ISP

Future Skills Requirements for Software Development

INPUT®

FUTURE SKILLS REQUIREMENTS FOR SOFTWARE DEVELOPMENT

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ABSTRACT

This report identifies the changing skills mix requirements of the corporate information systems function brought about by the innovations in systems design and development.

The advent of the information center and end-user-developed systems is demanding new skills from IS. The phenomenon of end-user computing is analyzed, and the skills implications are uncovered. Many of the latest productivity schemes are looked at to determine the impact the new methods are having on the skills mix of IS professionals. Recommendations for staffing and recruiting are included, along with analyses of desirable applicants and possible sources of new skills.

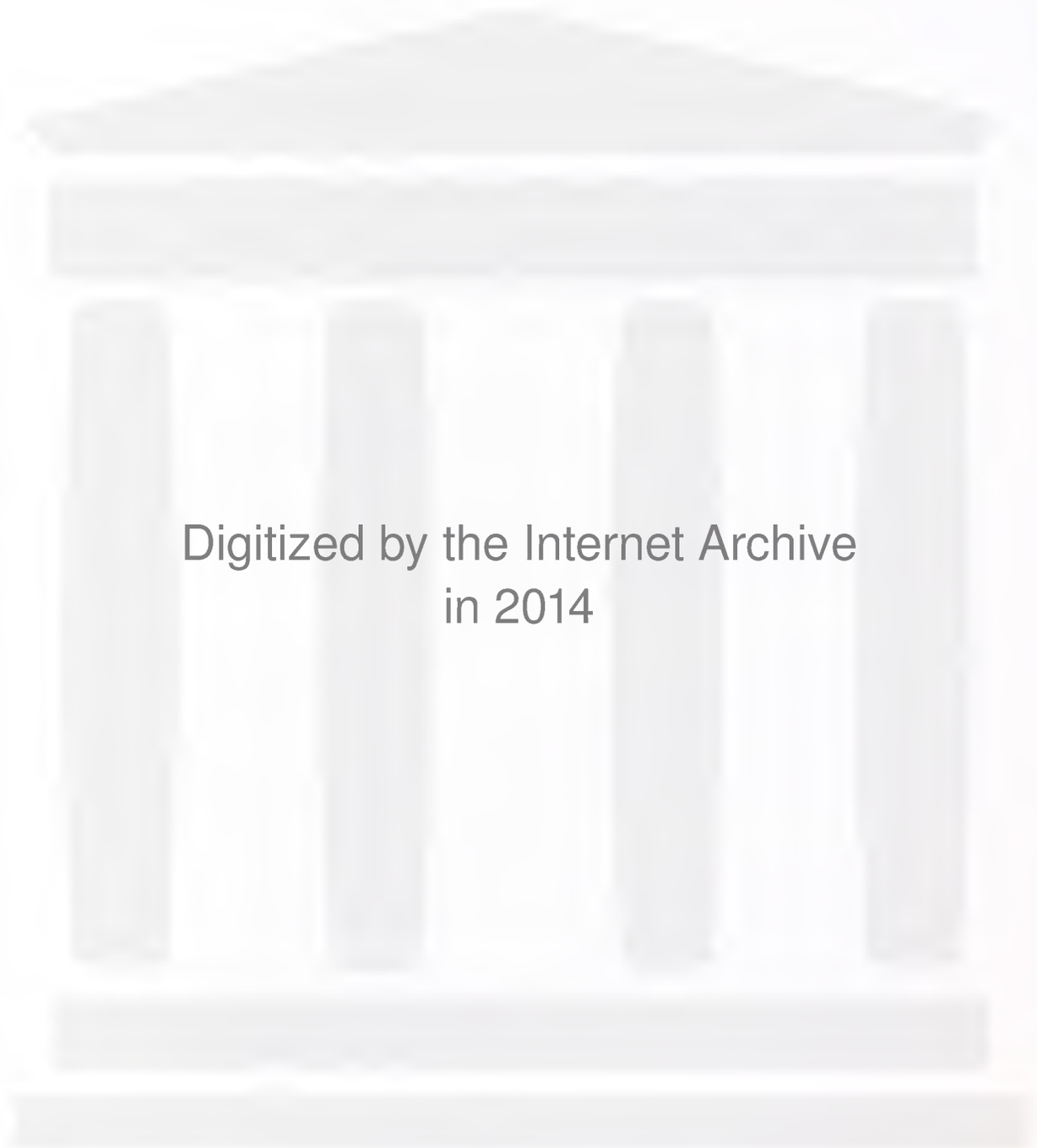
This report contains 89 pages, including 23 exhibits.

FUTURE SKILLS REQUIREMENTS FOR SOFTWARE DEVELOPMENT

CONTENTS

FUTURE SKILLS REQUIREMENTS FOR SOFTWARE DEVELOPMENT

EXHIBITS



I INTRODUCTION

- This report is part of INPUT's Information Systems Program and is one of a series of studies devoted to software planning. The report will help the information systems management identify the changes in the skills mix requirements brought about by the emerging approaches in systems development.

A. REASONS FOR PREPARING THIS REPORT

- The major systems development bottleneck has been in the detailed design, programming, and implementation phases of the systems life cycle. The traditional approach to systems development is giving way to packages, end-user computing, information centers, and such tools as program generators.

- Are these new approaches having an impact on the skills mix requirements of the information systems professional staff? What skills will be in demand? What can information systems management do to be certain their organizations maintain an adequate skills mix level? These are some of the issues addressed in this report.

B. SCOPE AND USE

1. SCOPE

- This report will primarily concentrate on skill requirements for the development of business systems applications. There will be some references made to the skills requirements of the technical support professionals, but this will be in relationship to applications development. The report will be directed generally to all information systems departments and specifically to those employing or starting to employ new systems development methodologies designed to improve productivity.

- This report will examine the impact on the IS skill requirements from the following systems development approaches:

  - The Information Center.
  - End-user-developed systems.
  - Prototyping.
  - Applications packages.
  - Program Generators and/or Report Writers.
  - Traditional systems development methodologies.

2. USE

- This report will:

- Provide an analysis of how other companies are approaching the problems of staffing, recruiting, and training to maintain the necessary skills mix required for future software development.

- Assist in identifying the specific skills required to employ the new techniques and methodologies for future software development.

- Aid in planning changes to the information systems organization brought about by the new approaches in software development.

- The audience for this report includes:

  - Senior information systems management.

  - Systems development management.

  - Information center/end-user computing management.

  - Technical support management.

  - Information systems professionals.

C. METHODOLOGY

- The information for this report was gathered from the following sources:

  - Fifteen companies were selected from a variety of industries, including banking, manufacturing, retailing, utilities, and insurance. The revenues ranged from $200 million to $8.5 billion, with half of the surveyed companies having over $1 billion in sales.

- In-depth interviews were conducted with the senior IS managers using the open-ended-type questionnaire found in the Appendix.

- Use was made of INPUT's reference library of over 100 industry periodicals and 4,000 vendor files.

- Also used were the INPUT studies listed in the following section.

D. OTHER RELATED INPUT REPORTS

- Interested readers are referred to the following INPUT reports:

  - Organizing the Information Center, August 1984.

    . Discusses how to organize an information center, including chargeback methods.

  - Micro-to-Mainframe Communications, May 1984.

    . Analyzes, in detail, personal computer communications modes, their advantages and limitations, and how these communications are likely to change in the next two to three years.

  - Personal Computers in the IS Strategy, December 1982.

    . Evaluates five approaches for IS to consider in its involvement in managing the personal computer revolution.

- Training Techniques for End Users, June 1984.

  . Identifies the issues and requirements for end-user training, and evaluates the training sources and techniques being utilized by industry.

- New Opportunities for Software Productivity Improvements, August 1984.

  . Assesses the impact of the trend toward decentralized systems development on software productivity and evaluates the tools being used to facilitate and control this trend.

E. REPORT ORGANIZATION

- Chapter II is the executive summary in presentation format.

- Chapter III identifies the changing IS skills mix requirements brought about by the latest approaches in systems development.

- Chapter IV defines the current techniques being used to improve software development productivity, and identifies the skills requirements and sources.

- Chapter V assesses the impact of the latest trends in software development on the IS organization; structure, career paths, staffing, and training issues are examined.

- Chapter VI contains the conclusions drawn from the research and provides recommendations to IS management for maintaining the proper balance of skills.

II EXECUTIVE SUMMARY

- Note: This executive summary is designed in presentation format in order to:

  - Help the busy reader quickly review key research findings.

  - Provide a ready-to-go executive presentation, complete with a script, to facilitate group communications.

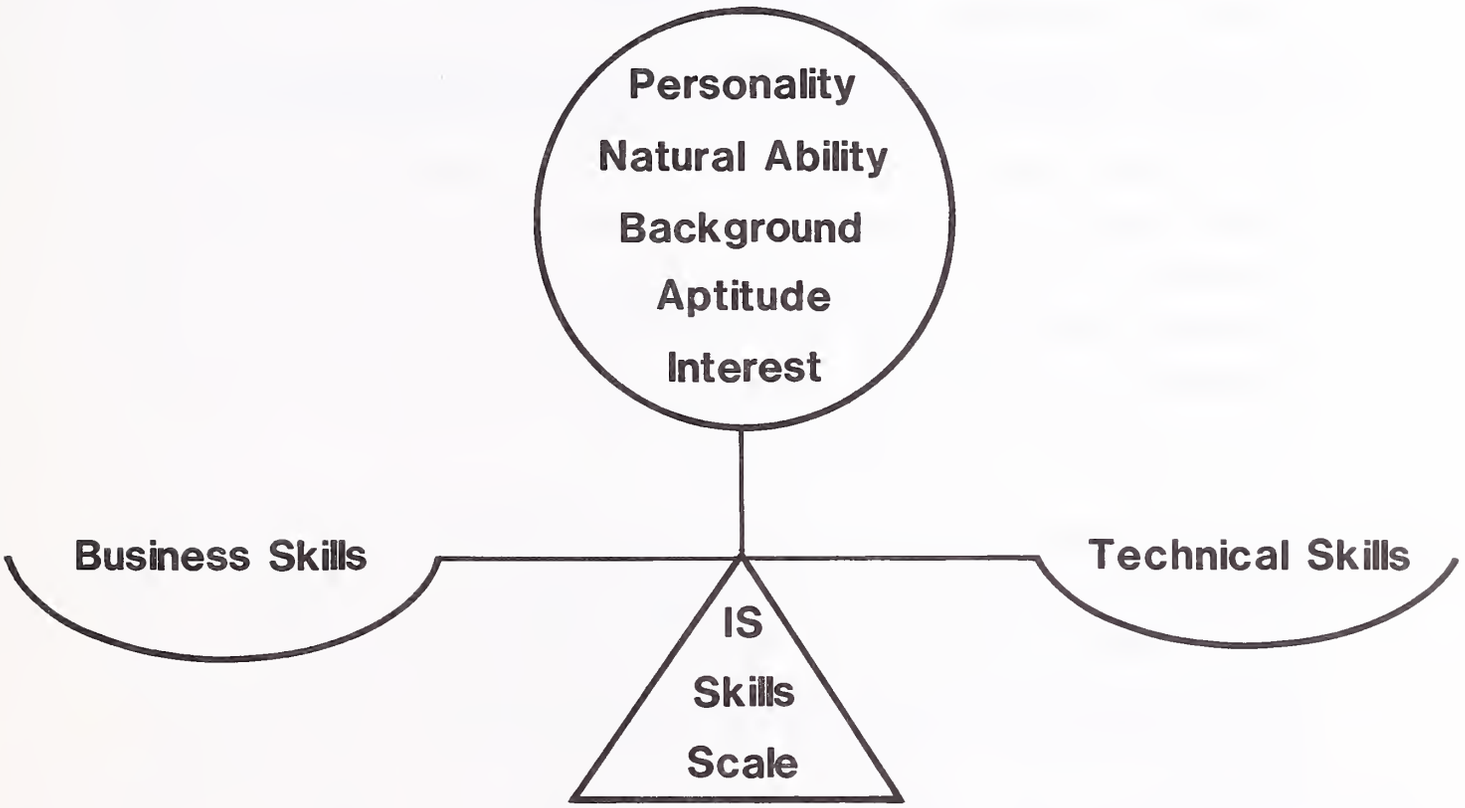
  - The key points of the entire report are summarized in Exhibit II-1 through II-7. On the right-hand page facing each exhibit is a script explaining its contents.

A. BALANCE THE I.S. SKILLS

- The key to the future success of information systems management is in the maintenance of the proper mix of technical and business skills. There will virtually be two types of IS professionals: those concerned with the technical aspects of computing and those concerned with the dynamics of the business. There is a need for specialists in communications, networking, data bases, languages, and operating systems, but there is an equally important need for people who possess a business perspective. It is rare to find a very technically oriented person who comprehends business processes. IS management must make certain that all of the skill bases are covered.

- Each person has a variety of skills from which to draw. Some of these skills involve natural aptitude or innate qualities. The best performance will be achieved by assigning people to jobs that fit their innate qualities. For instance, a person who gets along well with others and has a natural ability to teach would be a good candidate for assisting end users in developing their own systems. Selecting the right people for each functional area of the information systems organization is the responsibility of IS management.

BALANCE THE I.S. SKILLS



- Finance
- Personnel
- Purchasing
- Production
- Inventory
- Engineering
- Marketing

- Data Communications
- Networking
- Data Bases
- Languages
- Operating Systems
- Hardware Selection
- Security

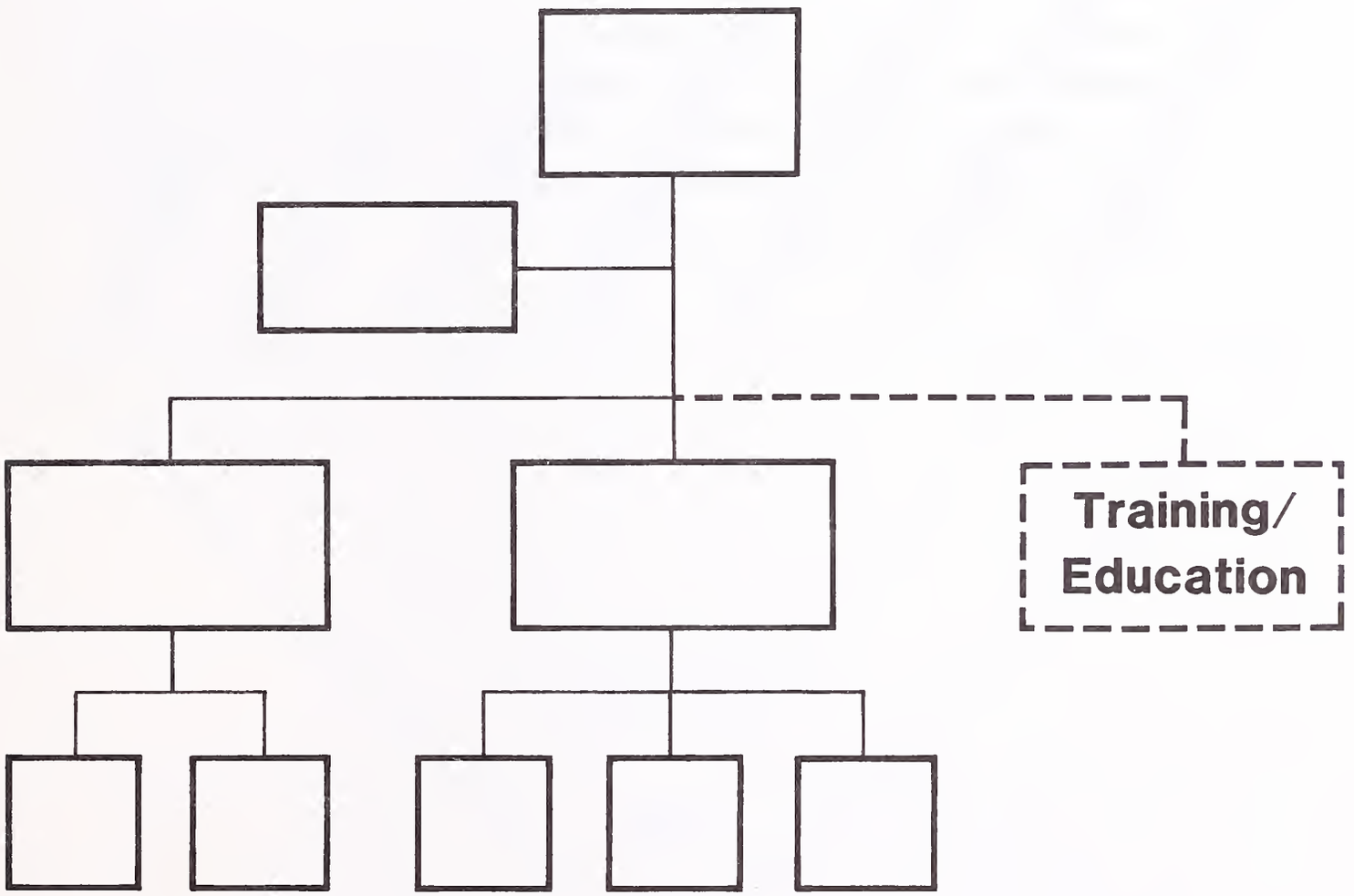
B. REASSESS ORGANIZATIONAL STRUCTURE AND ADD TRAINING AND EDUCATION UNITS

- During the past few years, significant changes have taken place in the approaches, methodologies, and techniques in information systems development. The information center has been introduced and the use of microcomputers has mushroomed, just to mention a couple of changes. These two items have brought about a vast array of new hardware and software options. In order to take full advantage of the many opportunities, the IS executive must periodically evaluate the structure of the organization to determine if it can adequately handle the new alternatives. To assess different approaches, the IS executive should evaluate the structure of IS organizations compared to other companies within the same industry.

- Most of the large IS shops retain an audiovisual education service to keep the professional staff abreast of the advances in the computer industry. The systems programmers are still required to attend special outside courses to learn the details of newly acquired software or hardware. With the need for people and the ever increasing number of software tools to use, the pace of education should be stepped up. Many companies are turning to a formal education and training unit within the IS organization. The unit is responsible for training new recruits, educating seasoned IS professionals, and training and educating end-users in the use of computing tools.

EXHIBIT II-2

REASSESS ORGANIZATIONAL STRUCTURE AND ADD TRAINING AND EDUCATION UNITS



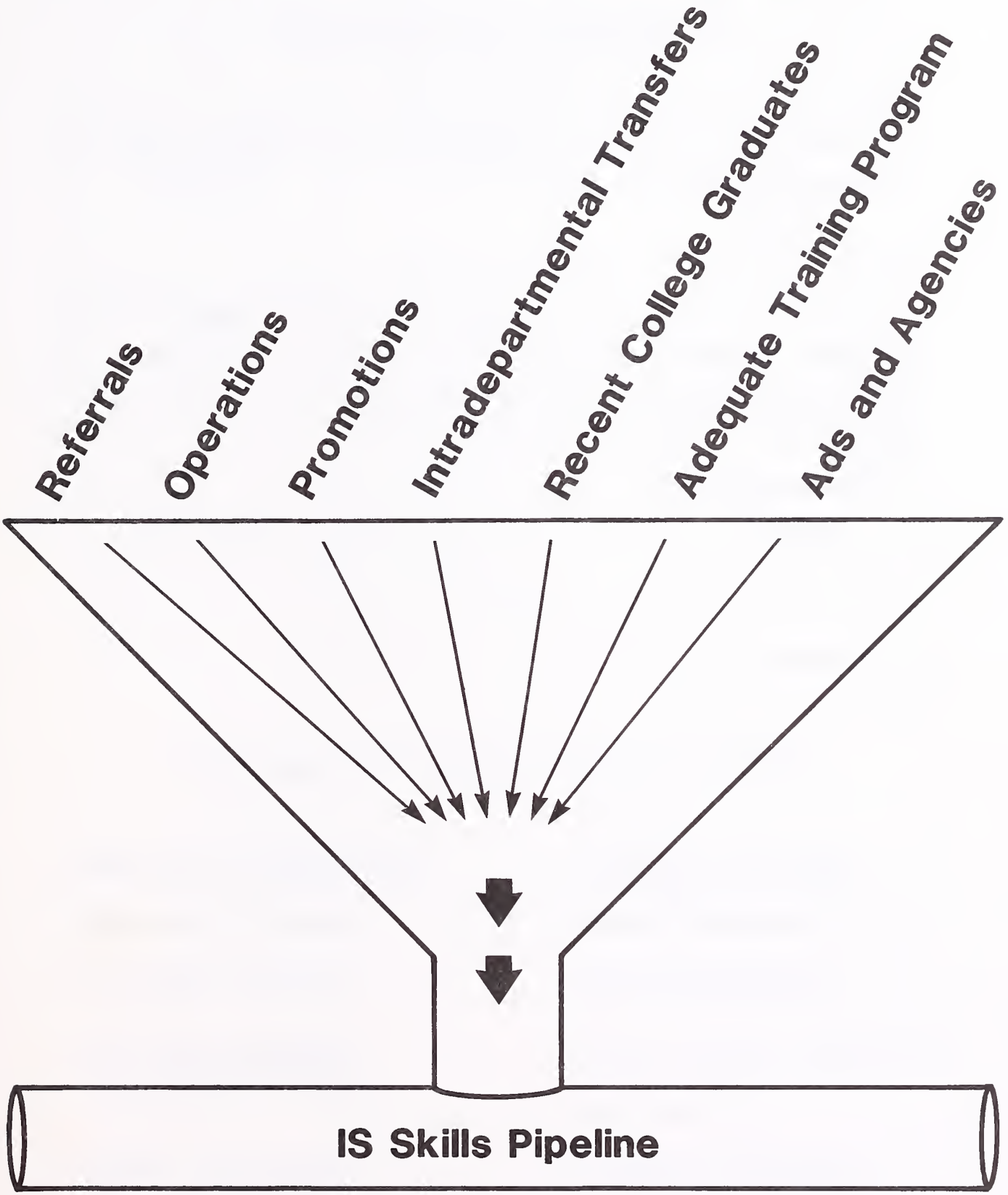
C. KEEP THE I.S. SKILLS PIPELINE FULL

- The IS management should not overlook any possibility for finding the skills required to make a well-rounded team. All too often the employment agency is the first place to contact when a new skill is required. The internal IS organization should be the first place to look and then the user community. Raw recruits from college may be the way to go. The best way to keep the skills pipeline full is to recruit from a variety of places and maintain a sound training program.

- If there is a need to fill many openings in a short period of time, then an incentive referral program is an effective approach. The concept is simple: if an existing employee identifies a viable candidate and the candidate accepts an offer, then at the end of a probationary period the employee making the referral receives a finder's fee.

EXHIBIT II-3

KEEP THE I.S. SKILLS PIPELINE FULL



D. DIRECT SUBORDINATES DOWN THE RIGHT PATH

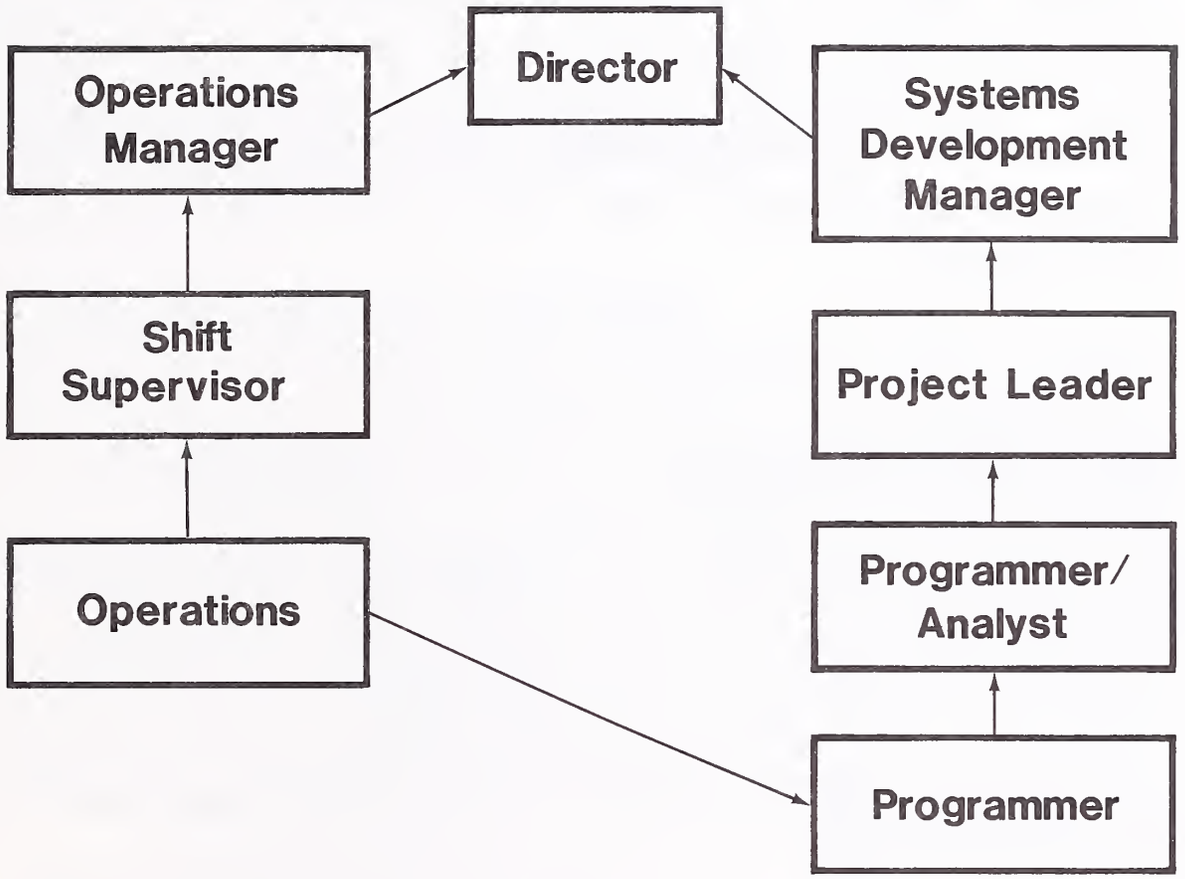
- Today, there are several paths from which to choose in the careers of the IS professional. There is the conventional programmer/analyst path and the path of end-user computing assistance. There are the technical positions that are in direct support of the development staff, and also technical positions responsible for the systems software. There are more and more specialties sprouting up in the industry. IS management should counsel their subordinates in the area of career development.

- Positions perceived by individuals as being prestigious and monetarily rewarding are often chosen as career objectives regardless of the skills required. An example would be where an excellent technician becomes a mediocre manager. IS management must periodically reassess the wage ranges of each job class to ensure adequate compensation for hard-to-replace skills.

EXHIBIT II-4

DIRECT SUBORDINATES DOWN THE RIGHT PATH

Early DP Career Paths



Present IS Career Opportunities

- Systems Development
- Systems Software
- Capacity Planning
- End-User Support/ Information Center
- Office Automation
- Strategic Planning
- Data Management
- Communications
- Data Center/Operations
- Networking
- Training/Education

E. I.S. SUPPORT GROUPS GROWING AT A RAPID PACE

- No more than three years ago the concept of the information center was a twinkle in IBM's eye. Today, the number of people working in the information center account for 6% of the entire professional staff on the average. Data base/data management and communications account for 17%. The systems programming staff continues to grow and now represents 7% of all IS professionals. All of these groups are growing and the demand has become much greater than the supply. The information center, above, is projected to be 9% of the IS professional staff by 1988. This represents a 50% growth over the next three years.

- There is a difference between decentralized data processing and decentralized systems development. A company can have several autonomous information systems departments, but within each one there is a group responsible for all phases of a systems development life cycle. On the other hand, a company could maintain one centralized information systems function, but allow the line organizations to actually develop their own automated systems. This would fall into the category of decentralized systems development. There could come a time when the corporate information systems organization worried only about policies, standards, guidelines, security, capacity planning, and system integration.

- The way the information systems function fits into an organization depends on the size of the company, the type of industry, and the corporate needs in IS services. There is no correct answer to the question of centralized versus decentralized data processing. There is a trend, however, toward end-user-developed systems. INPUT is predicting that user computing will account for 80% of all computing power by 1990.

I.S. SUPPORT GROUPS GROWING AT A RAPID PACE

- Emphasis on User Computing

- Support Groups Growing

Function	Percent of IS Staff
Information Center	6% (9% by 1987)
Data Base Support	8%
Communications	9%
System Programmers	7%

- Trend Toward Decentralized Systems Development

F. THE SKILLS PRIORITIES FOR FUTURE I.S. BUSINESS ANALYSTS

- The majority of IS executives are looking for systems analysts who possess strong interpersonal communications skills. They want people who can be diplomatic and tactful when helping users design and develop systems. They aren't saying other skills aren't important, but only that if the analysts don't know how to get along with people they will have a difficult time utilizing the other skills.

- After interpersonal skills comes a knowledge of business dynamics. If analysts are going to direct and persuade users to arrive at the best solution to a business problem, analysts must gain the confidence of users. The closer an analyst can come to envisioning the problem from the users' perspective, the better chance the analyst has of winning the users' confidence.

- Another way to win the confidence of the user is to provide technical leadership. The analyst must be aware of the available technical tools, and should be knowledgeable about the most frequently used software.

- Teaching skills are becoming desirable because of the advent of end-user computing. Much of the work performed by the information center consultants is in the form of advising, coaching, and counseling. Users want to learn more about computing and IS should be in a position to teach them.

- Sometimes it becomes necessary to sell a user on a certain way of accomplishing an objective. Also, selling techniques become important when trying to convince senior management to spend more money on new technology.

- The ability to negotiate is also important. Most everyone is starting to employ applications packages to reduce the information systems backlog. Care must be taken in dealing with the vendors of these packages. The buyer is entitled to restitution if the package does not perform as advertised or is not delivered on time. Protection can be assured during contract negotiations.

EXHIBIT II-6

THE SKILLS PRIORITIES FOR FUTURE I.S. BUSINESS ANALYSTS

1. Interpersonal Communications Skills

2. Diplomacy and Tact

3. In-depth Understanding of the Business

4. Technical Awareness

5. Analytical/Problem-Solving Staff

6. Teaching Skills (Advising, Coaching, Counseling)

7. Selling Skills (New Techniques, Ideas, Concepts)

8. Negotiating Skills (Application Package Contracts)

G. SKILLS SOURCES

- As requirements for new skills surface and normal turnover creates openings, the IS management is required to recruit the necessary human resources. Promotion from within is always the best way to fill openings, but sometimes the needed skills are not available.

- Many companies have established formal training programs for entry-level positions and are finding recruits from the following areas:

  - Recent college graduates who studied humanities and social sciences rather than computer science.

  - MBAs with undergraduate experience in computer science, engineering, or any business-related area.

  - Teachers, who make excellent information center counsultants.

  - Secretaries and clerical support people from other areas in the company.

  - IS operations and clerical support employees.

- If the needed skills are not available among existing IS employees and if entry-level training will not suffice, then agencies, search firms, and advertising will have to be used.

- Staffing and recruiting are becoming the most important functions of IS management. All of the plans in the world are worthless without the right people carrying them out. If the IS manager can do only one thing well, that one thing would have to be staffing. With the right balance of skills all else falls into place.

EXHIBIT II-7

SKILLS SOURCES

- Training and Educating Existing Staff
- Recent College Graduates with Majors in the Humanities and Social Sciences
- MBAs with Undergraduate Experience in Engineering or Computer Science
- Teachers from the Public School System
- Transferees from Other Parts of the Company
- Agencies, Search Firms, and Advertising
- IS Operations and Clerical Support Staff

III THE CHANGING INFORMATION SYSTEMS SKILLS MIX REQUIREMENTS

A. HOW THE DISTRIBUTION OF SKILLS IS CHANGING

- The traditional systems development life cycle is alive and well and living in the information systems function of most companies. The COBOL programmer is not yet an extinct species. On the contrary, the COBOL programmer is still very much in demand. What is happening, however, is a growing need for additional skills brought about by the development of products and services designed to increase the effectiveness of the information resources.

1. THE I.S. PROFESSIONAL STAFF

- The career path of the the computer professional in the 1960s was very clear and straightforward. There were very few choices and if the data processing people didn't have the particular skills to advance to the next rung on the career ladder, they were stuck.

- The job titles in the 1960s focused on what it took to develop a large batch system for a centralized data processing center. Examples of job titles were:

  - Entry-level programmer.

  - Programmer.

- Programmer/analyst.
- Senior programmer/analyst.
- Project leader.
- Manager.
- Director.

- There were few systems programmers in the 1960s. They were usually applications programmers who preferred working with the equipment rather than with the users. Many installations had no technical support groups and relied on the vendors to provide technical services. Today, more than 7% of the IS professional staff is in the systems programming area.

- Because large batch systems took an inordinate amount of time and resources to implement, and were plagued with specifications changes, the industry sought ways of speeding up the process and lowering the price.

- The new tools (such as on-line program development software and techniques such as prototyping) helped simplify the systems design and development process, but at the same time introduced a rash of issues for IS management to consider. These issues required new skills and brought about an era of specialists. Today, most information systems departments will have the following types of positions (along with the aforementioned conventional job titles, which will not change appreciably in the near future):

  - Data base specialist.
  - Data management consultant.

- Security analyst.

- Information center consultant.

- Communications specialists.

- Hardware/software planner-configurator.

- Office systems analysts.

- Software specialist (e.g., UNIX, C, FOCUS, SQL/DS).

- Exhibit III-1 illustrates the percentage breakdown of the IS professional staff. These figures represent the mean of all data collected from the respondent companies. Each IS organization contacted for this study has the total information services responsibility for the area of the firm being serviced. Programmers/analysts represented COBOL-type programming and major operational systems development. Managers and project leaders included all IS management except operations. Communications applies to data only. Some of the IS organizations were also responsible for voice communications, but those figures are not represented. Systems programmers are those people directly involved with the implementation and maintenance of systems software.

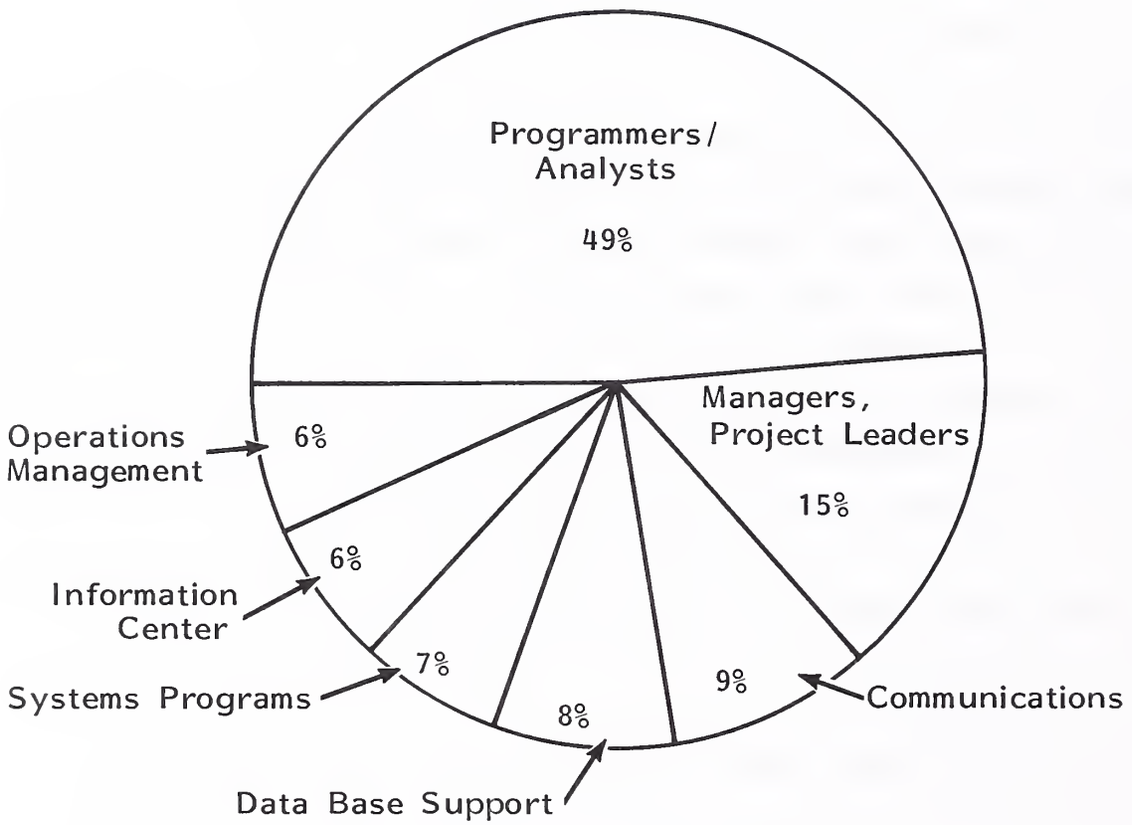
2. THE END-USER-DEVELOPED SYSTEM

- The mushrooming of microcomputers throughout most major corporations has not, thus far, had any significant impact on the backlog of requests for information services.

- Because the typical IS organization was slow in reacting to the PC explosion, end users were left to fend for themselves. Most of the micros were devoted to word processing, spreadsheet processing (e.g., Lotus 1-2-3, VisiCalc), and

EXHIBIT III-1

PRESENT DISTRIBUTION OF THE
I.S. PROFESSIONAL STAFF



general automation of manual functions, such as labor scheduling or budget preparation and tracking. In other words, end users are not very involved in developing an operational corporate-type system on personal computers.

- Until the end users can effectively interact with the corporate data base and communicate with other microcomputers' end users, they will have little or no impact on the data processing backlog. Data integrity and overall security are other issues that must be addressed before end-user-developed systems become a reality.

- Two INPUT reports analyze the personal-computer-to-mainframe phenomenon. They relate experiences and project future effects of this phenomenon. These reports are:

  - Micro-to-Mainframe System Experiences, May 1984.

  - Micro-to-Mainframe Communications, May 1984.

- What the IS management has come to realize is that additional technical skills are required to achieve the highest return on the microcomputer investment. Skills are needed in data management, communications, configurations, security, capacity planning, and fourth-generation software such as FOCUS.

- Some are saying that getting a micro is faddish and is not the panacea management thought it would be. IS must take control if the development of information systems is to be decentralized and made the responsibility of each functional unit throughout the organization. Only through the direction and guidance of the IS staff can end users really make an impact on the corporate information services backlog. IS must provide the expertise and provide the policies and standards. What the IS management must do is to make certain the proper level of skills mix is acquired and maintained. This is the most important challenge facing IS management today.

3. THE INFORMATION CENTER

- To address the issue of involving end users in solving their own systems problems or improving their decision-making process, most companies have established a small group of consultants to assist the end users. This group is a unit within the information system department that is more widely known as the information center.

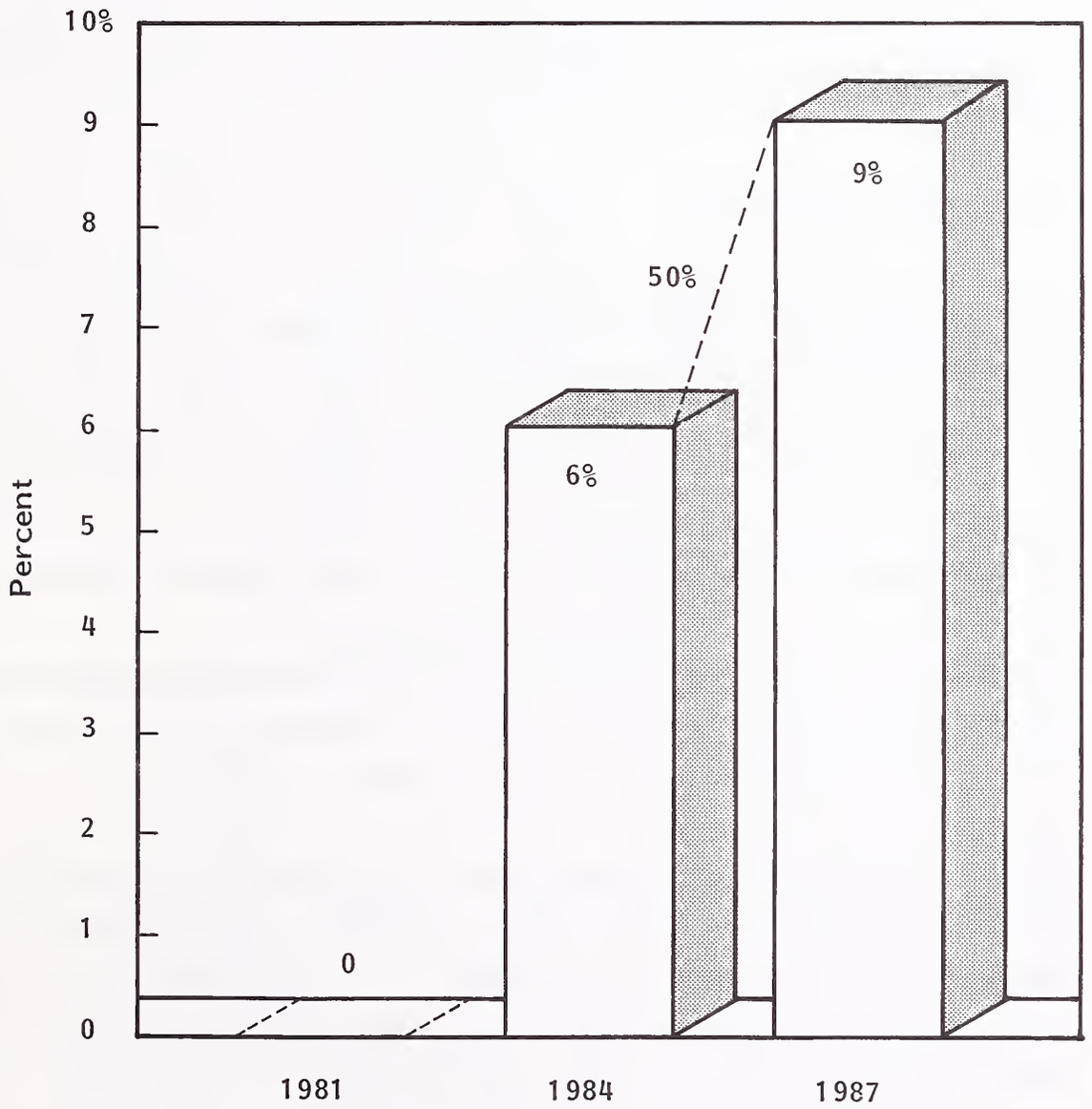
- Most believe the information center concept is the key to facilitating the evolution of end-user-developed systems. Three years ago most companies had heard about the idea of the information center, but hardly anyone had one in place. Today, the information center accounts for 6% of the overall professional IS staff. Over the next three years, the number of people allocated to the information center will jump by 50%, as illustrated in Exhibit III-2.

- The skills mix requirements for the information center will be discussed in more detail in Chapter IV. IS management is becoming aware of the fact that there are certain innate characteristics required of the information center employees. Many of these special qualities were not considered essential for a successful programmer or analyst. In fact, they weren't considered at all. This has forced IS management to become innovative in ways of finding candidates to fill the information center positions.

  - An in-depth analysis of the issues involved in establishing an information center can be found in INPUT's report titled Organizing the Information Center, August 1983.

EXHIBIT III-2

INFORMATION CENTER AVERAGE PROJECTED PERSONNEL GROWTH
1981-1987
(PERCENTAGE OF TOTAL I.S. PROFESSIONAL STAFF)



B. BREAKING THE SYSTEMS DEVELOPMENT BOTTLENECK

- The backlog of applications development projects is still several years despite all the hoopla surrounding the new productivity tools and approaches to systems development. The mainframe programmers and analysts account for 50% of the professional IS staff and even though the ratios may be changing, it is projected that this group will continue to grow over the next several years, but not at the same rate as some of the support groups. Exhibit III-3 compares the life cycle of a traditional system with the life cycle of future systems by which the user will become more involved in the design phase and possibly the programming phase.

1. EMPHASIS ON DESIGN

- What is taking place within the bag of skills of the systems analyst is a change from a technical to a business perspective.

  - Overall grasp of the business process is important.

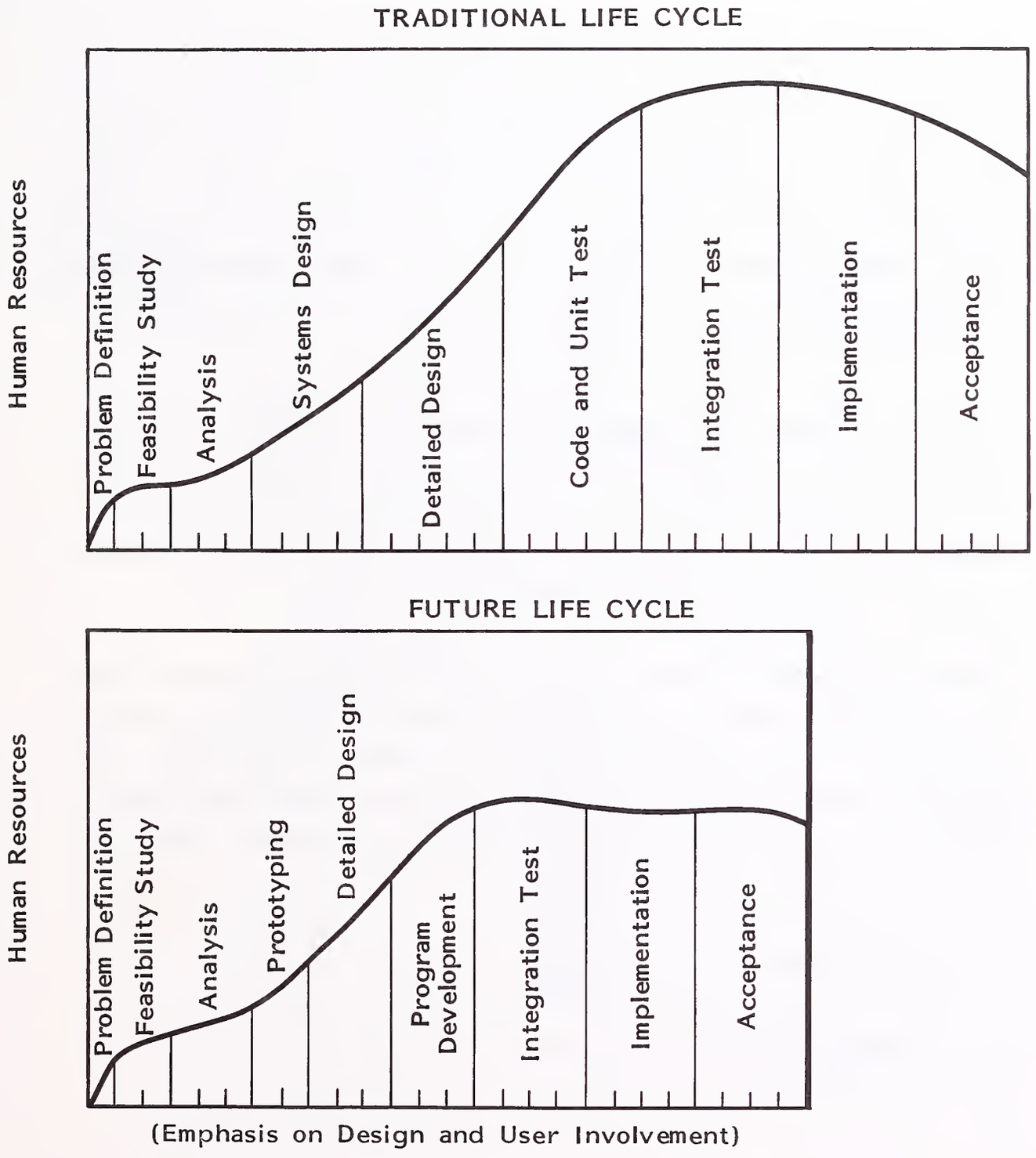
  - Thorough understanding of specific business functions is paramount.

- The consensus is that if the systems analysts understand the business first and foremost, they will be in a better position to work side by side with the users to arrive at the best solution to a business problem.

- Some companies are experimenting with programming productivity tools, (such as FOCUS from Information Builders) to replace COBOL in the development of a major corporate system. If this tack proves successful, less time will be required for the technical aspects of programming and more time can be allotted to the design of the business system.

EXHIBIT III-3

BREAKING THE SYSTEMS DEVELOPMENT BOTTLENECK



- Systems analysts will concentrate on improving their knowledge of the business process.

- A core of technical specialists will be available to assist in selecting and implementing the appropriate hardware and software.

2. MORE EMPHASIS ON END-USER INVOLVEMENT

- During the past dozen years much has been written on the advantages of getting the users involved in the systems development process. Systems development methodologies, such as structured systems analysis and design, have sprung up to help facilitate end-user involvement. Most of these methodologies are based on the phased approach to systems development and require the users' signature approval at the end of each phase. The idea is that if users had to sign off on each phase, they would have to understand the phases and would therefore become more involved.

- The phased approach has brought users closer to the systems development process, but their involvement has still been rather superficial and sporadic. The IS staff is still held responsible for the detailed systems design: that is, bringing the flow diagrams and layouts to the users for approval. This basic approach will continue for years to come.

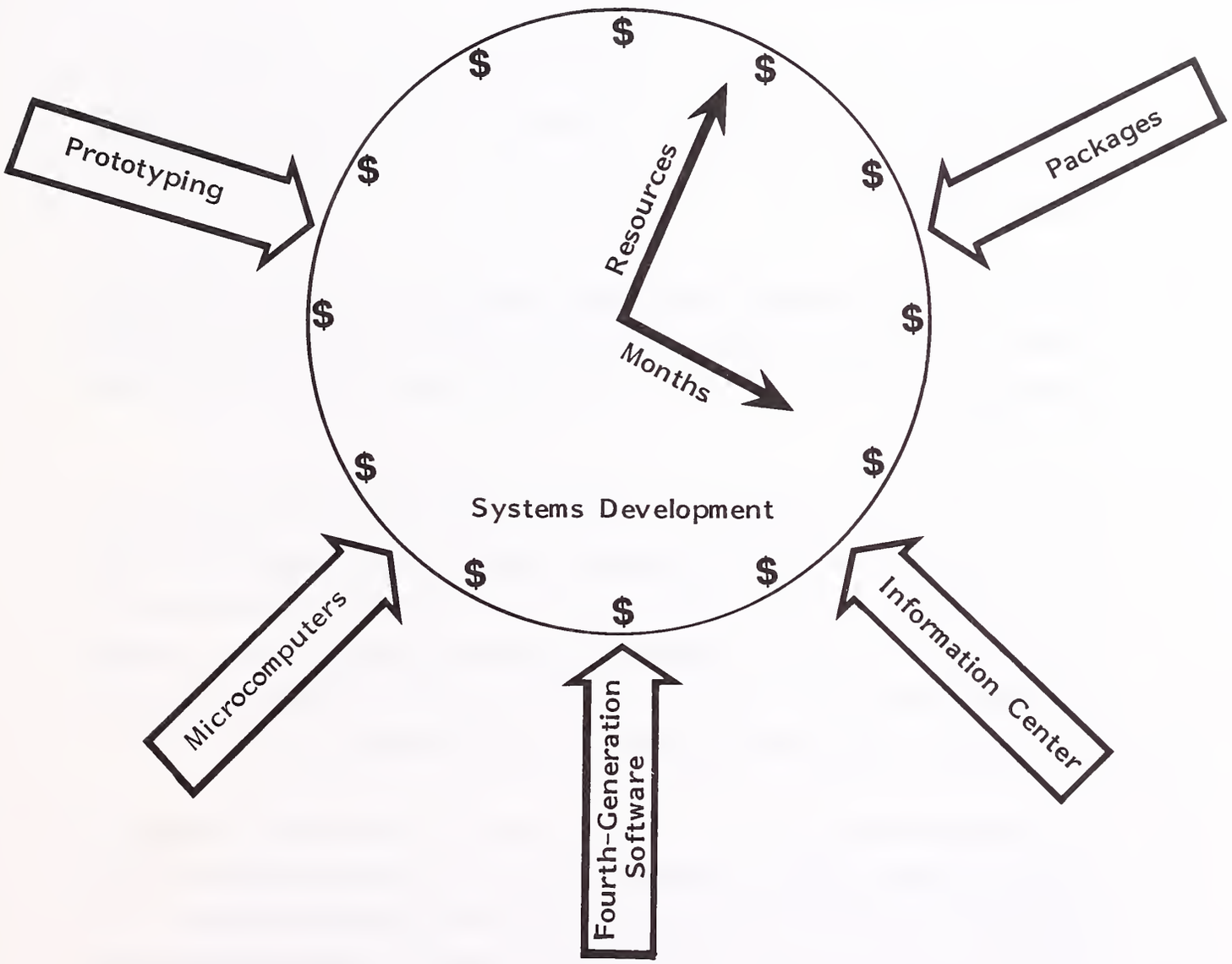
- What is evolving in this area, however, is more shirt-sleeved, direct involvement from end users in the design and implementation of information systems. As illustrated by Exhibit III-4, this new level of user involvement is directed at reducing the time, resources, and cost of developing corporate information systems. Some of the reasons for this new level of involvement are:

  - Prototyping.

  - Package evaluation and selection.

EXHIBIT III-4

ATTACKING THE SYSTEMS DEVELOPMENT CLOCK
WITH MORE END-USER INVOLVEMENT



- Microcomputers/workstations.

- Fourth-generation software.

- The information center.

- (Note: The above topics are discussed in detail in Chapter IV.)

3. IMPACT ON SKILLS REQUIREMENTS

- If the wave of the future is in decentralized systems development at the functional level, such as the production inventory control unit of the manufacturing division, what will this do to the role of the professional information systems analyst?

- During the past few years the title of consultant has crept into the IS organization chart. There are data management consultants and end-user computing consultants. This title connotes a facilitator, guide, trainer, advisor, coach, and counselor.

- The corporate core of information systems people will be comprised of business analysts and technical consultants. Their primary responsibility will be to make available to the divisions, departments, and units the tools and facilities necessary to design and implement improved business systems. Analysts and consultants will be concerned with the integration of information, and the management of data, security, standards, and guidelines.

- Evaluating, selecting, cost-justifying, and negotiating hardware, software, and communications resources will continue to be the responsibility of the corporate IS function. The alternatives are becoming so numerous that no one person can be knowledgeable enough to do an adequate job. Resource planning has become a critical issue and must receive the proper quality and quantity of human resources.

C. MORE TOOLS TO UNDERSTAND AND USE

1. TYPES OF SOFTWARE DEVELOPMENT TOOLS

- Datamation magazine publishes an annual survey of systems software. The list of packages keeps growing each year, which means there is more and more to consider. The choices are staggering and it's enough to give IS managers a huge headache, especially if they are not confident about the ability of the staff to evaluate the various tools. Here are the categories and number of packages surveyed by Datamation for 1983:

-	Data base/data management	23
-	Query/report writer/DBMS aids	13
-	Program development aids/program utilities	13
-	Communications software	13
-	Operating systems/utilities	34
-	Monitoring and performance aids	10
-	Total software packages surveyed	106

  - Examples of these software development tools are listed in Exhibit III-5.

- The above list does not, of course, include any applications software, such as payroll, personnel, general ledger, or MRP, etc. INPUT has projected that the overall software market will be at $30 billion by 1988, an average annual growth rate of 32%. This means there will be more and more choices and more and more decisions.

EXHIBIT III-5

MORE TOOLS TO UNDERSTAND AND USE

CATEGORY	EXAMPLES
Data Base/Data Management	SAS, IDMS, ADABAS, IMS/DB, FOCUS, RAMIS II
Query/Report Writer/DBMS Aids	DYL-280, CULPRIT, EASY-TRIEVE, UCC TEN, ADR DATADICTIONARY
Program Development Aids/ Programming Utilities	MARK IV, METACOBOL, MANTIS, VOLLIE, NATURAL
Communications Software	ROSCOE, TASK/MASTER, IMS/DC, ENVIRON/1, DATACOM/DC
Utilities/Operating Systems/ Enhancements	SYNCSORT, UCC ONE, PANVALET, LIBRARIAN, DOS/MVT/VSE, JARS
Monitoring and Performance Aids	ADR LOOK, CONTROL/IMS/ REALTIME RESOLVE/CICS, OMEGAMON

2. SKILLS IMPLICATIONS

- First of all, IS management should set some time aside each week to study, read, and adjust their perspectives on the issues, objectives, and problems facing their organizations. Really taking advantage of these new, somewhat expensive tools is going to require improved salesmanship. Selling senior management on an idea or concept will require a thorough understanding of the benefits to be derived.

- Software planners will require more time for learning the features of each product in order to better evaluate the applicability of the product to a specific environment. Planners must also earmark a time slot in their normal work schedule for research and study. It won't be good enough to arbitrarily select the most commonly accepted package. Formal criteria against which each package in a category must be measured will become standard. The IS senior management should provide the package selection guidelines that can be used by the software planners to establish standards.

- Because so much ready-to-use software is being acquired (and will continue to be so), effective vendor negotiations will become more important. Many problems and expenses can be avoided by improving the art of negotiating. Contracts should first be reviewed by the technical staff to be certain all elements and features are included, and then they should be reviewed by the legal staff to be certain that obligations will be met.

- The systems development staff will need to know what is in the tool kit and what tool is best to get a particular job done, but they will not be required to know what makes each tool work. If they need to know something about cellular radio communications technology, for example, they will call on the communications specialists. In other words, they should have the technical skills required to bring together the necessary specialists, but their main concentration should be focused on improving the profitability and/or effectiveness of the business.

3. TRAINING AND EDUCATION CONSIDERATIONS

- The advent of personal computers, micro-to-mainframe links, fourth-generation software, local-area networking and the hundreds of other software, hardware, and communications products and services has put training and education near the top of the objectives list for most IS managers.

- It is going to be a hard sell, but more budget dollars will be needed for training and education. The risks of not keeping the staff fine-tuned on the capabilities of the emerging technologies must be made clear to those managers with budget-approval authority.

- The potential revenues from selecting and implementing the most appropriate technical information systems tools are huge: Not only is it important that the professional IS staff continues to learn, but also that users continue to be educated.

- There are several levels of education and training that become the responsibility of the senior IS management:

  - In-depth education on a new systems software package for systems programmers.

  - Seminars on the subject of awareness and general knowledge for IS mangement, systems analysts and designers, programmers, and consultants.

  - In-house courses on such topics as the use of fourth-generation software tools for end users.

  - Technical familiarization courses for executive management.

- Not only does the IS staff need to be taught new skills, but one of the new skills showing up on the required list is teaching. The IS professional is becoming a mentor and instructor to the users being serviced. The ability to teach will play an ever-increasing role in future business systems development. Teaching techniques can be learned from an in-house course taught by a consultant, or individuals could be sent to courses offered by local colleges or professional organizations. More about the importance of the IS teaching skills is discussed in the INPUT report Training Techniques for End Users, June 1984.

IV TRENDS IN SOFTWARE DEVELOPMENT SKILLS REQUIREMENTS

- The one area of the systems development process that has caused the most delays is the design of input/output formats. From the users' perspective the system is what they see in the form of CRT screens or printed reports. As the systems develop, users are continually uncovering new requirements for data to be accessible on formats that have previously been approved. Some of this has been brought about by the fear of not knowing if the approved design will actually handle the situation, and some of it has been brought about by the fear of not being able to get additional information from the system after implementation. Both of these fears have been well founded on experience gained from previous projects.

- Many of the productivity tools and techniques have been directed at alleviating the problems of project delays caused by design changes. These new approaches to system design, development, and implementation have tended to alter the emphasis of skills requirements for the systems development staff. This chapter will identify the impact of the trends in software development on skills requirements.

A. PROTOTYPING

1. DEFINITION

- In the past, during the analysis and system design phases of a systems life cycle, pictorial representations of the proposed system would be presented to the users in form of flow diagrams and hand-prepared input/output formats. This was sometimes referred to as a model of the system. The weakness of this approach is that the users are not that experienced in following flow diagrams or evaluating layouts; they have a difficult time envisioning the merits of the proposed system or its limitations.

- Prototyping is a technique whereby the essential features of a new system are demonstrated to the users through a tangible model that actually works the way the full-blown system will. Usually this working model is written in an interactive, easy-to-use, high-level language. IBM's VS APL is an example of a high-level language used for prototyping. The programmer can simulate certain aspects of the system and VS APL is easy to modify.

- Prototyping allows the user to "play" with the system to better evaluate the pros and cons of the design. If the users wish to change or modify the design, prototyping can easily accommodate these requests. The users and IS representatives design the system through an interactive process utilizing prototyping techniques.

2. SKILLS REQUIRED

- Prototyping fosters collaboration on the design phase, which in turn brings the users and the systems development staff closer together. The IS analysts will need to sharper their interpersonal skills, including such qualities as communications, diplomacy, empathy, and patience.

- The analyst should understand as much about the business process as possible, so that the users' needs can be anticipated. The analyst should understand not only what function is performed by the business unit being assisted, but also how it fits into the overall mission of the organization.

- Of course, the systems development staff will be required to learn how to use the new prototyping tools selected. The better they understand the features of the tools, the smoother the prototyping process will be.

- Other than the normal expected skills required of a programmer/analyst, the following is a summary of the skills emphasis for prototyping:

  - Interpersonal communications.

  - Diplomacy, empathy, and patience.

  - Business perspective.

  - Prototyping technical skills.

3. SOURCES OF SKILLS

- Prototyping is a technique or approach to systems design and should be a part of the systems development methodology standards. The applications programmers and analysts will utilize prototyping and, if this approach is to play a heavy role in the organization, recruiters should make certain that future applicants possess the unique skills required.

- The existing staff will learn the skills they're missing through on-the-job training, but they should be encouraged to attend courses in these special areas. A required list of reading material could also be developed.

- The profile of prototyping is summarized in Exhibit IV-1.

EXHIBIT IV-1

PROTOTYPING

PURPOSE	SKILLS REQUIRED	SOURCES OF SKILLS
To demonstrate the features of a proposed system through a working model	• Interpersonal Communication • Diplomacy, Tact, Patience • Business Perspective • Prototyping Skills • Basic Programmer/ Analyst Skills	• Programmers/ Analysts - Education - O.J.T. • Recruits with Required Skills

B. INFORMATION CENTER

1. DEFINITION

- From the beginning of the use of digital computers in business the emphasis in systems design has been on reducing manual steps, increasing productivity, and providing decision-making information to all levels of management. Usually, management information became a by-product of automating the operational business process. As management increased its understanding of what the computer was capable of providing, it started demanding more and more information in a variety of formats and sequences. Before long the IS department was flooded with requests for information. The backlog grew and so did the impatience of management.

- Out of this ever-increasing desire for computer assistance sprung the concept of the information center. In most companies that employ this concept there is an actual center or room where users may sit down at a terminal and utilize an easy-to-use, high-level language to interact with data from a corporate data base. The idea is to give users the capability of satisfying their own requests for management information. The users learn how to use the tools to aid them in decision making. They learn how to analyze information and how to design output formats, including graphics.

2. SKILLS REQUIRED

- Information systems people that are assigned to the information center definitely must possess excellent interpersonal skills. Their job is to help users and advise them on how to utilize the facilities. Good instructors make good information center (IC) consultants.

- In conjunction with people skills an understanding of the business process is most desirable. If the IC consultants have a grasp of the mission and objec-

tives of the business areas being serviced, they will be in a much better position to aid the user in building an information system.

- Someone who enjoys working on multiple tasks and is enthusiastic and creative will enjoy working with end users in the information center.

- A patient, good listener can analyze a user's needs better than can the take-charge type. This ability to be an effective listener is an important quality for the IC consultant.

- People who have the ability to learn quickly have an advantage in the information center, because of all of the software tools that are being made available. They don't have to be technical geniuses, but they must have a working knowledge of each piece of software in the tool kit. And when new software is required they should have the ability to quickly determine its capabilities.

3. SOURCES OF SKILLS

- Most see the information center as a training ground for future application programmers and analysts. If the candidates have many of the desired skills they are apt to be found in several categories:

  - Programming.
  - Operations.
  - Public school teachers.
  - Recent college graduates.
  - Secretaries and general clerical.
  - Technical support.

- Resources are unlimited as long as you can find candidates with interpersonal communications skills who can learn the technology quickly and who have good business perspectives.

- Some companies are rotating people into the information center from the applications programmer/analyst ranks.

- The profile of the information center is summarized in Exhibit IV-2.

C. END-USER-DEVELOPED SYSTEMS

- The survey indicated that users are not out there building operational, transaction-driven, corporate systems on their PCs. They are doing more ad hoc reporting in the decision support area. They are satisfying individual needs that, heretofore, haven't been practical to program for the mainframe computer. Some are calling this work the invisible backlog, because it never surfaced before, and has never been requested.

1. INFORMATION SYSTEMS ASSISTANCE/COACHING

- The use of microcomputers is starting to extend past spreadsheets and word processing into an era of fairly sophisticated data base systems, with impressive graphics and report output. Users are learning fourth-generation languages and are learning how to access mainframe data through micro-to-mainframe links.

- As PC users become more sophisticated there is an ever-increasing need for support from the corporate information systems department. Users need assistance and coaching to help them understand their options. Being a coach to the end users takes a particular type of person, which translates to skills requirements.

EXHIBIT IV-2

INFORMATION CENTER

PURPOSE	SKILLS REQUIRED	SOURCES OF SKILLS
To provide the resources and expertise to allow End Users to directly access data bases to analyze decision-making information	• Human Relations • Business Awareness • Multiple Tasks Orientation • Effective Listener • Quick Learner • Teaching Skills • Technical Awareness • Interpersonal Communications • Diplomacy, Tact, Patience	• Programming • Operations • Public School Teachers • Recent College Graduates • Secretaries/Clerical • Technical Support

2. SKILLS REQUIRED

- Many of the skills required to be an effective information center consultant apply to end-user coaches. The following list represents the skills and innate qualities needed to make a good end-user coach:

  - Gets along with others.
  - Understands user's business.
  - Has in-depth knowledge of basic software tools.
  - Enjoys many different, short-term projects.
  - Has "get-the-job-done" attitude.
  - Has good teaching skills.
  - Is advisor, counselor.
  - Has data management skills.

- If an end-user coach is required to work with senior management on the installation of an executive workstation, it becomes crucial that he or she has the ability to grasp the business problem to be solved. MBAs with computer skills would be ideal if they could also employ tact and conciliation skills.

3. SOURCES OF SKILLS

- In most companies, the people working with end users on PC applications are employed in the information center. This is a logical approach, because both areas are helping the users help themselves to develop computer-aided solu-

tions to business problems. The source of candidates, therefore, is the same for both.

- Many companies have started or resurrected training programs for recent college graduates. These companies are looking for candidates from the humanities or social sciences rather than computer science graduates. Computer science majors aren't believed to be as adaptable to the business environment, nor are they as competent in human relations skills.

- The ideal candidate to work directly with end users is one with an MBA and undergraduate work in computer science, engineering, finance, accounting, economics, or statistics.

- The profile of end-user-developed systems is summarized in Exhibit IV-3.

D. APPLICATIONS GENERATORS / REPORT GENERATORS

1. DEFINITION

- Report writers such as RPG were introduced about 25 years ago. They were touted as the answer to the problem of increasing backlogs of requests for information. For its time, RPG was fairly sophisticated in its ability to generate a report with adequate headings and levels of totals. But applications programmers never accepted report writers and claimed they could produce a better report in about the same time using conventional programming methods. Thus RPG specialists were a rare breed found only in very large installations.

- Today, the category of productivity tools includes query languages, report writers, program development aids, and data management packages. These tools are shortcuts for coding. They either allow the programmer to generate

EXHIBIT IV-3

END-USER-DEVELOPED SYSTEMS

PURPOSE	SKILLS REQUIRED	SOURCES OF SKILLS
To assist the End Users in the application of Microcomputers for the development of information systems for specific segments of the business	• Human Relations • Understanding Users' Business Needs • Understanding Related Technical Resources • Multiple Task Orientation • "Get-the-Job-Done" Attitude • Consulting Skills • Teaching Skills • Data Management Skills • Interpersonal Communications • Diplomacy, Tact, Patience	• The Information Center • Programmers/Analysts • College Graduates - Business - Humanities - Social Science • MBAs

the necessary code through high-level, English oriented statements, or by entering the various data parameters into a prescribed format.

- The COBOL or PL/I programmer still hasn't accepted these tools as a replacement for the conventional programming methods, but they are showing up more and more in the end user's tool kit. Some of the higher level programming languages are becoming so powerful that companies are investigating them and experimenting on major corporate business systems.

2. SKILLS REQUIRED

- No special skills are required to learn and use program generators. The seasoned programmer has no problem picking up how to use productivity tools. The biggest problem associated with skills in this category is teaching end users the details needed to become competent technicians. In this case, you should look for the same skills required to support end-user-developed systems.

3. SOURCES OF SKILLS

- If the need is for individuals who will assist end users in learning how to apply these special program generators, then the sources will be the same as for the information center and end-user-developed systems.

- The more common this approach becomes in the life cycle of a major corporate system, the less emphasis there will be on technical know-how and the more emphasis there will be on understanding and solving business problems.

- The profile of application generators/report writers is summarized in Exhibit IV-4.

EXHIBIT IV-4

APPLICATIONS GENERATORS / REPORT WRITERS

PURPOSE	SKILLS REQUIRED	SOURCES OF SKILLS
To reduce the time and effort involved in programming through easy-to-use software aids	• None for Applications Programmers • For Assisting End-User - Human Relations - Business Perspective - Software Knowledge - Teaching - Consulting	• If IS is to assist End Users in learning how to use these tools, then sources are the same as for information center and End-User Development Systems

E. APPLICATION SOFTWARE PACKAGES

1. TRENDS AND APPROACHES

- Not too many years ago hardly any information systems/data processing manager would consider purchasing a canned software package to handle the information processing needs of a major segment of the business.

- Then it started making sense to acquire packages that handled universal systems such as general ledger and payroll/personnel. The only major problem was in determining the modifications required to make the package cover the unique situations of the organization. Once the packages were modified then maintenance became an even more serious problem.

- Today, wise IS managers will employ applications software packages wherever they can. They keep modifications to a minimum and change the business practices to fit the packages instead of the other way around. There are packages available to handle practically every type of transaction processed in the insurance industry or in the manufacturing industry. More and more packages are available to cover the information processing needs of a variety of industries.

- Packages can drastically reduce the time and effort involved in phases of the life cycle associated with detail design and programming, the two areas that usually consume the most human resources and elapsed time. The key is to adapt the company's policies and practices to the package as much as possible to keep modifications down.

2. SKILLS REQUIRED

- Primarily, there are three groups of people that work together when a software package is being considered: 1) the systems development staff, 2) the

users for whom the packages is being considered, and 3) the representatives of the supplier of the package. The users are there to make certain the package will adequately meet the requirements of the system. The system development staff must evaluate the technical feasibility of the package and assess the ease of implementation and maintenance. The vendors must adhere to the delivery schedules and provide any contracted modifications.

- The skills somewhat parallel the profile of a senior systems analyst: logical, analytical, good at problem solving, technically competent, etc. The big difference is the assessment of the package and the negotiations with the vendor. Also, users and the systems people need to work closer together when looking at packages.

- The systems development staff assigned to a package evaluation may be required to perform some research. That is, they may be required to survey other users of a package to gather statistical facts about performance and about vendor support.

- Negotiating contracts is another aspect of software packages that requires additional skills. If possible, a legal advisor should be retained to assist in the negotiation process. It will be extremely helpful if the systems people learn the art of negotiating. Remember, if the package is not delivered when promised or does not perform as promised, recourse will be governed by the terms of the contract.

- The profile of applications software packages is summarized in Exhibit IV-5.

EXHIBIT IV-5

APPLICATION SOFTWARE PACKAGES

PURPOSE	SKILLS REQUIRED	SOURCES OF SKILLS
To reduce the time and resources required to develop an Information System by purchasing and implementing a generalized proprietary software package designed to handle specific business transactions	• Basic Skills for Systems Analysts • Evaluating • Negotiating • Research	N/A

F. TRADITIONAL SYSTEMS DEVELOPMENT METHODOLOGY

1. IMPACT OF NEW TRENDS

- Cost is still the number one concern of senior management regarding the information systems function. The major cost is attributed to the amount of human resources required to provide the organization with automated information systems. Through vendor-supplied software the time required in human resources and computer equipment can be slashed from the life cycle of a business system. The attack centers on the design and programming phases of traditional system development methods.

- With the new productivity tools the systems people can concentrate more on the objectives of each business unit and on the overall mission of the firm. There will be more business orientation and less technical orientation.

- The technically oriented IS professional will also become more involved in direct support of end-users. The communications specialist and data management specialist, for instance, will become more of an integral member of the systems development team.

2. PERSONNEL CONSIDERATIONS

- The challenge facing IS management is maintaining the proper balance between the people who understand the business and the people who understand the technology. If the skills mix becomes lopsided, the objectives will be difficult to reach. Balance can be maintained through training and recruiting.

- Required skills must first be identified and then the strengths and weaknesses of the IS staff must be assessed. Once the assessment is completed a plan must be put in place to reduce the weaknesses.

- Adequate training for end users in the use of the information center and microcomputers will help relieve some of the pressures on the systems development staff.

G. SUMMARY OF TRENDS IN SOFTWARE DEVELOPMENT SKILLS

- Exhibit IV-6 summarizes the preferred skills required for each category of software development. This matrix indicates the types of skills that will most likely produce the desired results from each software development approach. Just because a preferred skill is not checked for a particular category doesn't necessarily indicate that the skill wouldn't be beneficial; it only means the unchecked skill is not mandatory. Ideally the entire IS professional staff should possess all of the skills listed, but unfortunately this is not feasible.

EXHIBIT IV-6

PREFERRED SKILLS FOR SOFTWARE DEVELOPMENT CATEGORIES

PREFERRED SKILLS	Prototyping	Information Center	End-User Computing	Package Selection	Generators/Report Writers	Traditional SDM
• Interpersonal Communications	X	X	X			
• Human Relations		X	X		X	
• Diplomacy, Tact, Patience	X	X	X			
• Effective Listener		X				
• Teaching			X		X	
• Consulting			X		X	
• Basic P/A Skills	X			X		X
• Business Perspective	X	X			X	X
• Quick Learner		X				
• Task Oriented			X			
• Understanding Users' Specfic Needs			X			X
• Evaluating Alternatives				X		X
• Negotiating				X		
• Researching				X		
• Multi Tasking		X	X			
• Technical Awareness		X				X
• Data Management			X			
• Understanding Specific Technical Tools		X	X		X	X
• Prototyping Technical Skills	X					

V ORGANIZATIONAL CONSIDERATIONS

A. THE CHANGING STRUCTURE

- The size of the company, the type of industry, and the corporate needs in IS services govern the way the information system function is planned and organized. Some companies (such as large, diversified discrete manufacturers) may have a complete IS department within each major division. These decentralized organizations may have considerable autonomy and only need approval from corporate headquarters on major expenditures. Banks, on the other hand, tend to tightly control all information systems activities from a centralized IS division. It really depends on the nature of the business when it comes to the question of IS decentralization or centralization.

1. DECENTRALIZED VERSUS CENTRALIZED SOFTWARE DEVELOPMENT

- A company could have independent IS organizations sprinkled all over the world and would be considered decentralized. Within each organization, however, the control over systems development, voice and data communications, office automation, end-user computing, etc., could be highly centralized.

- Decentralized software development in this context refers to the line functions writing their own programs. Most every company has some degree of this going on, and this trend is predicted to flourish over the next several years.

- Many believe that by the end of this decade most detail design and systems development will be done directly by the end user. Each functional unit or department may have a business analyst or analysts who perform the actual tasks, but these people will send their reports up the line-function hierarchy and will not answer to the corporate IS organization. The effect of this phenomenon on the future IS mix is summarized in Exhibit V-1.

- Even if application software development is totally off-loaded to the business functions being serviced, there will remain a corporate IS organization. It will be a core of advisors, consultants, and highly specialized IS technicians. They will be primarily concerned with issues related to data management, communications, security, capacity planning, and large-systems integration.

2. SPECIALISTS VERSUS GENERALISTS

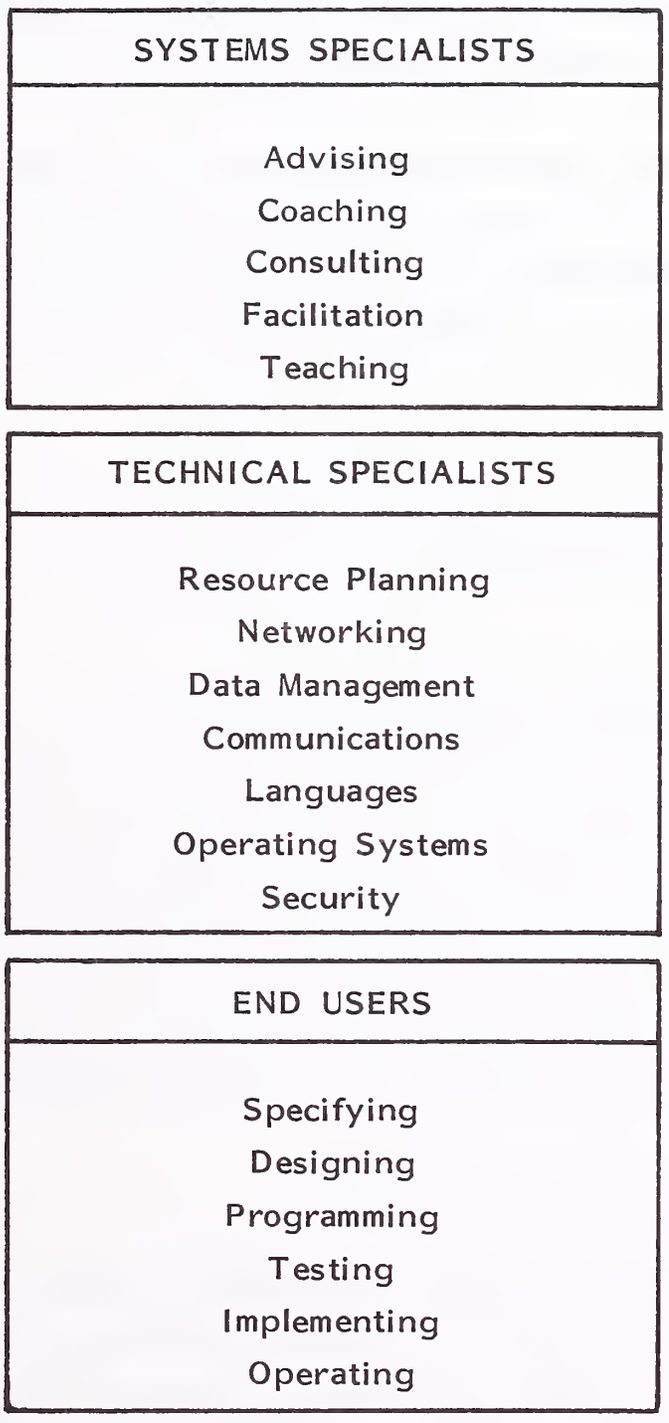
- When first asked about trends regarding specialization the majority will say we're moving to an era of generalists, because the vendors are making the tools so easy to use. After pondering the question for a while some doubt will enter their minds, and they will flip-flop back and forth on the subject.

- When IS starts considering networking, data base/data management, fourth- and fifth-generation software, knowledge-based systems, and the like, it realizes that someone in the organization will have to understand the technology before the company can put it to work.

- Most envision a relatively small group of highly specialized technical experts whose energies will be devoted to investigation, evaluation, and implementation of new information products and services. These experts will possess advanced degrees in computer science and will be excellent trainers and advisors. Many companies have already started assembling an elite group of hardware, software, and communications specialists.

EXHIBIT V-1

THE CHANGING SKILLS BALANCE OF THE I.S. FUNCTION



- The applications people need not become technical specialists, because the tools are indeed becoming easier to use and the corps of experts is always close by. The applications people usually end up as specialists in a particular operational function of the business (e.g., finance, personnel, procurement, inventory control, production control, point-of-sales systems, etc.). These groups will be growing via recruits with business or liberal arts degrees and possessing exposure to computer applications.

- The bottom line is that the IS organization is moving toward specialization. The individual will either be a technical specialist or a business specialist. These two groups tend to attract different types, and it sometimes becomes the responsibility of IS management to direct subordinates down the right path.

B. CHANGING CAREER PATHS

- Computer technology has become an integral part of every major business. Every aspect of a business operation is affected in some way by the computer. Business today cannot exist or prosper without the assistance of automated information systems. The entire society has become dependent on computer technology and this trend will continue. With office automation, the information center, executive workstations, and the general infiltration of computer technology throughout an organization, the career paths of the information systems professional have widened and added branches.

1. I.S. SUPERVISION AND MANAGEMENT

- Today, more than ever before, IS management can aspire to a senior position in the organization. Because of their overall knowledge of the enterprise and their grasp of information technology, IS managers have a better chance at the top spot than do many of the operational line managers.

- In order to achieve their career goals, however, IS managers must keep their basic managerial skills sharpened. They must continue to educate themselves on the theories and philosophies of management. Courses and reading material on the basics of effective management and leadership should be considered along with technical training. The following factors are still the most important elements in the list of skills requirements for IS managers:

  - Planning and decision making. The higher up the IS management ladder that one climbs, the greater the scope, depth, and impact of the planning and decision-making duties. Managers must recognize the difference between strategies and tactics, and maintain a balance of the two.

  - Organizing. An effective manager will continually reevaluate his or her objectives regarding the structure and reporting relationships within the IS function.

  - Controlling. IS management must assure the quality and timeliness of the services provided. It must also assure an effective level of productivity from employees, and it must run a monetarily efficient operation. These elements of control are achieved by establishing effective policies, standards, and procedures.

  - Leading. Probably the single most important skill for the IS manager to possess is leadership. If you cannot induce your subordinates to want to do what you believe must be done, then all is for naught.

- Interpersonal communication skills are becoming extremely important for IS management because there is more and more interfacing with all levels of employees throughout the organization. Being able to communicate effectively on technical and business issues will be the key to moving up the corporate management ladder.

- IS supervision and management should continue to maintain a technical awareness and be conversant with the major hardware, software, and communication issues facing the IS function. They should be able to discuss these issues with subordinates and vendors at a level where knowledgeable decisions can be reached. The IS supervisor or manager does not have time, however, to sit for hours in front of a terminal learning the details of a new language.

2. PROGRAMMERS AND ANALYSTS

- Depending on their innate qualities this group of IS professionals has several career path options, as illustrated in Exhibit V-2. The real trick is to match the personalities and interests with the proper jobs.

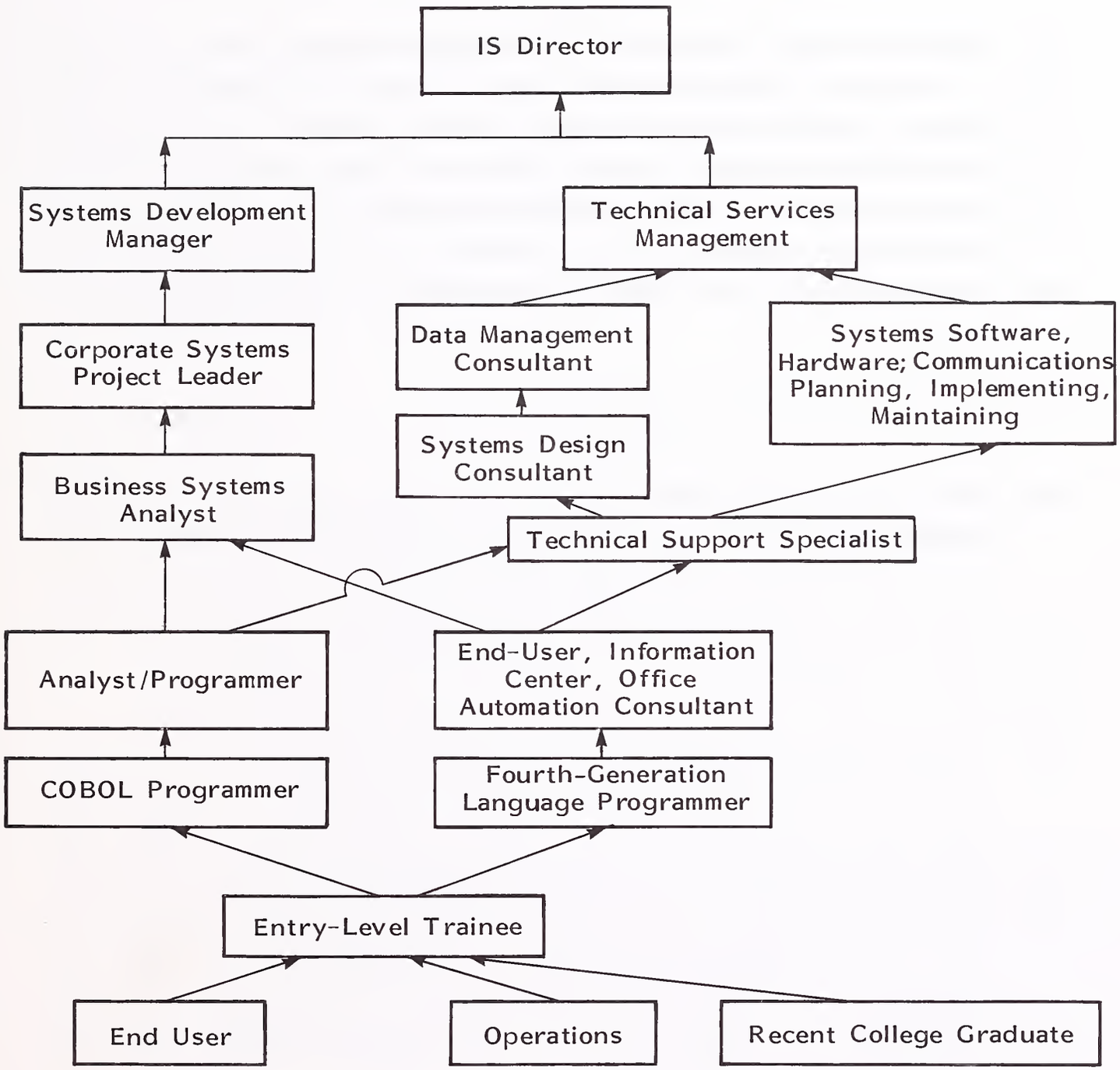
- Someone who has the ability to interact with others--that is, get along with people, will usually migrate to the business systems development side. If they enjoy advising and training others, and prefer to work on several short-term projects, as opposed to one huge long-term system, they will probably lean toward the information center or end-user computing.

- The individual that does better in a team environment and likes the security that accompanies knowing a lot about one business application will undoubtedly climb the traditional programmer, programmer/analyst, business systems analyst branch of the career tree.

- Interestingly enough, the person who works as a consultant for end-user-developed systems is usually independent and likes to rip through red tape to get the job done. The main objective of these people is to satisfy the needs of the user. As end users become more involved in the development and implementation of business systems this entrepreneurial approach will pose security/integrity problems.

EXHIBIT V-2

THE CHANGING CAREER PATHS



- Regardless of which path individuals choose (the large, lengthy project accomplished through a team effort or many short-termed projects working one-on-one with the user), each person has the opportunity to rise to the middle and senior managements positions within the IS organization, if he or she possesses the innate qualities for managing others.

- After entry-level training and a stint of applications programming, individuals start to get a feel of where they might fit within the IS organization. There comes a point, usually after they have been promoted to the programmer/analyst/consultant ranks, where they must choose between the technical side and the business side. If a individual is forced to proceed down one path and desires the opposite, it is only a matter of time before that person seeks employment elsewhere. This has been a difficult lesson for IS managers to learn.

3. TECHNICAL SUPPORT ANALYSTS

- This group of workers likes to solve very complex, highly technical problems, mostly related to hardware, software, or communications. They usually prefer working alone and possess good working habits. Some are excellent instructors, but are not known for their congeniality. They are more professional in nature.

- The true computer scientists will stay close to the hardware and software that makes the entire system function. They get excited over MFLOPS and MIPS ratings and worry about the features of a new operating system release. They have little interest in business applications and less interest in company politics. They don't concern themselves with career paths if the project on which they are working is challenging and rewarding. Some of them are capable of managing other technically competent co-workers, but most do not have the patience, diplomacy, communications skills, or desire to manage the applications development people.

- In a very large, sophisticated computer environment, with worldwide communications networks and many computers connected to one another and thousands of end users, the technical services manager could rise to the top information systems position. It would be unlikely, however, that this individual would advance beyond this point.

- The data management specialists and the communications specialists understand the technical details of their area of responsibility and they can relate their work directly to the business application. You will find these people as members of systems development teams and consultants for the information center. They also have a good chance at the top technical management spot and probably have a better chance to take over the reins of the entire IS organization than does the pure technician. These experts are in huge demand and the shortage is growing.

4. COMPUTER OPERATORS

- There was a time when most applications programmers were once operators. That seemed to be the logical progression--from operator to programmer.

- Computer operators are still a source for entry-level programmer trainees, but as such they are valued far below recent college graduates. The operators must make themselves known by taking after-hours courses in computer technology. The ambitious ones should be encouraged to take as many computer courses as their schedules will allow.

- There are several places for the operator who has problem-solving abilities. They of course can progress up the data center hierarchy and become shift supervisors and operations managers. The other spots include:

  - User assistance.

  - Scheduling.

- Communications support.

- Documentation.

- COBOL programming.

- The information center.

5. THE FUNCTIONAL AREA

- Transferring people from a using department to the data processing department has been a practice for as long as computers have been around.

- In the early days there was such a drastic shortage of computer people that companies put together programming courses for company employees. Some of these courses were after hours and open to anyone who passed the IBM programming aptitude test. Some of the great contributors to the field of automation got their start in these training programs.

- There has been new interest in this area in recent years, primarily due to the establishment of the information center.

- The big problem associated with recruiting users for positions within IS is money. Normally, the best qualified people are making too much money to be lured away from their current jobs. Nevertheless, some of them are willing to take a pay cut to become an entry-level programmer, especially if they believe their careers are stagnated.

- If a particular user has had exposure to computer programming at college and appears to be open-minded and willing to learn, they may be able to be brought in at the second rung. If they have innate analytical skills, with minimal training they could be placed either in the systems development

group as a programmer/analyst or in the information center as a consultant to end users.

- Sometimes it makes sense to transfer an IS staff member to a line function. This is particularly beneficial when the IS person has been assigned to an area of the business for an extended period. With a knowledge of the business and a knowledge of technology, the IS professional has a good opportunity for line management.

C. STAFFING AND RECRUITING

- The location of the company has a strong influence on recruiting methods. There are some companies that are fairly isolated from the mainstream of computer technology activity, and recuit primarily from within. These companies have formal entry-level training programs and formal screening and testing programs. They claim to have less turnover problems with recruits from within the company than they do with those from outside. If the company is in a highly competitive area it will probably depend heavily on agencies and search firms, in which case it pays all fees and any relocation costs. If the company is located in a "high-rent district" like the west coast, there is the additional problem of housing cost differences.

1. FUTURE HUMAN RESOURCE PLANNING

- People are the key to success as a manager within the information systems function. Every skill base must be covered with the best possible people. There is absolutely no way for managers to comprehend every aspect of their areas of responsibility. They must depend on their subordinates to supply them with decision-making information. Building an elite group, that not only possesses the knowledge and skills required to do the job, but also makes a compatible team, takes time and planning.

- When asked to identify some of the future skill requirements that will be critical to IS management, a sample of the respondents offered the following list:

  - Knowledge of interfacing techniques: PC to mainframe, mainframe to mainframe, workstation to workstation, etc.
  - Experience in data management/administration.
  - Emphasis on understanding the business.
  - Ability to sell computer services to end users.
  - Concentration on business school grads rather than computer science grads.
  - Concentration on finding people who are enthusiastic (self-starters with sound work ethics) and then teaching them the technology.
  - Ability to assist in technical strategic planning.
  - Concentration on improving the computer literacy of the end users.
  - Emphasis on interpersonal skills.
  - Emphasis on heavy technical skills.

- On one side of the skills ledger is a list of skills associated with working closer with the end users: business knowledge, interpersonal communications, technical awareness, analytical skills, etc. On the other side of the skills ledger is an array of technical skills associated with the tools of the trade: data base/data management, communications/networking, productivity tools, capacity planning, languages, etc.

- The point is that each manager must develop a strategic plan that spells out the goals, objectives, and general mission of the organization and then identifies the skills required to implement the plan.

2. RECRUITING NEW SKILLS

- As illustrated in Exhibit V-3, running advertisements in periodicals and utilizing employment agencies is still the most frequently used method for acquiring new people. This is a long, laborious, and costly process, but for special skills this may be the only way to go.

- By far, one of the best motivators and morale boosters is promoting existing employees into new positions of responsibility.

  - On the positive side is the motivation and morale factor, along with prior knowledge of the individual--the employee is a proven commodity.

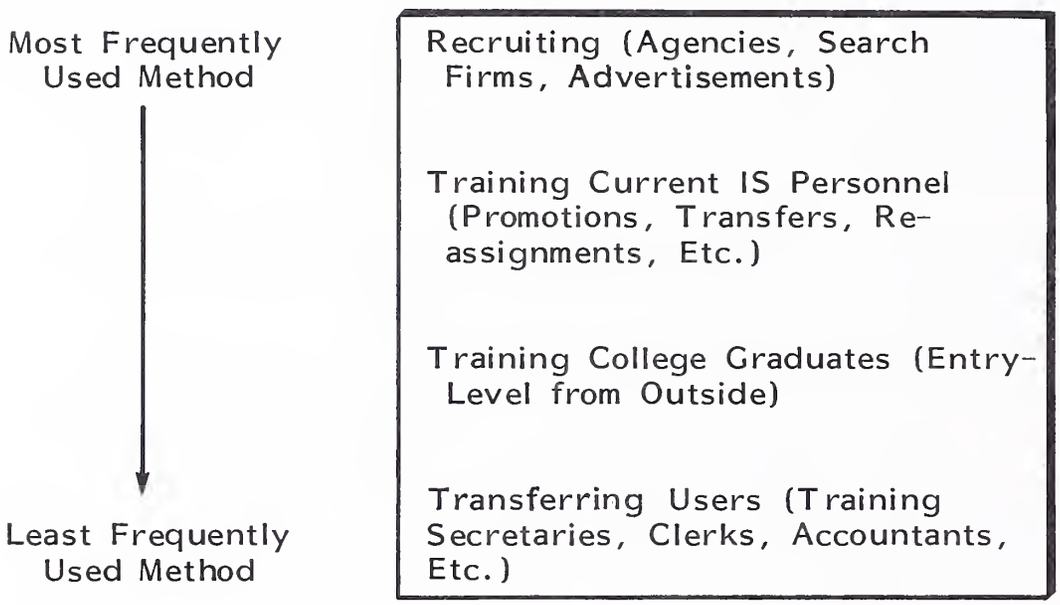
  - On the negative side is the loss of experience in the vacated position and the unknowns surrounding the individual's ability to handle the new job.

- More and more companies are attracting entry-level people from the outside. They try to find young college graduates with degrees in business, accounting, or liberal arts who have had some programming exposure. Many of the early pioneers in data processing had degrees in political science, history, art, music, drama, and the like. This old trend seems to be returning with a great deal of success; with the current emphasis on interpersonal communications skills, perhaps these nontechnical degrees are producing people with more of the skills required for the future IS environment.

  - It is thought that humanities and social science majors can build on the analytical and creative skills they have acquired and will have an open mind about the dynamics of the business.

EXHIBIT V-3

METHOD FOR ACQUIRING ADDITIONAL STAFF
AND/OR NEW SKILLS FREQUENCY DISTRIBUTION



- Computer science graduates tend to put their technical careers ahead of their careers with the company; they are narrow minded and have tunnel vision toward their particular interest or specialty. They are usually best suited for positions in systems programming or technical consulting.

- Transferring people into IS from other areas within the company, as discussed earlier, is still a viable alternative, but it is the least frequently used method. Surveys indicate that salary is the main reason for not seeking users for recruits. Most of the transferees have been clerical support people who view IS as a tremendous opportunity.

D. TRAINING AND EDUCATION

1. TYPES

- There are four formal methods for training and educating the IS staff:

  - Audio/visual service. This includes services such as those offered by DELTAK and ASI. Frequently this accounts for the biggest piece of the training and education budget. Usually there are special, quiet locations where individuals can study on their own, utilizing the audio/visual guides offered from the service. This category includes computer-aided training (CAT). As illustrated in Exhibit V-4, the statistics indicate that this method receives the largest portion of the training budget in most organizations.

  - Formal internal training department. More and more companies are recognizing a need for a dedicated group of instructors because of the onrush of new products being acquired for information systems. There

EXHIBIT V-4

METHODS FOR TRAINING AND EDUCATION
BUDGET DISTRIBUTION

Most Dollars Spent	Audio/Visual Training Services (DELTAK, ASI, ETC.)
	Formal Internal Training Department
	Outside Courses for Individuals
Least Dollars Spent	Outside Professional Conducts In-House Courses

is a trend to shift training and education budget dollars to this method. Many of the companies surveyed said they wished they could afford an internal training department, and were seriously working on obtaining appoval to establish this function.

- Individual outside courses. There was a time when all IS classifications of people attended outside courses to learn about the latest technology. Once this service was unbundled from the hardware acquisition contract and labor became so expensive, the courses became unaffordable. Not only are the courses very expensive, but the cost of travel, lodging, and time away from work must be added. This method is in third place for the budget dollars, primarily because the approach is used sparingly. Only those who are directly involved in implementing new technology are sent to an outside course.

- Professional instructor conducts in-house course. Sometimes there is a need to teach many employees how to use a new piece of software or understand a new concept. In these situations it makes economic sense to bring the instructor to the company.

2. TRENDS

- Audiovisual service is found in most large companies. This approach is only effective if there are policies and procedures in place to govern its use. IS management must be committed to this service and stick to the established schedules.

- Because of the rash of software products to understand and use, many companies are conducting classroom courses instructed by individual staff members. Some of these instructors are full-time and others only instruct when the need arises. They might be from the technical support group or from one of the middle management positions.

- Sending one person to an individual outside course and then having that person teach the rest of the staff is a sensible approach that is being used by some companies.

VI CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

- More changes have taken place during the last three years (relative to providing computer power to the end users) than took place during the previous 12 years.

- Advances in technology have provided microcomputers with capabilities matching the available mainframes of a few years ago. Data-handling software has become easier to use and much more comprehensive. There are sophisticated networks that link large and small computers.

- The cost of computing is coming down and the capabilities of computer technology are increasing. The computer can service every facet of an organization. The responsibility of the IS function has grown. With this growth comes a need for additional skills.

- Practically every scheme used to reduce the time and cost of a systems development project brings the end user closer to the technology and, in turn, brings end users closer to the information systems staff.

- More and more the systems people must think like the users being serviced. They must start thinking like business people and not like technicians. This has always been important, but with the advent of such tactics as the infor-

mation center, user-developed systems, prototyping, and application generators, it becomes even more significant. In many cases the user is working side-by-side with the IS analyst in the design and development of a system.

- This phenomenon of bringing computer capabilities directly to users will continue until all systems design and development will be done by the functional areas. This revolutionary approach to systems development will change the role of the IS analyst to that of advisor, counselor, teacher, and guide. IS will become a facilitator, making available the resources needed for the end users to build information systems.

- Facilitating end-user-developed systems will also require a group of super-technicians who will have the knowledge to put all the right pieces of hardware and software together to form the adequate level of technology.

- IS management must start immediately to build a staff to accommodate the future skills requirements for software development.

B. RECOMMENDATIONS

- Exhibit VI-1 summarizes the following recommendations:

  - IS management must first look at where computing is going in the organization. What will the environment be two to three years down the road? Will the concept of the information center grow? Will end users become more sophisticated in their application of PCs? What about the use of proprietary packages--will this increase? Will prototyping become a standard part of the systems development methodology? Will users be using more generators?

EXHIBIT VI-1

SKILL REQUIREMENT RECOMMENDATIONS FOR I.S. MANAGEMENT

- Examine the Two- to Three-Year Strategy for Information Systems
- Determine the Skills Mix Required to Carry Out these Plans
- Evaluate the Skills Level of the Present Staff
- Identify the Skills Weaknesses
- Develop Plans to Provide Needed Skills at Appropriate Intervals
  - Consider Desired Skills During Interviews
  - Step up the Pace in Training and Education
  - Consider the Establishment of a Formal Entry-Level Training Program
  - Investigate College Recruiting
  - Set up Formal Procedures for Users to Apply for IS Positions

- Depending on the strategy, IS management must determine what skills will be required and how the present staff is equipped to handle the future skills requirements.

- Once the skills weaknesses are identified then a solution can be developed that will assure that all skills bases will be covered.

- Here are some suggestions for closing the skills gap:

  - Be certain that all hiring managers are aware of the specific skills being sought, so they can consider them during interviews with applicants.

  - Assess the current training and education program to be certain that the present staff is being exposed to areas where skills are lacking.

  - Consider establishing a formal entry level training program if one is not already in place.

  - Look for college graduates with majors in business, social sciences, or humanities (and who possess innate people skills).

  - Set up a mechanism that will draw out users who possess the qualities essential for future IS personnel.

- Devote an adequate amount of time to the problem of staffing. Turnover rate alone does not measure the effectiveness of the staff. For an information systems organization to thrive and progress, the required skills must be covered by the people on board.

APPENDIX: QUESTIONNAIRE

1. What is the approximate distribution of employees in the following IS professional categories:

   Project Leader/Managers_____Excluding Operators

   Mainframe Programmers and Analysts_____

   IC Support _____ and/or End-User Computing Consultants _____

   Telecommunication Support_____

   DB Services_____

   Systems Programmers_____

   Operation Management_____

2. How has the skills mix of the IS professional staff changed over the past three years?

   _____

   _____

   _____

3. In order of frequency, what methods are used for satisfying the need for the many different skills?

   ( ) Recruiting

   ( ) Training Existing IS Personnel

   ( ) Transferring/Training User Personnel

   ( ) Training Recent College Graduates

   ( ) Other_____

4. What is the distribution of the training and education budget?

   Formal in-house ( )

   Individual Study Courses ( )

   Outside Courses ( )

   Audio/Visual ( )

   CAT ( )

   Other ( ) _____

5. How many people did you have working in the Information Center?

   3 years ago _____

   3 years from now _____

6. What is the main source of recruiting for the IC?

   Outside ( )

   Programmers ( )

   Systems Analyst ( )

   End-Users ( )

   Tech Support ( )

   Operations ( )

   Other ( )

7. What skills do you look for in candidates for the IC? What is the priority of skills?

   ( ) Strong business skills-understand user's needs
   ( ) Interpersonal communications
   ( ) PC technical skills- fourth generation language, operating systems
   ( ) Basic systems analysis skills - analysis and design
   ( ) Other_____

8. What group or function works with the users to evaluate and select the PC development tools?

   End-Users ( )

   Technical Support/Services ( )

   IC Support ( )

   Corporate Systems ( )

   Other ( ) _____

9. To what degree are the end-users involved in solving their own systems problem in PC's?

Zero ( )

Just starting ( )

Minor involvement ( )

Major involvement ( )

Comment _____

_____

_____

10. For IS to assist or coach the end-users in developing their own systems, rank the following skills:

( ) Strong business skills - understands users needs

( ) Interpersonal Communications - Can interface with all levels

( ) Basic Systems Analysis Skills - Analysis and Design

( ) PC Technical Skills - programming, debugging, tools

( ) Other _____

11. How prevalent do you see end-user-developed systems three years from now?

Not very ( )

Somewhat ( )

Very ( )

Comments _____

_____

_____

12. What is the trend in your company regarding the purchase of application software packages?

No packages ( )

Limited to very special situations ( )

Are moving toward more packages ( )

Heavily dependent on application packages ( )

Other ( )

13. What new skills are required to support the employment of application software packages?

_____

_____

_____

14. Are you using prototyping techniques for the development of systems?

None ( )

Investigating prototyping ( )

Have used some prototyping ( )

Prototyping is becoming standard ( )

Other ( ) _____

15. What impact have prototyping techniques had on skills mix of the development staff?

_____

_____

_____

16. To what degree do you see the trend moving back to the era of specialization?
(None) 0 1 2 3 4 5 6 7 8 9 10 (Considerable)

Comment _____

_____

_____

17. To what extent are you using application generators, program generators, and/or report writers?

None ( )

Investigating ( )

Just started using ( )

Significant role in systems development ( )

18. How is the use of generators and report writers affecting the skill requirements of the systems development staff?

_____

_____

_____

_____

19. What has been your experience with COBOL programmers whose primary systems have been converted to a package or to end-user computing?

_____

_____

_____

20. What skills do you look for in someone who is installing specialized management tools such as decision support systems?

_____

_____

_____

21. What do you believe are the main skill requirements for the IS management responsible for applications software development?

22. How do you envision the skill requirements of the application software development management changing over the next three years? Why?

23. What affect do you think the trend towards decentralized applications development will have on the IS function?

24. How do you keep track of the total expenditures for automation? How about 3 to 5 years from now?

25. How do you envision the structure of the IS organization three to five years from now?

26. What do you see as the biggest challenge facing the IS management relative to future skills requirements?

_____

_____

_____

27. What mainframe do you have installed and what is the primary programming language?

Mainframes _____

Language _____

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