F-FS9

INPUT

FIELD SERVICE PLANNING INFORMATION PROGRAM

FIELD SERVICE BRIEF

SOFTWARE MAINTENANCE IN
FIELD SERVICE ORGANIZATIONS

FIELD SERVICE PLANNING INFORMATION PROGRAM

OBJECTIVE: To provide senior field service managers with basic information and data to support their planning and operational decisions.

DESCRIPTION: Clients of this program receive the following services each year:

- Field Service Briefs - Six reports which analyze important new technical and management issues within the field service areas. Reports focus attention by senior managem
- Major Pl sent an in-depth analysis or management issue tha y alternatives in the plann
- Annual P ities in the field services he major trends and thei ervice planning. Forecast nd management changes requirements of users of
- Annual nnual in-house presenta e results of the previous the strategic guideline year. These presenta
- Consultir research staff on an as- its.

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Smith, Walter
AUTHOR
Software Maintenance in Field Service Organizations. 12/80

RESEARCH METHOD: in computers, communications and as

- Research ions with client represent
- Research ews with users, vendors, lysts.
- Conclusic e judgement of INPUT's s
- Professional staff supporting this program have 20 or more years of experience in data processing and communications, including senior management positions with major vendors and users.

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DECEMBER 1980

SOFTWARE MAINTENANCE IN FIELD SERVICE ORGANIZATIONS

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SOFTWARE MAINTENANCE IN FIELD SERVICE ORGANIZATIONS

LIST OF EXHIBITS

I INTRODUCTION

A. SCOPE

- This brief is published as part of INPUT's 1980 Field Service Program.

- The issue was selected in response to continued client interest in software maintenance.

- In the 1979 Field Service Program, INPUT published an issue report titled "Software Maintenance," which was based on a series of vendor interviews aimed at determining current procedures for handling maintenance of software. The material in the 1979 report is still relevant, and readers may want to refer to it for a vendor profile of the state of software maintenance within 26 field service organizations.

- The focus of this current brief is on two issues that were not treated in depth in the 1979 report:

  - What are the organizational alternatives related to software maintenance?

  - What are the considerations inherent in training current hardware FEs in software maintenance techniques?

- These issues relate to work done by INPUT since the 1979 study.

B. HISTORY OF SOFTWARE MAINTENANCE

- Systems software, that software that enables the computer/communications system to perform basic functions, is usually maintained by the vendor.

- The maintenance of applications software, that software that performs processing to serve user functions, is usually written and maintained by the user.

- The continued shortage of programming personnel is building pressures for vendors to become involved in the maintenance of both systems and applications software.

- Within vendor companies, the responsibility for software maintenance varies, with field service, marketing and/or research and development having either total or partial responsibility.

  - The use of the Program Support Representative (PSR) to provide high-quality on-site support is being impacted by remote diagnostics and support centers.

  - Remote diagnostics, coupled with the introduction of more reliable equipment, is also impacting the on-site hardware FE.

  - These forces combine to make a rethinking of the organizational and personnel aspects of software maintenance particularly timely.

II EXECUTIVE SUMMARY

A. THE INCREASING IMPORTANCE OF SOFTWARE MAINTENANCE IN FIELD SERVICE

- Software maintenance will be an increasingly important part of field service revenues in the 1980s.

  - INPUT estimates that software maintenance revenues in the U.S. in 1980 will be $325 million, slightly over 5% of the $6.4 billion in total maintenance revenues.

  - Software maintenance revenues are growing at 30% per year, however, compared to 15% for hardware maintenance revenues, and will represent 10% of total maintenance revenues by 1985. Field Service organizations that participate in software maintenance can experience above-average growth.

- Actual software maintenance revenue growth will be highly dependent on actions taken by field service management.

  - Unbundling of software maintenance, as was done by IBM as part of the 1979 announcement of the 4300 series and continued in the recent H-Series announcement, will accelerate growth.

- Willingness to take on the task of software maintenance from other parts of the company, or from the users themselves, will enlarge the market.

- Design of new products that include software to be vendor-maintained will be the ultimate determinant of market size and growth.

B. DRIVING FORCES

- Concurrent with the growth of software maintenance is a trend toward centralization. Software lends itself to maintenance from support centers rather than on-site maintenance. According to recent surveys, two-thirds of software problem calls typically can be resolved without an on-site FE.

  - With regard to hardware maintenance, more reliable hardware, modular versus component-level replacement, and reduced reliance on preventive maintenance are all tending to reduce on-site hardware maintenance.

  - For smaller equipment, particularly terminals, depot maintenance and user self-maintenance are eroding the growth of on-site maintenance.

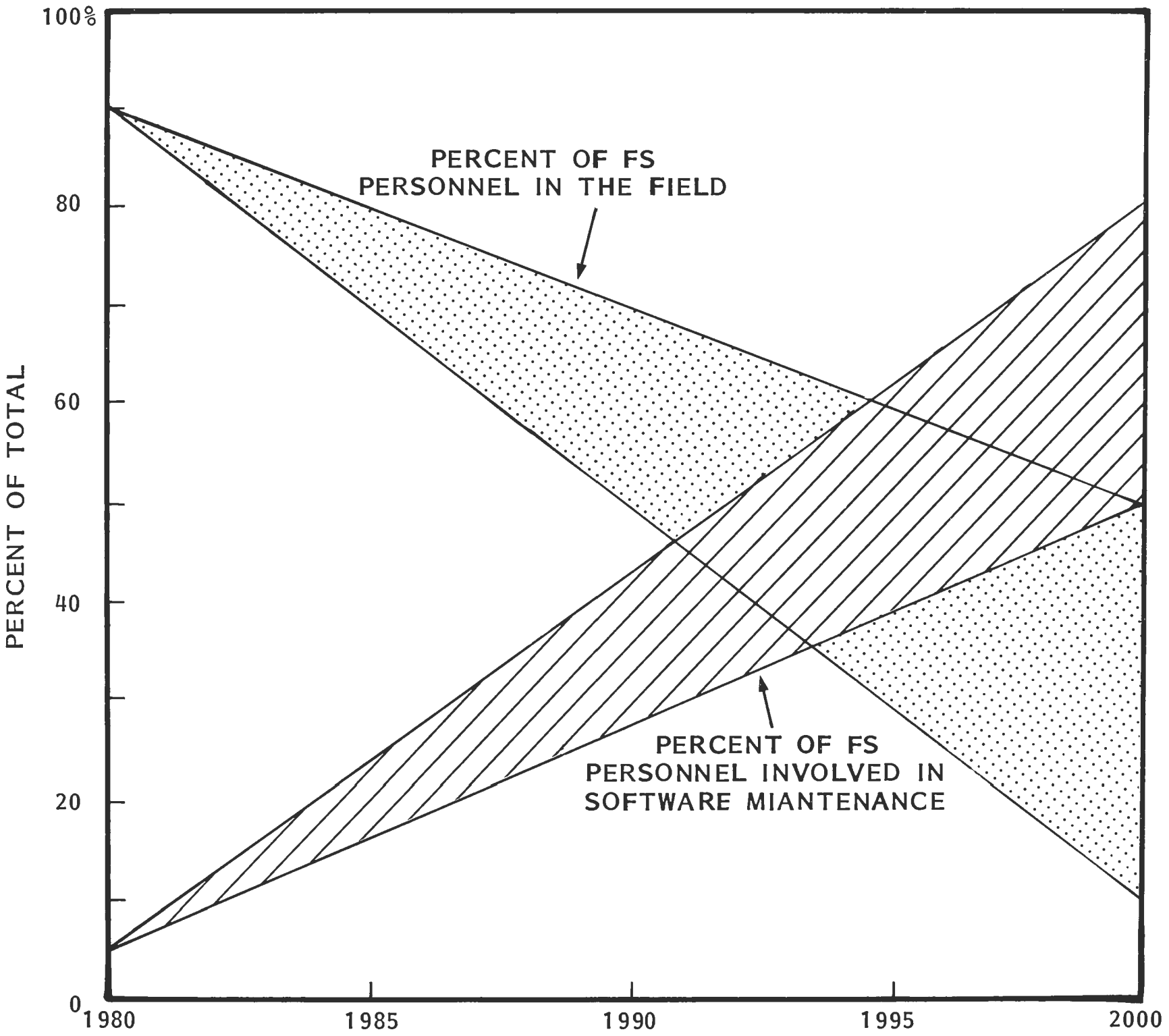
- The combined effect of the shift to software maintenance and to centralization of some hardware maintenance is shown graphically in Exhibit II-1.

  - The shaded areas represent uncertainty concerning the rate of change. Actual rates will depend largely on the structure of new product announcements in the early 1980s.

  - The exhibit does show, however, that 50% of the field service force may be involved by 1990 either in software maintenance or in a centralized function.

EXHIBIT II-1

SHIFT FROM HARDWARE TO SOFTWARE MAINTENANCE
AND FROM FIELD TO CENTRALIZED ORGANIZATION



NOTE: THE SHADED AREAS REPRESENT THE APPROXIMATE DEGREE OF UNCERTAINTY IN THE FORECASTS.

- Other forces driving the growth of software maintenance are:

  - A growing shortage of programmers. INPUT estimates a 25% shortfall in the mid-1980s.

  - A shift from centralized data processing to distributed data processing. This means that many users at distributed sites will not have the programming support typically available at the central site.

  - The shift in research and development funds from hardware to software. Software is widely recognized as the competitive edge in the 1980s, and new products will tend to have a higher software component.

C. THE PERSONNEL ISSUE

- As INPUT pointed out in the 1980 Field Services Annual Report, there is a significant shift in skill levels required by on-site FEs.

  - On-site FEs are losing position as more reliable hardware and remote diagnostics remove many problem determination and repair functions.

  - Large, central site-oriented mainframe companies have already reached a stage where FE growth has declined to the 0-5% per year range, based on INPUT's 1979 vendor survey.

- An opportunity lies in cross-training some existing hardware FEs in software maintenance.

  - This could serve to enhance the FEs' job skills to offset the current declines mentioned above.

- This could add a dimension to an FE's career path as an alternative to entering management.

- This would reduce management's reliance on other sources of software expertise. INPUT surveys reveal that the three most prevalent means to obtain software expertise now are:

  . Hiring from users.

  . Training new employees.

  . Recruiting from competition.

- Traditionally, hardware and software have drawn from separate personnel sources. The increasing overlap of hardware and software in new products makes a blind continuation of this separation unrealistic.

  - A prime example of overlap is the computer-aided design, computer-aided manufacturing marketplace. CAD/CAM systems, selling for $100,000 to $500,000 per installation, are marketed as a totally combined hardware/software package in a market growing at 50% per year.

  - New products will combine hardware and software, which raises the opportunity for field service to accelerate this trend by developing people who can deal in both areas.

- Cross-training of hardware FEs in software techniques requires several cautions:

  - Some FEs undoubtedly do not have the capability to maintain software. This can be determined on an individual basis by testing.

- The cost of training is significant. Costs are discussed in later sections of this brief.

- Cross-training of management will also be necessary. The payoff in this training is the removal of the cost of both a hardware and a software maintenance management organization.

- FEs trained in software will be even more likely to be approached by competition looking for software capability. This danger can be reduced by structuring the training so that capabilities are tailored to specific programs and products, and remain ungeneralized, so that the FE is not immediately attractive to another employer.

D. SOFTWARE MAINTENANCE IN THE ORGANIZATION

- Because software is increasingly the key element in the hardware selling process, software capability is often attached to the sales or marketing function.

- Because software is by nature dynamic and constantly undergoing change, some or all of the software maintenance responsibility is sometimes attached to the research and development activity.

- As software becomes more integrated in new products (sometimes as firmware), manufacturing becomes involved. The complexity of the organizational issue is presented in overview form in Exhibit II-2.

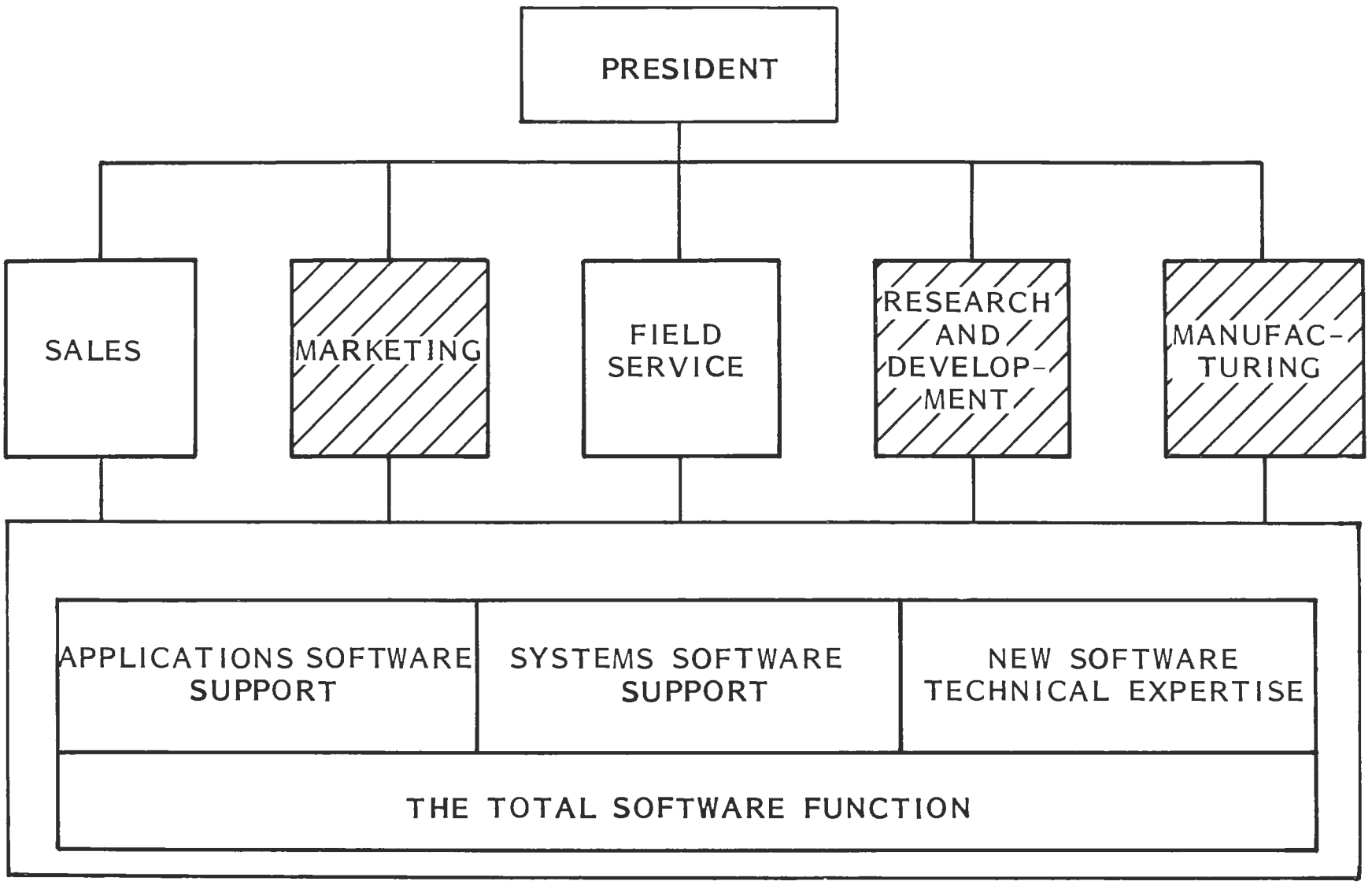
  - Marketing (and sales) often dominate applications software.

  - Field service often maintains systems software.

  - Research and development is the center of new software development.

EXHIBIT II-2

THE CRITICAL ROLE OF SOFTWARE IN COMPANY ORGANIZATION



☒ TYPICALLY CENTRALIZED

☐ TYPICALLY FIELD-ORIENTED

NOTE: NOT SHOWN IS THE ADMINISTRATIVE FUNCTION. THIS FUNCTION ALSO PARTICIPATES IN THE SOFTWARE MAINTENANCE FUNCTION IN DEFINING THE ALLOCATION OF COSTS AND REVENUES, WHICH CAN BE CRITICAL TO FIELD SERVICE FUNCTIONING AS A PROFIT CENTER.

- Field service management must clearly understand the organizational dynamics of their own company in order to develop an optimum mix of field service revenue and profit growth.

- As field service becomes more centralized, it will be better able to compete for influence on product and pricing decisions with the traditionally centralized functions of marketing, manufacturing and research and development.

E. RECOMMENDATIONS

- Field service management must develop a plan for participation in software maintenance which recognizes its unique technical, management, personnel and growth characteristics.

- Current field service hardware maintenance personnel should be considered for cross-training in software, even though this often will be expensive in terms of short-term management and financial resources.

- The trend toward centralization of maintenance, particularly for software, must be recognized as a basic organizational factor and potential source of cost saving.

III THE GROWING IMPORTANCE OF SOFTWARE MAINTENANCE

A. SOFTWARE MAINTENANCE PRICING IS INCREASING

- Companies providing software maintenance have established pricing structures that may or may not bundle maintenance into the purchase or lease price of the software.

  - Companies using unbundled pricing strategies on purchased software typically have priced annual maintenance charges at approximately 10% of the software purchase price.

  - Charges for software maintenance on leased products are less definitive and range between 10% and 20% of the monthly lease rate.

- A most significant development was the IBM 4300 announcement in 1979, which included unbundling of software maintenance.

- Monthly maintenance charges on IBM products vary considerably, but are above the traditional levels. Exhibit III-1 illustrates typical prices and software maintenance charges on the IBM 4300 Series.

  - Monthly charges for maintenance as a percent of software costs average 25.6%. Charges for maintenance involving additional locations averages 15.4%, but on these additional locations the user has the

EXHIBIT III-1

TYPICAL PRICES AND SOFTWARE MAINTENANCE CHARGES
ON THE IBM 4300 SERIES

PROGRAM	MONTHLY CHARGE FOR SOFTWARE*	MAINTENANCE PRICE PER MONTH**	MONTHLY CHARGE FOR MAINTENANCE AS PERCENT OF SOFTWARE COST	MONTHLY CHARGE FOR MAINTENANCE INVOLVING ADDITIONAL SITES
VSE/ADVANCED FUNCTIONS RELIABILITY 1 AND 2	$143	$48	33%	$28
VSE/INTERACTIVE PROBLEM CONTROL SUPPORT	27	5	17	3
DISPLAY MANAGEMENT SYSTEMS/CMS	22	7	32	4
DB/DC DATA DICTIONARY FOR DOS/VS	253	66	26	39
DOS/VS COBOL LIBRARY	25	5	20	3

TIME AND MATERIAL CHARGES: $97/HOUR PRIME TIME, $112/HOUR OTHER TIMES.
*INCLUDES ACCESS TO THE SUPPORT CENTER FOR TELEPHONE CONTACT.
**FOR ON-SITE SUPPORT IF THE PROBLEM IS NOT RESOLVED BY THE SUPPORT CENTER.

responsibility to consolidate the maintenance inquiries within the prime location.

- The key point is that IBM is increasing the traditional price levels for software maintenance.

B. FE REVENUES ARE BECOMING MORE DEPENDENT ON SOFTWARE

- Total maintenance revenues were $5.5 billion in 1979 and will increase at an average annual growth rate (AAGR) of 15% over the forecasted period to $13.2 billion by 1985, according to current INPUT estimates.

- The portion of total revenues which are from software maintenance is difficult to determine.

  - Most companies allocate total revenues between hardware and software groups on the basis of an internally generated ratio, for example, 25% for software.

  - INPUT estimates that currently only approximately 5% of total industry revenues are for software maintenance, as shown in Exhibit III-2.

  - IBM may account for up to 40% of current software maintenance revenues.

- The growth rate of software maintenance revenues, however, far exceeds the growth rate of hardware maintenance revenues.

  - INPUT surveys of the software industry (companies like CINCOM Systems, Software AG, MSA, etc.) show an annual growth rate of 30%.

  - IBM's aggressive actions in software further feed this growth.

EXHIBIT III-2

SOFTWARE/HARDWARE MAINTENANCE
REVENUE FORECAST, 1979-1985

CATEGORY	1979 ($ MILLION)	1980 ($ MILLION)	1985 ($ MILLION)	AVERAGE ANNUAL GROWTH RATE
SOFTWARE MAINTENANCE	$ 250	$ 325	$ 1,200	30%
HARDWARE MAINTENANCE	5,250	6,075	12,000	
SOFTWARE REVENUE AS A PERCENT OF HARDWARE REVENUE	4.8%	5.3%	10%	
COMBINED TOTAL	$5,500	$6,400	$13,200	15%

- As shown on Exhibit III-2, the percent of software maintenance will reach 10% of total maintenance revenues by 1985.

- Clearly, software maintenance is a key for companies wanting to grow.

IV PERSONNEL AND TRAINING

A. ATTITUDES OF MANAGEMENT

- The fact that software maintenance is growing in importance creates a problem in many field service organizations.

- There is a general reluctance on the part of field service managers to migrate into software maintenance due to several reasons:

  - A lack of knowledge about software.

  - Field service personnel are in short supply today, and adding a software capability only aggravates the problem.

  - Field service companies maintaining hardware are experiencing annual attritions, in some cases 20% or more. There is fear that the problem is even worse with software people.

  - Vendors who are short of qualified people can take the attitude, "I can't handle our present work load, why should I take on any more work?"

- Related to the shortage of personnel is the fact that software-trained people earn higher salaries than hardware-trained people.

- A qualified FE often earns $10,000 less per year than a qualified programmer.

- Service managers fear increased recruiting of their hardware-trained personnel if their attractiveness is increased by adding a software capability.

- There is also often an emotional conflict:

  - Generally, field engineers are looked upon as second-class citizens when compared to programmers.

  - Field service engineers perceive management careers as their only avenue of advancement, while programmers often prefer to develop their technical expertise.

  - Field service personnel believe programmers have the easier road; i.e., they work fewer hours, have less pressure, and earn more money.

B. AVAILABILITY OF SOFTWARE PEOPLE

- The increasing demand for software-trained people comes from two primary forces:

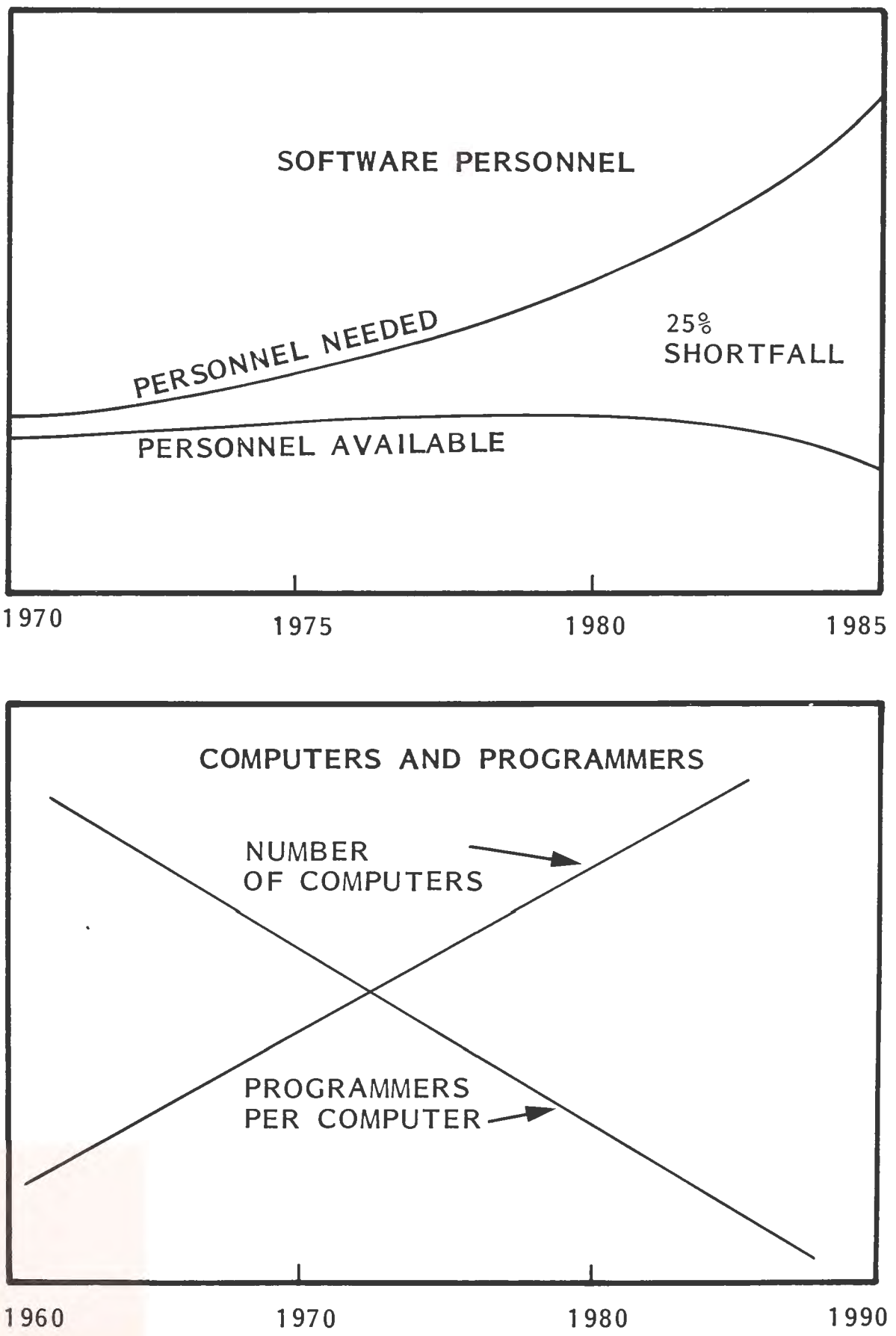
  - The increasing demand for special software for new applications.

  - The continued growth in the number of computer sites.

  - This leads to a situation shown conceptually in Exhibit IV-1. In the 1980s, the shortfall of programmers will increase, and the number of programmers per computer will decline.

EXHIBIT IV-1

IMPACT OF THE SHORTAGE OF SOFTWARE PERSONNEL
AND THE INCREASING NUMBER OF COMPUTERS



- The latter fact in particular provides an opportunity for software maintenance services, because the personnel simply are not available to do the maintenance job in-house.

C. TRAINING

- The issue of combining software and hardware maintenance is controversial among users and vendors. For reasons stated earlier, software capability can be a major contributor to growth, and yet many managers are hesitant to become deeply involved.

  - Instructors are usually hardware-oriented, with little or no formal education in software training techniques.

  - Field service companies have done little long-range planning to establish future software training programs.

  - Careful planning and recognition of software training techniques are an essential first step in the process.

D. THE EDUCATION PROCESS

- The education process of developing individuals in software must be accomplished in building-block fashion. There are no short cuts.

- The following paragraphs will examine four key elements in the process of developing software maintenance capability:

  - Planning process.

- Methodology.

- Timing.

- Cost analysis.

I. PLANNING PROCESS

- Planning starts with a definition of the software skills which must reside in the field engineering force. For some vendors this will involve skills unique to their own products. For others, particularly those involved in IBM-compatible products, IBM-type training is appropriate.

  - Exhibit IV-2 provides a format for training people in levels of IBM programming.

  - Each individual should understand entry-level programming, which offers the following:

    . Fundamentals of programming knowledge.

    . The opportunity for the individual to determine whether he or she has a general interest in programming.

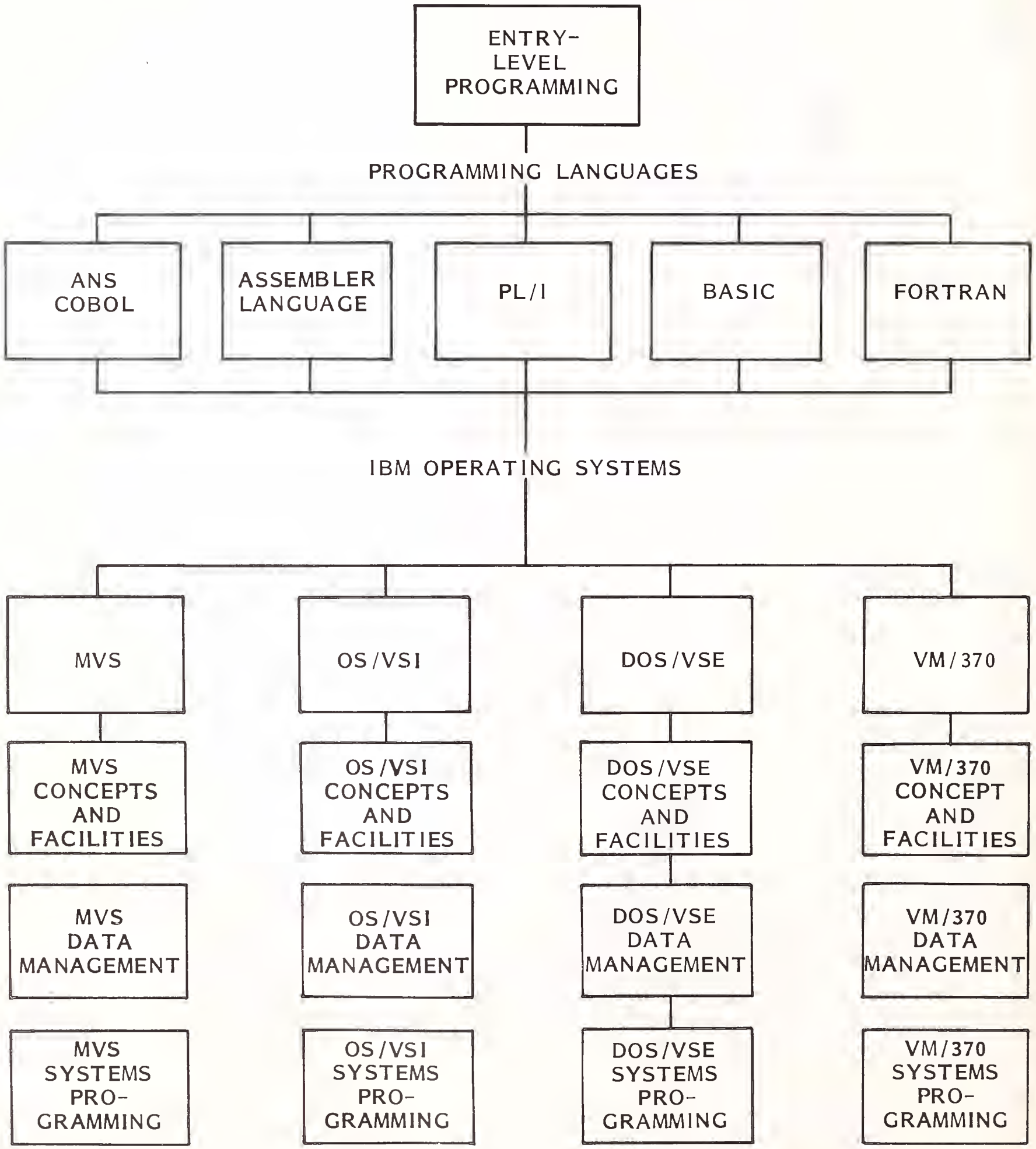
    . The opportunity for management to determine whether employees are capable of proceeding further.

    . Beginning of career paths.

  - Programming languages (Basic, Fortran, Pascal, etc.) can now be selected. Due to the simplicity of these languages, some programmers are capable of being proficient in more than one language.

EXHIBIT IV-2

TYPICAL SEQUENCE OF PROGRAMMING COURSES



- As with training for hardware maintenance, each vendor will have to select the elements that best fit its own product mix. In the following sections, IBM software is used as an example.

2. METHODOLOGY

- There are three commonly used methods presently being offered to teach programming:

  - Independent study programs (ISPs).

  - Video tape programs.

  - Stand-up lectures.

- Many educational companies and users believe that computer-aided instruction (CAI) is the teaching wave of the future.

  - CAI is an application program that provides training via a terminal.

  - IBM presently offers a CAI system called Interactive Instructional System, which operates in OS/VS, DOS/VS, and VM/370 environments with one of the following facilities:

OS/VS	DOS/VS	VM/370
IMS/VS	CICS/VS	CMS
CICS/VS	VTAM	
TSO		
TCAM		
VTAM		

  - Programs at this time are limited to very basic programming and operations functions.

- Other vendors such as CDC offer alternative CAI programs.

- Companies offering ISPs, such as IBM, Deltak and ASI, provide an economic means for educating students in the basics of programming.

- Video tape programs, while initially more costly than ISP, may be re-used, thereby reducing education cost when multiple people are trained. Deltak is a leader in offering video programs.

- Stand-up lectures, while typically the most costly means of education, are often the most effective.

  - While IBM remains the giant in tutorial education, companies such as Boeing Computer Services and Advanced Educational Systems (AES) provide users with effective and flexible lecture training alternatives.

  - Major universities generally do not teach systems programming; they offer courses in entry-level programming and programming languages.

  - Exhibit IV-3 compares the advantages and disadvantages of educational methods.

3. TIMING

- Determining the amount of time necessary for the education process is a major task in itself.

  - Course length varies depending on the selected teaching method; i.e., ISP, video, lecture, etc.

  - Length of courses for each programming language will vary with the complexity of the language.

EXHIBIT IV-3

ANALYSIS OF METHODS OF DELIVERY OF EDUCATION

ATTRIBUTE OF METHOD	DELIVERY VEHICLE			
	ISP	VIDEO	LEC-TURE	UNI-VERSITY
IN-HOUSE EDUCATION	X	X	X	
SCHEDULING FLEXIBILITY	X	X	X	
TAILORED SUBJECT MATTER			X	
CURRENT TECHNOLOGY	X	X	X	X
CAREER PATH PLANNING			X	X
PERSONALIZED ATTENTION			X	X
REUSABLE TEXT		X		
CPU EXERCISES			X	X
COURSE AVAILABLE FOR PURCHASE	X	X	X	
WORK AT OWN RATE	X	X		
VISUAL EFFECTS		X	X	X
PEER GROUP INTER-RELATIONSHIP			X	X
EDUCATION CONSULTATION			X	X

NOTE: NOT ALL COMPANIES OR UNIVERSITIES OFFER EXACTLY THE SAME PROGRAMS. THERE ARE EXCEPTIONS, AND THE ABOVE CHART THEREFORE DESCRIBES TYPICAL, RATHER THAN EXACT, ATTRIBUTES.

ISP = INDIVIDUAL STUDY PROGRAMS

- Courses offered by various companies and universities will vary depending on course content and depth.

- Exhibit IV-4 presents an average of education person days necessary for a cross-section of programs.

4. COST ANALYSIS

- The computation of cost statistics for software education is complex due to numerous variables.

  - While on the surface, ISP and video appear to cost less than stand-up lectures, they take two to three times as long to complete.

  - End results may be accomplished by a mixture of media; i.e., ISP, video and stand-up lectures could be used to move from a beginner level to a system programmer level.

  - The number of people to be trained must be considered. The cost per student decreases when multiple students can use the same teaching medium.

- Typical costs vary widely.

  - The cost of an ISP may range from as little as $25 to as much as $700, depending upon content and length.

  - Video programs range from as little as $500 up to $7,000 for similar reasons. In addition to the cost of video programs, the user must keep in mind that equipment necessary to use this medium must be purchased or leased, which adds to the cost.

EXHIBIT IV-4

PERSON DAYS REQUIRED FOR TRAINING
IN TYPICAL PROGRAMS

PROGRAM	AVERAGE DURATION OF TRAINING (PERSON DAYS)
ENTRY-LEVEL PROGRAMMING	20
PROGRAMMING LANGUAGES	
ANS COBOL	13
FORTRAN IV	5
BASIC	3
PL/I	16
SYSTEM CONTROL PROGRAMS	
VM/370	40
MVS	73
DOS/VSE	34
OS/VS1	42

- Universities and community colleges offering programming languages range from $110 per semester to $165 per semester. Universities usually limit extension programs to basic languages.

- In-house lecture programs range from $5,000/week to $10,000/week, again depending on content, depth and source.

- The rate per student for classroom lecture at an educational vendor's site averages $150 per student day. Fees may range from as low as $90 per day to as high as $210 per day, primarily dependent upon the amount of CPU time involved.

- Exhibit IV-5 illustrates the cost of a series of courses. The exhibit assumes the student will start with entry-level programming and continue through either DOS/VSE systems programming or OS/VS1 systems programming using the planning process shown earlier in Exhibit IV-2.

  - Exhibit IV-5 assumes that all courses used will be those supplied by IBM at IBM's published rate per student.

  - Mixed media are used; e.g., self-study, video, lecture.

- Exhibit IV-5 also gives an indication of the cost to educate a student to varying levels of proficiency.

  - To attain procifiency in programming and debugging assembler language programs (a basic language of system programmers) costs $5,061. The cost would be less for simpler programs such as Basic.

  - For a student also becoming proficient in DOS/VSE systems programming, the course cost is $5,061 + $3,309 = $8,370.

EXHIBIT IV-5

TYPICAL COSTS OF IBM COURSES

ENTRY-LEVEL PROGRAMMING SUBJECT	DURATION	MEDIUM	COST*
Programming Fundamentals	35 Hrs.	Self-Study	$ 221
Assembler Language Coding	85 Hrs.	Video	3,225
Assembler Language Workshop	5 Days	Classroom	622
Macro Writing for Assembler	2 Days	Classroom	200
Assembler Coding Techniques	5 Hrs.	Video	793
		TOTAL COST	$5,061
DOS/VSE SYSTEMS PROGRAMMING			
Introduction to DOS/VSE	30 Hrs.	Self-Study	$ 11
DOS/VSE Systems Control	25 Hrs.	Self-Study	252
DOS/VSE POWER	10 Hrs.	Self-Study	154
VSAM Access Methods	25 Hrs.	Self-Study	276
VSAM Coding	15 Hrs.	Self-Study	390
SAM Coding	18 Hrs.	Self-Study	174
DOS/VSE Installation	30 Hrs.	Self-Study	150
VSE/VSAM Implementation	4 Days	Classroom	913
VSE Advanced Topics	5 Days	Classroom	500
DOS/VSE Problem Determination	3 Days	Classroom	489
		TOTAL COST	$3,309
OS/VS1 SYSTEMS PROGRAMMING			
OS JCL Coding	30 Hrs.	Video	$2,186
VSAM Access Methods	25 Hrs.	Self-Study	372
VSAM Application	2 Days	Lecture	275
VSAM Coding	14 Hrs.	Self-Study	390
VSAM System Progamming	3 Days	Lecture	525
OS/VS Assembler	5 Days	Lecture	943
OS/VS Multiprogramming	5 Days	Lecture	850
OS/VS1 System Programming	10 Days	Lecture	2,260
OS/VS1 Problem Determination	3 Days	Lecture	594
		TOTAL COST	$8,395

*COST DOES NOT INCLUDE TRAVEL AND RELATED EXPENSES FOR NON-LOCAL CLASSROOM COURSES. COSTS ASSUME ONLY ONE STUDENT PER VENDOR PER COURSE. FOR SELF-STUDY AND VIDEO COURSES, ADDITIONAL WORKBOOKS ARE AVAILABLE AT SMALL ADDITIONAL COST, THEREBY LOWERING THE AVERAGE COST PER STUDENT IF MORE THAN ONE STUDENT PER VENDOR ENROLLS.

- For a student becoming proficient in the larger and more complex systems represented by OS/VS1, the course cost is $5,061 + $8,395 = $13,456.

- If more than one student is trained, there are significant variables in the total cost per student. The more students trained, the lower the cost per student rate, as shown in the following example:

Cost for one student	$8,370/student
Less cost of reusable ISP and video materials for the courses shown	- $5,646
Equals incremental cost of classroom courses	$2,724/student
Plus additional cost of ISP and video workbooks (approximately 10%) used	$ 564
Total cost of each incremental student	$3,288

- The cost of training must be compared to the incremental revenue and profit potential of a software-trained FE in order to determine the optimum training method to use.

V ORGANIZATIONAL ASPECTS OF SOFTWARE MAINTENANCE

A. THE HARDWARE/SOFTWARE MAINTENANCE ORGANIZATION

- Most hardware and software maintenance organizations are virtually identical. Many vendors that supply both hardware and software maintenance have vacillated between placing both responsibilities under one entity or dividing them into separate and distinct divisions.

  - Of 26 companies interviewed by INPUT in 1979, 18 expected organizational changes. Two companies planned to combine hardware and software maintenance, and two planned to separate them.

  - Both typically use local or first-line personnel for initial problem determination, with centralized support as backup.

  - With its 4300 announcement, IBM implemented centralized support centers as the first line of support, with on-site support being the second-level (optional from a user viewpoint) line of support.

- In its 1979 study, INPUT found that 46% of software maintenance executives (among 26 companies) reported at the vice-presidential level, 46% at the director level, and 8% at the managerial level.

- Local and support management structures are almost identical for hardware and software.

- Justification for duplicate management structures seems to be: software managers don't know how to manage hardware personnel and hardware managers don't know how to manage software personnel. The cost of this duplicate management structure is difficult to justify as hardware and software increasingly overlap.

B. ORGANIZATIONAL NEEDS

- Potential problems are evidenced by the sequence of events that occurred recently at a plug compatible mainframe manufacturer.

  - It was determined that responsibility for software maintenance would be within the well-established field service organization.

  - Software maintenance personnel would be recruited and trained by field service, with increased maintenance rates offsetting additional costs.

  - Software maintenance personnel were responsible for support of program products, and for providing sales support.

- At the outset, sales were to be limited to large industrial areas. Reasons were:

  - Concentration of sales would limit costs through better utilization of software people.

  - Software people are more readily available in highly concentrated areas.

- Sales would have easy access to software personnel for sales support calls.

- Economic pressures forced sales plans to change. Equipment was installed wherever it could be sold.

- Since the service organization was organized as a profit center, the increased costs of supporting dispersed equipment were unacceptable.

  - Quality of software personnel declined due to an inability to fund adequate recruiting and training.

  - The final negative result was insufficient marketing support, which further hurt potential sales.

- At this point, there was universal support that software maintenance become its own entity.

  - The software maintenance organization was formed as a mirror image of the hardware field service organizaton.

  - Both organizations had principle executives reporting directly to the vice-president with overall responsibility for their specialty.

  - Because software maintenance was not unbundled, field service organization revenues were split, with 25% of all maintenance revenues allocated to the software maintenance organization.

  - In return, it was decided that field service would receive software maintenance support for problem determination.

- The actual outcome was negative.

  - Duplication of management caused costs to increase.

- Software maintenance had little control of rates; therefore it could not control its own destiny.

- The hardware service organization fell into "a second-class citizen" status. Software personnel preferred to work in the more glamorous marketing environment, rather than field service.

- Field service felt they were not receiving what they were paying for; i.e., 25% of revenue going to software support was felt to be excessive.

- Field service and sales were in competition for the same people, with some software people moving to sales.

- The conflicts that evolved came from the different organizational needs shown in Exhibit V-1.

- In this example, the company ceased operations with the conflicts unresolved. The lesson is plain, however. A separate organization for software maintenance can cause, as well as resolve, problems.

  - Both groups provide services to virtually the same user base within the organization.

  - Administrative costs in some cases are twice what they could and should be because of mirrored management structures.

  - Both can use centralized support groups, to some degree, to increase personnel availability and reduce costs.

C. CENTRALIZATION VERSUS DECENTRALIZATION

- A final organizational issue is that of centralization versus decentralization.

EXHIBIT V-1

DIFFERING ORGANIZATIONAL NEEDS FOR
THE SOFTWARE MAINTENANCE FUNCTION

FIELD SERVICE	SALES	EXECUTIVE MANAGEMENT
. Support for problem determination; e.g., is the problem hardware or software?	. Software support for sales calls.	. Increase corporate revenues.
. Additional means to increase revenues.	. Avenue for quick phone response for user questions.	. Provide full-support package to bolster sales activity.
. On-site and phone support for software-related problems.	. Company image to portray total service support to the user.	. Increase customer satisfaction.
. Good communications on potential hardware/ software-related problems.	. Accurate and quick communication on the effects of new software releases.	. Maintenance personnel can provide technical input to help shape future company growth.

- The trade-offs between centralization and decentralization are shown in Exhibit V-2.

- Centralization and decentralization concepts of software maintenance present advantages and disadvantages. Service organizations should optimize the advantages of both, depending on the needs and resources within the company.

  - By concentrating software expertise in centralized locations, and equipping on-site hardware personnel with adequate software expertise for routine maintenance, field service organizations can capture some of the "best of both worlds."

  - The challenge is to find the balance of management techniques, training and people to deal in the often divergent environments of hardware and software.

EXHIBIT V-2

CENTRALIZATION VERSUS DECENTRALIZATION OF SOFTWARE MAINTENANCE

	ADVANTAGES	DISADVANTAGES
DECENTRALIZATION (PERSONNEL IN THE FIELD)	. Good response to user problems. . Installation support and maintenance readily available. . Increased customer contact. . More personnel available for marketing support	. Requires more software personnel. . Decreases communication among personnel regarding new problems. . Increases operating costs. . Increases training costs. . Less control due to arm's-length management.
CENTRALIZATION (PERSONNEL IN SUPPORT CENTERS)	. Good control of software modifications. . Reduced operating costs. . Phone assistance readily available. . Close interaction for problem determination among highly skilled people. . Better control of system library functions.	. Longer lead times for on-site support. . Less personal user contact. . Users often must assume more responsibility for problem determination, something they tend to resist.

SUBSCRIPTION PROGRAMS: Designed for clients with a continuing need for information about a range of subjects in a given area. All subscription programs are fixed fee and run on a calendar year basis:

- Planning Service for Computer & Communications Users - Provides managers of large computer/communications facilities with timely and accurate information on developments which affect today's decisions and plans for the future.

- Small Establishments Service - Analyzes and forecasts small establishments' (<500 employees) use of office, communication, and computer services and products. Applications requirements and economics are emphasized.

- Computer Services Market Analysis Service - Provides market forecasts and business information to software and processing services companies to support planning and product decisions.

- Computer Services Company Analysis and Monitoring Program - Provides immediate access to detailed information on over 2,000 companies offering software and processing services in the U.S. and Europe.

- Field Service Planning Information Program - Provides senior field service managers with basic information and data to support their planning and operational decisions.

MULTICLIENT STUDIES: Research shared by a group of sponsors on topics for which there is a need for in-depth "one-time" information. A multiclient study typically has a budget of over $100,000, yet the cost to an individual client is usually less than $10,000. Recent studies specified by clients include:

- Maintenance Requirements For The Information Processing Industry

- Value Added Network Services

- IBM Series/1 Analysis

CUSTOM STUDIES: Custom studies are proprietary to a client. Fees typically range from $10,000 to over $50,000 and are a function of the extent of the research work. Examples of recent assignments include:

- Survey Fortune 500/50 companies to determine plans for distributed data processing.

- Compare the internal charges for EDP services in a large company to those of commercially available services.

- Determine the market potential for an associative Relational Data Base Management System Processor.

- Conduct the 1979 ADAPSO Survey of the Computer Services Industry.

- Analyze the opportunities and problems associated with packaging terminals and/or minicomputers with remote computing services.

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THE COMPANY

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

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