Office Automation Service Opportunities Data Book
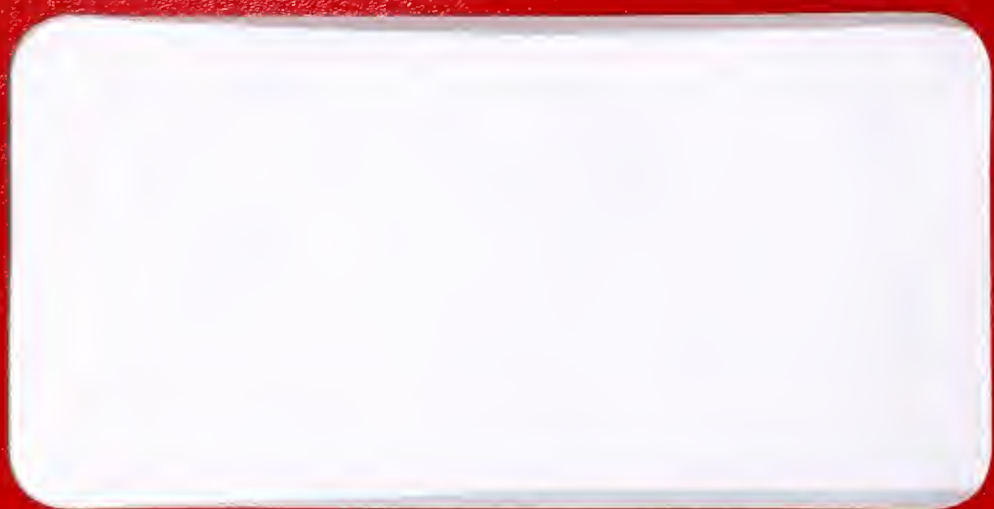
January 1984

INPUT

Office Automation
Service Opportunities
Data Book

January 1984

I   INTRODUCTION

A.   OVERVIEW

o   This report is the result of a study authorized verbally on December 16, 1983 by W.D. Trotten, Division Manager of AT&T, 95 Madison Avenue, Room 52-2E11, Morristown, New Jersey 07960. At the time of writing this report the final proposed contract (dated December 21, 1983) had not been received by INPUT.

o   The data provided comes from INPUT's service files, the library of company data held by INPUT and relevant studies accomplished in the last eighteen months. This factual data is supplemented by INPUT's own subjective opinion on many issues, which is the result of INPUT's involvement in field service issues and office automation markets since 1979.

o   The "Strategic Link" chapter summarizes INPUT's views on the opportunity that AT&T has in the office automation market in its broadest perspective. The recommendations concern AT&T specifically and are not applicable to any other company. In particular INPUT believes that AT&T has a communications market image equivalent to IBM's data processing/computer market image. This image can be parlayed into a market position (revenues, market share, etc.) through accurate product and service positioning where success is less dependent on the competitive strength of the product/service offered and more reliant on the AT&T name.

o   Nevertheless it is important that AT&T demonstrate leadership in the
     marketplace because of its image and this means having a very detailed and
     comprehensive conceptual understanding of exactly what office automation
     means to Corporate America:

     -      Overall corporate-wide system design needed.

     -      Current elements of office automation available and entry points.

     -      Conversion milestones and boilerplate blueprint for implementation.

B.   SCOPE

o   The purpose of this report is therefore to provide an in-depth view of the
     service requirements and opportunities in the office automation sector of the
     computer systems industry. The product lines examined are as follows:

     -      Word processing systems.

     -      Personal computers, workstations, and itelligent terminals.

     -      Commercial application minicomputers.

     -      Network-based services.

     -      Terminals.

     -      Peripherals.

     -      Software products.

II   OFFICE AUTOMATION SERVICE OPPORTUNITIES

A.   INTRODUCTION

o   All office products share one common characteristic - they are generally
        shipped in high volumes. Maintenance can therefore become a very profitable
        or very costly enterprise; poor decisions made during product development can
        have disastrous results and engineering changes can become extremely
        expensive and must be tightly controlled.

o   Therefore it is necessary to maintain an accurate data base on shipped
        equipment. The vendors service and support management must have adequate
        authority to insure shipped products perform as forecast. There are several
        risks for independent organizations servicing products in the office product
        sector. Product performance, competition, availability and cost of spares,
        product life cycle and engineering change policies. The overall rewards,
        however, make taking such risks worthwhile.

o   Another factor separating this marketplace from the rest of the systems
        business is the level of user sophistication. In many cases, this is the users
        first involvement with computers or high technology equipment. It is also an
        area of high employee turnover. In the past, business colleges provided a
        relatively high level of knowledge of office products. A similar resource for
        the new generation of products is not yet available. This should improve in
        the near future as many organizations are gearing up for that purpose.

o   The competition for servicing this marketplace is constantly increasing. There are also several independent agents in local areas beginning to increase their role in this sector of the business. Success will depend on the quality and speed of service provided to the users of office products.

o   Unlike personal computers, IBM encourages end user service on their word processing product line. These products are not marketed through product centers but are included in their normal sales activities. The success of capturing a significant portion of this business is questionable.

o   Along with IBM PC's, equipment manufactured by corporation like CPT and NBI offer excellent maintenance opportunities. They are normally serviced by the distributor and the quality of service varies enormously by location. By offering a professional and consistent nationwide service organization, the revenues involved will more than justify the initial costs.

o   Several procedural questions must be dealt with prior to setting up such an organization:

-      Is AT&T going to work in cooperation with vendors or remain independent?

-      Which specific vendor products will be maintained and which will not?

-      Will AT&T also support the software involved?

-      How many locations are involved?

-      Will AT&T offer a complete line of services, i.e., on-site, mail in and carry in?

o The following are examples of the advantages to working with vendor cooperation in the office product area of the systems business:

- Training provided by vendor at far less than normal (e.g., $600 per class week, plus living expenses).

- Plant support services provided.

- Spare parts available at 10% to 20% over cost (or one-third of retail).

- Compensation for installing engineering changes.

- Documentation available concerning latest maintenance information and software releases.

- Defective unit replacement (free under warranty).

o These items reduce the costs of providing maintenance drastically. Throughout this report we will calculate manpower estimates based on the assumption that the above services will be provided when servicing products in a cooperative manner with the vendors involved.

B.   ORGANIZATIONAL SET-UP PARAMETERS

o In order to estimate set-up and organizational costs for a service organization handling office products, some existing standard industry parameters were used. These standards may vary from actual costs depending upon the level of the organization's experience and expertise.

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o   The standards used are as follows:

Education Development	Development Cost		Course
Lecture/lab method	8 hours	to	I hour
Programmed instruction	72 hours	to	I hour
Computer-assisted instruction	110 hours	to	I hour
Video production	85 hours	to	I hour
Animation	235 hours	to	I hour

I.   LOGISTICS

o   Spares purchased from vendor - three times burdened manufacturing cost for
       each spare.

o   Sparing units level - 5% to 7% of installed base for each element of the
       system being maintained.

o   Number of spare kits needed - 5% to 7% of installed units.

2.   MANAGEMENT RATIOS

o   Operational service organizations determine when they need to have the next
       level of management by the following parameters:

       -      Fourteen field engineers per manager.

       -      Five managers per region.

       -      Three regions per operations manager.

3.   DOCUMENTATION

o   Technical documentation: development - eight hours, finished - one page.

4.   ORGANIZATIONAL BLUEPRINT

o   Exhibit II-I shows the bare minimum manpower needed when starting a
     service organization regardless of the products involved. A key to success is
     the experience of the initial staff, (failure in any one area can have disastrous
     consequences). The director of field service must have had extensive
     experience in the position before and must have a solid financial performance
     history in field service.

o   The support and operations manager positions are equally as important but
     require more specialized knowledge and experience. The number of field
     offices vary, but a minimum of three to four field engineers per location is
     required (because of illness, training, and vacation needs).

o   If the service organization works in cooperation with vendors, the
     headquarters staff can be held to a minimum. If it acts independently, this
     area will require many talented and creative individuals and will create large
     initial operating costs. Throughout the report, we will show the approximate
     manpower required in these areas based upon current operating philosophies.

C.   SUPPORT SERVICE REVENUE (1982-1987)

o   INPUT has estimated the field service support revenues for hardware and
     software broken down into finer detail than that required by the study and
     including maintenance revenue, education revenue, over-the-counter parts,
     sales, and software installation fees. Note that hardware installation fees are
     carried as a part of maintenance revenue and are equal to one month's rental
     (industry-wide standard and therefore easy to calculate when doing a revenue
     plan based on shipments).

EXHIBIT II-1

MINIMUM START-UP ORGANIZATION
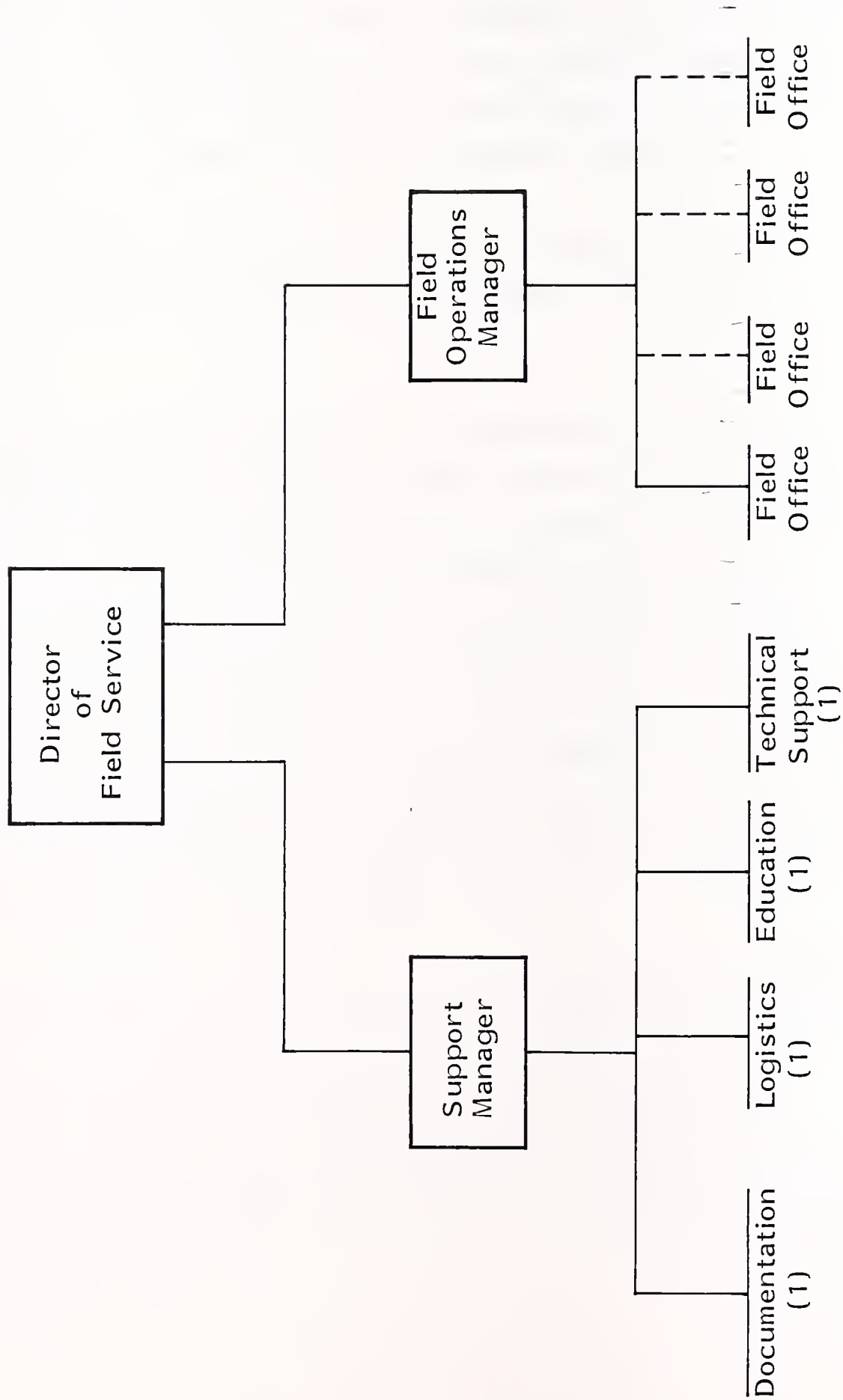
o   Exhibits II-2 and II-3 provide the INPUT estimates for revenues from these
        sources for 13 categories of equipment in 1982 and 1987. The total hardware
        service revenue in 1982 was $9.4 billion and is expected to rise to $24.2 billion
        by 1987. This, of course, includes all service revenue from all hardware
        shipments in the U.S. The software service revenues, where applicable to
        equipment, have been included in the several equipment categories.

o   Appendix A provides a breakdown of the shipments, software sales, and
        service revenue produced by the various product markets and a forecast of the
        growth to 1987.

o   One major consideration in the evaluation of a marketplace opportunity in
        office automation services is the question of how much of the total revenue
        produced is captive (i.e., non-available for whatever reason) and how much is
        real potential revenue? This is an extremely difficult question to answer,
        because much depends on the marketing agreements that AT&T is able (or
        willing) to enter into with the various product vendors in each of the office
        automation markets targeted. Nevertheless, INPUT has made an estimate of
        the available revenue opportunities in each market in Exhibit II-4. The
        revenues indicated apply to third-party maintenance (TPM) opportunities only
        and ignore the revenues available from single-source maintenance (SSM) and
        network consulting which are discussed later.

o   Available revenues listed in Exhibit II-4 are revenues that are theoretically
        available to an outside TPM vendor. However, this revenue would only be
        accessible if contracts were negotiated with the principle suppliers of
        equipment to each market sector. In the case of word processors, for
        example, it depends on agreements with companies such as NBI and CPT.
        Excluded from the available word processor service revenues are other major
        vendor products such as IBM.

EXHIBIT II-2

U.S. 1982 SUPPORT SERVICES REVENUE
($ million)

Number	EQUIPMENT CATEGORY	HARDWARE			SOFTWARE			TOTAL
		Maintenance	Education	Over The Counter Parts	Maintenance	Education	Installation	
1	Personal Computers (home)	10	5	45	*	*	*	60
2	Personal Computers (business)	100	5·	260	*	10	*	375
3	Workstations	135	*	40	10	*	*	185
4	Systems ≤ $25K	1220	25	230	215	*	15	1705
5	Systems > $25K ≤ $350K	480	15	46	90	15	4	650
6	Systems > $350K	1839	54	58	281	47	17	2296
7	Displays	555	*	180	*	*	*	735
8	Printers/Copiers/Plotters	680	*	170	*	*	*	850
9	Point of Sale Devices	45	1	9	10	*	*	65
10	Other Peripherals	1090	*	200	*	*	*	1290
11	Telecom Equipment	360	*	40	*	*	*	400
12	Typewriters/Word Processors	1440	10	120	10	*	*	1580
13	Banking Equipment	23	*	3	*	*	*	26
	TOTALS	7977	115	1401	616	72	36	10217

* negligible

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EXHIBIT II-3

U.S. 1987 SUPPORT SERVICES REVENUE

($ million)

Number	EQUIPMENT CATEGORY	HARDWARE			SOFTWARE			TOTAL
		Maintenance	Education	Over The Counter Parts	Maintenance	Education	Installation	
1	Personal Computers (home)	100	15	50	5	10	*	180
2	Personal Computers (business)	400	30	750	20	50	*	1250
3	Workstations	500	*	170	20	5	*	695
4	Systems ≤ $25K	3400	75	700	740	*	55	4970
5	Systems > $25K ≤ $350K	965	34	86	310	45	15	1455
6	Systems > $350K	4090	125	105	735	143	52	5250
7	Displays	1574	*	582	*	*	*	2156
8	Printers/Copiers/Plotters	2140	*	560	*	*	*	2700
9	Point of Sale Devices	103	3	24	28	*	2	160
10	Other Peripherals	2400	*	550	*	*	*	2950
11	Telecom Equipment	725	*	70	*	*	*	795
12	Typewriters/Word Processors	3583	27	270	45	*	5	3930
13	Banking Equipment	80	*	10	2	*	*	92
	TOTALS	20060	309	3927	1905	253	129	26583

* negligible

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EXHIBIT II-4

OFFICE AUTOMATION EQUIPMENT SERVICE
AVAILABLE REVENUES BY MARKET SECTOR
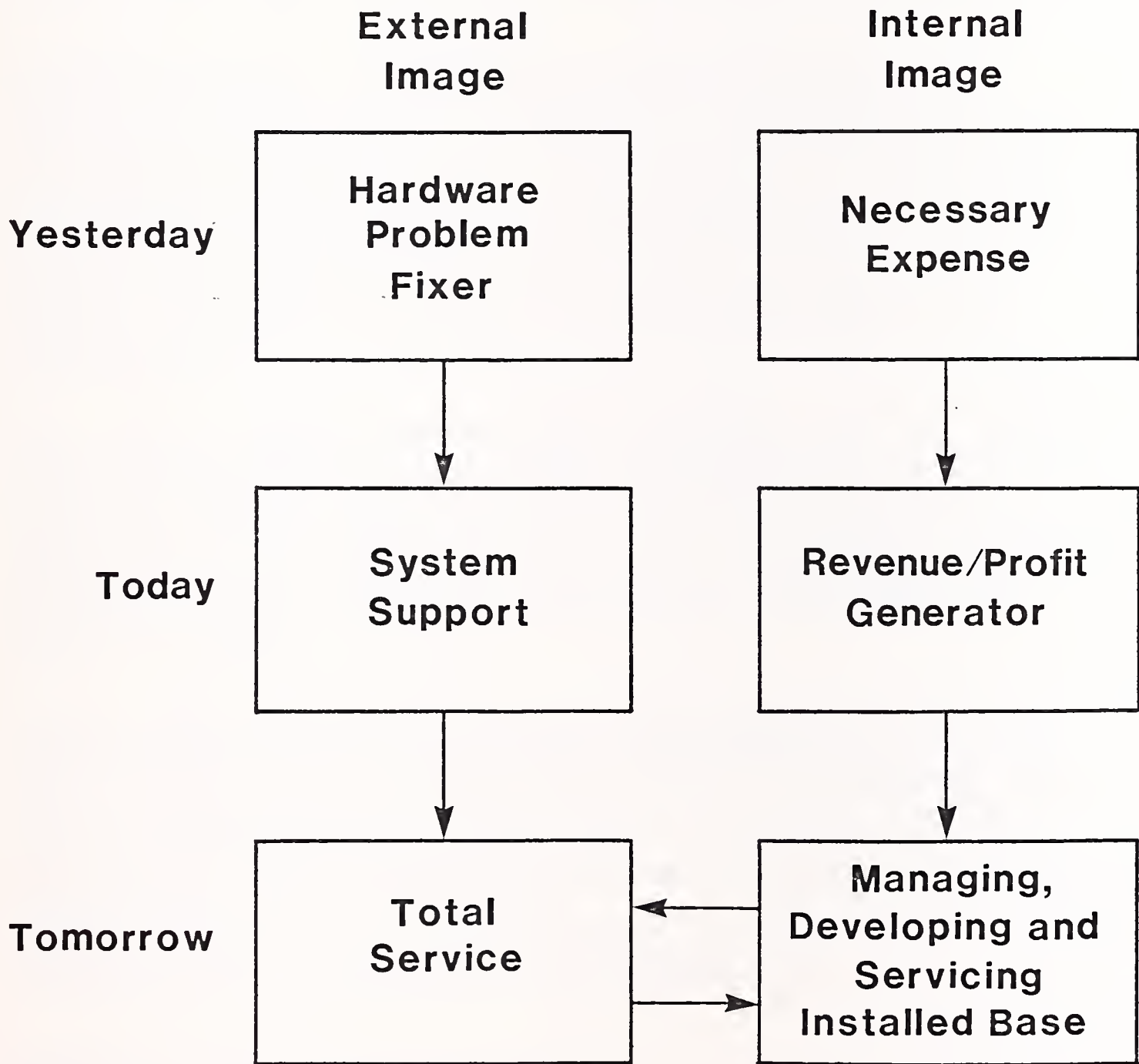
SECTOR	1982		1987
	TOTAL SERVICE REVENUE ($ millions)	AVAILABLE REVENUE ($ millions)	AVAILABLE REVENUE ($ millions)
Personal Computers (Home)	$60	$15*	$45
Personal Computers (Business)	375	110*	350
Workstations	150	50	180
Displays	140	20	60
Printers/Copiers/Plotters	170	50	160
Other Peripherals	250	25	60
Telecommunications Equipment	200	40	80
Typewriters/Word Processors	1,580	150	370
Office-related Minicomputers	200	30	100
Totals	$3,125M	$490M	$1,405M

*Undeveloped market not properly serviced by anyone to date.

D.   CHANGING ROLE OF FIELD SERVICE

o   It is important for AT&T to recognize the environment into which they would
be entering and how it has changed in the last five years.

o   In the past, the internal (company) view of the role of field service has always
been at odds with the external (user) view:

  -    In the past many vendors viewed field service as a necessary expense:
in order to sell products a vendor was expected to service them when
they failed as well as install, upgrade, and de-install. Meanwhile users
viewed the field service engineer as a hardware problem fixer:
engineering in a literal sense.

  -    Today a significant change has occurred in both the external and
internal view of field service: internally field service is viewed as a
source of revenue growth and profit (90% of all vendors' field service
organizations operate as profit centers now) while externally the user
looks to field service to provide systems support, which includes
(depending on the user base) system software and application software
maintenance as well as hardware maintenance.

  -    In the near future a measure of coincidence in the views of both user
and company will occur, as the user expands the list of services that he
expects to receive from the field service organization; simultaneously
the company will expand the role that it expects the service group to
play to include managing and developing the account base in addition to
system support.

o   A graphic summary of that development is shown in Exhibit II-5.

EXHIBIT II-5

CHANGING ROLE OF FIELD SERVICE

	External Image	Internal Image
Yesterday	Hardware Problem Fixer	Necessary Expense
Today	System Support	Revenue/Profit Generator
Tomorrow	Total Service	Managing, Developing and Servicing Installed Base

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E. CHANGING ROLE OF SUPPORT STAFF

o   The role of both hardware and software engineer is also changing, from the standpoint of job content, type of intervention accomplished in the field and degree of specialzied knowledge needed to accomplish the function (skill mix).

o   In the past an engineer was dispatched to a problem site with no prior knowledge of the type of failure to be expected. The diagnostic was accomplished, with available means, at the systems level. Currently, thanks to a broader and broader application of remote diagnostics, the failure can be isolated down to the subsystem level prior to the arrival of the field engineer. In the future many systems will be self diagnosing down to the component level.

o   From a repair standpoint little or no repair is attempted on site at present (in contrast to yesterday's engineer). Instead a failed board is swapped and repaired off-site (at a repair center). In the near future redundant circuitry and components will be more widely used, so that the failed system may continue to function.

o   A similar picture emerges for the software engineer who will be able, in the future, to remotely access failed software systems for both diagnostic and down-line loading of patched or revised code to the library version of the failed program. This will then be booted for use by the system. Although this patching will not often be the definitive revision of the failed system, it will nevertheless allow the user to operate in a degraded mode.

o   Exhibits II-6 and II-7 summarize the trends.

EXHIBIT II-6

CHANGING ROLE OF HARDWARE ENGINEER

	Past	Present	Future
Diagnostic	• On Arrival with Available Means • At System Level	• Prior to Arrival • At Sub-system Level	• Self Diagnosing • At Component Level
Repair	• On-site Repair of Failed Component	• Swap Failed Board, No Repair	• Redundant or Fail-soft Hardware • Swap Failed Subsystem
System Status	• Down	• Down	• Up

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EXHIBIT II-7

CHANGING ROLE OF SOFTWARE ENGINEER
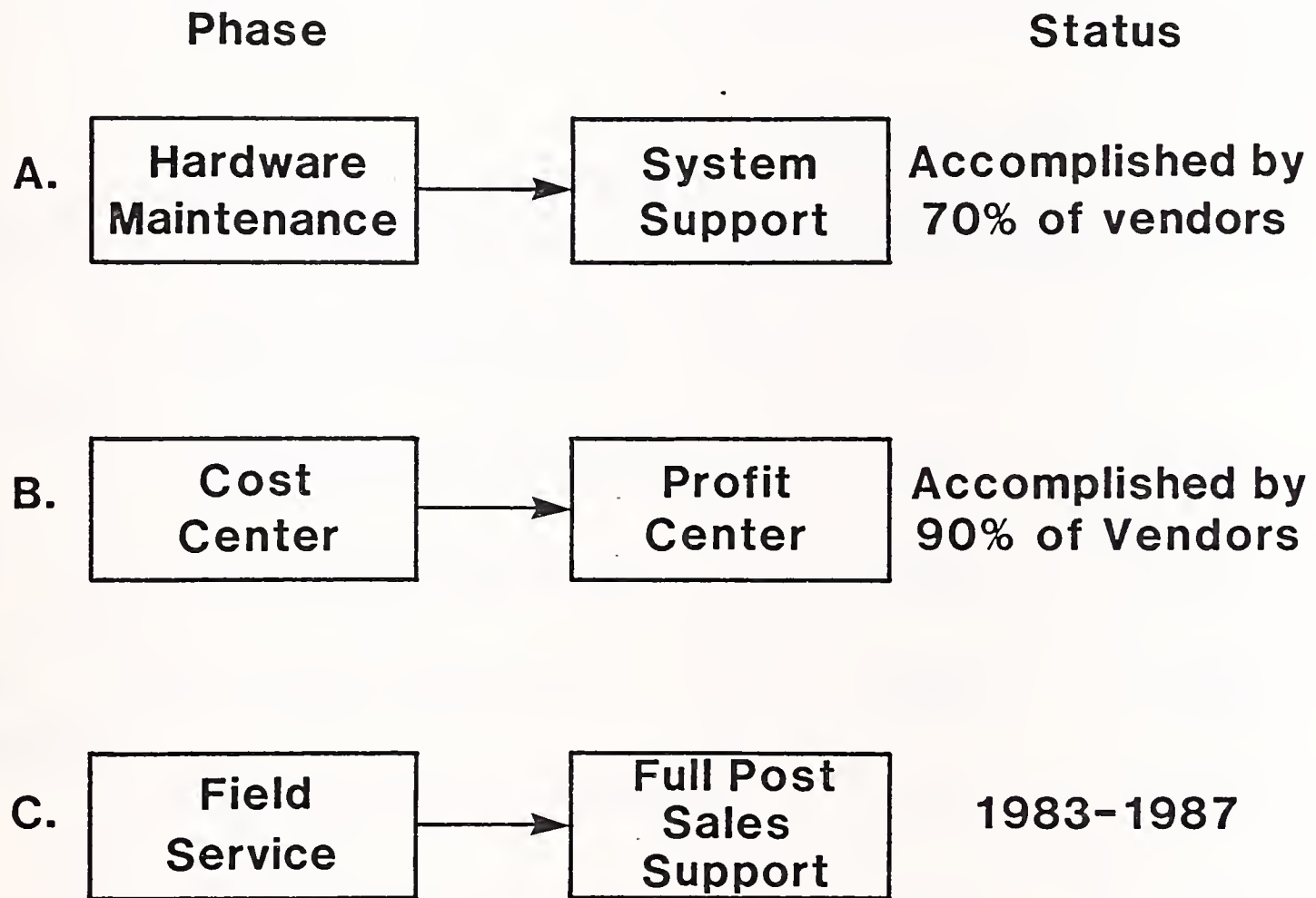
	Past	Present	Future
Diagnostic	• On-site	• Support Center Assistance	• Remote Tie In
Repair	• On-site	• Revised Version Shipped	• Down-line Loading of Patched or Revised Code
System Status	• Down	• Down	• Degraded But Still Operable

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F.   CONVERSION OF FIELD SERVICE

o   Field service has seen many dramatic changes over the last five years, and an even more dramatic shift is underway for the next five-year period.

o   The shift to systems support has been made by 70% of all U.S. manufacturers as of the end of 1982, as shown in Exhibit II-8. The degree of integration is variable, according to the market that is supported. Some inroads on application support have been made (i.e., application products provided by the systems vendor) but little headway has been made on servicing third-party software products, as shown in Exhibit II-9.

o   An equally important shift has been made from cost center control to profit center (alghough the definition of what this means precisely varies from vendor to vendor). At year end 1982, 90% of all major U.S. computer vendors has accomplished that shift.

o   The next major shift concerns a move from the concept of field service to that of full post-sales support or the total service concept.

o   The main component of this shift, as shown in Exhibit II-10, is the polarization of all support activities under two lines of responsibilities:

    -    Pre-sale support (responsibility of marketing with service manpower subcontracted is needed).

    -    Post-sales support (responsibility of field services with sales manpower involved as needed).

o   The principal goal of post-sales support is to manage, develop and monitor (through ongoing user requirements analysis) the progression of the installed base, site by site.

EXHIBIT II-8

CONVERSION OF FIELD SERVICE TO TOTAL SERVICE CONCEPT

Phase		Status
A. Hardware Maintenance → System Support		Accomplished by 70% of vendors
B. Cost Center → Profit Center		Accomplished by 90% of Vendors
C. Field Service → Full Post Sales Support		1983-1987

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EXHIBIT II-9

LARGE SYSTEM INTEGRATION OF
S/W SUPPORT INTO H/W SUPPORT FUNCTION

MARKET	SOFTWARE SUPPORT PROVIDED	PERCENT OF VENDORS IMPLEMENTING	DEGREE OF INTEGRATION (percent)	
			1983	1985
Large Systems	Systems Software	71%	76%	88%
	Applications Software	43	100	100
	Third Party Software	14	100	100
Small Systems	Systems Software	60%	46%	68%
	Applications Software	53	27	47
	Third Party Software	0	0	0
Office Products	Systems Software	83%	16%	40%
	Applications Software	50	12	22
	Third-party Software	33	2	10

EXHIBIT II-10

CONSOLIDATE ALL CLIENT SUPPORT INTO TWO AREAS OF RESPONSIBILITY

- Prospect Needs Evaluation/Pre Sale Support

  - Responsibility of Marketing and Sales With Service Manpower Subcontracted as Needed (e.g., Environmental Planning, Installation Planning)

  - Subcontracting Entails Intercompany Billing

- Post Sale Support/Customer Management and Development

  - Responsibility of Field Services With On-going User Requirements Analysis

  - Sales Involved as Needed (e.g., Add-on Sales, Upgrades, Software and New Model Sales)

  - User Requirements Analysis is Site by Site, Summarized Model By Model

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III   THE STRATEGIC LINK

A.   INTRODUCTION

o   In order to have any hope of success in the office automation service
        marketplace, AT&T needs to have a clearly defined strategy. This strategy
        must have a strong and clearly identifiable public image that enables the
        marketplace to answer the question "What role does AT&T play in office
        automation?

o   INPUT believes that there are two possible strategies that can be pursued:

        -       Office automation solutions: where AT&T undertakes the role of total
                solution supplier, providing system design, equipment and software
                selection, software and procedure writing where necessary, installation
                planning, OEM purchasing, installation, training, and documentation.

        -       Network specialist: where AT&T concentrates on providing the
                network design, interfaces design consulting (and programming where
                appropriate) to link the various office automation equipment elements
                together for a corporation and, as a by-provude of the solution
                provided, will service the final system from a hardware and a software
                standpoint.

o   Both options have advantages and drawbacks. The advantage in offering
        office automation solutions lies in the control of a larger per-site budget, the
        participation in professional service activities at the system design and
        programming stages as well as in service, as well as the margins produced by
        OEMing the equipment and software. There are several drawbacks:

        -       AT&T has no office automation image in the marketplace, leading
                potential users to ask "What does AT&T know about office automation
                that we don't?"

        -       An exhaustively detailed blueprint for office automation has to be
                available, showing how each component of hardware and software can
                be integrated, how the implementation of the full office automation
                can be phased, how a company can enter the various levels, how a
                company can identify which stage of automation it has already reached
                and how it can move from one level to the next, etc.

        -       Specific services (with appropriate pricing) need to be thought out that
                package such an approach; the drawback with professional services in
                the classical sense is that its total costs cannot be clearly identified.
                Fixed price contracts are far easier to come by than are open-ended
                T&M contracts.

o   The network specialist option has an obvious advantage: it makes the most of
        AT&T's market image. No user will ask "What does AT&T know about
        networks that I don't?" The disadvantage in the approach lies in the difficulty
        of packaging the service to the marketplace:

        -       A fixed price network consulting contract approach could easily lose
                money; a T&M contract might be hard to sell.

        -       Programming services to provide implementation support for linking
                different vendor equipment into a unified automation system would

require a broad array of programmer/analyst skills covering hundreds of products.

- Consulting, at the front end of implementation, is difficult to tie to TPM service at the back end of implementation.

B.   INTEGRATION - KEY TO OFFICE AUTOMATION

o   At the present time, office automation is an ill-defined scheme for integrating the work functions of separate individuals in a way that facilitates communications, exchange of data, and distribution of the results. There are almost as many definitions of office automation as there are vendors.

o   The essential component - integration - has an informational and functional content which will accelerate and motivate the fusing of separate markets and products in the manner indicated in Exhibit III-1. The new markets targeted by the new multifunctional products (e.g., data/word processors) need a catalyst to make them viable. In other words without some driving force or market leader these markets may develop at a far slower pace than is otherwise possible. AT&T can fill such a void with either of the strategic options discussed earlier.

o   INPUT believes that today's market is for office equipment, not office information, that the essential players (from a hardware vendor standpoint) are almost in place and that true office automation is unlikely to be a reality for most corporations before 1990.

o   An overview of the proliferation of vendors and vendor products is shown in Exhibit III-2. The units installed as of 1982, and the expected growth of that base shows an almost three-fold expansion of the units by 1986. This is formidable growth of the component parts needed to make up a meaningful

EXHIBIT III-1

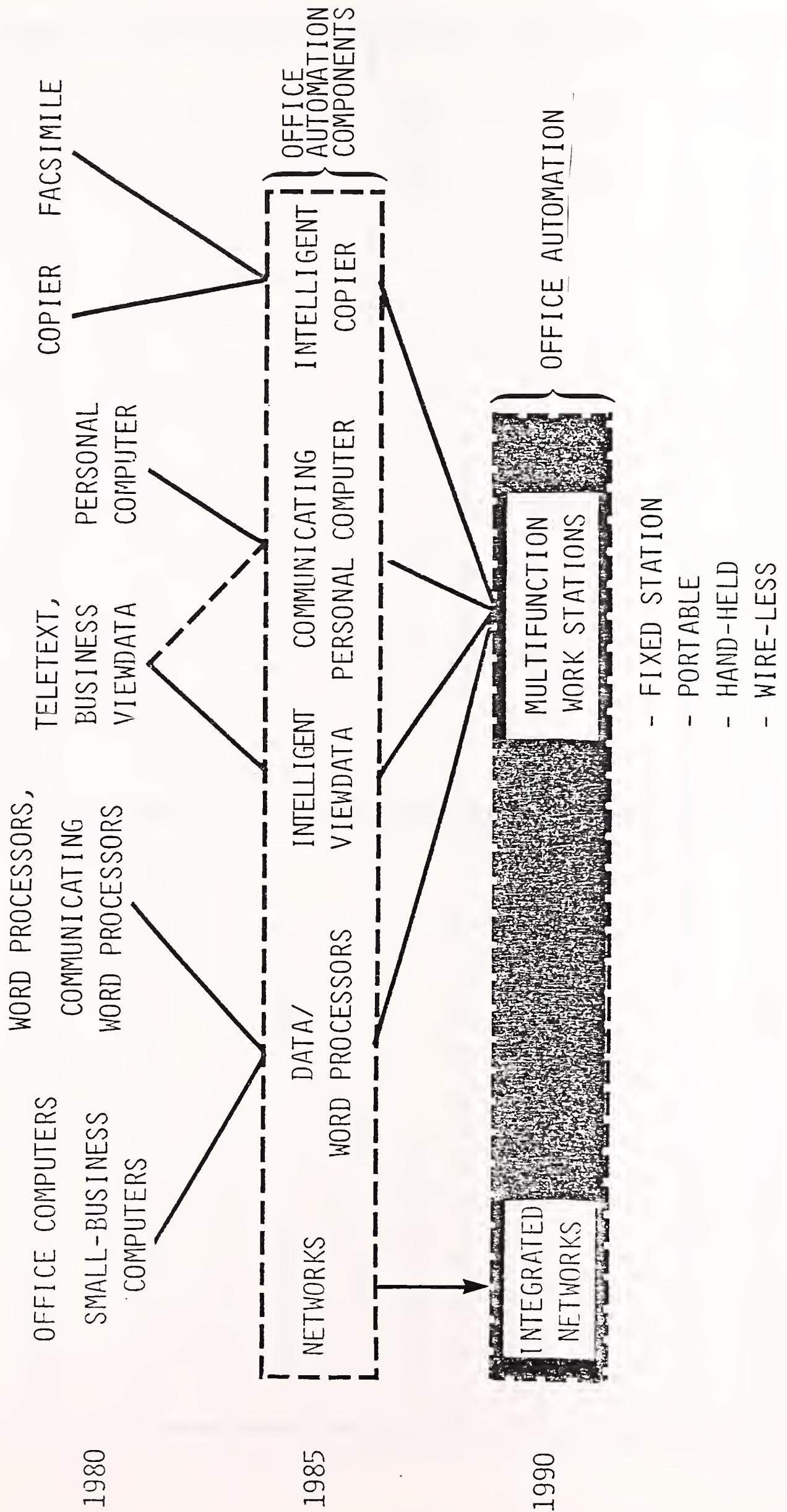WORK-STATION INTEGRATION: INFORMATION INTEGRATION, FUNCTIONAL INTEGRATION

EXHIBIT III-2

OFFICE AUTOMATION AND INTERCONNECT EQUIPMENT

TYPE OF EQUIPMENT	NUMBER OF VENDORS	NUMBER OF MODELS	INSTALLED BASE	
			1982	1986 (FORECAST)
WORD PROCESSORS	45	175	1,000,000	2,600,000
ELECTRONIC TYPEWRITERS	20	70	550,000	2,700,000
DESK TOP AND PERSONAL COMPUTERS (FOR OFFICE USE)	165	285	1,900,000	14,100,000
COPYING EQUIPMENT	34	180	2,100,000	4,800,000
COMPUTER TERMINALS	110	635	9,400,000	20,100,000
OTHER OFFICE AUTOMATION EQUIPMENT (FACSIMILE, ETC.)	70	370	3,250,000	8,400,000
T O T A L S	440	1,715	18,200,000	52,700,000

office automation market, but it does not indicate the degree of integration accomplished between the components without which office automation does not exist. The dollar value of shipments for major office products sales is also provided in Exhibit III-3.

C.   USER ATTITUDES TOWARDS ALTERNATIVE SERVICE DELIVERY MODES

o   When targeting the office automation market service opportunities, one key aspect is the kind of services that users believe they require. INPUT's user research provides an immediate answer to that question.

o   Exhibit III-4 details the user preferences for hardware and software maintenance between the principal maintenance options that are open to them:

-    Traditional on-site service, i.e., a visit by a qualified technician to resolve the failure (this doe not necessarily mean repair).

-    User involvement in diagnosis of failed systems, working with a support center (usually by telephone contact, and manipulation of the failed system through a keyboard).

-    User replacement of circuit boards and/or patching software.

-    User delivering failed modules to a repair center (carry in).

-    On-site standby of service personnel during critical periods.

o   The message is clear: despite vendor preference to involve users in the diagnostic and repair functions, users prefer the vendor to handle the entire service function unaided. This is sometimes mitigated by the various service

EXHIBIT III-3

ESTIMATED U.S. SALES OF OFFICE PRODUCTS

($ MILLIONS)

PRODUCT	YEAR				
	1981	1982	1983	1984	1985
PBX/PABX	$2,600	$3,000	$3,300	$3,700	$4,100
COPIERS	3,400	4,000	4,500	5,000	5,940
WORD PROCESSING SYSTEMS/WORK STATIONS	1,700	2,000	2,600	3,100	3,800
FACSIMILE	100	300	500	800	1,000
PERSONAL COMPUTERS (BUSINESS USE)	1,200	1,800	2,900	3,800	5,600
TOTAL	$9,000	$11,100	$13,800	$16,400	$20,440

EXHIBIT III-4

USER ATTITUDES TOWARDS ALTERNATIVE DELIVERY MECHANISMS

(RATING SCALE OF 1-10, 10 BEST)

DELIVERY MECHANISMS	OVERALL		COPIERS		FACSIMILE		PBX/PABX		PERSONAL COMPUTER		WORD PROCESSOR		WORK STATIONS	
	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE	HARDWARE	SOFTWARE
TRADITIONAL ON-SITE SERVICE	8.32	8.24	8.92	N/A	8.69	N/A	8.28	7.28	6.95	6.67	8.83	8.75	8.42	8.42
USER INVOLVEMENT IN DIAGNOSIS, WORKING WITH SUPPORT CENTER	6.42	6.43	6.11	N/A	5.69	N/A	6.21	5.34	6.57	6.39	6.99	6.91	6.35	6.35
USER REPLACEMENT OF CIRCUIT BOARDS, COMPONENT AND SOFTWARE PATCHING	4.73	4.91	3.90	N/A	2.97	N/A	5.10	4.37	5.21	5.25	5.29	5.28	4.97	4.97
USER DELIVERING MODULES TO REPAIR CENTER	3.98	4.20	2.43	N/A	3.06	N/A	3.10	3.27	5.36	5.26	4.09	4.11	4.23	4.23
ON-SITE STANDBY OF SERVICE PERSONNEL DURING CRICITAL PERIODS	4.02	4.26	3.20	N/A	3.00	N/A	6.76	5.82	2.98	2.95	4.41	4.13	4.55	4.55

discounts that vendors have been willing to offer, but essentially good quality, prompt on-site service is what users are willing to pay for.

D.   TACTICAL AND STRATEGIC CONCLUSIONS

o   Seen from the tactical and strategic standpoints the office automation service opportunities must take into account the trends and issues that are prevalent in the marketplace, as well as the issues that this section has already discussed.

o   The main tactical issues are:

-    The phenomenal proliferation of personal computers for which no vendor has provided adequate service.

-    The "full service need" that will emerge as a result of the gradual integration of office products.

-    The increasing complexity of equipment (and software).

-    The deregulation of the telecommunication environment.

-    The growing user demands for shorter response and repair times.

-    The growing range of user choices in respect of products available.

-    The need to contain service costs.

-    The gradual growth of local area networks.

EXHIBIT III-5

TACTICAL ISSUES AND CONCLUSIONS

KEY TRENDS AND FACTORS	IMMEDIATE CHALLENGES TO FIELD SERVICE ORGANIZATIONS	SHORT TERM ACTION PLANS 1984-1985
RAPIDLY GROWING USE OF PERSONAL COMPUTERS IN BUSINESS AND INDUSTRY	PROVIDE INTEGRATED RESPON-SIVE NATIONWIDE ON-SITE SERVICE FOR PC'S ON A COST-EFFECTIVE BASIS	1. EXPAND SERVICE CAPABILITY TO INVOLVE PC'S 2. INTRODUCE FULL SERVICE PORTFOLIO FOR PC END USERS WILLING TO PAY
GROWING INTEGRATION OF OFFICE AUTOMATION PRODUCTS	SERVICE FULL PRODUCT ARRAY WITHOUT FINGER POINTING	1. ESTABLISH SERVICE MANAGEMENT CAPABILITY AND FUNCTION 2. EXPAND TECHNICAL SKILLS AND PARTS AVAILABILITY AT FIELD LEVEL
INCREASING COMPLEXITY AND SOPHISTICATION OF EQUIPMENT	IMPROVE ABILITY TO IDENTIFY PROBLEMS AND PROVIDE RAPID RESPONSE	1. IMPLEMENT REMOTE DIAGNOSTICS/ TECHNICAL ASSISTANCE CENTER HOT LINE
DEREGULATION OF TELCOM-MUNICATIONS (PBX/PABX) EQUIPMENT AND BLURRING OF FUNCTIONS BETWEEN DP, OFFICE AUTOMATION, AND TELECOMMUNICATIONS	PROVIDE COST-EFFECTIVE SERVICE IN DIRECT COMPETITION WITH NEW TELECOMMUNICATIONS VENDORS (ATTIS, RBOC'S, ETC.)	1. RECOGNIZE IMPACT OF DEREGULATION; GAIN UNDERSTANDING OF TELECOM-MUNICATIONS SERVICE AND SUPPORT PRACTICES 2. EXPAND CAPABILITY TO SERVICE TELECOMMUNICATIONS PRODUCTS
INCREASINGLY TIGHTER RESPONSE AND REPAIR TIME REQUIREMENTS DUE TO GROWING DEPENDENCE ON EQUIPMENT BY USER	MANAGE AND CONTROL SERVICE RESPONSE AND REPAIR BY TARGETS IN ACCORDANCE WITH CONTRACTUAL GUARANTEES AND AGREEMENTS. AVOID "OVER" OR "UNDER" SERVICING	1. IMPLEMENT COMPUTERIZED SYSTEMS TO MANAGE AND CONTROL: • CALL HANDLING AND DISPATCH AND • LOGISTICS/SUPPLY BASED ON MANAGEMENT SET TARGETS AND OBJECTIVES
WIDE RANGE OF CHOICES DUE TO INCREASING NUMBER OF VENDOR AND PRODUCTS	PROVIDE CONSULTING AND TECHNICAL ASSISTANCE AS PART OF INITIAL SALES/ SERVICE DECISION -- PLACE INCREASING EMPHASIS ON SERVICE QUALITY AND RESPONSIVENESS	1. ESTABLISH TECHNICAL CONSULTING ASSISTANCE AND INSTALLATION SUPPORT PLANNING SERVICES 2. PROVIDE SERVICE ON A FORMAL BASIS FOR A PRICE
INCREASING CONCERN OVER SERVICE COST CONTAINMENT	DEVELOP INNOVATIVE PRICING FOR PRODUCT PORTFOLIO - TARGETED BY MARKET SEGMENT	1. ESTABLISH FULL PRODUCT/PRICE PORTFOLIO 2. EVALUATE CURRENT SERVICE PRICES
INCREASING USE OF LOCAL AREA NETWORKS (LAN) TO INTEGRATE INDIVIDUAL OFFICE AUTOMATION PRODUCTS	PROVIDE ABILITY TO SERVICE AND SUPPORT LAN TECHNOLOGY AS PART OF PRODUCT SERVICES	1. EXPAND TECHNICAL CAPABILITIES TO SUPPORT LAN TECHNOLOGY 2. OFFER LAN SERVICE AND SUPPORT
INCREASING DISSATISFACTION WITH SERVICES OFFERED BY BOTH OEM VENDORS AND RETAIL DISTRIBUTION CHANNELS	EXPAND NATIONAL SERVICE, AND BACK UP RETAIL/MASS MERCHANDISE CHANNELS TO PROVIDE INTEGRATED SERVICE SUPPORT WHEN REQUIRED	1. OFFER NATIONAL CALL HANDLING AND TECHNICAL ASSISTANCE SUPPORT TO BACK UP LOCAL RETAILERS 2. PROVIDE FULL SERVICE AT A PRICE FOR THOSE SEGMENTS REQUIRING SERVICE ON-SITE

EXHIBIT III-6

STRATEGIC ISSUES AND CONCLUSIONS

MAJOR TRENDS AND FACTORS	LONG RANGE CHALLENGES TO FIELD SERVICE MANAGEMENT	STRATEGIC OPPORTUNITIES	RECOMMENDATIONS FOR LONG-TERM ACTION PROGRAM; 1985-1988

INTEGRATED OFFICE SYSTEMS COMBINING DATA PROCESSING, WORD PROCESSING AND TELE-COMMUNICATIONS FUNCTIONS
 	
GROWING IMPORTANCE OF SERVICE IN PURCHASE DECISION AS PRODUCTS BECOME INCREASINGLY COMMODITY-LIKE AND LIFE CYCLES SHORTENED
 	
NEED FOR INTEGRATED SINGLE-SOURCE OF SERVICE; ESPECIALLY IN CONNECTION WITH FULLY INTEGRATED NETWORK BASED OFFICE AUTOMATION SYSTEMS
	• ESTABLISH SERVICE AS A SEPARATE LINE OF BUSINESS IN SUPPORT OF THE GENERAL OFFICE AUTOMATION TECHNOLOGY
	
	• DEVELOP A FULL SERVICE ORGANIZATION TO PRODUCE A FULL ARRAY OF "PRODUCTS" FOR THE OFFICE ENVIRONMENT INCLUDING:
	  – INSTALLATION & SITE PLANNING
	  – INSTALLATION
	  – HARDWRE MAINTENANCE
	  – SOFTWARE MAINTENANCE
	  – MOVES AND CHANGES
	  – UPGRADES/CONFIGURATION CHANGE
	  – DOCUMENTATION
	  – TRAINING
	  – PARTS/SUPPLIES
	  – CONSULTING
	  – OTHER SUPPORT SERVICE
		• SERVICE AS A SEPARATE REVENUE AND PROFIT GENERATING LINE OF BUSINESS
		
		• SERVICE MANAGEMENT AS A FRMEWORK/CONCEPT FOR MANAGING AND DELIVERING SUPPORT
			• ESTABLISH FULL PROFIT CENTER SERVICE OPERATION WITH SUPPORTING MARKETING, PRODUCT AND BUSINESS PLANNING AND FINANCIAL/ ACCOUNTING FUNCTIONS
			
			• DEFINE FULL SERVICE PRODUCT PORTFOLIO
			
			• EXPAND INTO THIRD PARTY MAINTENANCE FOR THOSE PRODUCTS UNDER THE SERVICE MANAGEMENT UMBRELLA

NEED FOR A COMPREHENSIVE PORTFOLIO OF SERVICES TO SUPPORT ALL ASPECTS OF AFTER SALES SUPPORT, INCLUDING TRAINING
 	
NEED FOR ESTABLISHMENT OF STRATEGIC PRICING APPROACH, BY MARKET SEGMENT
	• IMPLEMENT A COMPREHENSIVE SYSTEM TO MANAGE AND CONTROL SERVICE AS A BUSINESS INCLUDING:
	  – INSTALLATION-PLANNING AND SCHEDULING
	  – CALL HANDLING AND DISPATCH
	  – PREVENTIVE MAINTENANCE SCHEDULING
	  – TECHNICAL ASSISTANCE/REMOTE DIAGNOSTICS
	  – ORDER PROCESSING AND INVENTORY CONTROL
	  – DATA BASE MANAGEMENT
	  – REPORTING
	  – INVOICING & COST ACCOUNTING
	
	• PROVIDE SERVICE PORTFOLIO CUSTOMIZED TO MEET NEEDS OF INDIVIDUAL MARKET SEGMENTS AND NICHES
	
	• BASE PRICING ON EVALUATED COMBINATION OF COST, COMPETI-TION, AND VALUE-IN-USE
		• MANAGEMENT AND CONTROL OF SERVICE DELIVERY, RESPONSIVE-NESS, AND QUALITY TO MEET CUSTOMER NEEDS AT A PROFIT
		
		• INCREASE PROFIT MARGINS AND RETURN ON INVESTMENT FROM SERVICE BASED ACTIVITIES
			• COLLECT AND ALLOCATE DATA ON COSTS AND REVENUES FROM INDIVIDUAL PRODUCTS AS A BASIS FOR SERVICE PRICING
			
			• IMPLEMENT REMOTE DIAGNOSTICS AND TECHNICAL ASSISTANCE CENTERS ACCESSIBLE VIA A NATIONAL 800 LINE NUMBER
			
			• MEASURE CUSTOMER NEEDS, REQUIREMENTS, & PERFORMANCE ON A CONTINUING BASIS
			
			• DEVELOP ACCURATE DATA ON MTBF AND MTTR AS A BASIS FOR NEW PRODUCT PLANNING
			
			• IMPLEMENT INTEGRATED SYSTEM FOR SERVICE MANAGEMENT CONTROL WITH COMMON DATA BASE

EXHIBIT III-7

EXTENDED SHIFT COVERAGE PREMIUMS FOR HARDWARE SERVICE

PERCENT PREMIUM ON BMMC			
COVERAGE	MONDAY-FRIDAY	SATURDAY	SUNDAY AND PUBLIC HOLIDAYS
8 Hours	(Base Rate)	+15%	+30%
12 Hours	+10%	+25%	+40%
16 Hours	+20%	+35%	+50%
24 Hours	+40%	+55%	+60%

- Four hour response is usually limited to 50 miles radius of a designated Service Center only.

- Two hour response is usually limited to 25 miles radius of a designated Service Center only.

IV   WORD PROCESSING EQUIPMENT

A.   PRODUCT TYPES

o   This area of the marketplace is separated into several different levels of products.

- Standalone word processing systems (dedicated systems).

- Shared resource systems (dedicated, but shared).

- Extended editors (terminal based).

o   In a standalone environment, the product acts similar to a workstation but incorporates the normal work processing features and operating procedures. Many can also communicate with large systems or other word processors on the network.

o   In a shared resource environment, individual users are connected to a central processor and share both disk and printer resources. Log-ons and passwords protect data. Some have both message and electronic mail capability.

o   Extended editors are not word processors in the true sense of the word. They are terminals connected to large systems and have no significant local processing power of their own.

o   Taken in its broadest sense, the word processing approaches used by the U.S. market today can cover eight different categories of equipment, as shown in

Exhibit IV-I. The INPUT estimate of the percentage of the nation's word processing needs processed by the installed base of these eight product categories (and how INPUT sees the load shifting) is included in the exhibit.

B.   TECHNOLOGIES USED

o   The technologies used for word processing equipment vary, but not to any great extent. The standalone word processing system is generally made up of a electronic or logic section, diskette storage, a detachable keyboard, a power unit, monitor, and printer.

-    The electronic section is generally constructed as either a single mother board containing all the logic circuitry or several logic boards inserted into functionally defined slots. These are normally mounted in the display unit. Current products are using Z80, 8088, or 68,000 chip technology. These boards are not field repairable and maintenance is performed through board swapping.

-    Diskettes are electrical mechanical devices which may be adjusted but normally are returned to the factory for repairs.

o   Detachable keyboards normally are also not field repairable, (their cost is generally too low to warrant repair). Some organizations have begun to repair them at field depots.

o   Power units are mounted within the display case in several ways; some unit have all the power components in one unit that can be removed from the system for depot repair, others are designed for field repair. In most cases, both are repairable at the local field office and complete power units are replaced mainly to reduce mean time to repair time.

o   Monitoir maintenance philosphy generally is governed by the unit cost. Several vendors service monitors very successfully in the field. CRTs are the most replaced component within the monitor unit.

EXHIBIT IV-1

WORD PROCESSING APPROACHES

(AS A PERCENT OF INSTALLED BASE)

METHOD USED	YEAR	
	1981	1985
MANUAL AND PORTABLE TYPEWRITERS	10%	12%*
ELECTRIC TYPEWRITERS	72%	40%
ELECTRONIC TYPEWRITERS AND STANDALONE WP WORK STATIONS	1%	20%
WORD PROCESSING SYSTEM/MULTI STATIONS	10%	9%
MAINFRAME COMPUTER PRINTERS	3%	8%
PERSONAL COMPUTERS	1%	5%
SMALL BUSINESS SYSTEMS	2%	5%
TIME SHARING SERVICES	1%	1%
T O T A L	100%	100%

* INCLUDES PORTABLE ELECTRONIC PC'S AND TYPEWRITERS

o   Printers use electromechanical devices which experience wear and changes in adjustments. Their maintenance methods have not changed significantly over the years and they are almost always serviced on-site. They also require some form of preventive maintenance, which separates a printer's service requirements from the rest of the system. Also several optional printer attachments are available on most systems. These include form feeds and envelope handlers which are high maintenance products whose performance criteria is measured by duty cycles (the other components of the system are normally measured by total hours available.

o   Shared Resource Systems require a greater maintenance effort. Their architecture is more like those found in the large systems sector. Several display units and printers are connected through cables to a central processing unit. This central processing unit contains an enlarged electronics and logic unit and more sophisticated and larger disk storage devices. Included in these devices are diskette cartridges, fixed disk, and removable 8" diskette. The software involved and problem determination is more complex and requires experienced maintenance personnel.

C.   TECHNICAL SKILLS REQUIRED

o   Since word processing systems are not as modularly constructed as terminals and PCs, the level of expertise required by a field service representative supporting these products must be at a level equal to those maintaining medium- to small-business systems.

o   Basic electronics, mechanical electrical interrelationships and problem determination skills are a necessity. Although basic electronics can be learned through education institutions, the ability to logically determine failing components and adjusting or replacing mechanical devices is learned through experience.

EXHIBIT IV-2

MAINTENANCE PRICING OF SELECTED VENDORS OF WORD PROCESSORS

VENDOR	MODEL NUMBER	FIRST SHIPPED	AVERAGE PURCHASE PRICE	AVERAGE MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
CPT	8100	1981	$13,965	$95	8.2%
IBM	Display Writer	1981	12,360	114.50	11.1
NBI	3000s	1982	13,200	87	7.9
NBI	System 8	1980	22,200	179	9.7
Wang	Wangwriter	1980	6,400	75	14.1
Philips	MICOM 2002	1980	15,870	142	10.7
Xerox	860	1980	12,625	100	9.5

o   This is why companies entering the systems service industry hire experienced
       field service personnel. Entry level people can be added later, but they
       require approximately two years to be effective.

D.   STARTUP AND ORGANIZATION COSTS

o   Startup costs vary greatly depending upon the vendor and maintenance groups'
       relationship. Cost of parts, training, and support are much less when working
       in cooperation with the product manufacturers. If AT&T desires to work
       independently of the manufacturer, spares costs generally run three times
       burdened manufacturing cost, development costs run $250 per day plus
       expenses, and support availability is limited. When dealing with vendors like
       IBM, parts availability is also more difficult, requiring higher stocking levers.

o   Word processor systems are marketed and supported by IBM as part of their
       standard product line. Personal computers are handled in a different
       manner. It is questionable whether maintaining the IBM word processing
       system product line is worth the effort.

o   The following is an estimate of startup costs for maintaining word processing
       systems with both vendor involvement and independently.

E.   PRICE OF SERVICE AVAILABLE

o   Word processing is generally serviced through on-site maintenance. The
       products are not easily transportable, although they can be moved easily
       within the facility. The more common products being shipped today are
       shared resource systems consisting of several interconnected units.

o   Each unit is priced for maintenance separately but billed on a combined
       invoice. The average system maintenance price is 9-11% of the product
       purchase price. A standard system maintenance charge is from $750 to $900

EXHIBIT IV-3

(INDEPENDENT OPERATION)

FIRST YEAR SET UP AND ORGANIZATIONAL
COSTS ESTIMATES AND ASSUMPTIONS

Manpower Requirements

1 - Field Service Director

1 - Field Operations Manager

1 - Support Manager

6 - Field Engineers (2 per Location)

3 - Field Administrators (1 per Location)

1 - Logistics Manager

1 - Logistics Planner

1 - Distribution

2 - Instructors

1 - Tech Writer

1 - Tech Support Manager

1 - Support Representative

3 - Headquarters Administrators

_____

23 - Total

EXHIBIT IV-4

(INDEPENDENT)

HEADQUARTERS SALARY AND BENEFITS

Director Field Service	$119,000
Field OPs Manager	89,000
Field Support Manager	71,400
Logistics Manager	53,500
Distribution Clerk	25,500
Logistics Planner	32,000
Instructors (2)	76,000
Tech Writer	38,000
Tech Support Manager	50,000
Tech Support Rep	42,000
Administrators (3)	49,980
	$646,380

FIELD SALARY AND BENEFITS

Field Engineers Salary (6)	$214,000
Field Administrators (3)	51,170
	$265,170

INPUT
ZAT1

EXHIBIT IV-5

OTHER EXPENSE

Transportation Expense	$ 18,000
Field Facilities	36,000
20% Overtime/Shift	36,000
Training Expense	41,400
Headquarters Facilities	100,000
Training Equipment Exp	76,365
Miscellaneous	50,000
Spares Expense Capitalized over Sixty Months	30,000
Total	$387,265
Total Yearly Expense	1,299,315

per month (these are large systems and shouldn't be confused with personal computers).

V PERSONAL COMPUTERS, WORKSTATIONS, AND INTELLIGENT TERMINALS

A. CATEGORIES OF PRODUCTS

o The difference between these products is rapidly disappearing. At present, they may be described as follows:

- Personal computers are standalone products built to use operating systems and data base management routines specifically designed for them. They handle applications software in the same manner as any other computer system. They now support multiprocessing, communication, and spooling. IBM's new XT offers the capabilities once only found in large-scale computer systems. It will set the standard for the industry and open up new peripheral product development.

- Workstations are primarily dedicated application devices with local disk storage and processing capability, usually complemented with good communications capabilities. Their standalone capability varies with the vendor.

- Intelligent terminals are input/output devices for a central system. They have some local storage and are capable of performing processing that relieves the main processor workload. They are the forerunner of workstations.

B. TECHNOLOGY USED

o The technologies used by all the aforementioned products is similar. Most are based on the 8080, 8088, and 68,000 chip. Intelligent terminals tend to have one large mother board containing all the logic and control circuits.

o Workstations and personal computers generally use several boards inserted into slots; each board handles a particular function. They use a great variety of monitor types and this is further complicated by the number of interconnect schemes. Keyboards also vary between product types and vendors.

o Workstations and personal computers have disk and diskette storage capabilities which are fairly similar; however, the format in which information is stored varies considerably. Almost all provide an RS 232 interface.

o Personal computers and workstations are becoming more modularly designed for ease of service. Terminals are generally desigend for portability and transportability. Most can be serviced by mail-in or courier type maintenance plans.

o Current personal computer users prefer on-site maintenance, and the products do not lend themselves to mail-in maintenance. It requires technical expertise to swap out boards in the logic unit, replace or adjust diskette and disk drives and still more expertise to repair and adjust printer equipment. Most monitors, however, are enclosed in a separate housing and can be easily exchanged.

o Many experts predict personal computers will be packaged in such a modular fashion that hardware maintenance as we know it today will disappear. These modules will be so inexpensive that they will be disposable. The maintenance required at that time will become more software support and user-assistance oriented.

\-   A closer look at the PC and workstation modules follows:

\-   Logic units are enclosed in the same housing as the standard diskette drives. They are generally on boards designed for particular functions. A diskette used for diagnosing errors is normally included in the basic operating system material and tests the function to assist in determining the failing board. These are easily swapped out by the FE and returned for repair to a depot or the vendor.

\-   The standard diskettes are enclosed in the CPU housing along with the logic unit. They normally are replaced when they malfunction and are serviced in a depot or returned to the vendor.

\-   Keyboards are treated in a similar manner to those in word processors. They are replaced and discarded due to their low cost.

\-   Power units are normally enclosed in the CPU housing in one module. They are repaired on-site by some service organizations. This requires a fairly good technician. They can also be removed as a unit and returned to a depot or local field office for repair.

\-   Most personal computer monitors are easily exchangeable and should be swapped out. These monitors are generally much lower in cost than those found in word processors.

o   There is such a variety of printer equipment available on personal computer systems that any single maintenance strategy cannot be used. Each product must be analyzed separately. Most, however, need on-site maintenance. This unit has a higher failure rate than any other part of the PC or workstation. They are all electromechanical devices with several optional attachments.

C.   TECHNICAL SKILLS REQUIRED

o   The technical experise required depends on the maintenance strategy followed. If module replacement is adopted for all units except the printer, then the level of experience and expertise of the average field engineer is significantly less. A good electromechanical background and an aptitude for problem determination is adequate.

o   Normal training is limited to determining the failing module and replacing it. Common component replacement can be performed on the failing modules in a local field location by more technically qualified personnel in a non-stressful environment.

o   The training required for these employees is a "theory of operations" course. In shore, the FE is taught how to fix and the module repair person is taught how it works. This approach appears to be the most logical method to provide service on this product group. Terminals can be serviced either on0site or in the local field office using mail-in, carry-in, or pickup maintenance.

o   Field service engineers can be hired through trade schools or recruited from computer dealerships. Several technicians working on television and stereo equipment make excellent component repair engineers. A small percentage of the FEs hired initially should have prior experience. This allows entry level personnel to gain some experience and have backup support when required.

o   The same decisions dealing with vendor involvement and independent operators apply to this product group as other in the office product sector of the systems business. Operating independently, education, spares, and support require both increased setup time and additional expense.

D. SETUP AND ORGANIZATION COSTS

o   Using the unit replacement and local module repair method of repairing equipment, a slightly different corporate structure is required. The handling and repair of spares become critical. The organization takes on more of a manufacturing environment than that of a pure field service group. The support function insures the spares are kept at the latest release level so most fixes are handled by replacing modules or units.

o   Corporations, including IBM, who manufacture personal computers are showing reluctance to provide the support normally given to computer products. With the volumes being shipped each month, it almost appears to be an unmanageable problem.

o   Products being marketed by unauthorized dealers compound the situation. Therefore, it becomes necessary that independent organizations fill the gap. Most vendors, including IBM, welcome this participation. What makes this such an opportunity for third-party maintenance groups is the ability to increase volumes within a location by servicing several different vendors' products.

o   To insure profitability, third-party or independent maintenance groups must track product performance closely. The number of failures per year should be a major factor in establishing maintenance costs. This should be tracked through incident reports and parts replacement data. In order to plan for servicing any product, performance studies should be made or future profits may not be realized. This should be handled by the support group.

o   Education is also dealt with differently in a high volume market. As much training as possible must be done locally or through a local independent education group. Any courses generated by the corporation should be done using video training methods which are continually available at the field locations. The cost of developing these courses is initially significantly higher than the traditional lecture/lab method; however, the training expenses saved by eliminating travel and living expenses more than pay for it.

EXHIBIT V-1

IBM PC

Qty.	Code	Product Description	(dollars) Purchase Price	Carry-in	Mail-in
1	5150	CPU, 64KB, Keyboard	$1,575.00	$106.00	$92.50
1	5151	Monochrome Display & Card	680.00	28.00	24.50
2	3907	5 1/4 Single-side Floppy	1,058.00	75.00	65.00
1	5152	80 cps Matrix Printer	595.00	40.00	35.00
		Total	$3,908.00	$249.00 6.4%	$217.00 5.6%

INPUT

EXHIBIT V-2

IBM PC

| Qty. | Product | | (dollars) | | |
	Code	Description	Purchase Price	Courier	On-site
1	5150	CPU, 64KB, Keyboard	$1,575.00	$132.00	$165.00
1	5151	Monochrome Display & Card	680.00	35.00	44.00
2	3907	5 1/4 Single-side Floppy	1,058.00	93.00	116.00
1	5152	80 cps Matrix Printer	595.00	50.00	62.50
		Total	$3,908.00	$310.00 7.9%	$387.50 9.9%

INPUT

FCP3

EXHIBIT V-3

ON-SITE SERVICE PRICING ON IBM PC
1983

	Product	Compu-terland	IBM	IBM Price Advantage (percent)
5150	CPU, 64KB, Keyboard	$189.00	$165.00	(14.5%)
5151	Monochrome Display & Card	81.60	44.00	85.5
3907	5 1/4 Single-sided Floppy (2)	126.96	116.00	9.4
5152	80 cps Matrix Printer	97.50	62.50	56.0
Total		$495.06	$387.50	(27.8%)

INPUT

o   Also, such training methods are available on demand in large quantities for the life of the product. A more experienced individual is necessary to write these courses. He should have a complete technical background including the use of CAI and video products. If needed, independent education organizations can provide this service.

o   Most maintenance documentation can be purchased locally eliminating the need for a documentation group.

o   The director of field service must be experienced in all areas of the system business and must be an expert in logistics and high volume product service methods. They differ greatly from the large system sector and require a different management philosophy.

o   The average field service engineer makes a total of four calls per day in the personal computer and workstation area of the business. The response time being experienced by most users is three days. This provides a lot of room for improvement. However, the capability of FEs to increase their productivity is limited. When making initial manpower forecasts, four calls per day is probably correct.

E.   PRICING OF MAINTENANCE

o   A personal computer system consisting of a monitor, CPU, two diskettes, keyboard, and printer costs $500 per year for on-site maintenance. They also are handled on a time and materials basis with the hourly rate of $80 per hour fairly standard.

o   A comparison of IBM's pricing of the PC maintenance, by delivery method, is provided in Exhibits V-1 through V-3.

  -     Workstations are also generally serviced on-site with maintenance charges of $350 to $500 fairly typical.

EXHIBIT V-4

MAINTENANCE PRICING OF SELECTED VENDORS OF TERMINALS

VENDOR	MODEL NUMBER	PRODUCT DESCRIPTION	FIRST SHIPPED	PURCHASE PRICE	MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
CDC	751-10	CRT	1979	$1,995	$30	18.1
Honeywell	VIP-7100	CRT	1976	1,500	23	18.4
IBM	3278 2A	CRT	1978	2,505	22.50	10.8
IBM	3279 2C	Color CRT	1978	4,525	39.50	10.5
Univac	UTS-20	CRT	1980	$2,597	28	12.9

EXHIBIT V-5

(INDEPENDENT OF VENDORS)

PERSONAL COMPUTER START UP COST ESTIMATES

Manpower Requirements

1 - Field Service Director

1 - Field Operations Manager

1 - Logistics Manager

1 - Support Manager

1 - Administrative Manager

2 - Secretary (2)

1 - Logistics Planner

1 - Distribution Representative

2 - Instructors (2)

2 - Support Reps (2)

15 - Field Engineers

6 - Component Repair Technitions

6 - Administrators

Other Requirements

3 - Field Facilities

1 - Headquarters Facilities, Test
    Equipment, Spares 7% Level

EXHIBIT V-6

(INDEPENDENT OF VENDORS)

PERSONAL COMPUTER START-UP COST ESTIMATES

Headquarters Salary and Benefits

Field Service Director	$119,000
Field Operations Manager	89,000
Logistics Manager	75,000
Support Manager	70,000
Administrative Manager	38,000
Secretary (2)	28,500
Logistics Planner	38,000
Distribution Representative	28,500
Instructors (2)	95,200
Support Reps (2)	57,120
Yearly Total	$638,320

Field Salary and Benefits

Field Engineers (15)	$499,840
Component Tech (6)	228,480
Field Administrators (6)	102,816
Yearly Total	$831,136

INPUT
ZAT1

EXHIBIT V-7

(INDEPENDENT OF VENDOR)

OTHER EXPENSES

Field Facilities	$180,000
Test Equipment (Cap. 5 Years)	12,000
Headquarter Facilities	100,000
Spares 7% First Year (Cap. over 5 Years)	168,000
Video and CAI Courses	120,000
Miscellanious	75,000
Yearly Total	$655,000
Yearly Total Expenses	$2,124,456

-   Working in cooperation with the vendors reduce the requirement for component repair and spares costs only.

Vendor Contract Savings

New	Component Tech.	$ 114,240
New	Spares Cost (Capitalized over 5 Years)	67,200
New	Yearly Total	$1,909,416

- Intelligent terminals are serviced on-site, mail-in, courier, and carry-in. On-site charges are on the average $350 per year, carry-in/mail-in costs $200, and courier runs $230 per year.

VI   COMMERCIAL APPLICATION MINICOMPUTERS

A.   CATEGORIES OF PRODUCTS

o   The main categories of product found in the office area are:

-    Business application processing minis.

-    Office application processing minis.

-    Energy management handling minis.

o   The business application mini is no different from the small business computer system other than in the functional capability and design of the system itself. The minicomputer was originally designed to handle real time data capture from both analog and digital sources, principally for the scientific, engineering, military, and education sectors. Its low cost (which has still not ceased dropping) brought it into the business data processing market, for which it was not designed, and is now bringing it into the office application market. Some shared word processors are minicomputer-based (e.g., CPT).

o   Energy management minis began as load monitoring and environment control systems and have extended their capabilities to message handling and accounting. Much of their market is now under attack from dedicated microcomputers.

B.   TECHNOLOGY USED

o   The minicomputer logic unit, processor, and memory are similar to those
     found in other computer products. Physically, they are composed of a back
     plane, bus, 19-inch rack and a series of boards, the function of which can vary
     from memory to I/O logic to logic. Many have customized circuitry to satisfy
     particular needs, including floating point, compatibility features and operating
     system code.

o   With the exception of the CPU described above, the peripheral technologies
     are described in the appropriate section.

C.   TECHNICAL SKILLS NEEDED

o   As throughout the remainder of this report, we must distinguish between the
     technical skills needed for in-field maintenance (increasingly oriented toward
     remotely assisted diagnostics, board swapping, and limited on-site repair) and
     repair (usually concentrated in repair centers). On the one hand technical
     stability needed is limited to understanding how the hardware and software
     components handle functional ability (and therefore where the failure is likely
     to reside) and on the other hand highly specialized engineering ability is
     needed to determine which component or circuit has failed and if and how it
     can be repaired.

o   This has determined that most repair centers specialize their engineering
     staff into subsystems: disk drive specialists, printer specialists, and logic
     circuitry specialists, etc., whose interface is rarely with clients. The skills
     needed by the repair center are almost the opposite end of the skill spectrum
     compared to the in-field engineer.

D.   ORGANIZATIONAL COST

o   The models provided for word processor service organizations apply to minicomputers: service oriented toward on-site service to the base. The principal difficulty with offering TPM service for the minicomputer base is that:

-     Minicomputer vendors are beginning to offer single-source maintenance for their own products (eliminating the entice to TPM vendors).

-     TPM vendors are already established and the competition is strong.

E.   PRICING OF SERVICE

o   The accepted industry norms for pricing are shown in Exhibit VI-I.

EXHIBIT VI-1

MAINTENANCE PRICING OF SELECTED VENDORS OF SMALL BUSINESS

AND MINICOMPUTER SYSTEMS UNDER $25,000

VENDOR	MODEL NUMBER	MEMORY SIZE OF BASIC CONFIGURATION	FIRST SHIPPED	AVERAGE PURCHASE PRICE	AVERAGE MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
IBM	System/32	8 KB	1975	$23,490	$168	8.6%
Texas Instruments	DS 990	64 KB	1979	9,995	114	13.7
Wang	VS-100	256 KB	1977	22,000	235	12.8
Basic Four	System 200	40 KB	1978	24,990	260	12.5
Burroughs	B 90	128 KB	1979	7,900	56	8.5
NCR	8150	32 KB	1978	18,300	192	12.6
Hewlett Packard	3000/30	256 KB	1979	24,925	220	10.6
DEC	Data System 336	128 KB	1980	25,000	242	11.6

EXHIBIT VI-2

MAINTENANCE PRICING OF SELECTED VENDORS OF SMALL BUSINESS COMPUTERS

AND MINICOMPUTERS OVER $25,000

VENDOR	MODEL NUMBER	MEMORY SIZE OF BASIC CONFIGURATION	FIRST SHIPPED	AVERAGE PURCHASE PRICE	AVERAGE MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
Data General	CS-50 Model C5	128 KB	1980	$37,000	$262	8.5%
Data Point	8630	256 KB	1981	33,500	240	8.6
DEC	Data System 356	256 KB	1980	41,900	288	10.6
Hewlett Packard	3000/40 SX	256 KB	1982	42,100	320	9.1
Honeywell	DPS 6/48	512 KB	1981	116,060	814	8.4
IBM	System 38 Model 03 21	512 KB	1980	59,210	358	7.3
Perkin-Elmer	8/32	1 MB	1978	100,000	750	9.0
Prime	150/11	256 KB	1981	54,000	272	6.0

VII NETWORK-BASED SERVICES

A. CATEGORIES OF SERVICES

o Electronic mail requires a central system which is available 24 hours a day.
Mail must be password protected, numbered, show proof of receipt, and
remained stored for a specific period of time.

   - MCI is now providing central site capability for personal computer
      users. In the future several organizations, including the postal service,
      is planning to provide those services.

   - Large systems have provided mail capability for users for several
      years. These services have significantly reduced mail costs, but more
      importantly provide instand access to mail. The impact of this
      capability on companies like Western Union and others will be felt in
      the coming years.

   - In order to provide electronic mail and facsimile service, very large
      data storage must be available. Most organizations constantly increase
      the size of the storage space used to store mail. This limits use of this
      service to large data storage type systems. The personal computer and
      word processing systems currently available are not large enough to
      efficiently provide this service.

   - Facsimile devices will be replaced by the technology allowing copies
      and other devices to communicate directly across a local area
      network. These local area networks also have modems attached which

allow them to communicate to other locations. The use of local area networks opens up a whole new area requiring new approaches to maintenance.

B.   TECHNOLOGIES USED

o   Until the introduction of local area network services, devices were connected to the central processor via a unique cable. The central processor handled all the routing throughout the network. With LAN services the devices are all connected to the same cable. Protocol formats and device addresses identify them. The central processor becomes just another device.

o   This technology will require maintenance strategies to be drastically altered. The network itself becomes a critical part of the system. Devices, such as repeater and protocol identifiers require service. Each device type will also enhance its processing capability to make more efficient use of the network.

o   The technology used is all electronic. LSI, VLSI, and fiber optics make up the majority of the components used. Disk storage devices will be attached directly to the network for shared use. Printers, copiers, and terminal devices will directly communicate with each other. The problem determination capabilities required to service these products will forge a retraining effort on all vendors' parts.

C.   TECHNICAL SKILLS NEEDED

o   There are very few field engineers in the industry with extensive experience in maintaining communications equipment as complex as those being developed. This equipment has extensive diagnostic routines built in, but network lockouts are going to create tough problems to correct.

o   IBM, Wang, and Xerox have training programs in place to handle this new technology. For other vendors to compete successfully, an investment in education is necessary. This investment will be considerable.

o   The technical skills required to handle these products are advanced electronics, telecommunication methods, software support experience, and problem determination experience.

D.   ORGANIZATION AND SETUP

o   For any organization to startup just to handle this section of the business is not recommended. The cost to hire qualified field engineers and provide the education and support necessary is prohibitive. Also, the tools and test equipment required is expensive.

o   Once an organization is fully operational handling equipment connected to local area networks then the resources must be invested in to support the network itself. The units themselves should not become more difficult to maintain as internal diagnostics should identify problems.

o   The previous organizational charts should continue to hold true for equipment used in telecommunications.

E.   PRICING FOR MAINTENANCE

o   Maintenance pricing is difficult to determine on products like electronic mail. They are usually provided with the system and are included in the system maintenance price.

o   Network maintenance pricing is normally negotiated similar to the method used for maintenance management contracts. It is normally based on terms and conditions as well as the products involved.

VIII   TERMINAL PRODUCTS

A.   PRODUCT TYPES

o   Terminal products have created more employer involvement with the data
    processing equipment installed within a business than any other product. They
    vary from small portable modules to large bulky units. Some have removable
    keyboards, others are built in. They are relatively inexpensive and are very
    reliable.

o   Terminals can be found everywhere and are installed in a varied environment
    that forces them to operate in areas where former products would be
    prohibited. They also bring remote areas closer to a central site for large
    data distribution.

o   Terminals are designed to communication with specific mainframes, therefore
    when selecting products to maintain, a major decision factor is the number of
    systems a particular manufacturer has installed.

o   Maintenance rates are generally low because of their reliability and volumes
    installed in a single locatin. Most are portable and easily swapped out.

o   For any organization to set up just to maintain terminals is not
    recommended. They can add significant revenues to a service organization
    but cannot carry one alone. They are also being replaced by workstations and
    personal computers.

B.   TECHNOLOGY USED

o   Their are several generations of terminals still in use. Earlier models used
     TTL and ECL logic, new products use LSI and VLSI technology.

o   Many terminals are packaged for appearance and cost. Their serviceability is
     not as much a factor as in the case of PCs and word processors. In most cases
     the entire unit is swapped out and the terminal worked on off line.

o   Repair of some of these products require a complete disassembly to replace a
     failing component. They are generally composed of a power unit logic,
     monitor ASM and keyboard. The interconnect schemes used vary, so spares
     which may be compatible with different vendors are not useable.

o   When third-party maintenance organizations use other than recommended
     spares, they open themselves to several legal ramifications. UL approval for
     radiation and leakage standards must be accomplished. Also, monitor
     ergonomic specifications must be met. Several labor union groups are looking
     closely at this product for detrimental affects on their constituents.

o   Since these products are connected to a main processor, clear definitions of
     service responsibilities must be understood by all concerned. As local area
     network technology becomes more prevalent this area will become more
     critical.

C.   TECHNICAL SKILLS REQUIRED

o   Before determining the skills FEs require to maintain terminal products, the maintenance philosophy of supporting these products should be discussed. On-site maintenance can be defined as repairing the unit at the site or carrying a spare unit and swapping it out.

o   If on-site repair is chosen the expertise needed is rather extensive. A heavy background and mechanical dexderity is required.

o   If units are swapped out, a minimum of electronic expertise is needed. Just disconnecting the unit and making a replacement is required. Also, a knowledge of computer operations is helpful.

o   The use of component techs at the local office, as in the case of PCs and workstations, is essential. This is where the maintenance expertise is needed.

D.   ORGANIZATION SET-UP COSTS

o   The wisdom of setting up an organization to service just terminals is questionable. It can bring increased revenues to organizations servicing PC, workstations and word processors but cannot support itself. Many users are purchasing their own spare units for swap out and gamble on time and material charges at repair centers. IBM charges only $80 per year to maintain their small 3101 terminal - using repair center maintenance. To compete in this marketplace alone is very risky.

o   When a corporation is set up to repair both PCs and word processors then they have already paid the cost of setting up a repair centers. To include terminal maintenance to their offerings make sense.

o   The main additional cost is in the area of spares, based on a 5% sparing level, operating independent of vendors.

o   These component techs should have a high level of electronic background and have similar abilities to that of an engineering tech or TV repair person.

o   The training required for field personnel is basically OJT type and conducted in the local office. Video tapes and CAI packages can be used for computer operation courses. Several are available.

o   Trade schools are an excellent source of hire for FE personnel who provide pick-up or swap-out service.

E.   PRICES OF SERVICE

o   On-site, carry-in, pick-up, deferred maintenance and mail-in are all viable maintenance offerings for terminal products. Maintenance pricing has becom every competitive with volumn discounts and other discounting schemes prevalent.

o   On-site maintenance for terminal products average $22 per month, with volume discounts based on reduced travel costs. This reduces to $17 per month.

o   Prices for mail-in repair range from $80 to $120 per year for those vendors surveyed.

o   Courier on pick up range from $15 to $20 per month.

o   Mail-in and pick-up require the user supply spare units.

o   Sparing costs would be $65 per unit maintained. Operating with the vendor would result in a cost of $26 per unit maintained. Labor costs per repair should run about $65 per hour burdened.

o   These repair centers could also handle other product lines such as home computers and telephone equipment.

IX   PERIPHERAL PRODUCTS

A.   CATEGORIES OF PRODUCTS

o   Within the office product area of the system business the main peripheral
     products are disk storage devices and a selection of printers.

o   Word processing equipment uses various peripheral devices. The variety of
     disk and diskettes are constantly increasing. They use both 5" and 8" single
     diskette drives and diskette cartridge drives which select a diskette from a
     cartridge containing up to 8. They also use fixed and removable hard disk.
     There are normally a combination of these products on a single shared
     resource word processing system. The printers used are generally letter
     quality printers. Printers being shipped in the near future will be lazor
     printers and should speed up the printing process and increase the productivity
     of the whole system.

o   Personal computer also use several forms of disk equipment. Diskette drives
     are the main storage devices used currently, but hard disk installs are growing
     rapidly. Printers used are either letter quality or dot matrix printers.

o   Printers have the ability to encompass several options and attachment.
     Standard form feeds, continuous forms, envelope handlers, and label writers
     are but a few. Multicolored printers for handling graphics are also becoming
     popular.

o   Most of these products are very portable, but normally remain in a single location within the users facilities. Through the use of spooling high speed printers will soon be commonplace in the office. Word processing require the fastest printing possible and should be the first to incorporate these large printer systems.

o   With the advent of local area networks links to almost any output or storage device will become normal. Graphics can be transmitted to a copier or other graphic output device.

B.   TECHNOLOGIES USED

o   Disk and diskette drives are electro-mechanical devices that require adjustment and replacement. Some disk devices are being developed with a control or logic unit using technology similar to that found within the computers themselves. This allows the central processor to continue processing while information is being outputed or retrieved. As we move into multiprocessing in the PC marketplace this will become commonplace.

o   Printers are also electro-mechanical devices requiring adjustment and parts replacement, but also need preventative maintenance periodically. They also are being connected to control units to allow multiusers.

o   Daisy wheel print elements are used in many letter quality printers. These provide high quality output but are very slow.

C.   TECHNICAL SKILLS REQUIRED

o   A strong electro-mechanical background with an understanding of timing relationships is necessary. In most cases this is a talent people develop through experience.

o   Training is conducted in a lab environment having the students perform disassembly and assembly as well as adjustments.

o   The field engineers hired should work on all office products. The skills necessary for handling the complete personal computer and workstation line are common to the needs for peripheral maintenance.

o   Trade schools and comaputer distributors are a good source of employees as well as previously experienced FEs.

D.   ORGANIZATION AND SET UP COSTS

o   In the office product area of the systems business, peripherals are treated as part of the system. It is not like the large system sector where users accept two groups supporting their products. All the organizational costs for supporting peripherals were included in system cost estimates.

E.   PRICE FOR MAINTENANCE

o   The maintenance price for printers vary depending on their size and function. On word processors they can run from $29 to $65 a month.

EXHIBIT IX-1

MAINTENANCE PRICING OF SELECTED VENDORS OF TAPE AND DISK DRIVES

VENDOR	MODEL NUMBER	PRODUCT DESCRIPTION	FIRST SHIPPED	PURCHASE PRICE	MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
Honeywell	MTU 0610	Tape	1980	$21,000	122	7.0
Honeywell	MSU 0501	Disk	1979	49,650	197	4.8
CDC	858/11	Disk	1980	59,900	166	3.3
CDC	679-6	Tape	1978	31,540	134	5.1
STC	3670	Tape	1974	26,312	343	15.6
STC	8650 A2	Disk	1979	60,880	251	5.0
IBM	3370 A1	Disk	1978	29,550	94.50	3.8
Univac	8470	Disk	1979	87,200	327	4.5

EXHIBIT IX-2

MAINTENANCE PRICING OF SELECTED VENDORS OF FAST PRINTERS

VENDOR	MODEL NUMBER	PRODUCT DESCRIPTION	FIRST SHIPPED	PURCHASE PRICE	MONTHLY MAINTENANCE CHARGE	ANNUAL MAINTENANCE AS PERCENT OF PURCHASE PRICE
IBM	1403 NI	1100 lpm	1978	$ 40,040	625	18.7
IBM	3800	Up To 20,040 lpm	1978	373,150	938	3.0
CDC	580/200	2000 lpm	1977	91,956	797	10.4
Honeywell	PPS II/E	18,000 lpm	1981	240,745	1,697	8.5
Honeywell	PRU 1600	1600 lpm	1974	$ 64,940	1,538	28.4

o   Diskettes are normally included in the maintenance price for the system. The price varies depending on the model of personal computers. Diskettes are relatively high maintenance items. Hard disks are extremely reliable and require little service.

X   SOFTWARE MAINTENANCE

A.   PRODUCT CATEGORIES

o   The principal software product maintenance categories are as follows:

- System software (operating systems, languages, and utility software).

- Application software products from equipment vendor.

- Application software products from third party.

o   System software maintenance is increasingly billed as an additional line item on the hardware maintenance invoice and the function is being integrated into hardware support. As a result much of the market for this maintenance revenue is captive.

o   Application software maintenance is inadequately priced (at about 50% of what the market will bear). The range of software services available is also below what the market requires. However, the software maintenance revenue will increasingly be bundled into the hardware.

o   Third-party applications include custom developed software and application products from the software houses for hardware not of their own manufacture.

B.   SERVICE PRICING BY CATEGORY

o   There are no industry norms to guide vendors in setting software maintenance prices. This is indicated by the spread of maintenance changes being levied today: from 10% to 25% of the purchase price per annum. This normally covers on-site service, one shift, five days a week. There are rarely any extensions offered.

o   It is likely that this picture will not change rapidly but continue to evolve slowly (in a pattern reminiscent of hardware maintenance in the 1960s). The functions contained in software maintenance are also ill defined, as shown by Exhibit X-1, with many basic maintenance functions not included in the maintenance charge.

C.   TECHNOLOGIES USED

o   Not applicable to the majority of software products currently, but this is likely to chage as increasing amounts of systems software and application software are delivered in firmware. At that time it may be necessary to change the software board.

o   One other possibility is raised by the trend shown in Exhibit X-2. If most vendors are considering using telecommunications as the means to diagnose failures, then the possibility exists of downline loading software patches with no on-site visit.
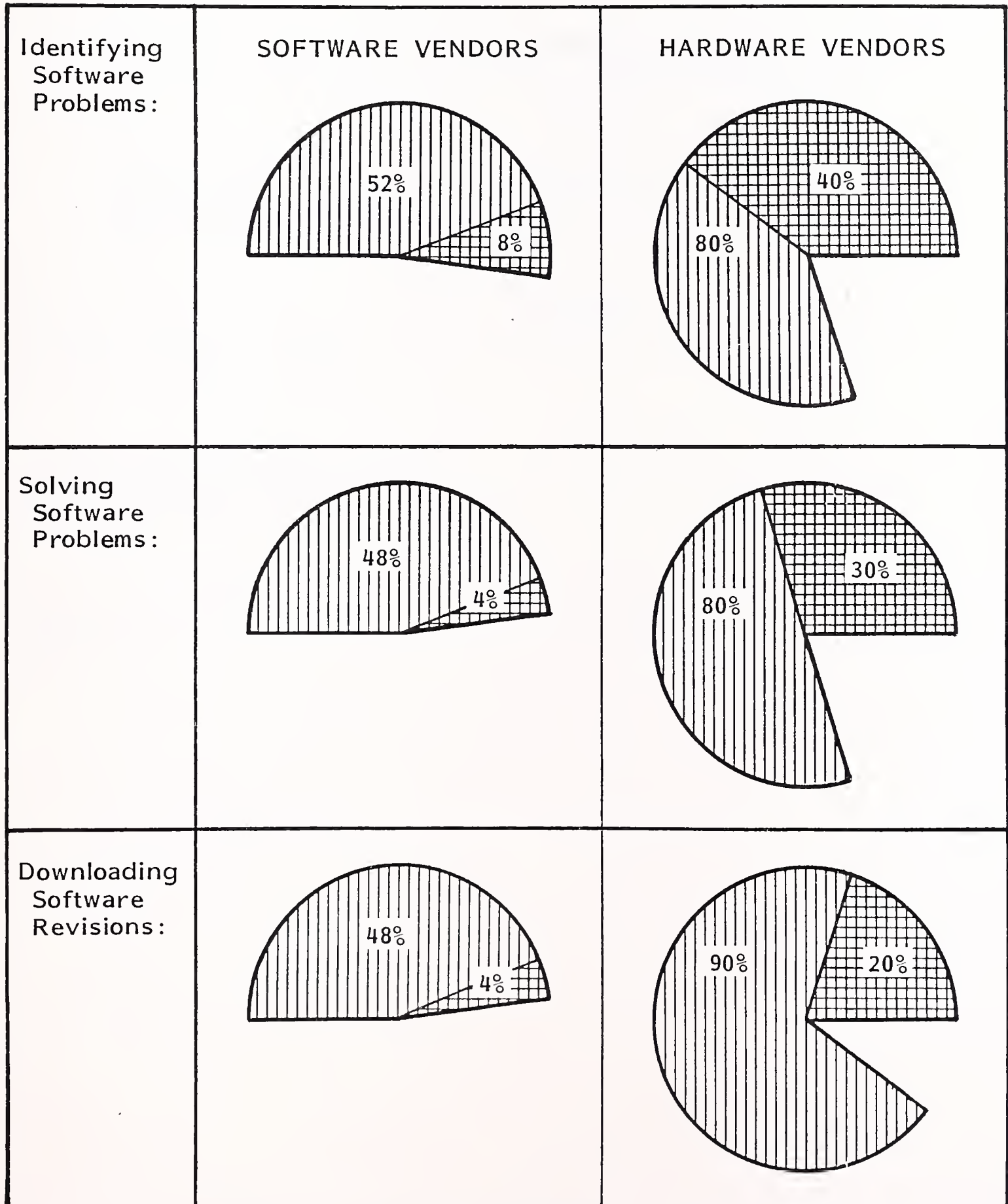
EXHIBIT X-1

FUNCTIONS INCLUDED IN VENDOR
MAINTENANCE SOFTWARE
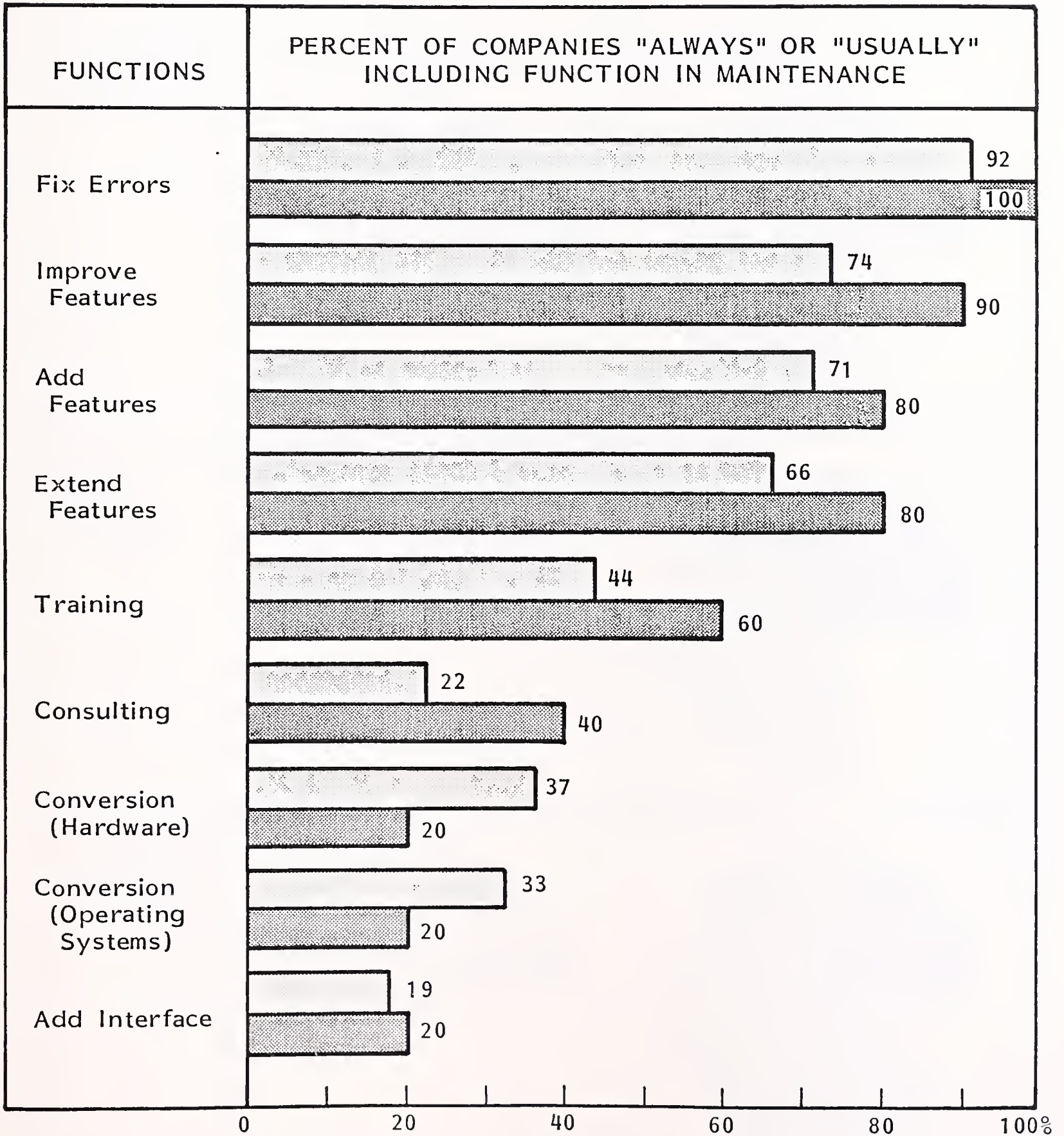
INPUT
FPS3

EXHIBIT X-2

PERCENT OF VENDORS USING AND PLANNING TO USE
TELECOMMUNICATIONS IN SOFTWARE MAINTENANCE

	SOFTWARE VENDORS	HARDWARE VENDORS
Identifying Software Problems:	52% / 8%	40% / 80%
Solving Software Problems:	48% / 4%	30% / 80%
Downloading Software Revisions:	48% / 4%	90% / 20%

▦ = Now   ▥ = Future   Note: Percents refer to vendor "always"
or "usually" using or planning to use

SOURCE: INPUT Survey

INPUT
FPS3

## D.   TECHNICIAN SKILLS NEEDED

o   The essential skills are once again divided into two groups:

        -       Support staff: to interface with the customer, define the problem and
                relate the failure to a given subset of the software system/product.

        -       Software engineers: to examine the code, make changes, test modified
                systems/products and deliver the changes to the support staff for
                distribution.

o   This is a replica of the kind of hardware maintenance organization that many
        vendors are moving forwards.

E.   ORGANIZATIONAL STRUCTURE

o   The typical software support organization in a hardware company is shown in
        Exhibit X-3.

EXHIBIT X-3

SOFTWARE FIELD SUPPORT ORGANIZATION
IN A TYPICAL HARDWARE COMPANY
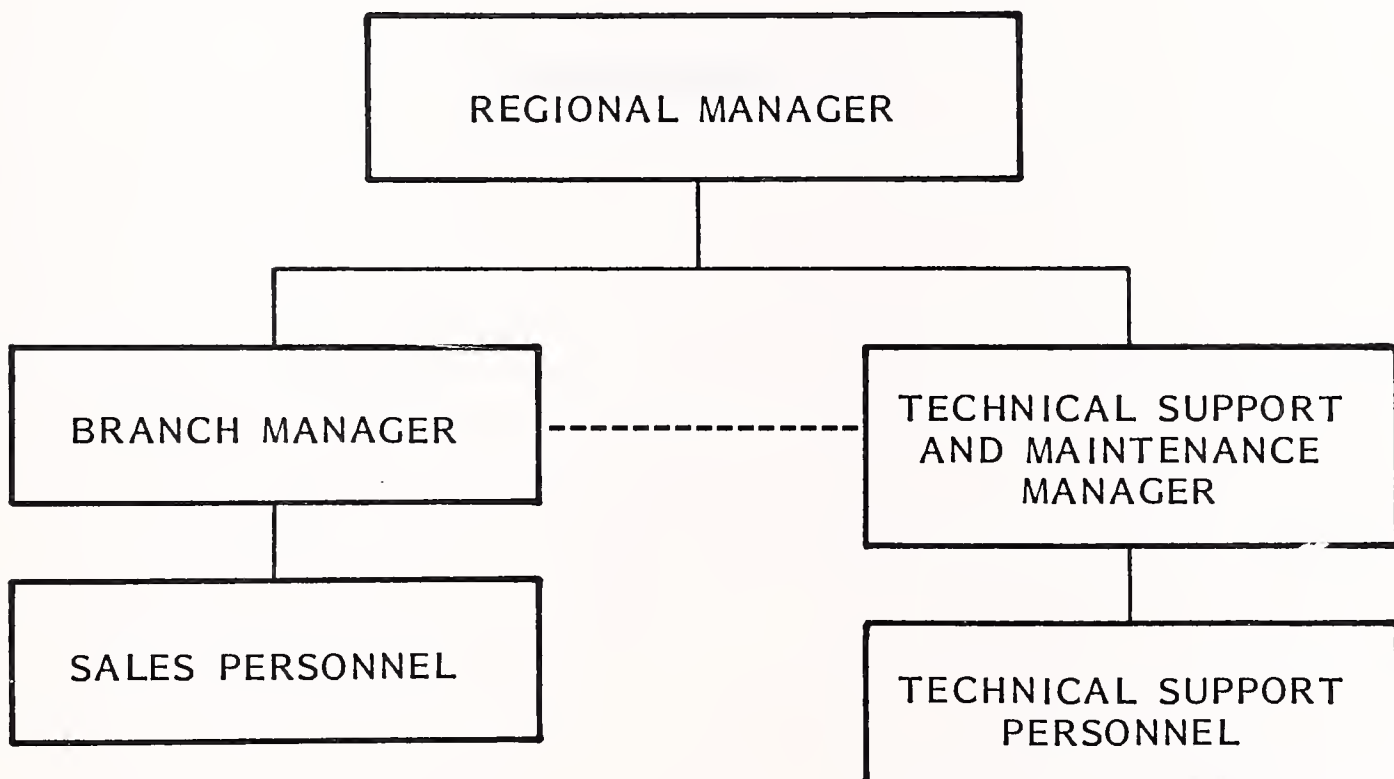
APPENDIX A

APPENDIX A

HOME COMPUTER REVENUES 1982–1987

1. REVENUE FORECAST $ Millions

		1982	1987	Percent AAGR
–	Hardware shipments	$ 1,200	$ 2,300	14%
–	Software sales	150	2,000	68
–	After-sales support	60	180	25
	TOTAL	$ 1,410	$ 4,480	26%

2. HARDWARE SUPPORT

		1982	1987	Percent AAGR
–	Maintenance	$ 10	$ 100	58%
–	Education	5	15	25
–	Over-the-counter parts	45	50	2
	TOTAL	$ 60	$ 165	22%

3. SOFTWARE SUPPORT

		1982	1987	Percent AAGR
–	Maintenance	*	$ 5	NA
–	Education	*	10	NA
–	Installation	*	*	NA
	TOTAL	*	$ 15	NA

*   Negligible

BUSINESS PC REVENUES 1982–1987

			1982	1987	Percent AAGR
1.	**REVENUE FORECAST**			$ Millions	
	-	Hardware shipments	$ 2,605	$ 6,340	19%
	-	Software sales	548	2,457	35
	-	After-sales support	375	1,250	28
		TOTAL	$ 3,528	$ 10,047	23%
2.	**HARDWARE SUPPORT**				
	-	Maintenance	$ 100	$ 400	32%
	-	Education	5	30	43
	-	Over-the-counter parts	260	750	24
		TOTAL	$ 365	$ 1,180	26%
3.	**SOFTWARE SUPPORT**				
	-	Maintenance	*	$ 20	NA
	-	Education	10	50	38
	-	Installation	*	*	NA
		TOTAL	$ 10	$ 70	48%

* Negligible

WORKSTATIONS REVENUES 1982-1987

I. REVENUE FORECAST		$ Millions	
	1982	1987	Percent AAGR
- Hardware shipments	$1,610	$5,980	30%
- Software sales	100	200	15
- After-sales support	185	695	30
TOTAL	$1,895	$6,605	28%
2. HARDWARE SUPPORT			
- Maintenance	$ 135	$ 500	30%
- Education	*	*	*
- Over-the-counter parts	40	140	28
TOTAL	$ 175	$ 640	29%
3. SOFTWARE SUPPORT			
- Maintenance	$ 10	$ 45	35%
- Education	*	5	NA
- Installation	*	5	NA
TOTAL	$ 10	$ 55	41%

* Negligible

MINICOMPUTER REVENUES 1982-1987

1. REVENUE FORECAST		$ Millions	
	1982	1987	Percent AAGR
- Small business system shipments	$ 2,585	$ 6,990	22%
- Minicomputer system shipments	5,580	17,000	25
- Software sales	1,630	6,000	30
- After-sales support	1,705	4,970	18
TOTAL	$ 11,500	$ 34,960	25%
2. HARDWARE SUPPORT			
- Maintenance	$ 1,220	$ 3,400	23%
- Education	25	75	25
- Over-the-counter parts	230	700	25
TOTAL	$ 1,475	$ 4,175	23%
3. SOFTWARE SUPPORT			
- Maintenance	$ 215	$ 740	28%
- Education	*	*	NA
- Installation	15	55	30
TOTAL	$ 230	$ 795	28%

* Negligible

DISPLAY REVENUES 1982–1987

1. <u>REVENUE FORECAST</u>   <u>$ Millions</u>

		1982	1987	Percent AAGR
-	Hardware shipments	$ 2,628	$ 7,700	24%
-	After-sales support.	735	2,156	24
	TOTAL	$ 3,363	$ 9,856	24%

2. <u>HARDWARE SUPPORT</u>

		1982	1987	Percent AAGR
-	Maintenance	$ 555	$ 1,574	23%
-	Education	(included in systems, when available)		
-	Over-the-counter parts	180	582	26
	TOTAL	$ 735	$ 2,156	24%

3. <u>SOFTWARE SUPPORT</u>

(none)

PRINTER/COPIER/PLOTTER REVENUES 1982-1987

1. REVENUE FORECAST

Shipments ($ millions)

		1982	1987	Percent AAGR
-	Printer	$ 2,950	$ 9,000	25%
-	Plotter	1,300	4,300	27
-	Copier	3,100	7,400	19
-	After-sales support	850	2,700	26
	TOTAL	$ 8,200	$ 23,400	23%

2. HARDWARE SUPPORT

		1982	1987	Percent AAGR
-	Maintenance	$ 680	$ 2,140	26%
-	Education	*	*	NA
-	Over-the-counter parts	170	560	27
	TOTAL	$ 850	$ 2,700	26%

*   Negligible

TYPEWRITERS/WORD PROCESSORS REVENUES 1982-1987

1. REVENUE FORECAST	$ Millions		
	1982	1987	Percent AAGR
- Hardware shipments	$3,712	$10,000	22%
- Software sales	30	140	35
- After-sales support	1,580	3,930	20
TOTAL	$5,322	$14,070	21%
2. HARDWARE SUPPORT			
- Maintenance	$1,440	$3,583	20%
- Education	10	27	22
- Over-the-counter parts	120	270	18
TOTAL	$1,570	$3,880	20%
3. SOFTWARE SUPPORT			
- Maintenance	$ 10	$ 45	35%
- Education	*	*	NA
- Installation	*	5	NA
TOTAL	$ 10	$ 50	38%

* Negligible

TELECOMMUNICATIONS EQUIPMENT REVENUES 1982-1987

1. <u>REVENUE FORECAST</u>   <u>$ Millions</u>

		1982	1987	Percent AAGR
-	Hardware shipments			
	• Digital data switches	$ 1,920	$ 3,700	14%
	• Front-end processors	725	1,460	15
	• Modems and couplers	525	1,200	18
	• Facsimile	205	415	15
	• Teleprinters	225	120	(12)
	• Earth stations	510	1,220	19
	• Other (LAN, protocol converters)	70	175	20
	TOTAL	$ 4,180	$ 8,290	15%

2. <u>HARDWARE SUPPORT</u>

		1982	1987	Percent AAGR
-	Maintenance	$ 360	$ 725	15%
-	Education	-	-	-
-	Over-the-counter parts	40	70	12
	TOTAL	$ 400	$ 795	15%

3. <u>SOFTWARE SUPPORT</u>

   - Usually counted in the system to which the telecommunications equipment is connected.

PERIPHERAL REVENUES 1982–1987

1. **SHIPMENTS** — $ Millions

		1982	1987	Percent AAGR
–	Back-end processors	$ 45	$ 650	70%
–	Floppy disk drives	2,300	6,400	23
–	Disk drives	3,800	10,300	22
–	Tape drives	2,100	5,200	20
–	After-sales support	1,290	2,950	18
	TOTAL	$ 9,535	$ 25,500	22%

2. **HARDWARE SUPPORT**

		1982	1987	
–	Maintenance	$ 1,090	$ 2,400	17%
–	Education	*	*	NA
–	Over-the-counter parts	200	550	22
	TOTAL	$ 1,290	$ 2,950	18%

3. **SOFTWARE SUPPORT**

(Negligible)

* Negligible