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PERSONAL COMPUTER/WORKSTATION USER REQUIREMENTS

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Customer Service Program (CSP)

***Personal Computer/Workstation
User Requirements***

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Abstract

This report analyzes the service and support requirements of users of the following PCs/workstations: Altos, Apollo, Apple, Compaq, IBM, Sun, and Tandy. Each individual user group is analyzed separately, and the entire PC/workstation user sample is analyzed as a group in order to provide an industry standard.

Each individual vendor analysis begins with a discussion of the factors most important to users in choosing a service vendor and typical service contract coverage reported by the users. Next, user requirements for and satisfaction with system availability, response time, and repair time are analyzed in-depth, comparing 1989 satisfaction levels with the third-party maintenance findings and the large and midrange systems findings. An analysis of user satisfaction in the pre- and post-sales support areas of hardware maintenance, software support, and ancillary service (preinstallation planning, consulting, installation, network design, and maintenance related user training) follows. A discussion of users' experiences with and contacts by third-party maintenance, including reasons why they stay with the current service vendor, is also included. Each analysis concludes with a summary of strengths and weaknesses as reported by the users, as well as service opportunities requested by the users.

The report is broken into five chapters. Chapter I provides an introduction to the report. Chapter II is an executive overview that summarizes the key findings of the study. Chapter III provides an analysis of PC/workstation user service requirements of all vendors and provides an industry standard for comparing individual vendor performance. Chapter IV contains individual vendor performance analyses, measuring each vendor's performance with respect to its own users' requirements. Chapter V provides tables contrasting the responses of the user sample broken down by the type of service provider; manufacturer, dealer, or third-party maintainer.

Appendixes at the end of the report provide a copy of the questionnaire used in the data collection, as well as a list of definitions of terms used in this report.

The report contains 162 pages, including 154 exhibits.

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I

Introduction

I

Introduction

Personal Computer/Workstation User Requirements is one of three reports for clients of the PC/workstation module of INPUT's 1989 Customer Service Program. A second report, *Service Vendor Analysis—PCs/ Workstations*, provides analysis of the service operations of leading PC/ workstation service vendors. *U.S. Customer Service Market,* the third report, will provide both current market sizing and five-year forecasts for the entire service market as well as detail on the PC/workstation service market.

A

Scope

This report analyzes the service requirements of users of the following PCs/workstations: Altos, Apollo, Apple, Compaq, IBM, Sun, and Tandy. Exhibit I-1 provides a breakdown of the sample by equipment vendor and service provider.

Each vendor/product analysis begins with a discussion of the vendor selection criteria and the typical service contract coverage reported by that sample's respondents. User requirements for and satisfaction with traditional service measurements of system availability, response time, and repair time (including depot service) are analyzed, followed by an analysis of user requirements for and satisfaction with support areas such as hardware maintenance, software support, and ancillary service (preinstallation planning, consulting, installation, network design, and maintenance-related user training). Next, user contacts with third-party maintenance (TPM) vendors and user willingness to change to TPMs based on discounts is discussed. Each analysis concludes with a discussion of major user major service concerns and additional service requirements.

The report contains five chapters. Chapter I provides an introduction to the report. Chapter II is the Executive Overview, which summarizes key findings of the report. Chapter III is the analysis of PC/workstation user service requirements versus services delivered for the sample as a whole, providing a standard by which individual vendors may be examined.

EXHIBIT I-1

PC/Workstation Sample— Number of Respondents Using Selected Service Providers

Manufacturer	Manufacturer-Provided	Dealer-Provided	TPM-Provided	Total
Altos	1	4	20	25
Apple	1	13	7	21
Apollo	16	1	8	25
Compaq	0	7	17	25
IBM	10	6	10	25
Sun	21	2	2	25
Tandy	19	7	6	32
Total	68	40	70	178

Chapter IV contains the individual analyses by vendor, which measure user service requirements versus service delivered particular to that vendor sample. Chapter V contains PC/workstation summary data by the type of vendor providing service. Appendixes at the end of the report provide the questionnaire used in data collection and a list of definitions used in the report.

B
Methodology

INPUT surveyed 178 users of personal computers (PCs) and workstations to determine their requirements for and satisfaction with the service maintenance they received. Each of these interviews (using the questionnaire contained in Appendix A) was conducted by telephone, each lasting approximately 30 minutes. The appropriate information systems executive was targeted at each company. Companies from a wide range of industries were surveyed, as shown in Exhibit I-2.

INPUT emphasizes the value of telephone surveys over other types of information-gathering practices (i.e., mail surveys, focus group research) because of the ability of phone surveys to control the sample size, source of information, and the ability to probe for more complete answers.

EXHIBIT I-2

Industries Represented in Sample

Industry	Vendors							
	Altos	Apollo	Apple	Compaq	IBM	Sun	Tandy	Total
Discrete Manufacturing	5	10	7	7	4	3	12	48
Process Manufacturing	3	1	3	3	6	1	5	22
Retail Distribution	2	-	-	1	-	-	-	3
Wholesale Distribution	2	1	1	3	4	-	4	15
Banking/Finance	1	-	4	2	1	-	1	9
Insurance	-	-	-	1	2	-	1	4
Transportation	-	-	-	-	1	-	1	2
Telecommunications	-	-	-	-	1	1	-	2
Medical	1	2	1	-	-	2	1	7
Education	-	5	2	-	3	13	-	23
State/Local Government	-	-	-	-	1	-	3	4
Federal Government	3	1	2	1	-	1	-	8
Utilities	1	-	-	1	-	-	-	2
Services	6	5	1	4	1	4	3	24
Other	1	-	-	1	2	-	1	5
Total	25	25	21	21	26	25	32	178

After the information-gathering process is complete, the survey data is subjected to quality control prior to data entry. Survey results are entered into a dBASE III Plus (Ashton Tate Corporation) data base, where additional quality control is applied and analyzed using ABstat (Anderson Bell). The calculations for percent of respondents satisfied are performed. INPUT calculates percent satisfied by examining and evaluating the user requirement versus the service received. During the final statistical data analysis, additional quality control tests are performed to ensure data integrity.

II

Executive Overview

II

Executive Overview

This chapter is provided as a convenient summary of the main issues of the report. It is presented in a format that facilitates its use as a short presentation, with each exhibit accompanied by text that details the key findings of the study.

In 1989, INPUT surveyed 178 personal computer/workstation users concerning their attitudes toward, and satisfaction with, the service and support they received from their service vendor. The following brands are represented in the personal computer/workstation sample: Altos, Apple, Apollo, Compaq, IBM, Sun, and Tandy.

INPUT has been tracking the service and support requirement and satisfaction level of the computer maintenance market since 1983. During this period, INPUT has seen opposing pressures of increased demand for service quality and competitive prices between manufacturer-provided service and third-party maintenance providers. As a result, service vendors have become competitive not only in the pricing of the services, but the services offered and the quality of those services.

It is important to note that only a small percent of the personal computer/workstation users have maintenance contracts of any type. For example, during the course of this study, INPUT found that only 40% of the PC/workstation users contacted had service contracts. This study focuses only on users with service contracts.

To aid in market expansion and penetration, service vendors have had to look for new service opportunities. These new opportunities have served to expand the definition of service beyond the traditional hardware maintenance areas into support areas such as consulting, preinstallation planning, installation/deinstallation of equipment, and network design.

A

Service Issues Outweigh Price

In the past, INPUT has watched the market fluctuate between service quality and price as being the main criteria used to select service vendors. Exhibit II-1 presents a ranked list of the service vendor selection criteria as reported by the overall sample, with the mean rating in importance as reported by the sample.

EXHIBIT II-1

Service Vendor Selection Criteria

Ranking	Factor	Importance
1	Technical Expertise	8.4
2	System Availability	8.1
3	Response Time	8.0
3	Access to Spares	8.0
4	Vendor Reputation	7.5
5	Price	6.9
6	Service Quality	6.6
7	Contract Flexibility	6.5
8	Software Support	5.9
9	Ability to Service Other Products	5.4

Technical expertise and system availability ranked as the number one and two items, with response time and access to spares tying for the number three position. It appears that the service issues are outweighing the price issue, with price ranking number five. Vendor reputation completes the list of the top four items of importance to the PC/workstation sample. Ability to service other vendors' products is ranked as the least important criteria, with a rating of 5.4. This finding seems completely out of line when considering the changes announced during the past three years by the vendors to provide multivendor support for the personal computers and workstations.

B

System Interruptions

The mean system interruptions reported per machine per month (0.6) by the users is analyzed in Exhibit II-2. This number of system interruptions seems very high, but a second call was made to these users to verify accuracy. It is important to note that these are perceptions as reported by the users. Sixty-nine percent of the interruptions were reported to be caused by hardware problems. Seventeen percent of the interruptions were reported to be caused by software problems, by either systems or applications software. Environmental influences (operator error, site problems, power surges, etc.) were reported to be the causes for approximately 14% of the system interruptions.

EXHIBIT II-2

System Interruption Analysis
All Users

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.6	0.2
Hardware-Caused (Percent)	69	3.9
System Software-Caused (Percent)	11	2.6
Application Software-Caused (Percent)	6	1.8
Other-Caused (Percent)	14	2.9

C

System Availability Performance

Exhibit II-3 provides an overall look at the system availability requirements and performance of the sample. High system availability is a key requirement of personal computer users—the average requirement was 93.3% availability—but 41% of the sample required 100% system availability. Seventy-one percent of the users were satisfied with the system availability received from the service provider. On-site maintenance service, comprising 89% of the sample, reported satisfaction levels of 79% for response time and 82% for repair time. Depot maintenance was

used by only 11% of the sample, indicating a strong user preference for on-site service.

EXHIBIT II-3

System Availability Performance

Performance Criteria	Mean Ratings of Sample		Satisfaction Level (Percent)
	Required	Received	
System Availability (Percent)	93.3	95.0	71
On-Site			
Response Time (Hours)	10.3	9.4	79
Repair Time (Hours)	8.1	7.0	82
Depot Turnaround Time (Days)	3.5	3.8	65

D

Traditional Hardware Maintenance

The traditional areas of hardware maintenance are in need of some improvements, as shown in Exhibit II-4. Hotline support is the only area where the mean received rating exceeded the mean required rating, with only 69% of the users satisfied with the hotline support received. For hardware maintenance overall the mean rating required was 8.9, while the mean rating received was 8.2, with 66% of the users satisfied with the overall hardware service received.

EXHIBIT II-4

Hardware Maintenance

Service	Mean Ratings of Sample		Satisfaction Level (Percent)
	Required	Received	
Hardware Engineer Skill	8.5	7.9	64
Spare Parts	8.6	8.0	65
Hotline Support	6.4	6.5	69
Hardware Maintenance Overall	8.9	8.2	66

E

Software Support

Thirty-seven percent of the overall sample reported receiving software support from their primary personal computer/workstation service vendor. Exhibit II-5 shows that there are significant improvements required in the software support areas to meet the requirements of the users. This finding may represent a business opportunity in the area of an offering for user support answering "how-to" questions on multivendor software. The area with the highest satisfaction (70% of the sample) was operational training, where the mean rating required was 5.7 and the mean rating received was 5.5. Software documentation is an area where the users are disappointed with the support they receive. Software documentation reported a mean rating required of 8.3, a mean rating received of 6.7, with only 48% of the users satisfied with the software documentation support received.

EXHIBIT II-5

Software Support

Service	Mean Ratings of Sample		Satisfaction Level (Percent)
	Required	Received	
Software Engineer Skill	8.5	7.2	49
Software Hotline Support	7.6	6.6	52
Software Documentation	8.3	6.7	48
Operational Training	5.7	5.5	70
Software Support Overall	8.0	6.8	49

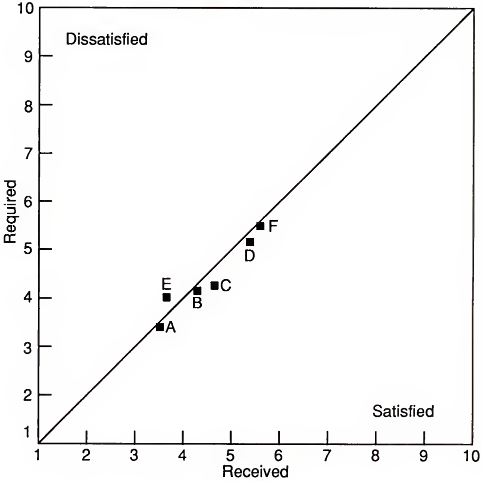
F

Ancillary Services

The overall demand for ancillary services does not appear to be great. Mean ratings, as reported by personal computer users, ranged from 3.4 (on a scale of 1 - 10) for maintenance training to 5.5 for ancillary services overall (see Exhibit II-6). The vendors, however, are doing a good job of satisfying these needs, as indicated by the percent satisfaction levels, which range from 75% to 83%.

EXHIBIT II-6

Ancillary Services
Required versus Received
All Users



Key	Service	Required Mean	Required SE	Received Mean	Received SE
A	Maintenance Training	3.4	0.3	3.5	0.4
B	Preinstallation Planning	4.1	0.3	4.2	0.4
C	Consulting	4.2	0.3	4.6	0.4
D	Install/Deinstall	5.1	0.3	5.4	0.4
E	Network Design/Planning	3.9	0.3	3.6	0.4
F	Ancillary Services Overall	5.5	0.3	5.6	0.3

G

Service Concerns

Exhibit II-7 presents the top four service concerns as reported by the overall sample. System availability ranks as the number one concern as the users see the effects of the increasing demands on PCs/workstations as this equipment becomes a critical component of the overall company information function. With the increasing importance of personal computers and workstations in supporting the information needs of the company, the availability of the equipment increases in importance. Response time has also become a critical issue—when the equipment is down for repairs, the productivity of the department suffers. Software support echoes the mean ratings for software support required, seen previously in Exhibit II-4. Users are looking to the service vendors to fill the gaps in the software vendors' support programs. Spare parts availability ties back to the need for high system availability and also relates to the increasing importance of the PC/workstation to the information processing needs of the company.

EXHIBIT II-7

Service Concerns

- System availability
- Response time
- Software support
- Spare parts availability

H

Service Opportunities

Exhibit II-8 presents the top five service opportunities, as reported by the users as additional services required. Training relates to the expanded scope of the services required from the service vendor to fill the gaps in the user's available support arena. When services are not available through other channels, the users look to the service vendors to provide these services. More users are recognizing their requirement for additional software support, creating an opportunity for the service vendor in terms of providing services to answer how-to questions. Personal computer and workstation users are beginning to recognize the advantage of

preventive maintenance that larger system users have practised for years. As the PC systems become more complex, with multiple peripherals and networks, users are requiring increased support for these multivendor, networked systems.

EXHIBIT II-8

Service Opportunities

- Training
- Software support
- Preventive maintenance
- Multivendor support
- Network support

III

Personal Computer/Workstation User Service Requirements—All Users

III

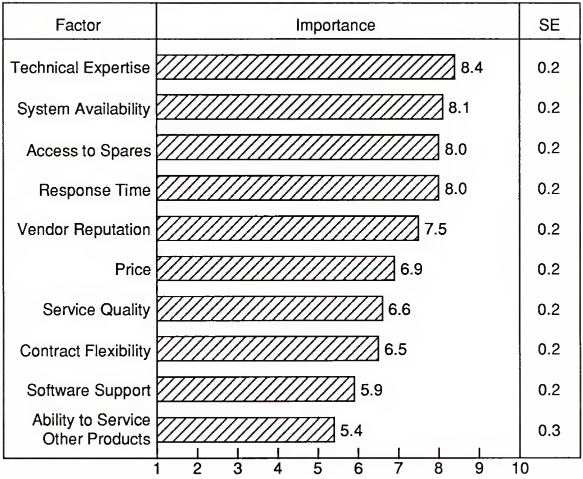
Personal Computer/Workstation User Service Requirements—All Users

In 1989, INPUT surveyed 178 personal computer/workstation users concerning their attitudes toward, and satisfaction with, the service and support they received from their service vendor. The following brands are represented in the personal computer/workstation sample: Altos, Apple, Apollo, Compaq, IBM, Sun, and Tandy. A further breakdown of the sample by vendor is found earlier in Exhibit I-1.

Exhibit III-1 presents the mean ratings of service vendor selection criteria for all users. The major items (technical expertise, system availability, response time, access to spares, and vendor reputation) relate to the quality of service provided. The service quality item itself was sixth in importance, behind price. As seen in other service reports, such as *Analysis of Third-Party Maintenance* and *Large-Systems User Requirements*, the users are placing service issues ahead of price in selecting service vendors.

EXHIBIT III-1

Service Vendor
Selection Criteria
All Users



PC/workstation service contract coverage is presented in Exhibit III-2. Because personal computers and workstations are usually operational only for the time that a user is sitting in front of them, the contract coverage reflects the dominant single-shift, Monday-through-Friday, normal working schedule.

EXHIBIT III-2

Contract Coverage
All Users

Coverage	1989 Percent of Sample
Days Covered	
Monday - Friday	76
Monday - Saturday	1
Monday - Sunday	23
Hours Covered	
1 - 9	75
10 - 16	4
17 - 24	21

Exhibit III-3 analyzes the mean system interruptions reported per month by the users. Approximately 69% of the interruptions reported were due to hardware problems, while a total of 17% were systems- or applications software-based.

EXHIBIT III-3

System Interruption Analysis
All Users

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.6	0.2
Hardware-Caused	69	3.9
System Software-Caused	11	2.6
Application Software-Caused	6	1.8
Other-Caused	14	2.9

PC/workstation users are receiving slightly greater system availability than they require, as presented in Exhibit III-4. Users required an availability of 93.3% and actually received 95.0% from their service vendors, with 71% of the users being satisfied with the availability they received, as shown in Exhibit III-5. The hotline response time averaged 3.1 hours across all users.

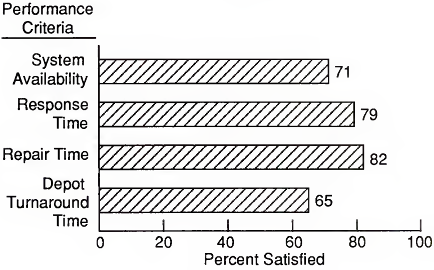
EXHIBIT III-4

System Availability Performance Analysis
All Users

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	93.3	0.6	95.0	0.5
On-Site Response Time (Hours)	10.3	0.9	9.4	1.0
On-Site Repair Time (Hours)	8.1	0.9	7.0	0.9
Depot Turnaround Time (Days)	3.5	1.2	3.8	1.3
Hotline Response Time as Part of Contract (Hours) 99 Respondents (56%)			3.1	0.6

EXHIBIT III-5

System Availability Performance Satisfaction
All Users

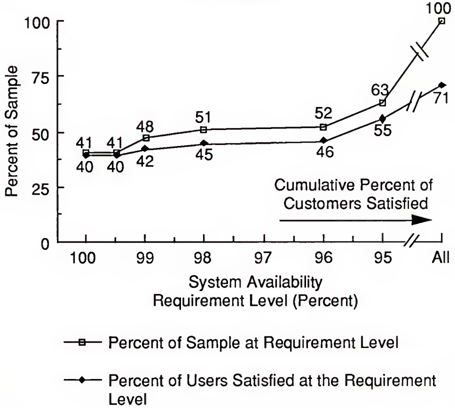


Approximately 89% of the sample received on-site service, while 11% received depot service. The vendors fared well in meeting the requirements for on-site response time and repair time. The mean depot repair time reported was slightly higher than the required time, indicating somewhat less-than-satisfactory service, but 65% of the users were satisfied with the depot repair time they received.

Exhibit III-6 shows the user system availability satisfaction at each requirement level for the overall sample. Fifty-one percent of the sample had an availability requirement of 98% or greater, while only 45% of the sample was satisfied with the availability received at the 98% level.

EXHIBIT III-6

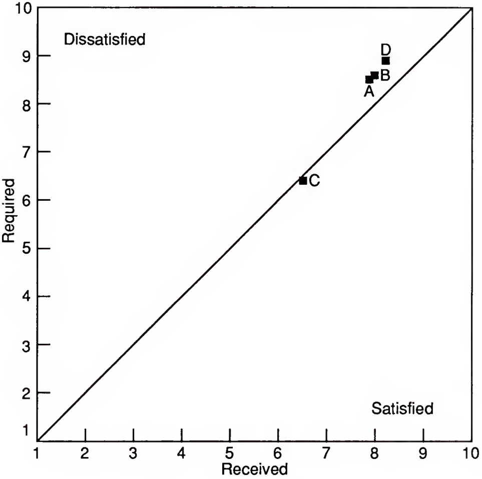
PC/Workstation System Availability Satisfaction at Each Requirement Level All Users



Exhibits III-7 and III-8 analyze required versus received service for traditional hardware maintenance items—engineer skill level, spare parts availability, hotline support, and hardware maintenance overall. As shown in Exhibit III-7, with the exception of hotline support, the mean ratings received fall short of the mean ratings required. The user satis-

EXHIBIT III-7

Hardware Maintenance Required versus Received All Users



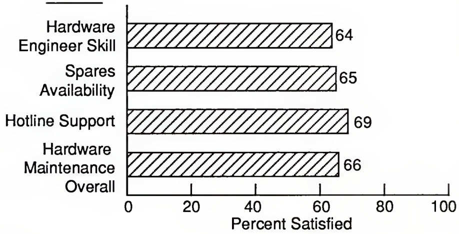
Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.5	0.1	7.9	0.1
B	Spare Parts	8.6	0.1	8.0	0.2
C	Hotline Support	6.4	0.3	6.5	0.3
D	Hardware Maintenance Overall	8.9	0.1	8.2	0.1

faction levels for these items range from 64% to 69% of users being satisfied. Clearly, there is opportunity for improvement in providing traditional hardware maintenance.

Approximately 56% of the respondents reported receiving telephone hotline response as part of their service contract. As shown in Exhibit III-8, telephone hotline support received the highest user satisfaction (69%).

EXHIBIT III-8

Hardware Maintenance Satisfaction Levels
All Users

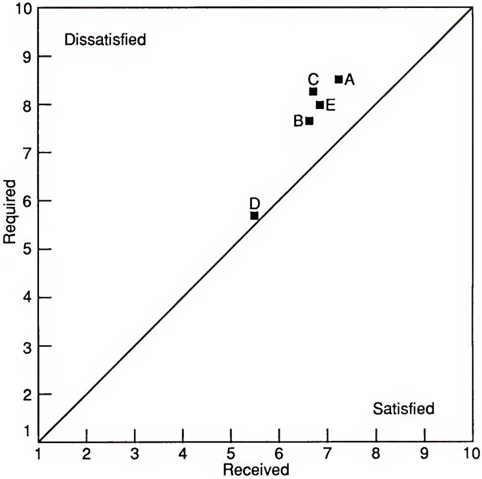


Approximately 37% of the PC/workstation sample (66 respondents) received software support from their primary service vendor. There was an average of 1.4 major problems reported by the sample and 3.7 minor problems reported per month. INPUT defined a major problem as one in which all processing is prevented and a minor problem as one that allows processing to continue with some degradation. The average turnaround time reported by the sample for problem resolution was 22.4 hours for major problems and 14.3 hours for minor problems. Exhibits III-9 and III-10 present software support required versus received and user satisfaction with software support.

The mean ratings for software support requirements ranged from 5.7 to 8.5, with all of the mean ratings received lower than those required, as shown in Exhibit III-9. Software documentation had the largest difference between the mean rating required and the mean rating received. It appears that PC/workstation users expect the support vendors to comple-

EXHIBIT III-9

Software Support
Required versus Received
All Users

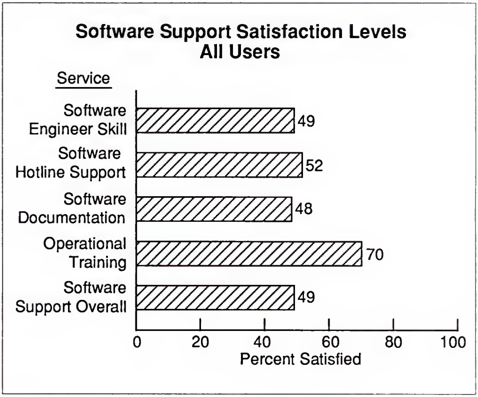


Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.5	0.3	7.2	0.3
B	Software Hotline Support	7.6	0.4	6.6	0.4
C	Software Documentation	8.3	0.2	6.7	0.3
D	Operational Training	5.7	0.5	5.5	0.5
E	Software Support Overall	8.0	0.3	6.8	0.3

ment the documentation provided with the software and fill in existing gaps. When the vendor provides software support, the user expect the vendor's engineer skill level to be competent, as shown by the mean rating of 8.5 for engineer skill required.

The services listed on Exhibit III-9 that received ratings of 7.6 or higher for services required had the lowest support satisfaction ratings in Exhibit III-10. For software operational training, the mean requirement was 5.7, with the users reporting a mean rating of 5.5 and a 70% user satisfaction level.

EXHIBIT III-10

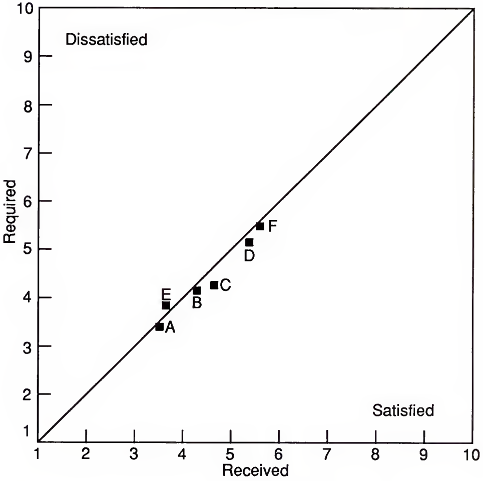


The mean ratings required for ancillary services ranged from 3.4 (maintenance training) to 5.5 (ancillary services overall), as shown in Exhibit III-11. All services except network design and planning had mean ratings received higher than the requirements. In Exhibit III-12, users reported ancillary service satisfaction levels of 75% and higher.

Forty-three percent of the sample reported receiving multivendor service on other manufacturers' peripherals, while 33% received service on other manufacturers' systems. Only 20% of the sample reported receiving service on other manufacturers' network products.

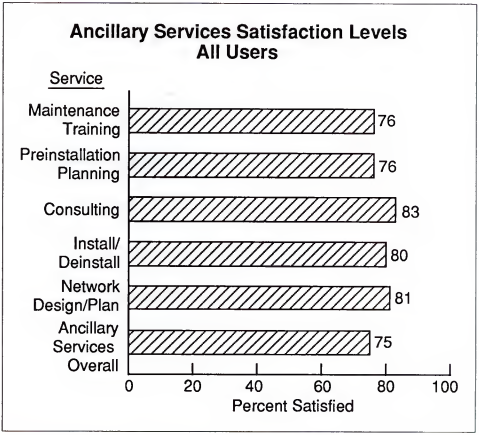
EXHIBIT III-11

Ancillary Services Required versus Received All Users



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	3.4	0.3	3.5	0.4
B	Preinstallation Planning	4.1	0.3	4.2	0.4
C	Consulting	4.2	0.3	4.6	0.4
D	Install/Deinstall	5.1	0.3	5.4	0.4
E	Network Design/Planning	3.9	0.3	3.6	0.4
F	Ancillary Services Overall	5.5	0.3	5.6	0.3

EXHIBIT III-12



Respondents were surveyed on self-maintenance activities and discounts received for the performance of these activities. Exhibit III-13 presents the responses reported by the sample. Eighty percent of the respondents reported performing their own software support, while 4% of the sample receive a discount of between 15% and 45% for doing so.

EXHIBIT III-13

Self-Maintenance Activities
All Users

Activity	Percent Performing	Percent Receiving Discount	Discount Range (Percent)
Component or Board Swap	53	14	10 - 50
Software Support	80	4	15 - 45
Operational Training	79	2	15 - 30
Installation	74	10	3 - 40

Forty-one percent of the sample receiving service through the manufacturer or dealer had been contacted by a third-party maintainer within the past 12 months. The reasons given for not switching to TPM service are presented in Exhibit III-14. Satisfaction with the current maintenance vendor was mentioned most often as a reason not to switch. Competitive pricing was mentioned second as a common reason for not switching to TPM service.

EXHIBIT III-14

Reasons for Not Switching to TPM Service—All Users

Number of Responses	Description
20	Satisfied with current vendor
7	Price
4	Would not cover specific equipment
4	Still evaluating vendors
2	Time-consuming to switch
1	Does not offer complete service options
1	Prefers manufacturer service
1	Not factory authorized
1	Spare parts
1	Long-term contract
1	Bound by leasing contract
1	Location of TPM
1	In process of switching

Exhibit III-15 examines the percent of respondents currently receiving service from the manufacturer or a dealer willing to switch to TPM service for a discount. Forty-six percent of the sample were unwilling to switch at any discount. Fifteen percent of the sample reported being willing to switch for a 21% to 30% discount on service.

EXHIBIT III-15

Willingness to Change to TPM for Discount All Users

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	11	11
11 - 20	10	10
21 - 30	15	15
31 - 40	8	8
41 - 50	3	3
50+	7	7
Unwilling at Any Discount	45	46

When users were asked to identify their most pressing service concerns, 21% of the respondents listed system availability as being the most pressing service concern. Exhibit III-16 presents the overall sample's responses ranked in order of number of mentions. Twenty percent of the respondents could not list a serious concern at the time.

EXHIBIT III-16

Most Pressing Service Concerns
All Users

Service	Rank
System Availability (37)	1
Response Time (24)	2
Software Support (14)	3
Spare Parts Availability (12)	4
Repair Time (10)	5
Price (8)	6
Multivendor Support (6)	7
Network Support (5)	8
Technical Knowledge of FE (5)	8
General Maintenance and Repair (5)	8
Replacement Equipment (4)	9
Peripheral Maintenance (4)	9
None (35)	

Note: The number of respondents listing each concern is shown in parentheses.

Additional services not currently available from the service provider but required by the users are presented in Exhibit III-17. Training and software support ranked number one and two, respectively, in the number of respondent mentions. Preventive maintenance and multivendor support tied for number three in the number of mentions. Fifty percent of the respondents could not list any service required that was not currently available from the maintenance provider.

EXHIBIT III-17

Additional Services Required
All Users

Service	Rank
Training (15)	1
Software Support (13)	2
Preventive Maintenance (8)	3
Multivendor Support (8)	3
Network Support (6)	4
On-Site Service (5)	5
Response Time (5)	5
Installations/Deinstallations/Moves (4)	6
Local Support (3)	7
Contract Flexibility (2)	8
Provide Loaner Equipment (2)	8
Trade-In Programs for Upgrades (2)	8
Round-the-Clock FE Support (2)	8
Hotline Support (2)	8
None (89)	

Note: The number of respondents listing each concern is shown in parentheses.

IV

User Performance Analyses

IV

User Performance Analyses

In this chapter, the service received by the sample for each of the top brands of personal computers and workstations is analyzed. Each analysis provides information on service contract coverage, traditional service support elements, and vendor performance. Items covered under traditional service support include system availability, response time, and repair time and user satisfaction with each element. Vendor performance items include hardware maintenance, software support, and ancillary services such as consulting, planning, installation, and network design. User requirement for and satisfaction with critical services as spare parts availability, software documentation, and network design is measured in each analysis.

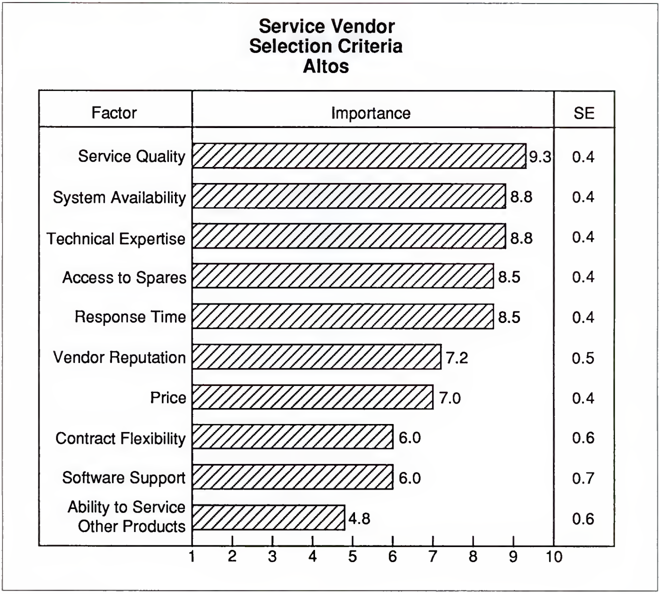
A

Altos

In 1989, INPUT surveyed 25 users of Altos workstations and personal computers. The sample included respondents from the following industries: discrete manufacturing, process manufacturing, retail distribution, wholesale distribution, banking/finance, utilities, services, federal government, health, and other specific industries. Eighty percent of the users had service contracts with third-party maintenance (TPM) providers, 16% with dealers and 4% with the manufacturer.

Exhibit IV-1 presents service vendor selection criteria for Altos users. As seen in the overall sample, service issues such as service quality, system availability, technical expertise, response time, and access to spares had the highest mean ratings, ranging from 8.5 to 9.3.

EXHIBIT IV-1



Contract coverage of the Altos sample is shown in Exhibit IV-2. The majority of the users had one-shift, five-days-per-week coverage from their service vendors.

EXHIBIT IV-2

Contract Coverage
Altos

Coverage	Percent of Sample
Days Covered	
Monday - Friday	76
Monday - Saturday	0
Monday - Sunday	24
Hours Covered	
1 - 9	72
10 - 16	4
17 - 24	24

Exhibit IV-3 analyzes system interruptions as reported by respondents. Fifty-eight percent of the system interruptions were caused by hardware problems, with 28% being caused by other environmental factors.

EXHIBIT IV-3

System Interruption Analysis
Altos

	1989	
	Mean	SE
System Interruptions per Month per Machine	1.1	0.7
Hardware-Caused (Percent)	58	13.8
System Software-Caused (Percent)	3	2.1
Application Software-Caused (Percent)	11	8.0
Other-Caused (Percent)	28	13.3

System availability performance analysis is presented in Exhibit IV-4. The mean system availability received by Altos users was greater than the mean availability required, and 70% of the users were satisfied with the availability they receive, as shown in Exhibit IV-5.

Eighty-eight percent of the Altos users reported having on-site maintenance as part of their service contract, with 12% of the sample receiving depot maintenance of the PCs/workstations.

Mean response time received was higher than mean time required, thus showing the need for some improvements in this area, even though 77% of the users were satisfied with the response time received, while only 57% of the users were satisfied with the repair time received. Depot turnaround time, with only 33% of the users satisfied, also showed the need for improvements to meet the requirements of the users.

Twenty-eight percent of the Altos users received hotline support as part of their service contract. The mean hotline time received was 1.1 hours.

EXHIBIT IV-4

System Availability Performance Analysis
Altos

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	92.6	1.9	93.4	1.7
On-Site Response Time (Hours)	7.3	2.4	7.9	10.4
On-Site Repair Time (Hours)	5.5	1.7	6.4	2.5
Depot Turnaround Time (Days)	2.1	1.5	2.7	2.2
Hotline Response Time as Part of Contract (Hours) 7 Respondents (28%)			1.1	0.3

EXHIBIT IV-5

System Availability Performance Satisfaction
Altos

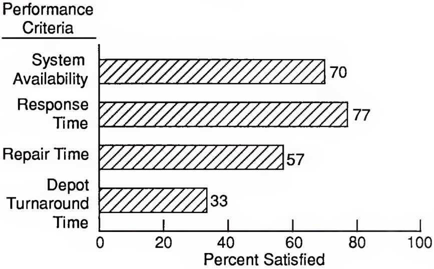
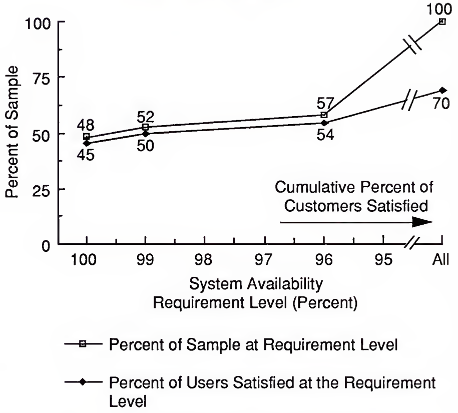


Exhibit IV-6 presents the system availability satisfaction at each requirement level for Altos users. Fifty-two percent of the Altos respondents required system availability of 99% or greater, while only 50% received it.

EXHIBIT IV-6

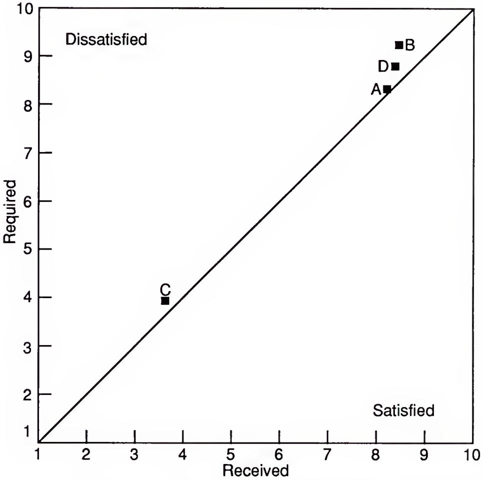
PC/Workstation
System Availability Satisfaction at Each Requirement Level
Altos



Hardware maintenance activities are analyzed in Exhibit IV-7, and hardware maintenance satisfaction levels are presented in Exhibit IV-8. The mean ratings received were lower than the mean rating required in all of the areas examined. The widest difference between the mean required and the mean received was for spare parts. The users reported a mean requirement of 9.2, and the mean rating received was 8.4, with 63% of the users satisfied with the spare parts availability they receive. Hotline support had the lowest mean requirement, and the highest percent of users receiving the service were satisfied with the support they received.

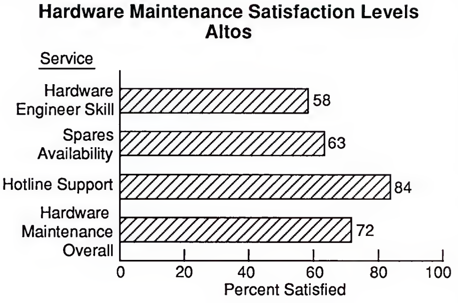
EXHIBIT IV-7

Hardware Maintenance Required versus Received Altos



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.3	0.5	8.2	0.3
B	Spare Parts	9.2	0.3	8.4	0.4
C	Hotline Support	3.9	0.9	3.6	0.9
D	Hardware Maintenance Overall	8.8	0.3	8.3	0.4

EXHIBIT IV-8

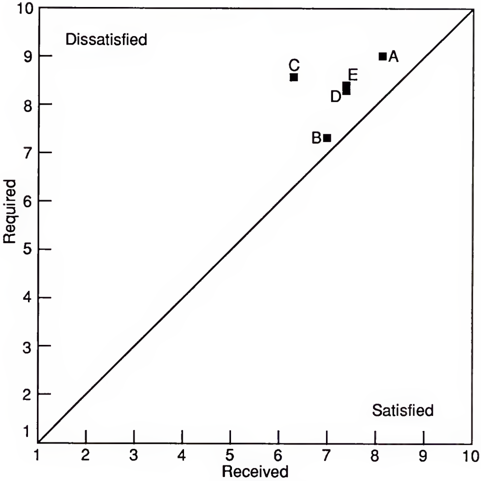


Seven of the 25 respondents (28%) in the Altos sample received software support as part of their service contracts. Users reported an average of less than one major software problem per month and an average of more than six minor problems per month. Average turnaround time for major software problems was 20 hours and almost 16 for minor problems.

Exhibits IV-9 and IV-10 analyze the support required versus received and user satisfaction with the support received. With 57% of the users satisfied with the support received, there appears to be improvement needed in software support. The mean requirements for the users that received software support ranged from 7.3 for software hotline support to 9.0 for software engineer skill level.

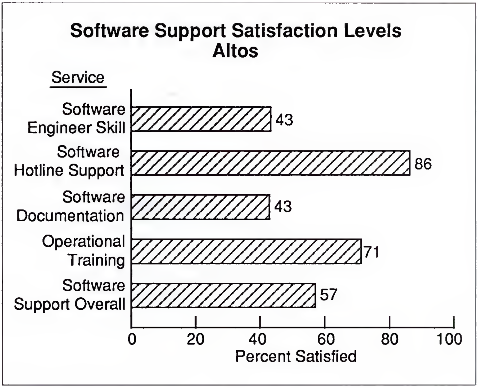
EXHIBIT IV-9

Software Support
Required versus Received
Altos



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	9.0	0.4	8.1	0.6
B	Software Hotline Support	7.3	1.2	7.0	1.2
C	Software Documentation	8.6	0.7	6.3	1.1
D	Operational Training	8.3	0.8	7.4	1.1
E	Software Support Overall	8.4	0.8	7.4	1.1

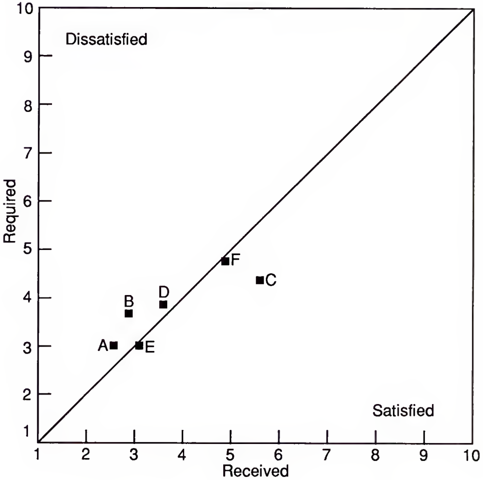
EXHIBIT IV-10



Roughly 72% of the Altos respondents received some type of ancillary services from the support service provider. Ratings for required versus received ancillary services and satisfaction levels are presented in Exhibits IV-11 and IV-12. Mean received ratings were higher than requirement ratings in the areas of consulting, network design and planning, and ancillary services overall. Even in the areas where the mean ratings showed a less than satisfactory service, more than 74% of the respondents were satisfied with the service they received.

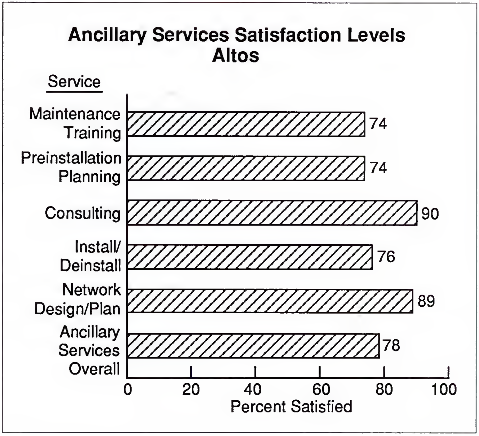
EXHIBIT IV-11

Ancillary Services
Required versus Received
Altos



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	3.0	0.6	2.6	0.5
B	Preinstallation Planning	3.7	0.7	2.9	0.7
C	Consulting	4.4	0.8	5.6	0.8
D	Install/Deinstall	3.9	0.7	3.6	0.7
E	Network Design/Planning	3.0	0.7	3.1	0.7
F	Ancillary Services Overall	4.8	0.7	4.9	0.6

EXHIBIT IV-12



Self-maintenance activities performed by the Altos sample are shown in Exhibit IV-13. Seventy-six percent of the sample reported performing their own software support. Twenty-eight percent of the sample performed component or board swaps and 14% received a discount on the service contract for doing so.

Forty percent of the Altos sample received service on other manufacturers' peripherals, 16% received service on other manufacturers' systems, and 12% received service on other manufacturers' network products as part of the service contract.

EXHIBIT IV-13

Self-Maintenance Activities
Altos

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	28	14
Software Support	76	-
Operational Training	72	-
Installation	52	-

The five respondents currently receiving service through a dealer or the manufacturer had not been contacted by a TPM over the past 12 months to entice them away from their service provider. These five respondents did show a willingness to change to TPM service for a discount off the service price. The discount levels required to interest the five users in switching service are shown in Exhibit IV-14.

EXHIBIT IV-14

Willingness to Change to TPM for Discount Altos*

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	2	40
11 - 20	-	-
21 - 30	2	40
31 - 40	1	20
41 - 50	-	-
50+	-	-
Unwilling at Any Discount	-	-

* 5 respondents

Exhibit IV-15 presents the most pressing service concerns as reported by the Altos sample. System availability was mentioned by 28% of the respondents as being the major concern. Spare parts and general maintenance ranked the second most often mentioned items by the sample.

EXHIBIT IV-15

Most Pressing Service Concerns
Altos

Number of Responses	Description
7	System availability
3	Spare parts
3	General maintenance and repair
2	Response time
2	Repair time
1	Software support
1	Network support
1	Price
1	Multivendor support
4	None

Sixty-four percent of the sample did not have any additional services that could not be provided by the service vendor. Exhibit IV-16 shows that preventive maintenance is the most mentioned item respondents give when listing additional service requirements.

EXHIBIT IV-16

Additional Services Required
Altos

Number of Responses	Description
5	Preventive maintenance
2	Software support
1	Hardware wiring
1	Custom contract
16	None

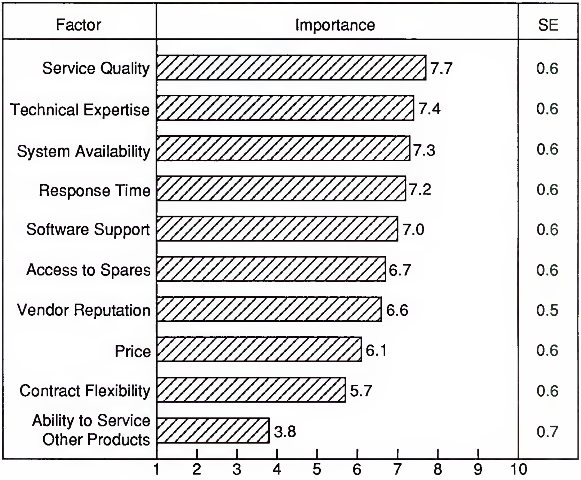
B
Apollo

The Apollo sample consisted of 25 users representing the discrete manufacturing, process manufacturing, wholesale distribution, federal government, medical, education, and services industries. Sixteen of the users had service contracts through the manufacturer, eight through a TPM, and one through a dealer.

Exhibit IV-17 presents service vendor selection criteria as reported by the Apollo sample. The top four items were service quality, technical expertise, system availability, and response time with mean ratings ranging from 7.7 to 7.2. Software support received a mean rating of 7.0, ranking as the fifth highest criteria considered important by Apollo users. This is significant because software issues had mean ratings near the bottom in all of the other PC/workstation vendors surveyed. Apollo users appear to place a greater importance on vendors being able to service the related software as well as the hardware.

EXHIBIT IV-17

Service Vendor Selection Criteria Apollo



Contract coverage of the Apollo sample is presented in Exhibit IV-18. As seen in the overall sample and the Altos sample, the majority of the users reported one-shift, five-days-per-week service coverage.

EXHIBIT IV-18

Contract Coverage
Apollo

Coverage	Percent of Sample
Days Covered	
Monday - Friday	92
Monday - Saturday	0
Monday - Sunday	8
Hours Covered	
1 - 9	88
10 - 16	4
17 - 24	8

Exhibit IV-19 presents an analysis of system interruptions for the Apollo sample. The mean number of system interruptions per month followed the pattern of the overall sample. A lower percent of interruptions were caused by hardware than in the overall sample, while a higher percent were caused by other environmental/user situations.

Seventy-six percent of the Apollo sample reported receiving telephone hotline support as part of their service contract. The mean hotline response time reported was 6.3 hours.

EXHIBIT IV-19

System Interruption Analysis Apollo*

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.5	0.3
Hardware-Caused (Percent)	57	7.2
System Software-Caused (Percent)	7	3.4
Application Software-Caused (Percent)	6	3.6
Other-Caused (Percent)	30	7.5

* 17 respondents

System availability performance is analyzed in Exhibit IV-20. The Apollo sample received a higher mean system availability (96.2%) than the overall sample (95.0%), with a greater percent of satisfied users (80%) as shown in Exhibit IV-21.

EXHIBIT IV-20

System Availability Performance Analysis
Apollo

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	93.4	1.4	96.2	0.6
On-Site Response Time (Hours)	15.4	3.7	11.1	3.1
On-Site Repair Time (Hours)	9.0	3.3	3.9	1.2
Depot Turnaround Time (Days)	1.3	0.3	1.5	0.3
Hotline Response Time as Part of Contract (Hours) 19 Respondents (76%)			6.3	2.0

Eighty-eight percent of the Apollo sample received on-site maintenance as part of their service contract. Eighty-one percent of the users were satisfied with the response time received and 80% with the repair time received, also shown in Exhibit IV-21. Only 67% of the users were satisfied with depot turnaround time.

EXHIBIT IV-21

System Availability Performance Satisfaction Apollo

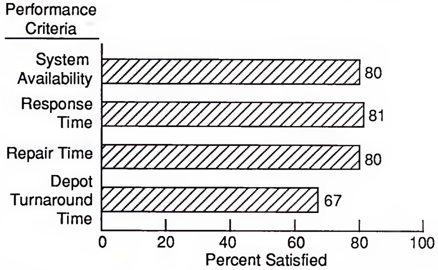
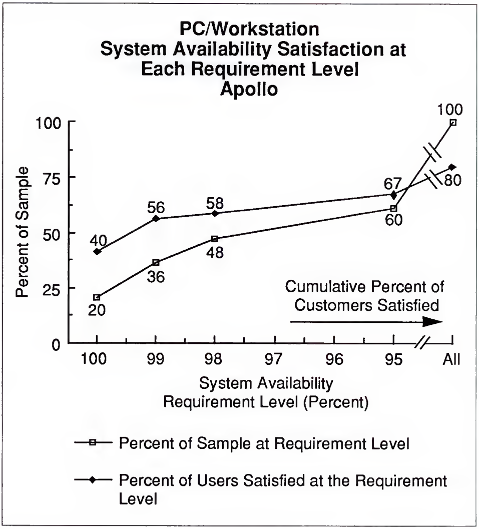


Exhibit IV-22 presents the system availability at each requirement level for the Apollo sample. Forty-eight percent of the sample had a requirement of 98% or greater, while 58% of the sample were satisfied with the availability they received at the 98% level.

EXHIBIT IV-22

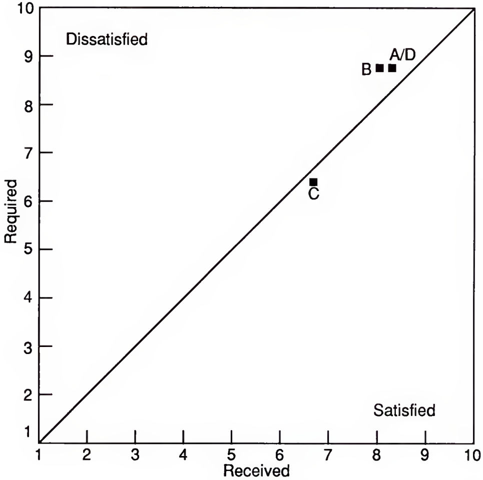


An analysis of hardware maintenance required versus received and satisfaction levels are presented in Exhibits IV-23 and IV-24. The mean hardware engineer skill, spare parts, and maintenance received overall fell slightly short of the mean requirement, but with between 63% and 83% of the users satisfied with the service they received. The mean hotline support required was 6.4, with a mean rating of 6.7 received and 70% of the sample satisfied with the hotline support received.

Eighty-four percent of the Apollo users had software support as part of their service contract. An average of 0.7 major software problems were reported by the sample per month, with an average of 2.4 minor software problems per month. The mean time for resolution of major problems was 27.1 hours and an average 12.2 hours to resolve minor problems.

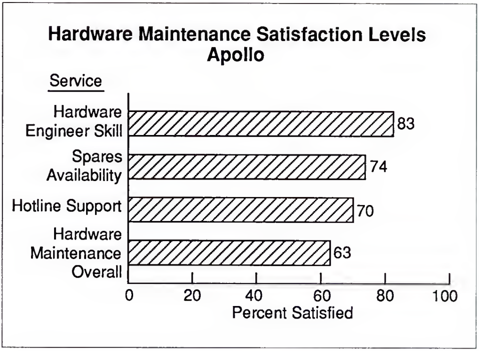
EXHIBIT IV-23

Hardware Maintenance
Required versus Received
Apollo



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.6	0.3	8.3	0.4
B	Spare Parts	8.6	0.3	8.1	0.4
C	Hotline Support	6.4	0.7	6.7	0.7
D	Hardware Maintenance Overall	8.6	0.3	8.3	0.3

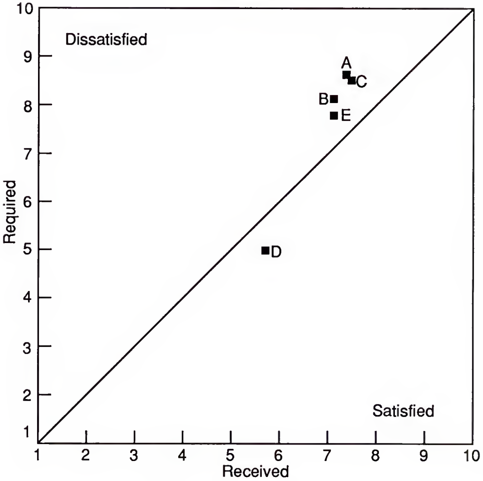
EXHIBIT IV-24



Exhibits IV-25 and IV-26 present software support required versus received and software support satisfaction levels for the Apollo sample. The mean software support ratings received were below the mean ratings required in all cases except operational training, where the mean rating required was 5.0 and the mean rating received was 5.7. Operational training also had the highest satisfaction level, with 86% of the users satisfied with the level of service received. Satisfaction levels for the other software services were very low, ranging between 42% and 58% of the users.

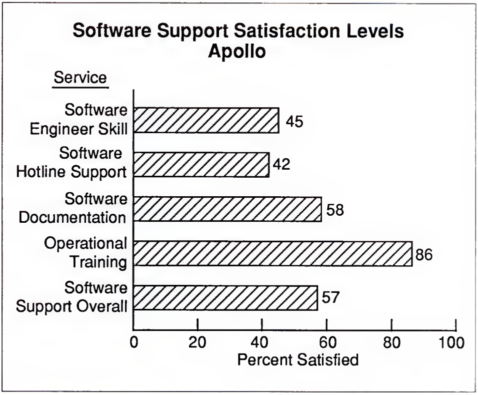
EXHIBIT IV-25

Software Support
Required versus Received
Apollo



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.6	0.3	7.4	0.5
B	Software Hotline Support	8.1	0.6	7.1	0.6
C	Software Documentation	8.5	0.2	7.5	0.4
D	Operational Training	5.0	0.7	5.7	0.9
E	Software Support Overall	7.8	0.4	7.1	0.4

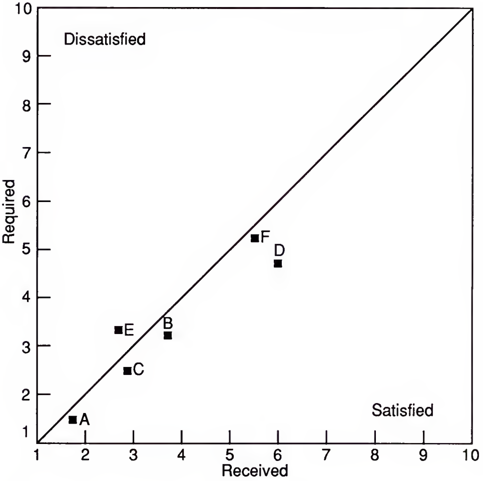
EXHIBIT IV-26



Sixty percent of the sample reported receiving at least one ancillary service as part of their service contract. The mean ratings for services required versus received and satisfaction levels are presented in Exhibits IV-27 and IV-28. Based on the mean scores, most of the Apollo users were satisfied with the ancillary services received, with satisfaction levels ranging from 86% to 100%. The Apollo users receiving consulting services were satisfied with the service received. Although the mean rating for network design and planning required was 3.3 and the mean rating for services received was 2.7, 94% of the users receiving this service were satisfied with the network design and planning service they received.

EXHIBIT IV-27

Ancillary Services
Required versus Received
Apollo



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	1.6	0.4	1.8	0.5
B	Preinstallation Planning	3.2	0.7	3.7	0.9
C	Consulting	2.5	0.7	2.9	0.8
D	Install/Deinstall	4.7	0.8	6.0	0.9
E	Network Design/Planning	3.3	0.7	2.7	0.7
F	Ancillary Services Overall	5.2	0.7	5.5	0.6

EXHIBIT IV-28

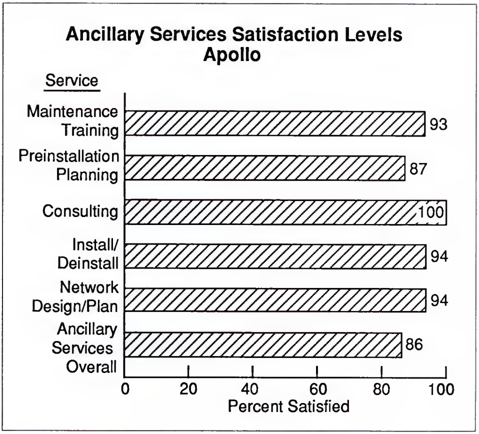


Exhibit IV-29 presents the self-maintenance activities reported by the Apollo sample. Ninety-two percent perform their own software support and/or installation. Twenty-one percent of the users that performed their own installation received a discount for doing so.

Twenty-nine percent of the Apollo sample reported receiving maintenance service on other manufacturers' peripherals, while 13% received service on other manufacturers' systems and 9% on other manufacturers' network products.

EXHIBIT IV-29

Self-Maintenance Activities
Apollo

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	44	9
Software Support	92	5
Operational Training	72	-
Installation	92	21

Seventeen of the Apollo users reported receiving their service from the manufacturer or a dealer. Ten of the respondents were unwilling to change to a third-party maintainer at any discount, as shown in Exhibit IV-30. Only five of the users had been contacted by a third-party maintainer within the past 12 months.

EXHIBIT IV-30

Willingness to Change to TPM for Discount Apollo

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	2	12
11 - 20	-	-
21 - 30	2	12
31 - 40	-	-
41 - 50	1	6
50+	2	12
Unwilling at Any Discount	10	58

Response time and price headed the list of most pressing service concerns by the Apollo users, as shown in Exhibit IV-31. System availability, software support, and network support tied for the second most mentioned items by the respondents.

EXHIBIT IV-31

Most Pressing Service Concerns
Apollo

Number of Responses	Description
4	Response time
4	Price
3	System availability
3	Software support
3	Network support
1	Repair time
1	Spare parts
1	Compatibility with older equipment
1	Changing technology
4	None

Forty-eight percent of the respondents could not list any additional service that the service provider could not offer them. Multivendor support was mentioned by 12% of the sample, as listed in Exhibit IV-32. Network support, software support, and trade-in programs for upgrades ranked as the second most mentioned items by the sample.

EXHIBIT IV-32

Additional Services Required
Apollo

Number of Responses	Description
3	Multivendor support
2	Network support
2	Software support
2	Trade-in program for upgrades
1	Depot board swap program
1	Local support
1	Round-the-clock CE support
1	Installations/deinstallations/moves
12	None

C

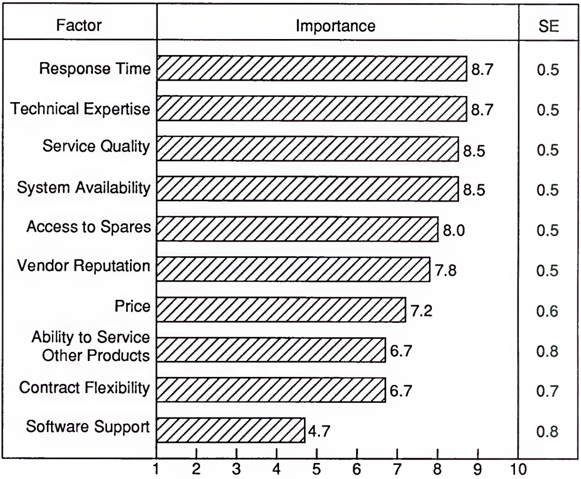
Apple

The 1989 INPUT sample of Apple users consisted of 21 respondents representing the discrete manufacturing, process manufacturing, wholesale distribution, banking and finance, federal government, medical, education, and services industries. Sixty-two percent of the sample had service contracts with dealers, 33% with a third-party maintainer, and 5% with the manufacturer.

The service vendor selection criteria mean ratings are presented in Exhibit IV-33. The top four items of importance to the Apple sample were response time and technical expertise (tying for the first position), and service quality and system availability (tying for the second position). Access to spares received the third highest rating (8.0). As seen in the overall sample, contract flexibility, ability to service other products, and software support had the lowest mean ratings.

EXHIBIT IV-33

Service Vendor Selection Criteria Apple



Contract coverage of the Apple sample is presented in Exhibit IV-34 with 71% of the sample reporting Monday-through-Friday, one-shift service as part of the service contract.

EXHIBIT IV-34

Contract Coverage
Apple

Coverage	Percent of Sample
Days Covered	
Monday - Friday	71
Monday - Saturday	-
Monday - Sunday	29
Hours Covered	
1 - 9	71
10 - 16	-
17 - 24	29

Exhibit IV-35 analyzes system interruptions as reported by respondents. The number of system interruptions for Apple were more than twice the interruptions per machine in the overall sample. This finding may be related to the high standard error of the mean and a small sample size. Hardware was reported to be the cause for approximately two-thirds of the interruptions, with 23% being system software-related.

EXHIBIT IV-35

System Interruption Analysis
Apple*

	1989	
	Mean	SE
System Interruptions per Month per Machine	1.5	1.0
Hardware-Caused (Percent)	67	10.1
System Software-Caused (Percent)	23	10.0
Application Software-Caused (Percent)	6	5.4
Other-Caused (Percent)	4	3.8

* 13 respondents

System availability performance and satisfaction are presented in Exhibits IV-36 and IV-37. The mean system availability received was 94.6%, while the required mean was 94.5%, with 68% of the sample being satisfied with the system availability received.

Eighty-six percent of the sample reported receiving on-site maintenance, while 14% (3 respondents) receive depot service maintenance on their Apple equipment. The mean response time reported was higher than the mean time required, but 77% of the Apple sample were satisfied with the response time they received from the service vendor. Repair time had a very high satisfaction level at 93% of the users, with a mean required of 10.0 hours and mean received of 8.8 hours. Fourteen percent of the respondents reported having depot service for their Apple equipment and were satisfied with the depot service received.

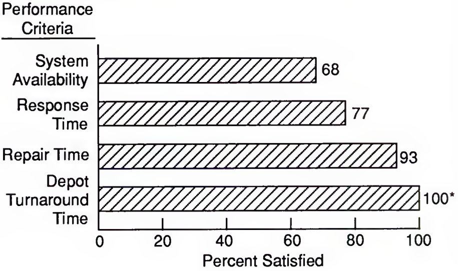
EXHIBIT IV-36

System Availability Performance Analysis
Apple

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	94.5	1.8	94.6	1.3
On-Site Response Time (Hours)	9.3	2.0	12.1	3.3
On-Site Repair Time (Hours)	10.0	3.3	8.8	3.3
Depot Turnaround Time (Days)	5.3	2.4	2.8	0.8
Hotline Response Time as Part of Contract (Hours) Respondents (48%)			2.1	1.1

EXHIBIT IV-37

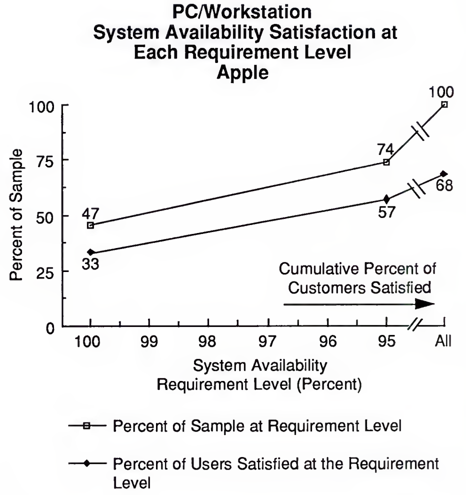
System Availability Performance Satisfaction
Apple



*Two respondents in sample

System availability satisfaction at each requirement level is presented in Exhibit IV-38. Forty-seven percent of the sample had a system availability requirement of 100%; 33% of the respondents were satisfied with the availability received.

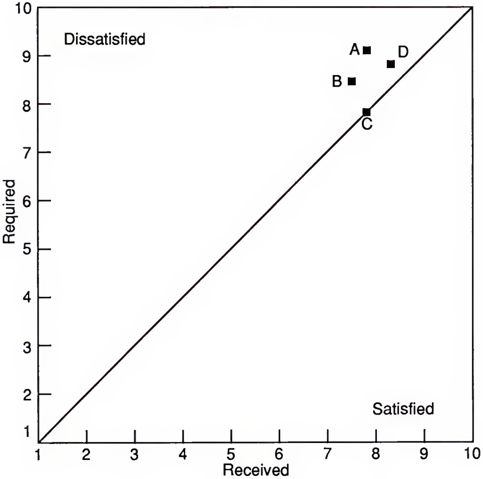
EXHIBIT IV-38



Hardware maintenance issues are analyzed in Exhibits IV-39 and IV-40. As shown in Exhibit IV-39, the mean ratings for hardware maintenance required were higher than the ratings received, with the exception of hotline support. Hotline support had a mean required rating equal to the rating received, with 70% of the Apple sample satisfied with the hotline support received. Spare parts availability had the highest satisfaction (83% satisfied) of all of the hardware maintenance issues, even though the mean rating required was 8.4 and the mean rating received was 7.7. Seventy-five percent of the Apple sample was satisfied with their overall hardware maintenance.

EXHIBIT IV-39

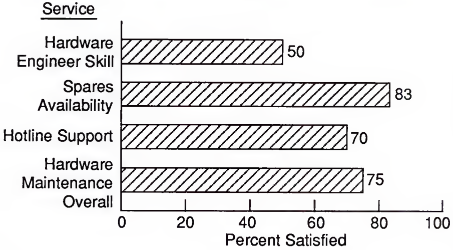
Hardware Maintenance
Required versus Received
Apple



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	9.1	0.3	7.9	0.4
B	Spare Parts	8.4	0.5	7.7	0.6
C	Hotline Support	7.9	0.8	7.9	0.9
D	Hardware Maintenance Overall	8.9	0.4	8.3	0.4

EXHIBIT IV-40

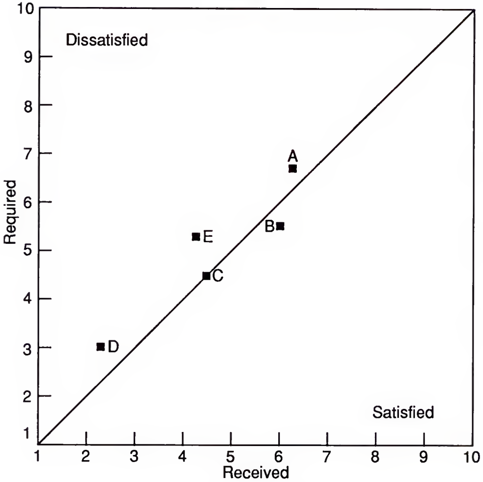
Hardware Maintenance Satisfaction Levels
Apple



Only three respondents in the Apple sample received software support from their primary service vendor. Exhibits IV-41 and IV-42 present the software support required versus received mean ratings and satisfaction levels. With such a small sample, providing an overall evaluation of service is questionable. The Apple users that INPUT interviewed appear to be satisfied with the software hotline support and the documentation they received from their service vendors. The users reported an average of 4.4 major software problems per month and 1.1 minor problems. The major problems were resolved in an average of 1.7 hours and the minor problems resolved in 1.1 hours.

EXHIBIT IV-41

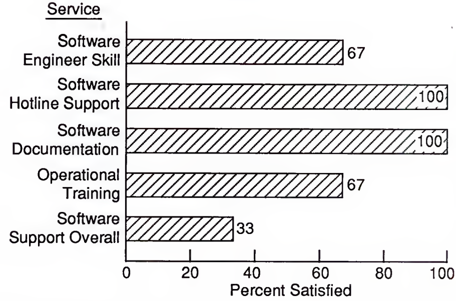
Software Support
Required versus Received
Apple



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	6.7	1.3	6.3	0.9
B	Software Hotline Support	5.5	1.5	6.0	2.0
C	Software Documentation	4.5	0.5	4.5	0.5
D	Operational Training	3.0	1.2	2.3	1.3
E	Software Support Overall	5.3	2.2	4.3	0.7

EXHIBIT IV-42

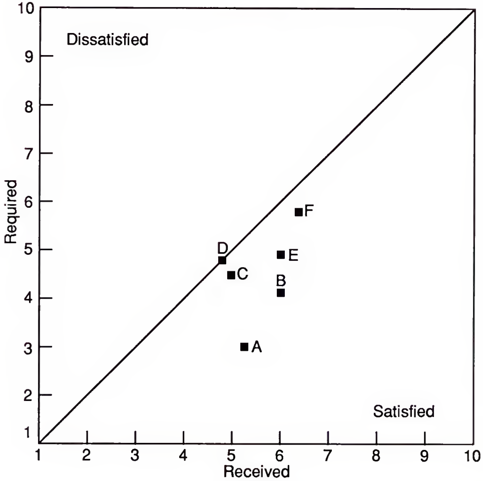
Software Support Satisfaction Levels
Apple



Only a small sample of users (between 3 and 7) received any type of ancillary services from their service vendors. An analysis of ancillary services required versus received and satisfaction levels are presented in Exhibits IV-43 and IV-44 for the Apple sample. Three respondents receive consulting services as part of the service contract, with two out of the three being satisfied with the service they receive. Seven respondents receive preinstallation planning with their service, and 71% of them are satisfied with the preinstallation service they receive.

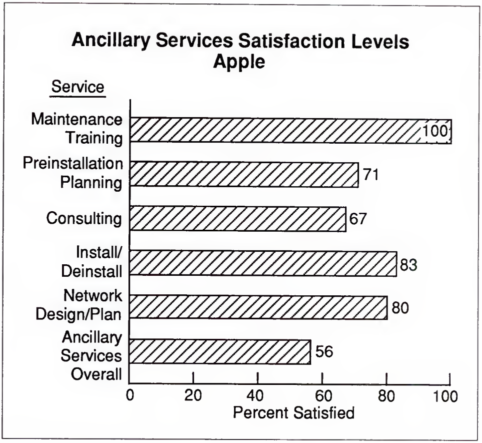
EXHIBIT IV-43

Ancillary Services
Required versus Received
Apple



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	3.0	0.9	5.3	2.5
B	Preinstallation Planning	4.1	0.9	6.0	1.3
C	Consulting	4.5	1.1	5.0	2.0
D	Install/Deinstall	4.8	0.9	4.8	0.9
E	Network Design/Planning	4.9	1.0	6.0	1.6
F	Ancillary Services Overall	5.8	0.7	6.3	0.9

EXHIBIT IV-44



Sixty-five percent of the Apple sample reported receiving service on other manufacturers' systems and peripherals, and 40% reported receiving service on other manufacturers' network products from their Apple service vendor.

Self-maintenance activities are presented in Exhibit IV-45 for the Apple sample. Ninety-one percent of the sample reported providing their own software support, with 6% of them receiving a service discount for doing so. The highest percent of respondents received a discount for component or board swapping on their equipment—60% of the respondents performed this service for themselves and 36% of them received a service discount for this self-maintenance.

EXHIBIT IV-45

Self-Maintenance Activities
Apple

Activity	Percent Performing	Percent Receiving Discount	Discount Range (Percent)
Component or Board Swap	60	36	10 - 20
Software Support	91	6	45
Operational Training	86	6	30
Installation	81	7	40

Sixty-seven percent of the Apple sample reported receiving their service from the manufacturer or a dealer. The reported willingness to change to a TPM based on discounts is displayed in Exhibit IV-46. Five of the nine users were unwilling to change to a TPM at any discount. Five respondents from the Apple sample had been contacted by a TPM in last 12 months to discuss their service requirements.

EXHIBIT IV-46

Willingness to Change to TPM for Discount Apple

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	-	-
11 - 20	1	11
21 - 30	-	-
31 - 40	2	22
41 - 50	1	11
50+	-	-
Unwilling at Any Discount	5	56

System availability, response time, and spare parts availability were mentioned most often as pressing service concerns of the Apple sample, shown in Exhibit IV-47. System availability was mentioned by one-third of the sample, while response time was mentioned by 24% of the respondents and spare parts by 14%.

EXHIBIT IV-47

Most Pressing Service Concerns
Apple

Number of Responses	Description
7	System availability
5	Response time
3	Spare parts availability
1	Multivendor support
1	Replacements
4	None

Exhibit IV-48 presents additional service requirements as reported by the Apple sample. Software support and on-site service were the two most mentioned items, while 38% of the sample could not list any service that the service provider could not offer at this time.

EXHIBIT IV-48

Additional Services Required
Apple

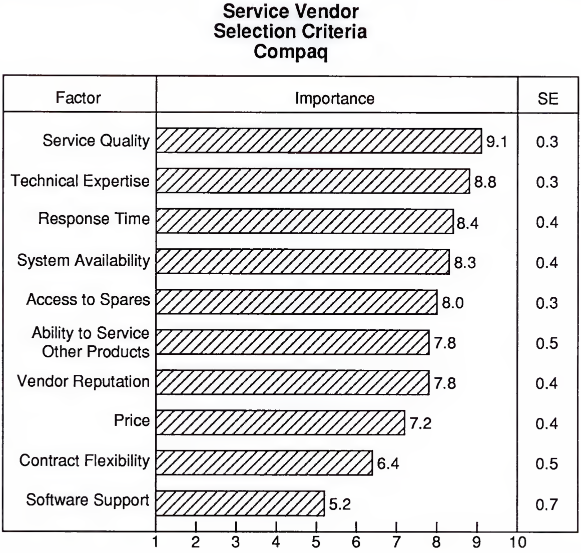
Number of Responses	Description
5	Software support
2	On-site service
1	Repair time
1	Spare parts
1	Training
1	Multivendor support
1	Proficient peripheral support
1	Reinstallation after repair
8	None

D
Compaq

In 1989, INPUT surveyed 24 users of Compaq personal computers. The Compaq users represented the insurance, discrete manufacturing, and banking and finance industries. Seventy-one percent of the sample reported having service contracts with third-party maintainers and 29% with dealers.

Service vendor selection criteria for the Compaq sample is presented in Exhibit IV-49. The top four criteria items received mean ratings of 8.3 through 9.1. Service quality received the highest mean rating, 9.1; other items in the top four include technical expertise, response time, and system availability. Software support received the lowest mean rating in the Compaq sample, 5.2.

EXHIBIT IV-49



Maintenance contract coverage, presented in Exhibit IV-50, followed the pattern of the overall sample with the majority of the users receiving Monday-through-Friday, one-shift coverage.

EXHIBIT IV-50

Contract Coverage
Compaq

Coverage	Percent of Sample
Days Covered	
Monday - Friday	83
Monday - Saturday	4
Monday - Sunday	13
Hours Covered	
1 - 9	79
10 - 16	8
17 - 24	13

Compaq users had the lowest reported system interruptions per month per machine with 0.1 reported interruptions, as shown in Exhibit IV-51. A high percent of those interruptions (88%) were reported as being hardware related, while the remaining 12% were reported to be application software-caused.

EXHIBIT IV-51

System Interruption Analysis
Compaq*

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.1	0.02
Hardware-Caused (Percent)	88	10.0
System Software-Caused (Percent)	-	-
Application Software-Caused (Percent)	12	10.0
Other-Caused (Percent)	-	-

* 11 respondents

System availability performance and satisfaction ratings are presented in Exhibits IV-52 and IV-53. The Compaq sample required a mean system availability of 94.0% and received a mean availability of 97.6%, with 71% of the users being satisfied with the availability received.

All of the respondents in the Compaq sample received on-site maintenance as part of their service contracts. The mean response time received (10.0 hours) was lower than the required mean time (10.8 hours), with 91% of the users satisfied. Even though the mean repair time received was higher than the mean required, 8.9 hours versus 8.0 hours, 91% of the users received satisfactory repair time.

Hotline support was reported to be part of the service contract by 63% of the Compaq sample. The users reported a mean hotline response time of 1.3 hours.

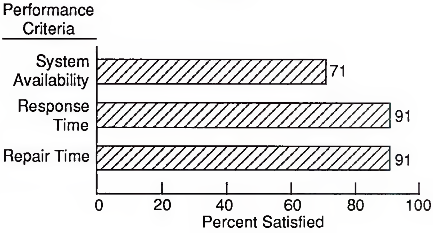
EXHIBIT IV-52

System Availability Performance Analysis Compaq

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	94.0	1.9	97.6	1.0
On-Site Response Time (Hours)	10.8	2.0	10.0	2.6
On-Site Repair Time (Hours)	8.0	2.0	8.9	2.6
Depot Turnaround Time (Days)	N/A	N/A	N/A	N/A
Hotline Response Time as Part of Contract (Hours) 15 Respondents (63%)			1.3	0.4

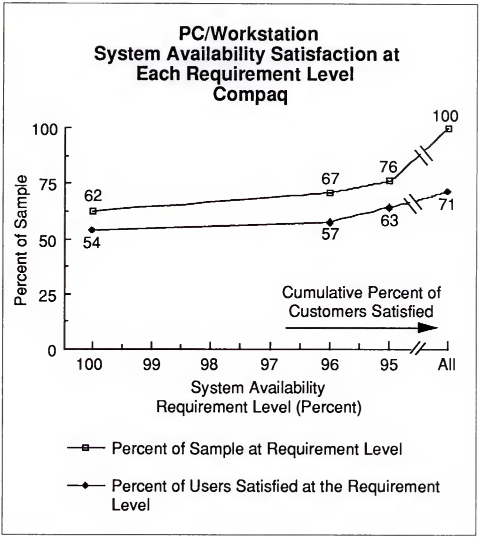
EXHIBIT IV-53

System Availability Performance Satisfaction Compaq



System availability satisfaction at each requirement level is presented in Exhibit IV-54. A wide range of availability requirements was reported with 62% requiring 100% availability and the rest requiring 96% or less. fifty-four percent of the sample was satisfied at the 100% requirement level, with 71% of overall sample being satisfied with system availability.

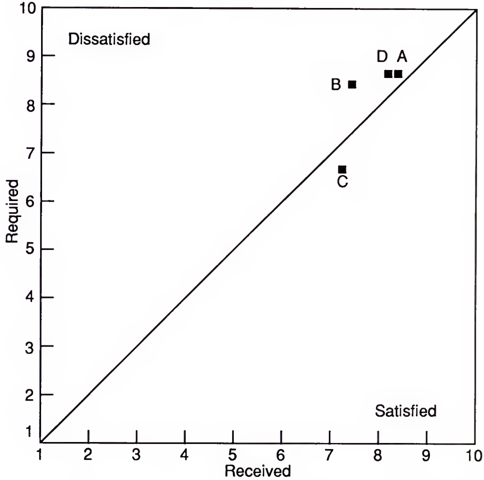
EXHIBIT IV-54



Hardware maintenance issues are analyzed in Exhibit IV-55, with satisfaction levels presented in Exhibit IV-56. Hotline support received the highest satisfaction level, and was the only issue where the mean rating received was higher than the mean rating required in Exhibit IV-55. Spare parts availability had the lowest satisfaction level at 50% of the users satisfied, with a 0.9 difference between the mean rating required and mean rating received. It appears that the dealers and TPMs servicing these users are having a difficult time stocking the parts required for service.

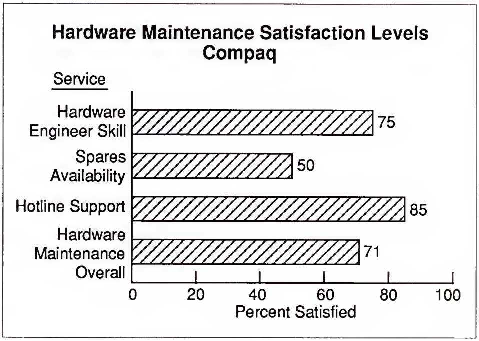
EXHIBIT IV-55

Hardware Maintenance
Required versus Received
Compaq



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.6	0.3	8.2	0.3
B	Spare Parts	8.3	0.3	7.4	0.4
C	Hotline Support	6.7	0.9	7.2	0.8
D	Hardware Maintenance Overall	8.6	0.4	8.1	0.4

EXHIBIT IV-56

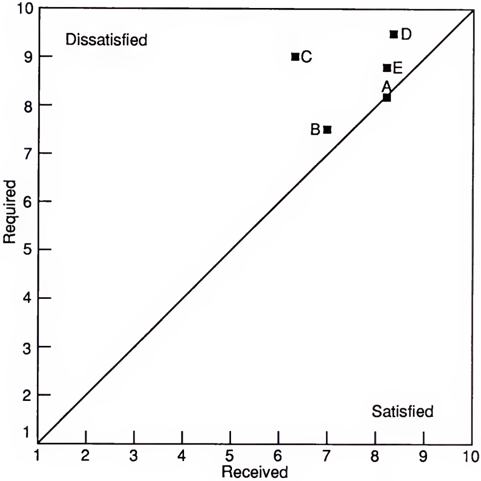


Software support services were reported to be part of the service contract by 21% of the Compaq sample. The mean ratings received were generally below the mean ratings required as shown in Exhibit IV-57, with a wide range of satisfaction levels (see Exhibit IV-58). Software engineer skill had the highest satisfaction level by the users (80%) with the mean rating received being equal to the mean rating required. Software documentation received the lowest satisfaction level (25%) and had the largest range between rating required and rating received. Software support also had the lowest reported satisfaction in the overall sample.

There were 0.3 major software problems per month reported by the Compaq sample and 0.2 minor software problems. Major software problems took an average of 24 hours to resolve and minor problems an average of 1.5 hours.

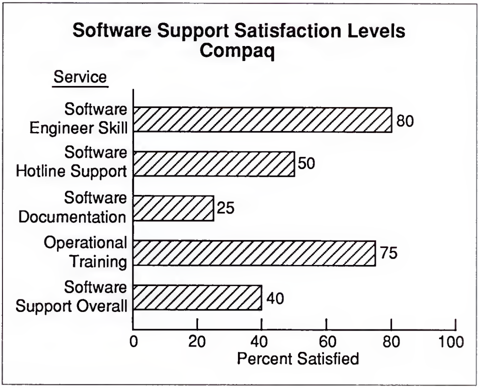
EXHIBIT IV-57

Software Support
Required versus Received
Compaq



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.2	0.9	8.2	0.5
B	Software Hotline Support	7.5	1.0	7.0	0.4
C	Software Documentation	9.0	0.7	6.3	1.4
D	Operational Training	9.5	0.5	8.3	1.2
E	Software Support Overall	8.8	1.0	8.2	0.6

EXHIBIT IV-58

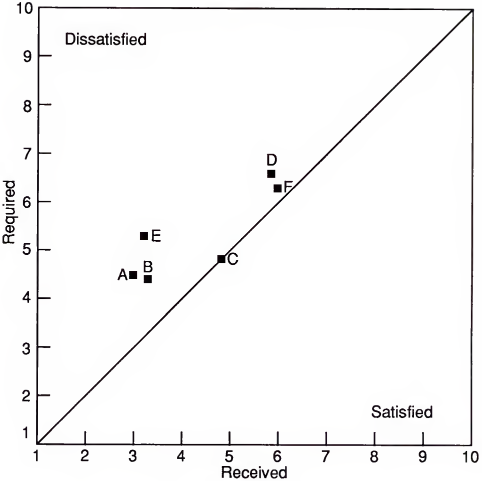


Fifty-eight percent of the respondents reported receiving some type of ancillary services from their service vendor. The required versus received ratings and satisfaction levels are presented in Exhibits IV-59 and IV-60. The mean ratings of required versus received fell in the dissatisfied quadrant of the chart in Exhibit IV-59, with the exception of consulting, which had equal mean ratings and 100% of the users receiving the service being satisfied.

Seventy-one percent of the sample reported receiving, from their Compaq service vendor, service on other manufacturers' peripherals, 63% on other manufacturer's systems, and 46% on other manufacturers' network products.

EXHIBIT IV-59

Ancillary Services Required versus Received Compaq



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.5	1.2	3.0	1.2
B	Preinstallation Planning	4.4	1.1	3.3	1.0
C	Consulting	4.8	1.1	4.8	1.2
D	Install/Deinstall	6.5	1.2	5.8	1.3
E	Network Design/Planning	5.3	1.4	3.2	1.4
F	Ancillary Services Overall	6.3	0.8	6.0	0.9

EXHIBIT IV-60

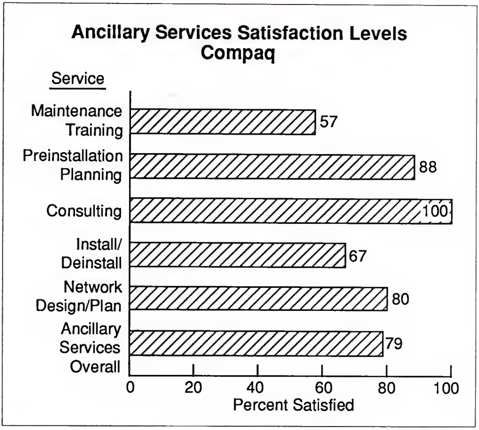


Exhibit IV-61 presents the self maintenance activities reported by the Compaq sample. Ninety-six percent of the sample performed their own software support and operational training as part of the service contract, with 13% of the users receiving a discount for performing the software support.

Twenty-nine percent of the Compaq sample (7 respondents) reported receiving service through a non-TPM channel; four of these respondents reported being contacted by a third-party maintainer over the past 12 months to discuss service.

EXHIBIT IV-61

Self-Maintenance Activities
Compaq

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	79	11
Software Support	96	13
Operational Training	96	9
Installation	92	9

Exhibit IV-62 presents the discount levels required at which non-TPM respondents would change from dealer service to TPM service based on discounts. Fifty percent of the users answering the question would not change at any discount.

EXHIBIT IV-62

Willingness to Change to TPM for Discount
Compaq

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	-	-
11 - 20	-	-
21 - 30	2	33
31 - 40	1	17
41 - 50	-	-
50+	-	-
Unwilling at Any Discount	3	50

System availability, repair time, and response time were mentioned most often by the Compaq sample as being serious service concerns, shown in Exhibit IV-63.

EXHIBIT IV-63

Most Pressing Service Concerns
Compaq

Number of Responses	Description
4	System availability
3	Repair time
3	Response time
2	Spare parts
2	Technical knowledge of FE
1	Multivendor support
1	Preventive maintenance
1	Software support
1	Price
1	Maintenance on Laptops
1	Replacements
5	None

Exhibit IV-64 presents additional services required, not currently available from the service provider, as reported by the Compaq sample. Multivendor support was mentioned most often by the sample, with on-site maintenance, response time, and preventive maintenance ranking second in frequency of mentions. Fifty percent of the sample could not list any additional services that were not available from the maintenance provider.

EXHIBIT IV-64

Additional Services Required
Compaq

Number of Responses	Description
3	Multivendor support
2	On-site maintenance
2	Response time
2	Preventive maintenance
1	Software support
1	Network support
1	Software customization
1	Installation/deinstallation/moves
12	None

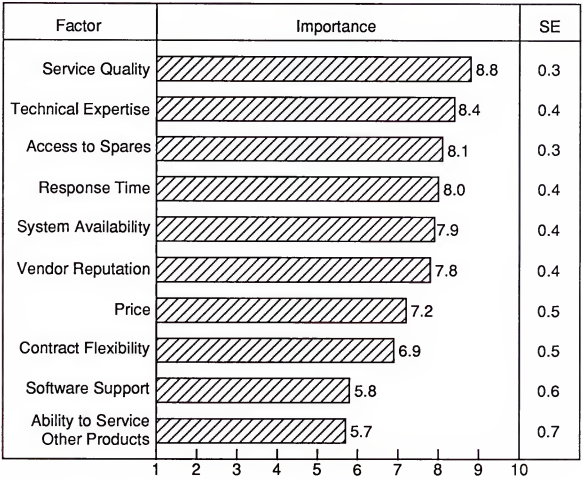
E
IBM

There were 26 respondents in the 1989 sample of IBM personal computer and workstation users. The IBM sample had representation from the insurance, discrete manufacturing, process manufacturing, banking and finance, telecommunications, transportation, state and local government, services and other industry sectors. The IBM sample received their PC/ workstation maintenance through vendors (38%), third-party maintainers (38%), and the remainder through dealers.

Exhibit IV-65 presents the mean ratings for service vendor selection criteria as reported by the IBM sample. The top four service issues were service quality, technical expertise, access to spares, and response time with system availability having the fifth-highest mean rating.

EXHIBIT IV-65

Service Vendor Selection Criteria IBM



The contract coverage presented in Exhibit IV-66 shows the IBM sample being more evenly split between five-days-per-week, one-shift coverage and seven-days-per-week, round-the-clock coverage than is seen in the overall sample or other vendor sections. The IBM standard contract provides seven-days-per-week, 24-hour coverage. As these terminals and workstations become part of larger, more critical systems, the importance of round-the-clock coverage increases.

EXHIBIT IV-66

Contract Coverage
IBM

Coverage	Percent of Sample
Days Covered	
Monday - Friday	58
Monday - Saturday	-
Monday - Sunday	42
Hours Covered	
1 - 9	54
10 - 16	4
17 - 24	42

System interruption analysis is presented in Exhibit IV-67. The mean system interruptions per machine per month for the IBM sample was 0.1, with hardware causing 84% of the interruptions and system software causing 12%.

EXHIBIT IV-67

System Interruption Analysis
IBM*

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.1	0.03
Hardware-Caused (Percent)	84	8.4
System Software-Caused (Percent)	12	8.3
Application Software-Caused (Percent)	2	2.5
Other-Caused (Percent)	2	2.3

* 14 respondents

System availability performance analysis and satisfaction are presented in Exhibits IV-68 and IV-69 for the IBM sample. The IBM sample reported a mean required availability of 91.0% and a mean received of 93.1%, with 70% of the users satisfied with the availability received for the service provider.

Response time appears to be an area requiring improvement where the mean response time fell short of the requirement (4.6 hours versus 6.0 hours received), and only 65% of the users were satisfied with the response time received. All of the IBM respondents received on-site maintenance as part of their service contract. Very high satisfaction levels were reported with the repair time—91% of the sample—with the mean repair time required of 5.4 hours and mean time received of 3.8 hours.

Sixty-five percent of the IBM sample received hotline response as part of their service contract, with the mean time for problem resolution being 20 minutes.

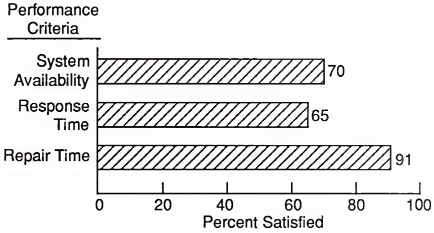
EXHIBIT IV-68

System Availability Performance Analysis IBM

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	91.0	1.9	93.1	1.4
On-Site Response Time (Hours)	4.6	0.9	6.0	1.8
On-Site Repair Time (Hours)	5.4	1.6	3.8	1.2
Depot Turnaround Time (Days)	-	-	-	-
Hotline Response Time as Part of Contract (Hours) Respondents (65%)			.33	0.1

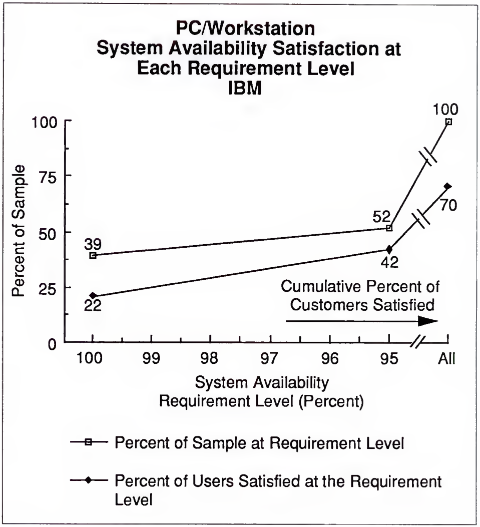
EXHIBIT IV-69

System Availability Performance Satisfaction IBM



The system availability satisfaction at each requirement level for the IBM sample is presented in Exhibit IV-70. Thirty-nine percent of the sample required 100% system availability, though only 22% actually received 100% availability.

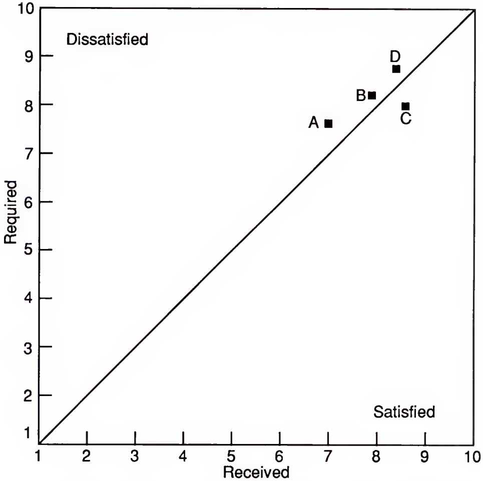
EXHIBIT IV-70



Mean ratings and satisfaction levels of traditional hardware maintenance activities for the IBM sample are presented in Exhibits IV-71 and IV-72. The mean ratings required ranged from 7.6 for hardware engineer skill to 8.8 for hardware maintenance overall. Hardware engineer skill had the lowest reported satisfaction (64% of the sample), while hotline support received the highest satisfaction, 79% of the users.

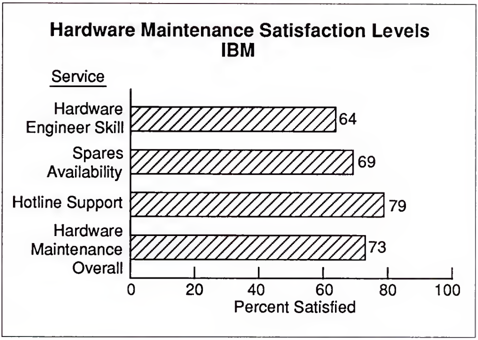
EXHIBIT IV-71

Hardware Maintenance
Required versus Received
IBM



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	7.6	0.4	7.0	0.4
B	Spare Parts	8.2	0.3	7.9	0.4
C	Hotline Support	8.0	0.5	8.6	0.4
D	Hardware Maintenance Overall	8.8	0.2	8.4	0.3

EXHIBIT IV-72



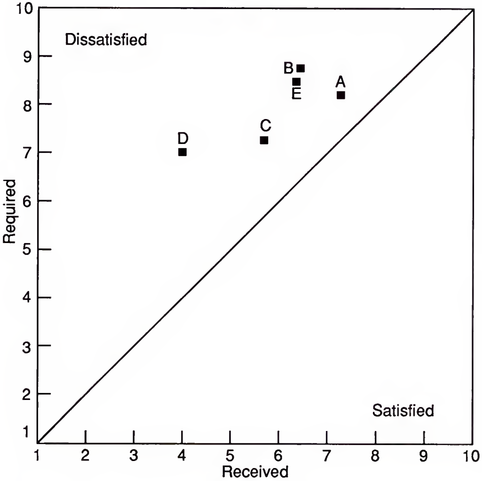
Twenty-three percent of the IBM sample received software support from their primary service vendor. The mean ratings for software support required versus received and satisfaction levels are shown in Exhibits IV-73 and IV-74.

This sample is fairly small, therefore it is difficult to draw strong conclusions. But the sample appears to have a greater requirement for software support than is being supplied by the service providers at this time, as shown by the satisfaction levels ranging from 33% to 67% of the users.

The sample reported a mean 1.1 major software problems per month and 10.4 minor software problems. The mean resolution time for major software problems was 17.8 hours and 12.2 hours for minor problems.

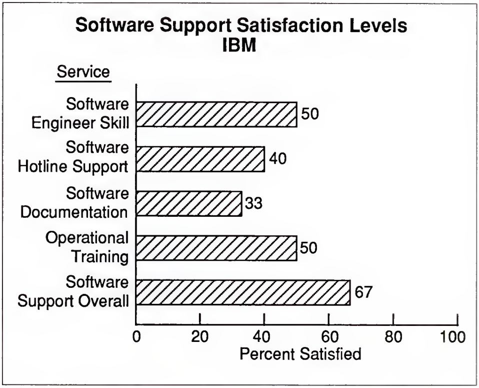
EXHIBIT IV-73

Software Support
Required versus Received
IBM



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.2	0.7	7.3	1.3
B	Software Hotline Support	8.8	1.0	6.4	1.2
C	Software Documentation	7.3	1.0	5.7	1.0
D	Operational Training	7.0	2.0	4.0	1.0
E	Software Support Overall	8.5	0.6	6.3	1.0

EXHIBIT IV-74

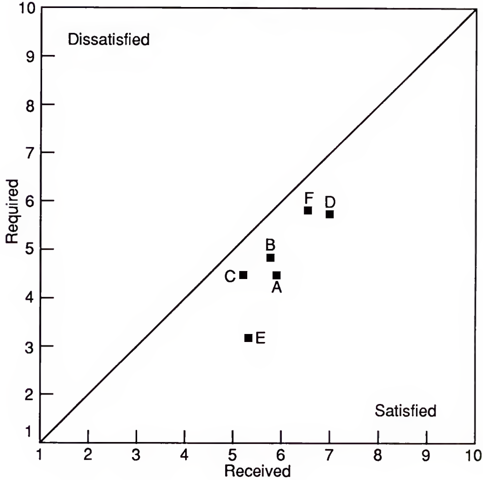


Approximately 65% of the IBM sample received some type of ancillary services from their service vendor. Exhibit IV-75 analyzes the mean ratings for services required and services received, and Exhibit IV-76 presents the satisfaction levels with ancillary services provided. The sample appears to be fairly satisfied with the ancillary services being provided, as evidenced by the range of satisfactions levels and high mean ratings of services received.

Sixty-five percent of the sample reported receiving service on other manufacturers' peripherals from their service vendor. Fifty-eight percent received service on other manufacturers' systems and 27% on others' network products.

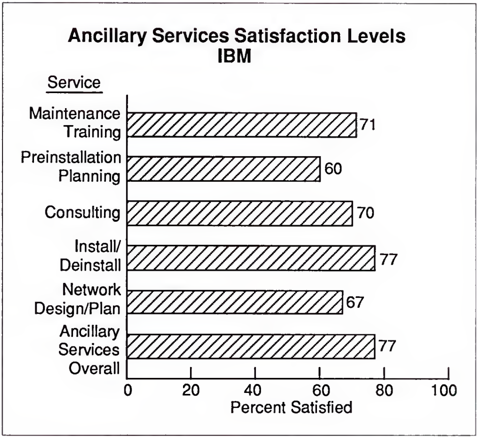
EXHIBIT IV-75

Ancillary Services
Required versus Received
IBM



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	4.5	1.1	5.9	1.2
B	Preinstallation Planning	4.8	0.9	5.8	0.9
C	Consulting	4.5	0.9	5.2	1.0
D	Install/Deinstall	5.7	0.9	7.0	0.9
E	Network Design/Planning	3.2	1.0	5.3	1.3
F	Ancillary Services Overall	5.8	0.7	6.5	0.5

EXHIBIT IV-76



The self-maintenance activities performed by the sample as part of the maintenance contract are presented in Exhibit IV-77. Eighty-one percent performed operational training and installation, with 14% of the sample receiving a discount for doing the installations.

Sixty-two percent of the IBM sample reported receiving their service through non-TPM channels. Seventy-five percent of this group reported being contacted by a TPM to discuss service requirements during the past 12 months.

EXHIBIT IV-77

Self-Maintenance Activities IBM

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	62	13
Software Support	73	0
Operational Training	81	0
Installation	81	14

Exhibit IV-78 presents the willingness of the sample to change to TPM service for discounts. Nine of the thirteen respondents answering this question reported not being willing to change at any discount. Price does not appear to be a major factor in the service vendor decision, as shown previously in Exhibit IV-65.

EXHIBIT IV-78

Willingness to Change to TPM for Discount
IBM

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	-	-
11 - 20	1	7
21 - 30	2	13
31 - 40	2	13
41 - 50	-	-
50+	1	7
Unwilling at Any Discount	9	60

Exhibit IV-79 presents the most pressing service concerns as reported by the IBM sample. Response time and system availability were mentioned most often as being important issues by respondents.

EXHIBIT IV-79

Most Pressing Service Concerns
IBM

Number of Responses	Description
4	Response time
4	System availability
2	Field engineer technical knowledge
2	Replacement equipment
2	General maintenance and repair
1	Software support
1	Peripheral support
1	System configuration
8	None

Forty-eight percent of the respondents reported no additional services that their service provider could not offer at the present time. Exhibit IV-80 presents the items listed by the other 52% of the respondents. Training and improved response time were mentioned most often as additional services required.

EXHIBIT IV-80

Additional Services Required
IBM

Number of Responses	Description
6	Training
2	Improved response time
1	Preventive maintenance
1	Network support
1	Round-the-clock CE support
1	Installation/deinstallation/moves
1	Improved service quality

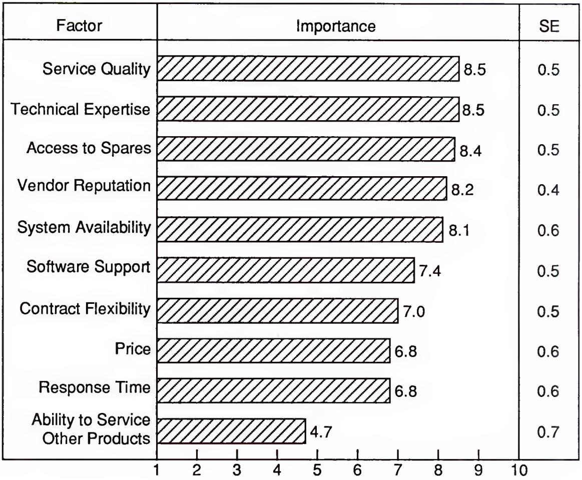
F
Sun

The sample of Sun personal computer/workstation users consisted of 25 respondents, representing discrete manufacturing, telecommunications, federal government, and education industry markets. Eighty-four percent of the sample receive their maintenance service through the manufacturer, 8% through a dealer service provider, and the remaining 8% through third-party maintenance (TPM).

Exhibit IV-81 presents the service vendor selection criteria mean ratings for the Sun sample. Service quality and technical expertise tied for the number one mean rating of 8.5 in importance. Other issues in the top four include access to spares, vendor reputation, and system availability. Fifty percent of the users rated technical expertise a 10 on the scale of 1 to 10 in importance, with 9 being the median rating for service quality.

EXHIBIT IV-81

Service Vendor
Selection Criteria
Sun



Contract coverage, as presented in Exhibit IV-82, shows 76% of the users reporting Monday-through-Friday coverage and 80% of the sample having one-shift coverage from the service vendor.

EXHIBIT IV-82

Contract Coverage
Sun

Coverage	Percent of Sample
Days Covered	
Monday - Friday	76
Monday - Saturday	0
Monday - Sunday	24
Hours Covered	
1 - 9	80
10 - 16	0
17 - 24	20

System interruption analysis is presented in Exhibit IV-83. The mean number of system interruptions per machine per month is slightly lower than in the overall sample. There is a higher mean percent of interruptions being caused by system software than seen in the overall sample or for other manufacturers' PCs/workstations.

EXHIBIT IV-83

System Interruption Analysis
Sun*

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.4	0.2
Hardware-Caused (Percent)	59	13.0
System Software-Caused (Percent)	34	11.6
Application Software-Caused (Percent)	5	5.0
Other-Caused (Percent)	2	1.4

* 10 respondents

Exhibits IV-84 and IV-85 present the system availability performance analysis and satisfaction levels. Even though the mean system availability required is less than the mean availability received, only 60% of the users were satisfied with the availability received. Exhibit IV-86 presents a more detailed picture showing 28% of the sample requiring 99.5% or better availability and not receiving it. Forty-eight percent of the respondents require 99.0% or better and only 17% receive availability meeting the 99% availability requirement.

Ninety-two percent of the sample reported receiving on-site service. The mean response time and repair times received were lower than the mean time required by the users, with 84% of the users satisfied with response time and 85% satisfied with repair time.

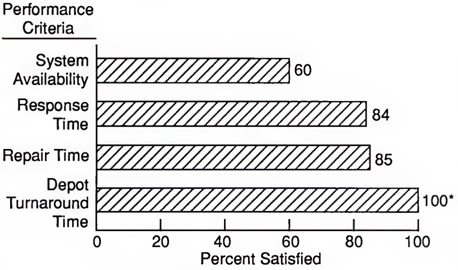
EXHIBIT IV-84

System Availability Performance Analysis
Sun

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	94.3	1.5	95.8	0.8
On-Site Response Time (Hours)	14.9	2.0	12.2	2.4
On-Site Repair Time (Hours)	8.2	2.5	7.2	2.6
Depot Turnaround Time (Days)	1.5	0.7	1.5	0.7
Hotline Response Time as Part of Contract (Hours) 15 Respondents (60%)			2.8	0.7

EXHIBIT IV-85

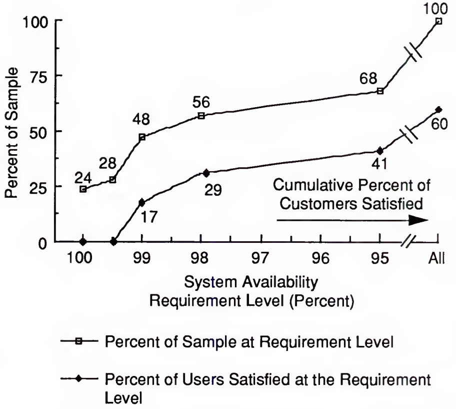
System Availability Performance Satisfaction
Sun



*Two respondents in sample

EXHIBIT IV-86

PC/Workstation
System Availability Satisfaction at Each Requirement Level
Sun

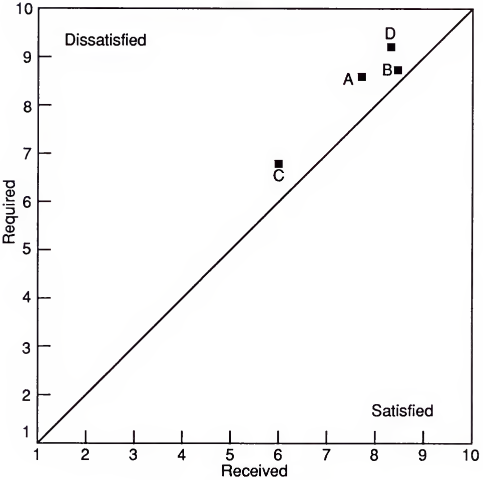


Hardware maintenance required versus received and satisfaction levels are analyzed in Exhibits IV-87 and IV-88. The mean ratings received do not meet the mean ratings required for hardware maintenance items, as further evidenced by the low satisfaction levels. Hotline support appears to be a problem, with only 45% of the users being satisfied.

Sixty-four percent of the users reported receiving software support from their primary service vendor. These users reported an average of 0.9 major and 2.3 minor software problems per month. Problem resolution time by the service provider was an average of 29.5 hours for major problems and 31.9 hours for minor problems.

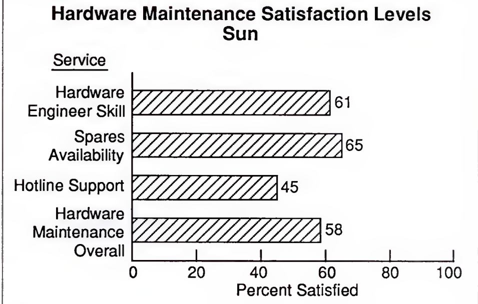
EXHIBIT IV-87

Hardware Maintenance
Required versus Received
Sun



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.6	0.4	7.7	0.5
B	Spare Parts	8.7	0.4	8.5	0.4
C	Hotline Support	6.8	0.8	6.0	0.7
D	Hardware Maintenance Overall	9.2	0.2	8.3	0.3

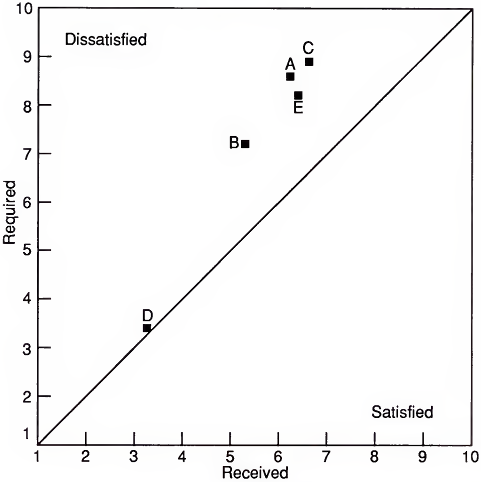
EXHIBIT IV-88



Software support required versus received and satisfaction levels are presented in Exhibits IV-89 and IV-90. Most of the software support items have very low satisfaction levels, except operational training with 78% of the nine users receiving this service being satisfied with the level of service received.

EXHIBIT IV-89

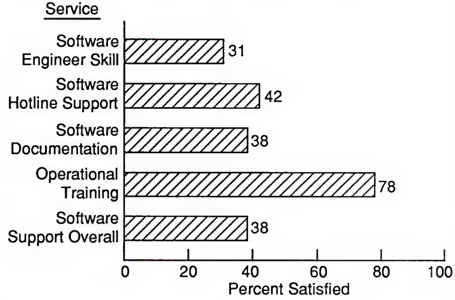
Software Support
Required versus Received
Sun



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.6	0.8	6.2	0.7
B	Software Hotline Support	7.2	1.0	5.3	1.1
C	Software Documentation	8.9	0.6	6.6	0.7
D	Operational Training	3.4	1.0	3.3	1.2
E	Software Support Overall	8.2	0.6	6.4	0.6

EXHIBIT IV-90

Software Support Satisfaction Levels
Sun

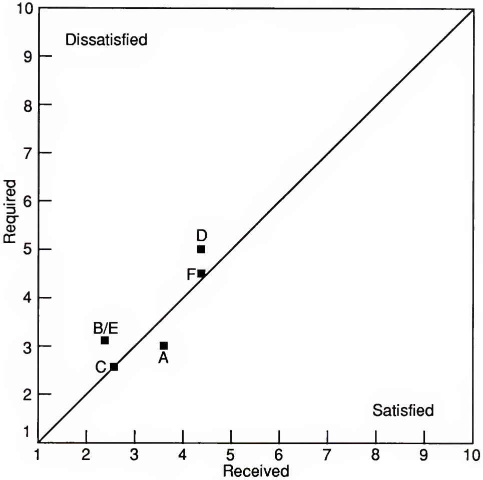


Eighty percent of the users reported receiving some type of ancillary services from the maintenance provider. Mean ratings for ancillary services required versus received and satisfaction levels are shown in Exhibits IV-91 and IV-92. In most cases the mean ratings received are less than the mean required, yet the satisfaction levels range from 73% to 87%.

Twenty percent (5 respondents) of the Sun sample reported receiving service on other manufacturers' peripherals as part of the service maintenance contract. Three users receive service on other manufacturers' systems and one respondent on other manufacturers' network products.

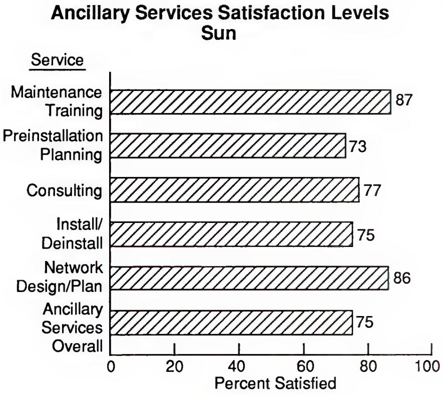
EXHIBIT IV-91

Ancillary Services
Required versus Received
Sun



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	3.0	0.7	3.6	0.9
B	Preinstallation Planning	3.1	0.7	2.4	0.6
C	Consulting	2.6	0.6	2.6	0.6
D	Install/Deinstall	5.0	0.8	4.4	1.0
E	Network Design/Planning	3.1	0.7	2.4	0.7
F	Ancillary Services Overall	4.5	0.7	4.4	0.7

EXHIBIT IV-92



Seventy-six percent of the Sun sample perform their own software support, as shown in Exhibit IV-93. The exhibit also shows percent of sample receiving discounts for the performance of these activities.

Ninety-two percent of the sample reported receiving service through non-TPM channels. Only 10 of these respondents reported being contacted by a TPM during the past 12 months to discuss service requirements.

EXHIBIT IV-93

Self-Maintenance Activities Sun

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	52	23
Software Support	76	5
Operational Training	68	-
Installation	72	12

Exhibit IV-94 presents the willingness of the non-TPM Sun sample to change to TPM service based on discounts. Ten respondents (45%) responded as being unwilling to change to a TPM at any discount.

EXHIBIT IV-94

Willingness to Change to TPM for Discount Sun

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	2	9
11 - 20	2	9
21 - 30	5	23
31 - 40	-	-
41 - 50	1	5
50+	2	9
Unwilling at Any Discount	10	45

Exhibit IV-95 presents the most pressing service concerns as reported by the Sun sample. System availability, software support, spare parts availability, and response time headed the list as being mentioned most often. Twenty percent of the respondents could not identify an issue of serious concern.

EXHIBIT IV-95

Most Pressing Service Concerns
Sun

Number of Responses	Description
6	System availability
4	Software support
3	Spare parts availability
2	Response time
1	Repair time
1	Network support
1	Peripheral maintenance
1	Price
1	Contract negotiations
5	None

Exhibit IV-96 presents additional services required by the Sun respondents. Sixty-eight percent of the respondents had no additional need for service that their current service vendor could not provide.

EXHIBIT IV-96

Additional Services Required
Sun

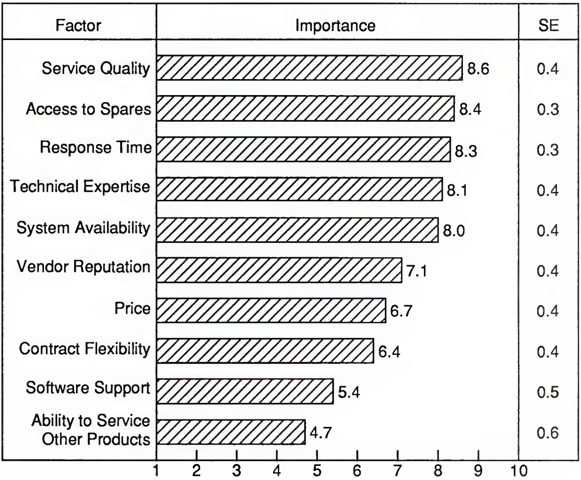
Number of Responses	Description
2	Software support
2	Training
1	Hotline support
1	Remote support
1	Network support
1	Multivendor support
17	None (68%)

G
Tandy

The Tandy user sample consisted of 32 users of Tandy personal computers and workstations. The sample was representative of the insurance, discrete manufacturing, process manufacturing, wholesale distribution, banking and finance, transportation, services, state and local government, medical, and other industries. Fifty-nine percent of the sample reported receiving maintenance service from the manufacturer, 22% from dealers, and 19% from TPMs.

Exhibit IV-97 presents mean ratings for service vendor selection criteria as reported by the Tandy sample. The top four mean rating included service quality, access to spares, response time, and technical expertise. System availability received the fifth highest mean rating.

EXHIBIT IV-97



Contract coverage of the Tandy sample is presented in Exhibit IV-98. Seventy-eight percent of the sample reported Monday-through-Friday, one-shift coverage as part of the service maintenance contract.

EXHIBIT IV-98

Contract Coverage
Tandy

Coverage	Percent of Sample
Days Covered	
Monday - Friday	78
Monday - Saturday	3
Monday - Sunday	19
Hours Covered	
1 - 9	78
10 - 16	3
17 - 24	19

System interruptions are analyzed in Exhibit IV-99. The Tandy sample reported an average of 0.3 system interruptions per machine per month. Seventy-two percent of the interruptions were reported to be caused by hardware problems. A higher percent of interruptions in the Tandy sample were caused by other-environmental factors than seen in the overall sample.

EXHIBIT IV-99

System Interruption Analysis
Tandy

	1989	
	Mean	SE
System Interruptions per Month per Machine	0.3	0.2
Hardware-Caused (Percent)	72	9.4
System Software-Caused (Percent)	8	5.2
Application Software-Caused (Percent)	1	1.3
Other-Caused (Percent)	19	8.3

System availability performance and satisfaction are analyzed in Exhibits IV-100 and IV-101. The Tandy sample reported a mean system availability of 93.6% required versus 94.4% availability received, with 75% of the users satisfied with the system availability received.

Seventy-two percent of the sample reported receiving on-site maintenance as part of the maintenance contract, with 28% having depot maintenance service. While the mean repair time required by the Tandy sample was 11.5 hours and the mean repair time received was 11.8 hours, 80% of the sample was satisfied with the repair time received.

Fifty percent of the sample reported receiving hotline response as part of the service contract. The mean hotline response time reported was 6.2 hours.

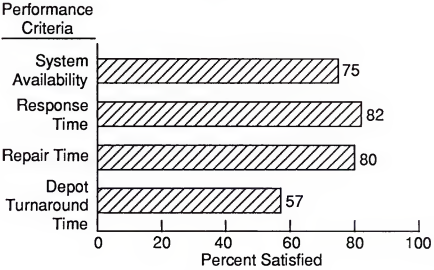
EXHIBIT IV-100

System Availability Performance Analysis Tandy

Performance Criteria	Required		Received	
	Mean	SE	Mean	SE
System Availability (Percent)	93.6	1.4	94.4	1.5
On-Site Response Time (Hours)	10.8	2.1	8.1	2.1
On-Site Repair Time (Hours)	11.5	3.0	11.8	3.3
Depot Turnaround Time (Days)	4.5	2.5	6.3	3.0
Hotline Response Time as Part of Contract (Hours) 16 Respondents (50%)			6.2	2.7

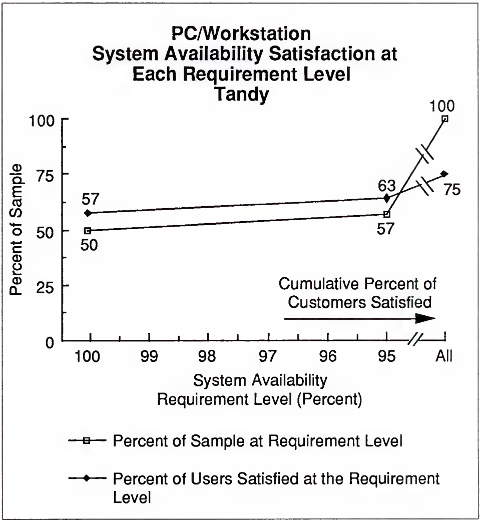
EXHIBIT IV-101

System Availability Performance Satisfaction Tandy



As shown in Exhibit IV-102, 57% of the Tandy sample reported requiring 100% system availability, while only 50% of them received 100% availability. In total, 75% of the Tandy sample was satisfied with the system availability.

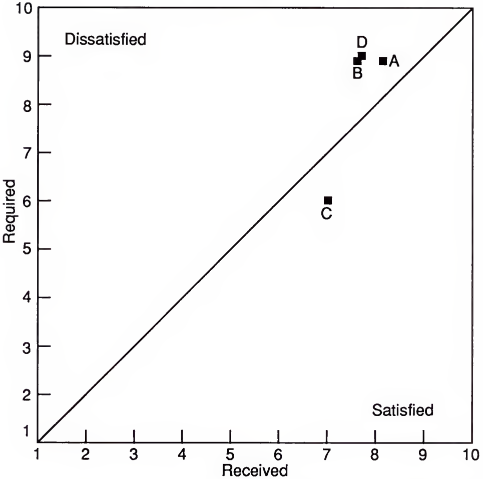
EXHIBIT IV-102



Hardware maintenance required versus received and satisfaction levels are presented in Exhibits IV-103 and IV-104. Hotline support is the only area where the mean rating received exceeded the mean rating required by the Tandy users, with hotline support having the highest satisfaction (57%) of all of the aspects examined of hardware support.

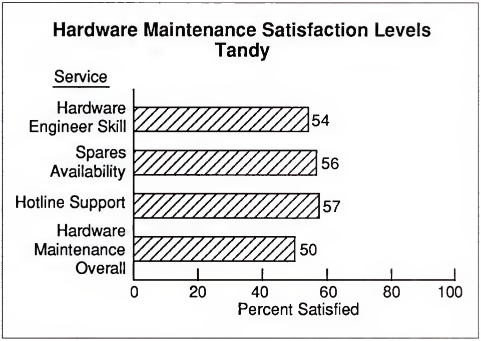
EXHIBIT IV-103

Hardware Maintenance Required versus Received Tandy



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Hardware Engineer Skill	8.9	0.2	8.1	0.3
B	Spare Parts	8.9	0.2	7.6	0.5
C	Hotline Support	6.0	0.6	7.0	0.7
D	Hardware Maintenance Overall	9.0	0.2	7.7	0.5

EXHIBIT IV-104

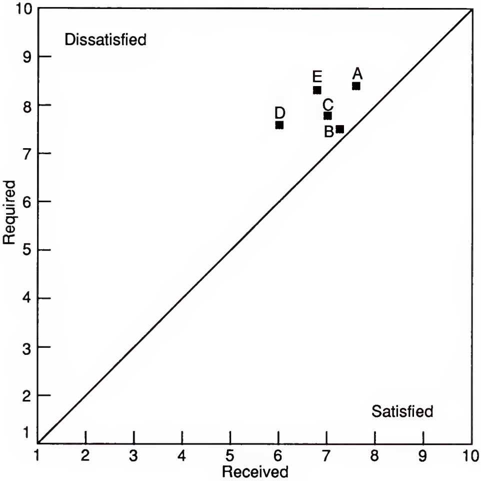


Twenty-five percent of the Tandy sample reported receiving software support as part of the service contract. Exhibits IV-105 and IV-106 present the software support required versus received analysis and satisfaction levels. All of the mean ratings required for software support were higher than the mean ratings received for the sample, but 75% of the respondents were satisfied with the software engineer skill level received. Other satisfaction levels ranged from 60% for software hotline support to 29% for operational training.

The Tandy respondents receiving software support from the service vendor reported an average of 5.5 major software problems per month and an average of 4.4 minor software problems. The mean time for problem resolution was 7.5 hours for major problems and 2.0 hours for minor problems.

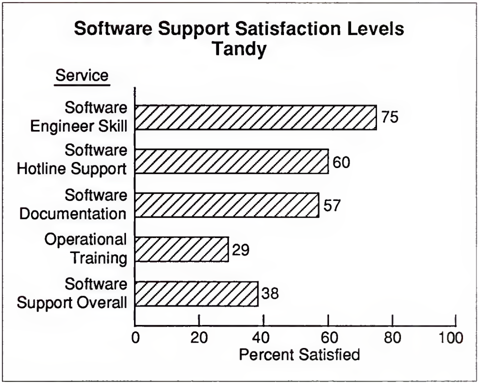
EXHIBIT IV-105

Software Support
Required versus Received
Tandy



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Software Engineer Skill	8.4	0.4	7.6	0.6
B	Software Hotline Support	7.5	0.4	7.2	0.6
C	Software Documentation	7.8	0.6	7.0	0.3
D	Operational Training	7.6	0.7	6.0	0.9
E	Software Support Overall	8.3	0.3	6.8	0.7

EXHIBIT IV-106

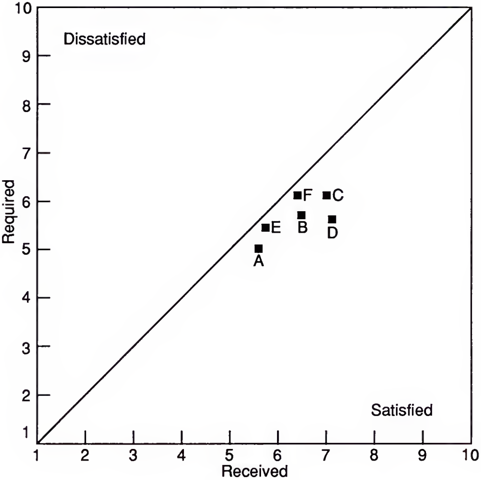


Sixty-six percent of the Tandy sample received some type of ancillary services from their service vendor. The mean ratings required versus received for ancillary services are presented in Exhibit IV-107, with the satisfaction levels shown in Exhibit IV-108. All of the mean ratings received exceeded the mean ratings required for ancillary services. The satisfaction levels ranged from 46% for maintenance training and network design/planning to 81% satisfaction for installation and deinstallation of equipment.

Twelve percent of the Tandy sample reported receiving service on other manufacturers' peripherals from the service vendor, 8% on other manufacturers' systems, and 8% on other manufacturers' network products as part of the maintenance contract.

EXHIBIT IV-107

Ancillary Services Required versus Received Tandy



Key	Service	Required		Received	
		Mean	SE	Mean	SE
A	Maintenance Training	5.0	0.8	5.6	0.9
B	Preinstallation Planning	5.7	0.7	6.5	0.7
C	Consulting	6.1	0.7	7.0	0.7
D	Install/Deinstall	5.6	0.6	7.1	0.6
E	Network Design/Planning	5.4	0.9	5.7	1.0
F	Ancillary Services Overall	6.1	0.6	6.4	0.6

EXHIBIT IV-108

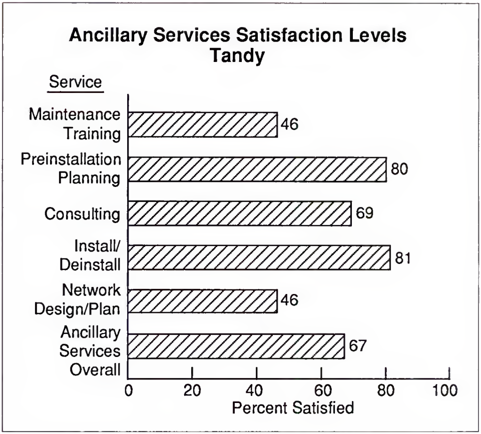


Exhibit IV-109 presents the percent of Tandy user currently performing self-maintenance activities. Operational training and software support headed the list, with only 47% of the users performing component or board swap activities. None of the respondents reported receiving a discount off the service price for performing any of the listed self-maintenance activities.

Eighty-one percent of the Tandy sample reported receiving their service maintenance through the manufacturer or a dealer, and only eight of these respondents had been contacted by a third-party maintainer over the last 12 months to discuss service requirements.

EXHIBIT IV-109

Self-Maintenance Activities
Tandy

Activity	Percent Performing	Percent Receiving Discount
Component or Board Swap	47	-
Software Support	66	-
Operational Training	81	-
Installation	53	-

Exhibit IV-110 presents the willingness of non-TPM service respondents to change to TPM service based on discounts. Eight respondents reported being unwilling to change at any discount, while 11 users would change for anywhere from a 1% to 20% discount.

EXHIBIT IV-110

Willingness to Change to TPM for Discount
Tandy

Discount Required (Percent)	Number of Respondents	Percent of Category
1 - 10	5	20
11 - 20	6	24
21 - 30	2	8
31 - 40	2	8
41 - 50	-	-
50+	2	8
Unwilling at Any Discount	8	32

The most pressing service concerns of the Tandy sample are presented in Exhibit IV-111. System availability was mentioned most often, with software support and response time tying for second place. Approximately 16% of the Tandy sample did not have any serious issues dealing with service at this time.

EXHIBIT IV-111

Most Pressing Service Concerns Tandy

Number of Responses	Description
6	System availability
4	Software support
4	Response time
3	Repair time
3	Multivendor support
2	Peripheral support
1	Technical knowledge of FE
1	Service quality
1	Price
1	Procurement of supplies
1	Consulting
5	None

Exhibit IV-112 presents the additional services required as reported by the Tandy sample. Training, local support, and the provision of loaner equipment were mentioned most often by the respondents. Thirty-eight percent of the sample could not list any services that they require that were not being provided by the service vendor.

EXHIBIT IV-112

Additional Services Required
Tandy

Number of Responses	Description
6	Training
2	Local support
2	Provide loaner equipment
1	Software support
1	Response time
1	On-site service
1	Network support
1	FE technical knowledge
1	Contract flexibility
1	Consulting
1	Better service channels
1	Hotline support
1	Installation/deinstallation/moves
12	None (38%)

V

Summary Data

V

Summary Data

In this chapter, INPUT presents selected data from the 1989 personal computer/workstation user service requirement analysis in summary charts that allow quick comparison between manufacturer service, dealer service, and TPM service on key service and support items. INPUT would like to emphasize the importance of the percent - satisfied analysis, since the key to any analysis of customer satisfaction is the vendor's ability to satisfy specific requirements of the users.

A

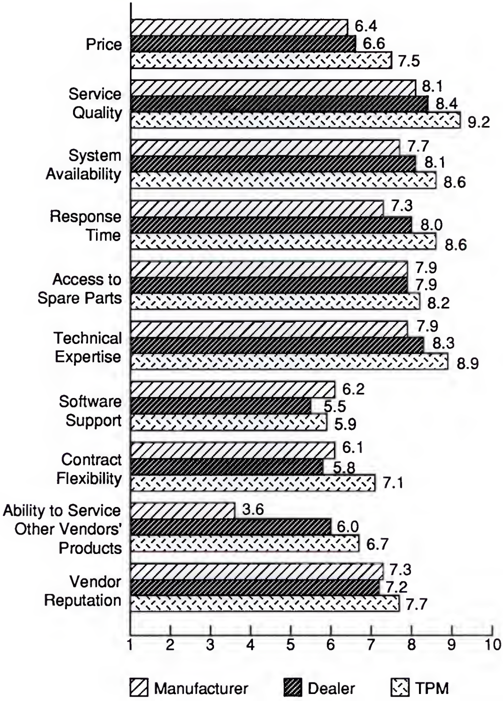
Vendor Selection Criteria

Exhibit V-1 presents the comparison of the vendor selection criteria segmented by the type of service provider. In most cases, the TPM sample had a higher mean rating for each issue than the manufacturer or dealer service sample, suggesting that users of TPM look at selection criteria differently and are more demanding than users of other types of service. In the area of software support, the manufacturer service sample reported a mean rating of 6.2, the TPM sample 5.9, and the dealer sample 5.5. These ratings are all very close, but it appears that the users of manufacturer service place a slightly higher importance on software support and that may be a reason why they go to the manufacturer for their support needs.

Many of the same items did appear in the top four ranks for category of service provider, suggesting that there are many similarities. Service quality ranked number one for all types of service providers, with technical expertise second. System availability ranked third for all types of provider service. Response time was also in the top four places, at either number four for the users of manufacturer or dealer service and number three for TPM users. Access to spares tied the number two place in importance for users of manufacturer service and was number four for the TPM service users.

EXHIBIT V-1

Service Vendor Selection Criteria Mean Ratings



B

System Availability

Exhibit V-2 presents the mean system availability for the sample by type of service providers. All of the providers gave higher mean availability than required, with TPMs providing a higher level above the requirement.

EXHIBIT V-2

System Availability

	System Availability (Percent)		
Service Provider	Required	Received	Difference
Manufacturer	94.0	95.7	1.7
Dealer	93.4	94.6	1.2
TPM	92.4	94.5	2.1
All Providers	93.3	95.0	1.7

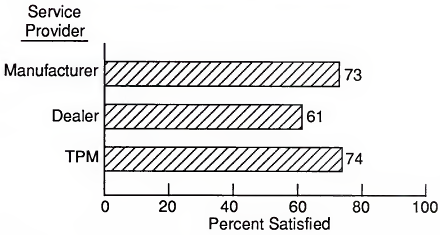
C

System Availability Satisfaction

Exhibit V-3 shows that the TPM sample also received a slightly higher system availability satisfaction than the manufacturer or dealer sample.

EXHIBIT V-3

System Availability Satisfaction



D

System Interruptions

The system interruptions analysis by service provider is presented in Exhibit V-4. The TPM-serviced PC/workstation sample reported the lowest mean number of system interruptions per month, with a higher percent of the interruptions caused by other environmental factors.

EXHIBIT V-4

System Interruptions

Service Provider	Mean Number per Month	Caused By (%)			
		Hardware	System Software	Application Software	Other
Manufacturer	0.5	70	15	2	13
Dealer	1.1	70	15	6	9
TPM	0.3	67	4	10	19
All Providers	0.6	69	11	6	14

E

Response Time

Exhibits V-5 and V-6 present the mean reported response time and satisfaction levels by type of service provider. The TPM is providing the lowest mean response time. The manufacturer service sample had the highest difference in response time required versus received, yet the TPM sample had a slightly higher satisfaction level for response time. One or two very high or very low responses could affect the mean time calculation, but the satisfaction level is calculated on a per respondent basis.

EXHIBIT V-5

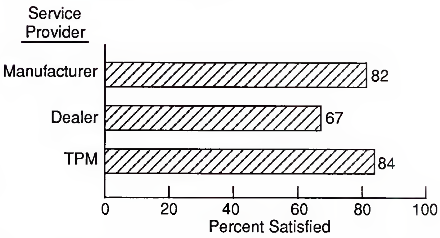
Response Time

Service Provider	Response Time (Hours) Required	Response Time (Hours) Received	Difference
Manufacturer	13.5	11.3	2.2
Dealer	8.1	11.1	(3.0)*
TPM	8.8	7.1	1.7
All Providers	10.3	9.4	0.9

*Negative number denotes higher received than required time.

EXHIBIT V-6

Response Time Satisfaction



F

On-Site Repair Time

Exhibits V-7 and V-8 present the mean on-site repair time for the sample and the associated satisfaction levels. The manufacturer service sample reported the highest mean ratings, with a difference of 2.9 between repair time required and repair time received. The dealer-serviced sample, with a mean repair time of only 3.9 hours, had the highest satisfaction with repair time, with the manufacturer sample being second.

EXHIBIT V-7

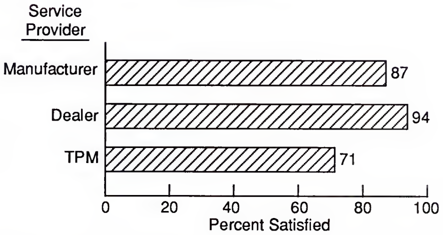
Repair Time
(On-Site)

Service Provider	Repair Time (Hours)		Difference
	Required	Received	
Manufacturer	9.8	6.9	2.9
Dealer	5.4	3.9	1.5
TPM	8.1	8.9	(0.8)*
All Providers	8.1	7.0	1.1

*Negative number denotes higher received than required time.

EXHIBIT V-8

Repair Time Satisfaction
(On-Site)



G

Overall Hardware Maintenance

The comparison of overall hardware maintenance mean ratings is presented in Exhibits V-9 and V-10. None of the service providers met the requirements of the sample for hardware maintenance, therefore all items require improvement. The TPM serviced sample reported the lowest difference between the hardware maintenance required and received, with the rating of maintenance received being 8.6 and the rating required

of 9.1. Seventy-three percent of the dealer-serviced sample reported being satisfied with the overall hardware maintenance, with the TPM sample showing a 68% satisfaction level and the manufacturer services sample 59% of the users being satisfied.

EXHIBIT V-9

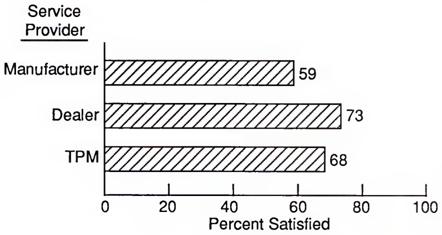
Overall Hardware Maintenance

Service Provider	Overall Rating (1 to 10 Scale)		Difference
	Required	Received	
Manufacturer	9.0	8.1	(0.9)
Dealer	8.2	7.6	(0.6)
TPM	9.1	8.6	(0.5)
All Providers	8.9	8.2	(0.6)

Note: Negative numbers denote higher received than required service.

EXHIBIT V-10

Overall Hardware Maintenance Satisfaction



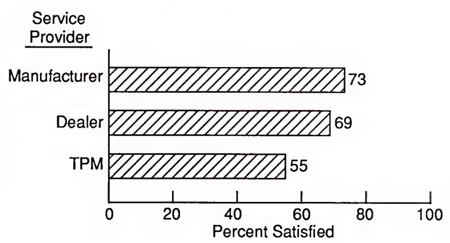
H

Spare Parts Availability

Spare parts availability has been viewed in the maintenance area as a critical issue. Without the availability of spare parts, the functions and satisfaction with system availability, repair time and overall hardware maintenance suffers. Exhibit V-11 presents the user satisfaction levels with spare parts availability by type of service provider. The users of manufacturer-provided maintenance reported a higher satisfaction level than those of dealer- or TPM-provided service. The manufacturers have access to and a stock of spare parts that facilitates the repair of the PCs/workstations.

EXHIBIT V-11

Spare Parts Availability Satisfaction



I

Overall Software Maintenance

Exhibits V-12 and V-13 present the overall software mean ratings and satisfaction levels of the sample. Again, none of the service provider types received mean ratings on software services received that were higher than the mean ratings required by the users. The TPM providers had the lowest difference between the mean rating required and the mean rating received, with the highest satisfaction level. The satisfaction levels ranged from 63% for the TPM-serviced sample to 38% for the dealer-serviced sample.

EXHIBIT V-12

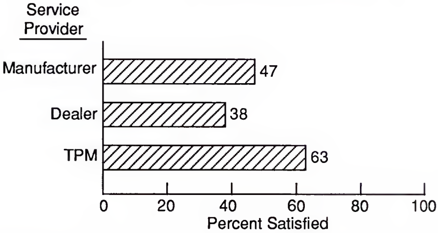
Overall Software Maintenance

Service Provider	Overall Rating (1 to 10 Scale) Required	Overall Rating (1 to 10 Scale) Received	Difference
Manufacturer	8.0	6.3	(1.7)
Dealer	7.6	6.4	(1.2)
TPM	8.6	8.2	(0.4)
All Providers	8.0	6.8	(1.2)

Note: Negative numbers denote higher received than required service.

EXHIBIT V-13

Overall Software Maintenance Satisfaction



J

Overall Ancillary Services

Overall ancillary services are compared in Exhibits V-14 and V-15 for the three types of service providers. Dealer-provided ancillary services showed a higher satisfaction level than TPM-provided services, even though the difference in mean ratings of services required versus services received was lower for the TPM-serviced sample. All of the service providers showed good satisfaction levels, possibly due to the low requirement levels of the users.

EXHIBIT V-14

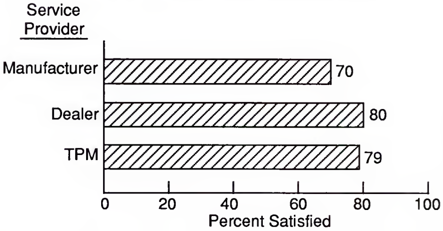
Overall Ancillary Services

Service Provider	Overall Rating (1 to 10 Scale) Required	Overall Rating (1 to 10 Scale) Received	Difference
Manufacturer	5.1	5.0	(0.1)*
Dealer	5.7	6.2	0.5
TPM	5.7	6.0	0.3
All Providers	5.5	5.6	0.1

* Negative number denotes higher received than required service.

EXHIBIT V-15

Overall Ancillary Services Satisfaction



A

Appendix: Questionnaire

A

Appendix: Questionnaire

INPUT
1989 Customer Service Program
PC and Workstation User Questionnaire

As listed on "call sheets," confirm with respondent:

1. PC/Workstation manufacturer
2. Model

We'd like to focus our questions on your *(manufacturer/model as listed)* system. Is that system still in use there? *(If no, terminate interview.)*

Please keep the service you receive for this system in mind throughout the survey.

First, some background information:

3. Do you have a monthly or annual service contract on the system? *(check one)*

Contract ________
No contract ________
If no contract, thank respondent and terminate interview here.

4. Who do you have that maintenance contract with? *(read list; check one)*

   a. The manufacturer __________

   b. A third-party maintainer __________
   If Third-Party Maintenance ("TPM"):
   Please specify company: ________________________

   c. A dealer __________
   If a dealer:
   Please specify dealer: ________________________

   d. In-house staff __________
   If in-house staff ("self-maintenance"),
   thank respondent and terminate interview here.

5. This contract covers:
   (Read list a and check one; then read list b and check one)

   a. 1) 5 days a week __________
   2) 7 days a week __________
   3) Other (please specify) ________________________

   b. 1) 8 hours per day __________
   2) 16 hours per day __________
   3) 24 hours per day __________
   4) Other (please specify) ________________________

Now we'd like to ask a few questions about how you chose your service vendor.

6. I have a list of different aspects of the service decision. As I read through them, would you please rate the importance of each criterion in the selection of your service vendor?

   On a scale of one to ten (ten being highest), what was the importance of:

Factor	Importance (1-10)
a. Price	__________
b. Service availability	__________
c. System availability	__________
d. Response or turnaround on service call	__________
e. Access to spare parts	__________
f. Technical expertise	__________
g. Software support	__________
h. Contract flexibility	__________
i. Ability to service other vendors' products	__________
j. Vendor reputation	__________

Now, some questions about your basic support requirements for your PC or workstation system:

7. Over the past twelve months, how many system interruptions (system failures) did you average per month? __________/month

8. What percent of these interruptions were caused by:

	Percent
a. Hardware failure	__________%
b. System software	__________%
c. Application software	__________%
d. Other (i.e., user error, environmental disruption, etc.) *Note: Total should equal 100%*	__________%

9. a. What percent system availability ("uptime") do you require? __________%
   b. What percent system availability do you actually receive? __________%

10. Does your service contract provide on-site or depot support? *(check one)*

    a. On-site service __________
    If on-site, proceed to question 11.

    b. Depot service __________
    If depot, skip to question 13.

11. *(Interviewer note: Ask "on-site" [from question 10] respondents only)*
    Defining response time as the time it takes a field engineer to arrive at your site after you place a trouble call, please answer the following:

    a. What response time do you require? __________ hours
    b. What is the average response time you receive? __________ hours

12. *(Interviewer note: Ask "on-site" [from question 10] respondents only.)*
    Defining repair time as the amount of time it takes on average to have your system up and running after the field engineer arrives, please answer the following:

    a. What repair time do you require? __________ hours
    b. What repair time do you receive on average? __________ hours

13. *(Interviewer note: Ask "depot" [from question 10] respondents only.)*
    Defining turnaround time as the time it takes to have your system back in-house after it goes out for depot repair, please answer the following:

    a. What is the total turnaround time you require? __________ days
    b. What is the average turnaround time you receive? __________ days

14. Do you receive "telephone hotline" service with your contract?
    (Interviewer note: "Telephone hotline service" allows the user to call up and talk to a support person about problems being encountered.)
    (check one):

    Yes __________ *(If yes, proceed to question 15.)*
    No __________ *(If no, proceed to question 16.)*

15. What telephone hotline response do you receive? __________ minutes
    (Interviewer note: "How long does it take for the hotline staff to get to you and resolve the problem?")

16. Now, I have a list of specific components of hardware service. As I read down the list, can I have you rate (again on a scale of one to ten) the level of service you require and then the level of service you're actually receiving in each area.

Let's start with	Required (1-10)	Received
a. Hardware engineer skill level	__________	__________
b. Spare parts availability	__________	__________
c. Telephone hotline support	__________	__________
d. Hardware maintenance overall	__________	__________

17. Do you receive software support from your primary service vendor as well? (Interv*iewer note: "Primary Service Vendor," as checked in question 3)* *(check one)*

Yes __________ *(If yes, proceed to question 18.)*
No __________ *(If no, proceed to question 20.)*

18. For this software support, please rate your requirements and what you've received in terms of:

	Required (1-10)	Received
a. Software engineer skill level	__________	__________
b. Software hotline support	__________	__________
c. Software documentation	__________	__________
d. Operational training	__________	__________
e. Software support overall	__________	__________

19. Defining a "major" software problem as one in which all processing is prevented, while a "minor" problem allows continued processing with some degradation, over the past twelve months:

    a. How many major software problems were reported, on average, per month? __________/month

    b. How many minor software problems were reported on average, per month? __________/month

    c. What was the average turnaround, in hours (based on a 24-hour day), for major problem resolution? __________ hours

    d. What was the average turnaround, in hours (based on a 24-hour day), for minor problem resolution? __________ hours

Now, if we can ask a couple questions about support beyond normal maintenance services (ancillary services):

20. For the following ancillary support services, could you please rate (1-10) your requirement for each service?

    Then, for those you do receive, rate the level of service your vendor is providing.

(1-10)	Required	Received
a. Maintenance-related training	__________	__________
b. Preinstallation planning services (i.e., *environmental, site, and installation planning)*	__________	__________
c. Consulting	__________	__________
d. Installations/deinstallations/moves	__________	__________
e. Network design/planning	__________	__________
f. Ancillary services overall	__________	__________

21. Do you currently receive any of the following multivendor services from your service vendor? *(check all that apply)*:

    a. Service on other manufacturers' systems __________
    b. Service on other manufacturers' peripherals __________
    c. Service on other manufacturers' network products __________

(Note: questions 22 and 23 skipped.)

24. a. Do you perform any of the following forms of self-maintenance? *(read list 1 thru 4, and check as appropriate:)*

    (Interviewer note: If yes to question 24 a., ask b. and c. If no, proceed to question 25.)

    b. Do you receive a discount from your contract price for performing these activities?

    c. Can I ask what percent discount you receive?

Self-maintenance activity:	a. Already perform? (Y/N)	b. Receive discount? (Y/N)	c. Discount received (%)
1. Component of board swap	______	______	______
2. Software support	______	______	______
3. Operational training	______	______	______
4. Installation	______	______	______

If yes to a. for 1 thru 4 above, proceed to question 26.

25. Regarding those self-maintenance activities that you are not currently performing:

    a. On a scale of 1 to 10, how willing would you be to perform this activity?
    b. What percentage discount would you require for performing these activities?

    (Read only those activities that respondent said they were not receiving in question 24)

	a. Willingness (1-10)	b. Discount required (%)
1. Component or board swap	________	________
2. Software support	________	________
3. Operational training	________	________
4. Installation	________	________

(Interviewer note: Skip to question 29 if "yes" to question 4b—Service vendor is a third-party maintainer.)

Finally, we'd like to ask you about your attitudes toward third-party maintenance (TPM). (*i.e., maintenance done by a specialized service company other than the manufacturer of the equipment)*

26. Have you been contacted by a TPM in the past 12 months? *(check one)*

Yes __________
No __________
(If yes, proceed to question 27; if no, skip to 28.)

27. Can I ask which TPMs have contacted you, and very briefly, why you didn't opt to switch to their service?

1. TPM company name	2. Reason
a.	
b.	
c.	

28. At what percentage discount would you be willing to switch to third-party maintenance, if at all? *(check one)*

a. 1-10% __________
b. 11-20% __________
c. 21-30% __________
d. 31-40% __________
e. 41-50% __________
f. 50+% __________
g. Unwilling at any discount __________

That about covers it! Thanks for your patience.

29. To wrap this up, can I ask what you consider to be your single most pressing service concern at this time?

____

____

30. If you could choose one additional service that your vendor is not currently providing, what would that be?

____

____

Thanks very much for your time. You've been a great help!

To make sure you receive your complimentary report summary, let me check the spelling of your name and the address information. *(Confirm and record on cover sheet.)*

B

Appendix: Definitions

B

Appendix: Definitions

Applications Software - Software that performs processing to service user functions.

Ancillary Services - A catagory of services that typically complement hardware maintenance and software support. Examples are install/ deinstall, preinstallation planning, network management and network design and management.

Artificial Intelligence - The academic discipline involving the study of the processes by which humans perceive and assimilate data (and use reasoning to process this data) for the purpose of duplicating these processes within computer systems. Also, this term refers to the computer systems that accomplish these duplicated processes.

BOC - Bell Operating Company.

Consulting - Includes analysis of user requirements and the development of a specific action plan to meet user service and support needs.

Dispatching - The process of allocating service resources to solve a support-related problem.

Divestiture - The action, stemming from antitrust lawsuits by the Department of Justice, which led to the breakup of AT&T and its previously owned local operating companies.

Documentation - All manuals, newsletters, and text designed to serve as reference material for the ongoing operation or repair of hardware or software.

End User - May buy a system from the hardware supplier(s) and do own programming, interfacing, and installation. Alternatively, may buy a turnkey system from a systems house or hardware integrator.

Expert Systems Applications - Applications for expert systems—a computer system based on a data base created by human authorities on a particular subject. The computer system supporting this data base contains software that permits inferences based on inquiries about the information contained in the data base. Expert systems is often used synonymously with "knowledge-based systems," although this latter term is considered to be broader and to include expert systems within its scope.

Engineering Change Notice (ECN) - Product changes to improve the product after it has been released to production.

Engineering Change Order (ECO) - The follow-up to an ECN that includes parts and a bill of material to effect the change in hardware.

Escalation - The process of increasing the level of support when and if the field engineer cannot correct a hardware or software problem within a prescribed amount of time, usually two to four hours for hardware.

Fiber Optics - A transmission medium which uses light waves.

Field Engineer (FE) - For the purpose of this study, field engineer, customer engineer, service person, and maintenance person were used interchangeably and refer to the individual who responds to a user's service call to repair a device or system.

Field Service Management System (FSMS) - A specialized application program that automates some (if not all) of the following activities of a field service organization: call handling, dispatching, parts inventory and tracking, billing, efficiency reporting, and other functions. Ideally, the system accesses one data base from which each function can use and modify data.

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals, and all other ancillary hardware components. May also develop control system software in addition to installing the entire system at the end-user site.

ISDN - Integrated Services Digital Network. A proposed standard for digital networks providing transport of voice, data, and image using a standard interface and twisted-pair wiring.

LADT - Local Area Data Transport. Data communications provided by the BOCs within local access transport areas (LATAs).

Large System - Refers to traditional mainframes including, at the low end, IBM 4300-like machines, and at the high end, IBM 308X-like machines. Large systems have a maximum word length of 32 bits and a standard configuration price of $350,000 and higher.

Mean Time Between Failures (MTBF) - The elapsed time between hardware failures on a device or a system.

Mean Time to Repair - The elapsed time from the arrival of the field engineer on the user's site until the device is repaired and returned to the user for his utilization.

Mean Time to Respond - The elapsed time between the user placement of a service call and the arrival at the user's location of a field engineer.

Microcomputer - A microprocessor-based single or multiuser computer system typically priced at less than $15,000. A typical configuration includes an 8- or 16-bit CPU, monitor, keyboard, two floppy disk drives, and all required cards and cables.

Minicomputer - See Small System.

Operating System Software (Systems Software) - Software that enables the computer system to perform basic functions. Systems software, for the purposes of this report, does not include utilities or program development tools.

PBX - Private Branch Exchange. A customer premises telephone switch.

Peripherals - Includes all input, output, and storage devices, other than main memory, which are locally connected to the main processor and are not generally included in other categories, such as terminals.

Planning - Includes the development of procedures, distribution, organization, and configuration of support services. For example, capacity planning, "installation" planning.

Plug-Compatible Mainframe (PCM) - Mainframe computers that are compatible with and can execute programs on an equivalent IBM mainframe. The two major PCM vendors at this time are Amdahl and National Advanced Systems.

Professional Services - A category of services including system design, custom programming, consulting, education, and facilities management.

RBOC - Regional Bell Operating Company. One of seven holding companies coordinating the activities of the BOCs.

Remote Diagnostics - Gaining access to a computer from a point physically distant from the computer in order to perform problem determination activities.

Remote Support Implementation - An extension of remote diagnostics where some level of support delivery is performed from a point physically distant from the computer. Currently, this capability is more common to software support where problems can be solved or circumvented through downline loading of new code (fixes).

Reseller - A marketing organization which buys long-distance capacity for others at wholesale rates, selling services at retail but discounted prices and profiting on the difference.

Small Business Computer - For the purpose of this study, a system which is built around a Central Processing Unit (CPU), has the ability to utilize at least 20M bytes of disk capacity, provides multiple CRT workstations, and offers business-oriented systems software support.

Small System - Refers to traditional minicomputer and superminicomputer systems ranging from a small multiuser, 16-bit system at the low end, to a sophisticated 32-bit machine at the high end.

Software-Defined Network - A private network which uses public network facilities and which is configurable on an as-needed basis by the user (see Virtual Private Network).

Software Engineer (SE) - The individual who responds (either on-site or via remote support) to a user's service call to repair or patch operating systems and/or applications software.

Software Products - Systems and applications packages which are sold to computer users by equipment manufacturers, independent vendors, and others. Also included are fees for work performed by the vendor to implement a package at the user's site.

Superminicomputer - See Small System.

Systems Integration - The action of a single service vendor's design, development, and implementation of a system or subsystem including integration of hardware, software, and communications facilities for a customer.

System Interruption - Any system downtime requiring an Initial Program Load (IPL).

Systems House - Integrates hardware and software into a total turnkey system to satisfy the data processing requirement of the end user. May also develop systems software products for license to end users.

T-I - Refers to a standard I.544 megabit-per-second digital channel used between telephone company central offices and now used for microwave, satellite, fiber optics, or other bypass applications.

Third-Party Maintenance (TPM) - Any service provider other than the original equipment vendor.

Training - All audio, visual, and computer-based documentation, materials, and live instruction designed to educate users and support personnel in the ongoing operation or repair of hardware and software.

Turnkey System - Composed of hardware and software integrated into a total system designed to completely fulfill the processing requirements of a single application.

VSAT - Very Small Aperture Terminal. A small satellite dish system, usually using Ku-band frequencies.

Virtual Private Network - A portion of a public network dedicated to a single user.