USERS' PERCEPTIONS OF CRITICAL MAINTENANCE

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Headquarters
2471 East Bayshore Road
Suite 600
Palo Alto, California 94303
(415) 493-1600
Telex 171407

Center II
Central Expressway
exas 75206
1-8565

Detroit
340 N. Main Street
Suite 204
Plymouth, Michigan 48170
(313) 459-8730

k
Plaza West-I
rook, New Jersey 07662
8-9471

Washington, D.C.
1730 North Lynn Street
Suite 400
Arlington, Virginia 22209
(703) 522-2118

ATES

Australia
Centre, 7-9 Merriwa St.,
110,
N.S.W. 2072
-8199
Telex AA 24434

Telex 269776

JAPAN
INPUT Japan
Suite 1106
7-7-26 Nishi-Shinjuku
Tokyo
Japan 160
(03) 371-3082

Italy
PGP Sistema SRL
20127 Milano
Via Soperga 36
Italy
Milan 284-2850

INPUT Planning Services for Management

USERS' PERCEPTIONS OF CRITICAL MAINTENANCE

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USERS' PERCEPTIONS OF CRITICAL MAINTENANCE

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USERS' PERCEPTIONS OF CRITICAL MAINTENANCE

LIST OF EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- The purpose of this study is to examine in depth EDP equipment users' attitudes toward maintenance services and techniques, and their cost and value to them.

  - This study focuses on applications that are extremely critical to the companies interviewed.

  - This approach was taken to determine the various levels of maintenance service that users require, the value to the user, and the price the user is willing to pay for them.

  - The user's needs are evaluated by industry, application, equipment type, and equipment manufacturer.

  - The intent is for clients to utilize this data and analysis in refining their techniques for pricing and marketing field services.

- The research in this study is based upon on-site and telephone interviews with EDP managers in 44 companies.

  - Nine of the interviews were on-site, and 35 of them were by telephone.

  - Thirty-two of the managers were in charge of all data processing activities, and the remaining 12 had lower level responsibilities.

  - . Eight of them were operations managers.

  - . Two were assistant managers of data processing, one was a systems administrator, and one was in charge of EDP planning.

- All of the interviewees were in a position to make qualified assessments of their needs for maintenance services and their related cost, quality and value.

- The companies were selected according to the following criteria:

  - The companies were selected to represent a broad range in terms of mainframe manufacturers.

    - . The largest number of mainframes by a single manufacturer was IBM which represented 30% of the sample; this is approximately half of its proportion of all major EDP installations.

    - . Eight other mainframe manufacturers were included in the companies interviewed, none of which represented more than 16% of the total.

  - Companies were also selected which were suspected to be more sensitive to downtime because of critical applications in their type of business. Most of the companies were in manufacturing (discrete and process) or finance (banking, savings and loan, brokerage and insurance).

  - In general, larger companies were favored over smaller companies in the selection process because these control larger and more complex EDP installations.

    - . The average number of employees per company was 4,600.

  - The smallest company had 30 employees and the largest had 49,000.

- Profiles of the companies interviewed by mainframe installed, industry, and number of employees are shown in Exhibits A-1 through A-3 in Appendix A.

  - Some of the profiles are stratified into three groups determined by the level of criticality of the user's most important application.

  - A full explanation of this stratification into critical groups appears in the first section of the Executive Summary.

- The questionnaire may be found in Appendix B.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. MAJOR FINDINGS

1. CRITICALITY OF USER APPLICATIONS

- This study focuses on critical applications and their maintenance needs.
  - Critical applications are particularly sensitive to and dependent upon maintenance.
  - Users' requirements for maintenance services are determined by the demands of their most critical applications.
  - A large number of users have critical applications, and their number is increasing rapidly.
- Emphasis is placed on the users' perceptions of their maintenance services and the ability of those services to sustain the availability of equipment during critical applications.
- The users surveyed are categorized into three groups by the level of criticality of their most important EDP applications.

- Group I companies have at least one very critical application. These companies feel the impact of downtime on their organization immediately. The impact is felt through most of the organization. Costs are measured in thousands of dollars per hour. The companies' primary production processes are fully integrated with and dependent upon data processing. When data processing is interrupted, the production operation is seriously disrupted and sometimes literally comes to a standstill.

- Group II companies' most important application is somewhat critical. Downtime impacts the company in a day or two. Costs of downtime are measured in days. The production process is slowed or disrupted, but not halted. Production is only partly dependent upon data processing.

- Group III companies do not have a critical application. The production process does not depend on data processing. Production can continue for days or weeks without serious disruption from system downtime. Costs of downtime are difficult to assess because the system can be brought up before losses are incurred.

- Criticality of an application is a function of how thoroughly it is integrated into the production process of the company.

  - To a much lesser degree, it is a function of the type of application.

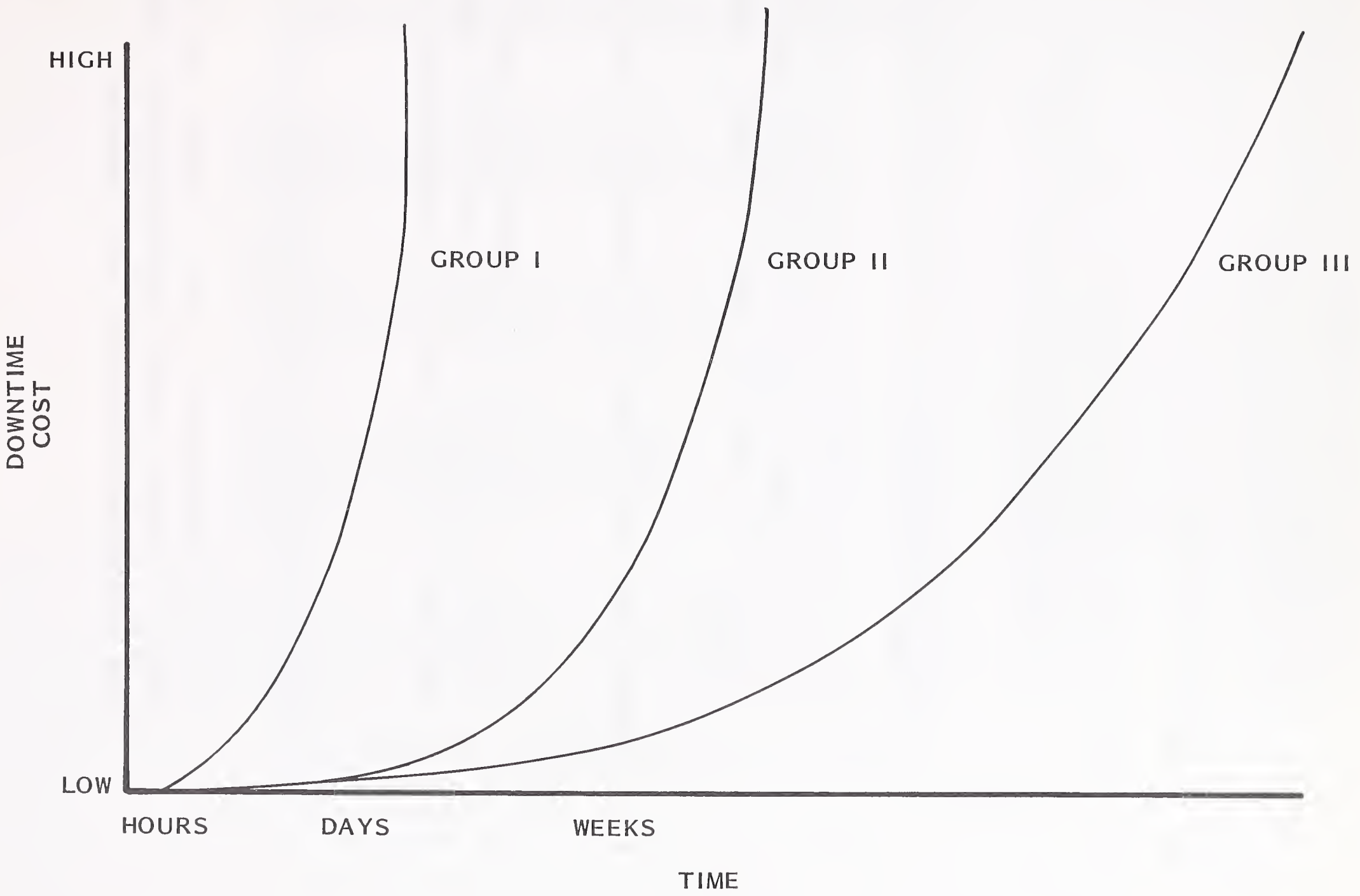
  - The three levels of criticality defined above could be and were found to apply to any one type of application, with the difference being how fully the application is integrated into the organization's operation.

- The differences in the cost of downtime to the three groups of companies are illustrated conceptually in Exhibit II-1.

  - In all three cases the cost is an exponential function of downtime.

EXHIBIT II-1

DOWNTIME COST AS A FUNCTION OF APPLICATION CRITICALITY*



*CONCEPTUAL EXHIBIT NOT BASED ON ACTUAL DATA

- In the Group I companies, 1,000 people might be impacted in the first hour of downtime. In the Group III companies, no one may even be aware of the downtime in the first hour.

2. MAINTENANCE COSTS

- The cost of maintenance may be evaluated in two ways.

  - Expenditure on maintenance is one measure.

  - Another is the cost of excessive downtime which may be attributed to inadequate maintenance.

  - Of course, the reliability of the equipment will also have a significant impact on downtime. In the following analysis, however, emphasis is placed on maintenance with equipment reliability assumed to be constant.

- The three groups of user companies differ significantly on the two measures of value.

  - The Group I companies (very critical applications) spend 43% more on maintenance as a percent of their data processing (EDP) budget than do the Group III (no critical applications) companies, as shown in Exhibit II-2.

  - The cost of downtime is 119% higher for the Group I companies than for the Group III companies, as shown in Exhibit II-3.

  - The cost of downtime for the Group II companies was slightly lower than for the Group III companies, because the Group II companies were less than one-third the size of the Group III companies.

EXHIBIT II-2

AVERAGE EXPENDITURES ON MAINTENANCE AS A PERCENT OF DATA PROCESSING BUDGET

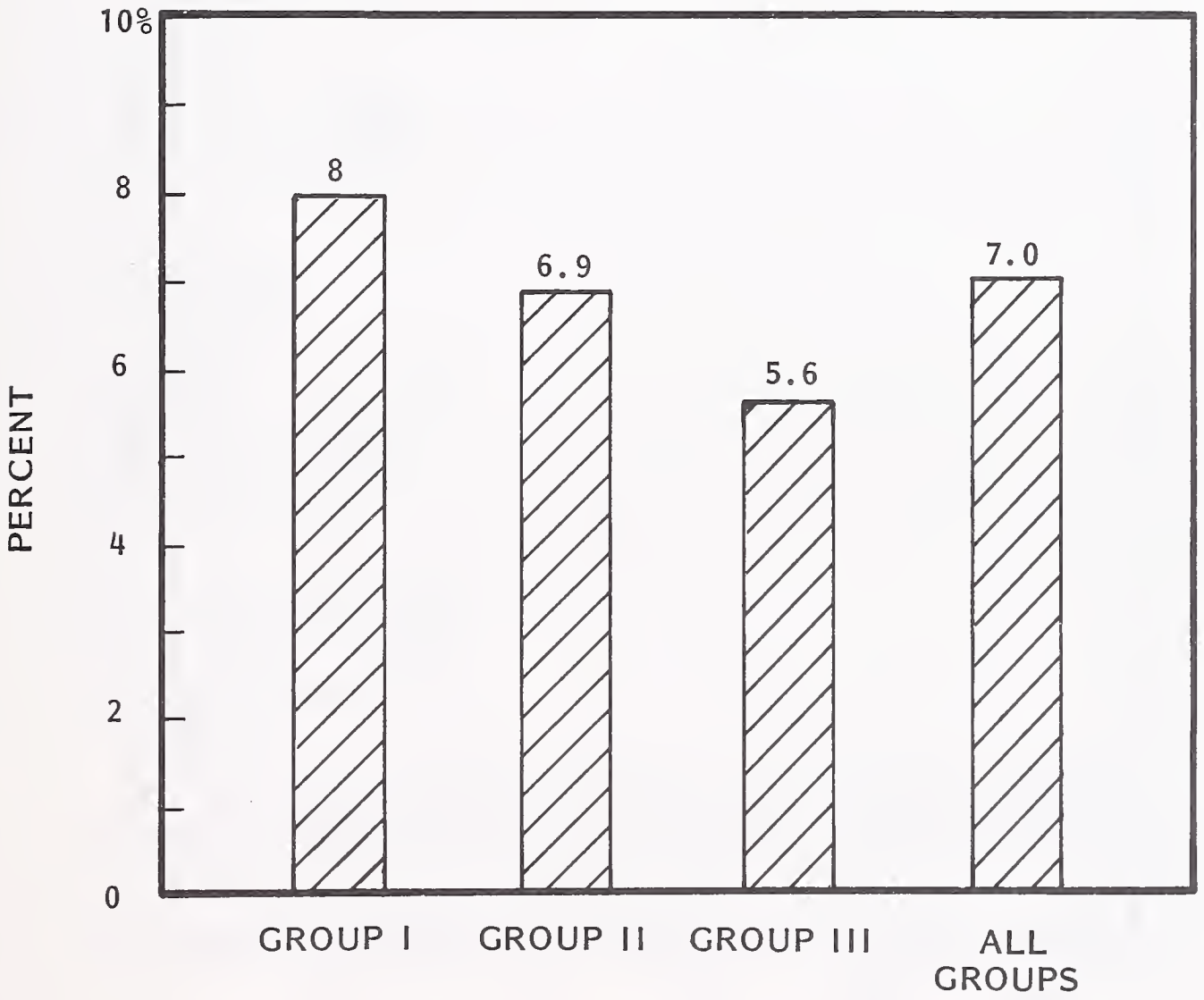
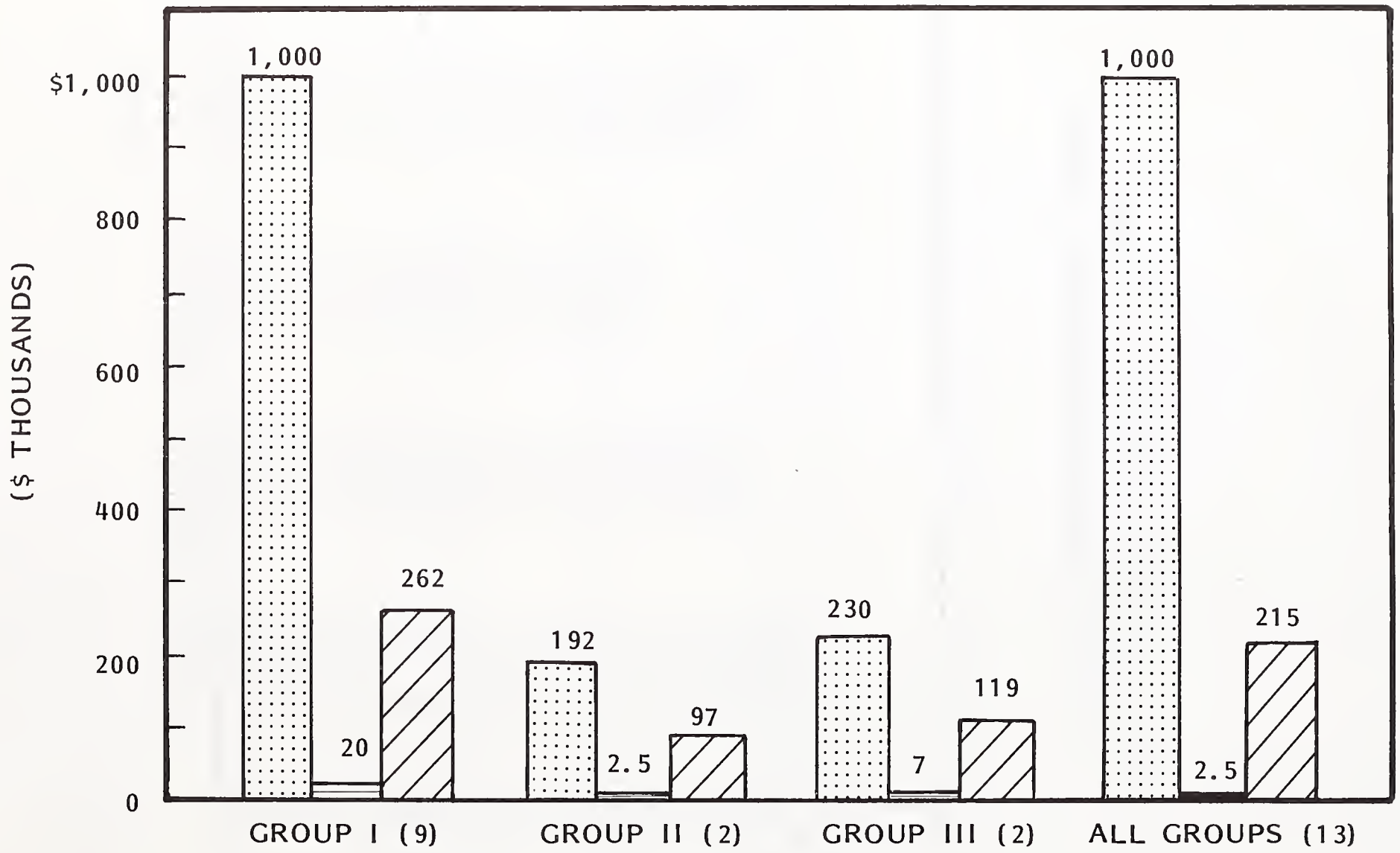


EXHIBIT II-3

MEAN DAILY PROFIT LOSS IF BOTH CRITICAL APPLICATIONS ARE DOWN



- The Group I and III companies were comparable in size. The cost of downtime to some degree is a function of company size.

- The cost to the Group I companies of critical applications being down is very apparent.

  - Sixty percent of them can quantify the lost profits in terms of dollars per hour or per day.

  - In some cases, the costs are staggering, as much as $1 million per day, as shown in Exhibit II-3.

- In virtually all cases, the Group I companies' downtime cost for a single day exceeds their annual maintenance cost by three times. Obviously, for these companies the value of uptime will tolerate a higher investment in maintenance.

- Although the managers with very critical applications feel that they are spending a great deal on field services, as much as 20% of their DP budget, they also feel that it is a small price to pay in comparison to the cost of downtime. Many said that they would pay more for field services if they could see a tangible return on their investment.

3. CRITICAL APPLICATIONS

- Forty-five percent of the companies surveyed have very critical applications. If their most important application goes down, operations of the company are seriously disrupted, if not halted altogether.

- The number of companies with a critical dependency on a key application is growing.

  - INPUT projects that virtually all companies will form such a dependency on their EDP operations by the end of the decade.

- Their need for higher performance levels in field services will increase correspondingly during the eighties.

- Critical dependence on EDP operations varies substantially by industry sector.
  - Seventy-five percent of the respondents in the discrete manufacturing sector are in Group I.
  - Only twenty-three percent of respondent process manufacturers are in the Group I category.
- Regardless of industry sectors, the most critical applications involve the control and management of assets.
  - These applications are frequently found to be on-line.
  - Applications are thoroughly integrated into the production process of the firm.
- The Group I companies differ from the others in equipment essential to their key applications. They are much more dependent on communications and special-purpose input devices.
- The second most critical application is quite different from the first.
  - It is less time dependent.
  - Printers become more important than communications equipment.
- Contract maintenance coverage is invariably determined by the demands of the most critical application in the firm. Group I companies contract for 39% more maintenance coverage in terms of shifts per week than do the Group III companies.

- It is clear that the amount of maintenance coverage that a company buys is directly related to the criticality of the application and not to the operating schedule of the application.

4. USER ATTITUDES

- Users with very critical applications are much less likely to tolerate low-quality field service than other users. Maintenance vendors who ignore this fact will lose business among these customers.

- Companies with very critical applications are twice as likely to replace equipment due to poor maintenance than other companies.

  - The most frequent reasons given for poor maintenance are incompetent personnel and lack of spare parts.

  - Peripheral equipment and terminals are the most frequently replaced types of equipment.

- The quality of maintenance a vendor provides is an important factor in the user's selection of new equipment.

  - Respondents forecast that it will be even more important in the future.

  - As the interface between end users and systems increases, so does the importance of the quality of maintenance in equipment selection.

- Users generally feel they are being charged fairly for field services.

  - Their feeling that they are paying excessive costs correlates with their level of satisfaction with field services.

  - Vendors of small business systems and minicomputers are rated as providing relatively poor service.

- A large proportion of users feel that their vendor's field engineers (FEs) need better training.

  - Associated with this problem is the high turnover rate or transfer rate of FEs. Users complain that as soon as an FE becomes competent at the job, the FE either leaves for a better opportunity or is promoted.

  - Another frequent observation is that FEs are not paid as much as they should be.

B. RECOMMENDATIONS

1. COMMUNICATIONS

- Each user is unique and his maintenance requirements are unique. Field service organizations must not only recognize this in principle, but also in each of their individual clients. Effective communications between vendor and user will assure that supply matches demand for critical maintenance services.

- One of the most cost-effective ways field services can improve the user's perception of the quality of its service is through improvements in communications between them.

  - Field services are frequently organized to address their own problems rather than the problems of the users.

  - Users differ greatly in their needs for field services, and it is only through improved communications with users that field service management will be able to address their needs.

- Field service should establish a user maintenance requirements audit procedure for equipment prior to its sale and on a regular basis after its installation.

- This audit should identify the field services required to satisfy the various applications of a user determined by their criticality.

- The services needed should then be tailored to the user's needs.

- A formal proposal, including cost, should be presented and agreed upon.

- Greater rapport with the user will be accomplished if more communications take place outside the usual crisis environment when the system is down. Increased satisfaction and mutual respect will also be enhanced.

2. TYPES OF SERVICES

- Differing levels of application criticality dictate different needs for maintenance.

- There is a broad range of criticality for user applications. In order to satisfy user needs for maintenance, the services offered must be equally broad.

- Effective packaging and marketing of field services will give vendors who understand their customer's requirements a competitive edge.

- Users with very critical applications are more willing than others to perform self-maintenance.

  - They want to increase the availability of their applications, not reduce the cost of maintenance.

  - Vendors should provide more self-maintenance options to users.

  - Users without critical applications are less interested in self-maintenance.

- In order to encourage self-maintenance, vendors should do the following:

- Provide improved documentation and manuals.

- Design equipment with self-maintenance as an objective.

- Make training available to users in maintenance techniques.

- Give the users several options which will make spare parts and kits more available to them.

- Provide several levels of diagnostics that the users may perform.

- More than anything else, users would like to see improvements in the field service personnel who service their equipment.

- Many users would be receptive to paying more for better qualified field engineers. Vendors should consider charging for field engineers according to their experience and qualifications and giving the users the option of choosing the level they need for their application.

  - Users without critical applications might be satisfied with a lower-priced service person just out of training.

  - Users with extremely critical applications would be willing to pay top price for the "star" service person.

  - Some vendors already tend to favor their larger critical accounts, but they haven't formalized it by incorporating it into their fee structure and giving the user a range of options.

  - This procedure has the further advantage of recognizing the value of the "star" service personnel.

- Field engineers should receive training about their client's industry and the applications that are most critical to it. They should learn how the EDP equipment supports the applications and how valuable it is to the client.

- Where the customer base is sufficiently large, vendors should establish industry-specialized groups within their FE organizations.

- Spare parts should have several levels of availability from which users can select according to their needs.

- Preventive maintenance is often viewed more as a problem than a cure. Users want it scheduled so as not to conflict with the operation of their critical applications; therefore, vendors should negotiate for PM schedules on non-critical shifts and adjust fees accordingly.

3. SERVICES AND PRICING

- Users with critical applications are willing to pay an average of 25% more for their maintenance contract for improved services.

  - Vendors have a lot of latitude in offering more services over a broader price range to these users.

  - Users with less critical applications are often receiving and paying for more services than they need.

- A guaranteed uptime contract is very attractive to users.

  - It gives them greater assurance of the commitment of field services.

  - It establishes the credibility of the vendor's design.

- Some users with very critical applications are already experiencing 99% uptime as guaranteed and aren't willing to pay more for what they already have.

- Users with lower uptime records are willing to pay the premium for this contract if they have an application which is somewhat critical.

- Redundant systems are very attractive to users.

  - They expect a 47% increase in reliability.

  - They are willing to pay 20% more for this type of equipment.

  - The benefit offered by this equipment is similar, but more concrete, than guaranteed uptime.

  - The success of this type of offering in the marketplace by Tandem Computers demonstrates that some users will pay much more for increased system availability.

4. SOFTWARE MAINTENANCE

- INPUT recommends that field engineers should be involved more in systems software maintenance. This involvement should be primarily limited to the diagnosing of problems rather than to fixing them. Cross training FEs to be totally competent in software has not been generally successful.

- Users who wanted their FEs to be more involved in maintaining systems software gave the following reasons:

  - The FE will be able to solve all problems more quickly.

  - It will eliminate "finger-pointing" between the FE and the software systems engineer.

- Hardware and software problems are closely related.

- The user would have one person - the FE - who would have total responsibility for problem recognition.

III MAINTENANCE COST

III MAINTENANCE COST

A. EDP EXPENDITURES

- A high proportion of EDP managers interviewed have little or no knowledge of their operating cost for critical applications, and many managers have trouble addressing any questions regarding cost of their operations.

- The managers generally do not consider cost except under two circumstances. Both involve decision processes.

  - The first is when equipment is being purchased.

  - The second is when annual budgets are established.

- Most of the time the EDP manager is only concerned with keeping his operation going.

- Consequently, surveys on cost, such as the one conducted for this study, provide more information on users' perceptions of cost rather than actual cost.

  - The information is not less valuable for this reason.

- The user's attitudes and decisions concerning field services and their cost are usually based on general perceptions and not on what is in the general ledger.

- An important finding is that a greater proportion of users with very critical applications have a better perception of their cost than do those with less critical applications.

  - Only 29% of the Group II and III respondents could identify cost for their most critical applications compared to 40% of the Group I respondents, as shown in Exhibit III-1.

  - To a lesser degree, the same applies to their second most critical application.

- The Group I companies expend nearly twice the funds for their critical applications as do the Group II and III companies.

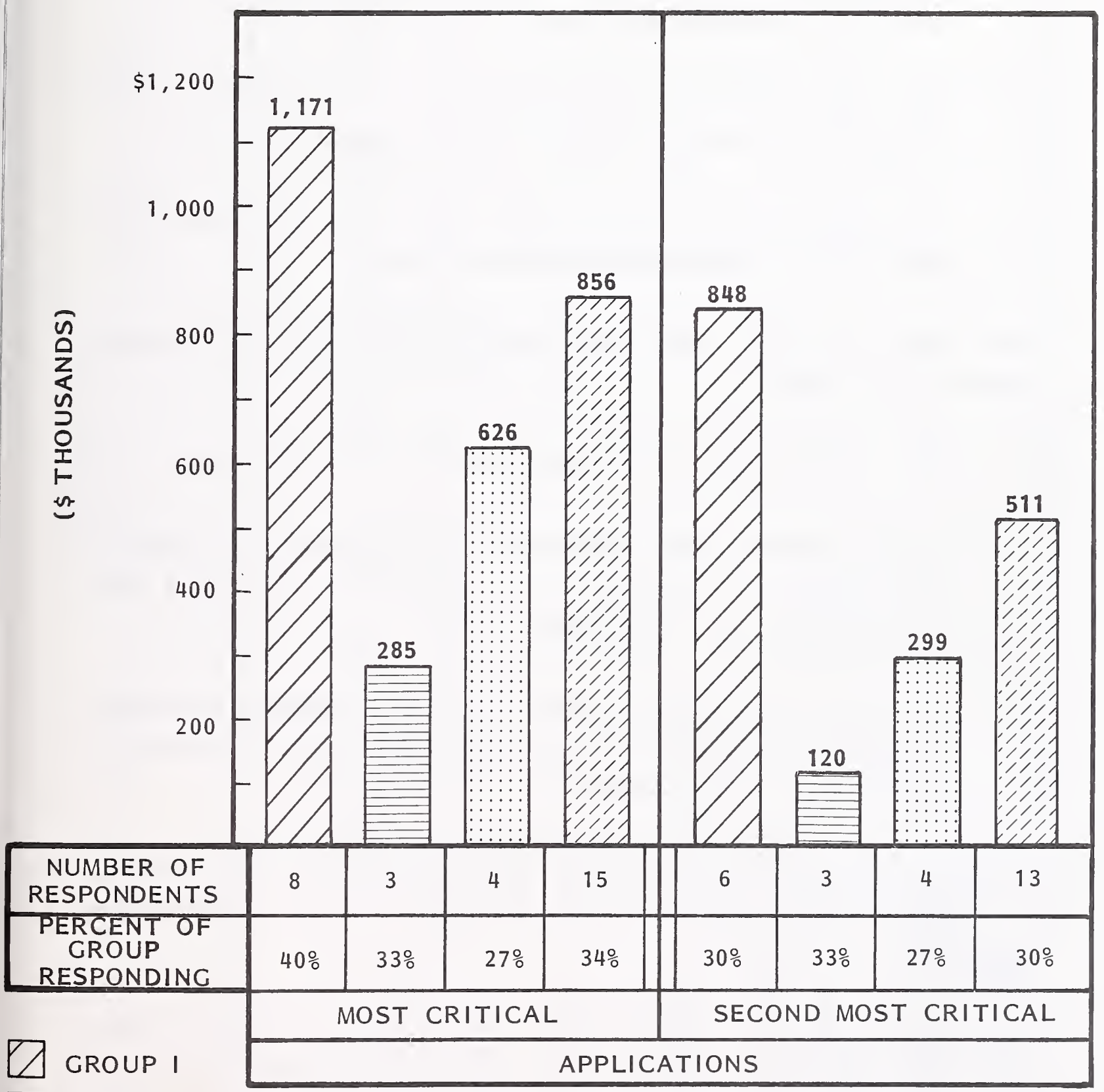
  - Part of this difference, particularly between Group I and III compared to Group II, is a result of the fact that Group II companies are considerably smaller than the other two groups based on the average number of employees.

  - A more important reason for the expenditure difference is the degree of integration of data processing into the organization. The Group I companies typically employ the most advanced technological techniques in their data processing.

  - Most of the Group I companies have their critical applications in an on-line environment as opposed to the batch environment more commonly found in the Group III companies.

EXHIBIT III-1

MEAN ANNUAL EXPENDITURES*
FOR TWO MOST CRITICAL APPLICATIONS



	MOST CRITICAL				SECOND MOST CRITICAL			
NUMBER OF RESPONDENTS	8	3	4	15	6	3	4	13
PERCENT OF GROUP RESPONDING	40%	33%	27%	34%	30%	33%	27%	30%

APPLICATIONS

GROUP I
GROUP II
GROUP III
ALL GROUPS

*EXPENDITURES INCLUDE HARDWARE, SOFTWARE, PERSONNEL AND MAINTENANCE COST.

- Only four of the 44 companies could provide a detailed breakdown of expenditures by application. All four were Group I companies. The results are displayed in Exhibit III-2.

  - As a percent of budget, these companies indicated that they are spending 38% more for maintenance of these applications (11%) than the Group I companies spend overall for maintenance (8%).

  - The Group I ratio is even greater when compared to the 5.6% of the DP budget spent on maintenance by the Group III companies.

  - The indication is that companies that have a higher awareness of their total costs are willing to pay more for maintenance.

- The Group I companies are all much more aware of their maintenance cost than the other companies.

  - This is due in part to the fact that these expenditures are larger.

  - More importantly, their dependency on the availability of equipment being more critical, they feel a need to monitor their field maintenance services more closely.

  - Although cost conscious, most of the Group I companies expressed a willingness to spend more on field services if that would improve the availability of their equipment.

- Most of the companies interviewed recognize that the cost of maintenance is increasing and will continue to increase as a percent of their expenditures on hardware.

  - The companies recognize the driving forces behind this trend - the decreasing cost of hardware and the scarcity of skilled field service personnel.

EXHIBIT III-2

MEAN ANNUAL EXPENDITURES FOR CRITICAL APPLICATIONS FOR GROUP I COMPANIES

EXPENSE	MOST CRITICAL		SECOND MOST CRITICAL		BOTH CRITICAL	
	ANNUAL EXPENDITURE ($ THOUSANDS)	PERCENT OF TOTAL	ANNUAL EXPENDITURE ($ THOUSANDS)	PERCENT OF TOTAL	ANNUAL EXPENDITURE ($ THOUSANDS)	PERCENT OF TOTAL
HARDWARE	$1,161	56%	$1,023	65%	$2,184	59%
SOFTWARE	143	7	178	11	321	9
PERSONNEL	568	27	199	13	767	21
MAINTENANCE	217	10	175	11	392	11
TOTAL	$2,089	100%	$1,575	100%	$3,664	100%
MAINTENANCE EXPENDITURE AS A PERCENT OF HARDWARE EXPENDITURES	-	19%	-	17%	-	18%

NOTE: 4 RESPONDENTS REPORTED DATA IN GROUP I, NO RESPONDENTS REPORTED DATA IN GROUPS II AND III.

- Many of them seemed disturbed, even angry, that the result seemed to be even poorer field services at higher cost.

- If a vendor could demonstrate that it would provide better field services at a higher price, most of the companies, especially those with very critical applications, would favor that vendor over other vendors.

- Personnel costs for the most critical application are more than twice as high as for the second most critical application.

  - This is due largely to the fact that the most critical application runs much more than the other application.

  - An indication of the importance of field services is the fact that these Group I companies said that they spend half as much on the maintenance of the equipment as they do on the personnel who operate the equipment for the two most critical applications.

- Among those companies who could provide a breakdown of expenditures for their entire operation, as shown in Exhibit III-3, the Group I and II companies spend on average more than twice as much on maintenance as a percent of hardware cost than the Group III companies.

  - The higher cost was not due to higher prices charged by the first two groups' vendors.

  - These companies spend more because they buy more field services, both in shift charges and more frequent on-call services.

- The lack of awareness of cost among the surveyed companies can be seen in the fact that less than 25% of them could give this level of breakdown for their operations.

EXHIBIT III-3

MEAN ANNUAL EXPENDITURES FOR EDP OPERATION

	NUMBER OF RESPON-DENTS	HARDWARE		SOFTWARE		PERSONNEL		MAINTENANCE		TOTAL		MAINTEN-ANCE AS A PERCENT OF HARD-WARE
		($ THOU-SANDS)	PER-CENT OF TOTAL	($ THOU-SANDS)	PER-CENT OF TOTAL	($ THOU-SANDS)	PER-CENT OF TOTAL	($ THOU-SANDS)	PER-CENT OF TOTAL	($ THOU-SANDS)	PER-CENT OF TOTAL	
GROUP I	4	$354	21%	$419	25%	$820	49%	$85	5%	$1,678	100%	24%
GROUP II	2	242	27	298	33	294	33	64	7	898	100	26
GROUP III	4	179	36	86	17	208	42	23	5	496	100	13
ALL GROUPS	10	262	25	262	25	470	45	56	5	1,050	100	21

NOTE: EXPENDITURES DO NOT INCLUDE ALL EDP COST.
FOR EXAMPLE, SUPPLIES ARE NOT INCLUDED.

B. COST OF DOWNTIME

- The cost of critical applications being down is very apparent to the Group I companies.

  - Sixty percent of them can quantify the lost profits in terms of dollars per hour or per day.

  - In some cases, the costs are staggering, as much as $1 million per day, as shown in Exhibit II-3.

- In virtually all cases, the Group I companies' downtime cost for a single day exceeds their annual maintenance cost by three times.

- Less than 15% of the Group III companies were able to quantify the cost of downtime.

  - Many of their DP managers have never really thought about it because the amount of downtime required to result in recognizable losses is far longer than any of them have experienced.

  - Although many of these companies have critical applications identical to the Group I companies, the integration of their processing into the company's operation is so much less that the impact of being down is substantially lower.

- If the most critical application goes down, the Group I companies often describe the results in catastrophic terms. Some quotes from this group follow:

  - "Operation of corporate function would cease. Cost for downtime would be incredible."

- "It is the heart of the bank's operation."

- "It is essential to the operation of the firm."

- "We would lose over a million dollars a day. If it were down for five days, the bank would go under."

- "If the system were down, it would cause an imbalance between inventory and orders having a direct effect on profits."

- "If the system goes down, we have to shut down."

- "The factory can't operate without it."

- In many cases EDP managers cannot quantify the cost of downtime because the consequences are so unthinkable or incomprehensible.

  - They have taken all reasonable actions to preclude such an event.

  - For the most part, their uptime has exceeded 99% for some time.

  - These managers act quickly to resolve any problems which would impact the availability of the system upon which their key applications depend. This is particularly true in respect to field services.

- The EDP managers cited a variety of impacts of downtime on their critical applications which are summarized in Exhibit III-4.

  - Many of the comments involve customer relations.

  - Others can be translated into financial losses or impact on employee morale.

EXHIBIT III-4

OTHER COSTS OF CRITICAL APPLICATIONS BEING DOWN

	COST OF DOWNTIME	NUMBER OF COMPANIES CITING THIS COST			
		ALL GROUPS	GROUP I	GROUP II	GROUP III
	IMPACT ON CUSTOMER RELATIONS				
1	LOSS OF GOODWILL, CREDIBILITY, TRUST, REPUTATION	20	11	6	3
2	IRATE AND/OR DISSATISFIED CUSTOMERS	10	3	4	3
3	LATE DELIVERIES OR DEFAULT ON SHIPMENTS	7	3	3	1
	SUBTOTAL	37	17	13	7
	IMPACT ON PROFITS				
4	LOST PRODUCTIVITY	7	4	1	2
5	LOST CUSTOMERS	5	5	0	0
6	GENERATES BACKLOG AND OVERTIME	4	1	1	2
7	LOST AND OVERDRAWN ACCOUNTS	2	2	0	0
8	LATE ACCOUNTS RECEIVABLE	1	0	0	1
9	POTENTIAL TO LOSE ORDERS	1	0	1	0
	SUBTOTAL	20	12	3	5
	IMAPCT ON EMPLOYEES				
10	MORALE PROBLEMS, IRATE EMPLOYEES	4	0	1	3
11	PAYROLL DELAY	1	0	0	1
	SUBTOTAL	5	0	1	4
	NO OTHER IMPACTS	3	0	0	3
	NO COMMENTS	1	1	0	0
	SUBTOTAL	4	1	0	3
	TOTAL	66*	30	17	19

* COMMENTS EXCEED RESPONDENTS BECAUSE MANY OF THEM STATED MULTIPLE COST

- A few of the companies have seriously explored installing duplicate standby systems to prevent downtime, but none have actually gone ahead with them.

  - Two of the companies have installed Tandem Systems which many feel is equal to or better than having a duplicate standby system.

  - Several others have bought other types of CPUs which featured some redundancy.

IV CRITICAL APPLICATIONS

IV CRITICAL APPLICATIONS

A. APPLICATION CRITICALITY AND FIELD SERVICES

- A large number of companies' data processing applications are very critical to their successful operation.

  - In many companies a single application is so critical that the company cannot function if the system goes down.

  - These applications are typically the critical path through which all significant production information flows. This is true whether the company is in the service or industrial sector of the economy.

  - The information flow controls the production process and it flows through data processing equipment.

- Although this study found that 45% of the companies surveyed have very critical applications, an estimate of the total number of companies of this type cannot be made because the companies sampled are not necessarily representative of the total population.

- One can assume, however, that the number of companies with very critical applications is large enough and growing fast enough to be of special interest to field services management.

- The full integration of data processing into the production process of American corporations is a continuing process whose growth is conceptually illustrated in Exhibit IV-1.

- INPUT estimates that, with advancements in computer technology, lower cost and increasing friendliness of systems, most businesses will have a critical dependence on data processing by the end of the decade.

- These companies will share many of the characteristics found in the companies in this survey which have very critical applications.

- These users desire, but do not expect to find, failproof hardware for their applications.

- In fact, their need for and dependence upon vendors' field services will increase as never before.

- Field services must understand the criticality of these applications in order to service their users' needs.

  - Communications between field services and the user are very important today, and they will be even more important tomorrow.

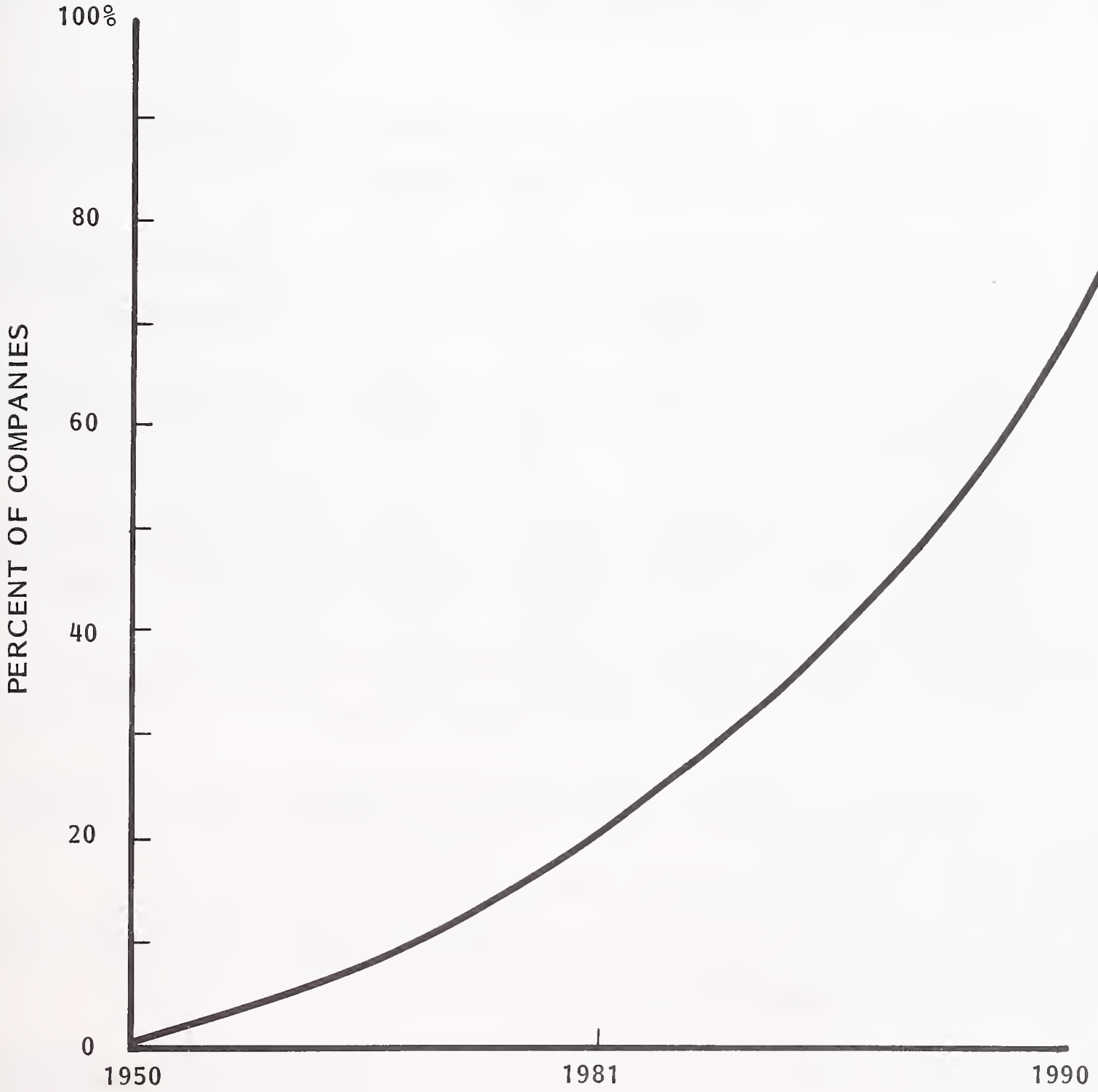
  - INPUT found in this study that many users feel there is very little if any communication between themselves and their vendor's field services organization.

  - The users place the responsibility for this communications failure on field services.

- Vendors must improve their communications with users if they are to understand their problems, and to help solve them.

EXHIBIT IV-1

PROPORTION OF COMPANIES WITH
VERY CRITICAL DATA PROCESSING APPLICATIONS



NOTE: THIS CHART IS CONCEPTUAL; IT IS NOT BASED ON SPECIFIC DATA.

- Vendors who take this course will find that they must offer a broader menu of services to meet the various needs of their clients.

- This menu of field services must be designed to address a range of application criticality from non-essential to vital-to-survival of the user.

B. CRITICALITY OF INDUSTRY SECTORS

- INPUT found in this study that the level of criticality of applications is to a large extent determined by the industry a company is in.

- The most important forces in the industries in respect to critical applications are time and competition. Often, these forces are closely interrelated.

- All industry sectors, in a large sample, would include a full range of criticality of applications.

- The discrete manufacturing industry sector companies included a very high proportion (75%) of companies with very critical applications, as shown in Exhibit IV-2.

- Savings and loans, and banks also had a high proportion.

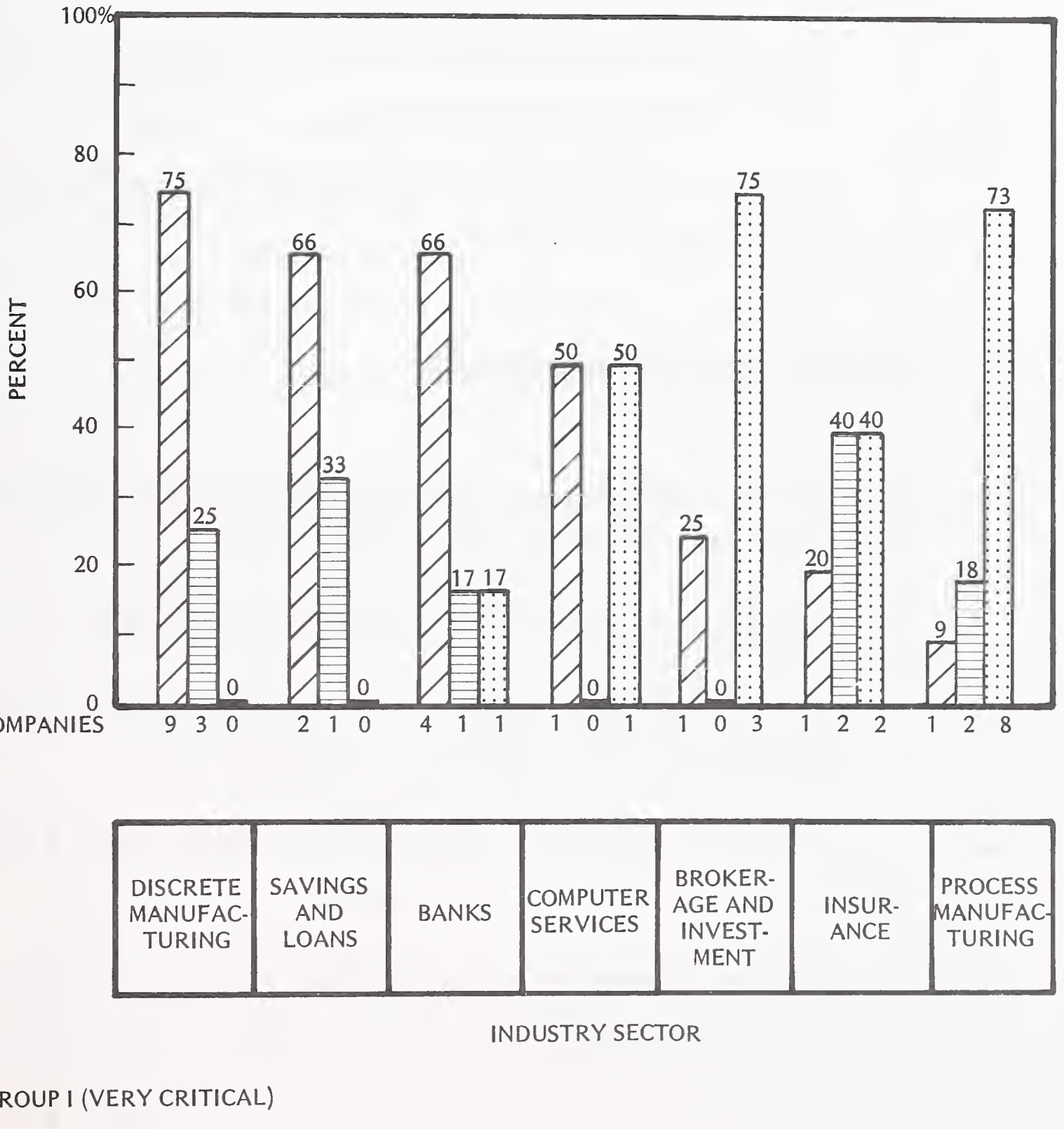
- At the opposite extreme, 73% of the process manufacturers did not have critical applications.

- Only one company in the transportation sector was interviewed - an airline, a Group I type of company.

- Response to competitive forces is important in the discrete manufacturing sector.

EXHIBIT IV-2

PROPORTION OF RESPONDENT COMPANIES
IN EACH GROUP BY INDUSTRY SECTOR



- A number of the companies are in the fiercely competitive semiconductor industry.

- Others are working at reducing production cost through computerized production control and materials requirements planning.

- Time is the major driving force in banks and savings and loan companies.

  - The systems control the flow of funds and determine when and how much interest will accrue to accounts.

  - Banks could lose the use of funds (and interest thereon) for the time a critical application was down.

C. THE MOST CRITICAL APPLICATIONS

- The most critical applications cited by the respondents usually are on-line and involve the control of assets, as shown in Exhibit IV-3.

  - The applications control funds in the financial institutions.

  - In manufacturing companies they control inventory, usually in production.

- A breakdown of most critical applications by industry sector is shown in Exhibit IV-4.

  - The three industries with the highest proportion of very critical applications - discrete manufacturing, savings and loans, and banks - were fairly consistent in what they considered to be their most critical applications.

EXHIBIT IV-3

MOST CRITICAL APPLICATIONS AND
NUMBER OF INSTALLATIONS BY RESPONDENT USERS

	APPLICATIONS	NUMBER OF INSTALLATIONS			
1	ON-LINE CHECK PROCESSING SYSTEM (POD, CIF)	6	4	1	1
2	MATERIALS REQUIREMENTS PLANNING (MRP)	5	3	2	0
3	ON-LINE ORDER ENTRY	4	1	2	1
4	ON-LINE SAVINGS AND LOAN SYSTEM	3	2	1	0
5	ON-LINE INVENTORY CONTROL	2	2	0	0
6	ON-LINE MANAGEMENT INFORMATION SYSTEM (MIS)	2	1	1	0
7	MORTGAGE AND RENT BILLING SYSTEM	2	0	0	2
8	PAYROLL	2	0	0	2
9	ACCOUNTS RECEIVABLES	3	0	0	3
10	ON-LINE INSURANCE POLICY FILING, MEMBERSHIP, CLAIMS	2	1	1	0
11	ON-LINE CUSTOMER INFORMATION SYSTEM - BROKERAGE	2	1	0	1
12	ON-LINE PROPERTY CASUALTY SYSTEM	1	0	0	1
13	INSURANCE RATE CALCULATION SYSTEM	1	0	1	0
14	INSURANCE CLAIMS MANAGEMENT SYSTEM	1	0	0	1
15	GENERAL BANK APPLICATIONS	1	1	0	0
16	TEXT PROCESSING SYSTEM FOR NEWS PRINT	1	1	0	0
17	PRODUCTION CONTROL	1	1	0	0
18	COST ACCOUNTING	1	1	0	0
19	ON-LINE PRODUCTION CONTROL SYSTEM	1	1	0	0
20	PRODUCTION ACCOUNTING SYSTEM FOR COAL MINING	1	0	0	1
21	SALES ANALYSIS SYSTEM	1	0	0	1
22	FINANCIAL CONTROL SYSTEM	1	0	0	1
		44	20	9	15
	GROUPS	ALL	I	II	III

EXHIBIT IV-4

MOST CRITICAL APPLICATION BY INDUSTRY

INDUSTRY	APPLICATION	NUMBER OF COMPANIES
DISCRETE MANUFACTURING	**MATERIALS REQUIREMENTS PLANNING**	5
	ON-LINE INVENTORY CONTROL	2
	ON-LINE ORDER ENTRY	2
	ON-LINE MANAGEMENT INFORMATION SYSTEM	1
	PRODUCTION CONTROL AND ASSEMBLY	1
	TEXT PROCESSING SYSTEM FOR NEWS PRINT	1
SAVINGS AND LOAN	ON-LINE SAVINGS AND LOAN SYSTEM	3
BANKING	ON-LINE CHECK PROCESSING SYSTEM	6
COMPUTER SERVICES	GENERAL BANKING APPLICATIONS	1
	PAYROLL	1
BROKERAGE AND INVESTMENT	ON-LINE CUSTOMER INFORMATION SYSTEM	2
	MORTGAGES AND RENT BILLING SYSTEM	2
INSURANCE	ON-LINE FILING SYSTEM, MEMBERSHIP AND CLAIMS	2
	CLAIMS MANAGEMENT SYSTEM	1
	ON LINE PROPERTY CASUALTY SYSTEM	1
	INSURANCE RATE CALCULATION SYSTEM	1
PROCESS MANUFACTURING	PAYROLL	2
	MATERIAL REQUIREMENTS PLANNING	1
	ON-LINE ORDER ENTRY	1
	ON-LINE MANAGEMENT INFORMATION SYSTEM	1
	COST ACCOUNTING	1
	COAL MINING SYSTEM	1
	ACCOUNTS RECEIVABLE	2
	SALES ANALYSIS	1
	FINANCIAL CONTROL SYSTEM	1
TRANSPORTATION	ON-LINE PRODUCT MANAGEMENT SYSTEM	1

- The other industries, particularly process manufacturing, were more diverse in their choice of critical applications.

- Field services should be sensitive to the criticality of a customer's industry and applications in order to serve him effectively.

  - Service offerings should be structured so that they can be sold to the client in a manner tailored to his particular needs.

  - Pricing of services should take into account user's needs in addition to their cost basis.

  - There is a greater profit potential in selling services on a value-received basis versus a cost basis.

- Effective packaging and marketing of field services will give vendors who understand their customers' requirements a competitive edge.

D. ESSENTIAL EQUIPMENT

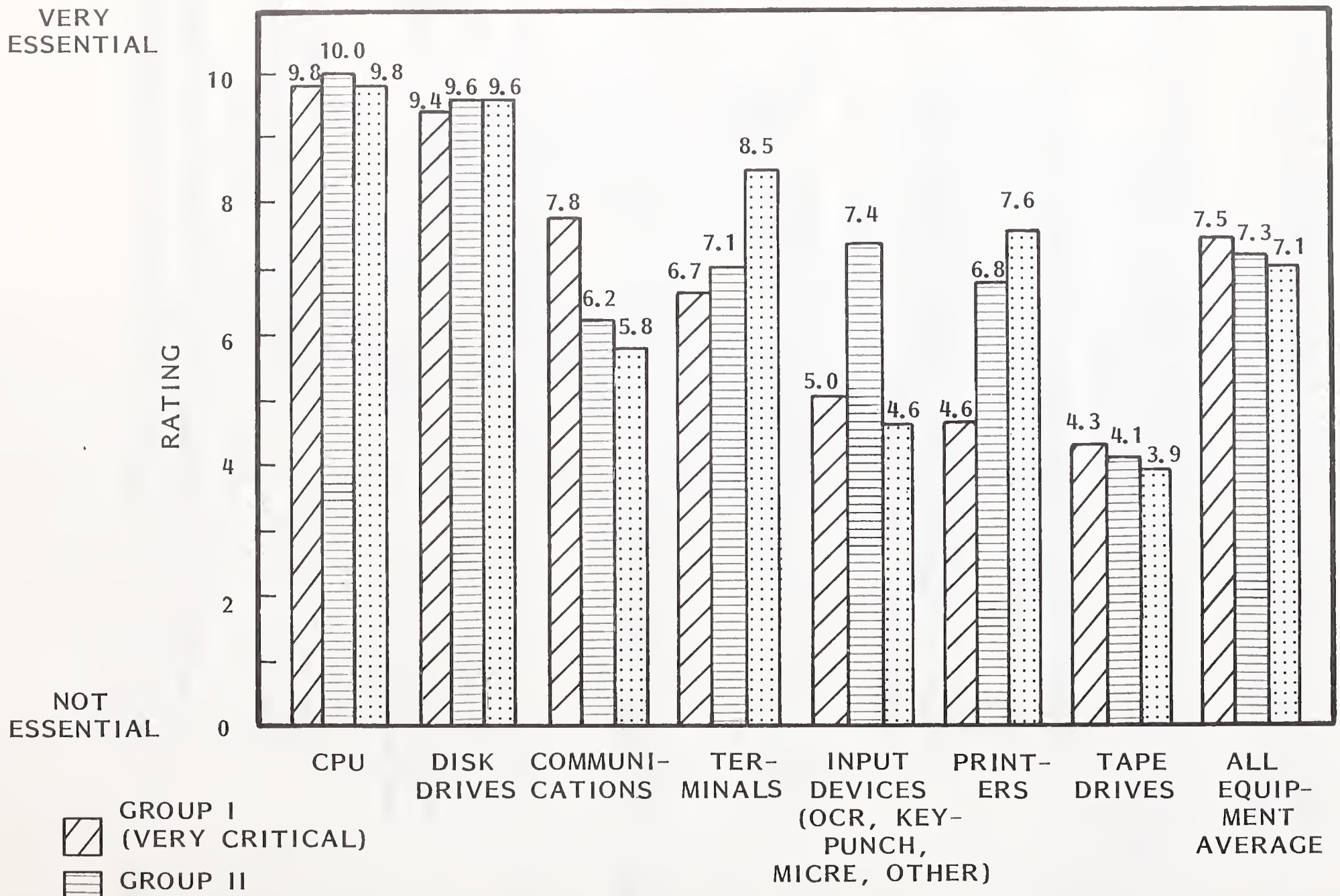
- In identifying the equipment that is most essential to the availability of their most critical applications, not surprisingly, all of the groups rated the CPU and disk drives at the top of the scale, as shown in Exhibit IV-5. The ratings were not perfect 10s for several reasons.

  - Two of the companies use Tandem Systems which by design reduce the essentiality of a given CPU or disk drive in the system operation.

  - A few companies' data processing is so distributed that major functions could continue to be performed by the satellite equipment if the central host was down.

EXHIBIT IV-5

RATING OF ESSENTIALITY OF TYPES OF EQUIPMENT TO
THE AVAILABILITY OF THE MOST CRITICAL APPLICATION



NOTE: LISTED IN ORDER OF HIGH RATINGS OF GROUP I.

- The Group I companies rated communications very essential since so many of their critical applications are on-line or distributed.

- Terminals rated lower because there is so much redundancy available through the number of terminals installed, that if a few are down it will not have a very large impact on the application.

- Some companies rated input devices very essential because their applications require special purpose devices.

  - Manufacturers use badge readers in their production control system.

  - Banks use special input devices to read the encoding on checks and other documents.

- Printers were rated fairly high on essentiality to the Group III companies due to their more batch-oriented critical applications.

- Nearly all the companies could live without their tape drives, requiring them only for backup.

- Except for CPUs and, to a lesser degree, disk drives, companies reduce their dependency on essential equipment through redundancy.

  - Terminals are vital to many operations, but because of their low cost, backup equipment can easily be put in place.

  - Users are more sensitive to the quality of field services when they are less able to provide for backup through redundant equipment.

- Ensuring availability through the purchase of redundant equipment is a very costly alternative users take when the application is very critical and/or the quality of field services is low.

- An opportunity exists for field services to provide a more cost-effective alternative to redundant equipment if a similar level of availability can be delivered through their services.

- It makes more sense to the user for the vendor to maintain adequate spare parts than for him to maintain a spare CPU or disk drive.

- The user would expect to pay more for field services and yet see his overall data processing cost at a lower level because of his lower capital investment.

E. SECOND MOST CRITICAL APPLICATION

- Respondents reported that their second most critical application is significantly less critical than the users' most critical application. It also has a number of different characteristics.

- The most frequently mentioned application, payroll, was mentioned by only seven of the respondents, as shown in Exhibit IV-6.

  - These respondents, plus the two who mentioned payroll as most critical, represent only 20% of the respondents.

  - Payroll would have been mentioned more frequently if it were not for the fact that many companies rely on outside service bureaus for this application.

  - Users' preference for service bureaus is based as much on their reliability as on any other factor.

- On the other hand, considering that payroll is usually run only once a week, its frequency of mention is significant.

EXHIBIT IV-6

SECOND MOST CRITICAL APPLICATIONS
AND NUMBER OF INSTALLATIONS

NUMBER OF APPLI-CATIONS	APPLICATIONS	NUMBER OF INSTALLATIONS			
1	PAYROLL	7	2	3	2
2	GENERAL LEDGER	6	1	2	3
3	INVENTORY CONTROL	5	2	1	2
4	ACCOUNTS RECEIVABLE	5	0	1	4
5	ORDER ENTRY	4	3	1	0
6	CAD/CAM	2	2	0	0
7	AIRCRAFT MAINTENANCE INFORMATION SYSTEM	1	1	0	0
8	INSURANCE CLAIMS AND MEMBERSHIP PROCESSING	1	1	0	0
9	ON-LINE CUSTOMER INFORMATION SYSTEM	1	1	0	0
10	LOAN PROCESSING SYSTEM	1	1	0	0
11	CREDIT CARD PROCESSING	1	1	0	0
12	MORTGAGE LOAN PROCESSING	1	1	0	0
13	ON-LINE CLASSIFIED AD PROCESSING	1	1	0	0
14	GENERAL MANUFACTURING APPLICATIONS	1	1	0	0
15	MARKETING AND SALES SYSTEM	1	1	0	0
16	SOFTWARE DEVELOPMENT TOOLS	1	1	0	0
17	PATIENT AND HOSPITAL COMPENSATION SYSTEM	1	0	1	0
18	REINSURANCE PROCESSING	1	0	0	1
19	SAVINGS PROCESSING	1	0	0	1
20	GRADE MARKING SYSTEM SERVICE FOR EDUCATION	1	0	0	1
21	ACCOUNTS PAYABLE	1	0	0	1
		44	20	9	15
	GROUPS	ALL	I	II	III

- In general, the second application is far less time dependent than the first application.

  - The financial impact is also much less.

  - Except for payroll, the number of people impacted by the second application being down is substantially lower.

- A profile of the application, by industry, is shown in Exhibit IV-7.

F. ESSENTIAL EQUIPMENT

- The essentiality of equipment to the second application is different in some respects from the most critical application.

  - The need for communications dropped considerably for the Group I companies, as shown in Exhibit IV-8. This is because very few of these applications are on-line compared to the most critical applications.

  - Printers are much more essential to these applications for the Group II companies. Frequently mentioned applications such as payroll, general ledger and inventory control require a lot of printing.

  - The need for input devices increased substantially for the Group II companies. This reflects a shift of dependency from terminals to keypunch for data entry on applications mainly in the manufacturing sector. The first application was an on-line application like order entry, and the second was payroll.

- The rating of essentiality of all equipment dropped by 12% from 7.5 for the first application to 6.6 for the second application among Group I companies.

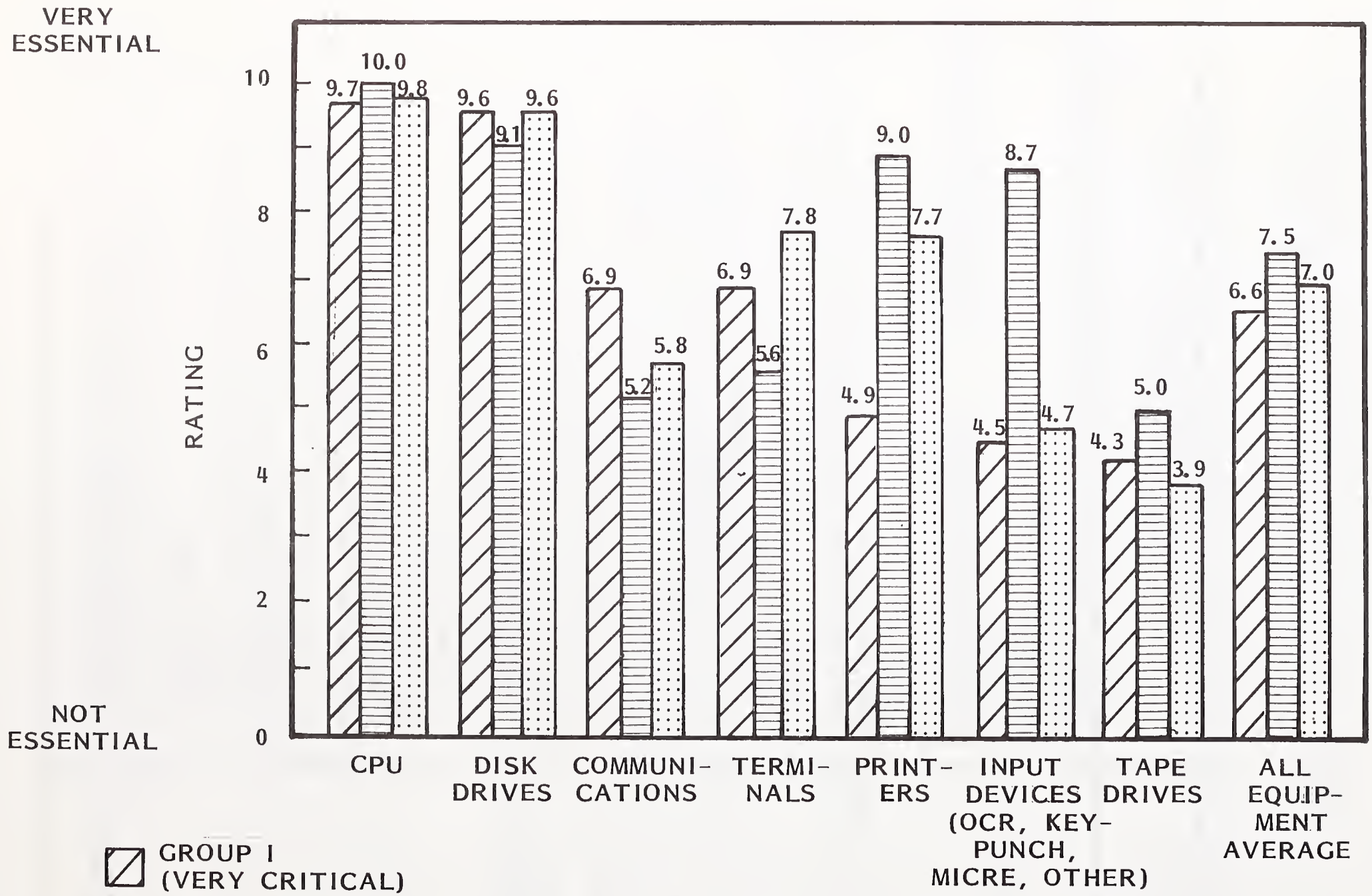
EXHIBIT IV-7

SECOND MOST CRITICAL APPLICATION, BY INDUSTRY

INDUSTRY	APPLICATION	
DISCRETE MANUFACTURING	ORDER ENTRY	4
	INVENTORY CONTROL	3
	PAYROLL	2
	CAD/CAM	1
	MARKETING/SALES SYSTEM	1
	ON-LINE SYSTEM TO PROCESS CLASSIFIED ADS	1
SAVINGS AND LOAN	PAYROLL	1
	GENERAL LEDGER	1
	MORTGAGE AND LOAN SYSTEM	1
BANKS	PAYROLL	1
	GENERAL LEDGER	1
	ON-LINE CUSTOMER INFORMATION SYSTEM	1
	LOAN PROCESSING SYSTEM	1
	CREDIT CARD PROCESSING	1
	SAVINGS PROCESSING SYSTEM	1
COMPUTER SERVICE	GRADE MARKETING SYSTEM	1
	GENERAL MANUFACTURING APPLICATIONS	1
BROKERAGE AND INVESTMENT	GENERAL LEDGER	2
	ACCOUNTS RECEIVABLE	1
	SOFTWARE DEVELOPMENT TOOLS	
INSURANCE	GENERAL LEDGER	1
	ACCOUNTS RECEIVABLE	1
	REINSURANCE SYSTEM	1
	PATIENT AND HOSPITAL COMPENSATION SYSTEM	1
	INSURANCE CLAIMS AND MEMBERSHIP PROCESSING	
PROCESS MANUFACTURING	PAYROLL	3
	ACCOUNTS RECEIVABLE	3
	INVENTORY CONTROL	2
	CAD/CAM	1
	GENERAL LEDGER	1
	ACCOUNTS PAYABLE	1
TRANSPORTATION	AIRCRAFT MAINTENANCE MANUFACTURING INFORMATION SYSTEMS	1

EXHIBIT IV-8

RATING OF ESSENTIALITY OF TYPES OF EQUIPMENT TO
THE AVAILABILITY OF THE SECOND MOST CRITICAL APPLICATION



NOTE: LISTED IN ORDER OF HIGH RATINGS OF GROUP I

- There was no significant drop for the other two groups.

- This reveals a fairly sharp distinction in how critical the equipment is to the Group I companies' most critical versus the second most critical application.

- Computer services companies and savings and loan associations rated both communications and terminals very essential. The former rated them both 10s, the latter 9.7s.

- Tape drives were also rated highly essential by banks (8.4) and savings and loans (8) for the second most critical applications.

G. OPERATIONS SCHEDULE VERSUS MAINTENANCE COVERAGE

- There was a substantial difference for all companies in the number of shifts. The most critical applications ran (2.0) compared to the second most critical (1.4), as shown in Exhibit IV-9.

  - The differences in maintenance coverage are not so great in number of shifts (1.8 versus 1.6) because both applications were often run on the same equipment, and the second application benefited by the coverage required by the first.

  - The fact that the days of maintenance coverage equal the days of the most critical applications operations (5.4) shows that the maintenance coverage was selected to match the requirements of that application. There is an excess of coverage both in shifts and days for the second most critical applications.

- All of the respondents stated that the maintenance coverage on their other applications is not less than the coverage on their most critical applications.

EXHIBIT IV-9

APPLICATIONS OPERATION SCHEDULE VERSUS MAINTENANCE COVERAGE SCHEDULE

GROUP	MOST CRITICAL APPLICATION						SECOND MOST CRITICAL APPLICATION					
	APPLICATION OPERATION		MAINTENANCE COVERAGE		PERCENTAGE DIFFERENCE*		APPLICATION OPERATION		MAINTENANCE COVERAGE		PERCENTAGE DIFFERENCE*	
	SHIFTS	DAYS	SHIFTS	DAYS	SHIFTS	DAYS	SHIFTS	DAYS	SHIFTS	DAYS	SHIFTS	DAYS
I	2.6	5.8	2.1	5.4	-19%	-7%	1.8	5.2	1.9	5.3	6%	2%
II	1.9	5.3	1.5	5.4	-21	2	1.2	3.0	1.5	5.1	25	70
III	1.4	4.9	1.5	5.3	7	8	1.1	4.7	1.3	5.0	18	6
ALL	2.0	5.4	1.8	5.4	-10	0	1.4	4.7	1.6	5.1	14	9

*BETWEEN OPERATION AND COVERAGE

- The amount of maintenance coverage is invariably determined by the demands of the most critical application in the firm.

- The Group I companies run the most shifts and pay for the most coverage for their most critical applications.

  - But there is a significant shortfall in maintenance coverage versus operation schedule for both shifts (19%) and days (7%) of coverage for their most critical applications.

  - This is because they find it more economical to rely on on-call service beyond the first two shifts and the first five days of coverage. For non-critical applications, the user may simply wait until his coverage is in effect rather than call immediately and incur time and materials changes.

- The Group III companies generally have more than enough maintenance coverage for their critical applications which run on a much less demanding schedule.

- An analysis of maintenance coverage for the most critical application by industry sector yields some useful information.

  - Savings and loans operate their applications the most with an average of 2.5 shifts, 6.7 days per week. But their maintenance coverage is substantially lower at 1.8 shifts and 5.7 days.

  - Banks are next highest with 2.3 shifts and 5.3 days per week for operation. Their maintenance coverage is more in line with their operations schedule with coverage for 2.5 shifts for five days a week.

  - The lowest operating time and maintenance coverage is in the insurance industry which is nearly 25% less than for all companies.

- The one company in the transportation sector - an airline - operates and has coverage for three shifts a day, seven days a week.

- There are extreme differences in operating schedules and corresponding maintenance coverage for individual companies in all the industry sectors except for insurance.

  - In a few cases, some companies have much higher maintenance coverage than their operating schedule would seem to require. The application might be running only one shift per day, yet they have three shifts per day maintenance coverage.

  - A reason for this anomaly was not found, but several could be surmised.

    . They may have been buying the excess coverage as extra insurance.

    . They may be able to schedule preventive maintenance outside of their normal operating hours.

    . Their vendor's pricing and/or service policies may have offered some advantages to buying three-shift coverage.

  - Of the fifteen companies which operate their most critical applications three shifts per day, only seven have three shifts of maintenance coverage. Six of the seven are Group I companies.

  - It is clear that the amount of maintenance coverage that a company buys is more directly related to the criticality of the application than to the operating schedule of the application.

V USER ATTITUDES TOWARD MAINTENANCE

V USER ATTITUDES TOWARD MAINTENANCE

A. REJECTION OF EQUIPMENT AND SERVICES

- Users with very critical applications are much less likely to tolerate low quality field service than other users. Vendors who ignore this fact will lose business among these customers.

- Two-thirds of the respondents who have replaced equipment due to poor maintenance service are Group I companies, as shown in Exhibit V-1.

- In addition to losing the installed base of business, vendors also lose the goodwill of important and influential members of the user community.

  - As shown earlier, these very critical users are more frequently found among the two sectors most important to vendors, discrete manufacturing and banking.

  - The importance of field services to a vendor's current revenues and future equipment sales is enlarged because discrete manufacturing and banking are two of the highest potential sectors in terms of future sale of EDP equipment and services.

- A variety of reasons were given by the respondents for replacing the equipment, as shown in Exhibit V-2.

EXHIBIT V-1

RESPONDENTS' REPLACEMENT OF EQUIPMENT DUE TO POOR MAINTENANCE SERVICE

GROUP	RESPONSE TO QUESTION OF WHETHER OR NOT RESPONDENT HAS REPLACED EQUIPMENT DUE TO POOR MAINTENANCE			
	YES		NO	
	NUMBER	PERCENT OF GROUP	NUMBER	PERCENT OF GROUP
I	8	40%	12	60%
II	1	11	8	89
III	3	20	12	80
ALL	12	27	32	73

EXHIBIT V-2

REASONS GIVEN FOR REPLACING EQUIPMENT DUE TO POOR MAINTENANCE

REASON	NUMBER OF RESPONDENTS
POOR MAINTENANCE AND SUPPORT	3
INCOMPETENT AND/OR POORLY TRAINED FIELD ENGINEERS	3
LACK OF SPARE PARTS	3
POOR RESPONSE TIME	2
PERFORMANCE LEVEL NOT BEING MET	1
POOR FIELD ENGINEERING MANAGEMENT	1
VENDOR NO LONGER MAINTAINED OUT-DATED EQUIPMENT	1
	14*

* TWO RESPONDENTS GAVE MORE THAN ONE REASON

- Nearly half of them stated that the vendor simply could not maintain the equipment, usually because of incompetent and/or poorly trained field engineers.

- Nearly one-third mentioned that the vendor failed to maintain an adequate supply of spare parts.

- The most common complaints by all respondents involved inadequate personnel or inventory of spare parts.

- IBM was most favored as the new vendor when equipment was replaced, as shown in Exhibit V-3.

  - IBM replaced 7 out of 12 of the vendors replaced.

  - IBM was only 1 of 14 vendors replaced.

  - This is further evidence of the high regard held by users of IBM's field services, particularly when they are disappointed by a non-IBM vendor.

- A majority of the equipment replaced included peripheral devices and terminals.

  - Most users were reluctant to replace CPUs due to the large cost usually involved, mostly in software conversions.

  - When CPUs were involved, the replaced equipment was either a minicomputer or small business system.

- Terminals were the most frequently replaced device, but no vendor was mentioned more than once.

EXHIBIT V-3

EQUIPMENT AND VENDOR REPLACED DUE TO
POOR MAINTENANCE AND THEIR REPLACEMENTS

EQUIPMENT*	REPLACED VENDOR	NEW VENDOR
TERMINALS	ITT COURRIER	AT&T
TERMINALS	TEXAS INSTRUMENTS	IBM
TERMINALS	INFOTRON	IBM
TERMINALS	OMRON	ADDS
DISK DRIVES	IBM	MEMOREX
DISK DRIVES	SORBUS	IBM
PRINTERS	PRINTRONIX	ADDS
PRINTERS	XEROX	HONEYWELL
ENTIRE SYSTEM	DEC	IBM
MINICOMPUTERS	HARRIS	NONE
SMALL BUSINESS SYSTEM	BURROUGHS	IBM
MEMORY	INTEL	IBM
SCANNER AND KEY TAPE	AM INTERNATIONAL	NONE
TAPE DRIVE	N/A	IBM

* TWO RESPONDENTS HAD REPLACED MORE THAN ONE VENDOR'S EQUIPMENT

- Two-thirds of the users who replaced equipment said the experience will cause them to change their method of evaluating vendors. Their comments are shown in Exhibit V-4.

  - Reference checking of other users on quality of field service will be used more.

  - The proximity of vendor's field services offices to the user site will be more important.

B. FIELD SERVICES' ROLE IN EQUIPMENT SELECTION

- In the procurement of currently installed equipment, all of the users rated the quality of maintenance as an important factor, as shown in Exhibit V-5.

  - Overall, the Group I companies rated maintenance higher than the other groups.

  - Their rating was particularly high in purchasing mainframes.

- In the selection of mainframes, some users selected equipment because of unique advantages of its operating system in spite of known deficiencies in the vendor's field services. In cases where the advantage involved on-line applications, the users later regretted their decision.

- The companies which had purchased small business computers indicated that high quality maintenance is extremely important with a rating of 9.5.

  - The system is going to be used directly by end users.

  - The system is going to be physically removed from the computer center.

EXHIBIT V-4

CHANGES IN METHOD OF EVALUATING VENDORS AND/OR EQUIPMENT DUE TO NEED TO REPLACE POORLY MAINTAINED EQUIPMENT

"We will only purchase from well-established and experienced vendors in the future."

"Our checks were good, but they were not thorough enough."

"The quality of maintenance will be rated much more important in our future decisions."

"We will interview more users about vendor's maintenance and we will also study more vendors."

"We will check the track records of vendors."

"We will make sure that future vendors will always have spare parts and we will also look for vendors who are located closer to our installation."

"We are going to pay much more attention to field engineering services."

"We will evaluate the field location of field engineers."

EXHIBIT V-5

IMPORTANCE OF THE QUALITY OF MAINTENANCE IN PURCHASES OF CURRENT EQUIPMENT

	RATINGS				NUMBER OF RESPONDENTS			
	GROUP I	GROUP II	GROUP III	GROUP ALL	GROUP I	GROUP II	GROUP III	GROUP ALL
MAINFRAMES	8.5	6.6	6.8	7.5	20	9	15	44
PERIPHERALS	7.7	6.3	7.5	7.3	20	9	15	44
TERMINALS	7.9	5.9	7.3	7.3	19	9	14	42
SYSTEMS SOFTWARE	7.8	7.3	7.0	7.4	19	9	15	43
APPLICATION SOFTWARE	7.6	8.5	5.5	7.3	13	2	3	18
SMALL BUSINESS COMPUTERS	9.5	N/A	N/A	9.5	4	0	0	4
MINICOMPUTERS	8.3	8.5	9.5	8.6	7	2	3	12
WORD PROCESSORS	6.8	N/A	7.0	6.7	6	0	1	7
OVERALL	7.9	6.9	7.2	7.5	–	–	–	–

SCALE FROM 0 TO 10: 0 = NO IMPORTANCE, 10 = MOST IMPORTANT

N/A = NOT APPLICABLE

- A high rating was given to minicomputers for the same reasons as to the small business system.

- Although word processors are used by end users outside the computer center, field services was not rated very important in their procurement. The application is not considered very critical, and experience with their maintenance is generally very satisfactory.

- The users increased their rating of the importance of field services for future procurement, as shown in Exhibit V-6.

  - The overall rating was about 7% higher.

  - The greatest increase was in the ratings for word processors (11%), peripherals (8%) and applications software (7%).

- Field service for word processors is becoming more important due both to their proliferation within corporations and their increased communications capability.

- Field service for peripherals is increasing in importance among the Group I and II companies because of the greater dependence of their critical applications on disk drives.

- Maintenance of applications software increased in importance because the Group I companies are buying more of their software, and its use in the organization is generally closer to the end user than other software.

- An increased reliance on systems software supplied by third parties contributed to a higher rating (8%) by the Group I companies.

EXHIBIT V-6

IMPORTANCE OF THE QUALITY OF MAINTENANCE IN FUTURE PURCHASES OF EQUIPMENT

	RATINGS				NUMBER OF RESPONDENTS*			
	GROUP I	GROUP II	GROUP III	GROUP ALL	GROUP I	GROUP II	GROUP III	GROUP ALL
MAINFRAMES	8.9	7.3	6.9	7.8	16	8	14	38
PERIPHERALS	8.5	7.1	7.6	7.9	16	8	14	38
TERMINALS	8.1	6.9	7.4	8.6	15	8	13	36
SYSTEMS SOFTWARE	8.4	7.3	7.4	7.7	16	8	14	38
APPLICATION SOFTWARE	8.3	9.0	5.3	7.8	12	2	2	16
SMALL BUSINESS COMPUTERS	9.7	N/A	N/A	9.7	3	0	0	3
MINICOMPUTERS	8.3	9.0	9.5	8.8	6	1	3	10
WORD PROCESSORS	7.5	N/A	8.0	7.6	6	0	1	7
OVERALL	8.4	7.0	7.4	8.0	-	-	-	-

* NUMBER OF RESPONDENTS IS GENERALLY LOWER BECAUSE QUESTION WAS CHANGED AFTER FOURTH INTERVIEW.

C. USER SATISFACTION WITH MAINTENANCE

- Maintenance is a sensitive issue for users. They usually associate it with problems. Consequently, they often find something bad to say about it, but they are generally satisfied with it, as shown by a rating (7.3), well above the mid-point, as shown in Exhibit V-7.

- Satisfaction with the maintenance of mainframes is significantly higher than all other equipment and software.

- Vendors of small business computers and minicomputers are viewed as providing relatively poor service.

D. USER EVALUATION OF COST OF MAINTENANCE SERVICES

- A majority of the users (63%) felt they were being charged fair prices for maintenance, as shown in Exhibit V-8.

- There is some correlation between the level of satisfaction and attitudes toward prices.

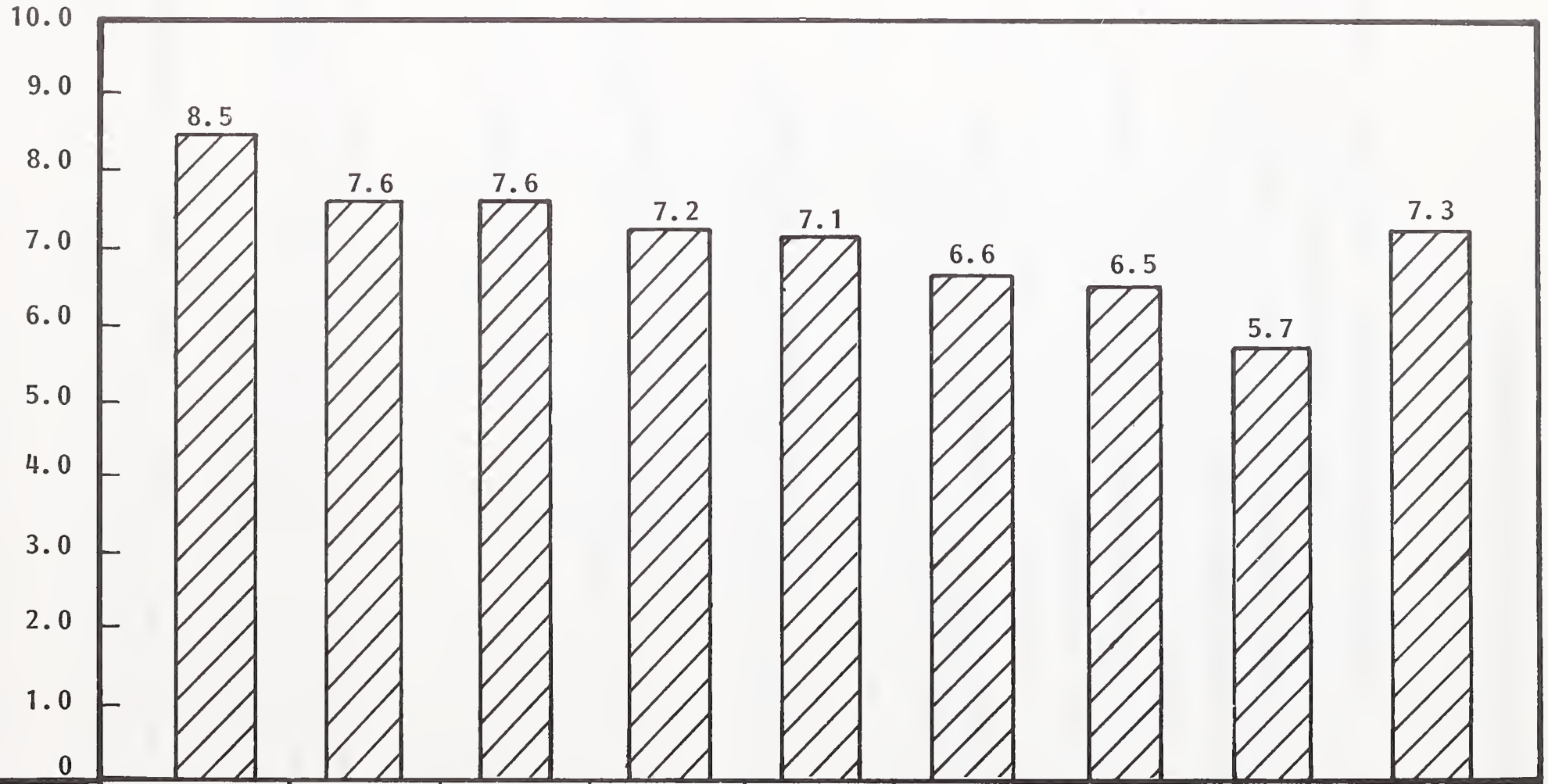
  - The categories which received the highest percentage of users' rating of "excessive" cost - minicomputers and applications software - also received the lowest satisfaction ratings.

  - Users tend to feel the price is excessive for any service they receive which is unsatisfactory.

  - If the user is satisfied, he will be more receptive to paying higher prices for field services.

EXHIBIT V-7

RESPONDENTS' RATING OF SATISFACTION WITH MAINTENANCE SERVICE



NUMBER OF RESPONDENTS*	46	46	45	43	12	3	13	6	
	MAIN-FRAME	PERI-PHERALS	WORD PRO-CESSORS	TER-MINALS	SYSTEM SOFT-WARE	MINI-COM-PUTERS	APPLI-CATION SOFTWARE	SMALL BUSINESS COMPUTERS	OVER-ALL

* NUMBER OF RESPONDENTS EXCEEDS COMPANIES INTERVIEWED BECAUSE SEVERAL GAVE MULTIPLE RESPONSES FOR DIFFERENT INSTALLED EQUIPMENT.

EXHIBIT V-8

RESPONDENTS' RATING OF THE COST
OF THEIR MAINTENANCE SERVICE

	PERCENT OF GROUP RATING BARGAIN, FAIR, EXCESSIVE COST												
	GROUP I			GROUP II			GROUP III			ALL GROUPS			ALL RE-SPON-DENTS
	B	F	E	B	F	E	B	F	E	B	F	E	
MAINFRAMES	10%	70%	20%	0%	89%	11%	28%	43%	29%	14%	65%	21%	43%
PERIPHERALS	5	75	20	0	89	11	21	57	21	9	72	19	43
TERMINALS	18	47	35	0	89	11	25	58	17	16	60	24	38
SYSTEM SOFTWARE	17	66	17	12	0	88	21	57	21	15	66	19	41
APPLICATION SOFTWARE	18	55	27	N/D	N/D	N/D	N/D	N/D	N/D	13	50	37	16
SMALL BUSINESS SYSTEMS	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	3
MINICOMPUTERS	0	25	75	N/D	N/D	N/D	N/D	N/D	N/D	0	42	58	12
WORD PROCESSORS	20	40	40	N/D	N/D	N/D	N/D	N/D	N/D	17	50	33	6
OVERALL	12%	59%	29%	0%	85%	15%	22%	53%	25%	12%	63%	25%	202%

N/D: NO DATA OR INSUFFICIENT DATA

B = BARGAIN
F = FAIR
E = EXCESSIVE

- Of those users who do not feel they are paying a fair price, more than twice as many feel the price is excessive rather than a bargain.

  - The Group I companies are particularly critical of vendors' prices for maintenance.

  - Less than one-half of them feel they are paying a fair price for field services on terminals, minicomputers and word processors.

E. REMOTE SITE VERSUS CENTRAL SITE MAINTENANCE

- Thirteen percent of the respondents' EDP equipment was located at remote sites.

- Respondents perceive very little difference between maintenance of remote and central site equipment.

  - Fifty-eight percent feel the costs are the same.

  - Only 12% feel that maintenance of remote equipment costs more than central site equipment, primarily due to increased travel cost.

  - Thirty percent believe maintenance of remote equipment is lower in cost because the equipment is generally less complicated (terminals) than central site equipment.

- Users said that the quality of maintenance at remote sites is the same as for their central site.

F. USER ASSESSMENT OF MAINTENANCE BY MANUFACTURERS

- The quality of maintenance is much more important to the purchasers of IBM, Hewlett-Packard and Burroughs mainframes than to purchasers of other mainframes, as shown in Exhibit V-9.

  - Users in general consider IBM maintenance to be the standard of excellence in the industry.

  - When any users expressed an opinion about Hewlett-Packard, they invariably praised it highly.

  - NCR users expected the importance of maintenance to increase in future purchase decisions.

- In selecting certain equipment, some other factors far outweigh the importance of the quality of maintenance.

  - Purchasers of DEC equipment usually consider the on-line capabilities of the system far more important than maintenance.

  - Purchasers of Tandem systems usually feel that maintenance is not a critical factor because of the expected reliability of the system.

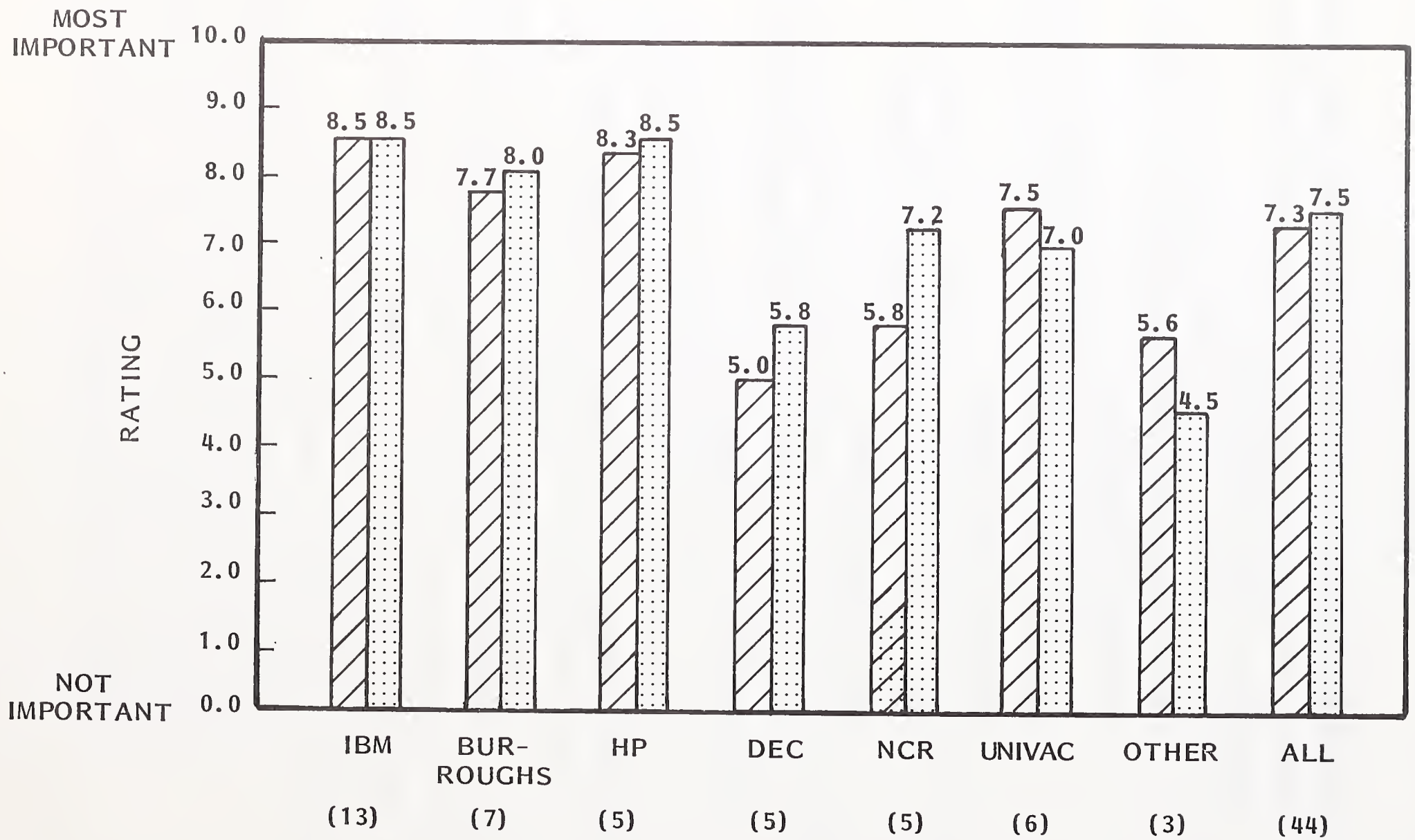
- Respondents with central sites situated in remote locations rated the quality of maintenance very high in their purchase decision.

  - A Burroughs user said, "Considering the fact that the bank is located in Reno which requires many vendors to fly their FEs out, it is highly important to choose the vendor who can be highly responsive to any emergency we might have. Availability of spares can also be a problem, so we had to be careful in selecting the right vendor."

EXHIBIT V-9

IMPORTANCE OF QUALITY OF MAINTENANCE IN PURCHASE DECISION

BY TYPE OF MAINFRAME INSTALLED



- A Univac user said, "Considering that we are in the boondocks, we will have to continue to deal with vendors who can service remote sites like Iowa."

- An IBM user said, "Since we are located about 100 miles from a lot of the major vendors, we had to be very selective. We had to find a company who could respond quickly, had the experience, and had spare parts available at any point."

- Most of the respondents said the quality of maintenance is increasing in importance in their selection of equipment. Some selected quotes on this subject from users who rated it highly important are shown in Exhibit V-10.

- When one compares the level of satisfaction, as shown in Exhibit V-11, with the level of importance rating of field services (Exhibit V-9), it is apparent that there is a strong correlation for most users.

  - NCR and the Other category of users rated field service low in importance and were the most dissatisfied.

  - The opposite is observed with the IBM, Burroughs and Hewlett-Packard users.

- As observed earlier, there is a correlation between the level of satisfaction and attitudes toward cost, as shown in Exhibit V-12. The lower the level of satisfaction, the more excessive the cost seems to be to users.

- A notable exception to this is shown by the IBM users. Although they were very satisfied with field servcies, 25% thought IBM charged too much for it.

- Hewlett-Packard users were the most satisfied with their field services support, and none of them felt that the costs were excessive.

EXHIBIT V-10

SELECTED COMMENTS BY RESPONDENTS ON THE IMPORTANCE OF FIELD SERVICES AS A FACTOR WHEN PURCHASING EQUIPMENT

"The experience of other DP managers has shown me that it pays in the long run to thoroughly investigate the quality of maintenance and customer support the vendor has to offer." - An IBM user.

"We made the mistake of evaluating vendors solely on reliability and performance, assuming that quality of maintenance would be no different than other vendors." - A minicomputer user.

"Once the equipment is installed, the customer engineer is the only guy you see (from the vendor)." - A Tandem user.

"I've been killed by poor maintenance in the past, so it's the most important factor in buying new equipment." - An IBM user

"It (field service) is an important matter which can be easily overlooked. Performance and reliability of a system means nothing unless you can have dependable and quality maintenance support as long as you have the system." - A Burroughs user.

"In all cases, quality of maintenance is considered first. Then it is weighed against the cost." - A Hewlett-Packard user.

EXHIBIT V-11

RESPONDENTS' RATING OF SATISFACTION WITH MAINTENANCE
OF MAINFRAME BY MAINFRAME VENDOR

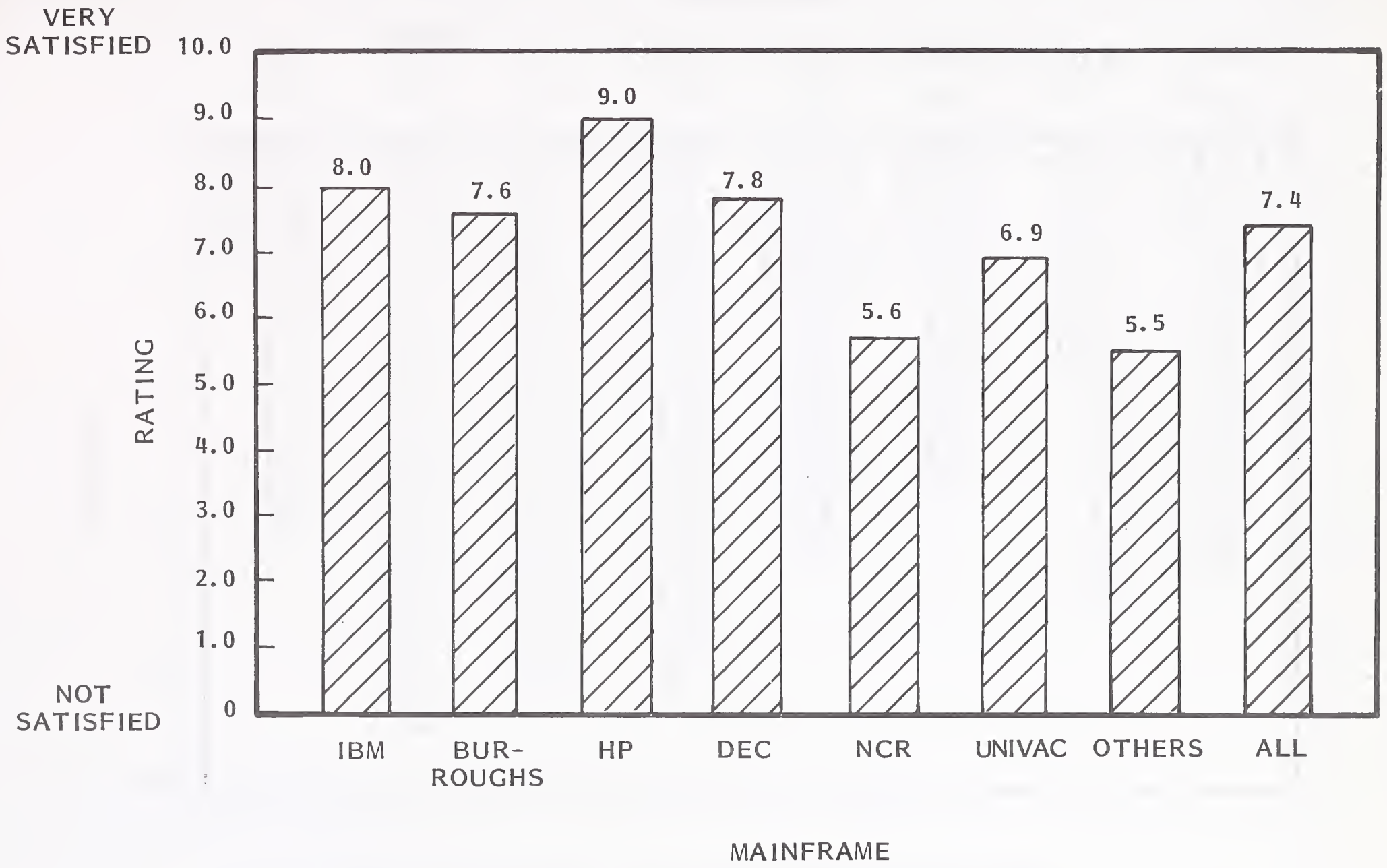
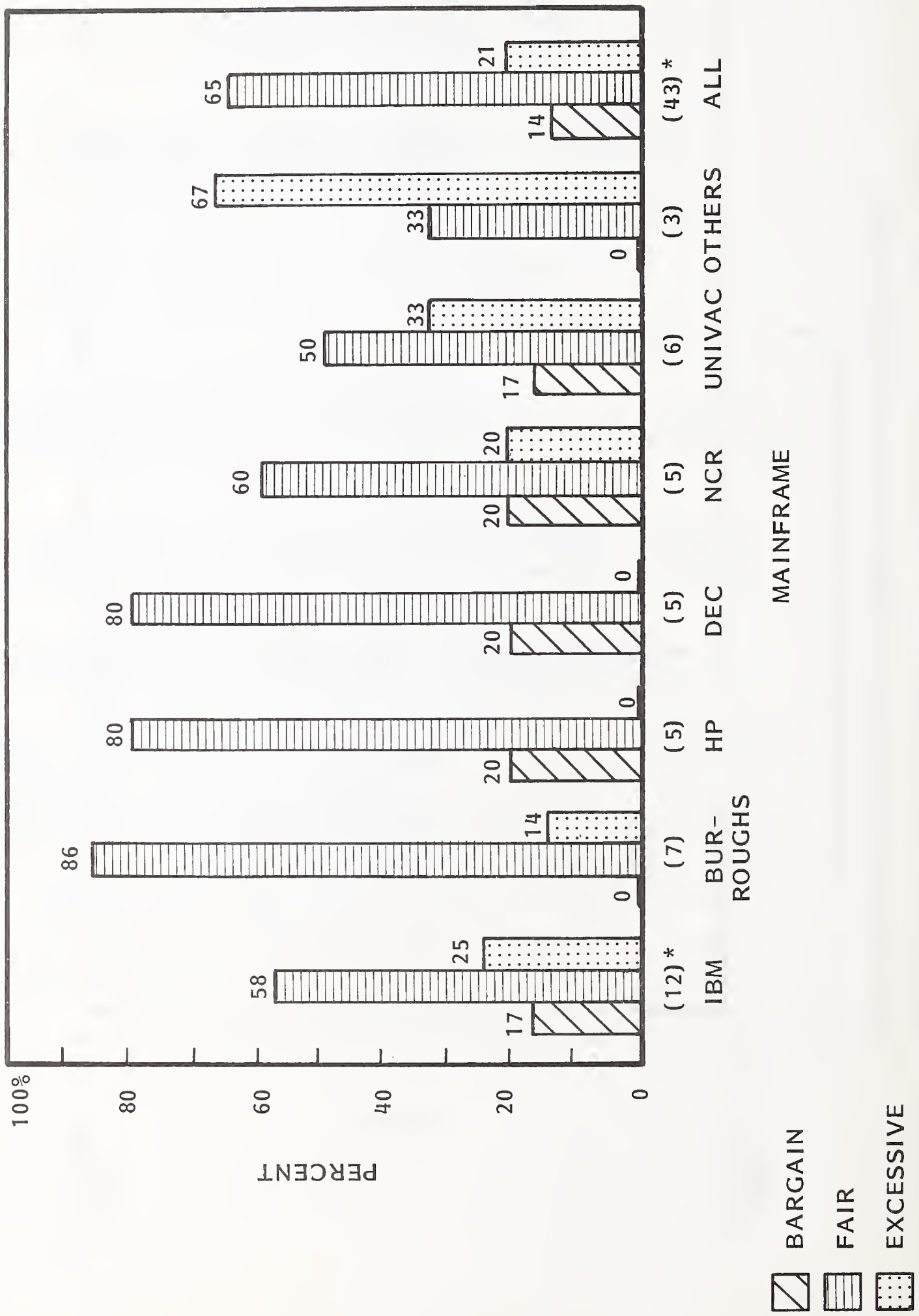


EXHIBIT V-12

RESPONDENTS' RATING OF THE COST OF THEIR MAINTENANCE SERVICE
BY TYPE OF MAINFRAME FOR MAINFRAME MAINTENANCE



* NO RESPONSE FROM ONE IBM INSTALLATION

- Overall, nearly 80% of the respondents felt they were paying a fair price or getting a bargain on the cost of their maintenance service.

VI USER NEEDS FOR TYPES OF MAINTENANCE

VI USER NEEDS FOR TYPES OF MAINTENANCE

A. HARDWARE

- Users were asked to evaluate a variety of techniques employed by field services organizations. They rated the technique's effectiveness in increasing systems availability and reducing maintenance cost on a scale of 0 to 10 where 0 is not effective and 10 is very effective. The results are shown in Exhibit VI-1.

- Having a field engineer on-site is considered to be the most effective technique in increasing systems availability. It is also considered the most expensive.

- Having spare parts stored on-site also is rated very high on increasing availability, but is viewed as being much more cost effective.

- The assignment of an FE with spare parts to every user site is obviously not a viable solution to the user's problems. But it does suggest a strategy for delivering field services which would be attractive to users.

  - Users have different needs for field services due to the varying criticality of their applications.

EXHIBIT VI-1

RESPONDENTS' RATINGS OF VENDOR MAINTENANCE TECHNIQUES FOR THEIR EFFECTIVENESS

	TECHNIQUE	INCREASING AVAILABILITY		REDUCING MAINTENANCE COST	
		GROUP		GROUP	
		I	ALL	I	ALL
	VENDOR RESPONSIBILITY				
1	ON-SITE FIELD ENGINEER	9.3	8.8	2.6	2.9
2	ON-SITE STORED SPARES	8.9	8.5	4.8	5.5
3	BETTER-TRAINED FIELD ENGINEERS	8.1	7.8	5.9	5.7
4	LOCALLY STORED SPARES	7.8	7.5	4.9	5.5
5	REMOTE DIAGNOSTICS	6.5	7.0	5.6	5.5
6	SUPPORT CENTERS	6.3	6.1	6.2	5.8
7	FAULT AND FIX DATA BASE	6.2	6.7	5.1	5.4
8	EXPANDED PREVENTIVE MAINTENANCE	5.4	6.0	5.3	5.3
	MEAN RATING	7.3	7.3	5.0	5.2
	USER RESPONSIBILITY				
1	MODULE SWAPPING	7.2	6.4	5.9	6.5
2	DIAGNOSTIC TOOLS	7.0	6.2	6.4	7.0
3	SEND MODULES TO DEPOT	3.5	3.7	6.4	6.6
	MEAN RATING	5.9	4.2	6.2	6.7

- They should have a variety of options on services to assure the availability of their system according to their needs.

- Vendors should consider ways in which they can offer services that the user feels meets his needs.

  - Many users are critical of the fact that their field services office is located too far from their site. Field service management should consider having several very small offices geographically dispersed instead of one large office, if they intend to appeal to users with critical applications.

  - Users could be given the option of purchasing a broad range of spare-part kits. Kits could range from low-cost, minimal coverage to a higher-cost, full replacement set.

- A large proportion of users feel that their vendor's field engineers (FEs) need better training.

  - Associated with this problem is the high turnover rate or transfer rate of FEs. Users complain that as soon as an FE becomes competent at the job, the FE either leaves for a better opportunity or is promoted.

  - Another frequent observation is that FEs are not paid as much as they should be.

- Users will pay more for an FE's service if they are convinced the FE is competent and experienced.

- Vendors should consider selling their field engineer's time as if the FE were a professional consultant. Fees for the FE's services would be tied to the FE's talent and experience.

- Users without critical applications might be satisfied with a lower-priced service person just out of training.

- Users with extremely critical applications would be willing to pay top price for the "star" service person.

- Some vendors already tend to favor their larger critical accounts, but they haven't formalized it by incorporating it into their fee structure and giving the user a range of options.

- Remote diagnostics is viewed favorably by users familiar with it.

  - They feel it saves money because the FEs can usually bring the necessary parts with them to effect the repair and save a trip back to their office.

  - They also feel that the most appropriate FE can be designated to address the problem when it is identified in this way.

  - Some users feel this technique gives early warning signals which prevent downtime.

  - In general, remote diagnostics is considered very cost effective by users.

- Many users are not well acquainted with "support centers" or "fault and fix" data bases. Their opinions are quite divided on the value of these services.

  - Some are cynical, feeling that these services are little more than public relations gambits.

  - Others feel that anything would help the situation, although they rarely could perceive a direct benefit.

- Expanded preventive maintenance is the last thing users with critical applications want. Some user observations follow:

  - "Expanded PM generally causes more problems. Constant tinkering reduces our uptime every time the field engineer is out here."

  - "It creates more problems by tinkering with it more often."

- Many users are very receptive to assuming more of the maintenance responsibility themselves. With a few exceptions they favor being able to perform their own diagnostics and replace faulty modules.

  - Users with critical applications want vendors to provide better tools, training and documentation to help them be more self-reliant.

  - They also would like to see equipment designed to facilitate more user involvement in maintenance.

  - The chief benefit they seek is a reduction in downtime. A very secondary but welcome benefit would be a reduction in cost.

- Three of the Group I DP managers cited their experience with self-maintenance.

  - "Our company is very much for user self-maintenance. We have had success with both diagnostic tools and module swapping."

  - "We have three highly qualified and competent technicians employed here who are capable of performing some level of maintenance and preventive maintenance. Because of them I have confidence in these techniques being effective."

- "We have embarked on our maintenance program with some Burroughs terminals and have found out that we are much more effective and efficient in increasing availability than Burroughs' FEs.

- "Doing diagnostics and swapping modules will definitely increase the availability of our equipment, but vendors must increase user training and provide better manuals which will cost more."

- The Group II and III companies more frequently prefer not to be involved in self-maintenance even though they feel even more strongly that it would reduce the cost of maintenance. Four of the Group III companies commented on this issue:

  - "Our management does not believe that placing any amount of maintenance responsibility on the user will increase availability. It will certainly complicate matters more than anything else."

  - "The user (self-maintenance) techniques are fine in reducing cost in maintenance contracts. However, availability might suffer because the user may not be trained well enough to diagnose the problem."

  - "These are the trends of the future, but, to me, it will be a bad situation. It will be easier for vendors to blame users for not properly maintaining and/or diagnosing a problem. Therefore, the vendors will likely not feel obligated to help solve the problem or to fulfill their obligations."

  - "My experience has convinced me that my shop shouldn't be given any responsibility. Even though such methods help to reduce maintenance costs, they do not necessarily help to increase availability. The reasons are: (1) our time is too valuable to waste, and (2) we don't need to complicate problems by adding another responsibility."

I. THE HEWLETT-PACKARD 99% GUARANTEED UPTIME OFFERING

- In many cases the user who has critical applications is the user who is more willing to take risks and extend himself. This willingness is one reason for the relationship between criticality of applications and willingness to do maintenance. Both require a more aggressive user management.

- Hewlett-Packard has taken an innovative approach to marketing field services. The new HP 3000 Series 44 offering guarantees 99% uptime on the processor and two system domain drives, if the user helps with the diagnostic procedures and allows remote diagnostics. If this level is not met, the user is given service credits.

- Without knowing the cost of this service, the users rated the service very attractive giving it an average rating of 6.9 on a scale of 0 to 10.

  - Non-HP users rated the offering at 7.2.

  - HP users rated it much lower at 5.2.

- The HP users rated the offering much lower than the others because they all were already experiencing 99% uptime. Consequently, the benefit offered wasn't so attractive.

- The overall rating would have been much higher if a few respondents had not given the offering low ratings (one said zero) because they needed 100% uptime. Ninety-nine percent simply wasn't good enough.

- Users were generally impressed by Hewlett-Packard's guarantee and respected the company for it. Some of their positive comments follow:

  - "It would certainly be a more solid guarantee than we are getting. We couldn't lose."

- "At least if the situation gets pretty bad there is no way the vendor can turn back."

- "When one's on-line applications are critical to the performance of the company, this alternative can provide the assurance we need."

- "I like the idea of getting service credits, but I hope the vendor can meet his commitments."

- "The fact that HP can back up such a guarantee and has the integrity to meet its promises is one point in their favor."

- "I am almost forced to have a lot of faith in a company that offers that type of guarantee because they must be pretty darn sure they can do it."

- "The HP 3000 is a user-oriented computer, and the end user needs the assurance that his system will keep running."

- Two users had diametrically opposed views on the legal aspects of the offering.

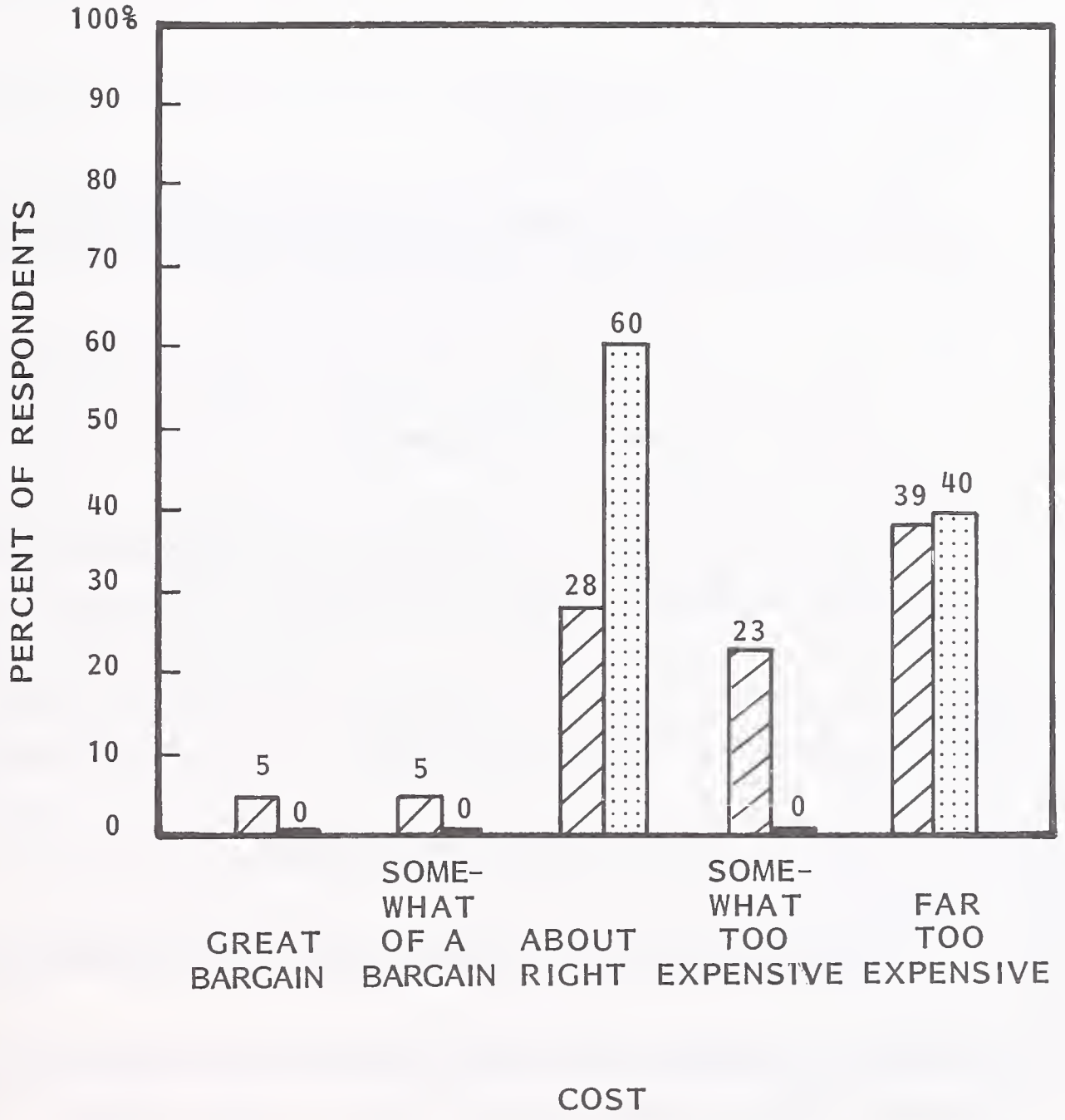
  - "The maintenance support is guaranteed. They can't back away once you have the system and contract or else they could face a serious lawsuit."

  - "The offering is really a gimmick. Most HP shops can maintain 99% uptime anyway. It is really giving HP some protection against lawsuits. With the guarantee it is more cost effective to give a month's free service than to pay for legal fees and risk exposure to bad publicity."

- When the respondents were told that the cost of the guaranteed uptime maintenance contract is 18% higher than the equivalent contract without the guarantee, 62% felt it was too expensive, as shown in Exhibit VI-2.

EXHIBIT VI-2

RESPONDENTS'* ASSESSMENT OF THE PRICE
FOR HP'S GUARANTEED UPTIME SERVICE



ALL RESPONDENTS

HP INSTALLATIONS (5)

* ONE RESPONDENT DID NOT ANSWER QUESTION

- Looked at by itself, the respondents were unable to compare on an absolute basis the cost with other standard services. The guarantee seems to be overpriced from the users' perspective.

- Typical of many of the respondents, one user stated, "It would not be cost effective based on our downtime and current maintenance cost."

- Selected comments by respondents are shown in Exhibit VI-3. Most users said it just wasn't cost effective. These comments reflect the diversity of the other responses.

2. TANDEM'S "NON-STOP" SYSTEM

- In order to increase the availability of a system, Tandem offers a system with built-in redundancy and calls it the "non-stop" system.

  - Tandem has had phenomenal success selling this system, and this success is expected to inspire imitators.

  - Users view this type of system as an effective alternative to relying on field engineers to maintain the availability of their system.

- Ninety-five percent of this study's respondents stated they believed that this type of equipment would increase reliability. Only 5% said they didn't know.

  - They felt reliability would increase by 47%.

  - They would be willing to pay 20% more for that increase in reliability.

- The Group I respondents were much more attracted to this type of equipment and were willing to pay more for it than the other groups. The following comments are fairly typical:

EXHIBIT VI-3

SELECTED COMMENTS ON THE COST OF HP's GUARANTEED UPTIME SERVICE

"It sounds like one is paying for the novelty of having the remote diagnostic capability which is still new and costly. Besides there are a lot of non-HP shops that experience that level of uptime and are paying 18-25% less than HP's proposed service."

"The premium may sound high but if you need your critical applications it seems like a fair price."

"They have no faith in their design."

"There are less expensive alternatives which will allow the shop to maintain the same level of uptime."

"We just purchased a backup to increase our uptime. It would have been more cost effective to have gone this route if NCR was offering such a guarantee."

"Way too much! We get 99.7% uptime anyway. Why pay more?"

"Considering the potential cost of downtime and the cost of maintenance contracts it is about right."

"I can get the same amount of uptime by having an on-site field engineer and pay just a little bit more than what HP is charging."

- "It would be more cost effective to buy their machine than going to a backup system."

- "I'd pay 75% more for this feature. I am proposing that my company buy a redundant system. In the long run it would be cost effective if you look at your investment in terms of an insurance policy. The difference between this increase in price and the possible cost of experiencing downtime and its consequences makes it a bargain price for an insurance policy."

- Respondents were evenly divided on their expectations about the cost of maintenance for redundant systems.

  - Forty-nine percent of them expected maintenance costs to be 23% lower.

  - Fifty-one percent expected maintenance costs to be 19% higher.

- Respondents who expected higher maintenance costs cited more hardware and more complexity as the reason.

- Respondents who expected lower costs did so because they felt the equipment could be serviced by the vendor at his convenience.

- Two respondents had Tandem equipment installed, and they had similar feelings about the equipment and its field service support.

  - Both stated that they had experienced 100% reliability.

  - Both complained about the low quality of field services provided by Tandem.

    . The users were located in a downtown metropolitan area, and the nearest field service office was located in a distant suburb.

- In the view of users interviewed, the incredible growth rate Tandem is experiencing has seriously impacted its ability to maintain an adequate staff of FEs to maintain the equipment.

- One of the users who complained about the poor service and the limited capacity of the machine had a number of new Tandem systems on order, so the dissatisfaction was overcome by the strength of the basic product.

B. SOFTWARE

- A majority of the respondents feel that field engineers should not be more involved in the maintenance of systems software, as shown in Exhibit VI-4.

  - Typically, the respondents feel that the two maintenance functions were too much to expect one person to handle.

  - Many users feel that FEs had enough problems dealing with hardware maintenance to preclude their involvement with system software.

- More than one-third of the respondents said the FE should be more involved in system software maintenance.

  - Considering that most users feel that FEs are already overextended in addressing their responsibilities, this was a very positive response.

  - Most of the reasons given for greater involvement were quite constructive.

  - Even three of the respondents who said "no" to greater involvement also stated that it would help if the field engineer was more familiar with systems software.

EXHIBIT VI-4

RESPONDENTS' ATTITUDES TOWARD FIELD ENGINEERS BEING MORE INVOLVED IN MAINTAINING SYSTEMS SOFTWARE

ATTITUDE	REASON	NUMBER OF RESPONDENTS
POSITIVE	THEY WILL BE ABLE TO SOLVE PROBLEMS MORE QUICKLY	7
	IT WILL END FINGER POINTING	4
	HARDWARE AND SOFTWARE PROBLEMS ARE CLOSELY RELATED	2
	THEY WILL APPRECIATE CRITICAL APPLICATIONS MORE	1
	THEY'LL HAVE TOTAL RESPONSIBILITY IN PROBLEM RECOGNITION	1
	THEY COULD COORDINATE RESOLUTION OF PROBLEMS BETTER	1
	TOTAL	16
NEGATIVE	IT'S TOO MUCH RESPONSIBILITY FOR ONE PERSON	9
	THE JOBS ARE TOO DIFFERENT AND THE AREA COVERED TOO BROAD	8
	NO REASON STATED	6
	IT JUST DOES NOT WORK	3
	THE TYPICAL FIELD ENGINEER ISN'T SMART ENOUGH TO WORK ON SOFTWARE	2
	TOTAL	28

- INPUT recommends that field engineers should receive more training and responsibility for maintaining systems software, at least to the point of problem identification.

  - This training should focus more on diagnosing problems than on fixing them.

  - The vendor's users should be sold on the idea that this will not detract from the FEs' performing their primary hardware responsibility but will enhance it.

- Ninety-five percent of the respondents said field engineers should not be involved in the maintenance of applications software.

  - Most of the users feel it is too unrelated to maintaining hardware and, in addition, unnecessary.

  - One respondent stated that, "It is like asking if an airline stewardess should be involved in repairing the jet engine of a Boeing 747."

  - The two users who feel that FEs should be more involved in the maintenance of applications software are concerned about CAD/CAM turnkey systems where there is a much closer tie than usual between hardware and applications software.

- Vendors should only involve their FEs in applications software if the software and hardware have a strong and necessary interdependence as in certain turnkey systems.

C. EDP MANAGERS' RECOMMENDATIONS TO FIELD SERVICE MANAGEMENT

- The managers surveyed in this study recommended a number of actions that field services management should take in order to improve its level of maintenance, as shown in Exhibit VI-5.

- More than half the users feel that the vendors should focus on improving the qualifications of their field personnel. One user summed up the attitude of many others by stating the following:

  - "Vendors should improve the selection and training of FE personnel. They should also provide them with incentives to reduce their turnover rates. I would be willing to pay a 15% to 45% higher fee for my maintenance contract to see this occur."

  - Some respondents indicated they wouldn't pay more for this because they felt they were already paying for it.

- The second most frequently sought improvement was in the availability of spare parts.

  - Respondents are particularly frustrated by this problem. They are relatively sympathetic about the personnel problem since they could identify with it. But they feel that there are no acceptable excuses for failing to have the parts to repair a machine.

  - The strongest statement made on this issue was, "I want total spare parts coverage. I would pay double for my maintenance contract if a faulty part could be replaced immediately by the vendor."

EXHIBIT VI-5

EDP MANAGERS' RECOMMENDATIONS TO FIELD ENGINEERING MANAGEMENT ON IMPROVEMENTS THEY WOULD LIKE TO SEE IN MAINTENANCE SERVICES

PRIORITY	RECOMMENDATIONS	NUMBER OF RESPONDENTS BY GROUP			
		I	II	III	ALL
1	IMPROVE TRAINING GIVEN TO FIELD ENGINEERS	6	4	4	14
2	INCREASE AVAILABILITY OF SPARE PARTS	2	1	4	7
3	RECRUIT MORE QUALIFIED/COMPETENT FIELD ENGINEERS	4	1	0	5
4	IMPROVE COMMUNICATIONS BETWEEN FIELD ENGINEERS AND CUSTOMERS	2	2	1	5
5	DEVELOP BETTER DIAGNOSTIC TOOLS AND METHODS	4	0	1	5
6	REDUCE TURNOVER RATE OF FIELD ENGINEERS	3	1	0	4
7	PERFORM BETTER PREVENTIVE MAINTENANCE	1	0	1	2
8	PROVIDE FINANCIAL INCENTIVES TO FIELD ENGINEERS	1	0	1	2
9	GIVE CUSTOMERS MORE INFORMATION ABOUT PROBLEMS AND REPAIRS ON EQUIPMENT	1	0	0	1

EXHIBIT VI-5 (CONT.)

EDP MANAGERS' RECOMMENDATIONS TO FIELD ENGINEERING MANAGEMENT
ON IMPROVEMENTS THEY WOULD LIKE TO SEE IN MAINTENANCE SERVICES

PRI-ORITY	RECOMMENDATIONS	NUMBER OF RESPONDENTS BY GROUPS			
		I	II	III	ALL
10	EXPAND SPECIALIZATION OF FIELD ENGINEERS TO IMPROVE EFFICIENCY	1	0	0	1
11	IMPROVE QUALITY CONTROL OF SPARE PARTS	1	0	0	1
12	FIELD ENGINEERING MANAGEMENT SHOULD BE MORE INVOLVED IN CUSTOMER ENVIRONMENT	1	0	0	1
13	IMPROVE RESPONSE TIME	1	0	0	1
14	ALLOW CUSTOMERS TO PARTICIPATE MORE IN MAINTENANCE PROCEDURES	0	1	0	1
15	ANTICIPATE PROBLEMS BEFORE THEY OCCUR	0	0	1	1
16	ENCOURAGE FIELD ENGINEERS TO UNDERSTAND THE CRITICALITY OF CUSTOMER APPLICATIONS	0	0	1	1
17	IMPROVE DESIGN OF CABINETS AND ACCESSIBILITY OF MODULES TO MAKE CUSTOMER PREVENTIVE MAINTENANCE EASIER	0	0	1	1

- Problems involving poor communications between the user and field engineering were frequently cited. User comments were particularly revealing on this subject, so a number of them are provided here:

  - "Vendors should structure a better interface between customer services and users. The better communications are between the two, the quicker the problem is solved."

  - "We're very pleased with our current vendor. Good communications are a key element in our relationship."

  - "We'd like our vendors to provide us with more information on the history of the maintenance of our equipment."

  - "Field services should develop better rapport with their clients. There is not enough face-to-face communication with the user."

  - "Field engineers in general fail to understand the importance and criticality of a piece of equipment and the relationship it has with our critical application. As a result, they don't seem to care."

  - "Field engineers should be given some training and exposure to the industries they will be working in. It would give them a chance to understand the criticality of the user applications they will be working with."

  - "Our FEs are unable to appreciate the criticality of our applications and, therefore, go through the motions without trying to improve their rapport with us. A result of this lack of communication is a lot of problems remain unsolved."

- Users also believe that diagnostic tools and methodology should be improved. One stated, "Vendors should develop more efficient diagnostic procedures. There seems to be no methodology in diagnostics. As a result, a great amount of time is wasted."

- High turnover among FEs is seen as a problem. One user suggested that, "Vendors increase FEs' salary scales. They are highly underpaid for a highly skilled and technical field. This will consequently reduce high turnover rates of personnel."

- In addition to asking the users what improvements vendors could make to field service, they were also asked what it was worth to them. They were asked to quantify the value of the improvements in terms of how much more they would pay to see them occur.

  - Thirty-four percent of the respondents either could not quantify it or would not comment.

  - Forty-five percent of the respondents said they would not pay more because they felt they were already paying for it.

- Users were obviously reluctant to say they would pay more because they were aware many of their vendors would be reading their responses in this report.

- Twenty percent of the users said they would pay an average of 25% more for their maintenance contract if their suggestions were implemented.

  - Seventy-eight percent of these users were among the Group I companies with very critical applications.

  - All of the respondents willing to pay more suggested improvements addressing personnel.

    . Improve qualifications.

  - Improve training.
  - Increase FE compensation.
  - Reduce turnover.

- The Group I companies offered 40% more suggestions per company than did the Group II and III companies.
  - The latter groups are relatively satisfied with their maintenance.
  - Some of the former had veritable shopping lists of things to do to improve services.
- INPUT estimates that the Group I companies were experiencing, on average, 99% or better uptime.
  - These users indicated that they would pay an additional 25% for field services in return for the additional 1% of uptime required for a perfect performance.
  - Vendors should devise strategies which will enable their customers to approach this goal.
- Advanced computer design will be required to satisfy the ever increasing critical needs of EDP users. Equally advanced field service techniques will also be essential.
- In conclusion, the levels of equipment reliability and service performance demanded by users will increase as applications become more critical.
  - The tools to meet the user demands will be available.

- Successful vendors will capitalize on these tools by offering products and services more tailored to the higher emerging user requirements.

- It is essential that vendors be aware of which environments are performance sensitive, and which are price sensitive; a strategy for one environment often will not be appropriate in the other.

APPENDIX A: SUPPORTING CHARTS

EXHIBIT A-1

MAINFRAME USED BY RESPONDENTS

MAINFRAME	GROUP			
	I	II	III	ALL
IBM	8	1	4	13
BURROUGHS	3	3	1	7
HP	0	2	3	5
DEC	3	0	2	5
NCR	2	3	0	5
UNIVAC	2	0	4	6
OTHER (CDC, ITEL, TANDEM)	2	0	1	3
TOTAL	20	9	15	44

EXHIBIT A-2

PROFILE OF RESPONDENT COMPANIES
BY INDUSTRY SECTOR

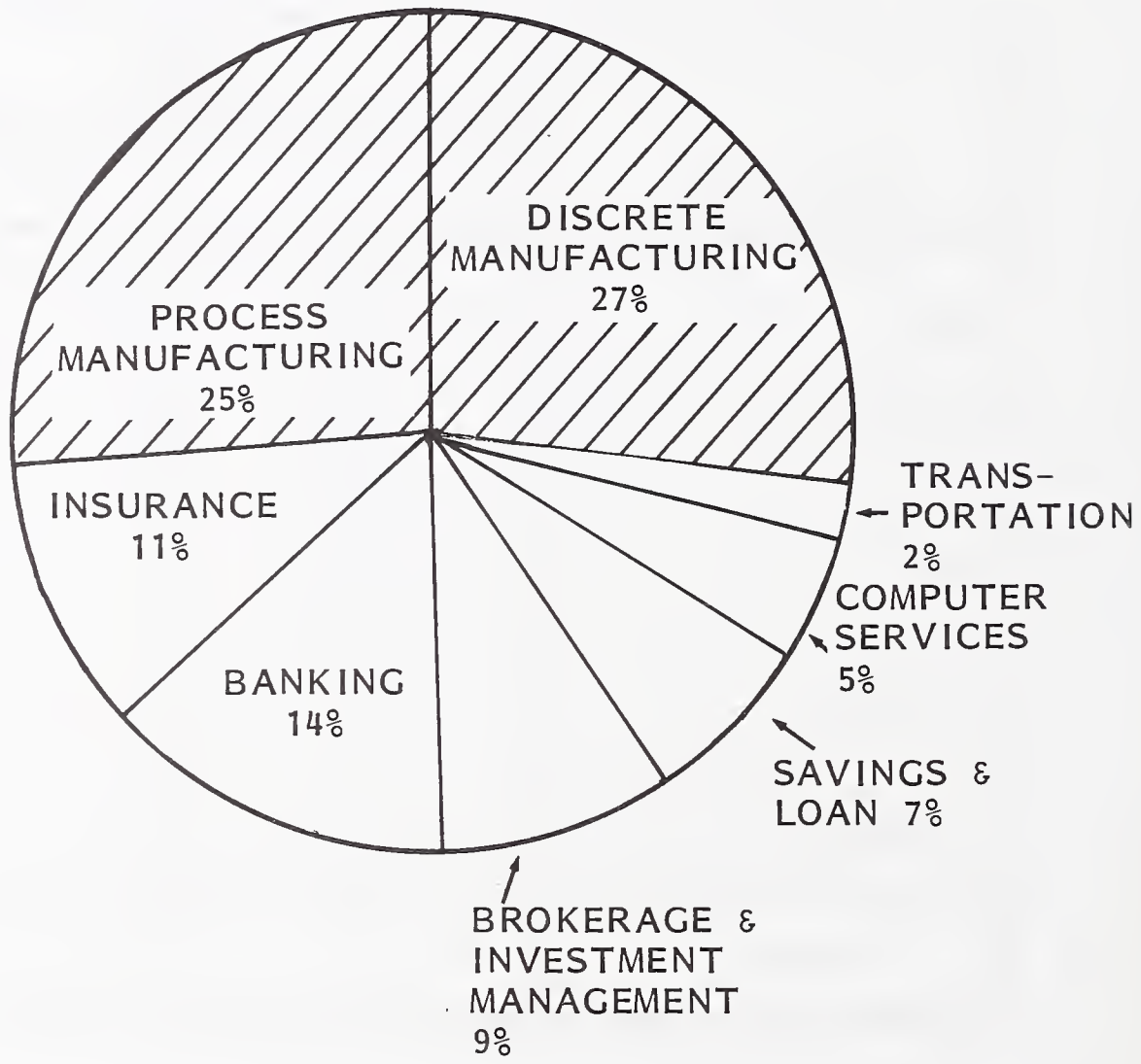


EXHIBIT A-3

AVERAGE NUMBER OF EMPLOYEES PER
RESPONDENT COMPANY BY GROUP

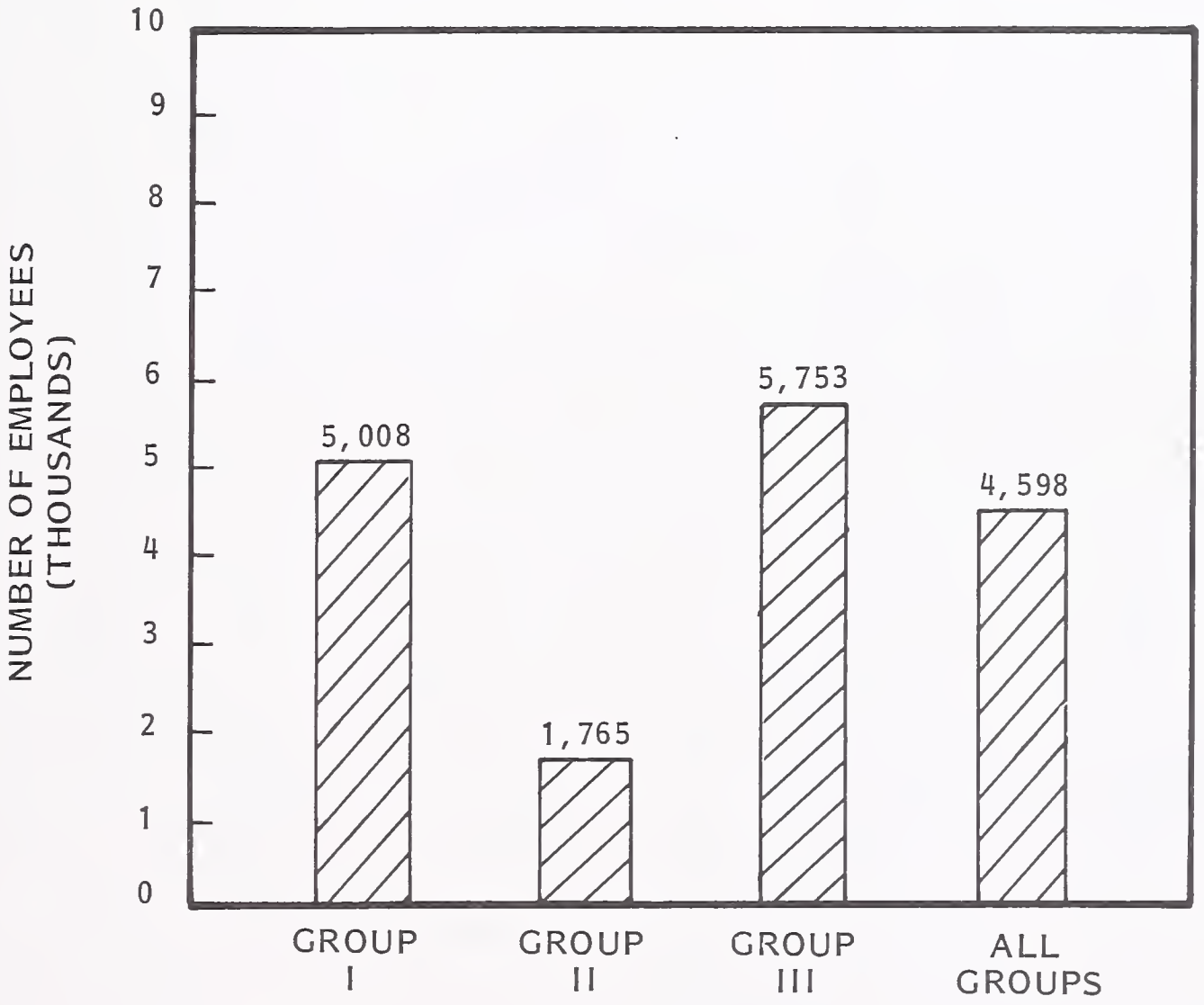
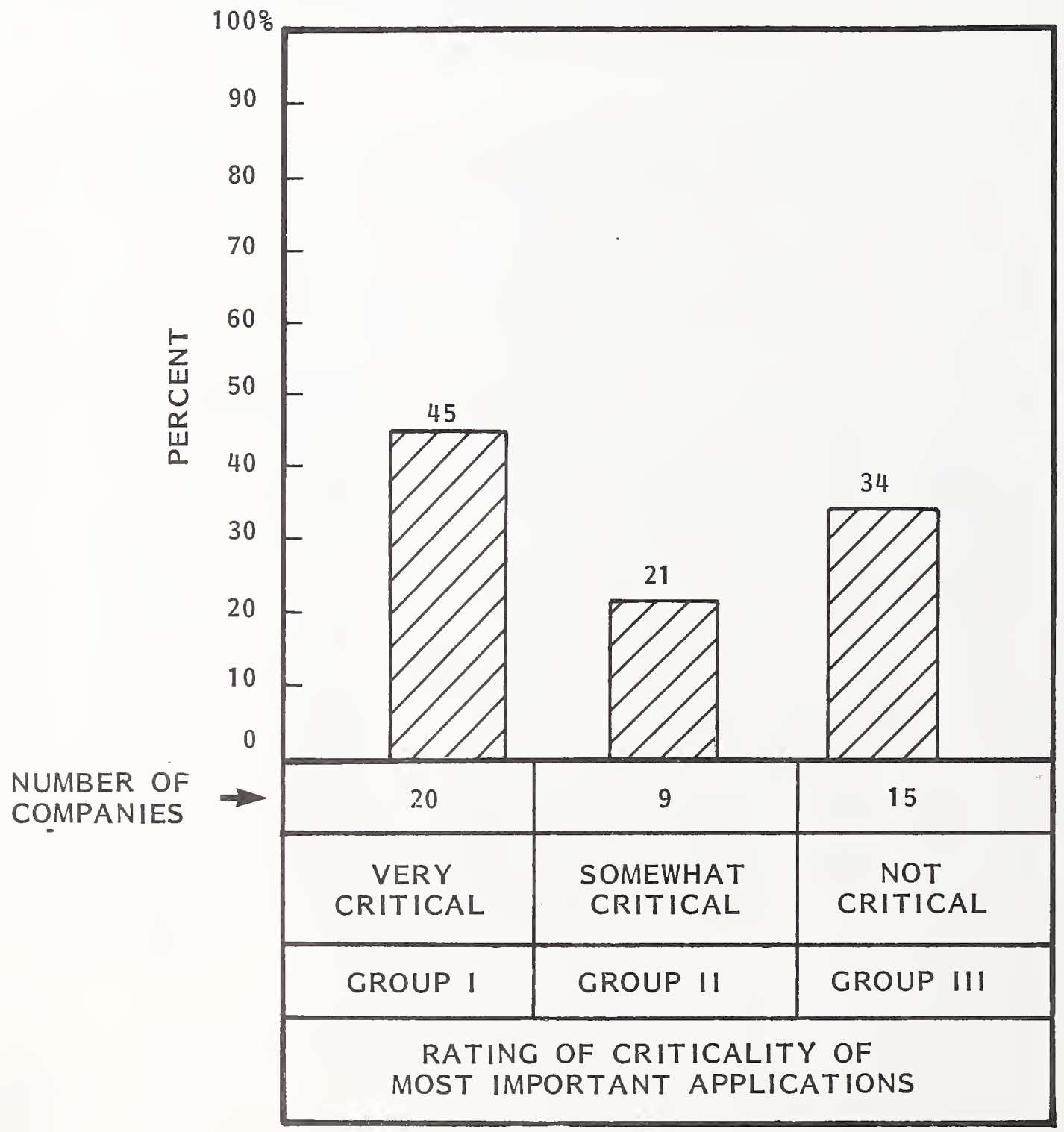


EXHIBIT A-4

PROPORTION OF RESPONDENT COMPANIES
IN EACH GROUP



APPENDIX B: QUESTIONNAIRE

The purpose of this study is to determine how system reliability and field engineering services can be improved for critical user applications.

1. What is your most critical application?

_____

_____

a. Why?

_____

_____

b. How essential to the availability of this application are the following? (Scale 0 - 10, 0 - low, 10 - high)

CPU	_____
Disk Drives	_____
Tape Drives	_____
Printers	_____
Terminals	_____
Communications	_____
Input devices (OCR, keypunch, micre)	_____
Other (specify) _____	_____

2. What is your second most critical application?

_____

_____

a. Why?

_____

_____

_____

b. How essential to the availability of this application are the following?

CPU	_____
Disk drives	_____
Tape drives	_____
Printers	_____
Terminals	_____
Communications	_____
Input devices (OCR, keypunch, micre)	_____
Other (specify) _____	_____

3. What are your monthly (or annual) expenditures for each application?

	Application 1	Application 2
Hardware	_____	_____
Software	_____	_____
Personnel	_____	_____
Maintenance	_____	_____
TOTAL	_____	_____

4. If the applicaton goes down, what is the cost to your company in profits and revenues?

	Application 1	Application 2
Revenue cost*	_____	_____
Profit cost*	_____	_____

*per _____hour _____day _____month

a. Are there costs other than financial associated with these applications downtime?

_____

_____

_____

5. How many shifts and days do these applications run?

Application 1	_____shifts/day	_____days/week
Application 2	_____shifts/day	_____days/week

a. How many shifts and days do you have maintenance coverage for these applications?

Application 1	_____shifts/day	_____days/week
Application 2	_____shifts/day	_____days/week

b. Do you have less coverage on your less critical applications?

Yes _____

No _____

6. What percentage of your current DP budget is spent on maintenance?

_____%

7. In the procurement of your current equipment, how important was the quality of maintenance (compared to other factors)? How important will the quality be on future procurements? (Scale 0 - 10; 0 = no significance, 10 - most significant)

	PAST	FUTURE
Mainframes	_____	_____
Peripherals (Disk, tape, printers, etc.)	_____	_____
Terminals	_____	_____
System Software	_____	_____
Application Software	_____	_____
Small business computers	_____	_____
Minicomputers	_____	_____
Word processors	_____	_____

a. General comments, especially on 0 or 10 ratings.

_____

_____

_____

8. Once installed, how would you rate the cost of your maintenance service?

	Bargain Price	Fair Price	Excessive Price
Mainframes	_____	_____	_____
Peripherals	_____	_____	_____
Terminals	_____	_____	_____
System Software	_____	_____	_____
Application Software	_____	_____	_____
Small business computers	_____	_____	_____
Minicomputers	_____	_____	_____
Word processors	_____	_____	_____

9. How satisfied have you been with the maintenance of yours:

(Scale 0 - 10; 0 = low, 10 = high)

	Primary Vendor	Rating
Mainframes		
Peripherals		
Terminals		
System Software		
Applications Software		
Small business computers		
Minicomputers		
Word processors		

10. Vendors are attempting to increase system availability and reduce maintenance costs through new maintenance techniques. Please rate their effectiveness in increasing availability and reducing cost.

(Scale 0 - 10; 0 = not effective, 10 = very effective)

	Increased Availability	Reduced cost
a. Vendor Responsibility		
Vendor remote diagnostics		
Vendor support centers		
Vendor locally stored spares		
Vendor on-site stored spares		
Vendor fault and fix data base		
Vendor expanded preventative maintenance		
Vendor on-site field engineer		
Vendor better trained field engineer		

i. Describe 0 ratings: _____

_____

ii. Describe 10 ratings: _____

_____

	Increased Availability	Reduced cost
b. User Responsibility		
User diagnostic tools		
User module swapping		
User sending modules to depot		

i. Describe 0 ratings: _____

_____

ii. Describe 10 ratings: _____

_____

11. What percentage of your EDP equipment is located at remote sites?

_____%

a. Compared with central site maintenance, of what quality is maintenance at remote sites?
(Scale 0-10; 0 - very poor, 5 - same, 10 - much better)

Rating: _____

b. Compared to central site maintenance, does remote site maintenance cost:

Much less _____

Somewhat less _____

Same _____

Somewhat more _____

Much more _____

c. Describe extreme ratings on A and/or B.

_____

_____

_____

_____

12. Have you replaced any equipment due to poor maintenance?

Yes _____ No _____

a. If yes, what was the problem? _____

_____

_____

b. What type of equipment? Who was the manufacturer?

_____

_____

_____

_____

c. What did you replace it with and why? _____

_____

_____

d. Has this experience changed your method of evaluating new vendors and/or equipment?

Yes _____ No _____

How? _____

_____

_____

13. IBM has unbundled customer engineering services for the 4341. Has this increased the cost of maintenace?

Very much _____

Somewhat _____

About the same _____

No, lower _____

No, much lower _____

14. With new maintenance techniques and better hardware, vendors have begun to guarantee minimum levels of system availability. The new Hewlett-Packard HP 3000 Series 44 offering guarantees 99% uptime on the processor and two system domain drives, if the user helps with the diagnostic procedures and allows remote diagnostics. If this level is not met, the user is given service credits.

a. How attractive is this type of offering to you? (Scale 0 - 10; 0 = no attraction, 10 = very attractive)

Rating: _____

Why? _____

_____

b. The cost of this guaranteed-uptime maintenance contract is 18% higher than the equivalent contract without the guarantee. At this price, is the guarantee:

A great bargain _____

Somewhat of a bargain _____

About right _____

Somewhat too expensive _____

Far too expensive _____

Why? _____

_____

15. Vendors have also tried building redundancy into their hardware to increase reliability. Tandem's "non-stop" systems is an example.

a. Do you believe such redundancy increases reliability? Yes _____ No _____

b. How much? _____%

c. In purchasing equipment, how much would this feature be worth as an increase in purchase price? _____%

d. Why? _____

_____

_____

e. Would you expect maintenance costs to be lower for redundent equipment?

Yes _____ No _____

If yes, how much lower? _____%

If no, how much higher? _____%

16. What could a vendor do to improve its current level of maintenance? What would it be worth to you to see these occur?

		Value
a.	_____	_____
	_____	_____
	_____	
b.	_____	_____
	_____	_____
	_____	

17. Should field engineers who maintain hardware be more involved in maintaining:

Systems Software? Yes _____ Why? _____

No _____ _____

_____

Applications Software? Yes _____ Why? _____

No _____ _____

_____

USERS' PERCEPTIONS OF CRITICAL MAINTENANCE

ABSTRACT

The relationship between the presence of critical EDP applications in a user's facility, and that user's perception of the importance of maintenance is the focus of this study. In-depth interviews of users reveal a definite relationship, with users with critical applications paying more for maintenance, willing to pay even more, and likely to replace equipment if maintenance falls below competitive levels. Users without critical applications are much more price sensitive with regard to maintenance.

99

Recent vendor activities, particularly Hewlett-Packard's 100% uptime guarantee, are evaluated. Recommendations for vendors to capitalize on the growing emergence of critical applications are presented.

F-UAM-84
June 1981

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