SERVICE MARKET ANALYSIS AND FORECASTS

LARGE SYSTEMS

INPUT

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Planning Services For Management

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LARGE SYSTEMS

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SERVICE MARKET ANALYSIS AND FORECASTS
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SERVICE MARKET ANALYSIS AND FORECASTS
LARGE SYSTEMS

EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- The large-system service marketplace is a well-defined market that is considerably larger and more stable than other service markets, such as those for personal computers and office products. This stability in the large-system market may lead the uniformed observer to think that the mainframe service market is so mature that it is stagnating. Nothing could be further from the truth.

- The purpose of this report is to identify the primary trends in large-system service, to demonstrate how these trends will affect the overall market, and to suggest possible "action plans" that will help INPUT's clients to take advantage of the inevitable changes in the large-system service market.

- The Large-System Service Management Strategy volume is divided into five sections:

  - The Executive Summary is designed to present a brief overview of the most prominent findings and recommendations of the report.

  - The Large-System Market Analysis provides a financial overview of the large system, third-party maintenance (TPM), and total service market for 1984-1989.

  - The Large-Scale System Product Analysis is a review of the latest mainframe, supercomputer, and superminicomputer products arranged

by vendor. Also included in this section is a summary of the effect of new products on service trends.

- Service Development Trends discusses the specific service trends affecting hardware and software maintenance, professional services, educational services, and pricing of services.

- Conclusions and Strategic Recommendations for Vendors concentrates on long-term recommendations in such areas as 1) anticipation of increasing user pressure on the service market, 2) how to accommodate lower hardware service pricing in the future, and 3) taking advantage of the new growth in third-party maintenance.

- The information on this report was based on interviews with and comments from over 300 large-system users as well as extensive on-site interviews with seven of the top nine large-system vendors. The questionnaires used in these interviews are included in Appendix A and B of this report.

- In addition to primary research, INPUT has used a number of secondary sources for background information. These sources include annual reports, 10K reports, and articles from professional journals and the trade press.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This Executive Summary is designed to help the busy reader quickly review the research findings of this report without having to read each section, while ensuring that key points are not missed. Each main point is summarized as an exhibit and an accompanying script is given on the facing page. This format is designed to facilitate use of the Executive Summary as an in-house overhead presentation.

- The mainframe market is perhaps the most stable service market in the industry. The installed base of mainframes is very large, service organizations well structured, and mainframe users are knowledgeable about the services that they require. It is, however, this established stability in the large-system service market that makes change, any change, an important event.

- INPUT expects a series of major changes in the large-system service market between 1984 and 1989. The market is being transformed into a complete after-sales support market, as opposed to the current hardware-maintenance-dominated market. The initial change is the reduction in the price of hardware maintenance resulting from improved system reliability. This price reduction will have an adverse effect on vendor profitability. Large-system vendors will be forced to be much more active in promoting and marketing service in order to maintain service profitability.

A. SERVICE REVENUE FORECASTS, 1984-1989

- Overall service revenue for mainframes is expected to increase from $3.4 billion (annually) in 1984 to $5.7 billion in 1989, an average annual growth rate of 11%. While mainframes will remain the largest service market, every other service sector (e.g., minicomputers, PCs, terminals) is growing more rapidly than that for mainframes.

- A major cause of the slowdown in the mainframe service growth rate is the expected lackluster performance in mainframe equipment sales. INPUT projects only a 7% average annual growth rate in mainframe sales. In order to compensate for reduced sales and to maintain high service growth rates, vendors will be forced to increase the percentage of service revenues in relation to equipment sales.

- INPUT expects mainframe equipment manufacturers to consolidate their control of the service market and to actually take market share away from TPM vendors. By 1989, TPM penetration of the mainframe service market will be only 3.3%.

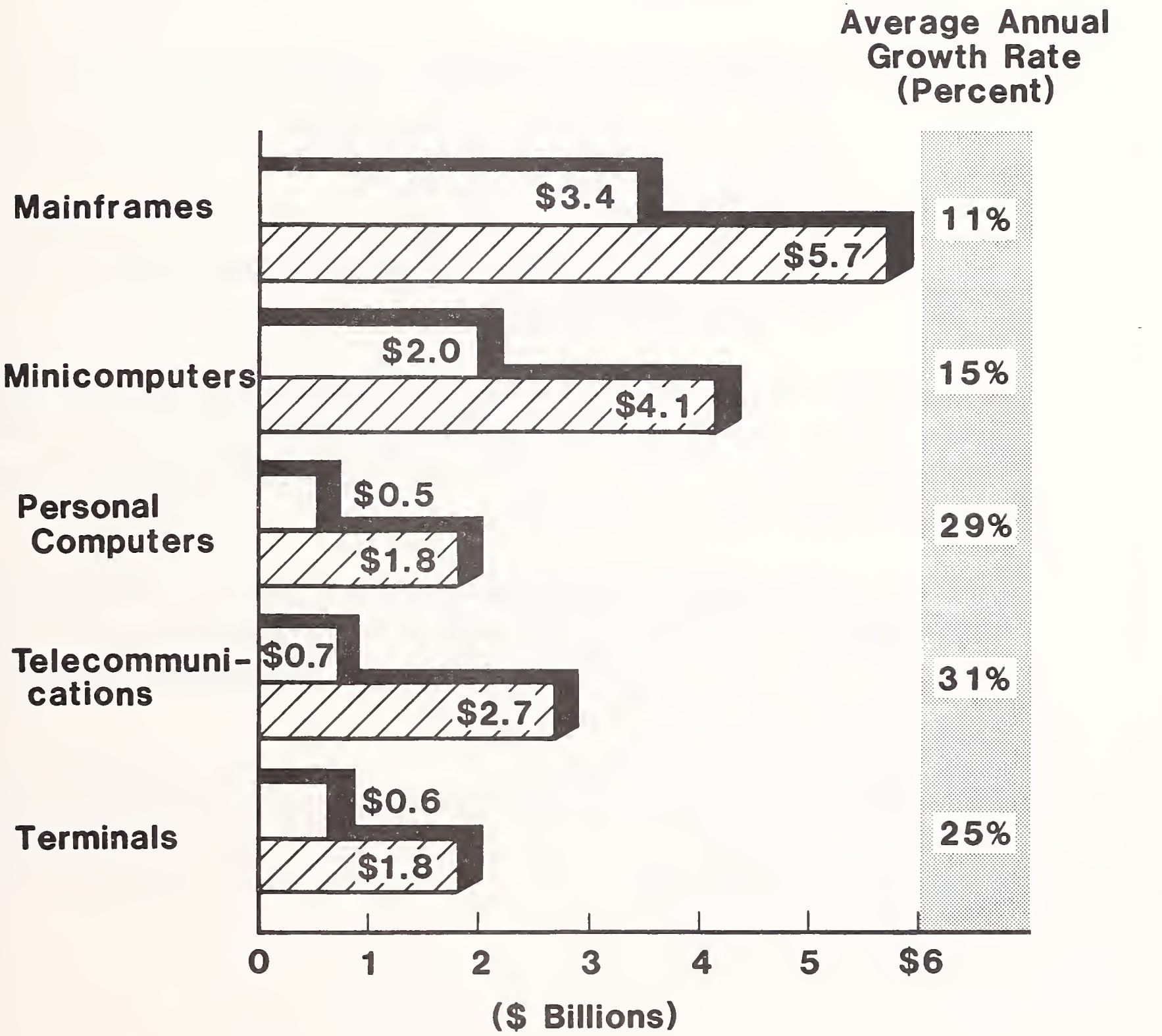
- IBM will increase its domination of the mainframe service market as a result of growing new product sales and improved service efficiency. Only two other companies (CDC and NAS) are expected to increase their percent share of the mainframe service market.

- Telecommunications is expected to be the fastest growing service sector between 1984 and 1989, with a 31% average annual growth rate. Mainframe vendors must be prepared to enter this market not only to benefit from the increased revenues derived from telecommunication service, but also to protect their installed base from service competitors.

- The 29% average annual growth rate in PC service is the result of increased demand by corporate users for extended services, in addition to a tremendous growth in PC sales.

EXHIBIT II-1

SERVICE REVENUE FORECASTS, 1984-1989



B. TECHNOLOGY'S IMPACT ON LARGE-SYSTEM SERVICE

- Mainframe service has been impacted more than any other service segment by new technology. The impact is felt more in mainframes than in other categories for several reasons:

  - Mainframes represent the largest service market.

  - Mainframe users are more service price sensitive but are willing to pay for new technology that improves service.

  - Mainframe users typically require the best service, which in turn requires advanced technology.

- Hardware service, traditionally the most important service segment, has benefited the most from new technology. INPUT expects much more emphasis on fault-tolerant systems as well as improved diagnostics (both remote and at the component level).

- Ironically, the closer mainframe vendors come to achieving 100% hardware availability, the less important this aspect of service becomes to the mainframe user. Look for users to expect similar improvements in all aspects of software support--particularly repair time.

- The bottom line is that new technology both in service and product design will result in decreases for the cost/performance ratio for service. This will increase user expectations of even lower service prices and improved reliability in the future.

EXHIBIT II-2

TECHNOLOGY'S IMPACT ON LARGE-SYSTEM SERVICE

- Mainframe Product Life Cycle Decreases as the Rate of New Product Introductions Increases

- New Technologies Require Less Traditional Service:
  - Increased Hardware Reliability
  - Fault Tolerance/ Redundant Systems
  - Improved Remote Diagnostics
  - Self-Diagnosing Components
  - Modular Design

- Improved Hardware Reliability Reduced the Perceived Need for Hardware Service -- Users Begin to Emphasize Software Services

- Bottom Line: New Technology Will Continue to Improve the Large-System Service Cost/Performance Ratio

C. THE CHANGING MIX IN LARGE-SYSTEM SERVICE

- Of the four major large-system service sectors, only hardware maintenance revenue is decreasing in proportion to total service revenue.

- Overall, hardware maintenance revenues will continue to grow, but at a very slow rate (5% AAGR). The major growth sectors will be software maintenance and support (33% AAGR), Professional Services (25% AAGR), and Educational Services (27% AAGR).

- Hardware maintenance revenues will not grow as fast as other service sectors due to increasing user price sensitivity and price competition from IBM. Revenues from software support, on the other hand, are expected to grow rapidly in response to increasing user demands for improved and expanded services.

- INPUT expects users to exert substantial pressure on mainframe service vendors to improve software support in these specific areas:

  - Response/repair time.

  - Training, documentation.

  - Timeliness of upgrades.

- Revenue from both professional and educational services is expected to increase in direct relation to the level of system integration at the user's site.

THE CHANGING MIX IN LARGE-SYSTEM SERVICE

- The Proportion of Hardware Maintenance Revenue to Total Service Dollars Generated Is Decreasing -- All Other Service Sectors Are Increasing

	1984	1989
Hardware Maintenance	83%	63%
Software Maintenance and Support	9	22
Professional Services	5	9
Educational Services	3	6

D. FOCUS ON USER REQUIREMENTS

- One of the most fundamental changes taking place in the large-system service market today is that it is becoming increasingly user-driven. Mainframe users are becoming much more knowledgeable not only about their particular service requirements but about the overall competitive environment as well.

- Large-system service vendors must understand how user requirements are changing if they are to meet those requirements and remain profitable.

- In general, users are moving away from demands for improved individual services and toward requiring fully integrated systems support (capable of satisfying all service needs with one call). Users will expect improved software support, consulting, and training as service emphasis moves away from hardware performance to overall system performance.

- Emphasis on overall system performance will make users appear to be a more cohesive group than they actually are. Vendors must be prepared to understand the needs of their user base, particularly in the areas of software support, consulting, training, and documentation, and to act on those user needs.

- Overall, INPUT believes that vendors must concentrate on improving service quality, defined as conformance to user requirements. While not all services will necessarily conform to specific user requirements, any service that does not contribute to satisfying user needs should be discarded as unnecessary to the profitable long-term operation of the service vendor.

EXHIBIT II-4

FOCUS ON USER REQUIREMENTS

- Single-Source Maintenance of Mixed-Vendor Hardware
- Quality Service
- Response Time Options
- Price-Sensitive

1984 USER REQUIREMENTS

- Integrated Post-Sales Support
- Includes:
  - Consulting
  - Training
  - Software Support
  - Documentation
- Price Less Important

1989 USER REQUIREMENTS

III LARGE-SYSTEM MARKET ANALYSIS

III LARGE-SYSTEM MARKET ANALYSIS

A. CURRENT MARKET FOR CUSTOMER SERVICES

1. TOTAL MARKET SERVICE REVENUE, 1984-1989

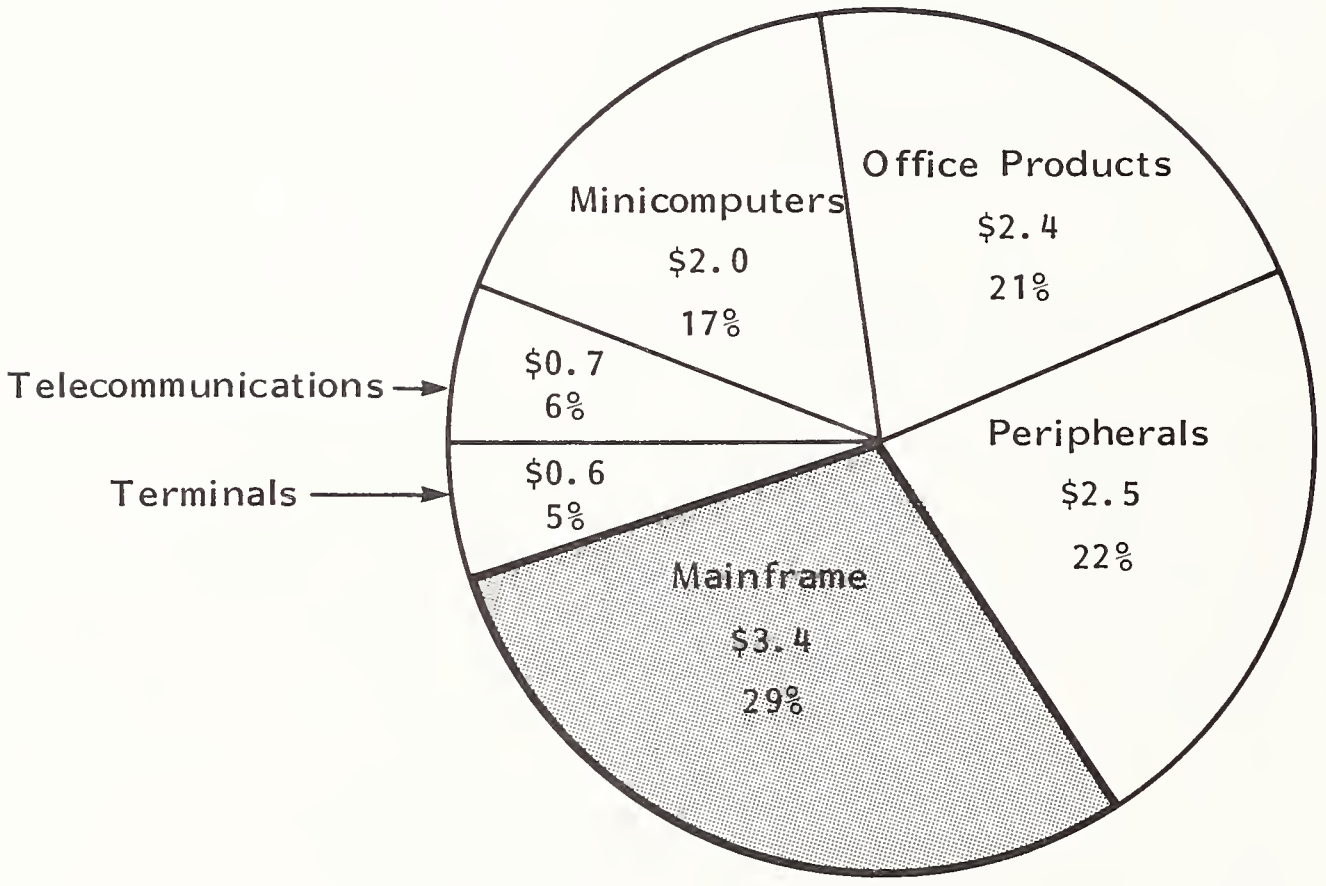
- Large-system customer service revenues have been growing at a steady if not spectacular rate since the late 1970s. The current mainframe service market is growing at just under 15% a year, but INPUT expects the growth rate to slow to under 10% by 1989. The average annual growth rate (AAGR) for 1984 to 1989 will be 11%.

- Although service revenue growth for the rest of the decade will not be as rapid as in the past, the importance of service revenue as a whole will grow considerably. As shown in Exhibits III-1 and III-2, INPUT projects 1984 total service revenue to be $11.6 billion, increasing to $25.4 billion in 1989.

- In 1984 mainframe service generated $3.4 billion, 29% of all service revenue. Although mainframe sales are not expected to increase as fast as other segments of the market, INPUT expects mainframe service to remain one of the largest revenue segment in the market through the end of the decade. Revenue from other service segments is expected to grow more rapidly than for mainframes:

EXHIBIT III-1

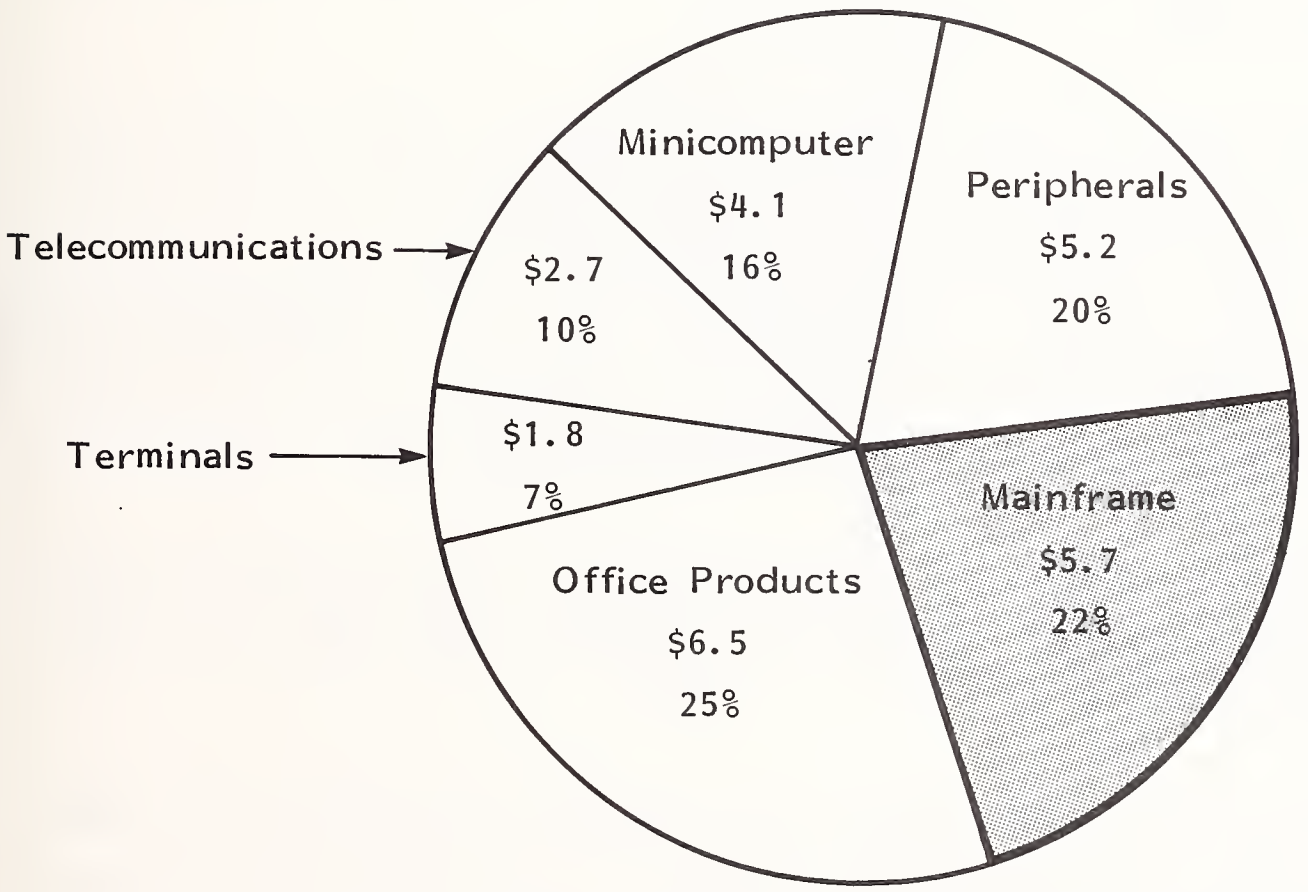
1984 CUSTOMER SERVICE REVENUES BY MARKET
($ Billions)



Total Service Revenue in 1984: $11.6 Billion

EXHIBIT III-2

1989 CUSTOMER SERVICE REVENUES BY MARKET (FORECASTS)
($ Billions)



Total Service Revenue Forecast in 1989: $26.0 Billion

1984-1989 Total Service AAGR: 17%

- Peripherals are another important segment of the service market, generating $2.5 billion in 1984. Service revenues derived from peripherals will grow at an annual rate of 16%, faster than both mainframe and minicomputer service revenues. By 1989, INPUT projects service revenues from peripherals to exceed $5 billion a year.

- Minicomputer/small business system service revenue represents 17% of the current service market, and is expected to grow at 15% per year thru 1989.

- Terminals, personal computers (as included in office products), and telecommunications each represent less than 8% of the overall service market in 1984 but the service market for these products is expected to grow rapidly. Telecommunications, with a 1984 service revenue of $0.7 billion, is expected to grow at 31% per year, and personal computer service revenue will increase at 29% per year.

- Service on terminals currently represents one of the smallest markets (0.6% billion) but is expected to increase at 25% a year to $1.8 billion by 1989.

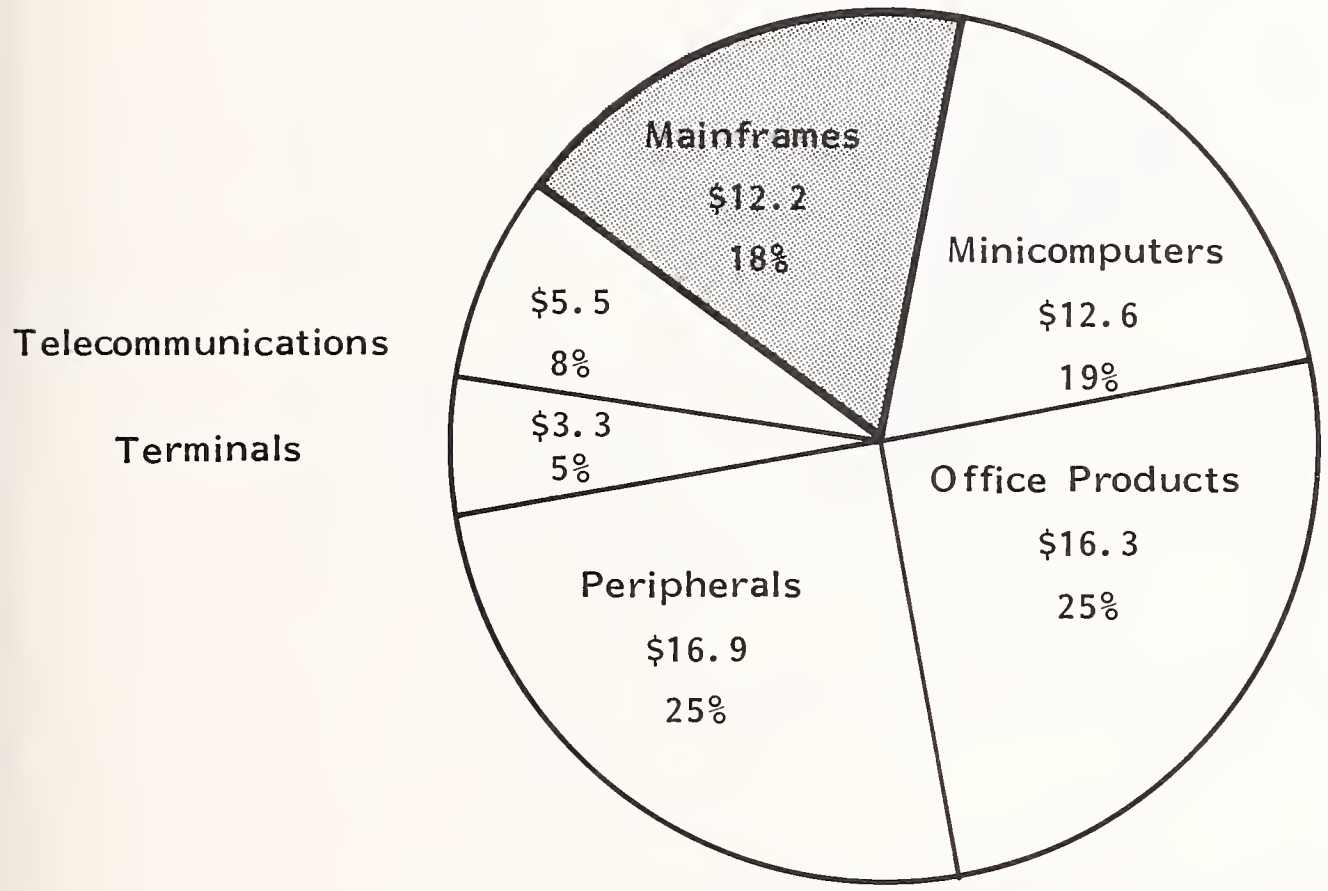
- The office products market (not including PCs) is expected to show steady service revenue gains through the end of the decade. Service revenues for this sector will increase from $1.9 billion (1984) to $4.7 billion (1989), a 20% average annual growth rate.

- One of the major contributors to service income is, as might be expected, equipment sales. Exhibits III-3 and III-4 provide a breakdown by product class of the $66.8 billion DP equipment market in 1984, and the $125 billion market of 1989.

- INPUT projects a 13.4% average annual growth rate in the shipment of DP equipment between 1984 and 1989. As Exhibit III-3 demonstrates, peripherals

EXHIBIT III-3

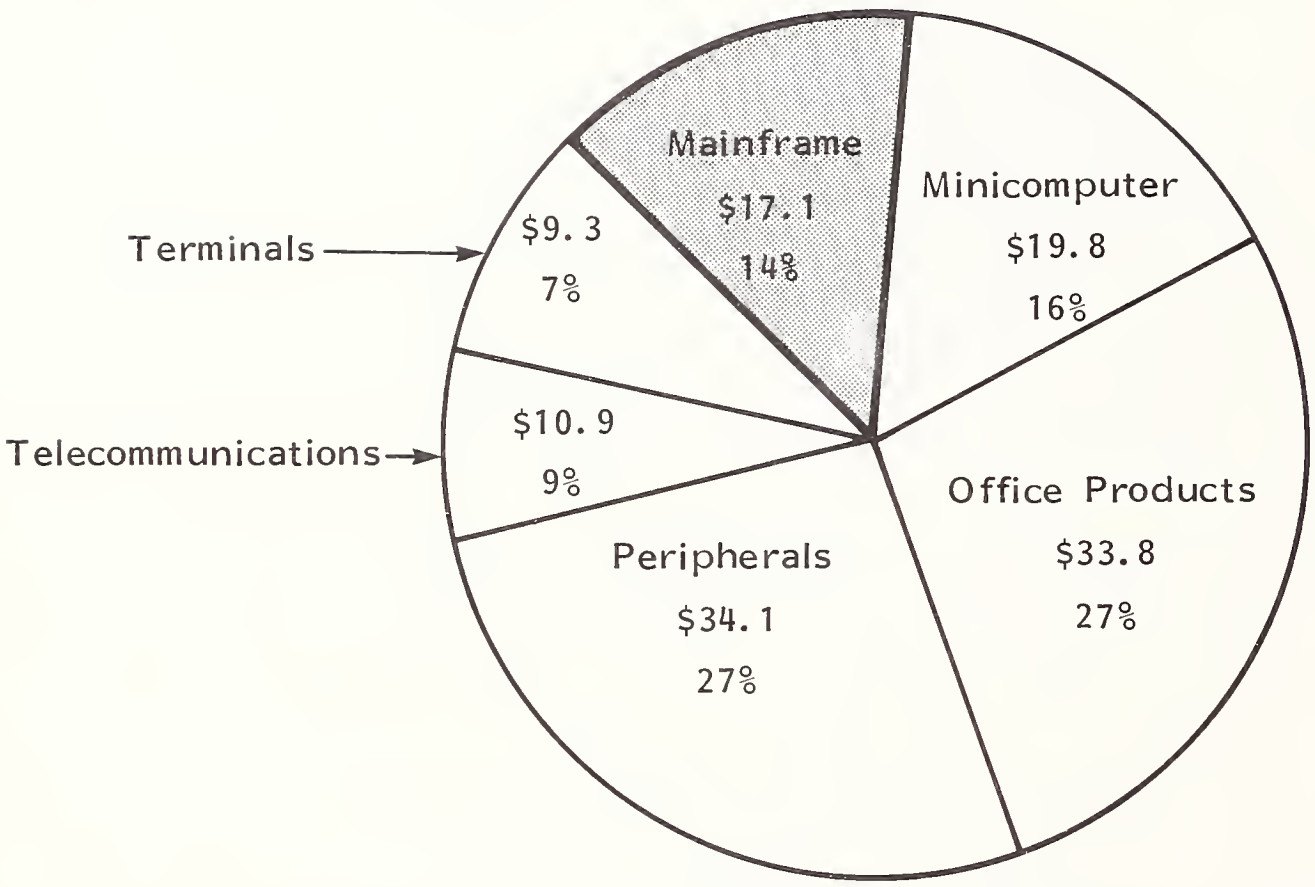
1984 DP EQUIPMENT SHIPMENTS
($ Billions)



Total Shipments in 1984: $66.8 Billion

EXHIBIT III-4

1989 DP EQUIPMENT SHIPMENTS (FORECAST)
($ Billions)



Total 1989 Equipment Shipments (Forecast): $125.0 Billion

and office products will lead the industry in total sales, while terminals and personal computers will register the fastest equipment growth rates. (PCs are included as a subset of office products, and are growing at 19% per year.)

- Although equipment sales have a direct impact on service revenue, INPUT has found that service departments are becoming less dependent an new equipment sales as the only method for increasing service revenues. Service vendors have been active in identifying new sources of revenue such as supplies sales and add-on services (stand-by equipment, guaranteed uptime options, etc.). By generating increased after-sales support revenue, several of the largest vendors (such as DEC) have been able to increase overall revenues (primarily on the strength of service contributions) despite lagging equipment sales.

- The relationship between equipment sales and service revenue by market segment is demonstrated in Exhibit III-5. Mainframe vendors generate a much higher level of service revenue in relation to equipment sales than do other market segments for several reasons:

  - Mainframe users are typically less cost-conscious than small- or micro-based system users.

  - The mainframe service market is older and more firmly entrenched than other market segments--a greater variety of services are typically offered.

  - Mainframe users require numerous support services in order to maintain high levels of system availability.

- Personal computers--as a market segment--generate the lowest service revenue in relation to equipment sales. This is caused by two major factors. First, the service market for PCs is not yet fully developed. Several manufacturers offer little or no service at all (they depend on TPM vendors).

EXHIBIT III-5

EQUIPMENT SHIPMENT AND SERVICE REVENUE FORECASTS, 1984-1989

PRODUCT CLASS	EQUIPMENT SHIPMENTS ($ Billions)			TOTAL SERVICE REVENUE ($ Billions)			AAGR 1984-1989 (Percent)
	1983	1984	1989	1983	1984	1989	
Mainframes	$11.4	$12.2	$17.1	$3.2	$3.4	$5.7	11%
Minis/SBS	11.1	12.6	19.8	1.6	2.0	4.1	15
Peripherals	13.7	16.9	34.1	2.2	2.5	5.2	16
Terminals	2.9	3.3	9.3	0.5	0.6	1.8	25
Personal Computers	3.1	3.7	8.9	0.4	0.5	1.8	29
Office Products	10.9	12.6	24.9	1.7	1.9	4.7	20
Telecommunications	4.8	5.5	10.9	0.6	0.7	2.7	31
Totals	$57.9	$66.8	$125.0	$10.2	$11.6	$26.0	17.5%

- The second major reason why PC service revenue has not improved in relation to sales is that PC users have traditionally been very price-sensitive. Service revenue for the PC market segment is expected to soar as a result of the conversion from the price-sensitive user of the past to the corporate, performance-oriented user of the future.

- Service revenues derived from telecommunications will suffer from the relatively long product life cycle and high degree of reliability of telecommunication equipment. Although service revenue will not increase substantially in relation to telecommunication sales, overall telecommunication service revenues will increase dramatically as a result of rapid telecommunication market expansion.

- Peripheral and terminal service revenues will increase substantially in the next three to five years, but, like telecommunications, service revenue will not increase dramatically in relation to equipment shipped. There will be some additional service revenue derived from high product availability requirements, but redundant/duplicate products will prevent unusually high service revenue growth (i.e., over and above normal increases resulting from new sales).

- Major increases in office product service revenue is likely as vendors begin to offer a greater variety of support services and as users become more dependent on their DP equipment. Although service revenue is 15% the size of office product sales today, by 1989 that figure will increase to 20%.

2. EFFECT OF THIRD-PARTY MAINTENANCE ON THE SERVICE MARKET

- Third-party maintenance in the computer industry is currently a $1.14-billion-a-year business representing 10% of the overall service market. The largest TPM market sector, as shown in Exhibit III-6, is personal computers (a component of office products), where TPM vendors control almost two-thirds of the market.

EXHIBIT III-6

THIRD-PARTY MAINTENANCE REVENUE AND MARKET PENETRATION BY PRODUCT SECTOR

MARKET SHARE	1984			1989		
	SERVICE REVENUE ($ Billions)	TPM REVENUE ($ Billions)	TPM PENETRATION (Percent)	TOTAL SERVICE REVENUE ($ Billions)	TPM REVENUE ($ Billions)	TPM PENETRATION (Percent)
Mainframes	$ 3.4	$ .16	4.7%	$ 5.7	$ .19	3.3%
Minicomputers	2.0	.17	8.5	4.0	.35	8.8
Peripherals	2.5	.23	9.2	5.3	.36	6.8
Terminals	0.6	.11	18.3	1.2	.31	25.8
Office Products	2.4	.37	15.4	6.5	.90	13.8
Telecommunications	0.7	.10	14.3	2.7	.39	14.4
Total	$11.6	$1.14	9.8%	$25.4	$2.5	9.7%

- TPM market penetration in personal computers has been caused, in large part, by two factors. First, because of large volume sales (particularly for systems like IBM and Apple), it is economically feasible to train technicians and stock parts. Second, most of the manufacturers had a "hands-off" attitude toward PC support and offered only the most marginal of services, such as mail-in depot service. (Although this is changing, many of the TPM vendors still offer better PC service than manufacturers.)

- The mainframe TPM market, discussed in greater detail below, currently controls about 5% of the overall mainframe service market. In many cases, TPM vendors are servicing obsolete systems that manufacturers no longer support. Mainframe TPM vendors are, in a sense, providing a service to manufacturers and users.

- Minicomputers represent about 15% of the TPM market. As do mainframe TPM vendors, minicomputer TPM vendors service obsolete systems, but these vendors are also active in servicing current CPUs. Growing interest on the part of minicomputer manufacturers in sole-source maintenance will probably reduce TPM penetration in the next three to five years in this market sector.

- Maintenance of peripherals is one of the most lucrative of the TPM markets ($230 million in revenue in 1984), but peripherals is also a market that will come under increasing pressure from manufacturers as the manufacturers promote sole-source maintenance.

- TPM penetration in the terminals market is expected to remain strong (17-18% of all terminals service revenue). This is due to the fact that TPM vendors can provide a generally faster turnaround time on terminals than can manufacturers.

- The office product market (excluding PCs) does not hold a great deal of promise for TPM vendors. Currently, only 2% of the market is serviced by

TPM vendors ($40 million in 1984) and, because of manufacturers' emphasis on single-source maintenance, it is unlikely that TPM vendors will be able to significantly expand their market share.

- TPM vendors are already making significant inroads in the telecommunications market with $100 million in revenue, 14% of the total market. Although the TPM market share will remain constant (at 14%), explosive growth in the telecommunications service market will make this market a major revenue producer for third-party maintenance vendors.

B. CURRENT LARGE-SYSTEM SERVICE MARKET

1. SERVICE REVENUE AND MARKET SHARE BY VENDOR

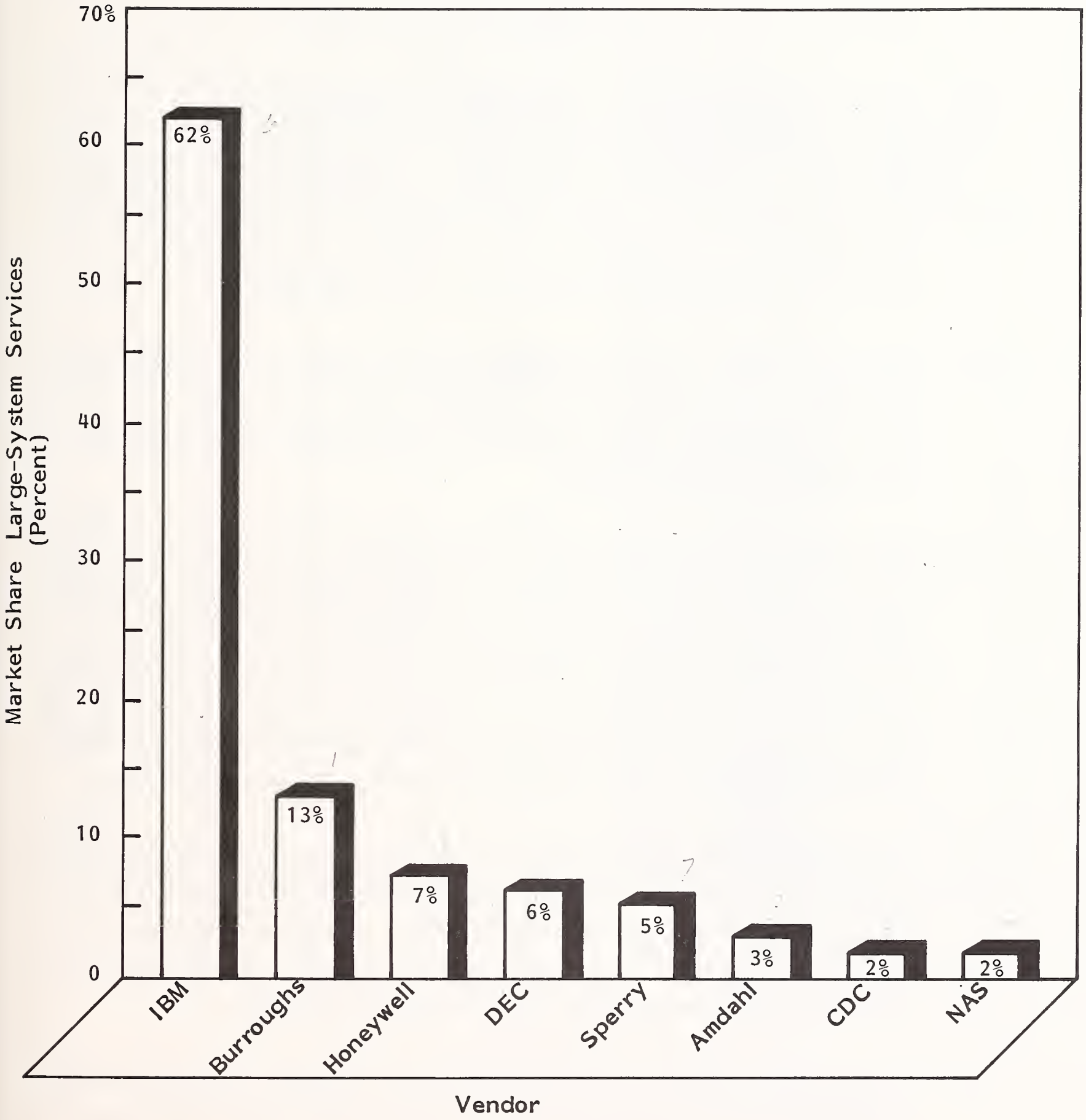
- The mainframe market currently (1984) produces about $3.4 billion in annual service revenues for eight major large-system vendors, as well as numerous speciality mainframe vendors and large-system TPM vendors. The mainframe market includes both large superminicomputers and mainframes, but does not include supercomputers such as Cray or ETA Systems.

- Between 1983 and 1984, the large-system service market grew by approximately 14% despite the fact that mainframe hardware sales are growing at only 7% per year. As explained earlier, mainframe service is becoming less dependent on hardware sales to fuel revenue growth. Large-system vendors such as DEC, Burroughs, and Sperry have been quite successful in selling new services to their existing customer base, even though increased competition has restricted expansion of hardware sales.

- Exhibit III-7 lists the large-system service market share for the top eight manufacturers. As expected, IBM dominates the large-system service market with a 62% share. Traditional mainframe vendors such as Burroughs, Honey-

EXHIBIT III-7

1983 LARGE-SYSTEM SERVICE MARKET SHARE



well, and Sperry have much smaller market shares. DEC is usually thought of as a minicomputer manufacturer, but the DEC-10 and DEC-20 mainframes, and the VAX-series of superminis compete in the mainframe market from which the company derives substantial service revenues.

- Despite the relatively small market shares listed for some of the vendors in Exhibit III-7, the reader should not conclude that service revenues are inconsequential to large-system manufacturers. In fact, most of the large-system vendors interviewed by INPUT regard service as an integral part of their business, not only to maintain system availability, but more importantly, to realize service-related revenues and bottom-line profitability.

- Service revenues typically represent 17-19% of a large-system vendor's total information services revenue and for some vendors, like Sperry, this figure can be almost 30%. Exhibit III-8 lists the estimated total service revenues for the major large-system vendors.

- All of the vendors listed in Exhibit III-8 participate in more than one computer industry market segment. Amdahl, for example, sells and services Fujitsu disk drives; NAS will service a wide variety of peripherals and systems as part of its Total Support Package. Large-system service revenue is a relatively minor component of total revenue for some vendors (e.g., DEC and CDC), but for four of the vendors in Exhibit III-8 (Burroughs, Honeywell, Amdahl, and NAS), large-system service revenue represents the major service revenue source.

- While DEC derives less than 20% of its service revenue from mainframes and superminicomputers, this market is still important to DEC because it is one of the company's fastest growing product sectors. A similar case exists at CDC, where the introduction of the new 180/800 mainframes is expected to increase the importance of large-system service revenue considerably.

- Large-system customer service revenue growth is listed in Exhibit III-9. DEC and NAS are currently registering the fastest service growth rates due to 1)

EXHIBIT III-8

1983 LARGE-SYSTEM SERVICE REVENUE

VENDOR	1983 WORLDWIDE INFORMATION SYSTEMS REVENUE	ESTIMATED TOTAL CUSTOMER SERVICE REVENUE	ESTIMATED MAINFRAME SERVICE REVENUE	MAINFRAME SERVICE REVENUE RANK
IBM	$40,200	$7,300	$2,118	1
Burroughs	4,390	1,073	444	2
Honeywell	1,666	460	239	3
DEC	4,272	1,053	205	4
Sperry	2,799	820	171	5
Amdahl	778	139	94	6
CDC	3,508	303	65	7
NAS	325	74	53	8

EXHIBIT III-9

LARGE-SYSTEM CUSTOMER SERVICE REVENUE GROWTH

VENDOR	1983 GROWTH (Percent)	PROJECTED GROWTH FOR 1984 (Percent)
Amdahl	7%	5%
Burroughs	4	3
CDC	6	7
DEC	29	25
Honeywell	2	5
IBM	16	18
NAS	21	20
Sperry	3	10
Weighted Average*	14%	15%

*Weighted by Total Customer Service Revenues.

Source: INPUT Estimates, 10Ks, ARs.

an upturn in equipment sales, and 2) entry into TPM markets. Sperry's service growth rate is expected to triple by 1984, primarily as a result of new revenue derived from two massive government contracts. Honeywell's large-system service revenues will grow from 2 to 5% in 1984 due to increased system sales.

- The service revenue growth rate is expected to drop for both Amadahl and Burroughs in 1984. Although these will not be major decreases, they are significant in the face of other large-system vendors' service returns. Amdahl's growth rate is slowing simply because the company needed to "catch-up" after an explosive 68% increase in sales for 1983. In 1984 revenues could not grow as quickly as in 1983, due to lack of availability of disk drives and some 580 series design flaws that have limited the customer demand. Disappointing service revenue growth at Burroughs is the result of lackluster sales performance of the company's large systems.

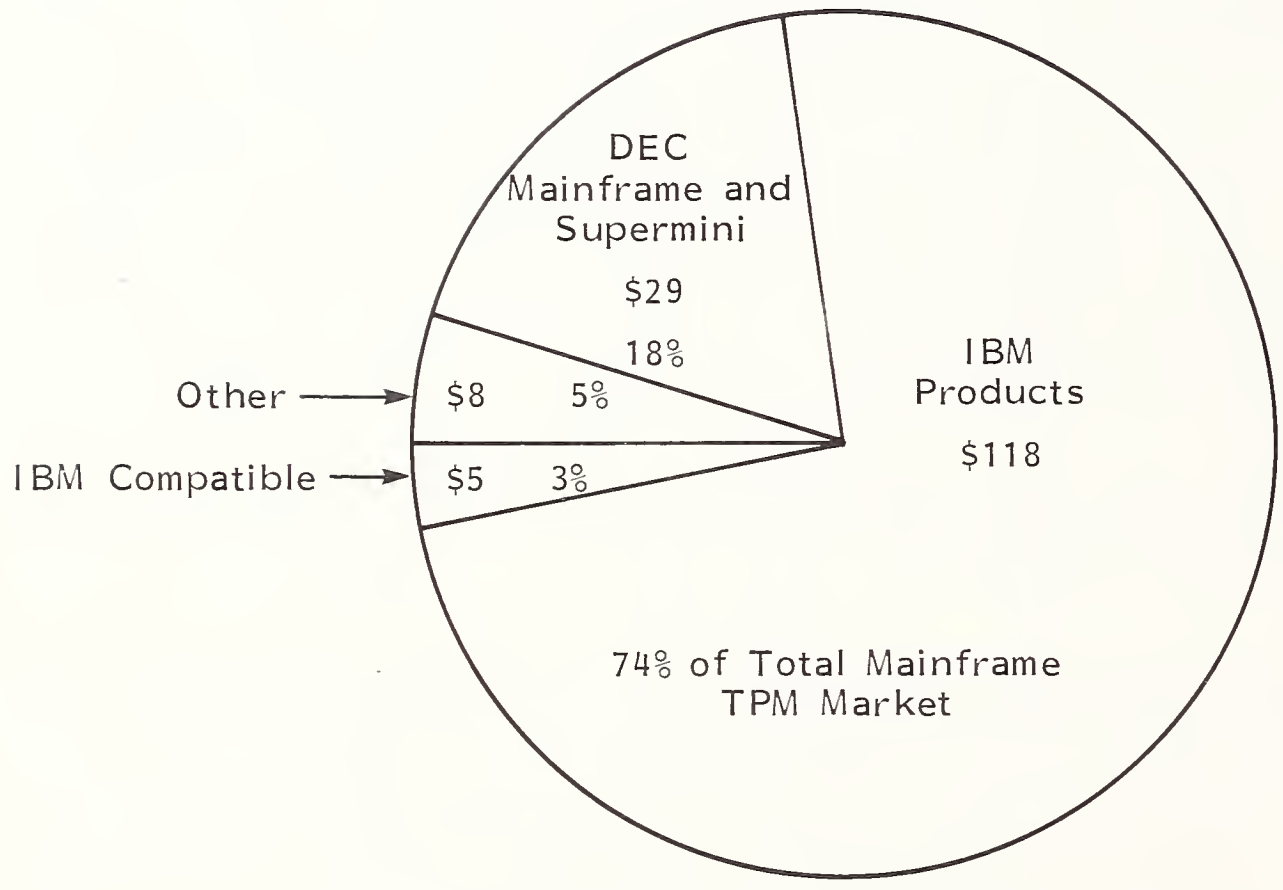
2. CURRENT IMPACT OF THIRD-PARTY MAINTENANCE ON THE LARGE-SYSTEM SERVICE MARKET

- Third-party maintenance vendors servicing the large-system market will earn an estimated $160 million in 1984, representing approximately 5% of the total mainframe service market. Most of the TPM revenue will be derived from service on obsolete CPUs or markets not actively pursued by the manufacturers.

- Exhibit III-10 illustrates the mainframe TPM market breakdown. As might be expected, service on IBM mainframes represents the vast majority of the TPM market--$118 million in 1984, 74% of the total. Service on DEC mainframes and superminis follows IBM with $29 million in TPM revenue. Service on IBM compatibles includes vendors such as Magnuson and IPL. Two of the largest IBM-compatible vendors, Amdahl and NAS, have reported little or no problems with TPM encroachment.

EXHIBIT III-10

1984 MAINFRAME TPM MARKET
($ Millions)



Total Mainframe TPM Market in 1984: $160 Million

- As noted above, TPM vendors typically service older/obsolete mainframes for which the manufacturer is no longer service price competitive. It is not unusual for many of the manufacturers to increase maintenance prices dramatically on older machines in order to encourage users to move to new equipment. Some users, however, have found that new equipment is incompatible with their old software or data. In these cases, the TPM vendor will service the older machine usually at a price considerably lower than the manufacturer's.

- The mainframe TPM market is dominated by three major vendors (CDC/Comma, Sorbus, TRW) that control 60% of the market. As Exhibit III-11 shows, CDC/Comma is the largest mainframe TPM vendor, with an estimated $40 million in 1984 mainframe TPM revenues. Comma has a distinct advantage in the mainframe market due to the company's past commitment to IBM mainframe maintenance.

- Sorbus has mainframe service revenues of $35 million in 1984 and is the second largest player in this market. The company was originally formed to support MAS equipment, but cut its TPM teeth on IBM and IBM-compatible tape and disk drives. The company has supported IBM mainframes (chiefly 1410, 360/370, and 303X systems) since the mid-1970s.

- TRW is the third-largest mainframe TPM vendor with $20 million 1984 revenue and a 13% market share. Mainframe revenues represent only 10% of TRW's total TPM revenue from 1984, but this does not necessarily indicate a lack of commitment to the market. TRW's policy appears to be to increase CPU maintenance as a prerequisite to total system control.

EXHIBIT III-11

TPM VENDOR MAINFRAME* MARKET SHARE

VENDOR	1984 ESTIMATED TPM REVENUE ($ Millions)	MARKET SHARE (Percent)
CDC/Comma	$40	25%
MAI/Sorbus	35	22
TRW	20	13
Total Technical Services	10	6
CMLC	8	5
Other	47	29
Total	$160	100%

*Includes Superminicomputers.

C. 1984-1989 FORECAST FOR THE LARGE-SYSTEM SERVICE MARKET

1. LARGE-SYSTEM SERVICE REVENUE GROWTH, 1984-1989

- The mainframe service market is currently growing at 14% per annum, but INPUT expects this rate to slow considerably. Between 1984 and 1989 INPUT projects an 11% average annual growth rate resulting in mainframe service revenues of $5.7 billion annually by 1989.

- Despite the fact that mainframe service growth will be the slowest of all the market sectors (compared to Minicomputer service growth of 15% and PC service growth of 29%), overall revenues derived from mainframe service will remain very high. This is caused by the large installed base of mainframes and the increasing dependence on mainframes by a variety of new markets.

- Service revenue from mainframes is going to grow considerably faster (at 11%) than mainframe equipment sales (7%). The increased growth in service revenue results mainly from the success of mainframe service vendors in expanding the market with additional support services such as consulting, planning, or training. INPUT's 1984 report User Service Requirements--Large Systems detailed the positive effects that improved after-sales support can have for mainframe service vendors.

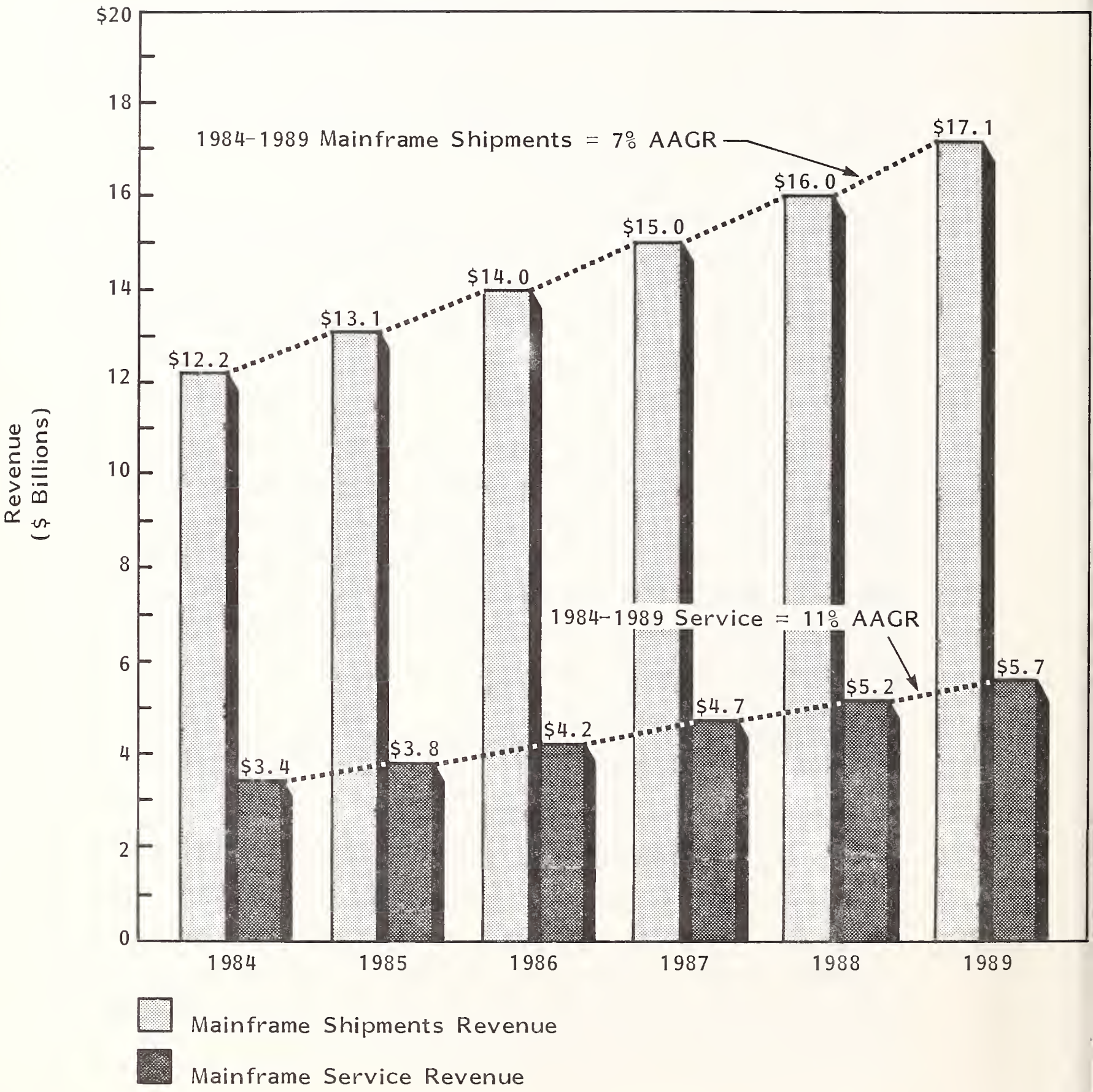
- Exhibit III-12 shows growth in mainframe shipments and service between 1984 and 1989.

2. MAINFRAME SERVICE MARKET SHARE BY VENDOR

- A computer vendor tends to regard its top-of-the-line mainframe as the company's flagship. Typically, vendors will spend more R&D money, improve production control, and increase the marketing effort in order to improve the potential for success of a new mainframe line.

EXHIBIT III-12

MAINFRAME MARKET GROWTH RATES, BY YEAR



- In addition to prestige, there is a practical side to mainframe sales as well. A successful new mainframe like the DEC VAX or IBM 370 can have a tremendous impact on a company's profitability and even viability. In addition to the actual sales of the mainframe, vendors can sell a variety of peripherals and services. Sales of "add-on" equipment and services often result in substantially greater profitability than the sale of the CPU itself.

- The importance of the mainframe in total system sales and profitability is not lost on any of the computer vendors. In just the last two years, five of the top eight computer vendors have introduced entirely new CPUs designed to compete in the mainframe market. These and other vendors in the industry know that it is much more difficult (if not impossible) to survive with outdated products.

- Since the mid-1970s IBM has increased new product introductions considerably, partly to introduce new technical innovations but also as a potent competitive weapon. Initially, IBM's response to mainframe competition centered around aggressive pricing. This strategy resulted in lower profitability for many mainframe vendors. By introducing a steady stream of new products, IBM threatens the very survival of some competitors.

- Most of the mainframe vendors reacted to increased competitiveness from IBM by specializing in particular markets, e.g., Burroughs in banking or Sperry in government contracts. INPUT believes that this market niche strategy can be particularly effective for increasing service revenues but can result in vulnerability if a major competitor, such as IBM, decides to enter the niche.

- Ultimately, the individual vendor's share of the service market between 1984 and 1989 will depend on the vendor's ability to identify vertical markets and meet the service needs of those markets while responding to increased competitiveness from the overall market leader (IBM) and from the individual segment (e.g., banking, manufacturing, government) market leaders.

- Exhibit III-13 demonstrates that IBM will not only continue its domination of the mainframe service market, but will increase its control over the market by 1989. IBM's 67% market share (1989) will result from several factors:

  - Increasing dominance of the mainframe hardware environment--boosted not only by new hardware introductions ("Sierra"), but also by extended product upgrades such as the "XA" option to the 308X series.

  - Dramatic growth in systems software service and professional service revenue.

- Other mainframe vendors that will increase or maintain current service market share include Amdahl, CDC, and National Advanced Systems.

  - Amdahl will be able to maintain a 3% market share through 1989, based on a high level of user acceptance of the 580 series of mainframes. In addition, Amdahl users are typically service price insensitive (although INPUT does see a trend toward increased price sensitivity among Amdahl users).

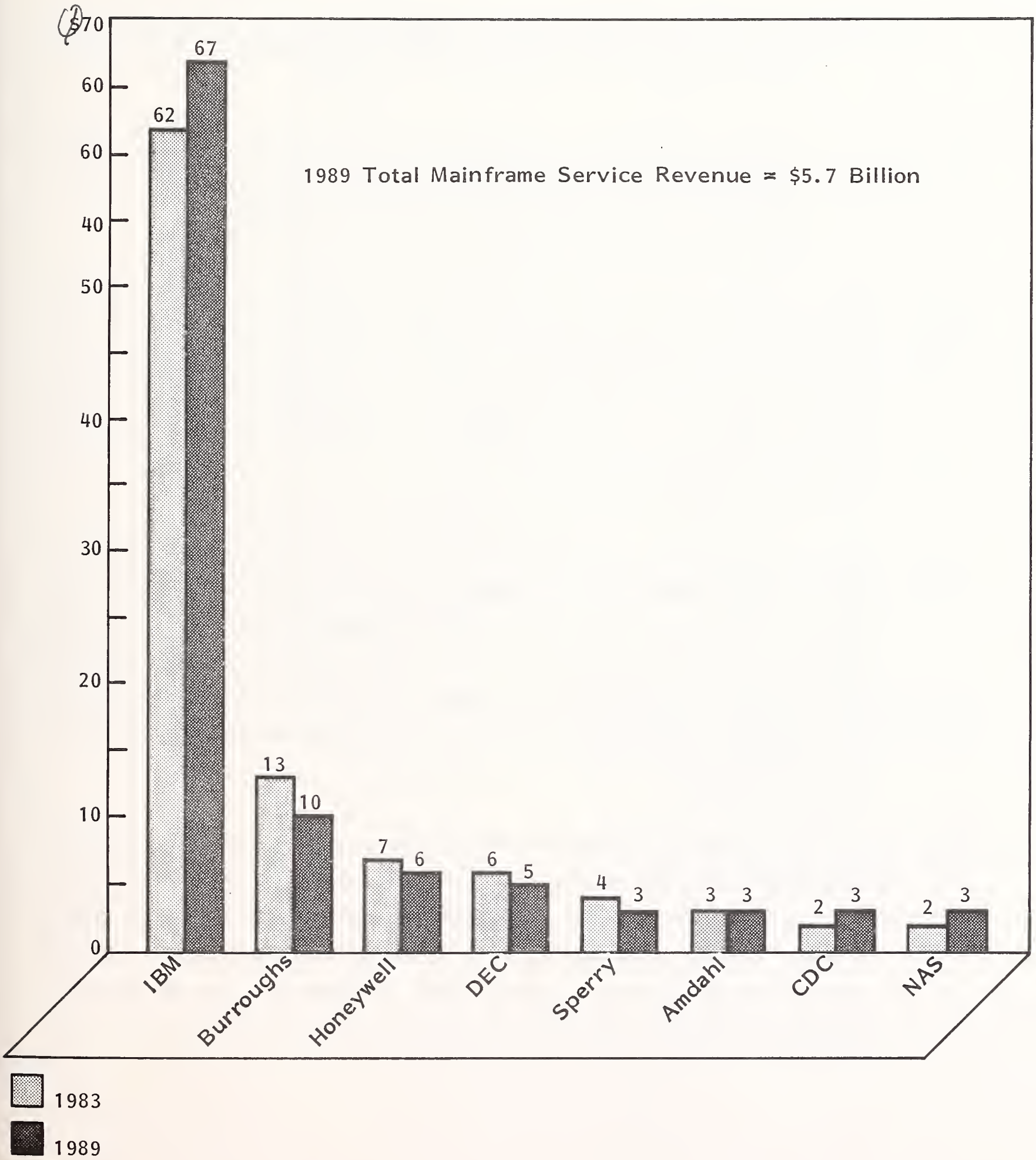
  - CDC has recently introduced its new line of mainframes (the 180/800 series) and although INPUT does not expect the new system to make major inroads in new markets, it does provide expansion room for CDC.

  - NAS has developed an excellent service reputation and the company should be able to build on this reputation via TPM services and increased sales of Hitachi-manufactured mainframes.

- Burroughs will suffer the greatest loss of mainframe service market share for several reasons:

EXHIBIT III-13

1983-1989 LARGE-SYSTEM SERVICE MARKET SHARE



- It is likely that IBM will begin to compete directly with Burroughs in selected market niches, such as banking. Although this competition does not necessarily mean the loss of the market for Burroughs, hardware and service revenues will suffer.

- Burroughs has not established a good reputation in service and its users are more likely to resist service price increases.

- Although Burroughs has recently introduced several new mainframes, its installed base is primarily older machines that cannot take advantage of the service efficiencies of the latest technology.

- DEC is expected to lose large-system service market share as a result of its decision not to upgrade or extend the popular DEC-10 or DEC-20 services of mainframes. Although the VAX line of superminicomputers will continue to produce substantial service revenues from the mainframes market, a slight decline in share will result as DEC-10 and DEC-20 users shift to other, primarily non-DEC, machines.

- Honeywell and Sperry will both lose large-system service market share as a result of reduced hardware development programs. Sperry's mainframe user base has been growing very slowly and its development of a new generation of mainframe (after the 1100/90) has been hindered by the delays in Trilogy's wafer scale integration (WSI) technology. (Sperry owns 13.5% of Trilogy and was depending on WSI technology to serve as a base for the next generation of Sperry mainframe.)

- Like Sperry, Honeywell stands to lose service revenue as mainframe product offerings become more and more limited. Honeywell already suffers from a relatively small mainframe market share and is confronted with intense competition from both IBM and plug-compatible vendors. The company's service revenues could get a boost from the agreement recently signed by Honeywell and NEC in which Honeywell will be given the exclusive marketing

(and service) rights to NEC's new mainframe, the S-1000. This agreement will not have much of an impact on Honeywell service revenues, however, until the late 1980s when the installed base of S-1000s will be large enough to overcome the service startup costs.

3. IMPACT OF THIRD-PARTY MAINTENANCE ON MAINFRAME SERVICE, 1984-1989

- Mainframes are currently one of the most profitable segments of the TPM marketplace. TPM mainframe contracts are typiclly larger and the profit margins better than other segments such as PCs or minicomputers. Some of the specific advantages of the mainframe TPM market include:

  - Because each contract is so large, sales are typically made on a direct sales basis. This allows a great deal of TPM vendor flexibility in satisfying user service requirements.

  - Users typically require extended services on mainframes, which are usually more profitable than are base services.

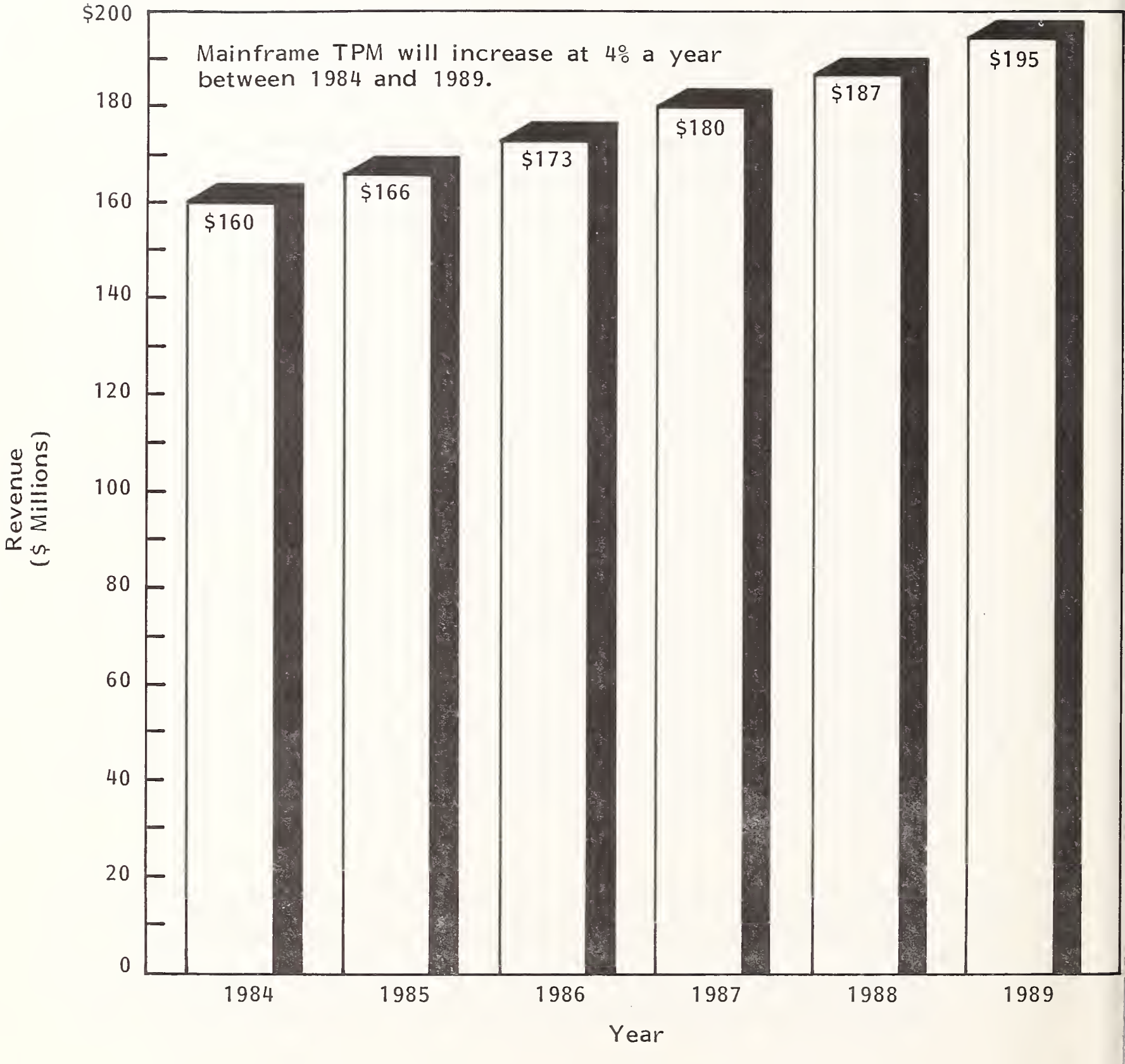
  - Customers are willing to commit to long-term contracts, which help to ensure stable profitability.

- As Exhibit III-14 demonstrates, TPM mainframe revenues are expected to increase from $160 million in 1984 to $195 million in 1989--an average annual growth rate of about 4% a year.

- Despite 4% AAGR growth in the mainframe TPM market, INPUT expects that TPM vendors will exert less influence on the mainframe market in the future. Currently TPM vendors control about 5% of all mainframe service revenue; INPUT estimates that by 1989, this number will be reduced to 3%.

EXHIBIT III-14

TPM MAINFRAME FORECAST, 1984-1989



- The primary reason for lack of growth in the mainframe TPM market between 1984-1989 is that INPUT expects IBM to gradually reduce the price of service, particularly on new products. This reduced price will not only make it more difficult for TPM vendors and resellers to compete in this market, but it will also make users more reluctant to move away from the manufacturer's service.

- Exhibit III-15 demonstrates that TPM revenue derived from IBM mainframes (75% of total TPM mainframe revenues in 1984) will grow at an annual rate of only 2% between 1984 and 1989. The IBM-compatible market, however, will expand by 28% per year, from $5 million in 1984 to $17 million in 1989. This expansion in service revenue is due to several factors:

  - Plug-compatible manufacturers (PCM) such as NAS and Amdahl typically charge high prices for service. As this installed base grows, there is a greater chance for TPM penetration based on price.

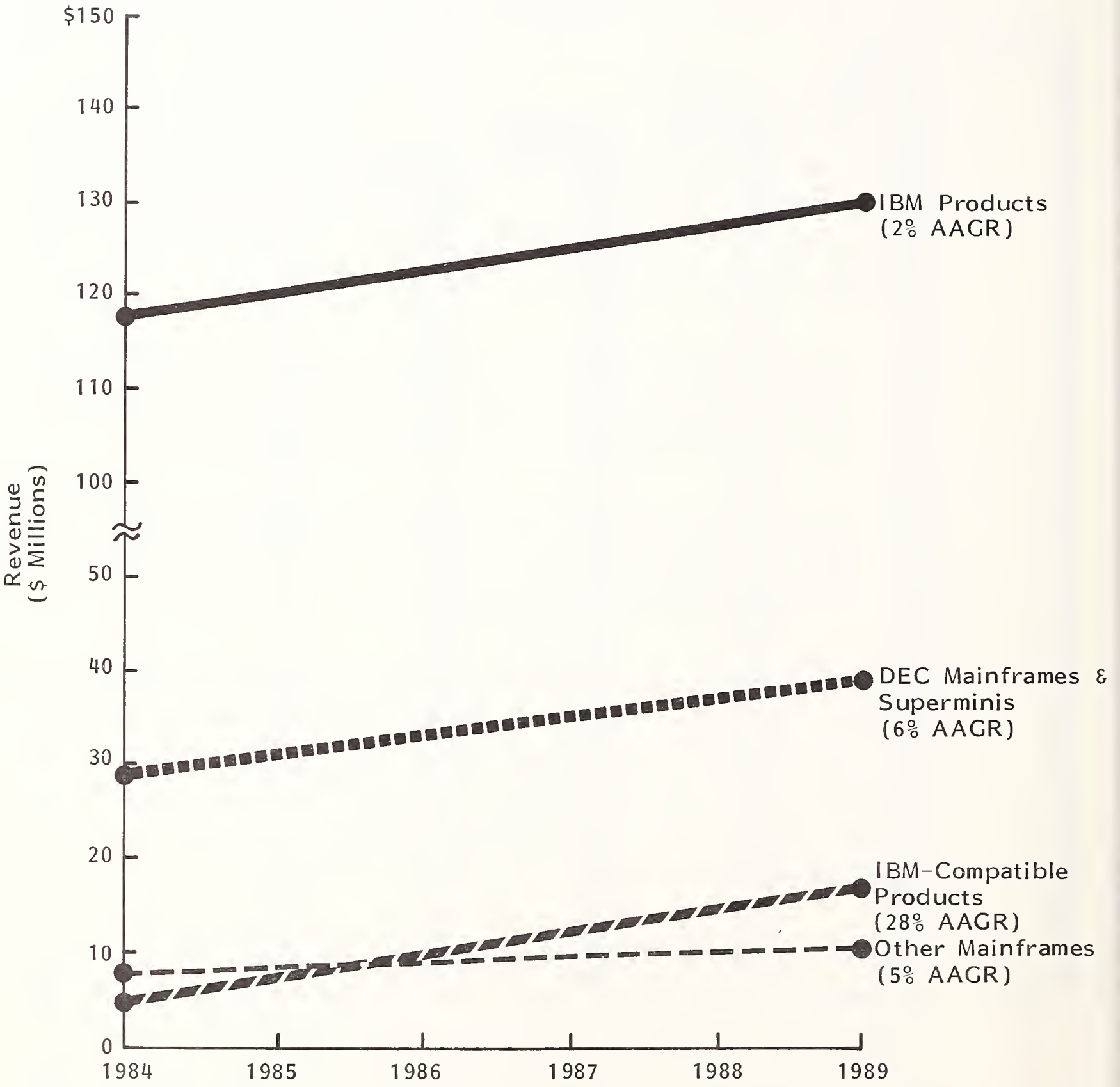
  - Currently, it is not worthwhile for the PCM vendor to respond to each (generally regional) TPM competitor. As these TPM vendors increase, however, a reaction--or accommodation--will be necessary.

- TPM revenues from DEC mainframe and superminicomputer products will increase from about $29 million in 1984 to $38 million in 1989--an average annual growth rate of 6%. The DEC market is very similar to the IBM mainframe market in that TPM vendors will find it increasingly difficult to compete against DEC as the Maynard-based company reduces prices and "squeezes" the service market.

- Competition in the TPM mainframe market is expected to increase as a result of growing interest on the part of the large-system manufacturers in offering a total support package at a user's site. Many of large-system vendors including NAS, DEC, CDC, Honeywell, and, to a limited extent, Amdahl already offer some TPM services in order to satisfy user requirements for "one-stop

EXHIBIT III-15

MAINFRAME TPM MARKET



service." INPUT expects increasing vendor interest, particularly from Burroughs and Sperry, in TPM service in the mainframe environment.

IV PRODUCT ANALYSIS BY VENDOR

IV PRODUCT ANALYSIS BY VENDOR

A. INTERNATIONAL BUSINESS MACHINES

- Although IBM has always been a major force in the mainframe market, it was the introduction and success of systems 360/370 in the early 1960s that created IBM's real dominance. These systems brought standardization, compatibility, and a clearly defined growth path to what had been a relatively disorganized, even chaotic, industry.

- Despite the fact that the 370s, in particular, were very popular, the new standardization in the mainframe market and IBM's pricing policies tended to invite competition. Vendors found that it was possible to accept the IBM standard and sell their own machines at considerably below IBM prices.

- Amdahl became one of the most successful "plug-compatible mainframe" vendors by exploiting IBM's pricing policy of linking price to performance rather than cost. Amdahl was able to produce a very high performance system (the 470) at substantially lower prices than corresponding IBM systems. A number of other vendors, including STC and Memorex, took advantage of IBM's pricing policy in order to gain share in the peripherals market.

- Growing competition was offset, in large part, by a rapidly growing market--particularly for mainframes. Overall revenues at IBM increased from $9.5

billion in 1972 to $22.9 billion in 1979. However, competition began to erode IBM's profitability, which fell by 3% in 1979--the first time in twenty years that IBM had not registered a growth in profitability.

- In the mid-1970s--just about the time Amdahl was delivering its first 470 mainframe--IBM began to develop a new overall product strategy that was to have a tremendous impact on the mainframe market. IBM was determined to become more competitive, and to do so required huge amounts of R&D expenditure for new products. In addition, current products were priced more competitively according to market conditions.

- As a result of the growth in new product releases and increased technological innovation, IBM began to move away from mainframe leases and rentals in favor of outright sales. The initial conversion, which is still taking place, has resulted in substantial increases in mainframe revenues. In order to maintain this revenue flow, however, the company must now offer a continuing stream of new products to replace the relatively steady lease revenues of the past.

- IBM's new product strategy has proven to be very successful, primarily because the company had the resources and the foresight to develop a variety of new and very expensive technologies that could not be duplicated (at least, not easily duplicated) by competition. For example, semiconductor chip packaging (called the Thermal Conduction Module) and new thin-film heads-recording technology reportedly cost $1 billion each to develop.

- Although this technology is extremely expensive to develop, it is still advantageous to IBM for several reasons:

  - Manufacturing and production costs can be lowered, allowing IBM to reduce product prices without sacrificing traditional levels of profitability.

- Competitors are continually kept off guard because they have less and less lead time to introduce their own versions of IBM products before IBM itself introduces a new product.

- By improving performance, both in absolute terms and in relation to price, IBM has reacquired lost market share and has eroded the competitors' traditional minicomputer market as well.

- As a result of IBM's new competitive stance, mainframe prices have fallen an average of 10% per year while performance (as measured in mips) has increased by nearly 10% per year. IBM's mainframe market share now stands at 74% and is expected to increase to 80% by 1987 as a result of aggressive pricing of the 4300 series, the XA upgrades (discussed below), and the introduction of the new "Sierra" large-scale mainframe (also discussed below).

- The rapid introduction of new products has extended across all product lines. In 1983 alone, IBM introduced or began volume shipment of five new personal computers (PC jr., PC-XT, 3270 Personal Computer, XT/370, and 5550 multistation), four new small-system processors (System/36, System/38 Model 6 and 8, 8150, and an expanded Series/1) and two major mainframes (4381 and the 3084). In addition, IBM began shipments of its Extended Architecture (MVS/XA) software.

- Although the mainframe market is not growing as fast as the mini or PC market, it is likely that mainframe development and sales will continue to dominate IBM strategic policy for several basic reasons:

  - Mainframes provide the base for entry into new, high-growth markets like as communications (data and voice) and office automation.

  - The mainframe market is strategically important to IBM in that it provides more revenue to the company than any other market segment except peripherals. IBM's mainframe sales and lease revenue is estimated at $7.5 billion in 1983 alone.

- Much of the "cutting edge" research, such as the Thermal Conduction Module mentioned above, which was originally designed for top-of-the-line mainframes, can also be applied to smaller systems. R&D expenditures can be distributed over a large number of systems, resulting in a low per-unit cost that the competition cannot match.

- While mainframe growth may be limited, overall service and support, particularly for software, is expected to grow at a much faster than average rate.

- IBM's current line of mainframes includes the 308X, 303X, and 4300 series. The company's mainframes are priced from under $100,000 to over $4 million, and range in performance from 2 mips to 27 mips. IBM is the only computer manufacturer attempting to meet all market segment requirements.

- The 308X represents IBM's top-of-the-line mainframe processor. Performance ranges between the 8 M-bytes, 3.7-mips 3083E and the 134 M-bytes, 27-mips 3084. The 308X systems were first introduced in 1980 and can be configured with up to four processors. In addition to a clearly defined migration path within the 308X line, these systems are also compatible with the System/370 and 303X Series mainframes.

- In February 1984 IBM announced a significant upgrade to the 308X with the introduction of the enhanced "X" versions. The new models offer up to 14% improved performance at the same price as the older 3081 and 3083 series. The upgrade, however, is not available on the older 3080 series of mainframes. The X model processor is available only as a new purchase/lease.

- Although IBM announced it would stop selling the non-X 3080 series of mainframes, it has offered a field performance upgrade of 6%. Users seem to have accepted the fact that the 3080 series has been made obsolete by the new X models and there is little chance that the older series will be upgradable to

IBM's new series of mainframes, currently code-named "Sierra" (discussed below).

- When IBM introduced the 3080X models, IBM also indicated that it planned no further enhancements to OS/VSI system software and encouraged users to migrate to the MVS/XA (370 Extended Architecture) software. This announcement significantly enhanced the 308XX mainframes in several ways:

  - The XA environment permits maximum performance gains for the new 3080 "X" models.

  - XA permits 31-bit real and virtual storage addressing rather than 24 bit.

  - XA, which may be upgraded as often as every six months, may prove to be significantly more expensive than previous systems and therefore represents a new revenue source for IBM.

- The IBM 303X series represents the company's mid-range mainframe, falling between the smaller 4300 series and the larger 308X series. The 303X model is offered in five separate versions, ranging from 2 to 32 M-bytes of main memory (with a performance rating of 1 to 8 mips). The system was first delivered over six years ago (March 1978) and currently ranges in price from $900,000 to $2.5 million.

- The 303X operates in a much more competitive environment than the 308X, primarily because plug-compatible vendors (Amdahl and NAS) and traditional mainframe vendors (Burroughs, Honeywell, and Sperry) all offer similar products. Competition is probably most intense from the plug-compatible vendors that can run System/370 programs and offer a better price-performance ratio than similarly configured 303X systems.

- IBM's low-end mainframe product is the 4300 series introduced in early 1979 and now expanded to thirteen different models. Performance ranges from 0.2 mips in the IBM 4321, up to 2.5 mips in the 16 M-byte 4381 Group 2. Popularity of the 4300 line is the result of:

  - Clearly defined upward mobility within the 4300 line.

  - Excellent price/performance ratio.

  - Industry-specific applications.

- The top of the 4300 line is the 4381, introduced in 1983 but not delivered until the first quarter of 1984. The 4381 is the only processor in the 4300 series to support the MVS/XA operating system (although MVS is offered on the 4341, 4361, and 4381). The XA capability provides increased compatibility with the 308X series of mainframe. Although the 4381 will impact the low end of the 308X series, particularly the 3083E, it was designed primarily to provide a clear upgrade path to the popular but aging 4341 series.

- The 4361, also introduced in late 1983, provides a much more efficient migration path for the aging 4331 line than does the 4341. Performance ranges from 0.79 to 1.14 mips, with a main memory size of 2 to 12 M-bytes. The 4361 reportedly has up to five times the overall performance of the 4331.

- The 4341 and 4331 are entry-level models corresponding to the higher level 4381 and 4361 discussed above.

- Unlike other 4300-based machines, the 41s and 31s are well suited to engineering and commercial applications. The 4341 offers a wider variety of models and greater performance than the '31; however, the 4331 is priced significantly less, on average, than the 4341.

- The 4321 is the entry-level system in the 4300 line and offers 1 M-byte of main memory, with a performance rating of 0.2 mips. The machine is upgradable to the 4331 and 4361.

B. AMDAHL CORPORATION

- Amdahl had an enormously successful year in 1983 primarily because of new product introduction, including the new 580-series mainframe and 6000-series disk drives. Overall revenue increased by 68% in 1983 to $778 million. Net income improved a phenomenal 587%.

- 1984 revenues have not kept pace with 1983. Overall revenues for the first quarter 1984 increased only two percent over the comparable quarter in 1983 and net income dropped by almost 17%. Management cited production delays in the dual processor 580 series and the unavailability of Fujitsu-manufactured disk drives as the primary reasons for lower than expected earnings.

- Although the 580 series is the company's largest mainframe, the 470 series represents most of the installed base. The 470 was originally introduced in 1978 and has an installed base of over 750 units. Main memory on the 470 ranges between 8 and 32 M-bytes, with a performance rating of 2.75-6.8 mips.

- The Amdahl 470 design is based on the System/370 functional architecture and competes in the plug-compatible market with IBM (303X and 308X series) and NAS (AS/7000 and AS/9000 series). The main advantages of the 470 series are an excellent reliability record; a System/320 program and peripheral compatibility; and an excellent price/performance ratio.

- Amdahl introduced the 580 series in June of 1983, primarily to accommodate the increased computing requirements of the Amdahl installed base, and partly to more effectively compete against the high-end IBM and NAS main-

frames. At the entry-level configuration (the 5840 series), the new Amdahl mainframe has a significantly larger main memory (16-64 M-bytes) and is faster (7.6 mips) than the older 470 series.

- The 580 series was expanded in early 1984 with the introduction of the 5860 (13 mips) and the announcement of "Attached Processor" (AP) models (5867 and 5870) that are to be shipped in the third quarter 1984. The AP models are reported to have 18-22 mips ratings.

- Along with Attached Processor announcement, Amdahl also announced two 580 series multiprocessor (MP) mainframes--the top-of-the-line 5880 and the smaller 5868. The MP models were designed to operate at 23.5 mips, with a maximum memory configuration of 128 M-bytes. The company deferred manufacturing the equipment, however, because of a lower than anticipated demand for the tightly coupled machines.

- One of IBM's major goals in introducing the 580 series of mainframes is to maintain a better performance at a lower cost for each of the IBM high-end processors. Generally, Amdahl aims at a 10% price reduction and 10% improved performance over comparable IBM equipment. In addition, the 580 series continues its compatibility with the System/370 and Extended Architecture (XA) instruction set.

- The major advantages of the 580 series of Amdahl mainframes include:

  - A clear migration path for 470 users.

  - Continued compatibility with the IBM System/370 instruction set.

  - Field upgradability.

C. NATIONAL ADVANCED SYSTEMS

- The fastest growing plug-compatible manufacturer (PCM) is National Advanced Systems, based in Mountain View (CA). NAS's main business is to market and service Hitachi-built mainframes ranging in main memory size from 2 M-bytes to 64 M-bytes and ranging in performance rating from .9 to 21 mips. In addition, NAS markets Hitachi-built disk drives.

- Because NAS does not actually manufacture any computer equipment, it is particularly dependent on Hitachi. (NAS dropped its own system development effort in 1983.) Hitachi has not given NAS the exclusive right to sell Hitachi equipment in the U.S. and has indicated that it will rely on NAS as long as Hitachi feels NAS "is doing the best it can" to sell Hitachi machines. Sales of Hitachi equipment in Europe are split between NAS, Olivetti, and BASF.

- Despite the uncertainty over Hitachi's future distribution plans, NAS has been successful in establishing a profitable marketing and service network in the United States. NAS, a division of National Semiconductor, began to be profitable in mid-1983--for the first time in the company's history. Earnings for fiscal 1985 may reach $30-$35 million.

- Profitability is resulting primarily from the larger mainframe and from the 7380 disk drive. NAS has reported an installed base of 350 large mainframes; the base is growing at a rate of 24 per month.

- NAS currently markets 13 Hitachi mainframes aimed at the IBM 4300 and large mainframe market. Like other PCM vendors, NAS generally attempts to offer improved performance at a lower cost than the comparable IBM models. The major NAS models include:

  - The AS/9000 is compatible with IBM's 3033 and 3081 systems. The 9000 can accommodate between 4 M-bytes and 64 M-bytes of main memory and has top-of-the-line performance of up to 21 mips.

  - NAS announced the AS/91XO series of supercomputers in July 1984. They are designed to handle vector-processing applications at one-third the price of a full-sized supercomputer such as the Cray 1.

  - The AS/9000 DPC is a dual-processor configuration and, like other Advanced System processors, is compatible with the IBM System/370 instruction set.

- AS/80X3 is an intermediary system placed between the AS/9000 and AS/6000. It can be upgraded to the upper end of the company's large-system line. The major advantage of the AS/80X3 (announced early in 1984 to be available in late 1984) is that it allows users to upgrade from mid-range CPUs to the high end of the mainframe environment. The 8000 series mainframes include:

  - AS/8023 , announced in April 1984, with a maximum of 32 M-bytes main storage. It competes against the IBM 4381-2.

  - AS/8043, having 8-32 M-bytes main storage with performance of 4.9 mips and compatible with the IBM 3083E.

  - AS/8053, similar to the 8043 but with greater performance.

  - AS/8063, 8 mips performance with up to 32 M-bytes main storage.

  - AS/8083, announced in April of 1984; this machine is designed to compete against the IBM 3081K series.

- The AS/6000 is a medium-scale system introduced in June 1983 and designed primarily to compete against the IBM 4341-12 basic configur-

ation. It includes 2 to 16 M-bytes of main memory and typically costs from $500,000 to $1 million. The AS/6000 series includes:

. AS/6620, 2-16 M-bytes, with 1.6 mips.

. AS/6630, 4-16 M-bytes of storage with 2.0 mips.

. AS/6650, similar to above but with a 2.4 mips.

- Some of the older NAS mainframes that continue to effect the mainframe market include:

  - AS/3000, 2-8 M-bytes storage with a performance rating of .9 mips.

  - AS/5000, similar to the 3000 with 1.2 mips.

  - AS/7000, up to 16 M-bytes, with up to 5.5 mips.

D. BURROUGHS

- Unlike many of the other "BUNCH" companies (Burroughs, (Sperry) Univac, NCR, CDC, and Honeywell), Burroughs has not diversified to any great extent outside the computer industry. Over 50% of Burroughs' DP revenues are derived from mainframe sales, with the remainder coming from sales of mini and personal computers, peripherals, and services. Overall revenue in 1983 was $4.4 billion.

- Because of its obvious dependence on computer revenues, Burroughs is particularly susceptible to competitive pressures from IBM. In order to deal with competition, Burroughs has developed a two-tiered market strategy:

- Concentrate on specialized market niches.

- Develop and market new products.

- Currently, Burroughs has a user base of over 40,000 customers. Maintenance of this user base is important to Burroughs, if only because it provides a ready market for add-on and migration products. The market is, however, being squeezed by IBM as that company regains lost mainframe market share. In order to defend its market share, Burroughs has indicated that it will specialize in six key markets:

  - Finance (banking).

  - Manufacturing.

  - Government.

  - Health care.

  - Education.

  - Health.

- The last three markets--health care, education, and hotels--will be relatively new markets for Burroughs, although the company is well known in banking, manufacturing, and government.

- Although targeting new markets is an important first step, Burroughs has also taken the necessary second step--the development of new products to meet the customers' specialized needs. Major 1983 product announcements included:

- Two new electronic workstations, the ET 1100 and ET 2000.

- B95 small business computer.

- B1990 minicomputer.

- B2925 mid-range system.

- B4900 mainframe (introduced in 1982, but not shipped until 1983).

- B7900 mainframe (introduced in 1982, but not shipped until 1983).

- A9 mainframe.

- Mainframe additions to the Burroughs product line have been extensive, as the above list indicates. Probably the most significant of the new mainframe products is the A9. Burroughs officials have indicated that the "A" series will eventually replace all the "B" series mainframes. The A9, for example, replaces the B6900 series.

- The A9 can accommodate up to 24 M-bytes of main memory, four times that of the 6900 series. The new mainframe is rated at 1.2 to 2.5 mips and is aimed primarily at the IBM 4300 series market. The A9 is fully compatible with other large mainframes from Burroughs.

- Other Burroughs mainframes include:

  - B7900 is a new (1983) top-of-the-line with up to 96 M-bytes of main memory (in multiprocessor configuration) and is rated at 4.4-13.7 mips.

    . The B7900 allows user growth from any of the 5000, 6000, or 7000 systems.

  - At 13.7 mips, the 7900 is considerably faster than its replacement, the B7800 series.

  - In addition to being faster, the B7900 requires less space and environmental prerequisites than the 7800.

  - Redundant microprocessor configurations should result in significantly improved availability performance.

- The B5900, originally announced in 1980, was significantly improved in 1982 with the introductions of the 5920 and 5935. Like most other Burroughs mainframes, the 5900 maintains full-program compatibility with larger mainframes (but not smaller systems).

  - The 5900 has a 6.2-M-bytes main memory capacity per CPU.

  - Maximum performance of the 5900 is .64 mips.

  - Up to four 5900 CPUs can be interconnected.

- The B4900, originally announced in 1982 (along with the B7900) but not delivered until 1983, is compatible with smaller Burroughs systems, but in terms of performance is more competitive with the larger mainframes.

  - Main memory is 5 M-bytes per CPU, with up to four CPUs configured together.

  - The 4900 is rated at 2.01 mips.

  - There is program compatibility with the B2900 and B3900 series.

E. CONTROL DATA CORPORATION

- Although CDC is often considered to be primarily a mainframe manufacturer, the vast majority of its revenue is derived from peripherals and services. In 1983, mainframe revenues amounted to just under $800 million from a total information services revenue of $3.5 billion.

- Most of CDC's 1983 mainframe revenue resulted from sales of the Cyber 170/800 computer and, to a much lesser extent, the Cyber 20 series supercomputer. The 170/800 series was introduced in mid-1982 and has already been made obsolete by the introduction in April 1984 of a 180/800 series of mainframes.

- CDC's mainframe business has traditionally revolved around the scientific and engineering markets. This market niche has allowed the company to remain profitable in mainframes despite increasing competition from IBM in other markets. CDC's statements about moving into the commercial market to the contrary (particularly with the 180/810 series), continued specialization in the technical markets is expected.

- The introduction of the 180/800 family of mainframes in mid-1984 was interesting for several reasons:

  - It caused a short product life for the 170/800 series, which was introduced less than two years earlier, in 1982.

  - The 180/800 supports both the traditional 60-bit architecture as well as the newer 64-bit state.

  - The new series allows users to run two incompatible operating systems simultaneously--NOS for older 170/800 series systems and the Virtual Environment (NOS/VE) for newer applications.

- The new 180 series does not have a field upgrade capability.

  . The lower end 800s, 810s, and 830s are air-cooled, whereas the upper end machines (845s, 855s, and 990s) are water-cooled.

  . The top-of-the-line 990 cannot be upgraded from mid-range 845 and 855 models.

- There is a conspicuous lack of new software to run under the new NOS/VE operating system, although the company has indicated that it currently has 50 independent software houses writing applications for NOS/VE.

- CDC has indicated that the 180 family has been developed for use in the following industries:

  - Manufacturing.
  - Petroleum.
  - Education.
  - Utilities.
  - Research.
  - Government.

- The lack of office systems application software and the preponderance of program development packages (including Fortune, COBOL, APL, and Cybil) that are currently available increase speculation that CDC is aiming the new 180/800 series more at the technical market (where users may have in-house software development staffs), than at the office system market.

- The 180 product line is as follows:

  - The 810 is an air-cooled system aimed at the office product environment. The 810 has a performance rating of .67 mips, and main memory ranges from 2 to 10 M-bytes. The 810 reportedly costs 40% less than the model it replaces, the Cyber 170/815.

  - The 830, field upgradable from the 810, can be configured as a dual processor rated at up to 1.9 mips.

  - Th 835 entry-level mid-range uniprocessor is liquid-cooled and has 4-16 M-bytes of main memory. The 835 is rated at 2.5 mips and is upgradable to the 845 or 855.

  - The 845 is similar to the 835 and has a rating of 5.6 mips.

  - The 855, top-of-the-line for the mid-range series, can be a uniprocessor (8.3 mips) or a dual processor (15 mips).

- The 180/835, 845, and 855 can be upgraded from comparable models in the 170 series, according to CDC.

  - The 990, the company's new top-of-the-line mainframe, is not scheduled for production until June 1985. The 990 cannot be upgraded from any of the 180/800 series machines. In the dual processor configuration it is rated at up to 38 mips. Uniprocessor rating equal 21 mips, with up to 32 M-bytes of main memory.

- Two of the high-end 170 series, the 865 and 876, will remain in production, although they will not have the NOS/VE operating system.

- The 865 can be configured as a uniprocessor or dual processor. Rated at 11 mips, the 865 offers a main memory of up to 1 M-bytes.

- The 876, upgradable from the 865, offers a 19-mips rating and main memory of up to 1 M-bytes.

F. DIGITAL EQUIPMENT CORPORATION

- The majority of DEC's products are minicomputers but they also have a popular line of mainframes in their DEC system--10 and 20 computers. The DEC-10 series was introduced in 1971, followed by the smaller DEC-20 in 1978.

- Until 1983, DEC had planned to upgrade the 10s and 20s with a new mainframe series, code-named "Jupiter." Unfortunately for DEC mainframe users, the company scrapped the Jupiter program in 1983, leaving DEC-10 and DEC-20 users with little or no upward migration capabilities.

- When the Jupiter program was cancelled, DEC offered its mainframe users two alternatives for continued large-system growth. The first alternative was a short-term solution whereby the company boosted capacity approximately 20% for both the 10 and 20 series. The second alternative was a more long-term option--DEC offered to assist large-system users in transferring programs and data from the 36-bit DEC 10s and 20s to the current top-of-the-line 32-bit VAX 11/700 series superminicomputers.

- There is a great deal of user resistance to both the alternatives listed above. Users are reluctant to upgrade their machines if they are, in fact, "dead" products. And rather than make the conversion to the VAX line, many users are considering other mainframe vendors. Some have expressed lack of confidence in DEC's commitment to maintaining even the VAX line.

- Although DEC has indicated that it will continue to support the 10 and 20 mainframe for at least 10 years, users fear that lack of program development and reduced parts availability will force abandonment of these mainframes within five years.

- The DEC system-10 can be configured with up to three processors and can have a maximum of 250 timesharing users. Maximum main memory is 4 M-bytes. Because the DEC-10 has excellent communication capability and because it was designed to execute many different jobs concurrently, the DEC-10 is often selected for service and timesharing applications.

- Like the DEC-10, the DEC system-20 is designed for timesharing functions. The DEC-20 is targeted primarily for in-house timesharing, usually in an office system environment. Maximum memory is 3 M-bytes and the 20 series can support up to 125 remote users.

G. HONEYWELL INFORMATION SYSTEMS

- Honeywell Information System (HIS) earned $1.7 billion in 1983--almost 30% of the corporate parent's total revenue. Although revenues actually fell by 1%, operating profit for the Information System division increased by 64% in 1983 to $131 million as a result of extensive cost-cutting measures.

- Despite the impressive gains made in turning the Information Systems division around, Honeywell seems more highly motivated than ever to make major alterations in its mainframe market strategy. The reasons for these changes include:

- Relatively small market share of the mainframe market.

- Intense competition from IBM and PCMs.

- Limited availability of software.

- Rather than try to compete head-on with IBM and other hardware manufacturers, Honeywell is attempting to maintain its strategically important computer revenues by shifting away from strict hardware production and toward providing solutions to computing and business problems. To make this transition, Honeywell has indicated that it will:

  - Concentrate on selling to its current user base of over 10,000 customers.

  - Find and promote market niches where Honeywell has a competitive advantage.

  - Reduce in-house hardware development.

  - Increase software and services support.

- Probably the most significant change was Honeywell's announcement in March of 1984 of an agreement with Nippon Electric Co., Ltd. to supply Honeywell with NEC's S-1000 mainframe. The agreement assigns Honeywell exclusive marketing rights in the U.S. and four other major markets to the S-1000 mainframe for the next two years.

- The S-1000, which will not be shipped until late 1985, will provide Honeywell with a new top-end mainframe processor with more than twice the speed (reportedly up to 15 mips) of the current top-end machine, the DPS 88. According to company officials, it is very likely that the S-1000 will be upgradable from the DPS 88 series. A Honeywell spokesman said that integration of the S-1000 and DPS 88 will be performed by Honeywell.

- Honeywell has attempted to prevent erosion of its customer base and reduce R&D expenditures by entering into cooperation agreements with companies like NEC and NCR. Software development expenditures have also been reduced by relying on independent software vendors to write programs for Honeywell computers.

- Honeywell's current line of mainframes includes:

  - DPS 88, the company's top-of-the-line mainframe, has up to 128 M-bytes of main memory (in the model 82, dual processor configuration). The DPS 88, which is designed for both distributed data processing as well as traditional batch and interactive workloads, is between three and eight times as powerful, depending on the configuration, than the earlier DPS 8 system. Over 2000 timesharing users can be accommodated on the DPS 88. Advantages of 88 service include:

    . A clear migration path for users of the Level 66 or DPS 8 equipment.

    . The DPS 88 uses advanced current-mode-logic (CML) technology to achieve fast processing speeds.

  - DPS 8 can be configured with between 2 and 64 M-bytes of main memory and was first delivered in the mid-1980s. There are currently 13 variations of five model types in the DPS 8 series, ranging from the DPS 8/47 to the DPS 8/70. Like the DPS 88 mentioned above, the DPS 8 series is a general mainframe but aimed primarily at the distributed data processing and communication environment.

    . In 1983 Honeywell introduced the models 47 and 49, which were upgradable from the earlier models 20 and 44 but employed much faster circuitry for substantially improved services.

. The DPS 8 series processors can use one of several different operating systems, including GCOS 8, GCOS, MULTICS, and CP-6. The primary advantage of GCOS 8 is its ability to support several activities concurrently.

- DPS 7 was originally introduced in 1981. Honeywell replaced several models of its low-end mainframe line with "E" series models that cost up to 20% less than the corresponding older models. The DPS 7 systems range from one to four M-bytes of main memory and are designed to offer upward mobility to Level 62 and Level 64 users. The new "E" series of DPS 7 processors offer:

  . A significantly improved price/performance ratio over the older DPS 7 series.

  . A wide range of performance. The top-of-the-line 7/65E is rated at 2.9 times the performance of the entry-level 7/35E.

  . A series of factors that facilitate use with older Level-62 mainframes.

H. SPERRY CORPORATION

- Computer system revenues at Sperry have shown little or no growth since 1981 and profits for the division are down. In order to counteract these sagging revenues the company has introduced over 30 new hardware and software products since the beginning of 1983. In addition, the division's research and development budget was increased to $320 million in 1983, representing 11% of total revenue for the division.

- Despite the fact that net income is down, Sperry has been successful in dealing with its traditional markets--defense and government. In 1983, the company won a series of U.S. and Canadian government contracts that totaled over $1.5 billion. Almost one-third of Sperry's mainframes will be sold to government agencies between 1984 and 1986.

- Sperry has remained active in the mainframe marketplace despite increasing competition from the Japanese mainframe vendors and IBM. Sperry has introduced several new mid-range and top-end mainframes (discussed below) and shows every indication that it intends to stay in the market. However, IBM's response to competition (particularly Japanese) has resulted in increased pressure on Sperry's traditional markets.

- Like most of the other U.S.-based computer vendors, Sperry relies heavily on its existing base to market new products. Sperry's mainframe user base, however, is particularly vulnerable to competition from IBM because of the relative ease of data transfer between IBM and Sperry equipment.

- In order to protect its mainframe user base, Sperry has been concentrating on finding market niches that are not directly competitive with IBM. For example, in 1983 Sperry introduced an 1100 series mainframe with a seismic software package for the petroleum industry. Sperrylink is another package designed for a specific market, this time the office automation environment.

- Both the seismic software package and Sperrylink are designed exclusively for the 1100 mainframe. Sperry does not appear to be attacking new markets, but rather protecting its existing user base.

- Sperry's next generation of mainframes (after the 1100/90) was going to be based on "Wafer-Scale Integration" developed by Trilogy Corporation. Sperry purchased 13.5% of Trilogy in 1983, along with an option to license the WSI technology, for $40 million.

- Currently, there is considerable doubt that WSI technology can be developed in time for the next generation of Sperry mainframes. The company hedged its bets, however, and instituted its own in-house CMOS development program. It appears that CMOS technology, rather than wafer-scale integration, will provide the basis for Sperry's next generation of mainframes.

- The current top-of-the-line mainframe for Sperry is the 1100/90, with a main memory of 16 M and performance of up to 7.6 mips. Although the machine was announced is 1982, production problems delayed mass shipments until late 1983.

- The 1100/90 can be configured with up to four CPUs; the basic single processor system can be purchased for $3.2 million. The primary markets for the 1100/90 are government, communications, and petrochemicals.

- Sperry's mid-range mainframe product, the 1100/70, was introduced in 1983. The 1100/70 replaces (and, in some cases is upgraded from) the 1100/60 and now represents the entry-level system in the 1100 series.

- A variety of 1100/70 configurations is available, including single- and dual-processor systems. Performance ranges from .5 to 2.5 mips and the average purchase price for the base system is $1 million.

- The 1100/70 competes against a variety of mid-range processors, most notably the 4300 series from IBM, the Burroughs B6900 (now B-9), and the Honeywell DPS 8. Like other Sperry mainframes, the 1100/70 is aimed at specific markets, including petroleum, manufacturing, and government.

- The 1100/80 series (introduced in 1977) is situated between the 1100/70 and the 1100/90 and is compatible with the top-of-the-line 1100/90. With a performance range of over 6 mips (and a fully configured price of up to $6 million), the 1100/90 is one of Sperry's most powerful processors.

- In addition to competing with the traditional mainframe vendors such as the IBM 303X series and the Honeywell DPS 8/70, the 1100/80 is available with an Array Processor Subsystem that allows competition at the entry-level supercomputer market as well.

- It is likely that price/performance considerations will erode the current and potential 1100/80 user base, particularly with competition from the newer, more efficient 1100/90 series.

- Although it is no longer manufactured, the model 90 series of mainframe still represents a force in the market. Originally introduced in 1973, the 90 series was designed to compete against IBM 370 and 303X, Burroughs B3900, and Honeywell DPS 7 mainframes.

- The 90 series machines (including the 90/60 and 90/80) rate at up to 0.7 mips and can be configured with up to 8 M-bytes of main memory.

I. SUPERCOMPUTERS

- The importance of supercomputers in the information services marketplace is the result of advanced technology rather than economic factors. The market for supercomputers was only $260 million in 1983, with an expected growth of over 200% by 1987 (to $800 million). Although this growth rate is substantially greater than the average increase in the overall computer market, it still represents a relatively minor portion of the total computer system market.

- The real impact of supercomputers lies in their capability of performing complete calculations and their ability to preview advanced technology that may be applied to general mainframes at same time in the future.

- Certain industries and markets have a requirement for systems with extensive "number crunching" capabilities. The aeronautical and automative design, weather forecasting, oil exploration, chemical processing/analysis, and defense planning industries all perform very complex calculations that would require an excessive amount of time if done on a traditional mainframe.

- The development of supercomputers is also important because of the advanced technology that is often employed--for example, specialized vector processors, parallel processor design, greater packaging densities, and innovative cooling technology.

- One of the important problems that has plagued the the commercial development of supercomputers (besides the $5-15 million price tag) is the issue of ease of use. Customers are expected to do most or all of their own programming even though this is a very expensive task.

- A second factor that has discouraged use of supercomputers is that they don't perform well as general-purpose processors. This is primarily because most supercomputers have specialized vector processors that are designed to perform specific algorithms very fast, but generally do not perform scalar operations well.

- Cray has dominated the supercomputer market since the mid-1970s and currently has approximately 70 machines installed. Control Data Corporation (and its spinoff company ETA) have installed 15 of their Cyber 205s and Denelcor, based in Aurora, Colorado, has installed six of its HEP systems. In addition, three Japanese companies (Hitachi, NEC, and Fujitsu) have recently entered the supercomputer market.

I. CRAY RESEARCH

- Cray Research had an excellent financial year in 1983 with total revenues of $170 million, an increase of 20% over 1982. Profits increased 37% in 1983 to $26 million overall; Cray's customers have increased by 25% in 1983.

- The first supercomputer developed by Cray, the Cray-1, was introduced in 1976 and the company reportedly has 53 of these systems installed. The Cray-1/M was introduced in 1982 as a replacement for the older Cray-1. The first Cray X-MP was installed in 1983 and was reported to have three to four times the performance of the original Cray-1.

- The X-MP model is Cray's top-of-the-line supercomputer, but it may be superceded as early as the first quarter of 1985 by the Cray-2. The Cray-2 is expected to be a UNIX-based four-processor system. (The XMP is a two-processor system).

- Significantly, Cray has increased its software development effort and introduced a number of new software packages in 1983. The company has indicated that over 200 major programs are now available on the Cray system. The use of UNIX on the Cray 2 is viewed as an indication of the company's acceptance of the need for a transportable and compatible operating system in the supercomputer environment.

2. CONTROL DATA CORPORATION

- Control Data Corporation's supercomputer, the Cyber 205, was first delivered in 1981 and upgraded in 1983. In 1983 CDC installed eight 205s and plans to install another eight in 1984.

- ETA (Engineering and Technology Associates) was formed in 1983 to develop the next generation of Cyber 2XX machines. According to company officials, ETA was spun off CDCs 2XX development effort as a way to provide more flexibility and market responsibility to the supercomputer development effort.

- By spinning off ETA, CDC also hopes to reduce the financial risk involved in supercomputer development. While CEC will retain a healthy 40% of ETA, the remaining 60% will be offered to the public. Lloyd Thorndyke, a former

CDC employee and now ETA chief executive officer, has indicated that both CEC and ETA will market any supercomputers developed by ETA.

- ETA is scheduled to deliver its first 10-giga-FLOPS supercomputer by 1986 and it is expected to be an eight-processor system.

3. DENELCOR, INC.

- Denelcor introduced the Heterogeneous Element Processor (HEP) in 1980. HEP was believed to be the first system to have the ability to execute different instructions on multiple data streams simultaneously. The original system was rated at between 10 and 160 mips.

- Because of HEP systems' parallel architecture, high performance is achieved at a relatively low price.

- Denelcor has installed six HEP systems primarily for U.S. government use, but at least one system was sold for commercial application. In 1984 the company expects to install 15 systems, again mostly to government agencies.

- Development of the HEP 2 is progressing, according to James Hill, President of Denelcor. The HEP 2 is proported to have a peak performance of 12 bilion instructions per second. This system should be introduced late in 1986.

4. JAPANESE SUPERCOMPUTERS

- Three Japanese computer makers--Hitachi, NEC, and Fujitsu--have announced supercomputers that compete with U.S. manufacturers like Cray and CDC. Both Hitachi and Fujitsu have installed their supercomputers at test sites; NEC plans to have its first delivery in early 1985.

- Performance tests run on existing Fujitsu and Hitachi supercomputers indicate that these machines generally exceed the performance of the Cray X-MP and

CDC 205. However, most experts acknowledge that these tests may not be conclusive because the Japanese machines are still in the experimental stage. For comparison, the Japanese supercomputers are rated at from 500 M FLOPS (floating-point operations per second) to 1100 M FLOPS; U.S.-made machines have 100 M - 750 M FLOPS.

- Fujitsu has installed two VP-100 supercomputers in Japan and apparently has developed a more powerful VP-200 that has not yet been released to the public. The VP-200 is reported to be significantly faster than the current Cray X-MP.

- Hitachi has installed its first supercomputer, the S-81-/20, at the University of Tokyo and is said to be even faster than the Fujitsu machines.

- The NEC SX-2 supercomputer is reported to be capable of 1.3 G FLOPS.

- It is interesting that the Japanese have opted for IBM software compatibility on their supercomputers. This will have a significant impact on the business market in that it will allow current users of IBM mainframes to link their IBM equipment to a supercomputer. In addition, IBM compatibility will open a potentially large submarket--IBM's scientific user base.

- By depending on IBM software compatibility, the Japanese have, no doubt, attempted to circumvent the software problem that has troubled U.S. manufacturers. However, some experts felt that the IBM 370 architecture may have some limitation that would restrict input/output speeds.

J. SUPERMINICOMPUTERS

1. DIGITAL EQUIPMENT CORPORATION

- The importance DEC places on the VAX 11/7XX series of superminicomputers was highlighted in 1983 when the company announced its decision not to manufacture a new generation of mainframes that was tentatively named "Jupiter." The VAX system was, and is, seen as the top-of-the line for DEC. The company has been active in developing new applications and upgrades for this system.

- The DEC VAX line offers several advantages over some of the newer and faster machines introduced recently by competitors. First, the VAX is often the system choice among users because of its proven performance. The 11/780 was originally introduced in 1977 and has had a tremendous impact on the supermini market.

- The second major advantage of the VAX line is the compatibility and upward mobility of the 11/700 series. Software migration is promoted by the use of the same operating system (VAX/VMS) on all the VAXs. In many cases, hardware upgrades can be installed in the field, as with the recently announced 780 to 785 upgrade.

- The VAX line can be divided into seven distinct products: Micro-Vax I, 11/725, 11/730, 11/750, 11/780, 11/728, and 11/785.

- The top-of-the-line VAX is the 11/785, which was announced in April 1984. The 11/785 is not scheduled to be shipped until September and will offer up to 50% more performance than the 780 series--the 785 is tentatively rated at 1.5 mips with up to 8 M-bytes of main memory.

- The 11/785 is viewed primarily as an interim upgrade for capacity-starved VAX users. DEC is thought to be developing a new high-end processor, code-named Venus, that will replace the VAX line sometime in 1985. VAX sales, however, have been brisk and DEC may be delaying the Venus announcement while VAX revenues are on the upswing.

- The 11/780 and its dual processor counterpart, the 11/782, is the former flagship of the VAX line. On the tightly coupled multiprocessor mode (11/782) the system is rated at 1.6 mips, whereas the single-processor 780 is rated at 1.1 mips.

- The mid-range VAX 11/750 is rated at 0.7 mips and has a maximum main memory capacity of 8 M-bytes. Although the system is relatively dated (first introduced in 1980), it remains popular because of its flexibility. The 750 can support up to five I/O channels, 128 workstations, and up to 19 Gigabytes of disk storage.

- The 11/725 and 11/730 represent the low end of the VAX line, with about 1/3 the processing power of the 780. The 725 is designed specifically for small office automation functions. It is limited to eight workstations and 52 M-bytes of disk storage, with a maximum memory of up to 3 M-bytes. The 730 can accommodate more workstations (up to 24) and up to 2 gigabytes of disk storage. DEC has designed the 730 to act as a standalone processor or in conjunction (via DECnet) with the VAS 780.

- The MicroVax I, introduced in October of 1983 but not delivered until March of 1984, is targeted as an entry-level system. Prices for the MicroVax start at less than $10,000 and yet the system supports up to 8 workstations, 29 M-bytes of disk storage, and 2.5 M-bytes of main memory. The MicroVax I is aimed primarily at the commercial and distributed data processing environment.

- As noted above, DEC is rumored to have a significant new upgrade or replacement to the VAX ready by early next year. The new machine, code named "Venus," has been well publicized by DEC as having up to 5 mips performance and is reported to be a "pipelined" machine using Emitter-Coupled Logic (ECL). INPUT expects the Venus line to have a very positive effect on VAX sales. Venus will extend DEC into new markets and provide a continued growth path for the company's large VAX user base.

2. DATA GENERAL

- Data General is known primarily as a traditional minicomputers manufacturer; however, its high-end line of MV superminis and low-end Desktop Generation PCs will be the primary reason for the record earnings in 1984.

- Total revenue in 1983 was $829 million, an increase of only 3% over 1982; net income fell 6% to $23 million in 1983. Revenues were adversely affected by two factors at Data General. First, both increased R&D and capital expenditures were needed to develop new lines of superminicomputers and PCs. Second, a new marketing philosophy emphasized office automation in addition to Data General's tradition data processing and technical/scientific markets.

- The company's new product and marketing strategy appears to be working--net earnings for the third fiscal quarter of 1984 alone increased to $16.1 million, up from a net of $4.3 million for the same period in 1983. Total revenue for the first three quarters of 1984 was up 33% to $745 million, compared with $557 million in 1983.

- INPUT estimates that Data General's total revenue for fiscal 1984 will equal $970 million--a 17% increase over 1983.

- Data General first introduced the 32-bit MV-Series in 1980, with volume shipments beginning in 1981. The MV-Series superminicomputer has been the company's fastest growing product sector since its introduction. INPUT

estimates that fiscal 1984 revenues for the MV Series will grow to $225 million, an increase of 47% over 1983. MV hardware sales represent approximately 22% of Data General's total revenues.

- The MV Series of superminicomputers consists of three basic processors--the MV/10000, MV/8000, and MV/4000.

  - The MV/10000 is Data General's top-of-the-line superminicomputer. It was introduced early in 1983, has a main memory capacity of 1-16 M-bytes and a performance rating of 1.2-2.4 mips.

  - When introduced, the 10000 offered a very attractive price-performance ratio. That is, it was priced at only 15% higher than the MV/8000, but offered twice the power of the 8000.

- Up to 192 workstations can be supported on the 10000. This may be on the small side, considering the company's goal of expanding government and Fortune 1,000 office automation business. (The DEC VAX 11/780, for example, can support twice as many workstations as the MV/10000.)

- The MV/8000 was one of the first of the 32-bit superminis, having been introduced in 1980. After a series of upgrades in 1983, it is currently one of the most advanced systems Data General offers. The MV/8000 C was one of the first computers to incorporate 256 K-byte semiconductor dynamic random-access memory (DRAM) technology and is rated at 1.2 mips.

- One of the distinct advantages of the 8000 C is its compact size. In addition, this system is compatible with programs developed under the 16-bit Advanced Operating System. These two features make the 8000 C particularly useful to its target market, OEM vendors.

  - The MV/8000 II is an upgrade of the older MV/8000 and has a larger main memory (up to 12 M-bytes) than the 8000 C (1-4 M-bytes). The

8000 II does not use the DRAM technology of the 8000 C. However, the 8000 II is very price competitive.

- Both the 8000 II and 8000 C can support up to 128 workstations.

- The MV/4000 is at the low end of the MV line and competes primarily against the IBM 4341 and DEC 11/750. The system is designed for small industrial and office automation applications. Performance is rated at 0.6 mips, with up to 8 M-bytes of main memory. Up to 64 workstations can be supported by the 4000.

- Data General has been active in designing entry-level applications for the MV/4000 in order to attract new users into the fully compatible MV line. Some of these applications include a sophisticated graphics program for CAD/CAM applications, a UNIX operating system, and a variety of office automation products, such as "Comprehensive Electronic Office" and "Quickplan."

- Compatibility between (and within) the MV line of superminicomputers and the 16-bit Eclipse computers is a significant advantage for Data General. A clear migration path within the MV line is particularly advantageous for users in the office automation market where growth is expected to be quite substantial. In addition, the company is rumored to be developing a new high-end processor to extend the MV-Series beyond the 10000. The new processor is reportedly based on the faster Emitter-Coupled Logic (ECL) technology, rather than the Transistor-to-Transistor Logic (TTL) technology currently being used. The new ECL technology will make possible faster processing speeds and an improved competitive position with the DEC VAX 11/700.

V LARGE-SYSTEM SERVICE DEVELOPMENT TRENDS

V LARGE-SYSTEM SERVICE DEVELOPMENT TRENDS

A. THE CHANGING STRUCTURE OF LARGE-SYSTEM SUPPORT, 1984-1989

- Ever since the advent of commercial mainframes, some industry observers have been predicting the demise of the large system. At first, observers questioned the necessity of such large, expensive machines. Then, with the introduction of "easy-to-use" minicomputers, many people said that the day of the bulky, hard-to-use mainframe was gone. Now microcomputers are proclaimed to be the heir apparent. However, the mainframe as a species has proved to be suprisingly resilient and, to paraphrase Mark Twain, reports of its death are greatly exaggerated.

- One of the major reasons that mainframes--and selected mainframe vendors--have been able to survive is that they have been adaptable to ever-changing market conditions. Higher level languages, real-time reporting systems, and distributed processing are just a few example of developments that have helped to make mainframes the largest segment (by far) of the entire computer market.

- As the mainframe market has grown, so has user dependence on the mainframe. Twenty years ago, a system failure would create havoc in the data processing department, but few others in the company would realize there was a problem. Today, entire departments (other than DP) are dependent upon constant system availability; downtime is much more recognizable.

- The value of mainframe service has increased in direct relation to the increase in user dependence on it. Consequently, service is currently one of the most important system selection criteria used by potential customers (second only to system capabilities). INPUT believes that by 1989 service (including factors affecting reliability and availability) will be the single most important system selection issue for most users.

- Despite the fact that service is becoming increasingly important to users, vendors must be quick to adapt to changing service conditions, requirements, and technologies. INPUT has found that users are not currently service price sensitive but this condition will change as equipment becomes more reliable and users become more reluctant to spend ever-increasing amounts for fewer required services.

- Changes in service technologies will have a substantial effect on service revenue, as shown in Exhibit V-1. The mix of revenues will change dramatically between 1984 and 1989: hardware service revenue will decrease in importance while the importance of software service will increase substantially. Professional and educational services will increase in revenue, but will remain a relatively small component of the service revenue mix.

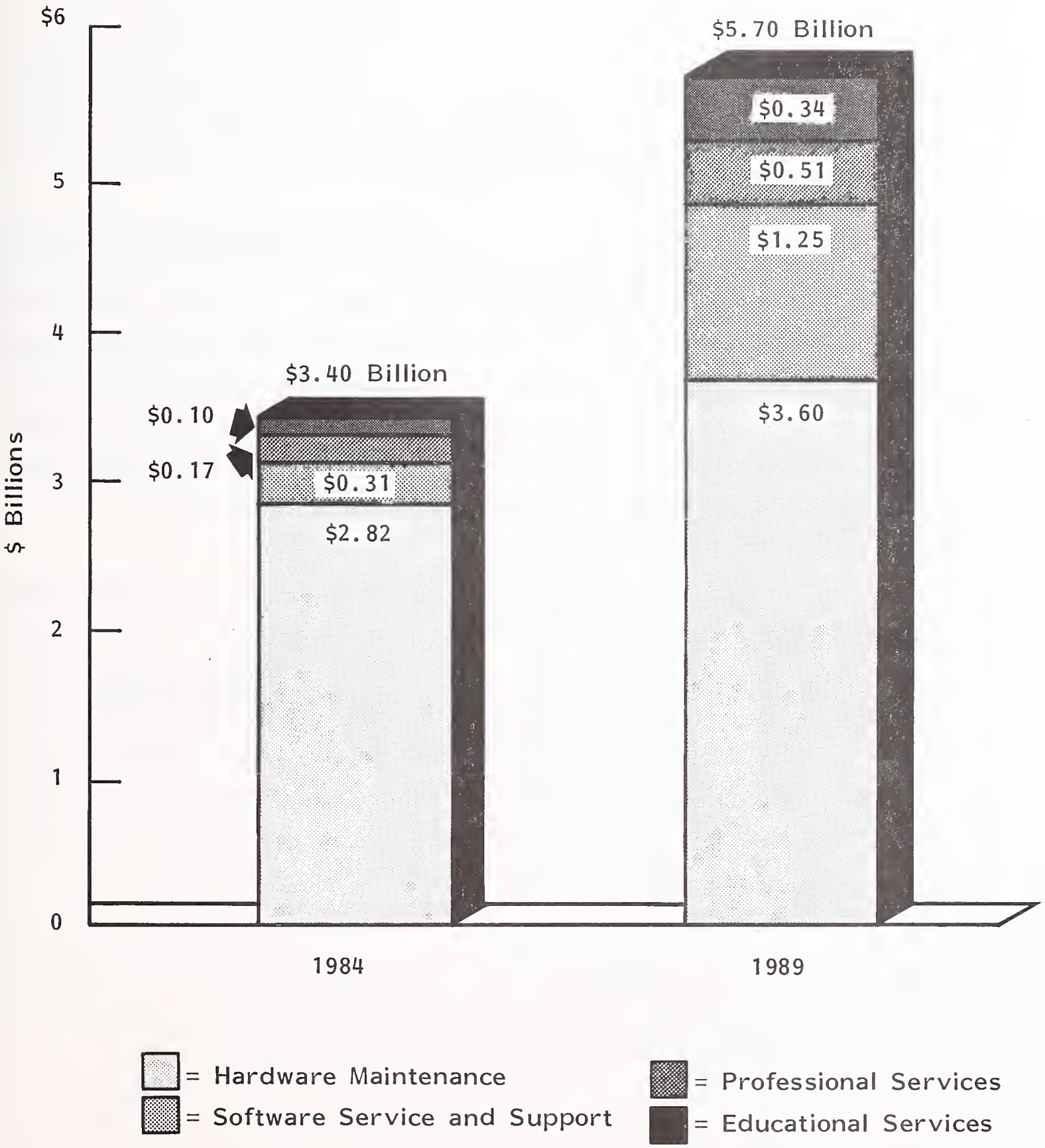
- Hardware service revenue (also discussed below) will suffer a substantial decrease in revenue as the result of several different factors:

  - Between 1984 and mid-1986 there will be a gradual decrease in revenues, resulting from increasing user pressure for lower service prices.

  - After 1986 there will be a sharp decline in mainframe hardware service revenue as a result of the strong competitive service pricing of IBM.

EXHIBIT V-1

LARGE-SYSTEM SERVICE REVENUE MIX CHANGING RAPIDLY



- The overriding cause of both user expectations for lower service prices and IBM's competitive service pricing is increasingly reliable mainframes that require less hardware maintenance.

- Exhibit V-2 demonstrates the long-term effect of changing growth rates on incremental revenue. By 1989 incremental revenue from software service and support will be $940 million--21% more than new revenues derived from hardware service. Revenues for both educational and professional services are expected to increase dramatically as a result of high growth rates.

- As Exhibit V-3 demonstrates, vendor software revenues are expected to increase 32% annually from 1984 thru 1989--moving software from 9% of total service revenue in 1984 to 22% in 1989.

- We are already beginning to see a substantial increase in both system and application software revenue. IBM, long a leader in software support, has announced it plans no further enhancements to OS/VSI systems software and has encouraged users to migrate to the more expensive MVS/XA (370 Extended Architecture) systems software. However, along with the XA upgrades, IBM has increased maintenance fees considerably. IBM justifies the increases by offering more frequent updates and improved support.

- After-sales professional services such as consulting and planning will become an increasingly important revenue source for mainframe service vendors, particularly as users are required to adapt to a multisystem environment. Some large-system vendors, such as NAS, have already introduced single-source services in order to increase service revenue growth (which had been limited by a relatively small installed base). Other vendors, such as DEC, have introduced very profitable supply sales operations--another example of a lucrative, nontraditional service opportunity.

- Educational services represents the smallest service component in Exhibit V-1, yet it is the second fastest growing service, as shown in Exhibit V-2. Educational revenue growth will result from three factors:

EXHIBIT V-2

LARGE-SYSTEM SERVICE GROWTH BY SECTOR

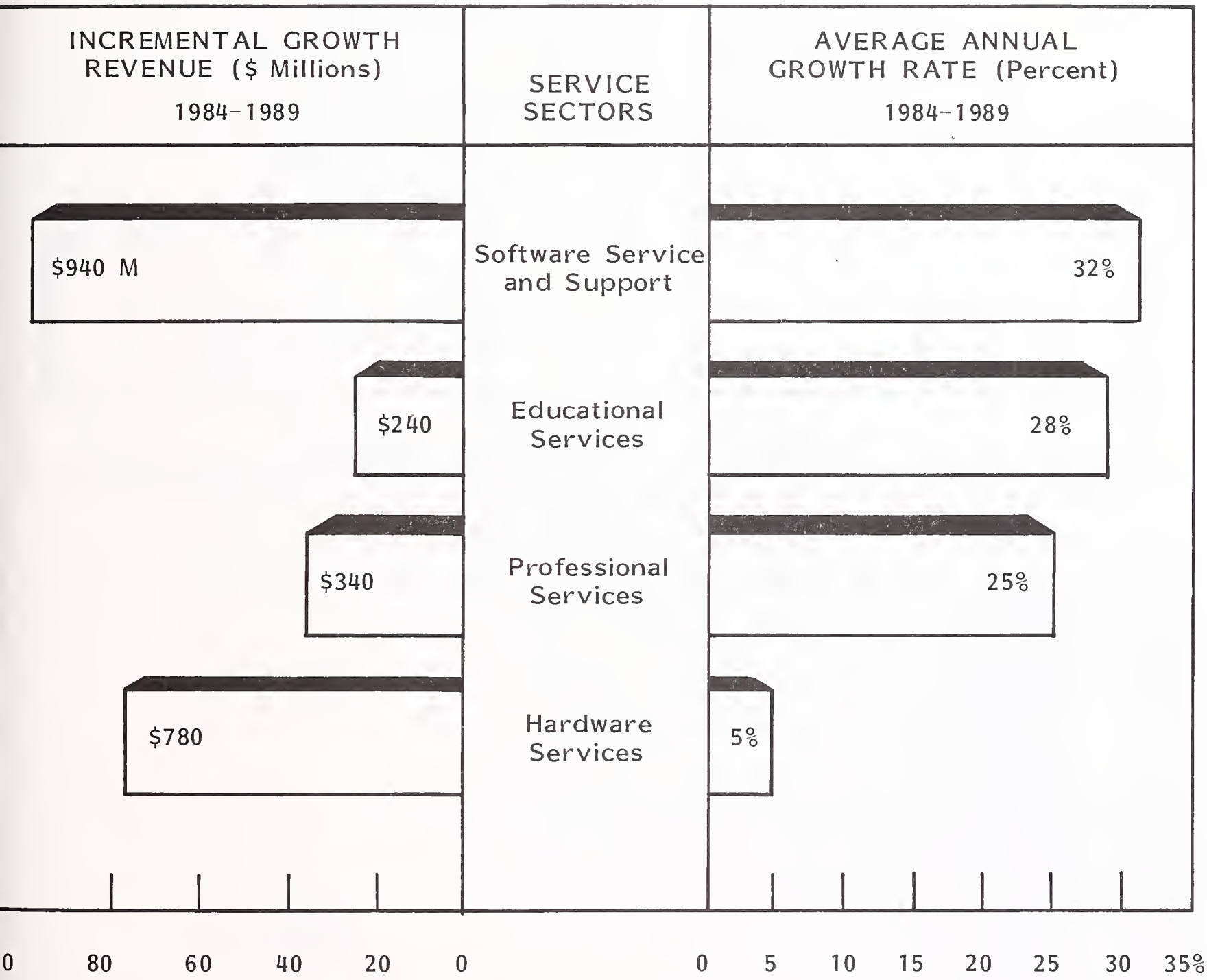
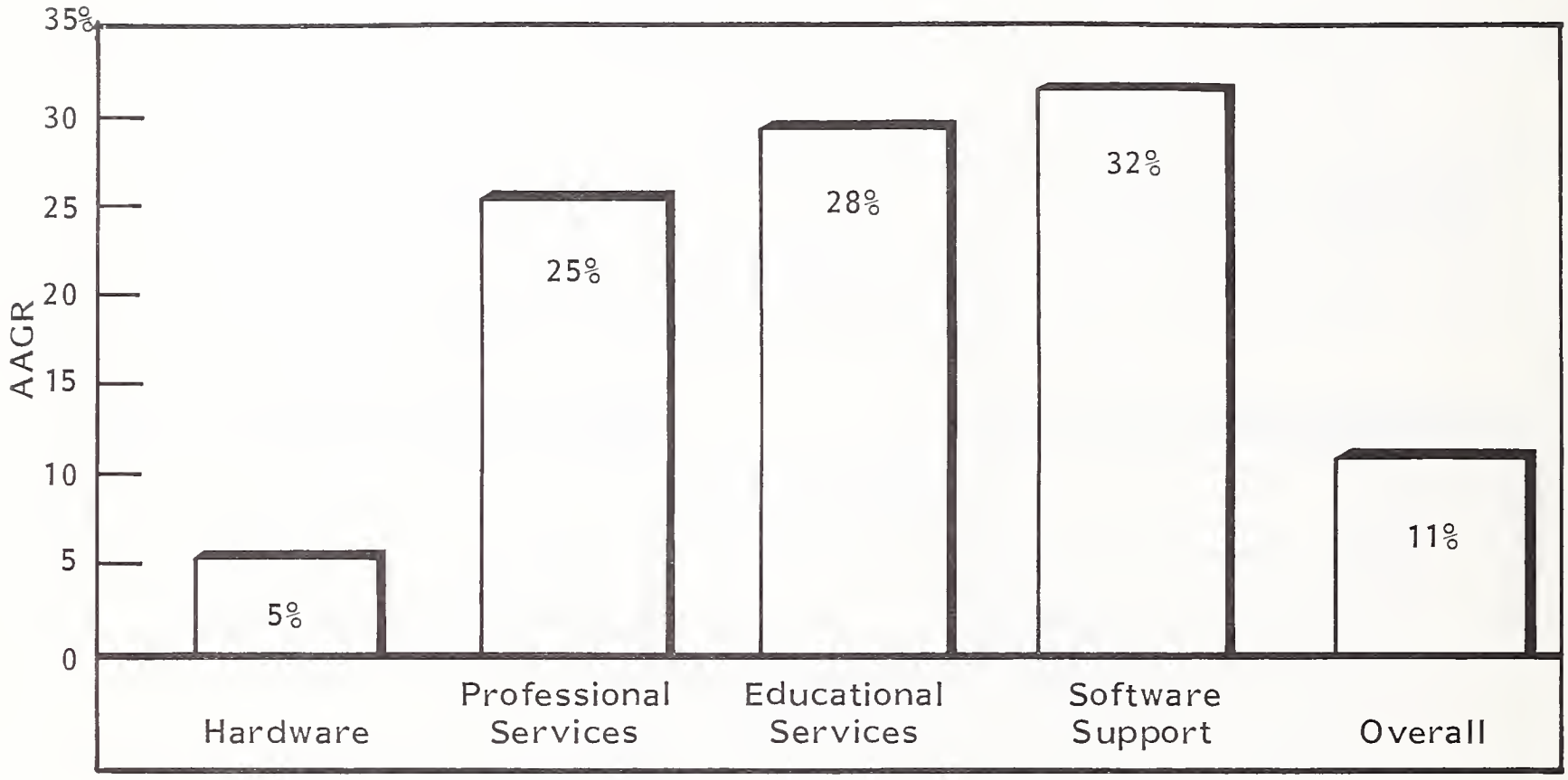


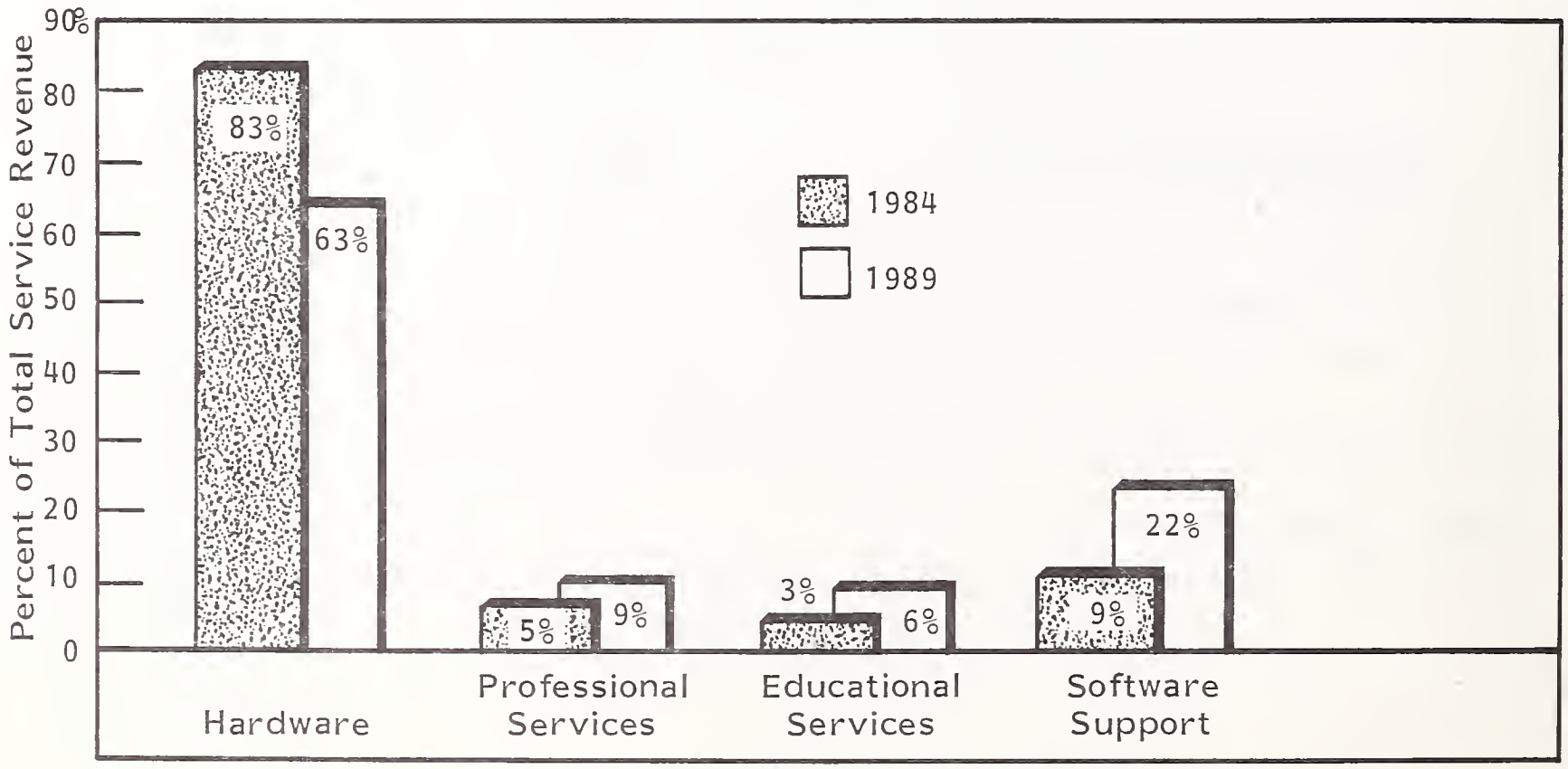
EXHIBIT V-3

LARGE-SYSTEM SERVICE GROWTH, 1984-1989

Average Annual Growth Rate
for Large-System Service Sectors, 1984-1989



Large-System Service Revenue
Mix by Sector, 1984-1989



- As mainframe vendors continue their penetration of the commercial market, there will be increasing user demand for training departmental workers in hardware as well as systems and applications software utilization.

- Because training materials are easily maintained and do not require frequent updates, educational services provide high profit margins once the initial program development is established.

- Educational programs are not necessarily tied to just one product. These programs can be spun-off as totally separate products (such as the CDC Plato products), or can be used to support several of the vendors' hardware product lines.

B. HARDWARE SERVICE TRENDS

- The continued development of new hardware service techniques will be prompted in large part by the large-system vendor's need to reduce the cost of providing service and thereby maintain profitability. Large-system service profitability was a given in the late 1970s and early 1980s, but starting in 1982 hardware service prices began to fall, particularly for new products and, to a lesser extent, for older machines as well. As a result of falling hardware service prices, profitability is no longer assured.

- Currently, overall large-system hardware service prices are falling at 7-10% per year. INPUT projects that this trend will continue at least through mid-1986. Between 1987 and 1990, hardware service prices will continue to fall, but at a slower rate (5-7%) than at present.

- Exhibit V-4 demonstrates that many large-system service vendors have been slow to react to this fundamental change in service pricing. Consequently, vendors are experiencing reduced profitability from hardware service or have reduced services in order to remain profitable. It is possible that vendors might mistake the recent trend in service price decreases as only a temporary aberration in pricing patterns. Considering the importance of service, vendors might assume that prices will again resume their upward spiral. Vendors are erroneous in this assumption, however. As demonstrated in Exhibit V-4, this type of analysis could result in sharply reduced hardware service revenue and, ultimately, the loss of service profitability.

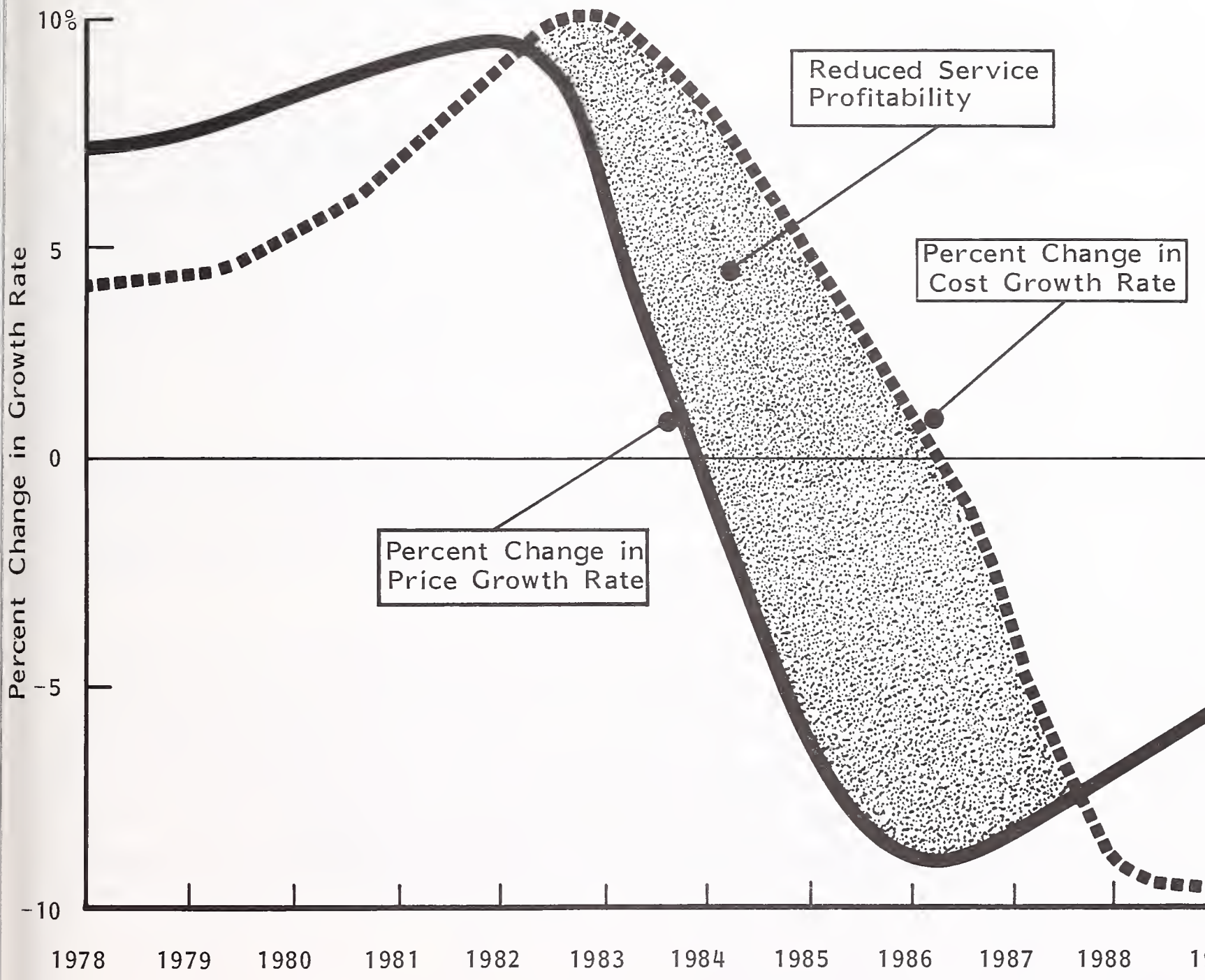
- The decrease in hardware service pricing will not have an immediate impact on service profitability, primarily because Exhibit V-4 refers to the percent change in the growth rate rather than the actual revenue and costs growth rate. For this reason, large-systems service vendors may continue to report profitable hardware service operations long after profitability has ceased to grow and is actually declining.

- The decrease in hardware service prices that began in 1982 and will continue through the end of the decade has been caused by technological advances resulting in vastly improved hardware reliability. This trend has become even more noticable as vendors have accelerated the introduction of products that are not only more reliable, but have the latest service technology, such as fault-tolerant subsystems, self-diagnosing boards, and "user friendly" diagnostics capabilities.

- Technological advances introduced in the late 1970s or early 1980s were designed primarily to lower the cost of service (and thereby increase profitability)--not to decrease the price of service. Currently, and for the next four to five years, there will be a tremendous pressure exerted on the vendors by users and competitors to lower service costs and ultimately reduce service prices. Service pricing will become an important weapon in the mainframe vendor's competitive arsenal.

EXHIBIT V-4

LARGE-SYSTEM HARDWARE SERVICE PRICE
VERSUS COST 1978-1989



- Service pricing will become a major competitive issue because the improved reliability of mainframe hardware will result, quite naturally, in user expectations of reduced or at least stable service prices. Growth in the third- party maintenance market is evidence of increasing concern by users regarding service price increases. Several vendors have indicated that users not only expect lower hardware maintenance costs, but are also applying sophisticated cost-accounting techniques to analyze the true cost of service over the life of the machine.

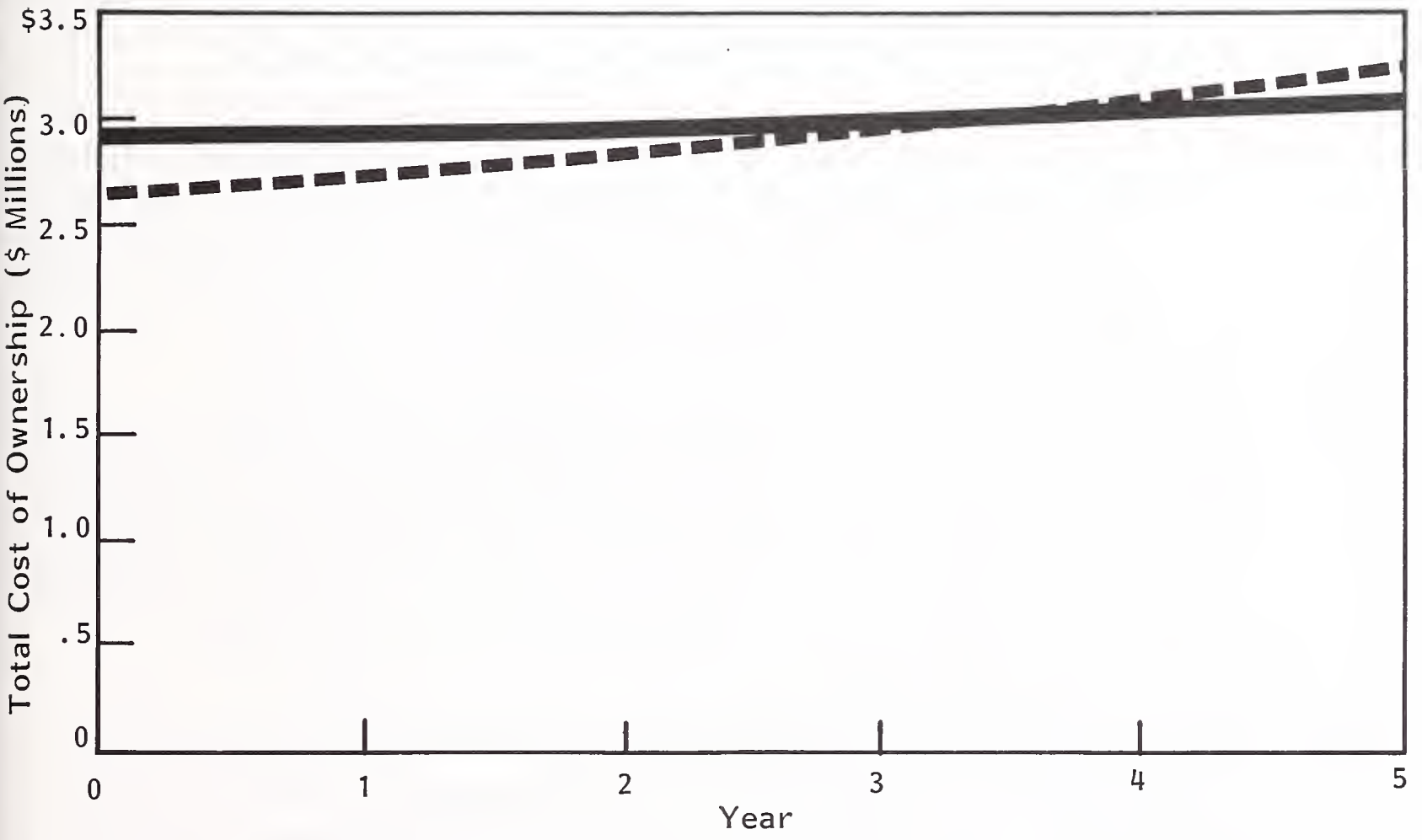
- Exhibit V-5 demonstrates the type of evaluation used by many customers in making equipment selection decisions. Rather than basing purchase decisions only on the initial cost of the machines, many users are now including long-term costs of service as well. The exhibit shows that even though the initial cost of a mainframe may be less than the competition's (as with example B), the total cost--which includes service--can be much more than the competition's.

- The essence of Exhibit V-5 is that Company A charges significantly lower maintenance fees for its mainframe than does Company B for its CPU. Reduced maintenance fees will allow Company A to be much more competitive in the long term than other vendors.

- As large-system service competition heats up, it will be more and more necessary for vendors to conserve resources in order to keep maintenance prices competitive. Technological developments in the service environment will be the most important, and in some cases they will be the only way for vendors to reduce hardware maintenance costs. New service technology is discussed below.

EXHIBIT V-5

TOTAL COST* OF LARGE-SYSTEM OWNERSHIP



Vendor	Purchase Price ($ Millions)	Annual Maintenance as a Percent of Purchase Price	Maintenance Over 5 Year Life of Machines ($ Thousands)	Total Cost ($ Millions)
A	$2.84	1.35%	$254.0	$3.09
B	2.60	3.79	652.0	3.25

* As viewed by the user; total cost includes purchase price and maintenance.

I. REDUNDANT AND FAULT-TOLERANT SYSTEMS

- All of the large-system vendors are investigating or developing fault-tolerant or redundant systems in order to improve system reliability. IBM, NCR, DEC, and other mainframe vendors have been experimenting with both loosely and tightly coupled multiprocessors.

  - A loosely coupled multiprocessor is a system in which each processor has its own memory, whereas in a tightly coupled system each processor shares a control memory.

  - The major advantage of a loosely coupled multiprocessor is that it suffers less performance degradation as the number of subsystems increase. Tightly coupled multiprocessors have the advantage of being less expensive due to shared components.

- From a service standpoint, redundant and fault-tolerant systems are most useful in on-line transaction processing (OLTP) industries such as banking, the federal government, and discrete manufacturing. These and other industries that require 100% system availability are typically service price insensitive and therefore offer tremendous growth potential for service vendors.

- INPUT believes that the market for fault-tolerant systems will grow dramatically in the next five years, primarily as the number of downtime-sensitive, on-line system users grows. Total revenues for fault-tolerant systems will increase from less than $1 billion in 1984 to almost $13 billion in 1987.

- In addition to providing improved reliability, fault-tolerant systems are much more adaptable to modular expansion than are conventional mainframes. This will have a significant impact on the way service is delivered, particularly to loosely coupled modular systems.

- Service on fault-tolerant systems will be considerably different than on conventional systems because of the resident self-diagnostics resulting from redundant component technology. Fault-tolerant systems will usually require less technical training for the FE and more component exchange activities. INPUT expects fault-tolerant systems to lead the market in the application of remote-diagnostic, remote-fix technology.

- As the market for redundant systems and fault-tolerant technology grows, there will be a corresponding decrease in the necessity for unscheduled mainframe maintenance. Individual CPU failures will still occur (although with less frequency than now), but these failures will be unnoticed by users, due to the efficiency of multiprocessor tasking. The vast majority of repairs will be attended to during scheduled maintenance periods.

- A much more efficient allocation of service resources will result from the scheduling of maintenance calls. Currently, this is not possible even on fault-tolerant system because of the general lack of system reliability. However, as modules of multiprocessors grow, the failure of one CPU will not require immediate service because system performance and data integrity will not be improved.

- The ability to schedule on-site maintenance will provide fault-tolerant manufacturers with a substantial competitive advantage over conventional mainframe vendors. Manufacturers of fault-tolerant mainframes will be able to reduce service prices at a much more rapid rate than conventional mainframe vendors because they will be able to reduce the number of on-site calls--which currently represent the most expensive component of service.

2. SELF-DIAGNOSING COMPONENTS

- The development of self-diagnosing components, such as circuit boards, will have a significant effect on repair times, logistics operations, and FE skill levels. Currently, self-diagnosing boards are being used with great success by

a number of vendors, and INPUT expects this technology to be integrated into all new mainframe products developed after 1986.

- Self-diagnosing technology's major advantage is that it will promote more efficient use of remote support and response times. Vendors that are currently using this technology report that FEs have a much lower call-back rate because on their first call they are prepared with the right tools and parts.

- Reduced service expenditures from lower inventory costs are another result of using self-diagnosing components. A major service-related problem reported by numerous vendors is the field replacement of functioning equipment. One vendor reported that almost 70% of the circuit boards replaced by engineers in the field were tested as good at repair depots. Self-diagnosing components help to reduce the in-field replacement of functioning equipment, thereby reducing the pipeline transportation, testing, storage, and redistribution costs.

3. REMOTE DIAGNOSTICS

- There will be continuing user pressure to improve hardware remote diagnostics so that:

  - They are easier to apply, particularly in a mixed-vendor environment.

  - They address user concerns about data security.

  - They are more effectively coordinated with other service components such as dispatching, parts distribution, etc.

- INPUT expects that all new mainframe products introduced from now on will have extensive remote diagnostics capabilities built-in. Users will not only accept, but demand remote support as they begin to experience improved hardware response and repair times. Improved service performance resulting from remote support should be used as a marketing tool to advertise the

product and as a profit generator (because users will pay premium service prices to receive improved repair time).

- One crucial issue is whether remote diagnostics will be vendor proprietary or whether there will be a standard diagnostic routine that can test an entire multivendor system. Users clearly want a standard diagnostic routine because that will provide them with some of the benefits of large-system diagnostics (e.g., improved response time, parts availability, etc.) on their peripheral devices.

- Despite the fact that users want standard remote diagnostic packages, INPUT does not expect vendors to give up their competitive advantage in this area. In fact, it is likely that remote support products (software, hardware, and firmware) will be made proprietary when possible, in order to protect the service vendor's market.

- One point that INPUT continues to stress about remote diagnostics (and remote support, in general) is that the vendors must market these service/system capabilities. Many users still resist using remote support because they do not understand the benefits. However, INPUT has found that when users experience the benefits of remote suport (e.g., improved response time or increased system availability), they became converts and almost refuse to accept traditional on-site service.

4. OTHER HARDWARE FACTORS AFFECTING THE SERVICE MARKET

- INPUT expects mainframe technological development to continue increasing through the end of the decade. Leading-edge semiconductor technologies currently used in the supercomputer market will find their way into the mainframe market as well. ECL logic circuitry will become increasingly popular, but vendors are also exploring alternative technologies such as CMOS and Gallium Arsenide devices for use in mainframes.

- The choice of semiconductor technology will probably not affect service to any great extent, but it does point out the increasing emphasis on improving system performance. This emphasis has already become critical with the introduction of a new generation of 3380-compatible disk drive storage devices. Several vendors have indicated that they believe this technology was brought to market too soon (i.e., before it was adequately tested in order to gain market share).

- Increasing competitiveness in the industry will make it much more likely that products will be introduced before adequate testing has been conducted. This could have an adverse effect on service, particularly during the "burn in" periods. Service management must become more involved in service planning during the product development stage in order to improve service responsiveness on new products. Service management involvement is particularly important when radically new technology is applied.

- Another hardware factor affecting the mainframe service market is the growing trend toward multivendor user sites. As this trend grows, users will become much more adamant in demanding an end to "finger pointing" between various service vendors. Users will expect the CPU service vendor to coordinate service on--if not actually service--"foreign" peripherals. Vendors (apart from IBM and possibly DEC) that do not offer this service will operate at a considerable competitive disadvantage.

- Mainframe vendors can take care of two approaches in offering multivendor sevice. First, like National Advanced Systems, the vendor can actually perform the maintenance and become a third-party maintenance company. The second option is the approach followed by Amdahl: carry out problem determination on all facets of the system, but rely on the original manufacturer to actually service any failed component.

- The major advantage to the NAS approach is that this is a very profitable option. The CPU vendor effectively controls the user's site and is more likely

to sell additional services and/or equipment than in an open-competition environment. The main disadvantage to this approach is that it requires extensive training and logistics support.

- The Amdahl approach is advantageous because it results in a high level of user satisfaction without requiring extensive capital resources. However, by only providing problem determination services, Amdahl forgoes extensive revenues--i.e., this option is not nearly so profitable as the NAS alternative discussed above.

C. SYSTEMS SOFTWARE SERVICE TRENDS

- The one irrefutable truth of the mainframe market is that machines are getting larger and faster. IBM is reported to be planning a multiprocessor ("Sierra") capable of 50 million instructions per second (mips). Some of the loosely coupled multiprocessors already available can have a main memory of between 120 and 150 M-bytes. But these hardware improvements are only as effective as the software that runs them; systems software is becoming an increasingly important problem.

- The basis of the systems software support problem is that the software currently available was not designed for today's network environment. Originally IBM's OS/360 systems software was started as a stacked job monitor. With the increasing size and centralization of mainframes, however, system software has become so complex that the reader might very well question whether any one person--or company, for that matter--can truly understand, after 20 years of continuous programming effort, how the operating system functions.

- The complexity of today's system software products provides a challenge--and opportunity--to mainframe service vendors. The challenge is that today's

interactive and distributed processing requirements place a greater burden on systems software than ever before. The opportunity is that users have found software suport so important that they are willing to pay substantial premiums to get the software service they need.

- There is a tendency to believe that today's mainframes and resident operating systems are more complex and therefore more efficient than previous generations of large systems. This is not necessarily true. In fact, less than 10% of mainframe execution time is spent running user-written code. The remainder of the time, the processor is busy driving the operating system or a data base management subsystem. As the size of and requirements on mainframes grow, the existing operating system becomes more complex and even less efficient.

- The fact that systems software is becoming relatively less efficient actually works to the advantage of mainframe manufacturers. Since the operating system requires a larger and larger portion of the processing power of the machine, users will be forced to purchase more and larger CPUs. Obviously, this trend benefits the mainframe manufacturer and makes it unlikely that any of the large-system vendors will totally restructure their systems software for greater efficiency.

- Users are well aware of the growing importance of systems software and expect to pay increased permiums for support. INPUT found that 62% of large-system users believe mainframe vendors will increase upgrade prices significantly rather than continue the traditional practice of charging nominal prices for upgrades. Currently, 46% of large-system users have indicated that they are willing to pay an added premium (over and above their basic monthly maintenance charge) for improved software support.

- Systems software support revenues will grow from 15% of total service revenues in 1984 to over 34% in 1989. By 1989 software maintenance and support will represent the largest growth segment of the large-system service

market. (Hardware maintenance will still represent a larger share at 46%, but this will be a declining segment.)

- Exhibit V-6 demonstrates that the growth in the cost of systems software support and maintenance is expected to double from 5% annual growth in 1980 to almost 10% in 1989. Systems software support price growth, however, is expected to increase even more dramatically, from 4.8% per year in 1980 to 13% annually in 1989.

- Software support profitability is expected to increase steadily from 1982 through 1989. This growth in profitability will be caused by several factors:

  - As noted above, system software is becoming increasingly important to users who are subsequently less price sensitive regarding support.

  - The complexity of the current system software package makes it impossible for the average user to support the operating system software internally.

  - Vendors are becoming more efficient at providing support through centralized support centers, problem determination data bases, and increasing specialization by software support groups.

- Although software support profitability will increase through the end of the decade, vendors must be prepared for a substantial growth in user demands for improved software support. As Exhibit V-7 demonstrates, users are dissatisfied with the most important software support function--fixing errors. Users reported that the average repair time for serious systems software problems was almost 50 hours (including response and repair time). This is far too long for most users, who typically require a fix in 10-20 hours.

- Training is the second most important software support function (after error fixing) for large-system users and yet there is substantial dissatisfaction with

EXHIBIT V-6

MAINFRAME SYSTEMS SOFTWARE MAINTENANCE AND SUPPORT GROWTH RATES, 1980-1989

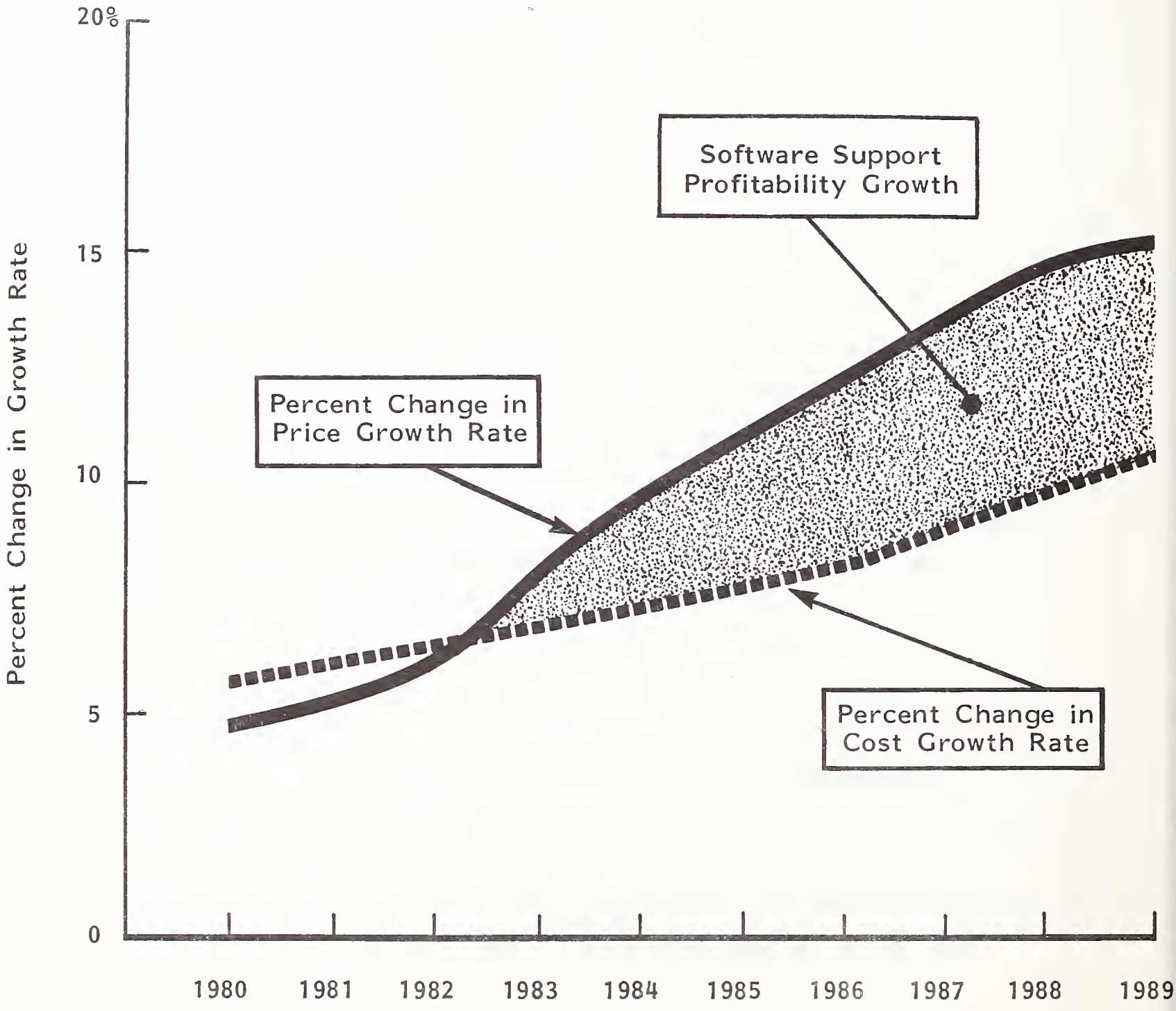
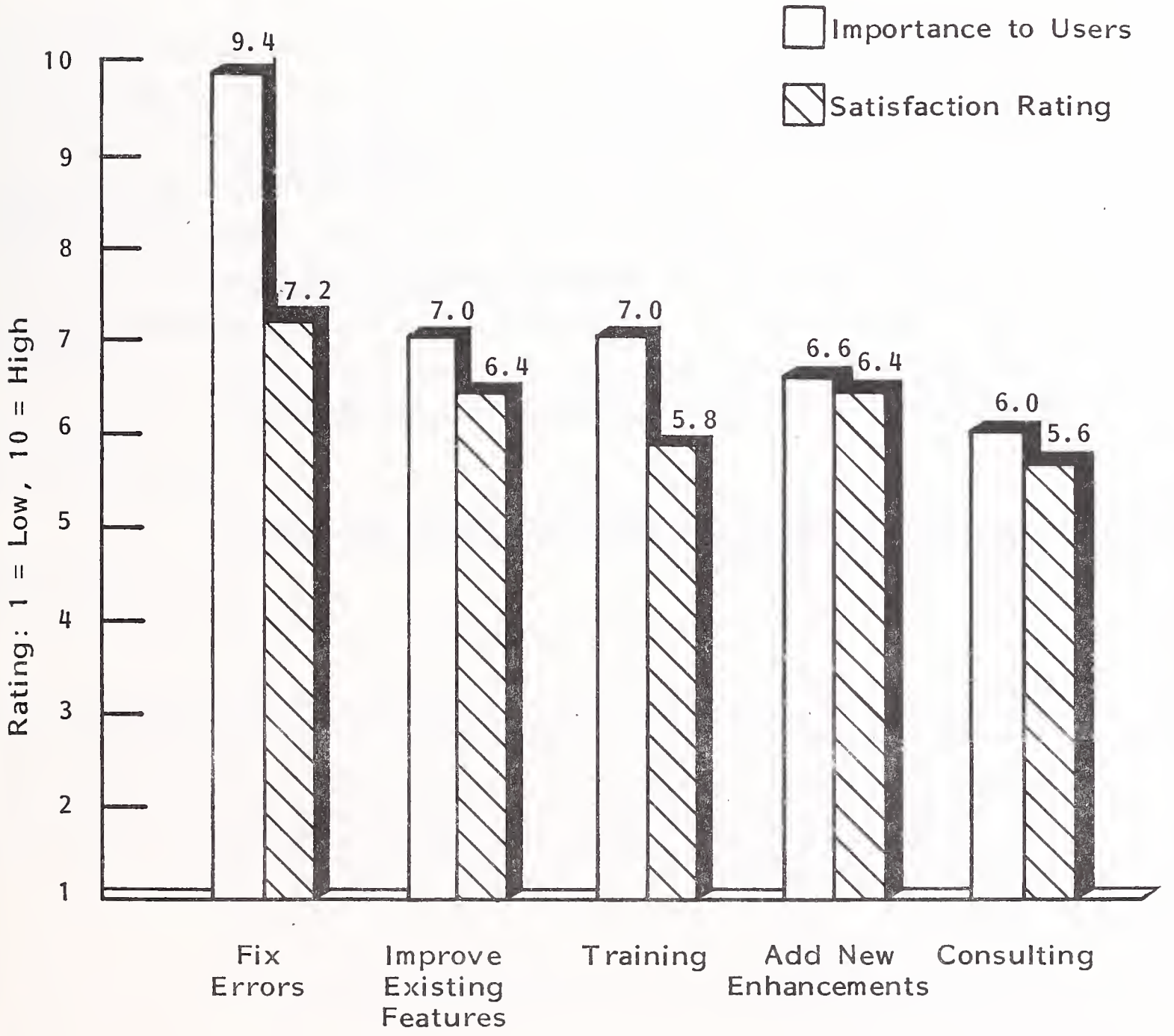


EXHIBIT V-7

USER RATINGS OF SOFTWARE SUPPORT FUNCTIONS



the services provided by mainframe vendors. This lack of emphasis on software training is a missed opportunity on the part of the vendors for several reasons:

- The training market is expanding very rapidly--particularly for software.

- Software training is very profitable because of low maintenance and update costs.

- Despite dissatisfaction with software support, INPUT has found no indication that users are trying to migrate away from manufacturers' software support services. As Exhibit V-8 demonstrates, only 22% of large-system users are planning to expand self-support of software. Although most users will provide some self-support for software problems (particularly in areas like installing software releases), the vast majority prefer not to modify source code. Only 21% of large-system users said they would modify software. INPUT believes that even this number will decline as systems software becomes more complex.

D. PROFESSIONAL SERVICES

- Professional services represent one of the fastest growing segments of the maintenance/support market for the period 1984 to 1989. The average annual growth rate will exceed 25% for the 1984-1989 period, with annual revenues in 1989 of 500 million (equaling almost 10% of all large-system service revenues for that year).

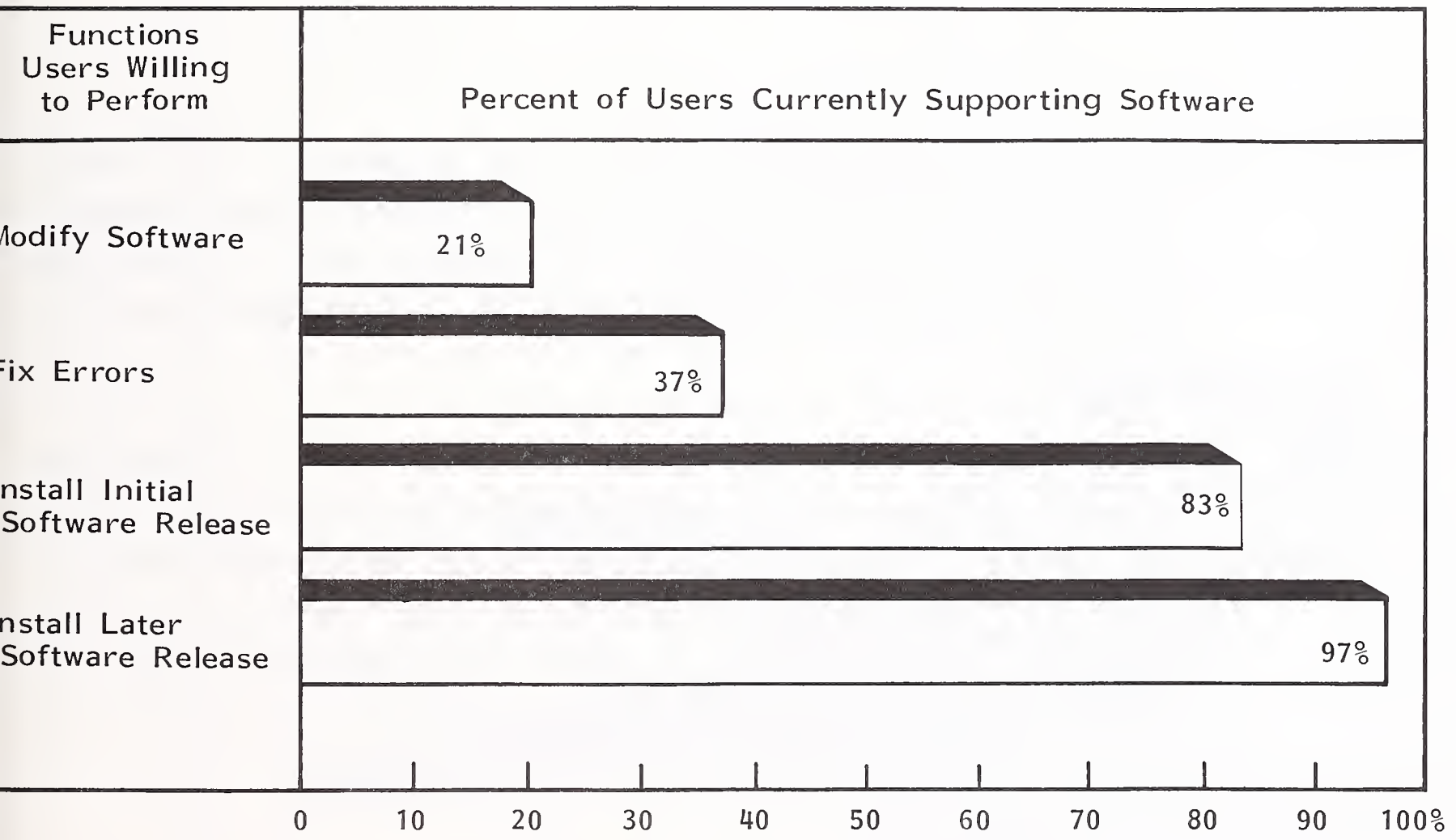
- The various components of professional services include:

  - Consulting.

  - Capacity management.

EXHIBIT V-8

MAINFRAME USER ATTITUDES TOWARD SELF-SUPPORT OF SOFTWARE



All mainframe users are willing to support SOME software functions, but only 22% are planning to expand user self-support of software.

- Site management services.
- Financial planning.
- Pre- and post-sales system design.
- Environmental analysis.
- Physical site planning.
- Site audits.

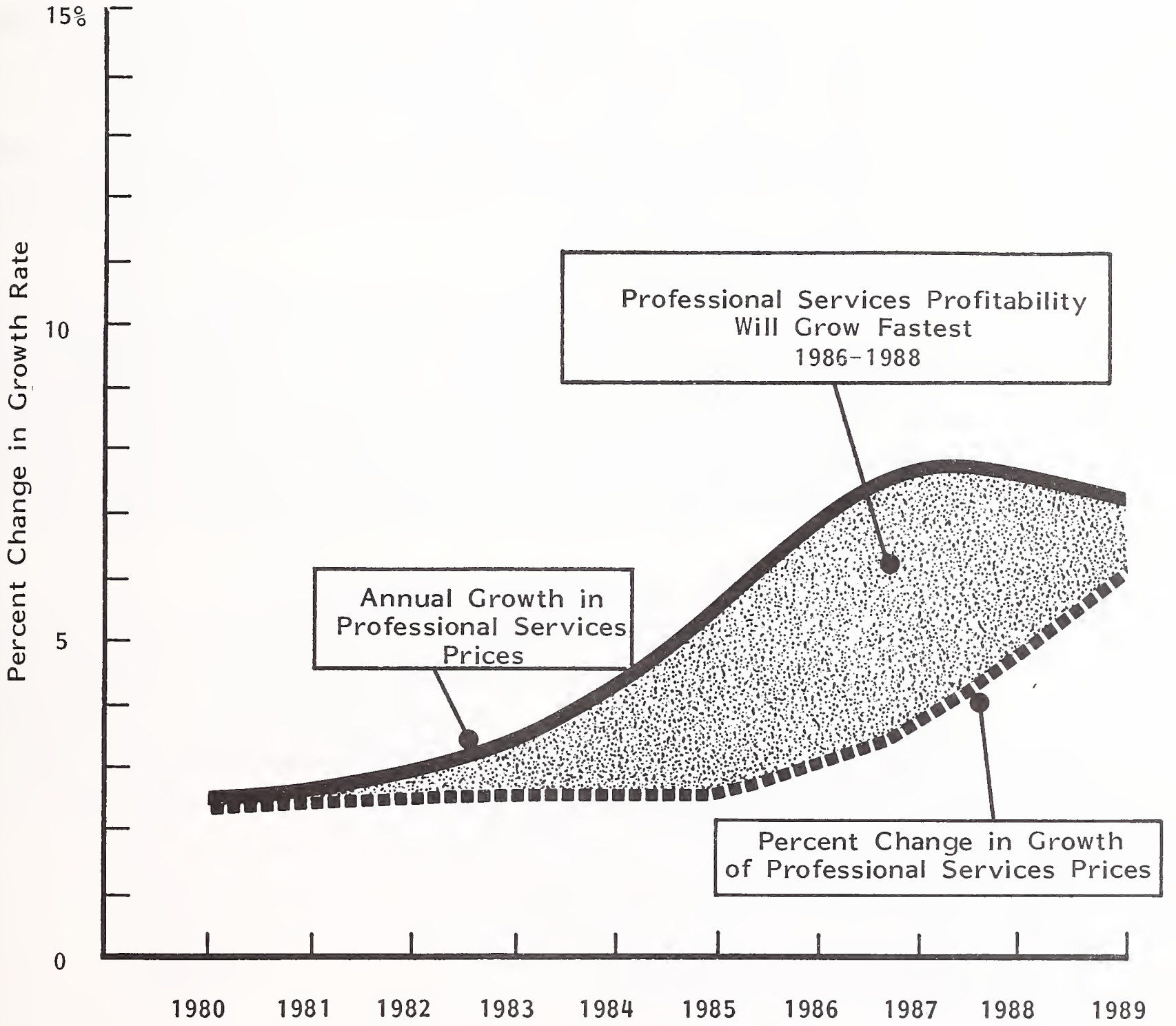
- Exhibit V-9 shows a steady increase in the annual cost of professional services. This growth is the result of increased demand by users for comprehensive pre- and post-sales support. The growth in prices for professional services will level off in 1988 and will actually begin declining by the end of the decade.

- Vendors will seek to promote professional services in order to differentiate their service products from the competition's. Currently, most large-system users admit to a strong service product and vendor identification. TPM penetration is limited and the manufacturers' profitability is growing. But service vendors have identified a trend in which the user's loyalty to a particular vendor is eroding as a result of the increasing "generic" level of service and growing competition among vendors.

- While all of the large-system service vendors have increasingly attempted to protect their installed base with reactive strategies (i.e., control of parts, diagnostic routines, enhancements, etc.), vendors are taking more proactive steps to differentiate their service products. Typically, these proactive techniques fall into the professional services categories--e.g., consulting, site management, and planning services.

EXHIBIT V-9

LARGE-SYSTEM PROFESSIONAL SERVICES
PRICE VERSUS COST GROWTH, 1980-1989



- For several different reasons, vendors have chosen to apply professional services in order to differentiate their service products.

  - Professional services are individually applied to each user and therefore result in a high level of user satisfaction.

  - Site management professional services are typically very profitable; they improve account control and reduce competitive comparisons.

  - Professional services improve the vendors' understanding of the user needs. This understanding, in turn, results in improved add-on equipment and supplies sales.

- The major growth in professional services started in the early 1980s and will continue through the end of the decade. Initially, this growth was inspired by the increase in mixed-vendor environments. Users who purchased equipment from different vendors in order to save money found that system availability suffered as the different vendor support organizations blamed each other for system failures.

- The greatest growth in professional services will be experienced in the next three to four years. Users will be particularly dependent on vendors for such areas as capacity management, pre-sales system design, and integration consulting. Toward the end of the decade profitability will fall as a result of the increasing dominance of IBM and reduced competition from other mainframe vendors.

E. EDUCATIONAL SERVICES

- Educational services are currently considered a subset of overall "professional services," but in the next three to five years education and training will be the

fastest growing service segment and will represent a major revenue source on its own. INPUT estimates that educational services currently represent only 2% of the $3.4 billion service market ($68 million), but that figure will increase 33% annually to $280 million by 1989, as shown in Exhibit V-10.

- There are three major causes for this expected increase in educational service revenues:

  - There will be a substantial increase in customer demand for training as mainframes increase commercial penetration, particularly in vertical markets.

  - Educational services are very profitable and therefore of interest to service vendors.

    . The increase in customer demand for education and training will result primarily from the growing dependence--at all organizational levels--on mainframe computer applications.

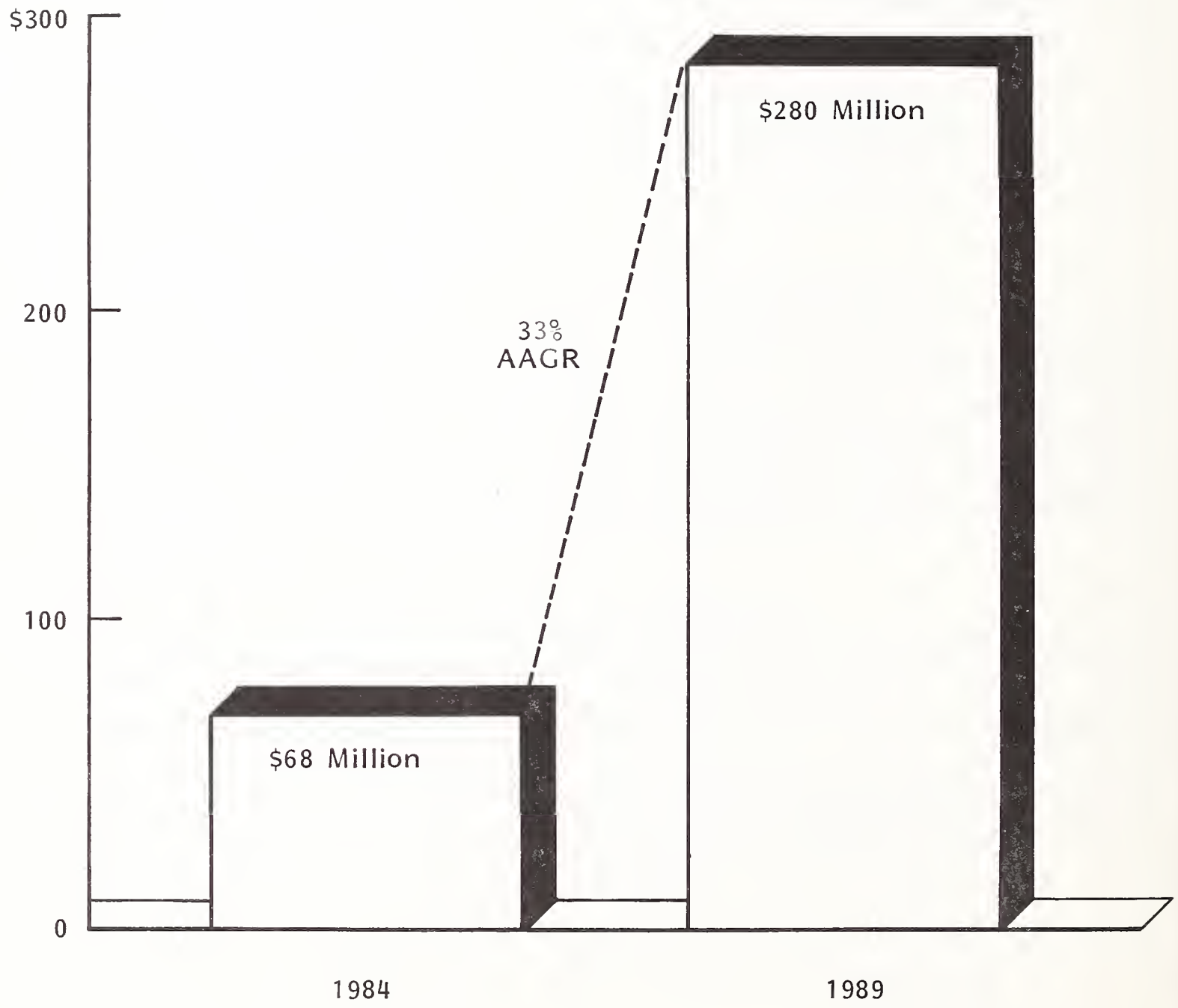
    . The majority of training will center around software applications, but there will be an ongoing need for hardware training of new employees as well.

- One application software vendor interviewed by INPUT indicated that over 15% of its revenues were derived from educational services--up from only 4% in 1980. This vendor said that although new sales of its software had been flat during the recession, educational services to current customers had expanded dramatically as customers tried to find new ways to increase employee productivity.

- As noted above, educational services are very profitable in that they require little or no maintenance. Large-system manufacturers interviewed by INPUT have consistently reported a high level of "transportability" of education and

EXHIBIT V-10

EDUCATIONAL SERVICES REVENUE GROWTH
1984-1989



FACTORS PROMOTING EDUCATIONAL SERVICES GROWTH

- Increased Customer Demand
- High Profit Margin
- Transportability Between Products

training services between products. Unlike consulting, which varies according to each individual application, educational services can be applied to a wide variety of applications with little or no modification. In addition, with the advent of video, audio, and self-paced instruction, labor intensiveness is being reduced.

- Improving profitability of educational and training services is based primarily on the efficiencies inherent in an expanding market, rather than on increasing prices for the current market (as with revenue growth in software support). Exhibit V-11 demonstrates that there will not be a dramatic increase in the price of educational services growth rate. The real change will come with the decline in the cost of providing educational services. As noted above, this decline will result from reduced product development costs and from a larger user base over which to distribute costs.

- INPUT believes that educational and training services should definitely be integrated into the service department. While some companies have set up separate training departments, INPUT believes this is a mistake for the following reasons:

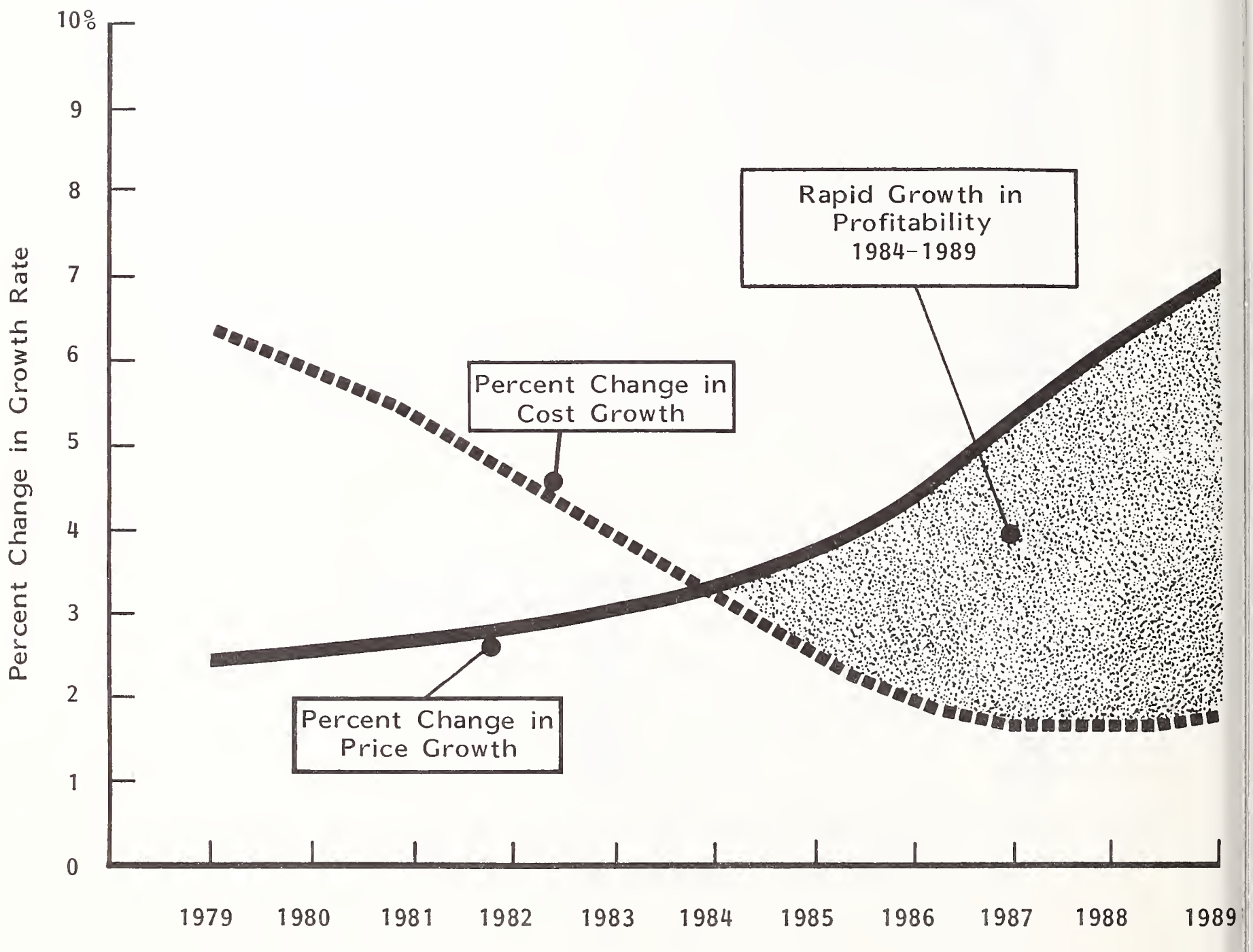
  - Training is likely to be an ongoing function that constantly involves both hardware and software maintenance personnel.

  - There must be a great deal of synergy between education and maintenance/support in order to reduce user instigated system failures.

  - Education and training, like all after-sales support services, should be combined into an overall maintenance/support group in order to optimize user requirements for add-on services.

EXHIBIT V-11

LARGE-SYSTEM EDUCATION SERVICE GROWTH
1979-1989



F. PRICING OF SERVICES

- The pricing of service and support represents one of the most crucial issues for mainframe service vendors. As third-party maintenance vendors (both manufacturers and nonmanufacturers) begin to penetrate this market, service vendors may choose to retaliate via competitive pricing. While this strategy may be appropriate, it by no means assures success in preventing TPM penetration.

- INPUT believes that only a small portion of the mainframe service market is actually price sensitive. The vast majority of companies believe that maintenance prices are equitable (although, of course, they would like to spend less on service) and a minority of companies would be willing to pay added premiums for extra services.

- Exhibit V-12 demonstrates the service price segmentation of large-system users. Five to ten percent of the users interviewed by INPUT were service price sensitive and required discounts on service even if the discount resulted in below-average service. At the other end of the price spectrum are users who are not at all price sensitive. These users are willing to pay premiums of up to 50% over their basic monthly maintenance charge (BMMC) for better than average service.

- The vast majority of users in Exhibit V-12 feel that standard maintenance is fairly priced. But this is not a totally homogeneous group. Almost all large-system users typically demand better than average service in some categories but will accept below-average service in others.

- The three segments of large-system users cannot be and are not currently satisfied with most vendors' fixed service pricing schedule, as shown in Exhibit V-13. Vendors typically offer a set fee for a given service, for example four-hour response time. If users want improved service, they pay according to a

EXHIBIT V-12

LARGE-SYSTEM SERVICE PRICING RELATIVE TO OVERALL QUALITY

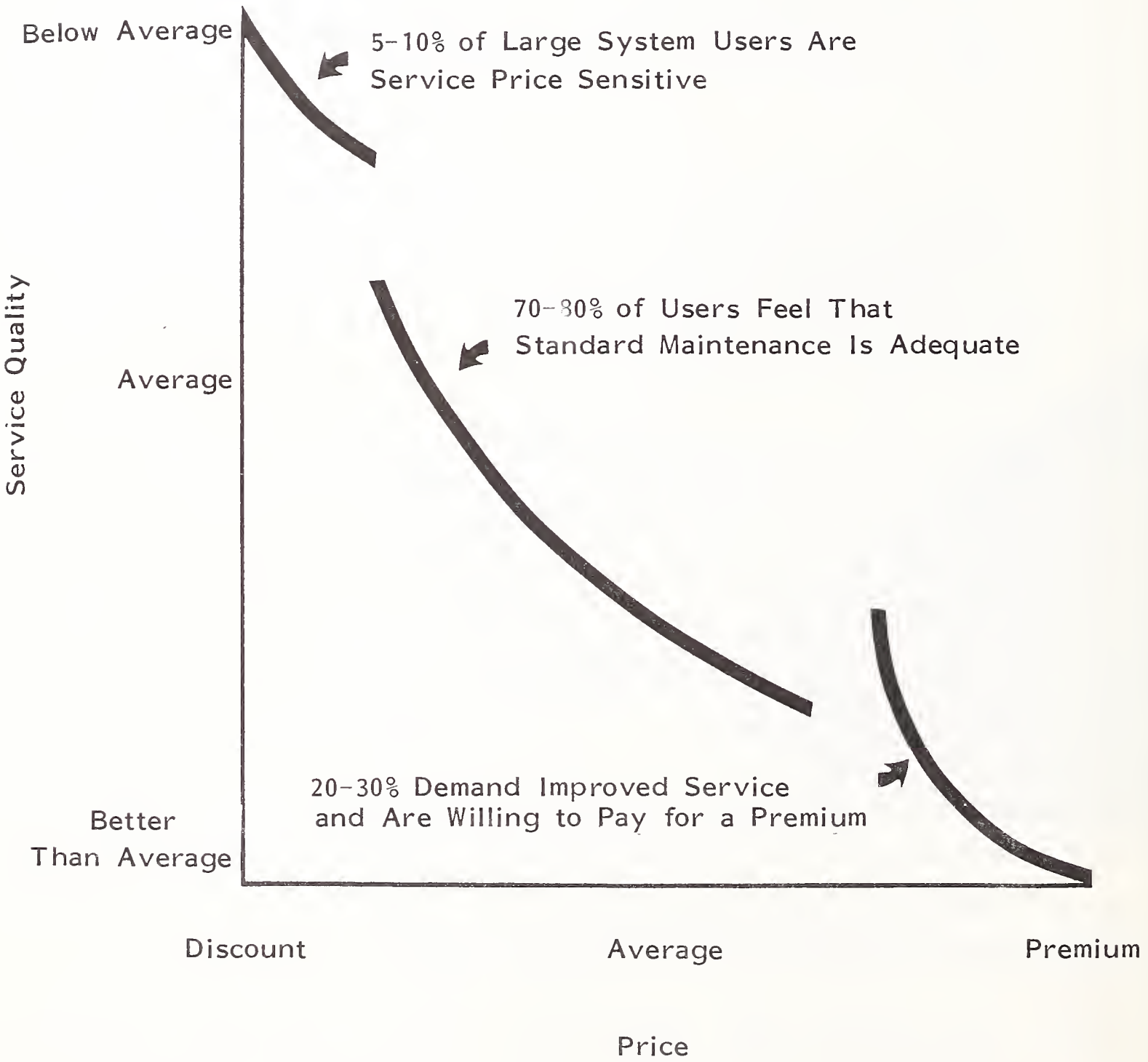
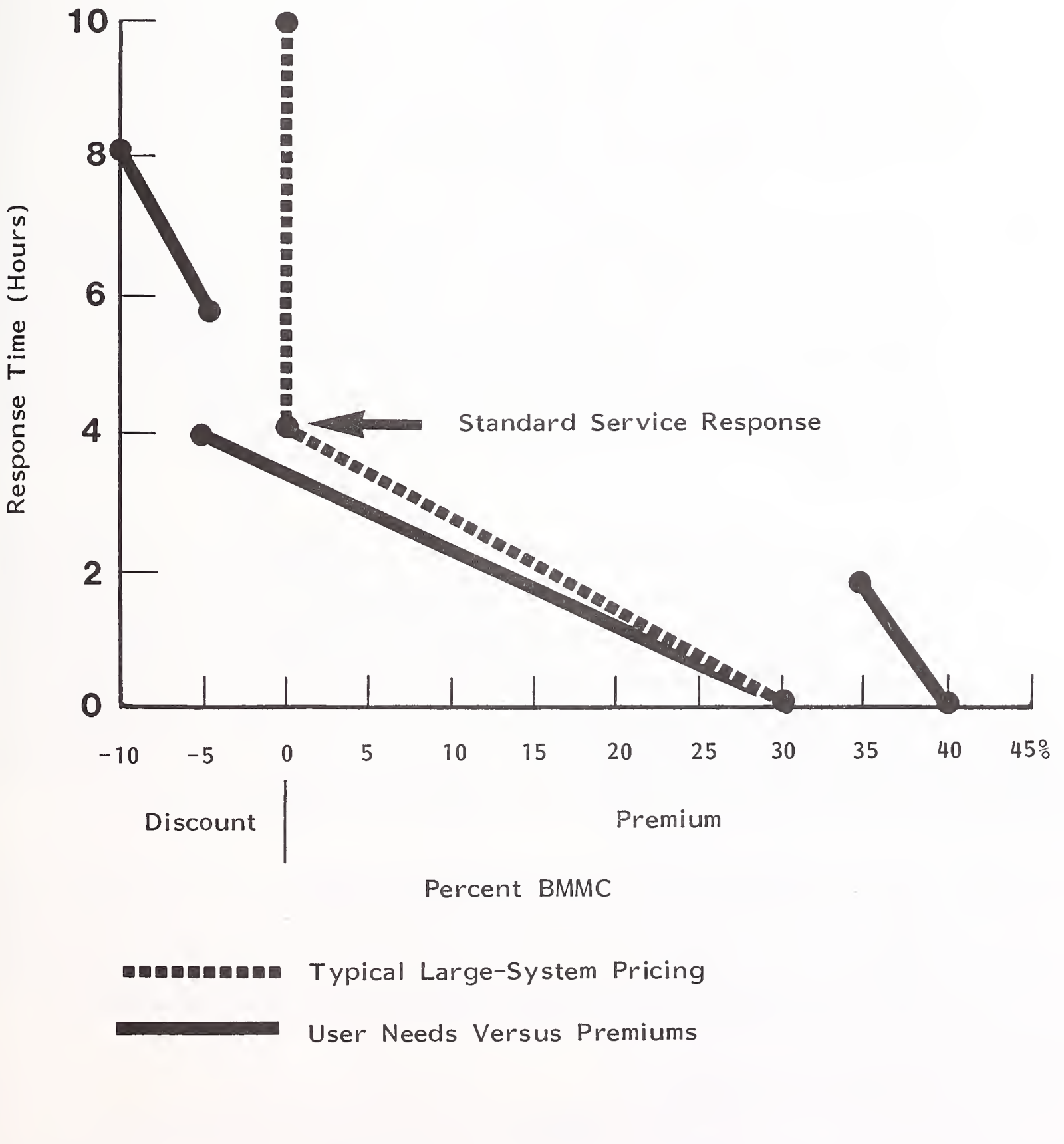


EXHIBIT V-13

LARGE-SYSTEM SERVICE PRICING RELATIVE TO RESPONSE TIME PERFORMANCE



fixed premium schedule. Although this option offers some flexibility to the user, Exhibit V-13 demonstrates that most users remain dissatisfied because the vendor's pricing schedule (in this case for response time) is not as flexible as users require.

- INPUT is not suggesting that service vendors design a service price schedule for each individual user, but rather that the vendor recognize that there are segments of users who are dissatisfied with the current method of service pricing. Users are looking for a greater service price flexibility on the part of the vendors; as the service business becomes more competitive, users will be much more demanding in their requirements for flexible service prices.

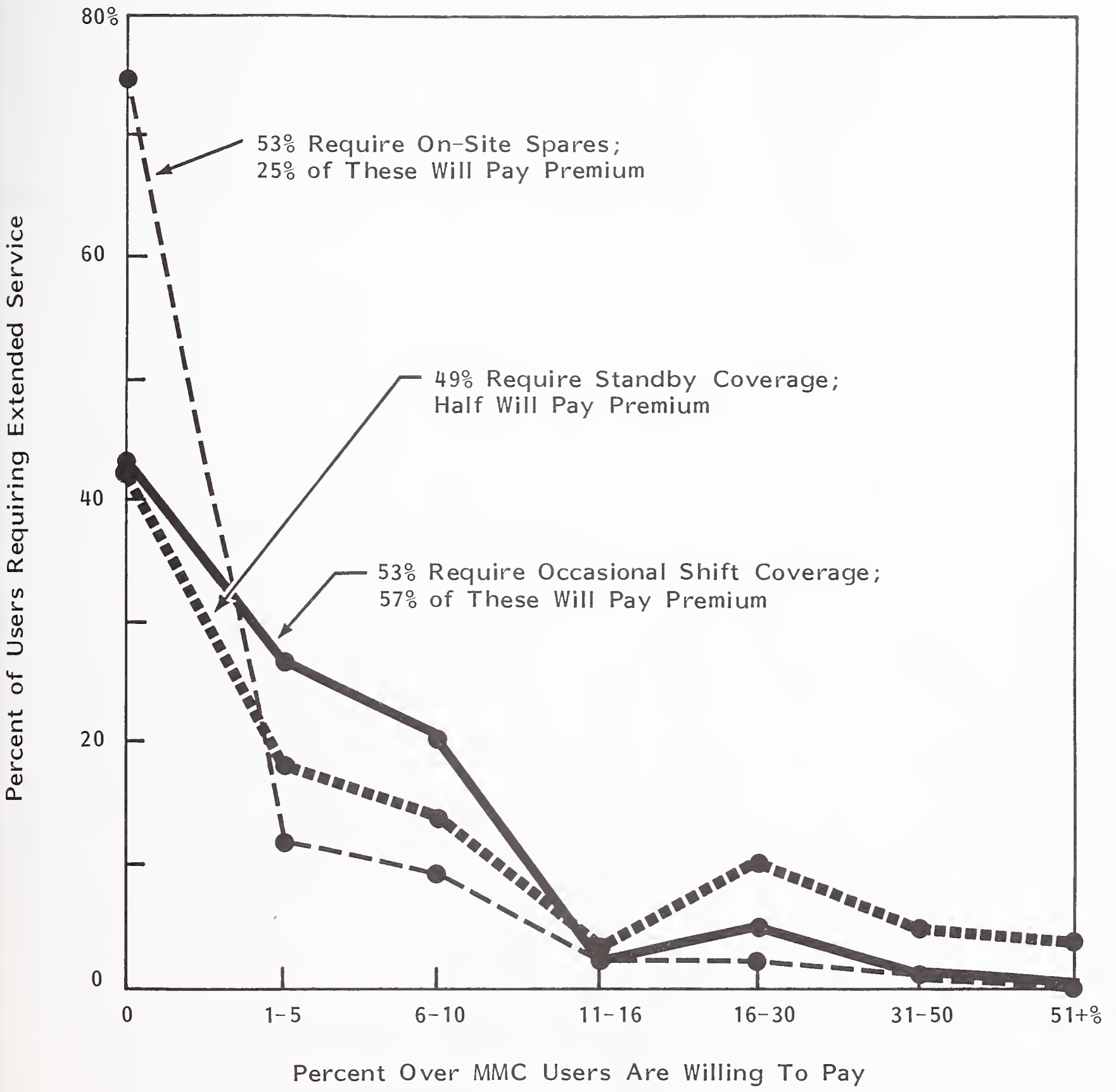
- The first step in maximizing service revenue is to establish a pricing structure that accurately reflects the needs of users. As noted above, INPUT has identified three groups of large-system users: price sensitive, price insensitive, and those that accept the current maintenance price structure. A maximized pricing structure must not only address the global needs of these three groups, but must also face the individual service requirements within each group.

- A measure of the importance users place on individual services is demonstrated in Exhibit V-14. Three key services--standby coverage, on-site spares, and occasional shift coverage--are measured first for the percentage of large-system users that require extended services and second for the premium they would be willing to pay for these services. As the Exhibit demonstrates, the number of users requiring extended services is roughly constant (49-53%), and yet the percentage willing to pay a premium varies dramatically.

- The most profitable of the services listed in Exhibit V-14 is occasional shift coverage; almost two-thirds of the users who require this extended service are willing to pay a premium. This contrasts with on-site spares, where only 25% of the users requiring this extended service are willing to pay a premium.

EXHIBIT V-14

LARGE-SYSTEM USER REQUIREMENTS FOR EXTENDED SERVICES



- INPUT has found that all the major services such as response time, parts availability, consulting, and even repair time can be segmented according to the price sensitivity of the user. Some services, such as occasional shift coverage and standby coverage during critical periods, can be particularly profitable because of the high premiums users are willing to pay. Other services, such as on-site parts and service "guarantees," do not have a great profit potential because users do not value these services highly enough to pay additional premiums.

VI CONCLUSIONS AND STRATEGIC RECOMMENDATIONS

VI CONCLUSIONS AND STRATEGIC RECOMMENDATIONS

A. INTRODUCTION

- The development of a long-range service strategy will be based, in large part, on broad industrywide trends, rather than on specific service issues. Specific issues (such as response time, parts availability, and system availability) are important in that they drive users' short-term satisfaction ratings. However, it will be the long-term trends that will have the most serious impact on the service vendor.

- Exhibit VI-1 lists the six major trends that will restructure the service environment. These trends, each of which will be discussed in greater detail below, point to a market that will be much more competitive than ever before. Steady revenue growth and profitability will no longer be assured. Large-system vendors will be forced to be much more attentive to the service market in order to continue service growth.

B. INCREASING USER PRESSURE ON THE SERVICE MARKET

- One of the most important trends in the large-system market is the fact that vendor service programs and the market in general are being increasingly driven by the user base. Users are now contesting pricing decisions, service flexibility, and support quality as never before.

MAJOR RESTRUCTURING OF SERVICE ENVIRONMENT UNDERWAY

- Market Is Increasingly User-Driven
- Maintenance Is Becoming a Commodity
- IBM Driving Maintenance Price Umbrella Down
- TPM Market Entering New Phase
- New, Agressive Competitors
- Service Quality: Growth, Profit, Customer Satisfaction

INPUT

- The growth of TPM and non-manufacturer-supplied service has provided the user with an alternative source of maintenance to compare with traditional manufacturer-supplied service. Competition produces greater user awareness of industry service standards and consequently has a major impact on user satisfaction levels. In addition, competition itself has opened up new service alternatives to users. The TPM vendors, for example, inadvertently segmented the large-system market and found a ready source of customers among price-sensitive users.

- Vendors must accept that the era of the passive service customers is gone and will, in all probability, never return. Users are becoming much more active in driving the market in areas like service pricing, flexible levels of support, response times, etc. While some vendors can take an "improved" attitude and ignore user demands, the successful service vendor will attempt to understand the user's needs and design the company's programs around those needs.

- Two of the most pressing user demands are software support and response time support. Software support, as Exhibit VI-2 demonstrates, is a key issue. Users report that only two of the major large-system service vendors (IBM and Amdahl) meet required software response/repair time levels. All of the other vendors fall short of the users' requirement. When current levels of software support are compared to historical data, users see little if any improvement in software support.

- INPUT believes that users will persist in demanding improved software services for a variety of reasons:

  - As hardware becomes more reliable and as response/repair time for hardware improves, the spotlight will be on software repair time. After hardware, software support is the most important service area to most users.

SOFTWARE REPAIR TIME - A KEY ISSUE

- With Hardware Response and Repair Times and Software Response Time Close to User Requirements, Spotlight Is on Software Repair Time.

- Few Vendors Meet or Beat User Requirements: Nearly Everyone Falls Short.

- The Key Component of User Satisfaction is Integrated Hardware/Software Staff.

  - FE Cross-training Is Not Mandatory, But FEs and SW Engineers Must Work Together Effectively.

  - Users Should Perceive That They Have Single-Source Support.

- Users are particularly vulnerable in the area of software support. Typically, there is very little vendor competition in the area of software support--users must depend on one vendor. When service problems do arise, the user must persist in dealing with that one vendor.

- Users typically have some internal software support staff (usually to support in-house application software) and are therefore more experienced and demanding with software service than with hardware service.

- When dealing with an increasingly active user base demanding improved software repair time, vendors should understand that the key component of user satisfaction with software support is in the integration, at least in the eyes of the user, of the hardware and software support staff. Users that perceive that they have a single source of both hardware and software support are invariably more satisfied than users who see two distinct support groups.

- INPUT is not suggesting that large-system service vendors cross-train all field engineers--quite the contrary, INPUT believes that specialization is the key to profitable service. INPUT suggests that users must perceive that they have a single source of support. Usually, this will mean that the hardware engineer will have the capabilities to initiate systems software service, typically via a telecommunication link with a centralized software support group.

- Although cross-training is not necessary, hardware and software engineers must work together effectively so that users feel that they have one central support group solving problems. Users that suffer through "finger-pointing" between hardware and software support departments have, on average, the lowest satisfaction rate of all customers interviewed. Conversely, vendors who, like Amdahl, have successfully integrated hardware and software support typically have the highest user ratings in the industry.

- Users are also driving the trend toward remote support services (RSS). As Exhibit VI-3 demonstrates, RSS is essential for improving service quality and containing service costs--two major objectives of large-system users. So while users are not specially requiring RSS, they are demanding the results of remote support and thereby driving this trend.

- It is important to note that vendors must understand user requirements for service. There has been a great deal of user resistance to RSS, but not because of the technology or results. Users tend to resist the introduction of RSS because they perceive it will reduce the amount of in-person vendor contact. Vendors must be careful to understand not only the stated demands of large-system users, but also the intent of user requirements.

- The only effective way of truly understanding user requirements is by expanding the service marketing effort--an option discussed in greater detail below.

C. MAINTENANCE AS A COMMODITY

- The second major service trend that vendors must confront is that there is a growing tendency on the part of users to view service in "generic" terms, rather than as associated with a particular vendor. "Brand name" loyalty (e.g., IBM service or DEC service) is decreasing and there is a greater emphasis on specific service components such as "how much will a two-hour response time cost?" or "Are parts available for my CPU?"

- The trend toward viewing service as a commodity rather than a specific product from individual vendors is being promoted by several of the factors displayed in Exhibit VI-4.

REMOTE SUPPORT SERVICES (RSS)

- Essential for Improving Service Quality and Containing Service Costs.
- User Resistance to Reduced Level of In-person Vendor Contact Is Diminishing.
- User Resistance to High Levels of Involvement in RSS and User Self-maintenance Is Increasing.
- Security Is a Critical Issue Not Adequately Addressed by Vendors.

MAINTENANCE BECOMING A COMMODITY

- Sharp Increases in Reliability Encourage Users to Think of Maintenance as Declining Need
- Service as "Commodity" Means:
  - Brand Name Loyalty Decreases
  - Service Market Opens to Competition which in Turn. . .
  - Causes Pressure on the Price of Maintenance
- Equipment Manufacturers/Service Vendors Must:
  - Distance Themselves from "Maintenance Only" Image
  - Develop Image of Total Service Company
  - Integrate all Post-Sale Services

INPUT

- Hardware is becoming more and more reliable, and this encourages users to think of maintenance as a declining need. In the not too distant future, fault-tolerant technology will provide users with a realistic opportunity to have 100% system availability. In this case, periodic maintenance becomes a necessary function, but will not dominate the user's planning process.

- When hardware does need to be repaired, users see fewer on-site repairs, and more component "swaps." As the skill level of the FE decreases, users typically see a reduced need to commit themselves to any particular vendor.

- Increasing competition has also led users to think of service as a commodity. Price-sensitive users started this trend, but as TPM vendors become more aggressive in promoting their cost-effective services, INPUT expects a growing number of large-system users to move away from comparisons based on the reputation of the service vendor, and toward comparisons based on price of service.

- In order to withstand the pressures to lower service pricing (resulting from maintenance becoming a commodity), large-system vendors must move quickly to distance themselves from a "maintenance only" image. Service vendors should integrate all post-sale services into one department (particularly the Customer Services Department) in order to develop an image of a total service company.

- The primary advantage of offering a total support package is that it allows the vendor to understand the user's needs and "control" the user's site. However, it is also important to note that the total service vendor will retain name and service product loyalty among users, while strictly hardware maintenance vendors will be forced to do business in an increasingly price-competitive market.

- Exhibit VI-5 lists the various pre- and post-sale functions that should be included in a total service package. Although most vendors will say that they currently offer all of the services listed in Exhibit VI-5, only a few will be able to report that all the services emanate from their service department.

- INPUT has found that even though users are becoming more resistant to hardware service price increases, there is little or no evidence that this trend is being carried over to other after-sales support areas. In fact, INPUT has found that users are willing to pay premiums (over and above BMMC) of up to 50% for improved after-sales support services like software support. Users have noted, however, a high level of dissatisfaction and a lack of support coordination between departments (i.e., finger-pointing).

- INPUT believes that unless the customer has a single access point to all after-sales support services, vendors will not be able to maximize service profitably. Users that perceive disparate support groups, even within one company, are likely to be more price sensitive about all services. This leads to a much higher level of competitive service comparisons.

- INPUT recommends that large-system service vendors should accommodate user requirements for a single access point for all after-sales support services. This type of support organization will not only improve user satisfaction but will also increase service revenues and profitability. In addition, by developing an image of a total support vendor, manufacturers will be able to differentiate themselves from the highly competitive, hardware-only service vendors. This differentiation will become vitally important as IBM drives the price of hardware service down to new lows between 1985 and 1989.

INTEGRATION OF END USER SUPPORT FUNCTIONS MANDATORY TO ENABLE VENDORS TO FOCUS SUPPORT ENERGIES

- **Pre-Sale:** Includes Prospect Visits, Proposal Assistance, Environmental Planning, Installation Planning, Etc.

- **Post-Sale:** Includes Training, Software Support, Documentation, Contracts Management, Hardware and Software Maintenance, Add-On Sales and Ongoing Analysis of End User Requirements

- Order-of-Magnitude Improvements in System Uptime will Encourage Users to Look for Cheaper Sources of Maintenance if that Is all System Vendor Provides

D. IBM SERVICE PRICING

- IBM has entered (in fact created) a new era in mainframe design and support. This new era is characterized by increased competitiveness, both in pricing and new product development. As noted above, the Armonk-based company has invested huge sums of money in new mainframe and peripherals technology. Extensive planning, dating back to the early 1970s, has helped to make IBM's strategy an overwhelming success. Obviously, the success of new product sales will have a major impact on IBM service, but INPUT also expects IBM to carry this new competitive spirit into the service environment as well.

- Service pricing has and continues to be one of the IBM's major competitive strengths. For example, the basic monthly maintenance charge (BMMC) on IBM's 4381 L1 is approximately 1.5% of purchase price, compared to 3.2% for Burroughs' comparable A9 mainframe. IBM maintenance on some mainframe is up to $10,000 per month less expensive than competitive models from other mainframe vendors.

- Even though IBM has dominated the large-system service market for the last 20 years, INPUT expects the company to increase competitive pressure on the market substantially in 1985-1989. As Exhibit VI-6 demonstrates, IBM will drive the hardware maintenance price umbrella down in order to maintain its position in the market.

- The number one computer manufacturer has been able to squeeze the hardware service market because it has a lower cost structure and is more flexible in taking advantages of service opportunities than other vendors. Considering that IBM controls almost 70% of the installed base of mainframes, it is easy to see that with higher product densities, greater service economies of scale and improved efficiency is possible. In addition, a continuing flow of new products and a shortened product life cycle have resulted in dramatic improvements in mainframe reliability.

IBM DRIVING MAINTENANCE PRICE UMBRELLA DOWN

- Target for IBM: Number 1 Competitive Force in Every Market It Participates in. Includes Hardware (Not Total Customer Services Yet)

- Vehicle for Increased Competition Is Dramatic Improvement in IBM Product Reliability

- Will Progressively Impact Ability of Other Equipment Companies to Continue to Generate the Same Level of Profits from Hardware Maintenance as Before: Cost Structure for Most Is Higher and Less Flexible than IBM's

- In Some Cases will Impact Total Profit Picture Because of High Contribution of Maintenance Profitability

INPUT

- INPUT believes that IBM will increase pressure on hardware service prices in order to force competitive reactions from other mainframe vendors. The result will be lower profitability for these vendors because they cannot match IBM's cost structure. Currently, IBM is restricting service price decreases to hardware maintenance. This is to be expected since hardware represents the largest service revenue source for most of IBM's competitors.

- It is unlikely that IBM will expand its competitive service pricing policy into areas such as software support, education/training, or professional service. These service sectors are not highly profitable for most mainframe vendors and represent only a small portion of the total service revenue. However, as services like software support becomes more profitable, mainframe vendors should expect increasing price competition from IBM.

E. EFFECT OF THIRD-PARTY MAINTENANCE ON THE MAINFRAME SERVICE MARKET

- The direct effect of third-party maintenance (TPM) on the mainframe service market will be minor from 1984 to 1989. Overall TPM mainframe revenues will grow to $190 million by 1989, but market share will fall to just over 3% of the total mainframe service market (down from 5% currently). As noted above in Chapter III, TPM vendors will lose market share primarily because of increased service competition from the industry giants (e.g., IBM and DEC).

- Despite the relatively low growth and shrinking market share, third-party maintenance represents an attractive service option for both mainframe manufacturers and users. As Exhibit VI-7 demonstrates, the TPM market as a whole in entering a new phase of increasing growth and market maturation. TPM will impact mainframe service indirectly and in the following ways:

TPM MARKET ENTERING NEW PHASE

- Short Sequence of Legal Battles
- Equipment Manufacturers Set to Compete
  - At Their Own Sites
  - In Peripheral/Terminal/PC/Telecoms
- 400 U.S. TPM's Beginning Consolidation
  - Acquisitions by Large TPMs and New Entrants
  - Mergers of Midsized Regional TPMs
  - Shakeout of Small TPMs
- $1 Billion New TPM Revenues 1984-1988

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- Equipment manufacturers will enter the TPM market to fully utilize service resources and to offer more comprehensive services to users.

- Independent TPM vendors are anticipating increased consolidation and eventual mergers with traditional and nontraditional (e.g., Bell Regional Operating Companies) service vendors thru increasing overall service competition.

- The TPM market as a whole represents $1 billion in new revenues between 1984 and 1988. Since mainframe service does not exist in a vacuum, the vendor that successfully taps this market will have a much better chance to withstand competitive service pressure from industry leaders like IBM.

- While TPM vendors will not have an immediate impact on the mainframe service market, equipment manufacturers will find that customer satisfaction rates and service revenues will improve dramatically if multivendor service is offered.

- Exhibit VI-8 shows that the original equipment manufacturer has huge advantages over the average TPM vendor because:

  - The manufacturer has the resources and talent to service a wide variety of products. Large-system vendors often service a variety of equipment they do not manufacture (such as printers) and therefore have some TPM expertise already.

  - An established service infrastructure is perhaps the most important advantage a manufacturer has over a TPM vendor. The incremental cost of servicing a new product (service education, parts supply, etc.) is low in comparison to the initial cost of establishing and marketing a service network.

NOW IS THE TIME FOR TPM

- **Biggest Incremental Service Revenue Sources in "Opportunity" Markets:**
  - **Peripherals**
  - **Terminals**
  - **Telecommunications**

- **Computer Equipment Manufacturers Have Huge Advantages Over TPM's:**
  - **Resources, Talent**
  - **Infrastructure, Technology**
  - **User Base**

- Service technology in the form of remote support, test equipment, and regional repair facilities is much more highly developed by manufacturers than by TPM vendors. This provides the manufacturer with a substantial competitive advantage over the TPM vendor because the manufacturer will have a lower cost of service.

- Manufacturers should not discount the importance of an established user base as a potential market for multivendor equipment services. By servicing "foreign" equipment in their installed base, manufacturers can increase user satisfaction with service, improve profitability, and protect their user bases from service competition.

- While equipment manufacturers have a service advantage over the average TPM vendor, this advantage lies mainly with service on peripheral devices rather than on the actual mainframes. As noted earlier, TPM growth in the service market is expected to be low (4%) from 1984 to 1989. The largest incremental service revenue sources will be in peripherals, terminals, and telecommunications.

- INPUT estimates that service revenue derived from peripherals (including tape and disk drives, controllers, etc.) will grow from $2.5 billion in 1984 to $5.3 billion in 1989, an average annual growth rate of 16%. Terminal service is growing at almost 15% and telecommunications service will be growing at almost 31% per year.

- Manufacturers, for the reasons stated above, will have a substantial competitive advantage over traditional nonmanufacturing TPM vendors. The large-system service vendor should specialize in peripherals and terminals--two areas in which users are relatively service price insensitive and in which users are demanding substantially more support than is currently available from TPM vendors.

- Although telecommunication is currently the fastest growing service segment and is experiencing the fastest incremental growth ($2 billion), INPUT urges caution before large-system service vendors commit themselves to this market segment. TPM service is typically most profitable in mature or disorganized markets. In mature markets (e.g., mainframes) the TPM vendor can find a niche (such as older IBM machines) and make a reasonable profit. Disorganized markets, such as the PC service market, invite the TPM vendor because there is an unmet need by users. However, telecommunications service is neither disorganized nor mature. With competition like IBM (via Rolm) and the Bell Regional Operating Companies, service penetration by large-system vendors is not expected to be rapid.

F. PROACTIVE MARKETING OF CUSTOMER SERVICES

- Most large-system customer service organizations have a product-related service outlook. Vendors view individualized services (such as a two-hour response time or guaranteed 99% uptime) as individual products that can be sold to the customer. Traditionally, vendors have added individual services as needed to support the overall goals of the organization.

- INPUT believes that the product-oriented service vendor will not be able to maximize profits because it cannot react quickly enough to changes in the service market. First, the product-oriented service vendor must recognize the trend in user demands for service. Then the service must be designed and finally offered to the user. Typically, user demands for new services go unmet for a substantial amount of time, resulting in a dissatisfied user and lost revenue for the vendor.

- In order to react more quickly to user demands, INPUT suggests that vendors institute a service marketing approach that recognizes that customer needs and market characteristics are of primary importance to maximizing service

revenues. In effect, INPUT recommends that large-system vendors take a more proactive stance when marketing customer services.

- The purpose of proactive marketing is to understand user needs and then to design services that anticipate those needs; vendors should not introduce a service and then attempt to mold user preferences in this area.

- A proactive marketing plan is by nature a long-term plan. Overall market opportunities must first be identified and then targeted. Long-term service trends should be analyzed in order to facilitate a better understanding of market needs. Most importantly, a proactive market plan for service will stress profit planning rather than sales revenue growth.

- The actual process for proactive marketing is listed in Exhibit VI-9. While each step is important, the planning function (steps one to four) are the most crucial to the overall success of the plan. It is in these first four steps that the vendor sets the foundation for the plan. This foundation includes an understanding of both the user's needs and the vendor's ability to meet those needs.

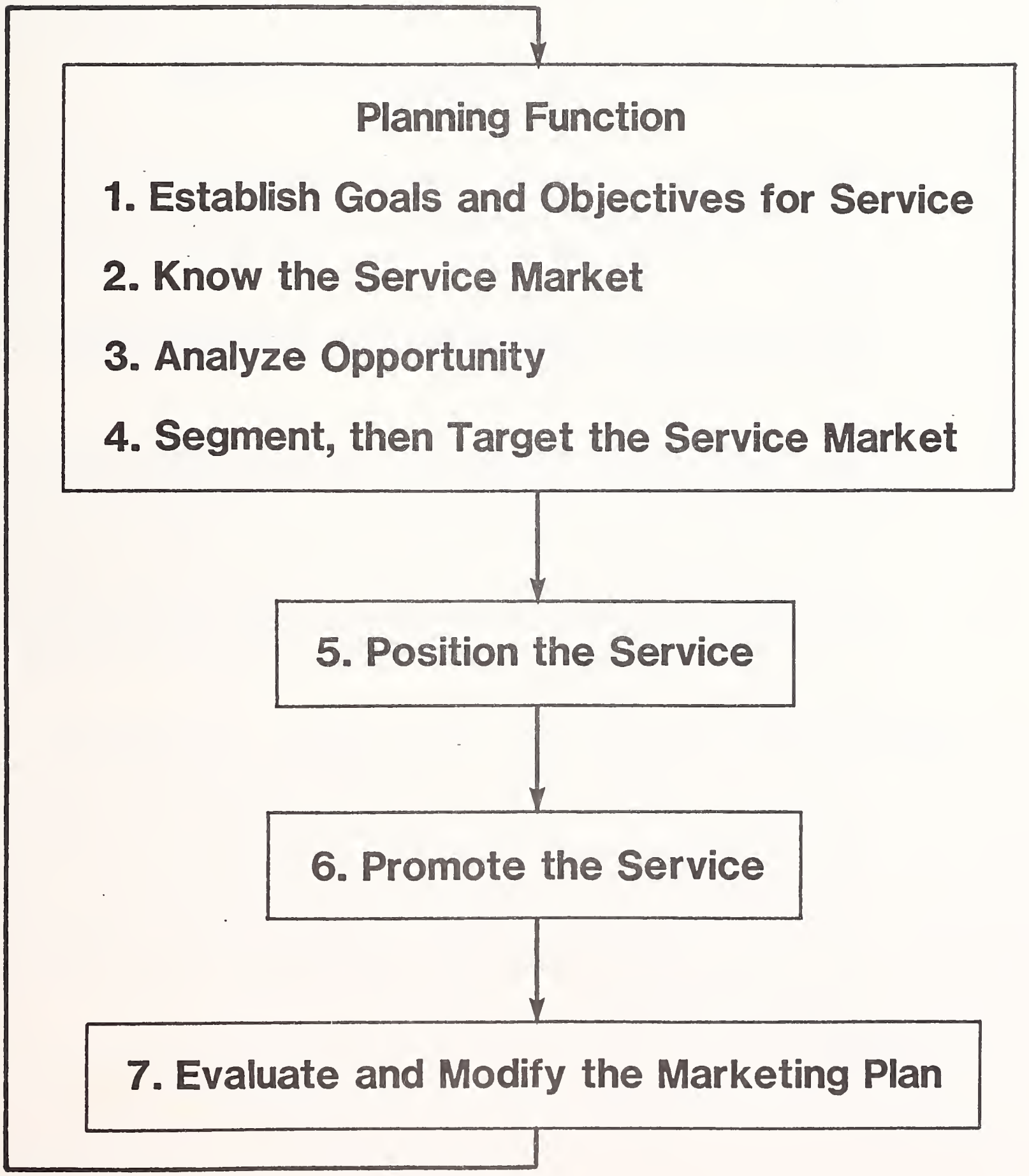
- A marketing plan such as the one in Exhibit VI-9 is necessary because it forces the vendor to view service in strategic rather than tactical terms. While individual service products are important, the proactive marketing plan will permit vendors to maximize service profitability and at the same time integrate service more fully into the long-term design for company growth.

G. TRENDS IN SERVICE QUALITY

- While almost all companies (large-system manufacturers included) say they have a commitment to quality, the evidence suggests that this commitment varies a great deal. The quality of mainframe service can and should be

EXHIBIT VI-9

DEVELOP A CUSTOMER SERVICE MARKETING PLAN



measured by the level of conformance to user requirements, rather than by an arbitrary internal measure of quality used by many service vendors.

- INPUT has found that when vendors use a strictly internal quality accounting system, the overall needs and requirements of the user are often neglected or ignored altogether. When internal measures of performance like inventory turnover or the direct cost of labor take precedence over user requirements, customer dissatisfaction invariably results.

- User requirements for service should not dictate all of the vendor's service-related decisions. Users typically expect improved services no matter what level of service is currently provided by the vendor. However, service quality as defined in Exhibit VI-10 should be measured by user rather than vendor standards. If a vendor is going to offer a service and is committed to high-quality service, then the user's opinion must figure heavily in the overall measure of the quality of performance.

- One of the most important advantages of a high level of conformance to user service requirements (i.e., high-quality service) is that it costs the service vendor so little. In fact, improved service quality can result in lower costs and improved revenues. Costs can be lowered, for example, when it becomes clear that most users place little or no value on a particular service. Vendors can then drop the service or price it according to the needs of the minority of users that actually require the service.

- A much more significant result of improved service quality is the major contribution it makes to long-term profitable service operations. Users have been very open about the fact that service is very important and that, in many cases, they prefer to pay a premium and receive improved service. Several vendors are just beginning to recognize the potential value of improving the quality of service, but INPUT expects much more activity in this area in the next three to five years.

SERVICE QUALITY IS . . .

- Conformance to User Requirements
- Measurable by Both User and Vendor
- At Worst: Free. At Best: Cost Reduction
- Applicable to Every Aspect of Service
- Path to Long-Term, Profitable Operations

INPUT

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- On a more negative note, large-system service vendors that do not satisfy the quality requirements of users generally have very low customer satisfaction rates. Not coincidentally, these vendors are also losing market share in both service revenue and hardware sales. Users surveyed by INPUT have consistently rated the quality of service as one of the most important considerations in purchasing a system. When these service requirements are not met, users become highly motivated to find replacement service vendors (TPM vendors) or to acquire a new system altogether--both of which result in reduced profitability for the vendor.

- The final point about service quality is that it can be applied to every aspect of service. Even internal service factors, such as an inventory turnover rates, can be measured by the effect on and conformance to user requirements. Obviously, some services will be much more visible in terms of user requirements and therefore are much more measurable by both user and vendor. It is the overall quality of service, however, that will affect service profitability--not just one or two individual services.

APPENDIX A: LARGE-SYSTEM USER QUESTIONNAIRE

APPENDIX A

LARGE-SYSTEM USER QUESTIONNAIRE

1. On a scale of 1-10, how important are each of the following maintenance factors in computer purchase decision-making: (1 = least important, 10 = most important)

   a. Price (of maintenance) _____ (Q1A)

   b. Uptime or system availability _____ (Q1B)

   c. Response time _____ (Q1C)

   d. Repair time _____ (Q1D)

   e. Vendor reputation _____ (Q1E)

2. On a scale of 1-10, please rate your maintenance vendor in the following categories:

   a. Hardware service engineers' communication _____ (Q2A)

   b. Software service engineers' communication _____ (Q2B)

   c. Overall service image of the vendor _____ (Q2C)

   d. Dispatching _____ (Q2D)

   e. Escalation _____ (Q2E)

   f. General responsiveness of the vendor _____ (Q2F)

3. a. What is your requirement for hardware response time? _____ (Q3A) (hours)

   b. What do you receive? _____ (Q3B) (hours)

4. a. What is your requirement for hardware repair time? _____ (Q4A) (hours)

   b. What is the average repair time (once the FE is on site)? _____ (Q4B) (hours)

5. a. What is your requirement for software response time? _____ (Q5A) (hours)

   b. What do you currently receive? _____ (Q5B) (hours)

6. a. What is your requirement for software fixes? _____ (Q6A) (hours)

   b. What do you currently receive? _____ (Q6B) (hours)

7. a. What overall level of system availability do you require? _____ (Q7A) %

   b. What level of system availability are you experiencing? _____ (Q7B) %

8. a. How many system interruptions do you have each month? _____ (Q8A)

   b. What percentage of system interruptions are hardware related? _____ % (Q8B)

   c. And software related? _____ % (Q8C)

9. Do you have a requirement for any of the following services, and if so, what would you consider a reasonable premium to pay over the basic maintenance charge?

Service	1 = Yes, 2 = No Yes/No	Reasonable Premium (percent)
a. Stand-by coverage during critical periods	_____ (Q9A1)	_____ % (Q9A2)
b. Guaranteed uptime	_____ (Q9B1)	_____ % (Q9B2)
c. Guaranteed response time	_____ (Q9C1)	_____ % (Q9C2)
d. On-site spare parts	_____ (Q9D1)	_____ % (Q9D2)
e. Remote diagnostics	_____ (Q9E1)	_____ % (Q9E2)
f. Preventive maintenance and field changes during off-prime hours	_____ (Q9F1)	_____ % (Q9F2)
g. Occasional shift coverage (versus fixed schedule)	_____ (Q9G1)	_____ % (Q9G2)
h. Full-time, on-site service engineer	_____ (Q9H1)	_____ % (Q9H2)
i. Guaranteed repair time (hardware)	_____ (Q9I1)	_____ % (Q9I2)
j. Guaranteed turnaround on software fixes	_____ (Q9J1)	_____ % (Q9J2)

10. a. Please rate, on a scale of 1-10, your requirements for the following vendor goods and services.

    b. Please rate your current level of satisfaction with the services you receive from your maintenance vendor.

Vendor Goods & Services	Requirement (a) 1-10	Current Level (b) 1-10
a. Planning (environmental, physical site installation)	(Q10A1)	(Q10A2)
b. Consulting	(Q10B1)	(Q10B2)
c. Documentation	(Q10C1)	(Q10C2)
d. Training	(Q10D1)	(Q10D2)
e. Sales of supplies	(Q10E1)	(Q10E2)
f. Add-on sales	(Q10F1)	(Q10F2)
g. Site audits	(Q10G1)	(Q10G2)
h. Relocation/deinstallation	(Q10H1)	(Q10H2)
i. Hardware maintenance	(Q10I1)	(Q10I2)
j. Software maintenance	(Q10J1)	(Q10J2)

11. Would you favor or oppose having the field service engineer take orders for: (1 = favor, 2 = oppose, 3 = neutral)

    a. Supplies _____ (Q11A)

    b. Add-on equipment _____ (Q11B)

    c. New models _____ (Q11C)

    d. Upgrades _____ (Q11D)

    e. Service contracts _____ (Q11E)

    f. Software _____ (Q11F)

12. Please rate the importance of receiving your hardware and software support services by the following methods: (scale 1-10)

	(1-10)	
	Hardware	Software
a. Your involvement in telephone diagnosis working with support center	____ (Q12A1)	____ (Q12A2)
b. Your involvement with remote diagnostics and software down-line loading	____ (Q12B1)	____ (Q12B2)
c. Your replacing circuit boards, or patching software	____ (Q12C1)	____ (Q12C2)
d. Ship in/carry in to repair center	____ (Q12D1)	____ (Q12D2)
e. Consulting/software customization	[redacted]	____ (Q12E2)
f. Traditional, on-site response to trouble calls	____ (Q12F1)	____ (Q12F2)

13. Do you currently use third-party maintenance on any of your equipment?

____ (Q13) (1 = yes, 2 = no) IF YES, GO TO QUESTION 15.

14. Have you considered using third-party maintenance? ____ (Q14) (1 = yes, 2 = no) IF YES, GO TO QUESTION 20. IF NO GO TO QUESTION 21.

15. a. Which third-party vendor are you currently using? ____ (Q15A)

b. And for which product? ____ (Q15B)

16. Do you receive third-party maintenance in: (1 = yes, 2 = no)

a. Per call ____ (Q16A) or b. Contract ____ (Q16B)

17. If contract:

What is your response time requirement?(1 = yes, 2 = no)

a. 2 hrs. ____ (Q17A) b. 4 hrs. ____ (Q17B) c. 8 hrs. ____ (Q17C)

d. Other ____ (Q17D)

18. What type of coverage do you receive? (1 = yes, 2 = no)

    a. Mon. - Fri. _____ (Q18A)

    b. Saturday _____ (Q18B)

    c. Sunday _____ (Q18C)

19. On a scale of 1-10, how satisfied are you with the third-party maintenance you are now receiving? _____ (Q19)

20. When considering third-party maintenance, how important are each of the following criteria to you? (1 = not important, 10 = very important)

    a. Price of third party maintenance _____ (Q20A)

    b. Improved response time _____ (Q20B)

    c. Third-party vendor reputation _____ (Q20C)

    d. Hardware support _____ (Q20D)

    e. Software support provided by the third-party vendor _____ (Q20E)

    f. Overall system uptime (guarantee) _____ (Q20F)

    g. Geographic accessibility _____ (Q20G)

    h Other features (spares, diagnostics) _____ (Q20H)

21. On a scale of 1-10, how important is a single source of maintenance to you?

    (1 = not important, 10 = very important) _____ (Q21)

    (A single source of maintenance provides a single maintenance contract for all DP products at your site.)

22. Please rate the importance of the following single source maintenance contract features: (1 = not important, 10 = very important)

    a. Improved convenience _____ (Q22A)

    b. Improved response time _____ (Q22B)

    c. Knowledge of site _____ (Q22C)

    d. Reputation of single-source vendor _____ (Q22D)

    e. Avoids "finger pointing" _____ (Q22E)

23. In your opinion, what single change should your maintenance vendor make to significantly improve the level of service?

_____

_____

_____

_____

_____

_____

THANK YOU.

APPENDIX B: LARGE-SYSTEM VENDOR QUESTIONNAIRE

APPENDIX B

LARGE-SYSTEM VENDOR QUESTIONNAIRE

1. Many of the large system service vendors are increasing the number of services offered to customers as a way to increase revenues and to improve user satisfaction. What type of post-sales support services does your department now offer or plan to offer in the next 3 years?

	Current	1987	Please Describe
- Planning	___	___	_____
- Consulting	___	___	_____
- Documentation	___	___	_____
- Training	___	___	_____
- Site Audits	___	___	_____
- Software Support	___	___	_____
System	___	___	_____
Application	___	___	_____
- Remote Diagnostics	___	___	_____

2. a. Dispatching technology has advanced very rapidly in the last few years. Do you see these changes in dispatching helping your field services group?

_____

_____

_____

b. Do you offer or plan to offer centralized dispatching?

_____

_____

_____

2. (Cont.)

c. Does your company have local, regional or national dispatching?

d. Please rate your dispatching performance.

e. Has new technology increased performance?

f. Describe the organization structure of your dispatching unit

g. Is parts tracking a function of dispatching?

3. a. Spare parts inventory is usually the second largest budget item for customer service organizations (coming right after personnel expenditures). Controlling these parts inventories is a major goal of most service vendors. Is your capital investment in spares growing?

b. What factors influence your parts investment?

c. Do you have parts depots on a national or regional basis?

3. (Cont.)

d. How many parts depots does your company have? _____

_____

e. Are parts depots at repair depots? _____

_____

f. What impact have parts depots had on productivity improvements in your company?

_____

_____

4. a. Please describe the remote support services that your company offers:

_____

_____

b. Does the customer receive a discount or a premium for using remote support?

_____

_____

c. What systems or products are covered by RSS? _____

_____

d. What was the impact of remote support services on customer support?

_____

_____

e. What trend do you see in remote support? _____

_____

5. a. We have noticed that in the last 2 or 3 years many of the major service vendors have been building up their depot service networks. Do you think that depot service will significantly impact on-site service?

_____

_____

b. Do you offer T/M or contract rates at depots? _____

_____

c. What products are covered by depot service? _____

_____

d. What channel of distribution do you use? _____

_____

e. How do you market depot service? _____

_____

f. How do you price depot service? _____

_____

6. a. Users have indicated to us that the number of call-backs has been growing, particularly as the number of experienced FE's has decreased. Is your customer services group tracking the problem of call-backs and, if so, how do you plan to reduce call-backs?

_____

_____

b. What percent of completed fault calls are completed in the first call?

_____

6. (Cont.)

c. What percent of call-backs have you experienced? _____

_____

d. Are you achieving goals for MTTRepair? (Y/N) _____

MTTResponse _____

MTBF _____

System Availability _____

7. a. Software support, in the minds of many users, has already become as important as hardware support. How do you see this trend toward increasing software support requirements affecting your customer services department and what is your department doing to meet these requirements?

_____

_____

b. Does your company offer:

	YES/NO	DESCRIBE
- System Software Support	____	_____
- Application Software Support	____	_____
- Training on Software	____	_____
- Support Centers	____	_____
Regional	____	_____
National	____	_____
- Hotlines	____	_____
- On-Site Support	____	_____
- User Involvement	____	_____
- Software Consulting	____	_____

8. a. Single source maintenance and third-party maintenance is becoming increasingly popular among the large service vendors. Honeywell, DEC, and NAS all have just recently announced major expansions in this area. How do you see this effecting your field service options?

_____

_____

b. Will you offer these services? _____ Describe: _____

_____

c. On what products? _____

d. Please describe TPM or Single Source as it relates to:

- Parts _____
- Pricing _____
- Training _____
- Documentation _____
- Software Support _____

9. a. Customer service is becoming more and more competitive with the growth of TPM, single source vendors, and new service vendors such as AT&T. How is this going to effect your pricing policies for field service?

_____

_____

b. When and why do you change service prices? _____

_____

9. (Cont.)

c. Do you offer discounts for any of these features?

	Yes/No	PLEASE DESCRIBE
- User involvement in Maintenance	____	_____
- User delivery of Plug-in Modules	____	_____
- Relaxed Requirements on Response Time	____	_____
- Remote Diagnostics	____	_____
- Volume Discounts	____	_____
- User purchase of Parts Kits	____	_____
- Invoice Prepayment	____	_____

10. Where do you see field service prices going in the next 2-3 years?

_____

11. Service guarantees such as guaranteed availability and guaranteed response time are an attractive option to many users. Where do you see guarantees fitting into the future role of your field service group?

_____

_____

12. a. Personnel costs are the most significant portion of field service expenditures. Improving staff productivity is one method vendors are using to improve their competitive position in service. How do you measure the field engineer's productivity and do you foresee any major changes in overall service staff productivity?

_____

_____

12. (Cont.)

b. Are FE's becoming more productive? _____

_____

c. Do you measure?

	Yes/No	PLEASE DESCRIBE
- Revenue per Engineer	____	_____
- Personnel per Equipment	____	_____
- Expense to Revenue	____	_____
- Down Time	____	_____
- Number Call-Backs	____	_____

13. Please complete the following personnel matrix:

	SOURCE OF NEW EMPLOYEES	TURNOVER 1983 (Percent)	EXPECTED GROWTH	TOTAL NUMBER
Junior FE				
Senior FE				
Software Support				
Line Manager				
Staff				

14. a. Field service revenues are always a touchy subject, but would you say that FS revenue growth has matched your expectations this year?

_____

_____

b. Was FS department profitable? _____ Please Describe: _____

_____

c. What level of growth? _____

_____

d. What are some of the factors affecting FS growth? _____

_____

e. What were FS revenues? _____

_____

f. What were FS expenses? _____

_____

15. Do you think that the field engineer should be involved in any of these sales or sales-support functions:

	Yes/No	DESCRIBE
- Making Goodwill Calls	____	_____
- Software	____	_____
- Maintenance Contracts	____	_____
- Attending Sales Meetings	____	_____

APPENDIX C: SOFTWARE SUPPORT QUESTIONNAIRE

APPENDIX C

SOFTWARE SUPPORT QUESTIONNAIRE

Introduction:

INPUT is a research and consulting firm. We are conducting a study on issues and trends in packages software support and maintenance from the corporate customer's standpoint. We will make recommendations on how corporations can best deal with these issues in the coming years. We would like your organizstion to take part in this study by describing what you are doing now, what your plans are and what problems you see. This information will be used by IS departments in their planning and will also be used by a wide variety of information service vendors to offer more useful products and services.

None of the information that you provide will be associated with your company. In return for your taking part in this study, we will send you a summary of this study on its completion and will also send you a summary of INPUT's report PC Software Support in Large Corporations.

1. a) Are your responsible for all significant packaged software support matters in your organization?

☐ Yes ☐ No

If No to 1.a)

b) Are you knowledgeable about all significant packaged software support matters in your organization?

☐ Yes ☐ No

If No to 1.b)

Which of the following are you Responsible for or Knowledgeable about: (Note with "R" or "K")

	Operating System(s)	Other Systems Software	Application Software
Mainframe			
Minicomputer Software			
Microcomputer Software			

(NOTE: get names of other people to complete the matrix).

For the rest of this interview I would like to discuss with you your support requirements for _____ software. (If respondent is responsible for one area select that; if responsible/knowledgeable in more than one, follow instructions).

2. Who are the suppliers of your major software packages, categorized by software type (Operating systems, Other Systems Software, and Applications Software) and Applications Software) and Hardware Type? (Use following matrix).

Software Suppliers

	Software Type		
	Operating System(s)	Other Systems Software	Application Software
Hardware Type			
Mainframe			
Minicomputer - IBM Sys 38, - Series 1, - 8100			
DEC Minicomputer			
Prime Minicomputer			
Data General Minicomputer			
Other Mini _____			
Office/PC - IBM PC Family - Other			

3. a) Using these same categories, about how much did you spend in 1983 on:

   - Software licenses, fees, lease or rental payments, etc? $_____

   - Software support or maintenance fees either in dollars or as a percent of License fees? $_____

     _____% of license fees.

   b) For what percent of your software is support included in the license fee? _____%

   c) What percent of your software is not supported by the vendor? _____%

   d) Overall, how much do you expect these to change in 1984 and 1985? ($ or percent change)

Changes in:

	Total License Fees	Total Support Fees
1984		
1985		

   e) If any of the changes in 3d were significant (i.e., 10% or more):

   - What is the reason for this? _____

     _____

   Do you expect this amount of change to continue? _____

   _____

4. a) I will read a list of functions or services that are sometimes or usually included as part of standard software support services. Please tell me how important each is to your organization generally and whether there are exceptions, depending on the type of package? Please be specific about the exception (e.g., from a particular vendor, for a particular application, at a particular location, for a particular type of machine). Please rate them importance on a scale of 1 to 5 with 1 being low importance and 5 representing high importance.

SOFTWARE SUPPORT FUNCTIONS

IMPORTANCE

Functions	Generally	Exceptions
Fix Errors		
Improve Features of Functionality		
Add Features or Functionality		
Extend Features or Functionality		
Training		
Consulting		
Other (Describe) _____		

4. b) How well have your software vendors generally met these support requirements? Have certain vendors performed much better or worse? (Note: Specific vendor names are preferred, but generic descriptions are acceptable; Please rate your satisfaction by the same functional areas (on a scale of 1 to 5).

Satisfaction with Software Support

Functions	Generally	Exceptions
Fix Errors		
Improve Features or Functionality		
Add Features or Functionality		
Extend Features or Functionality		
Training		
Consulting		
Other (describe) _____		

5. a) What kinds of services do your software vendors offer in addition to those contained in the standard support contract (e.g., additional training, consulting)? How extensive are they?

_____

_____

5. b) About how much do you spend annually on these additional services?

$ _____

c) What additional services do you expect to purchase from your packaged software vendors?

- When: _____

_____

- Why?: _____

_____

- What would this translate to in dollars? $_____

6. a) Have you experienced situations recently where a software vendor has brought out a new product rather than enhancing or modifying an existing product?

☐ Yes ☐ No

- If Yes:
  - Which product(s) was it? _____
  - Do yo feel this was justified? ☐ Yes ☐ No
    Explain: _____

    _____
  - Did licensees of the old product receive a discount on the new product? ☐ Yes ☐ No
    If Yes, how much was it and was it fair in your opinion?

    _____

    _____
  - Overall, do you feel the vendor(s) handled the situation well from your standpoint? ☐ Yes ☐ No
    Why? _____

    _____

6. b) Do you think that bringing out new products in this way will be a more common situation in the future?

☐ Yes ☐ No

Why? _____

_____

If yes, will this be common for:

☐ Mainframe Software
☐ Mini Software
☐ Micro Software

7. a) Does your organization keep logs or other records of major and minor bugs or other problems in packaged software?

☐ Yes ☐ No

- If Yes:
  - How many major and minor problems are reported annually for operating systems software, other systems software and application software packages? How many are resolved? What is the average time to resolve these problems? (Use attached matrix.)

7. a) Problem Reporting or Resolution

	Package Type		
Problems	Operating System(s)	Other Systems Software	Application Software
Major Number Reported			
Number Resolved			
Average Time to Resolve			
Minor Number Reported			
Number Resolved			
Average Time to Resolve			

7. b) Overall, is this problem resolution performance satisfactory?

☐ Yes ☐ No

If No:

How should it be improved? _____

_____

To what extent do you expect it to be improved? _____

_____

7. c) How much do you expect automatic downloading and installation of new releases, remote diagnostics, and remote fixes to imporve problem resolution and other services? Are these being done now at your installation? If so, what is your experience?

	Being Done Now (Yes/No)	Expected Improvements	Experience
Automatic Down-loading and Installation of New Releases			
Remote Diagnostics			

8. a) Is there one person in your company who tracks and analyzes software support contractual terms and conditions for all software products?

☐ Yes ☐ No

- If Yes:
  - How long has this been done? _____
  - How many products are covered? _____
  - What benefits has your company received? _____
- If No:
  - Do you plan to? ☐ Yes ☐ No

8. b) Do you feel that current contractual terms and conditions applying to software support and maintenance are satisfactory?

☐ Yes ☐ No

Why: _____

_____

- What sort of changes would you like? _____

_____

_____

- What kind of changes do you believe vendors are planning?

_____

_____

c) Does your firm ever seek to modify standard terms and conditions concerning software support?

☐ Yes ☐ No

Why? _____

_____

If Yes:

- How often is this attempted? _____

_____

- What terms do you try to modify? _____

_____

- What success have you had? _____

_____

9. To what extent do you feel you have little or no choice in the type or amount of software support you will be receiving?

_____

_____

_____

- What can you do about this? _____

_____

- What are you going to do about it? _____

_____

10. a) How much and what kind of self-support of packaged software is your organization currently doing?

_____

_____

Why? _____

_____

10. b) Do you usually, sometimes or never perform the following types of self-support? What are your future plans? (fill in matrix below)

Type of Self-Support	Current			Future		
	Usu.	Some	Never	Usu.	Some	Never
Install Initial Release						
Install Subsequent Releases						
Modify Packages						
Fix Errors						
Set up a Single Point in your Organization to Funnel Questions to a Vendor						

c) Do you expect to do more in the future? ☐ Yes ☐ No

Why? _____

_____

_____

If yes:

What kind of self-support? _____

_____

d) What kind of incentives do software vendors now give you to perform self-support functions?

_____

_____

_____

10. e) What additional incentives would you find attractive? _____

_____

_____

11. What other software support issues are important to you or your organization?

_____

_____

12. Overall, what changes do you see occurring in the way in which packaged software support is delivered?

_____

_____

_____