this as a high likelihood (Exhibit V-21). This relative lack of concern follows from the previous finding, where users expect vendors to add unique product extensions and reduces the likelihood of open systems hardware becoming a commodity..

Likelihood of Only Low-Cost Hardware Producers Remaining: Only about one-third of respondents expect this to occur (Exhibit V-22). This also follows from the expectation of vendors being able to add unique product extensions.

Likelihood of Maintenance Becoming Complex or Expensive: This is hardly seen as a problem at all (Exhibit V-23). In this case, INPUT believes that the respondents are not fully informed on maintenance issues, since most of them are involved in applications development or planning and are not involved in nitty-gritty support issues. INPUT believes that this will, in fact, become a significant issue to the extent that open systems become a reality.

EXHIBIT V-21

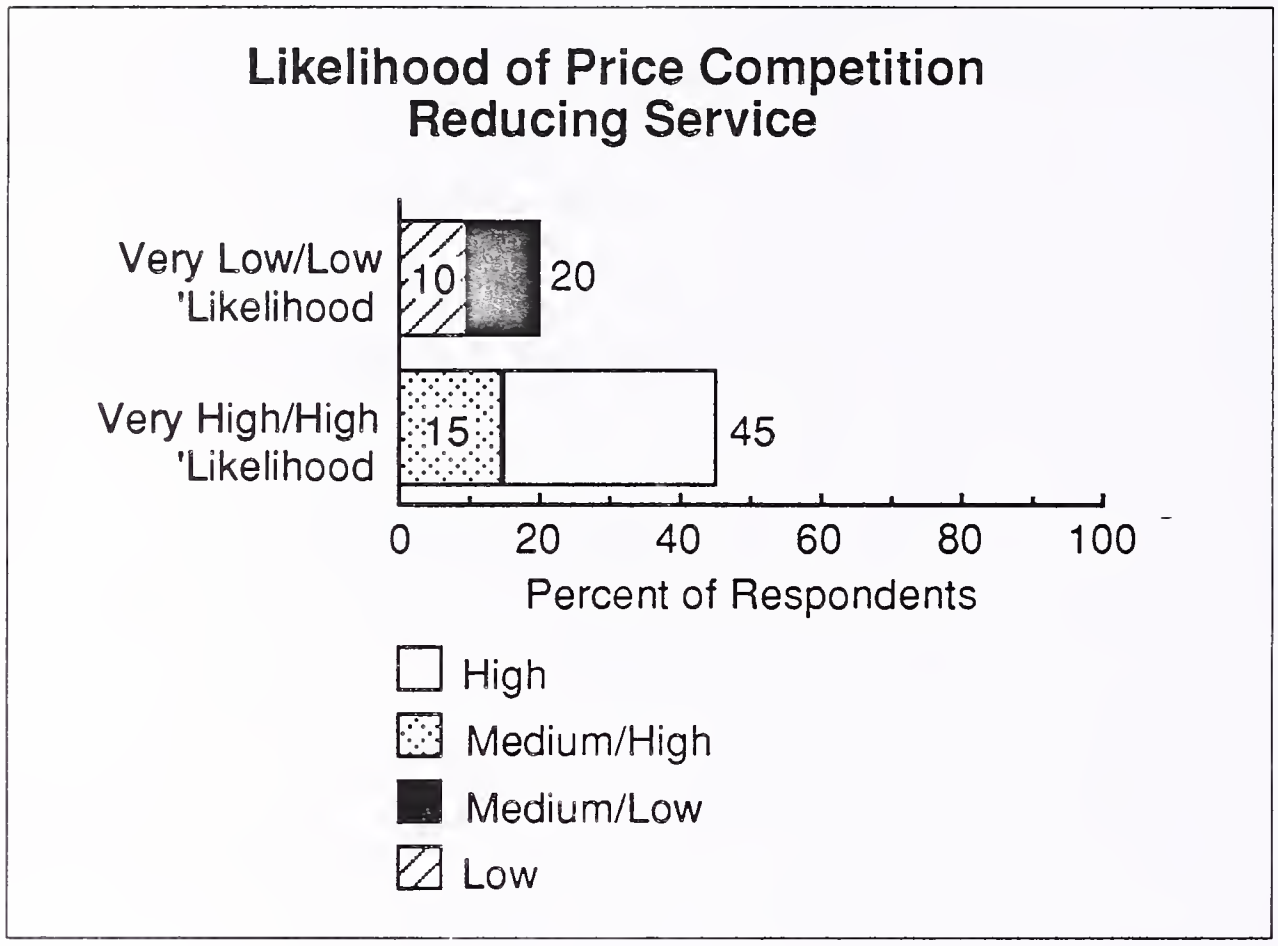


EXHIBIT V-22

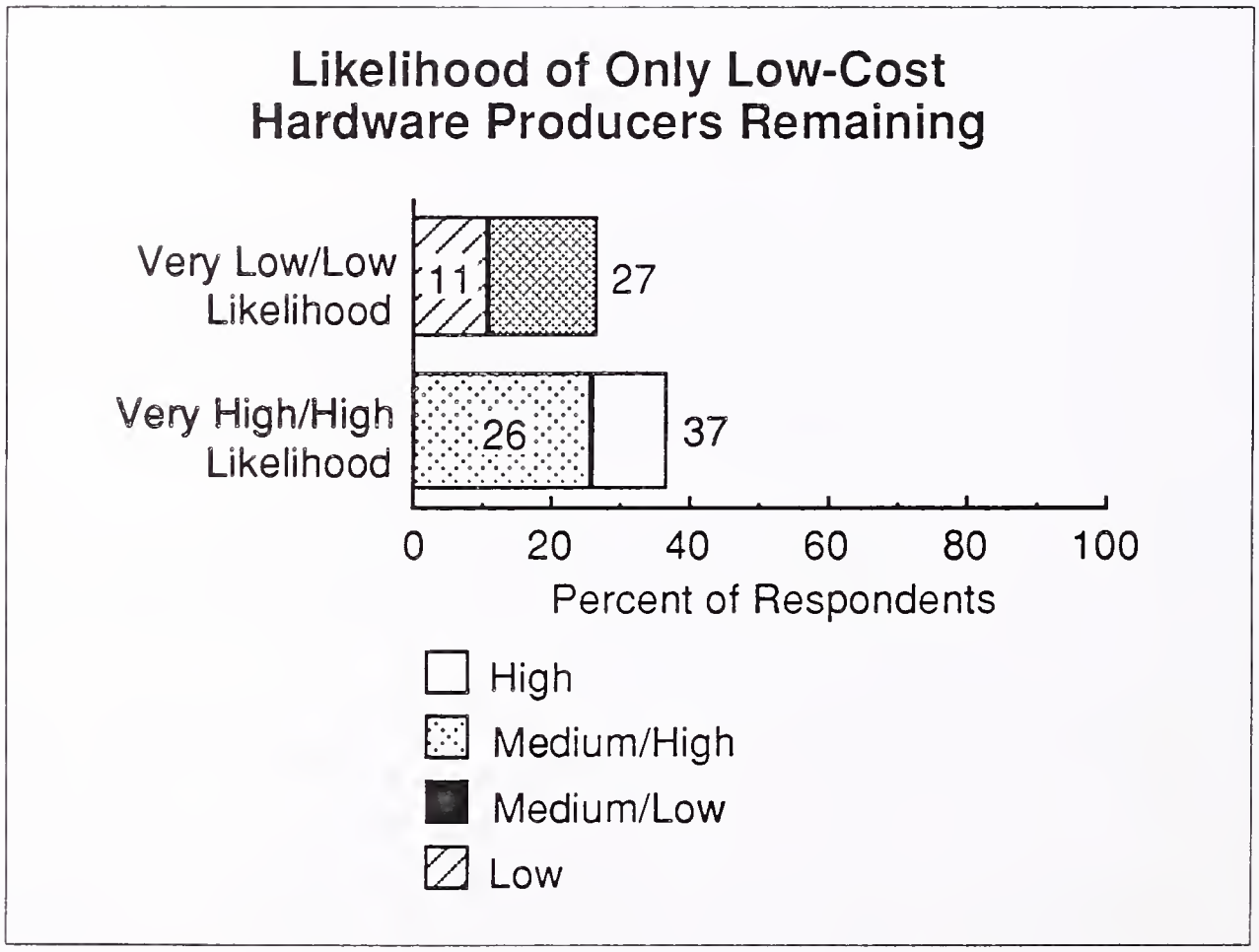
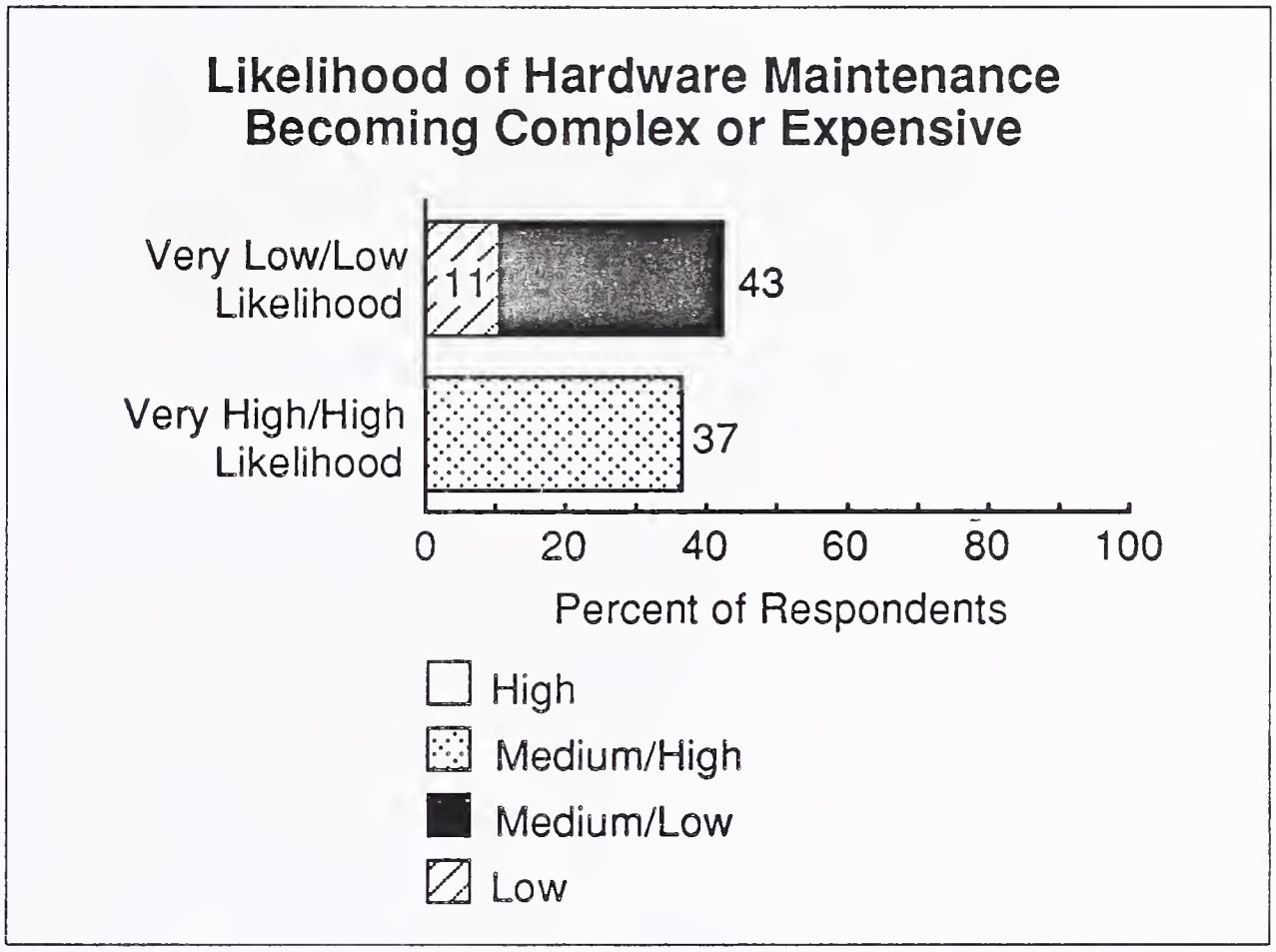
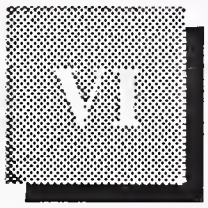


EXHIBIT V-23



Vendor and Product Positioning



Vendor and Product Positioning

The previous two chapters examined open systems largely from the user perspective. This chapter looks at open systems from the standpoint of computer systems vendors, since of all vendors they have the most to gain or lose from open systems.

This chapter contains three sections:

- An examination of the current status of proprietary systems environments
- An analysis of leading vendors
- UNIX and competing environments

A
Proprietary Operating Systems Environments

In order to properly compare open systems environments, it is useful to examine the major attributes of proprietary operating systems environments. From the vendor standpoint, these environments have the following attributes:

Discourage Migration to Competing Platforms: This is the most important reason for vendors to support their own environment. Put another way, software protects hardware.

Maintain a Robust and Feature-Rich Environment: This applies to the operating system itself as well as the supporting suites of operations control, data management and applications development software. This is another method of using software to not only protect hardware, but to sell more hardware, since all of this surrounding software consumes and creates more demand for hardware resources.

Generate Revenues: From one standpoint, operating systems and their associated environments have been very successful revenue producers since the unbundling of systems software by hardware manufacturers. Manufacturers have been selling to a largely captive market. However, over time, customers have come to view operating systems expenses as just one component of the cost of computer ownership (Exhibit VI-1). Therefore, it is difficult to say what, if any, incremental revenue operating systems actually bring to systems manufacturers.

EXHIBIT VI-1

Operating Systems: One Component in the Cost-of-Ownership Equation

Cost of system ownership =
- Initial hardware cost +
- Financing +
- Operating system license/maintenance +
- Systems software license/support +
- Customer service

Attract Third-Party Developers: Even IBM has found that it can not create all of the supporting software necessary to fill user needs. This is not just a resource issue for hardware companies, but also a talent and market issue: the third-party software companies have a better track record of attracting technical staff and, equally important, producing products that the market needs. This is a virtually unsolvable chicken-and-egg problem for the second-tier hardware companies: they do not have the critical mass of users to attract third-party developers, but without the third-party products, they cannot recruit new customers.

Support Cost-Effective Ongoing Development: Operating environments must always be moving forward to maintain their effectiveness. However, this can be very expensive. For example, at its peak, IBM is said to have had 5,000 programmers doing nothing but maintaining MVS. Increased operating system revenues may produce the illusion that this kind of development expense produces a profit; in reality, as discussed under Generate Revenue above, it is quite difficult to match development costs against revenue.

These points are summarized in Exhibit VI-2.

EXHIBIT VI-2

Proprietary Operating Environment Attributes

Attributes	Importance
Discourages Migration	High
Robust and Feature Rich	High
Generates Revenue	Medium
Attracts Third-Party Software Developers	
• Operations Management	Medium
• Applications Development	Medium/High
• Applications	High
Ongoing Development	
• Attractive Improvements	Medium/High
• Low Cost to Vendor	High

B
Vendor Environments

This section will look at the positions of IBM, DEC and NCR, and the overall positions of other traditional vendors.

1. IBM

IBM has historically supported multiple operating environments with little or no connection between them, e.g., MVS, VM, AS/400, MS-DOS, and now, RS/6000.

SAA, announced as a blueprint in the mid-1980s, was a precursor of open systems in the sense that the underlying environments would be hidden from the user via common interfaces. However, in spite of the considerable resources spent on it, SAA has had relatively little impact:

- Development has proceeded at a relatively slow pace.

- The direct value to customers will be small until most of SAA is in place.

- SAA is still an essentially hierarchically focused concept in spite of features such as LU6.2 that provide peer-to-peer communications between dissimilar platforms.

- SAA's largest problem is that it has often given the impression of having been conceived to solve IBM problems rather than customer problems.

An example of the internal focus of SAA has been the curious relationship between SAA and the RS/6000 and its operating environment AIX (a UNIX derivative). The RS/6000 and AIX are still not fully under the SAA umbrella in spite of the RS/6000 having had a very impressive reception, and a much better than expected reception outside of the traditional UNIX environment.

However, in common with other UNIX platforms it appears that the appeal of the RS/6000 lies more in the attractive price/performance of the underlying hardware rather than in the AIX operating environment.

AD/Cycle typifies IBM's current approach to openness:

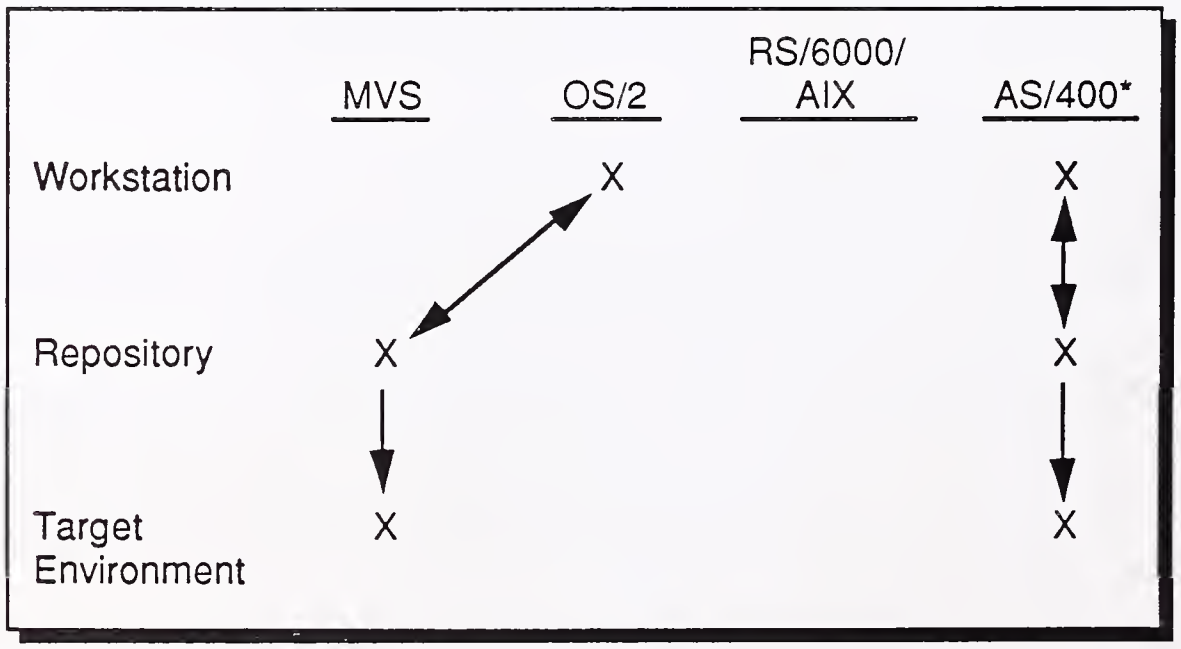
- A late child of SAA, AD/Cycle is now given as one of the chief rationales for SAA.

- However, there is not yet a strategy for linking the RS/6000 and AIX into AD/Cycle (or SAA).

Exhibit VI-3 shows the current relationships between AD/Cycle and the different IBM platforms at this early stage of AD/Cycle's development.

EXHIBIT VI-3

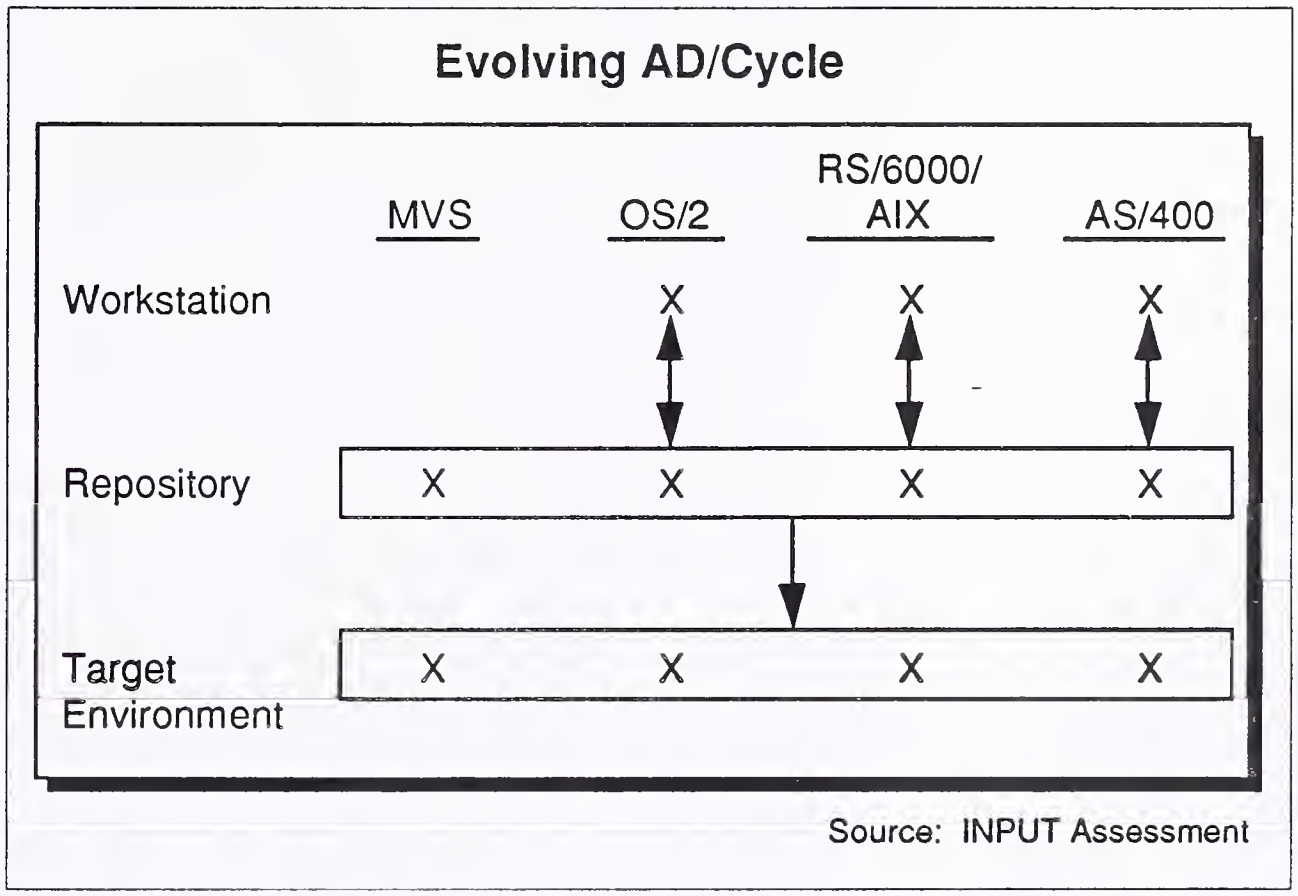
Current AD/Cycle: Compartments and Linkages



*Synon Product

INPUT believes that AD/Cycle will evolve into a much broader, more open architecture over the next several years (Exhibit VI-4).

EXHIBIT VI-4



- All major downsized platforms would then become AD/Cycle workstations.

- The applications logic in the repository could then be used to generate optimized code for the appropriate target platform. Obviously, IBM would strongly prefer that the target platforms be ones that IBM controlled.

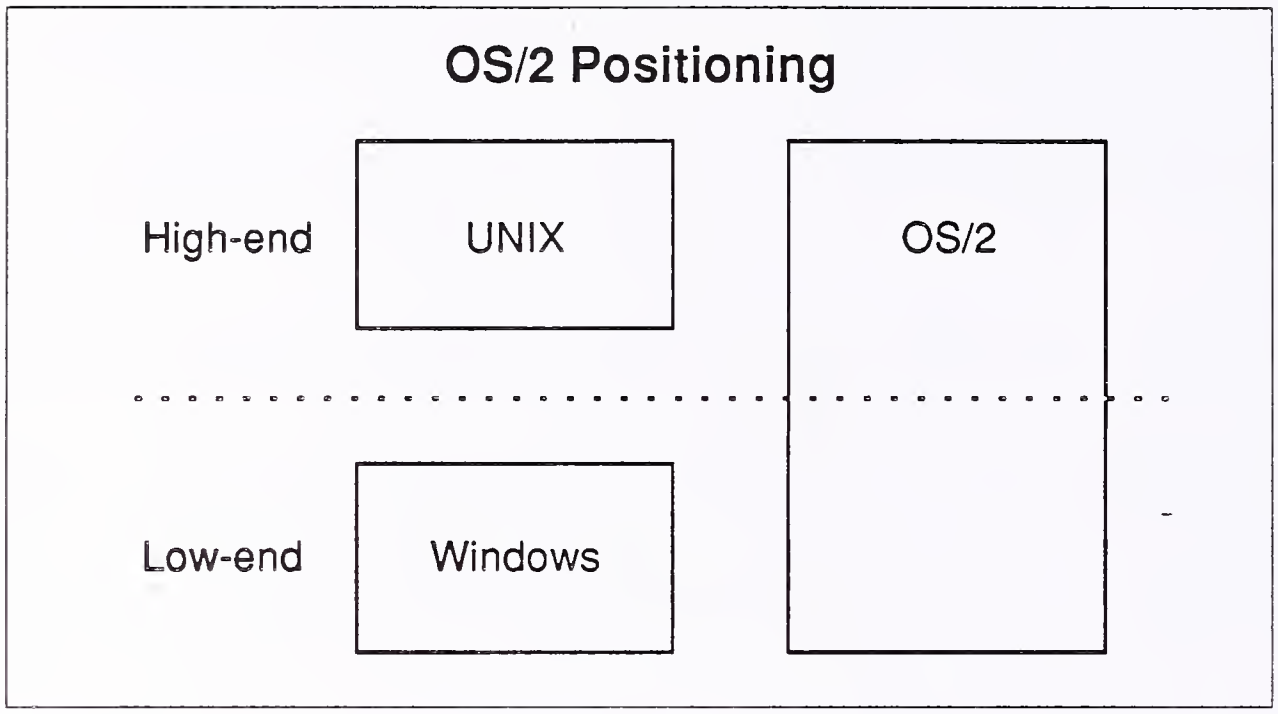
This scenario places equal burden on AD/Cycle development, which has been slow, and OS/2, which has had performance shortfalls and a tepid reception in the market. This is especially true when comparing OS/2's market performance against that of Windows, which has over five million copies in use.

However, OS/2 appears to be a dark horse that is gaining ground:

- Release 2.0 is light years ahead of the earlier versions of OS/2, based on reports from late beta sites. OS/2 now appears far more capable than the current version of Windows.

- However, much depends on OS/2's ultimate positioning. Is it to be merely a very capable desktop environment? Or is it to be positioned against UNIX at the client/server high end? This is shown graphically in Exhibit VI-5.

EXHIBIT VI-5



- For example, the AD/Cycle repository is now MVS-based. Having a much more robust and capable OS/2 would mean that the repository could meet market needs and be located on servers (see Exhibit VI-4).

2. DEC

Unlike IBM, DEC has in VMS a single, extensible operating environment, with excellent midrange price/performance and a wide range of software. DEC is somewhat weak on high-end processing and large-scale data management; however, the current generation of open systems would not provide much assistance in addressing this problem.

DEC's open systems strategy has up to now been to give support to POSIX, the UNIX-based interfacing standards.

- This strategy provides for interim VMS/UNIX coexistence, while keeping DEC competitive for federal and other open systems contracts.

- This also keeps VMS as the primary operating system to defend the installed base. Unlike other vendors' customers, there is little sign that DEC customers want to migrate to other platforms in the short or medium terms.

In the longer term, DEC's next generation of RISC processors would provide native UNIX support, while providing VMS coexistence. DEC would almost certainly add proprietary value to its UNIX environment.

3. NCR

NCR has gone furthest in adding value to a UNIX environment and may be the model for other vendors' open systems efforts. The new 3000 series is a scalable family, with UNIX as the common denominator (Exhibit VI-6). In that sense it is a completely open platform.

EXHIBIT VI-6

NCR 3000 Family

Characteristics	Model (C)					
	3200	3300	3400	3500	3600	3700 (D)
Type	Desktop Desktop	Large Coupled	Tightly Coupled	Tightly Coupled	Loosely Parallel	Massively
Processors	1	1	1-4	2-8	Up to 100	Up to 4096
MIPS (max)	7.5	40	160	320	4,000	60,000+
Trans/sec (max)	n/a	n/a	n/a	114	7,500	7,500+
Storage (max)	120MB[A]	680MB[A]	3.3GB[A]	86GB	180GB	1,000GB+
Op. Sys						
UNIX	X	X	X	X	X	X
OS/2	X	X	X	X		
DOS	X	X	X			
DBMS	Note B	Note B	Note B	Note B	Note B+ Scalable	Note B+ Scalable+ Teradata

Notes: (A) Internal Storage Only
(B) DBMS support: Sybase, Oracle, Informix, Ingres
(C) Does not include the 3100 portable running UNIX, OS/2, DOS
(D) Not yet available

Source: INPUT

On the other hand, NCR has added operating system and applications enabling enhancements that effectively remove much of its openness (Exhibit VI-7). It is reasonable to say that any large, complex application that is written to take full advantage of NCR's processor architecture and promised price/performance will be tied as tightly to the NCR 3000 as an MVS-based application would be to IBM mainframes.

EXHIBIT VI-7

Emerging Environment: NCR

Component	Standard Components	NCR Value Added
Chip sets/processor	• Intel microprocessors	• Software architecture • Application-specific integrated circuits (ASIC)
Operating system	• UNIX • OSI • MS/DOS • OS/2	• Processor coupling • Transaction processing "extensions" • Improved communication and file handling
Applications enabling	• Third-party DBMSs • KnowledgeWare • Communications management	• DBMS enhancements • "Cooperation" • C++ applications development process
Business	• UNIX-targeted • Third-party DBMS-targeted	• Document management • Retail and financial industry expertise

Source: INPUT

The 3000 series does not yet have a track record, so it will be some time until the issue of openness (and performance) is fully resolved. But it appears that if the new series is a success, it will not primarily be because of its openness.

4. Other Mainframe and Minicomputer Environments

The other traditional computer manufacturers are in a much more difficult position than are IBM and DEC:

- Their operating environments have not stemmed outward migration.
- They have not had the resources to maintain their environments at the same rate as the competition.
- There is little third-party software development around their platforms.

Their position is summarized in Exhibit VI-8. It is easy to understand their enthusiasm for UNIX and open systems, having little to offer from their proprietary environments (Exhibit VI-9).

EXHIBIT VI-8

Status of Major Proprietary Operating Environments

Proprietary Operating Environment Attributes	IBM	DEC	Other*
Discourages Migration	Yes	Yes	No
Generates Revenue	Yes	Yes	Marginal
Robust and Feature Rich	MVS: Too Complex Others: Yes	Yes	Marginal
Attracts Third-Party Software Developers			
• Operations Management	Yes	Some	No
• Applications Development	Yes	Some	No
• Applications	Yes	Yes	No
Ongoing Development			
• Attractive Improvements	Often No	Yes	Marginal
• Low Cost to Vendor	No	OK	No

*Representative of Unisys, Bull, HP, Data General, Prime, etc.

Source: INPUT Assessment

EXHIBIT VI-9

Proprietary Operating Environments versus UNIX

Operating Environment Attributes	IBM	DEC	Other*	UNIX
Discourages Migration	Yes	Yes	No	No
Generates Revenue	Yes	Yes	Marginal	Marginal
Robust and Feature Rich	MVS: Too Complex Others: Yes	Yes	Marginal	Marginal, Improving
Attracts Third-Party Software Developers				
• Operations Management	Yes	Some	No	Some
• Applications Development	Yes	Some	No	Yes
• Applications	Yes	Yes	No	Yes
Ongoing Development				
• Attractive Improvements	Often No	Yes	Marginal	Yes
• Low Cost to Vendor	No	OK	No	Yes

*Representative of Unisys, Bull, HP, Data General, Prime, etc.

Source: INPUT Assessment

C
UNIX versus the Competition

UNIX has a considerabe amount of competition—not the least of which, as will be seen below, is with itself. For the purposes of analysis, UNIX alternatives will be taken to be MVS, VMS, OS/2 (and, implicitly, MS-DOS and Windows).

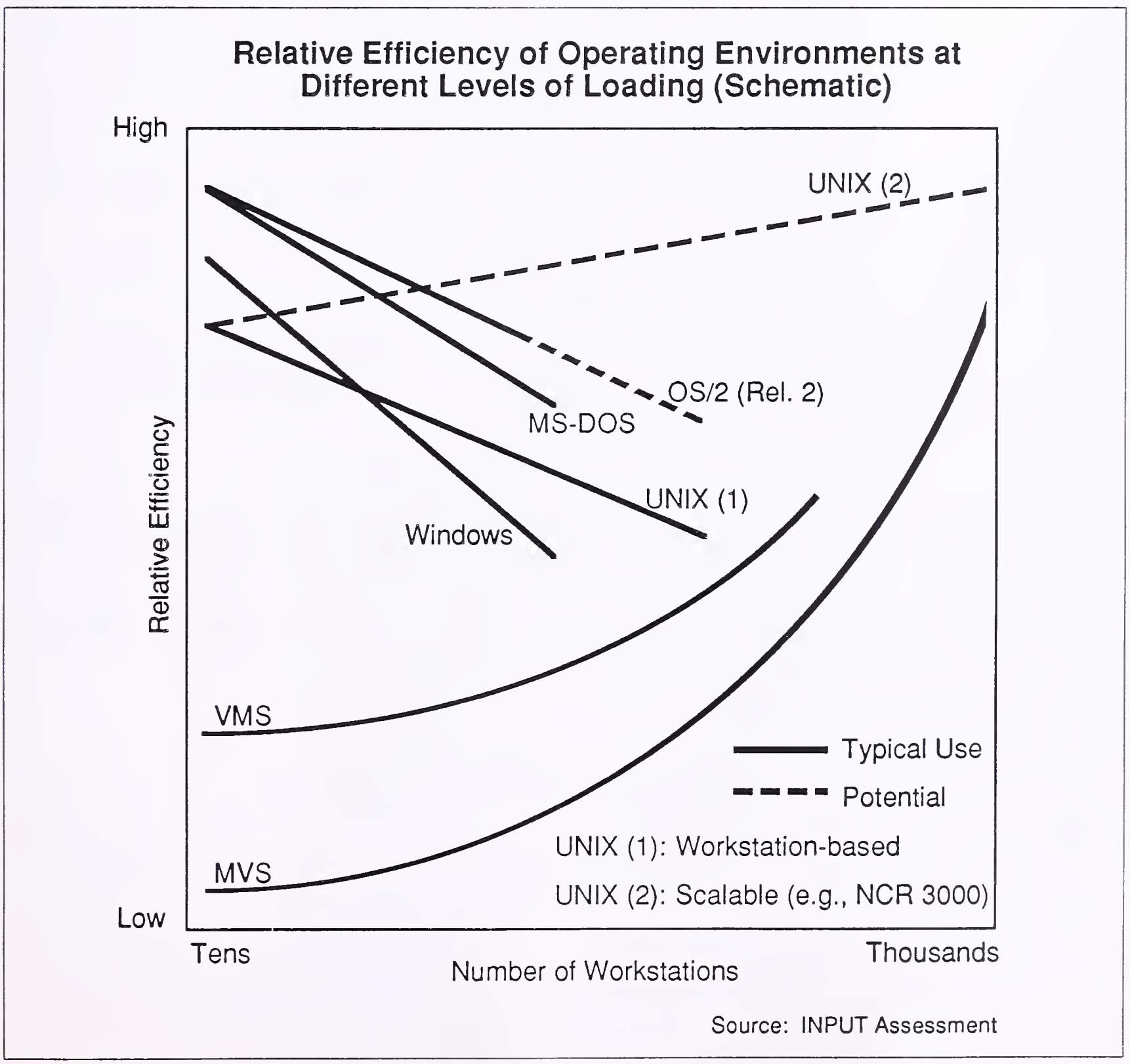
There are a number of bases for comparison that could be used. INPUT has selected several that are important to large-scale users of computing:

- The relative efficiency of an operating environment as workloads increase
- Power versus reliability

These comparisons are extremely difficult to do on an apples-to-apples basis, so INPUT has elected to show relative relationships on a schematic basis.

Exhibit VI-10 plots relative efficiency against increasing workloads (expressed in the number of workstations).

EXHIBIT VI-10



- MVS is still without real competition for very high-volume tasks (although each year its curve gets pushed further to the right by more cost-effective platforms).

- VMS is superior to MVS, but is also being squeezed more and more by newer, UNIX-based platforms ["UNIX (1)"].

- There are two UNIX curves:

  - The "traditional" workstation-based platform—UNIX (1)

  - "Scalable" UNIX, as with NCR [the "UNIX (2) curve"], that is not yet tested in the marketplace, but has considerable theoretical appeal

- OS/2 (Release 2) appears to have an advantage over UNIX (2) and certainly has the advantage over MS-DOS and Windows. OS/2 would appear to be at a disadvantage over scalable UNIX, unless OS/2 itself could be turned into a scalable operating environment.

A very important but sometimes underrated issue for large-scale computing is reliability. Exhibit VI-11 plots reliability against power.

- Here the traditional environments do quite well, as might be expected (Tandem is inserted for comparison).

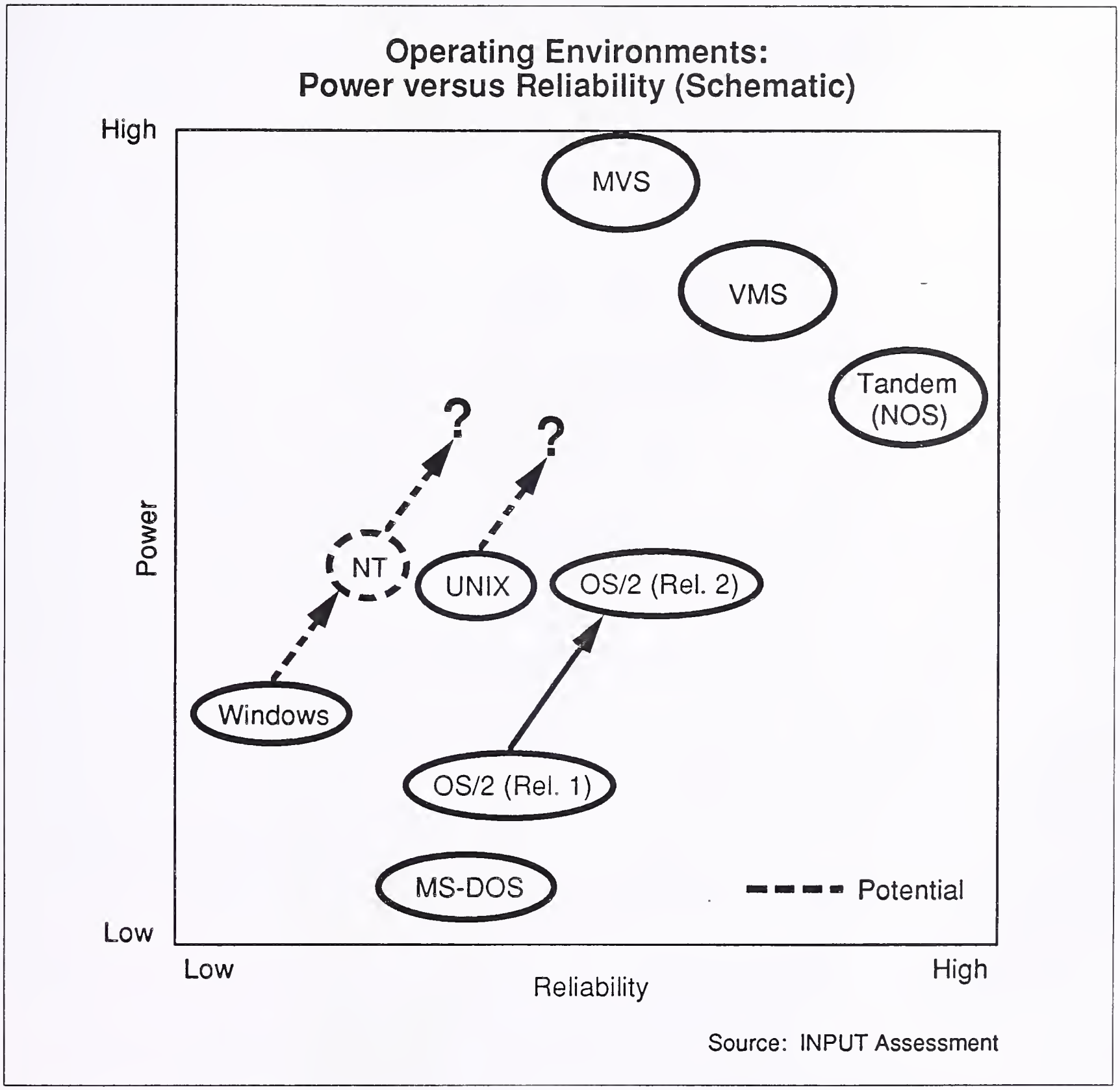
- However, the newer environments have already improved both their power and reliability and hold out every promise of gaining on the traditional operating environments.

  - The progress of OS/2 has already been commented on.

  - Microsoft's 32-bit NT operating system will undoubtedly help it catch up, but when and how much are impossible to say at present.

  - UNIX will also continue to improve. However, it is not clear that consortiums and committees are the best forum for making the kind of leapfrog progress that will be necessary.

EXHIBIT VI-11



The interesting thing about the preceding exhibits is how well OS/2 compares to UNIX. It would be useful to look at UNIX and OS/2 from IBM's perspective and give both of these operating environments a "report card" like that in Exhibit VI-12.

EXHIBIT VI-12

OS/2 versus UNIX from IBM Perspective

Attributes of Proprietary Operating Environment	UNIX	OS/2
Discourages Migration	C	B
Generates Revenue	C-	B-
Robust and Feature Rich	B	A
Attracts Third-Party Software Developers		
• Operations Management	B	C
• Applications Development	B/C	A
• Applications	B	A
Ongoing Development		
• Attractive Improvements	B/C	A
• Low Cost to Vendor	A	B

Source: INPUT Assessment

- OS/2 could provide a migration path away from IBM platforms, but not to the same extent as could UNIX.
- Neither OS/2 nor UNIX will be able to generate significant amounts of revenue.
- OS/2 already looks like a very robust environment and, equally important, will be able to attract third-party developers by means of its Windows and MS-DOS connections.
- IBM should be able to make attractive improvements to OS/2 at an acceptable cost.

A similar report card from the standpoint of an IBM customer would show the two environments closer, but with OS/2 in a slight lead (Exhibit VI-13).

EXHIBIT VI-13

OS/2 versus UNIX from Customer Perspective

Attributes of Proprietary Operating Environment	UNIX	OS/2
Ties to MVS, etc.	C	A
Cost	B	B
Robust and Feature Rich	B+	A
Attracts Third-Party Software Developers		
• Operations Management	B	B
• Applications Development	A	A
• Applications	B	A
Ongoing Development		
• Attractive Improvements	B-	A

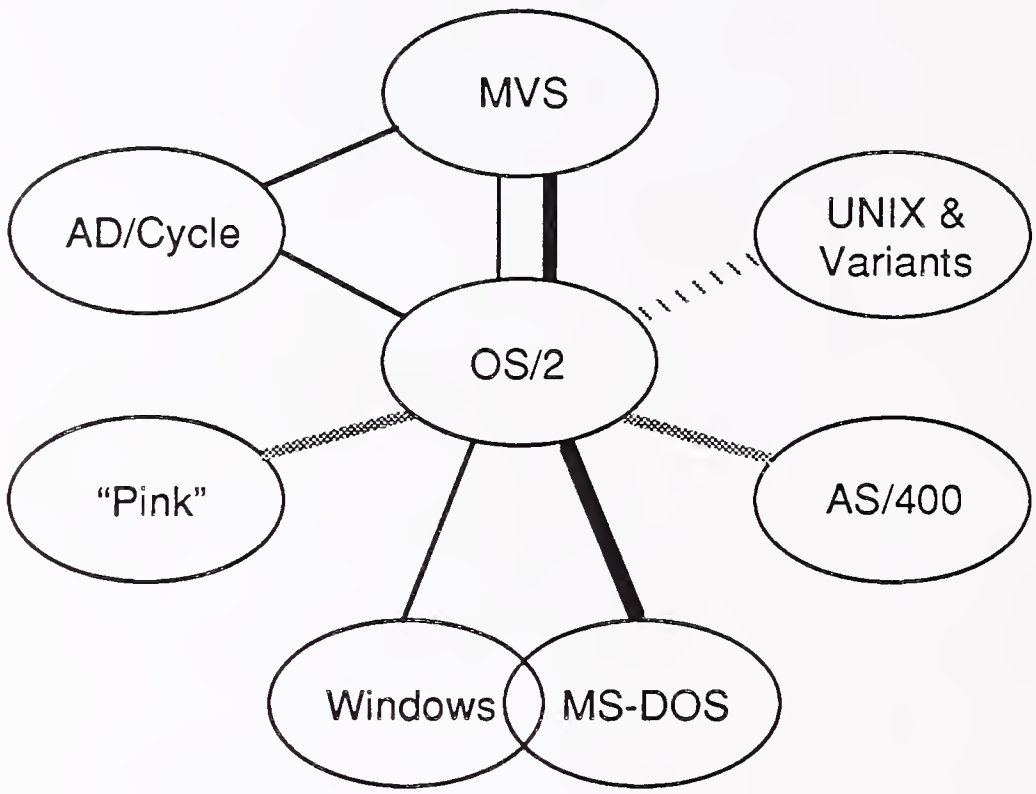
Source: INPUT Assessment

- IBM would obviously try to tie OS/2 to MVS, extending both IBM's and its customers' investments.
- IBM could also move somewhat faster than UNIX standards groups in making product changes.

Again, looking at OS/2 from IBM's viewpoint, OS/2 could become the center for its principal operating environments (Exhibit VI-14).

EXHIBIT VI-14

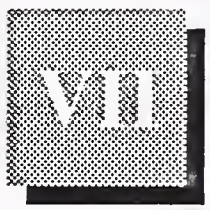
OS/2: The Emerging Center?



Key:	Existing	Potential
Client/Server	▬▬▬	▪ ▪ ▪ ▪ ▪ ▪
Other Linkages	———	▒▒▒▒▒▒

Source: INPUT Analysis

Conclusions and Recommendations



Conclusions and Recommendations

A Conclusions

Users have many needs that must be met by operating environments, including:

- Hardware platform price/performance
- Second sourcing of hardware
- High-performance support environment (e.g., OLTP, large-scale DBMS)
- A reliable and secure functional environment
- Compatibility with other major operating environments
- Availability of third-party software

There are inescapable trade-offs between these criteria. For example, the "non-standard" UNIX will be rated very highly in second sourcing, but not nearly as highly in providing high-performance support (that would perform better if optimized for a particular environment).

OS/2, on the other hand, would have en edge in third-party software and compatibility with major software environments.

Exhibit VII-1 shows these relationships in a "report card" format (with MVS as a comparison): there is no unambiguous winner yet in providing an open system. However, UNIX turns out *not* to be a one-word definition for open systems.

EXHIBIT VII-1

Key User Needs Met by Selected Operating Environments

Key User Needs	Operating Environments			
	Standard UNIX	Enhanced UNIX*	OS/2	MVS
Hardware Platform Price/Performance	B	A	B(?)	C
Second Sourcing: Hardware	A	C	B	C
High Performance Support Operating Environment	C	A	?	B
Reliable and Secure Operating Environment	C (Future = B?)	B+	B	B+
Compatibility with Other Operating Environments	B (Other UNIX)	C (Other UNIX)	A- (MS-DOS, Windows, MVS)	C (Guests)
Availability of Third-Party Software	B-	C	A	A

*Value added by a vendor

Source: INPUT Assessment

In any event, true open systems may be a long time in coming and, when they do, users may find that they prefer less open, but more powerful, environments.

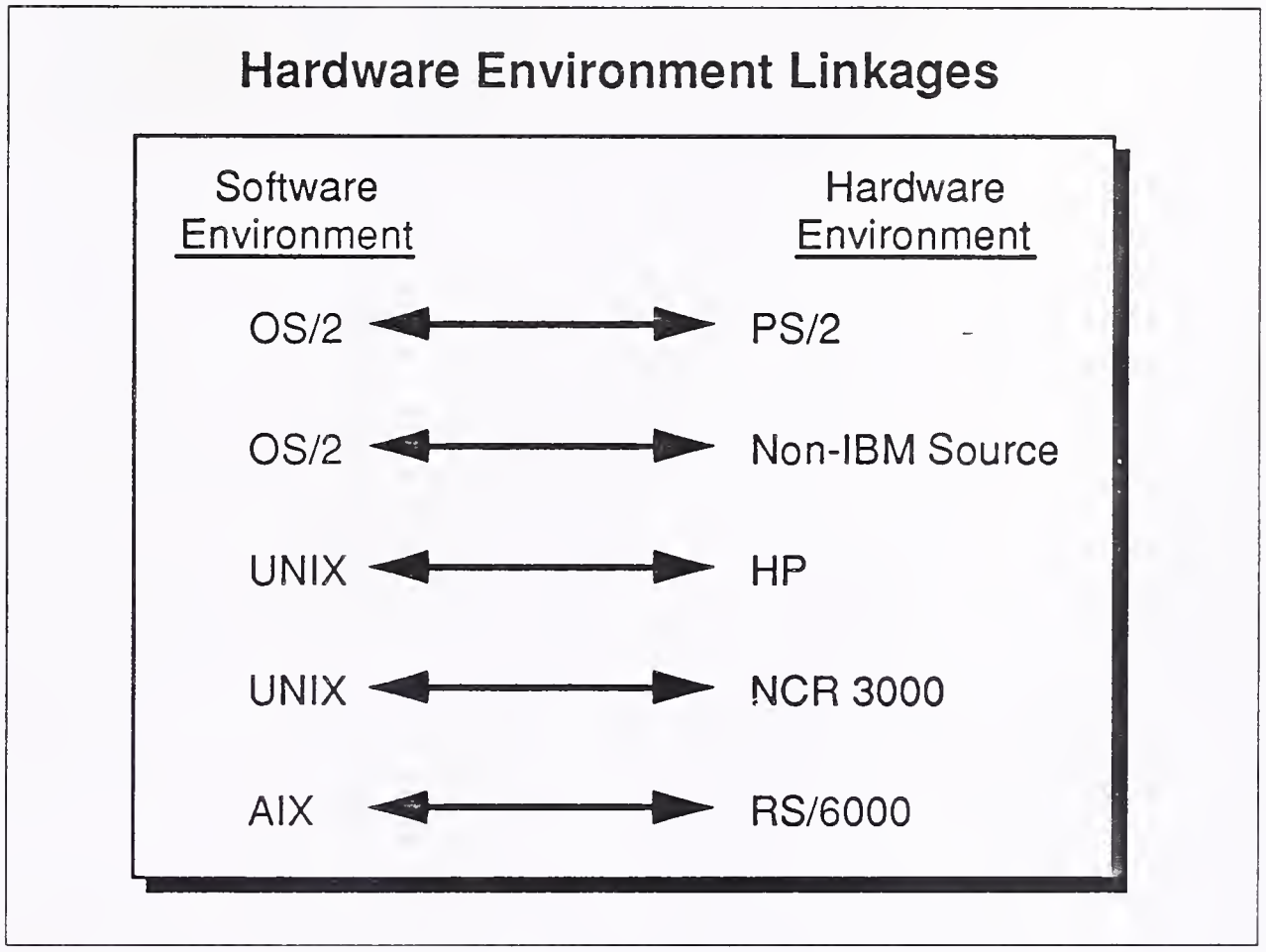
B
Recommendations

1. User Recommendations

Users should distinguish between the advantages of a software platform and the underlying hardware platform. Many of the assumed advantages of UNIX, for example, turn out to be due more to the underlying hardware platform.

Consequently, newer generations of operating environments should be assessed on their own as well as being analyzed as part of a hardware environment, as shown in the examples in Exhibit VII-2.

EXHIBIT VII-2



Second sourcing for any environment may be critical:

- Optimized hardware/software environments will often not really be open.
- Hardware vendor alliances may address this issue.
- CASE and DBMS platforms can also lock customers in.

The underlying requirements/technology framework may be ready to change especially quickly, e.g.:

- Client/server networks
- CASE
- Image processing

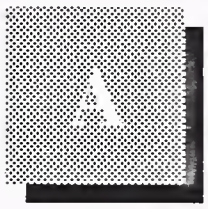
2. Vendor Recommendations

A large number of customers may not want (or need) true open systems. This means that vendors must find the right balance between open systems and value-added systems.

Fewer and fewer vendors will be able to go it alone in adding value to open systems. NCR, for example, added considerable value by selecting allies to add to its basic UNIX framework.

Vendors should not count out OS/2, in spite of its years of bad press. For many purposes, OS/2 may prove to be a better partner than UNIX, although both have obvious risks.

Appendix



Questionnaire: Opens Systems Issues and Directions

Introduction

INPUT is studying the issues involved in "open systems" as part of our syndicated research. Some of these issues have been discussed using terms such as "portability" and "interoperability." We are trying to understand how organizations like your own are dealing with these issues and which areas are most important to you.

I have several questions I would like to discuss with you. Hopefully, you will find them thought-provoking. When we are finished with our analysis, we will send you a summary of the results which may help you in your own planning efforts.

None of the respondents (either persons or enterprises) will be identified in our report.

1a. There are a number of possible definitions of "open systems." I'm going to read you several of them and I would like you to tell me whether you strongly agree (5), agree (4), feel neutral (3), disagree (2), strongly disagree (1) or don't know or aren't sure (0) with the statement as defining an open system. Please feel free to comment on your rating [Note: you may be in agreement with more than one statement]

"Open Systems" means

- Products based on vendor-independent standards _____
- An interface whose specifications are publicly available _____
- UNIX _____
- A processor architecture that is available from competing manufacturers (e.g., PC clones) _____
- An operating system/operating environment that has support from multiple vendors, even if controlled by a single vendor (e.g., MS-DOS) _____

- An operating system (e.g., MVS) that allows a wide choice of applications software _____
- Applications development tools (CASE) that allow a single specification to automatically generate code for multiple hardware/software platforms _____
- An operating system that allows "guest" operating systems and their applications to run on it _____
- A vendor-independent operating system _____

- If 1 or 2: Why?

- If 4 or 5: Why?

1b. Are there any other definitions that you believe should be considered?

Yes_____ No_____

If Yes, describe_____

1c. Next, I would like to explore the extent to which having competing standards with different implementations (as in UNIX) removes the potential benefits of open systems. Tell me which statement below you agree with most and why. Competing standards

- Remove all/most/some/a few benefits [circle]
- Have no effect on benefits _____
- Add to benefits by increasing competition _____
- Other (describe) _____

2a. (Answer Question 2 on attached answer sheet) I would like you to think about some of the factors associated with an operating system and tell me how important each of the following is on a scale of 1 to 5 (with 5 being high):

- Cost _____
- Power _____
- Reliability _____
- Availability of related system software, (e.g., DBMS) _____
- Availability of cross-industry applications software _____

- Availability of vertical applications software. [Fill in first line in the sheet provided]

Question 2: Operating Systems Answer Sheet

Factor	Cost	Power	Rel	Sys S/W	X-Ind S/W	Vert S/W	Other	Know
Importance	____	____	____	____	____	____	____	____
1991								
UNIX	____	____	____	____	____	____	____	____
MS-DOS with Windows	____	____	____	____	____	____	____	____
OS/2	____	____	____	____	____	____	____	____
MVS	____	____	____	____	____	____	____	____
1996								
UNIX	____	____	____	____	____	____	____	____
MS-DOS with Windows	____	____	____	____	____	____	____	____
OS/2	____	____	____	____	____	____	____	____
MVS	____	____	____	____	____	____	____	____

1=Low; 5=High

Have I left any factor off the list that you believe is important? [If so, add under "other"]

2b. Next, I would like you to rate the following operating environments for each factor (again, on a scale of 1 to 5, with 5 being high): UNIX, Windows under MS-DOS, OS/2 and MVS. [Put ratings in "1991" graph]

2c. For each operating system please also rate your familiarity with it (1=low knowledge, 5=high knowledge) [Fill in "Know" column]

2d. In your opinion, will any of these operating environments change enough so that they will have different ratings in 5 years?

Yes_____ No_____ if Yes:

- Which one(s)? What's the new rating?
- Why?

(Fill in "1996" group on answer page)

3a. I would like to understand how important each of the following benefits of portability and interoperability are to your organization. Please rate each on a scale of 1 to 5, with 5 being the most important, and give your reasons as well.

- Ability to run an application on multiple hardware platforms _____
- Ability to switch hardware vendors easily _____
- Vendor competition lowers hardware prices _____
- Ability to run an application on multiple operating systems _____
- Other (describe)_____

3b. There may be some negative aspects to open systems as well. Tell me how much your company perceives these issues as potential problems (on a 1 to 5 scale, with 5 being high importance). Please comment on your answers as well.

- Hardware vendors will compete primarily on price and will be unable to provide proper support and service _____
- Ultimately only a few low-cost hardware producers will be left in business, leaving less choice and competition _____
- Hardware maintenance will become more complex and expensive because there will be a mixture of equipment from many vendors throughout an enterprise _____
- Hardware vendors will provide unique extensions so it will often be the responsibility of individual customers to make sure that multivendor installations work as promised _____
- Other (describe)_____

3c. On balance, would you say that the benefits of open systems will outweigh the problems? Yes____ No____

If Yes, why?:

If No: could you quantify this relationship in terms of a ratio of benefits to problems (2 to 1, 3 to 1, etc)?

4. Are there other operating environments which you see as providing equivalent benefits as UNIX? Yes____ No____

If Yes: Which one(s)? Why?

If No: Why?

5a. What are the trade-offs in having a vendor-independent operating environment such as UNIX and a vendor-controlled environment such as OS/2?

UNIX

- **Positive** (prompts: wider choice of vendors)

- **Negative** (prompts: potentially narrower choice of functions)

OS/2

- **Positive** (prompts: vendor supply or support of applications software packages)

- **Negative** (prompts: vendor may charge more)

5b. On balance, do you see the positive or negative points as being most important for

- UNIX Pos____ Neg____
  Why?

- OS/2 Pos____ Neg____
  Why?

6. To what extent do you see multiplatform data bases (e.g. Oracle, Informix) as providing many of the same interoperability benefits as UNIX? (5= high benefits; 1=low benefits) _____

If 4 or 5, why:

7. A number of barriers have been cited to installing/using open-system applications. I'll read you several and I would like you to tell me how important a barrier you see each one as, on a scale of 1 - 5 (1 = not a barrier; 5 = a serious barrier). For issues you rate a 4 or a 5, please tell me how you think a particular problem will be resolved.

- Lack of application development tools _____
- Lack of other systems software _____
- Lack of off-the-shelf applications _____
- Lack of in-house skills _____
- Lack of external (consulting) skills _____
- Lack of standards _____
- Conflicting standards _____
- Non-standard implementations _____
- Inappropriateness of UNIX for certain applications _____

8a. What percent of your systems development effort is spent on applications running on the following operating systems?

What do you expect the percentages to be in five years: [Fill in 1996 column]

Operating System	1991	1996
MVS	____	____
MS-DOS	____	____
UNIX	____	____
OS/2	____	____
Other	____	____
• Mainframe-based	____	____
• Midrange-based	____	____
• Workstation-based	____	____
	100%	100%

8b. About what percent of development resources are spent for packaged applications versus custom development/enhancement (counting both in-house resources and outside contractors)?

Packaged_____% Custom_____%

Do these percents vary significantly by operating system? Yes____ No____

If yes, describe:

9. This concludes our formal questions. Do you have any other comments or are there other issues in this area you think should be addressed?

Thank you very much for your assistance. We will send you a summary of our findings in about six weeks.

Report Quality Evaluation

To our clients:
To ensure that the highest standards of report quality are maintained, INPUT would appreciate your assessment of this report. Please take a moment to provide your evaluation of the usefulness and quality of this study. When complete, simply fold, staple, and drop in the mail. Postage has been pre-paid by INPUT if mailed in the U.S.

Thank You.

1. Report title: ***Open Systems Opportunities*** (UIIS2)

2. Please indicate your reason for reading this report:
   - ☐ Required reading
   - ☐ Area of high interest
   - ☐ Area of general interest
   - ☐ New product development
   - ☐ Business/market planning
   - ☐ Product planning
   - ☐ Future purchase decision
   - ☐ Systems planning
   - ☐ Other _____

3. Please indicate extent report used and overall usefulness:

	Extent		Usefulness (1=Low, 5=High)				
	Read	Skimmed	1	2	3	4	5
Executive Overview	☐	☐	☐	☐	☐	☐	☐
Complete report	☐	☐	☐	☐	☐	☐	☐
Part of report (_____ %)	☐	☐	☐	☐	☐	☐	☐

4. How useful were:

	1	2	3	4	5
Data presented	☐	☐	☐	☐	☐
Analyses	☐	☐	☐	☐	☐
Recommendations	☐	☐	☐	☐	☐

5. How useful was the report in these areas:

	1	2	3	4	5
Alert you to new opportunities or approaches	☐	☐	☐	☐	☐
Cover new areas not covered elsewhere	☐	☐	☐	☐	☐
Confirm existing ideas	☐	☐	☐	☐	☐
Meet expectations	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

6. Which topics in the report were the most useful? Why? _____

_____

7. In what ways could the report have been improved? _____

_____

8. Other comments or suggestions: _____

_____

_____
Name Title

_____
Department

_____
Company

_____
Address

_____
City State ZIP

_____ _____
Telephone Date completed

Thank you for your time and cooperation.

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