METHODS OF COST / BENEFIT ANALYSIS

FOR OFFICE SYSTEMS

INPUT

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OFFICES

Headquarters
1943 Landings Drive
Mountain View, CA 9
(415) 960-3990
Telex 171407

Detroit
220 E. Huron
Suite 209
Ann Arbor, MI 48104
(313) 971-0667

New York
Park 80 Plaza West-1
Saddle Brook, NJ 076
(201) 368-9471
Telex 134630

United Kingdom
INPUT, Ltd.
Airwork House
35 Piccadilly
London, W1V 9PB
England
01-439-8985
Telex 23116

Italy
PGP Sistema SRL
20127 Milano
Via Soperga 36
Italy
Milan 284-2850
Telex 310352

eas Data Service Company, Ltd.
tsu Building
2 - 7 Kita Aoyama
me Minato-ku
o, 107
400-7090
26487

en
na Konsult
Persson & Co AB
22114
22 Stockholm
en
07 20
17041

West Germany
NOVOTRON GmbH
Am Elizabethenbrunnen 1
D-6380 Bad Homburg
West Germany
Telex 418094

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METHODS OF COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

SEPTEMBER 1983

METHODS OF COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

CONTENTS

METHODS OF COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

EXHIBITS

1 INTRODUCTION

I INTRODUCTION

- This report is part of INPUT's Information Systems Program (ISP). It describes the data collection and analysis techniques used for justifying office systems. It also identifies productivity and cost reduction measurements used in major corporations. Current techniques are evaluated, and recommended justification approaches are described.

A. REASONS FOR PREPARING THIS REPORT

- The evolution of office systems from word processing to knowledge-based systems will pose significant problems for information systems (IS) management. In the past it has been relatively easy to measure the costs and benefits of office systems such as word processing. But the new, advanced systems are designed for managers and professionals whose increased productivity is not as easy to measure.

- Among all office-systems-related topics at INPUT's 1982 Client Conference, clients were most interested in how to justify office systems when productivity and costs are considered.

- Due to this interest INPUT has chosen both of these topics as subjects for major reports.

- Impact of Office Systems on Productivity, October 1983, focuses on productivity in the office, its definition and its measurement.

- This report, Methods of Cost/Benefit Analysis for Office Systems, addresses techniques for cost justifying office systems. It should be viewed as a companion volume to the preceding report since white-collar productivity is invariably cited as one of the major justifications for office systems.

B. SCOPE

- The research for this report focused on the following office systems and products:

  - Computer-aided design (CAD).
  - Data base systems (DB).
  - Decision support systems (DSS).
  - Electronic filing systems (EF).
  - Electronic mail (EM).
  - Facsimile systems (FAX).
  - Fourth generation languages (FGL).
  - Information centers (IC).
  - Personal computers (PC).

- Phone systems (PBX).
- Video conferencing (VC).
- Word processing (WP).

- This report addresses the following major issues:
  - Senior management's requirements for cost justification.
  - The techniques Fortune 500 companies use to measure productivity and cost savings.
  - The effectiveness of the above techniques.
  - Identification of measurement and justification techniques to be avoided.
  - Identification of office systems benefits.
  - Categorization of tangible and intangible benefits.
- This report should be of interest to the following people:
  - IS management.
  - IS planners.
  - End-user management.
  - Senior corporate management.

- People responsible for justifying or approving office systems acquisitions.

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

  - Over 40 interviews with IS management from a variety of companies that have office systems installations. The questionnaire is contained in Appendix B.

  - Five in-depth interviews with vendors of office systems.

  - Five in-depth interviews with organizations that have advanced office systems.

  - INPUT's studies on office systems.

- A profile of the companies interviewed is contained in Appendix C.

C. OTHER RELATED INPUT REPORTS

- In addition to Impact of Office Systems on Productivity, October 1983, interested readers are referred to the following INPUT reports:

  - The Opportunities of Fourth Generation Languages, September, 1983.

    . Analyzes the extent to which fourth generation languages are used and how they fit into the information systems strategy.

  - Organizing the Information Center, August 1983.

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

- The Impact of the Office of the Future, December 1980.

. Describes the expected effects of the "office of the future" on both the organization and the people within it.

- Managing the Integration of Office Automation in the EDP Environment, November 1980.

. This report focuses on the tactical issues involved in managing the integration of office automation into the organization.

- Relational Data Base Developments, August 1983.

. This report defines, evaluates, and projects future directions of relational data base systems. It also provides guidelines for user selection and application of relational data bases.

- Personal Computers Versus Word Processors: Resolving the Selection Dilemma, June 1983.

. Compares and contrasts PC and WP roles in the office environment for today and the future. It also includes a methodology to assist decisionmakers in making cost-effective selections that reflect each organization's unique environment.

- Selecting User Friendly Operating Systems for Personal Computers, June 1983.

. This report establishes criteria and provides recommendations for selecting PC operating systems for different types of organizational environments.

D. REPORT ORGANIZATION

- The remainder of the report is organized as follows:

  - Chapter II is an executive summary formatted as a presentation for group discussion.

  - Chapter III describes the office environment from the people, organization, and technological perspectives. It addresses the functions performed in the office and how they may be categorized and measured.

  - Chapter IV describes the status of cost benefit analysis in the organization. This chapter includes an evaluation of current user justification techniques and case studies.

  - Chapter V describes office system vendors' approaches to cost justification. This includes the methods they espouse to their clients and a case study.

  - Chapter VI contains conclusions and recommendations including evaluation of cost justification techniques and management's requirements for justifying office systems.

  - Appendix A contains office systems definitions.

II EXECUTIVE SUMMARY

- Note: this executive summary is designed in a 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 communication.

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

A. METHODS OF COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

- This report was produced as part of INPUT's Information Systems Program (ISP).

- Office systems have grown from operational products (e.g., word processors) to strategic, unstructured systems (e.g., decision support systems). The changing products/systems require different justification techniques.

- INPUT's research report:

  - Describes successful data collection and analysis techniques.

  - Identifies productivity and cost reduction measurements used by major corporations.

  - Identifies senior management's office system justification requirements.

  - Investigates the effects of different office systems on justification techniques.

  - Contains two in-depth case studies on justifying traditional and advanced office systems.

  - Evaluates the justification techniques used by major companies.

  - Provides recommended approaches for cost justifying office systems.

- The remainder of this presentation will provide highlights from INPUT's report.

EXHIBIT II-1

METHODS OF COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

- Office Systems Have Grown
  - Originally Operational Products
  - Evolving Toward Strategic Systems
- Research Scope
  - Data Collection Techniques
  - Productivity Measurements
  - Management Requirements
  - Case Studies
  - Evaluations
  - Recommendations

B. THE PROFESSIONAL: THE EMERGING OFFICE SYSTEMS USER

- In the past, office systems have been synonymous with word processing, which has been primarily the province of clerks and secretaries. Word processing costs and benefits have been relatively easy to quantify, for example by recording the reduced turnaround time on documents.

- Secretaries, however, account for less than 10% of the office worker's compensation, while managers and professionals represent over 68% of office compensation costs. It is no wonder that office systems vendors are focusing on these groups for new products.

- Office systems targeted at professionals are not easy to cost justify. These systems are analysis- and communications-based and primarily generate intangible benefits:

  - Improved productivity.

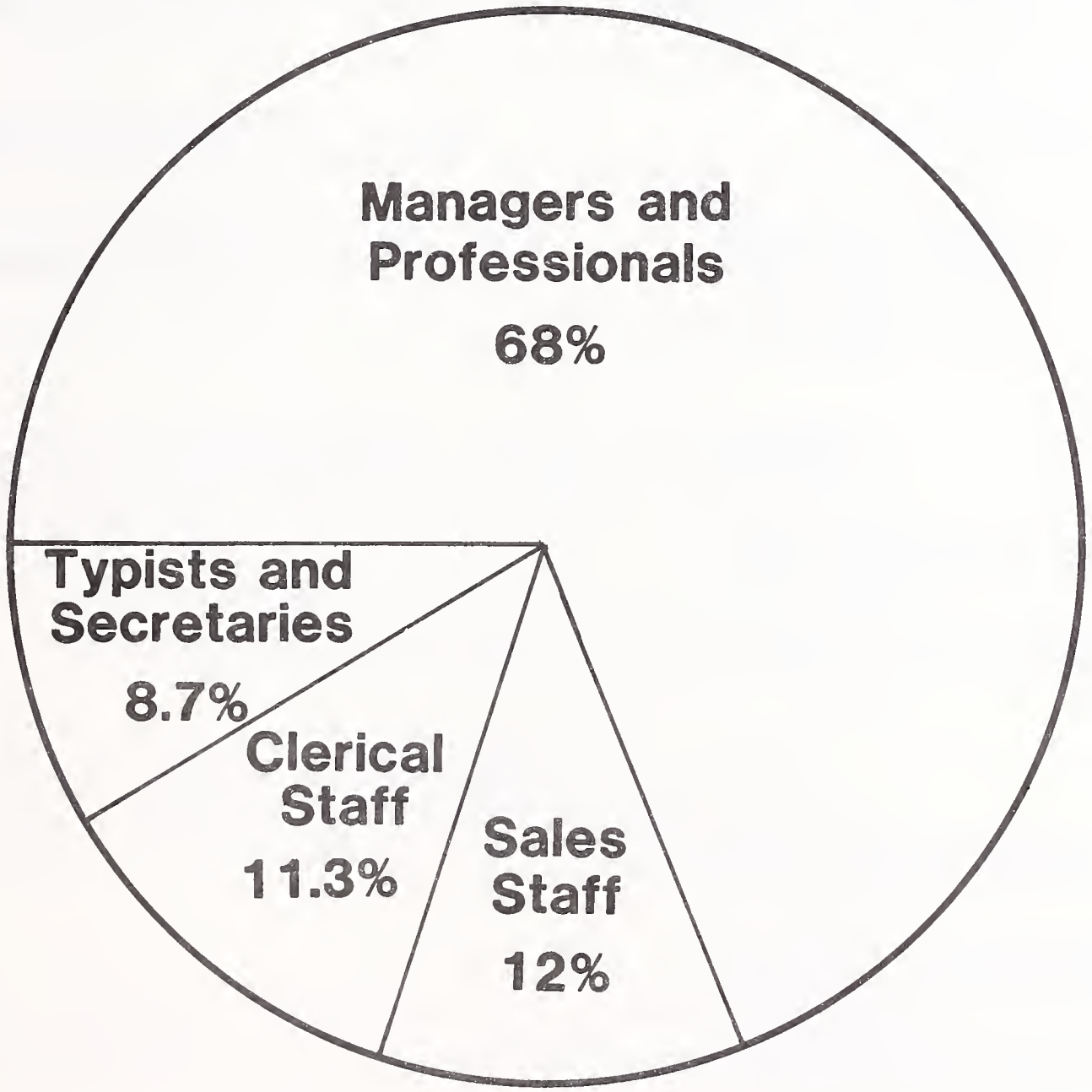
  - Increased quality.

  - Better decisions.

- Justifying an office system primarily on intangible benefits is a major challenge to its would-be user.

EXHIBIT II-2

THE PROFESSIONAL: THE EMERGING OFFICE SYSTEMS USER



Office Categories by Salary Cost

C. PERFORMANCE LEVELS HELP TO MEASURE PROFESSIONAL PRODUCTIVITY

- Productivity for the professional and management sector of the office is more intangible than tangible. Since this sector is concerned with analysis and decision making, measurement of improvements can be very subjective.

- To better understand the potential impact office systems have on office productivity in general and professional productivity in particular, INPUT has established productivity performance levels. These levels provide a framework for measuring productivity improvements caused by office systems.

  - Performance Level I (PL-I) is the hardware/software level. It is concerned only with the machine; the human factor is not considered.

  - Performance Level II (PL-II) is the human-to-computer dyad. It is concerned only with the one-to-one relationship between a person and a machine.

  - Performance Level III (PL-III) is work unit networks. It is communications oriented and contains networks of human-to-~~computer~~ human dyads (PL-II).

  - Performance Level IV (PL-IV) is the institutional level and contains systems and products that help their users to meet business objectives.

- Categorizing office systems by these performance levels will not only help identify the user but also the ultimate recipient of the systems' benefits. This should provide important information in developing an effective justification strategy for these systems.

EXHIBIT II-3

PERFORMANCE LEVELS HELP TO MEASURE OFFICE PRODUCTIVITY

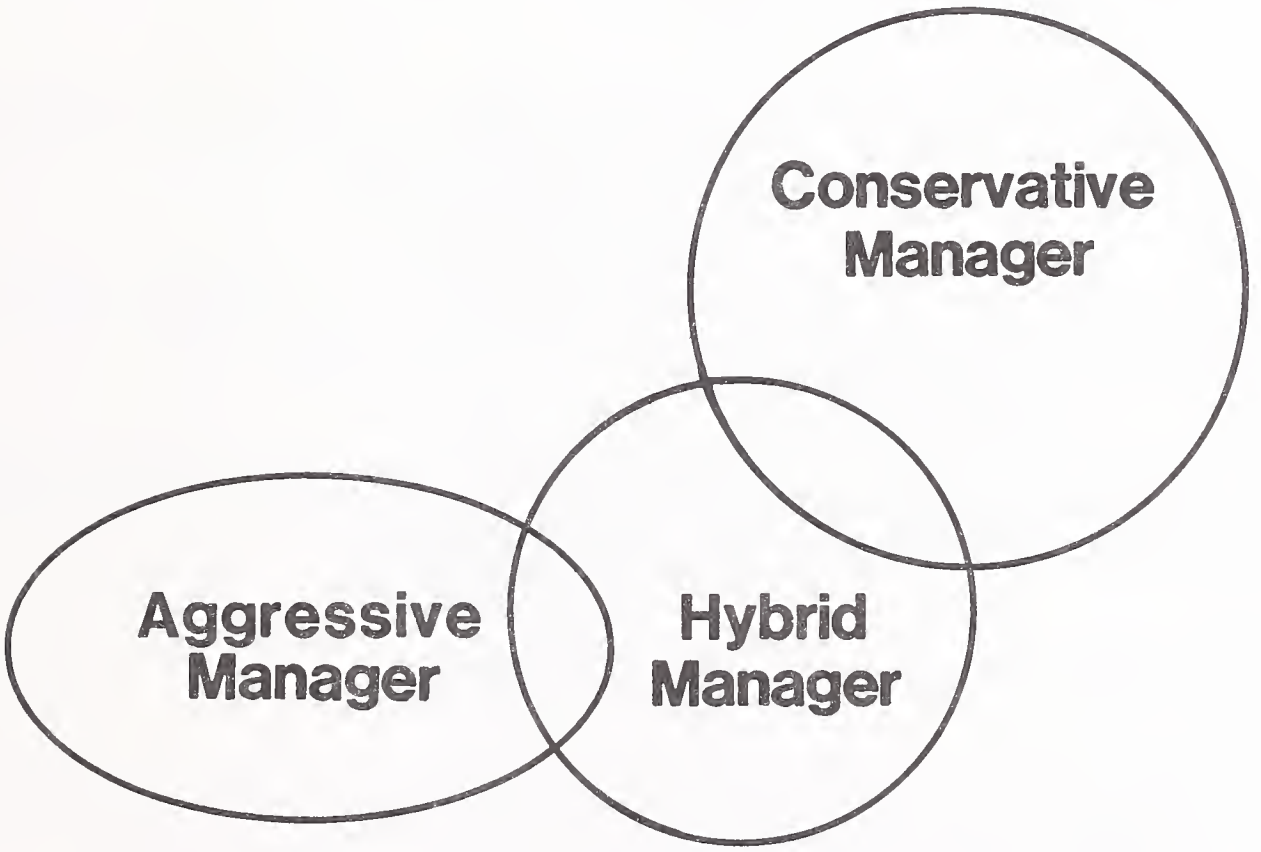
PERFORMANCE LEVEL	EXAMPLES
Hardware/Software (PL-I)	All Computer-based Products
Human-to-computer Dyad (PL-II)	CAD Personal Computers Word Processors
Work Unit Networks (PL-III)	PBX Electronic Mail Video Conferencing Facsimile Systems
Institutional (PL-IV)	Data Base Systems Decision Support Systems Information Centers

D. JUSTIFICATION REQUIREMENTS VARY BY MANAGER

- What managers require to justify office systems varies according to:
  - The manager's personality.
  - The organization's personality.
  - The manager's position in the organizational hierarchy.
- Conservative managers care only about the bottom line.
  - They only accept tangible benefits.
  - They require present value and cash flow analyses for both costs and benefits.
- Aggressive managers are willing to take risks solely on the basis of intangibles. These managers are usually senior managers, and they assume the risk because it makes business sense to do so.
- Some managers are hybrids who combine both approaches.
  - First they try to justify expenditures by basing them solely on tangible benefits.
  - If the tangible benefits are inadequate, they perform a break-even analysis to determine the minimum cost that must be offset by intangible benefits.
  - They decide whether to install the system despite the fact that the benefits are intangible.

EXHIBIT II-4

JUSTIFICATION REQUIREMENTS VARY BY MANAGER



E. HOW USERS COST JUSTIFY OFFICE SYSTEMS

- Users are still using tangible benefits to justify the costs of office systems, but more and more they are also using intangible benefits as a source of justification.

  - The incidence of intangible benefits is especially high at the institutional performance level (PL-IV).

  - Cost benefit analysis is most prevalent at the human-to-computer dyad performance level (PL-II).

- The tangible benefits used for justification include cost displacement, reduced personnel costs, and reduced backlog.

- The intangible benefits used include value added (increased effectiveness), increased productivity, and higher quality of work.

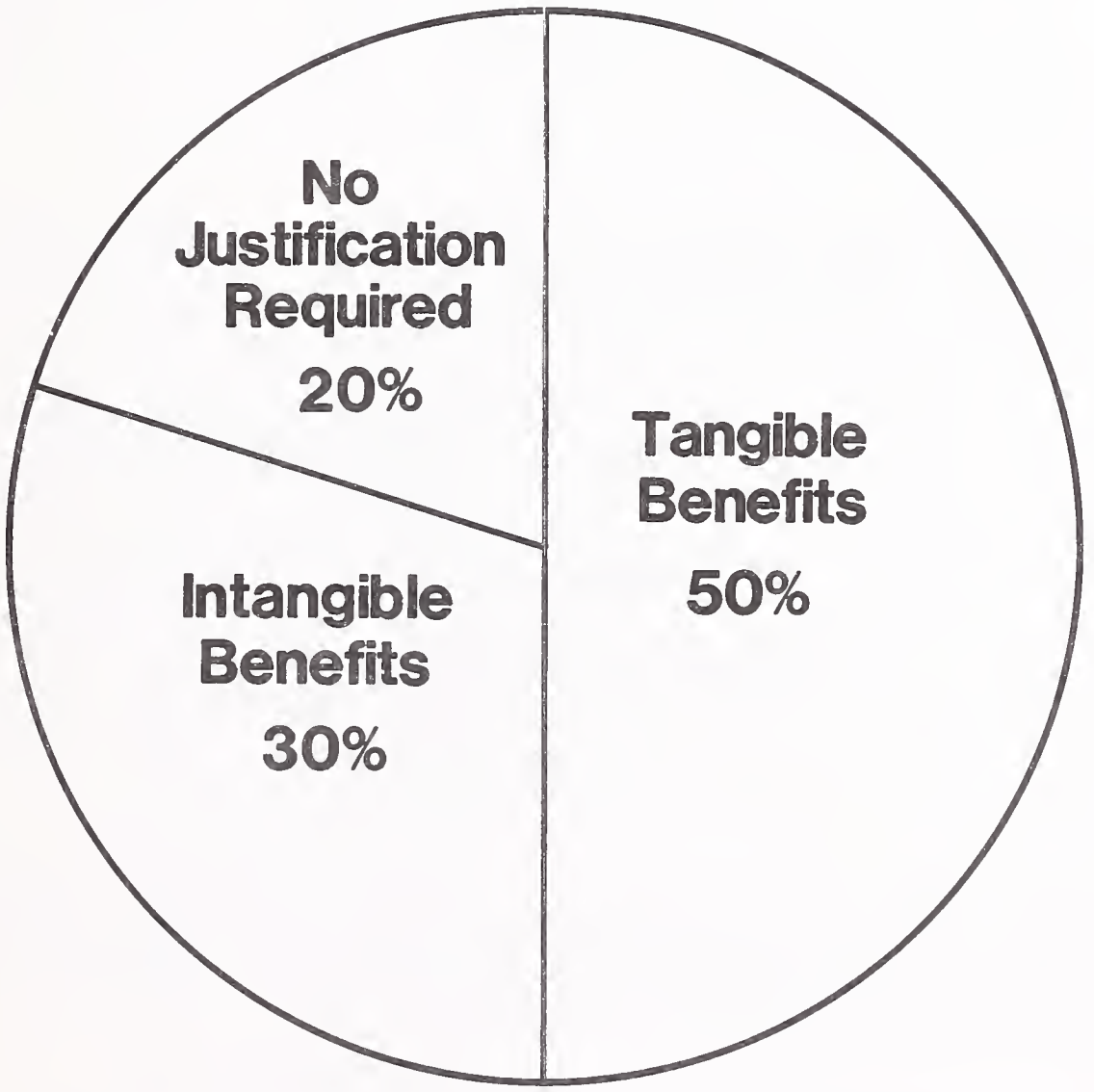
- Many users are not cost justifying office systems.

  - The systems in the institutional performance levels (PL-IV) were justified less often than systems in the other performance levels.

  - Electronic mail and filing systems are typically included in office systems acquired for other purposes and receive a "free ride" in the justification process.

EXHIBIT II-5

HOW USERS COST JUSTIFY OFFICE SYSTEMS



F. VENDOR'S ROLE IN JUSTIFICATION IS DECREASING

- INPUT's research has determined that the vendor's role in the justification process is diminishing. There is a healthy skepticism by user and IS department alike regarding vendor-provided justification techniques.

- Even though the vendor's role is diminishing, it is still important that their justification strategy be understood. This strategy is still used by many organizations to justify office systems.

- Vendors espouse axioms for using computer systems in general and office systems in particular. These axioms include:

  - "Office workers are technologically deprived because investment in their equipment is behind that for blue collar and agricultural workers."

  - "Information is a corporate asset with definable and measurable value."

  - "Just give white collar workers computer access, and they will automatically become more productive."

- Once these axioms are accepted, vendors' jobs become significantly easier. They tell their customers that justifying office systems is indeed difficult. Their recommendations to customers include:

  - Customize studies and procedures to fit unique situations.

  - Be conservative.

  - Start with small systems to reduce the risk.

- Vendors and many users believe that the IS department is a bottleneck in getting office systems installed.

VENDOR'S ROLE IN JUSTIFICATION IS DECREASING

- Users and IS Personnel Are Skeptical of Vendor-provided Justification
- Vendors Use Axioms
- Vendors Recommend:
  - Use Customized Studies
  - Be Conservative
  - Start Small
- Vendors Perceive the IS Department as a Bottleneck

G. JUSTIFY OFFICE SYSTEMS FROM THE CORPORATE PERSPECTIVE

- Know the decision makers and prepare the justification analysis consistent with their requirements.

- Install prototype systems that demonstrate their potential benefits. This is a good strategy to exhibit intangible benefits that are difficult to describe in a written analysis. Be sure the prototype system contains the correct mix and sufficient number of users to properly demonstrate its potential. Otherwise, the prototype will harm instead of help the justification.

- Vendors should be viewed as information providers with an obvious bias. Don't let them control the justification process. Let the vendors do what they do best: explain their products.

- Measure the potential benefits that are relevant, not the ones that are easy to calculate. Office systems provide the professionals with the opportunity to do their job better and to help meet business goals. Producing more documents faster may be easy to measure but may not be viewed as a corporate benefit.

- The IS department should assist office system users in justifying their systems. IS is in the best position to view a proposed system from the corporate perspective. But IS must not justify the system for the user. The user must live not only with the system but with the reasons it was installed. The user will eagerly transfer culpability for unattained benefits to the justifier.

EXHIBIT II-7

JUSTIFY OFFICE SYSTEMS FROM THE CORPORATE PERSPECTIVE

- Know Your Decision Maker
- Use Prototype Systems
- Treat Vendors as Salespersons
- Don't Measure the Wrong Things
- Consult, Don't Justify

III THE OFFICE ENVIRONMENT

III THE OFFICE ENVIRONMENT

- What is the office? Although "office work" dominates most organizations, it is not easy to characterize the office itself. But before office systems are justified, it is important to have a clear understanding of office functions and the office environment. This chapter describes the office from three perspectives:

  - People.

  - Organization.

  - Technology.

- The purpose of this chapter is to provide a framework to be used to analyze office system justification techniques. A more detailed discussion of this framework is presented in INPUT's upcoming report, Impact of Office Automation on Productivity.

A. PEOPLE

- INPUT's above-mentioned report discusses office productivity and its measurements. In that report, the office worker is defined from both functional and cost viewpoints.

- The problem of defining office functions has been aggravated by a myriad of occupational titles. For the purposes of INPUT's research, the following broad categories have been assigned:

  - Management and administrative.
  - Professional and technical.
  - Sales workers.
  - Secretaries/administrative assistants.
  - Typists/data entry.
  - Clerical.

- Sales workers have been included because:

  - Office work is primarily communication, as is sales work.
  - INPUT believes that improving general office productivity will also improve sales productivity.
  - Sales workers are included in the major occupational categories of white-collar workers by the Bureau of Labor Statistics.

- The following are the descriptions of the functions performed by office workers.

  - Analysis and decision making include reading, calculating, planning and scheduling, and "think time."

- Report preparation includes writing and proofreading, whether by pencil or with a computer.

- Typing/data entry includes keying previously prepared documents or data. It does not include data entry by an author or data entry required by professionals using a personal computer for their own analysis.

- Copying/information entry includes both conventional copying and that for publication for mass distribution. Information entry is document entry using cameras or scanners.

- Information handling/storage includes mail handling, document retrieval, filing, and distribution. This includes both paper- and electronic-based documents.

- Telephone time includes obtaining a number, dialing, wait time, missed connections, and actual conversation.

- Interpersonal communication includes casual face-to-face conversation, scheduled meetings, conferences, and travel for these purposes.

- Exhibit III-1 presents the occupational categories and general functions in matrix format. The matrix is intended to encompass all activities of office workers during formal business hours without regard to whether the activities are productive. The time distribution in this exhibit was derived from INPUT's accumulated experience in office systems. This information is, of course, very general and may vary not only according to industry and company but by individual offices performing the same functions within a company. How office workers spend their time is also influenced by management style and personal work habits. Despite these qualifiers, Exhibit III-1 provides good estimates of how office workers spend their time.

EXHIBIT III-1

DISTRIBUTION OF OFFICE WORKERS' FUNCTIONS BY TIMES

FUNCTION \ OCCUPATIONAL CATEGORY	EXECUTIVE, MANAGERIAL, ADMINISTRATIVE	PROFESSIONAL & TECHNICAL	SALES WORKERS	SECRETARIES, ADMINISTRATIVE ASSISTANTS	TYPISTS, DATA ENTRY	CLERICAL
Analysis & Decision-making	15.0%	35.0%	7.5%	12.0%	5.0%	25.0%
Report Preparation	23.0	20.0	12.5	12.0	5.0	5.0
Typing/Data Entry	0.0	0.0	0.0	20.0	40.0	10.0
Copying/Information Entry	0.0	0.0	0.0	6.0	12.0	12.0
Information Handling/ Storage	12.0	15.0	5.0	15.0	15.0	30.0
Telephone	20.0	10.0	25.0	17.5	10.0	8.0
Interpersonal Communi-cations	30.0	20.0	50.0	17.5	13.0	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: INPUT surveys.

- INPUT applied these estimates to occupational employment figures and average annual salaries to determine the costs of office function by occupational categories. These costs are summarized in Exhibit III-2.

  - Typists and secretaries have been the focus of office automation products. However, they account for less than 10% of the white collar compensation.

  - It is the professional, technical, executive, managerial, and administrative functions that account for over 68% of office costs. It is not surprising that most office system vendors are concentrating on the "professional" or "knowledge worker" and are reducing their effort on the text-oriented market.

B. ORGANIZATION

- In the previous section individual office workers were described by function. It was stated that the functional description may vary even among offices and departments within the same organization.

- There are, however, some similarities among the same types of departments in different companies. Based on numerous productivity analyses, most companies have the following distribution of their professional work force:

  - Operations - 33%.

  - Planning and analysis - 27%.

  - Marketing - 22%.

  - Other (includes personnel, finance, and legal departments) - 18%.

EXHIBIT III-2

WHITE-COLLAR SALARY COSTS, 1981
(ORDER BY OCCUPATIONAL CATEGORY & FUNCTION)
($ billions)

COSTS BY OCCUPATIONAL CATEGORY			COST BY FUNCTION		
CATEGORY	DOLLARS	PERCENT	FUNCTION	DOLLARS	PERCENT
Professional & Technical	$427.0	37.0%	Interpersonal Communications	$288.2	25.1%
Executive, Managerial, Administration	360.0	31.3	Analysis and Decision Making	253.9	22.1
Sales Workers	134.0	11.7	Report Preparation	195.5	17.0
Clerical Workers	130.0	11.3	Telephone	171.6	14.9
Typists/Data Entry Workers	57.0	5.0	Information Handling/ Storage	167.9	14.6
Secretaries	42.0	3.7	Typing/Data Entry	44.1	3.8
Total	$1,150.0	100.0%	Copying/Information Entry	24.9	2.2
			Dictation	3.9	0.3
			Total	$1,150.0	100.0%

- Exhibit III-3 reflects the distribution by departmental functions using the categories described in Exhibit III-2. The operations departments' high incidence of clerical- and document-related activities has caused office systems vendors to concentrate on these departments in the past.

- The next target for these vendors will be the marketing and planning and analysis departments, which have communication and analysis as their main functions. Although the products and services that support these functions are more difficult to quantify, inroads are being made into these departments by electronic mail and especially by personal computing applications.

C. TECHNOLOGY

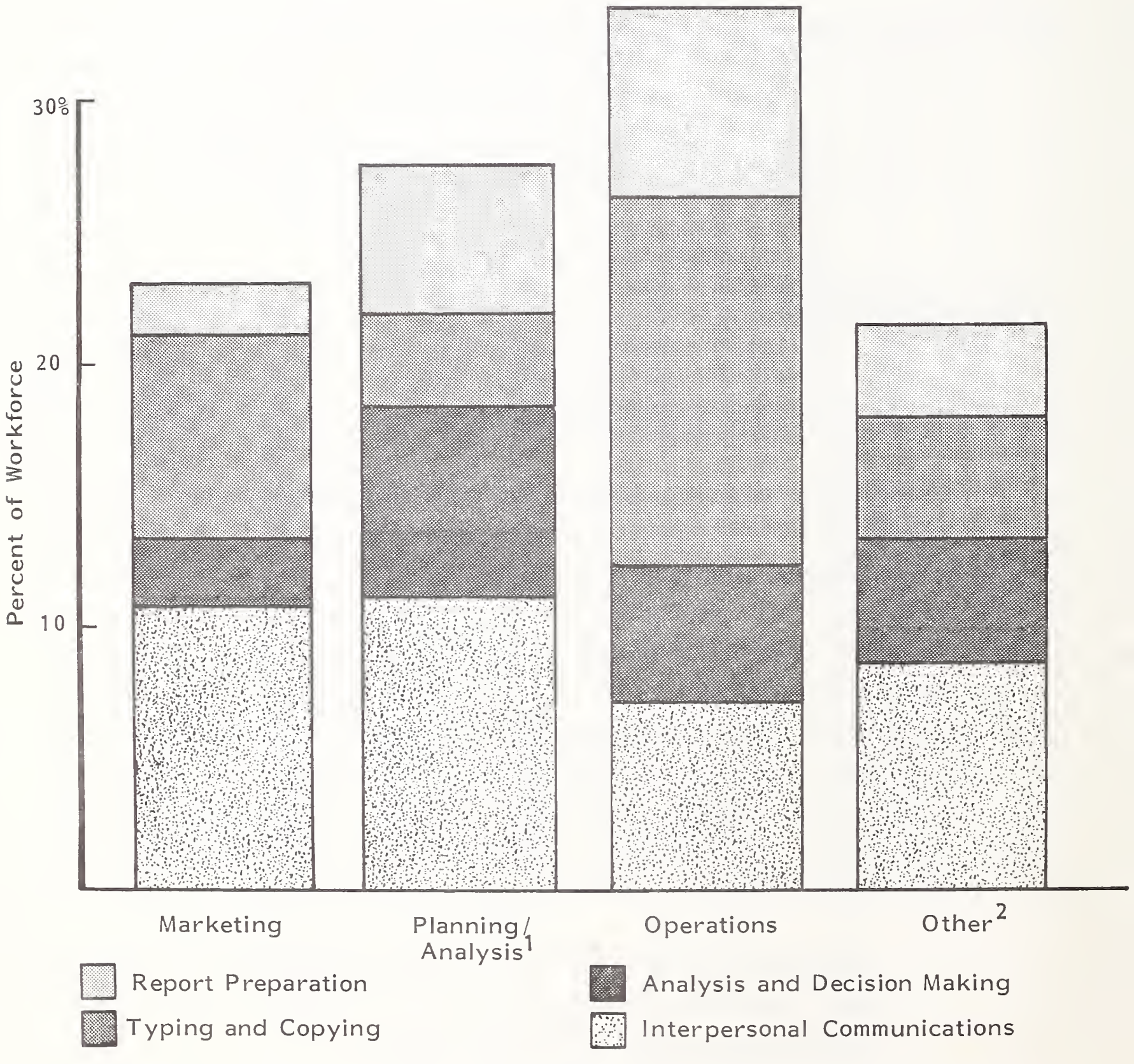
1. LEVELS OF PERFORMANCE MEASUREMENT

- Technology in the office exists to solve problems and, ultimately, to improve productivity. Office systems and products can be functionally classified (see section 2 following) but this does not address technology's impact on productivity. In order to consider the potential impact of office system solutions on productivity issues, it is necessary to establish a framework for these systems. INPUT established a framework called Productivity Performance Levels in its report, Impact of Office Automation on Productivity. This framework will be used to categorize justification processes in the following chapters. INPUT believes performance levels provide an unusually effective categorization of office systems. The following is a brief description of the Productivity Performance Levels.

  - Performance Level I (PL-I) is the hardware/software performance level. This level is machine oriented. It contains a broad range of systems and products. In fact, the products and systems in the higher

EXHIBIT III-3

DEPARTMENT'S OFFICE FUNCTIONS



[1] Includes: Information Systems, Research and Development, Engineering, and Senior Management

[2] Includes: Personnel, Finance, and Legal

levels are comprised of products in this level; all hardware and software is assigned to this level.

- Performance Level II (PL-II) is the human-to-computer dyad. This level is individual oriented and is concerned entirely with the human-to-machine interface on a one-person-to-one-machine ratio.

- Performance Level III (PL-III) is work unit networks. This is merely the connection of multiple human-to-computer dyads. The reasons for establishing these networks are:

  . They are defined by an existing organizational group that normally has a prescribed and frequently continuing function.

  . It is formed to solve a specific problem or to produce a specific product, and it may be interorganizational or even intercompany.

  - Work unit networks imply communications, and this information exchange accounts for over 75% of office workers' salaries. Unfortunately, the bulk of the communication functions are not easily measured. Only paper-oriented processes such as typing and work processing lend themselves to measurement. Moreover, it could be argued that paper communications indicate poor communications.

- Performance Level IV (PL-IV) is the institutional level of performance. It is the ultimate purpose of office systems to improve institutional performance. The office systems at this level directly aid in satisfying corporate goals.

- Exhibit III-4 summarizes the performance levels and designates the primary office functions associated with each.

EXHIBIT III-4

PRODUCTIVITY PERFORMANCE LEVELS

PERFORMANCE LEVEL	PRIMARY OFFICE FUNCTIONS
I - Hardware/Software	Support of All
II - Human-to-computer Dyad	Typing Copying Telephone Dictation
III - Work Unit Networks	Interpersonal Communications Telephone Report Preparation Information Handling
IV - Institutional	Analysis and Decision Making

2. PRODUCT CATEGORIZATION

- Office systems and products can be classified into six major categories.

  - Data/information entry and retrieval systems include:

    . Manual systems (paper based).

    . Word processing systems.

    . Copiers.

    . Workstations (including personal computers and portable terminals).

    . Pattern recognition systems (OCR).

  - Text/document storage and distribution systems include:

    . Paper filing systems.

    . Micrographics systems.

    . Multifunctional copiers (e.g., IBM 6670) and facsimile systems.

    . Image processing systems.

    . Electronic filing systems.

    . Electronic mail and messaging systems.

  - Sensory extension systems include:

  - Phone systems.
  - Video conferencing.
  - Audio recognition/response systems.

- Data/information-based computer systems include:
  - Batch systems.
  - Interactive systems.
  - Data base management systems.
  - Integrated information-based systems (data base management and document storage systems).

- Knowledge-based systems include:
  - Decision support systems (DSS).
  - Information centers (IC).
  - Integrated data/information-based systems with DSS (modeling and simulation).
  - Personal computers/personal data bases.
  - Computer conferencing.
  - Artificial intelligence systems.

- Expert systems include:

- Knowledge-based systems/specialized models.

- Business planning systems.

- Chapter I listed the office systems and products used in INPUT's research. Exhibit III-5 summarizes each of the products used as the basis for this report and indicates their product category and performance level. In some cases, a product may transcend product categories and/or performance levels, in which case the most appropriate selection possible is made.

- This chapter has provided a structure for evaluating the office and its systems. The productivity performance levels indicate not only the products but who the potential benefit recipients are within the organization. PL-III systems, for example, are communications oriented. Their benefits are achieved by multiple separated users with a need to interact.

- The next two chapters investigate the methods of cost/benefit analysis employed by user organizations and those proposed by office systems vendors. The structure established in this chapter will be used to describe and evaluate these methods.

EXHIBIT III-5

CATEGORIZING OFFICE SYSTEMS

OFFICE SYSTEM	PERFORMANCE LEVEL*	PRIMARY PRODUCT CATEGORY
Word Processors	Human-to-computer Dyad (PL/II)	Data Entry and Retrieval
Electronic Filing	Work Unit Networks (PL/III)	Text/Document, Storage & Distribution
PBX	Work Unit Networks (PL/III)	Sensory Extension
Video Conferencing	Work Unit Networks (PL/III)	Sensory Extension
Data Base	Institutional (PL/IV)	Data/Information Based
Fourth Generation Language	Work Unit Networks (PL/III)	Data/Information Based
Decision Support Systems	Institutional (PL/IV)	Knowledge Based I
Electronic Mail	Work Unit Networks (PL/III)	Text/Document Storage & Retrieval
Facsimile Systems	Work Unit Networks (PL/III)	Text/Document Storage & Retrieval
Information Centers	Institutional (PL/IV)	Knowledge-based Systems
Personal Computers	Human-to-computer Dyad (PL/II)	Data Entry & Retrieval
CAD/CAM	Human-to-computer Dyad (PL/II)	Data Entry & Retrieval

* See Exhibit III-4

IV STATUS OF USER COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

IV STATUS OF USER COST/BENEFIT ANALYSIS FOR OFFICE SYSTEMS

- This chapter discusses office systems users' experiences with cost justification.

  - Section A reports current office systems activity, the extent of systems installed, and the involvement of IS departments in the selection, installation, and justification process. It then relates the justification expectations of management, users, and IS departments. Finally, current cost justification techniques are analyzed and evaluated.

  - Section B contains two in-depth case studies.

    . The first centers on traditional office systems. These systems are primarily justified using detailed cost benefit analysis. This case describes the company's cost benefit analysis techniques and the detailed data-gathering requirements associated with this approach.

    . The second case investigates justification techniques for advanced office systems. It also addresses the strategic assumptions to justify systems that have primarily intangible benefits.

A. USER EXPERIENCES AND STRATEGIES

1. CURRENT OFFICE SYSTEMS ACTIVITY

- Most of the office systems activities have centered on office automation systems in general and text-based systems in particular (see Appendix A for definition of office systems). The explosive growth of personal computers in the office has raised awareness of office systems and of their potential to achieve corporate objectives.

- In the broad context of INPUT's definition of office systems, products included under this banner include:

  - Word processors.

  - PBX/PABX/CBX.

  - Video conferencing.

  - Decision support systems.

  - Facsimile/image processors (FAX).

  - Information centers (IC).

  - Personal computers (PC).

- New concepts and systems are also being included as office systems (see Appendix A for definitions of the following systems):

  - Computer conferencing.

- Knowledge-based systems.

- Expert systems.

- Other systems that have not traditionally been part of the office may become part of it in the future. The definition of robotics, for example, may be expanded to include voice-activated and response systems. Applications such as verification of customers' credit limits are currently being used in selected companies.

- INPUT's research has indicated that most companies use at least some of the above office systems and products.

  - The proliferation of personal computers is evident in that 90% of companies interviewed are using them in the office.

  - Only 40% of the interviewed companies stated that they had electronic filing systems, and only 50% had electronic mail systems. This is compared to 72% using decision support systems.

  - The success of electronic file and messaging systems is based on a "critical mass" of users. Inadequate numbers or the improper mix of users can result in an unsuccessful system. Therefore these systems require many more users than noncommunication-based systems.

  - Decision support systems can be individually used and still be successful. The personal computer has enabled individuals to perform some degree of decision support without interfacing with other systems. In the future, decision support systems may require more computer interfaces and may become a group activity using the capabilities of computer conferencing.

  - . Decision support systems are ill defined and this could, in part, account for its high response rate.

  - Video conferencing was only used by 10% of the respondents and, in most cases, was used in pilot activities. Even though the amount of use is small, it does indicate a renewed interest in this technology. And although most of these companies instigated their pilots at the behest of senior management, no justification was required other than its appearing to be a good business decision. There will be more on the justification process in section 3 of this chapter.

- The IS organization is responsible for the traditional "data processing" office systems:

  - Information centers.

  - Data bases.

  - Fourth generation languages.

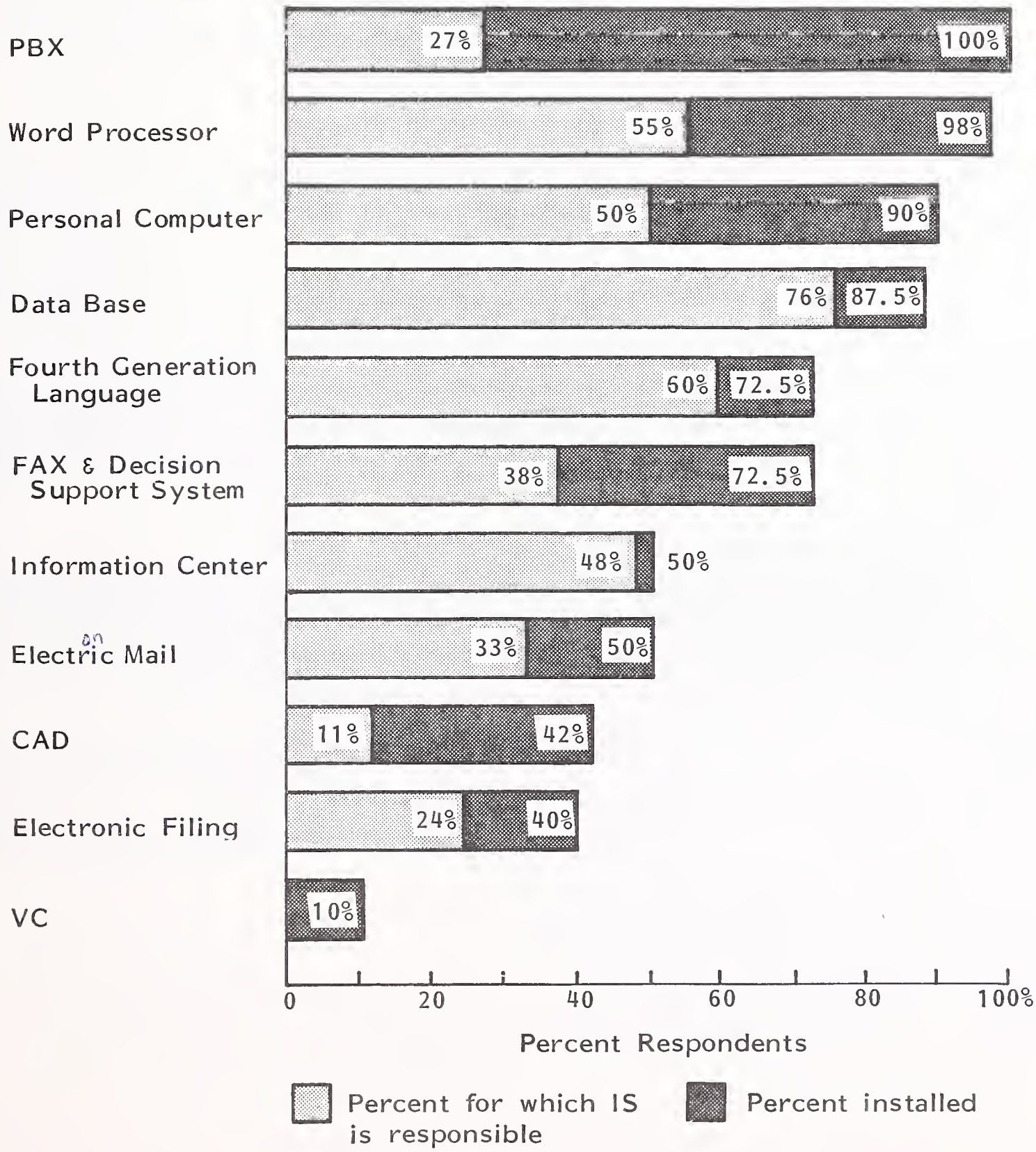
- Interestingly, the IS department is also responsible for word processing, DSS, and FAX in most companies. Exhibit IV-1 summarizes office systems technology installations and the portions of these installations in which IS has responsibility for evaluation, selection, and installation.

  - Users' responsibility was centered on fourth generation languages, PCs, and FAXs.

  - Some administrative departments are responsible for word processing. And with communication departments they are responsible for PBX, VC and FAX systems.

EXHIBIT IV-1

I.S. DEPARTMENTS' RESPONSIBILITY FOR OFFICE SYSTEMS



- The interviewed companies were aware of the new concepts of knowledge based and expert systems and were positive on the potential effects these systems could have on office productivity. There was also an awareness of the futuristic fifth-generation computer systems touted by the Japanese. There was a high degree of skepticism about the effect of computer conferencing on office productivity. Again, the spector of critical mass is the probable reason for the skeptical responses by IS managers. Exhibit IV-2 summarizes the degree of interest IS managers had in the new office technologies and their impact on office productivity.

- Senior management is becoming more aware of office systems and the effect they can have on the corporation's meeting its objectives.

  - Not only is management aware of the existence of office systems, but they are also taking a more active role in their justification. Even though management is generally satisfied with the office systems they have, the growing publicity in the media about new office systems is making management more critical of proposals.

  - Seventy percent of the IS managers questioned believed that their management is having increased interest in office systems. This could be the harbinger of the heretofore delayed growth of office systems so heralded by vendors since management sponsorship of office system projects would ease their acceptance and justification.

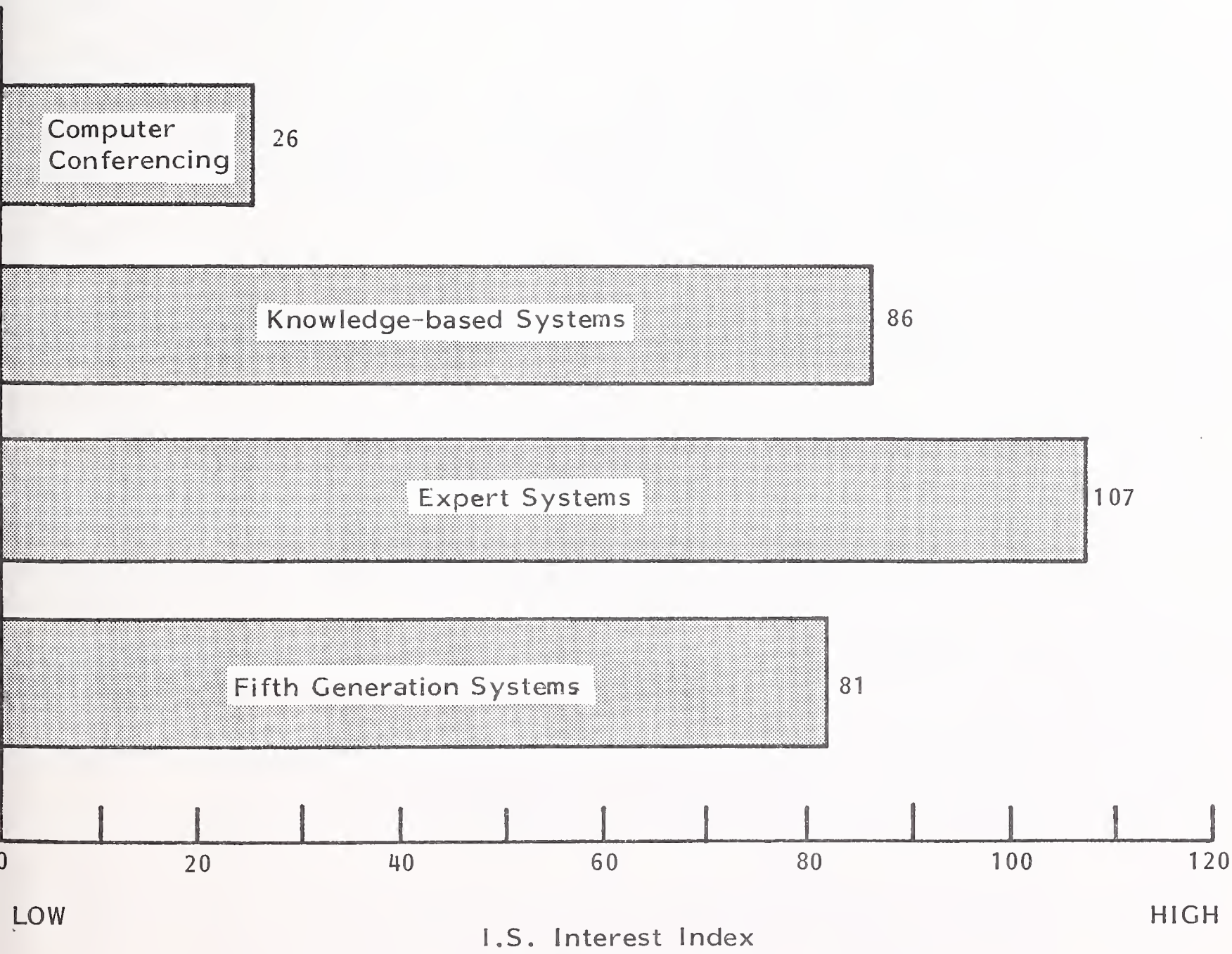
2. EXPECTATIONS OF OFFICE SYSTEMS JUSTIFICATION

a. Management - The Key Variable

- Management's expectation of how systems are justified varies. There is an inherent skepticism by non-IS management of any system justification.

EXHIBIT IV-2

I.S. MANAGERS' INTEREST IN NEW OFFICE TECHNOLOGIES



- Some managers have insufficient knowledge of computer technology, which makes it difficult for them to evaluate the differences in capabilities among systems.

- A bigger problem, however, is that processing projects in the past have cost much more than originally estimated. Managers are consequently leery of cost saving predictions.

- Managers differ on perspective. Some consider cost justification to be tangible, measurable, and accountable. The cost of any new system should more than displace the costs of the old system. This is a conservative approach and a relatively straightforward one, at least in theory. It often leads to the fractional staff syndrome (savings expressed as reducing a fraction of a person) and usually to dissatisfaction when the system fails to deliver the cost savings advertised in the proposal.

  - You can't fire part of a person, although not hiring additional staff is a "measurable" benefit (see next section on justification techniques).

  - These managers use discounted cash flow and return-on-investment calculations to see if a project is cost justifiable. Their approach is operational as opposed to strategic. Bottom-line orientation is their credo. Office system projects are the same as any other capital-intensive projects. The rules don't change. Intangible benefits are fantasy; tangible benefits are reality.

- Other managers take a value-added approach. Their objective is to meet corporate goals, and if office systems provide the vehicle for accomplishing those goals, then they will approve the system. Cost is important, but potential business opportunities are also important. These opportunities play a prominent role in the justification process. This manager is more interested in "office-of-the-future" solutions than in office automation solutions.

b. User - The Reluctant Justifier

- Users expect solutions to tangible problems. Unless they are part of a pilot or prototype system, the reason to have a system in the office is to make their lives easier. That means to get their work done faster and better. They are happy to relate improved performance experience but don't necessarily want to be measured. Macro justification of phantom personnel not hired and reduced overtime are measures they would embrace. Justification implies accountability, a risk that the user will only assume if the benefits of the system are self-evident; justification either is not required or is certain.

- The user will eschew systems that are not easily justified. They will transfer justification responsibility to the IS organization whenever possible. Thus systems that focus on the higher performance levels (work unit networks and institutional performance levels) are not solicited by the users.

- There still exists the fear that cost displacement is euphemistic for terminating staff. This fear can permeate an organization and defeat a system before it is installed. This fear is also apparent in the fractional staff strategy of justification and may account for the poor credibility of most cost justification exercises.

c. IS - The Middleman

- The system organization has become expert in generating cost justification documents for computer systems, and this expertise has expanded to include computer-based office systems. Cost justification often becomes part accounting and part mysticism. The expectation of most systems organizations is related to what is required on the document to justify the new system.

  - The justification process is not taken seriously because very few systems have postimplementation audits to determine if they met their benefit goals. In fact, the only postimplementation measure is user

satisfaction, which is highly subjective and usually negative. Most of the system justifications have been for major systems, taking many years and many groups of developers.

- Office systems are justified in the same manner but they have a broader audience, faster implementation and less direct involvement of the IS organization. The culpability for office systems' not realizing benefits can be easily assigned.

- The IS organization is in the paradoxical situation of encouraging the use of office systems, performing the justification, being held responsible and yet not having direct control of its use. More IS organizations are letting the users justify their own office systems and merely act as advisers. The dilemma of encouraging sometimes reluctant users to install office systems and yet requiring them to justify the systems must be solved if office systems are to expand and critical mass is to be achieved. The IS organization must become more diplomatic and less autocratic with their system implementation techniques if office systems are to succeed. The perception that office systems are justified like any other computer system is not necessarily valid.

3. COST JUSTIFICATION TECHNIQUES

- One of the fundamental issues of cost benefit analysis is distinguishing efficiency from effectiveness. Faster is not necessarily better. The genesis of office systems is the word processor. It entered the office replacing the typing pool and was very easy to justify using traditional industrial engineering methods. Key strokes were easy to measure as was the turnaround time of a document delivered from the typing pool.

- As the typing/word processing pool has evaporated, being replaced by "distributed" word processing, the justification exercise has become more difficult. Secretaries do not type 100% of the time, in fact some do not type at all. Justifying a word processor for this new group of users became more diffi-

cult. The solution was the most famous of all intangible benefits: improved quality.

- Word processors begot office systems that would not only provide text processing but also messaging, filing, and computing - all worthy tasks, all difficult to ascribe quantifiable benefits. The intangible benefit is again the means of justifying these systems.

- Before cost justification can be discussed at any depth, a basic question must be asked: To whom is the system being justified?

  - Although this question may seem basic, it is crucial in developing an acceptable case for a new office system.

  - The expectations of management are the key. If the manager is bottom-line-oriented, only tangible, measurable benefits will suffice. If, however, management is more interested in business opportunities, soft-dollar and intangible projections will do.

  - There is always the problem of spending an inordinate amount of money to justify any system. This is especially true in the realm of office systems, where individual solutions (PCs for example) can cost less than the effort required to justify it.

    . It is important to note that even though a system does not lend itself to quantifiable measurements, if management requires tangible benefits to offset systems costs, they must receive them or else they won't approve the system.

    . Educating management to the potential benefit of office systems is an important but long-term task. To get short-term results you have to play the game by their rules. An obvious first step is to find out the rules before you start the game.

- INPUT's research investigated the premise that the type of office system affected the justification techniques used. It was found that there was a certain consistency among products, primarily that most used analysis based on tangible costs and benefits. This does not necessarily mean it is the best technique, just that it is the required one.

- It was found that either tangible or intangible benefits were stated for justifying office systems, depending on the product. Intangible benefits predominated for knowledge and data base products and electronic mail. Information centers most often required no justification. Exhibits IV-3 and IV-4 summarize the justification techniques used.

- Exhibit IV-4 categorizes office systems by productivity performance levels and reflects the respondents that did detailed cost benefit analysis and those who did not justify these systems. As expected, there is an inverse relationship between systems justified using cost benefit analysis and those requiring no justification.

- The most frequently cited example of tangible benefits was cost displacement.

  - The cost displacement objective is to achieve overall reductions in support staff costs or to increase work volumes without adding support staff.

  - Cost displacement should be viewed from the corporate perspective. Too often cost displacement is merely cost transference. The reduced staff costs may be offset by increased systems support costs. This becomes apparent when host-computer-based office systems are installed (PL-III and PL-IV).

EXHIBIT IV-3

OFFICE SYSTEMS JUSTIFICATION: TANGIBLE VERSUS INTANGIBLE BENEFITS

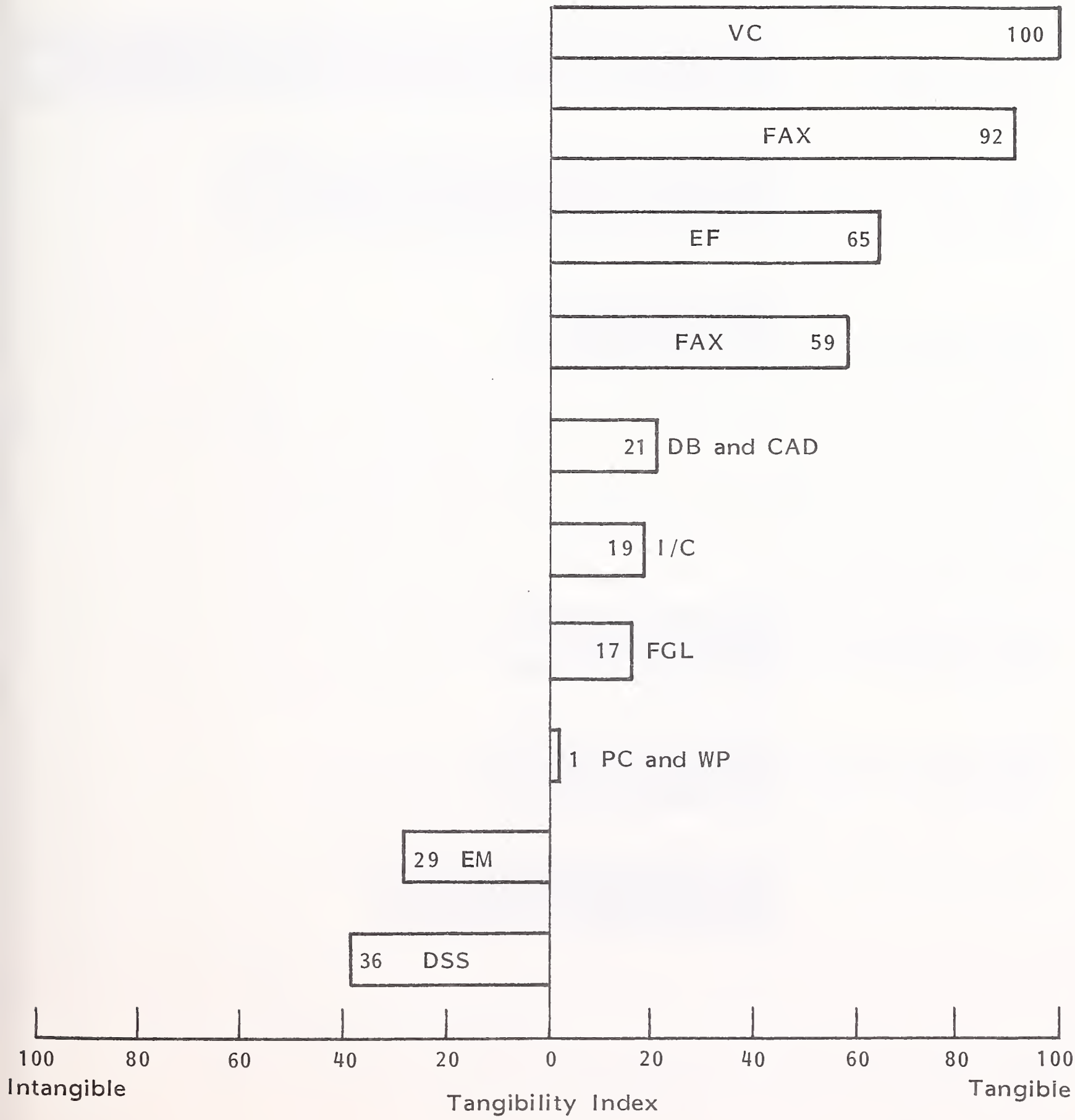
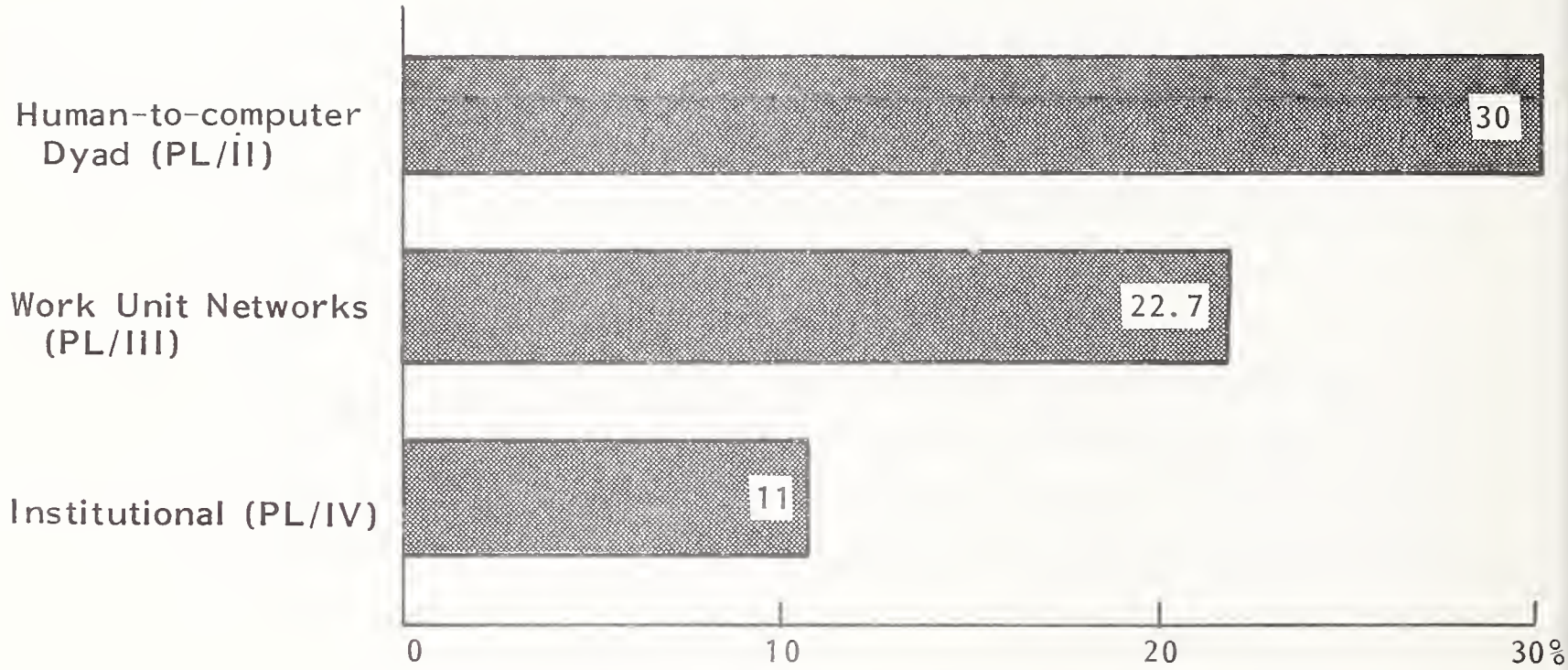
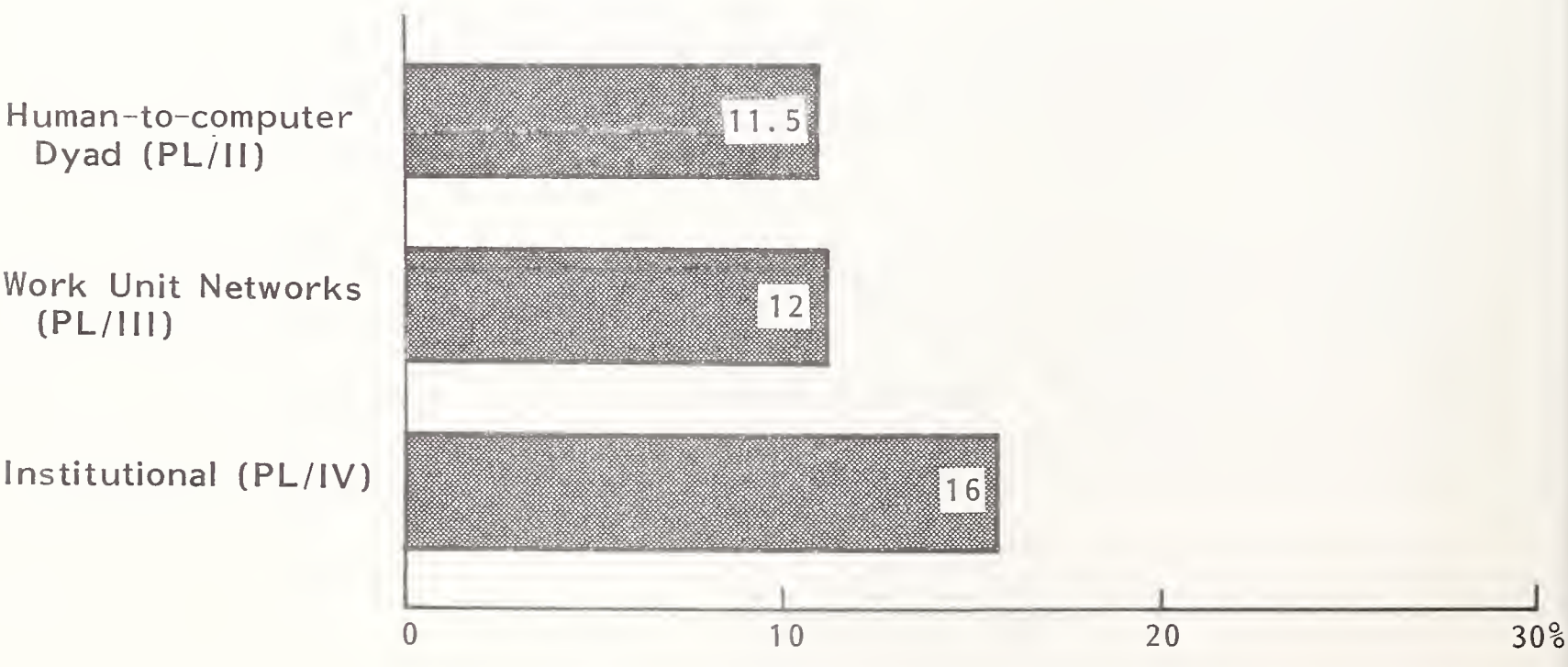


EXHIBIT IV-4

THE USE OF COST/BENEFIT ANALYSIS*
BY PERFORMANCE LEVELS



SYSTEMS WITH NO COST JUSTIFICATION*



* See Exhibit III-5 for products included in each performance level.

- Information centers and decision support systems can use extensive storage and computer resources.

- The marginal costs of an office system that is based on a host computer are difficult to measure until the need for an additional large-scale computer arises in the future.

- The most commonly cited intangible benefit was value-added benefit.

  - Value-added benefits improve managerial and professional productivity and effectiveness through the use of integrated office systems. It focuses on individuals and groups of managers and professionals as targets for productivity improvements. It provides opportunities for significant increases in organizational effectiveness and major cost benefits in the largest segment of the office cost milieu.

  - The value added is most often linked to productivity increases. As such, it would be assumed that organizations that cited added value as a key ingredient in cost justifying office systems would have a procedure for measuring productivity, but this is not the case. For the office products and systems studied, the companies did not normally measure productivity. In the few cases where productivity was measured, the classical industrial engineering techniques were used. This occurred as expected for word processing and systems. Other productivity measurements cited were reduced manpower, time savings, and reduced backlog.

    - Reduced backlog and time savings were mentioned primarily for information centers. It is not clear if they were actually measured or if they were the benefits stated by the press and vendors and then passed on.

. Exhibit IV-5 summarizes the productivity measurements used by the researched companies.

- The vendor's role in the past has been quite prominent in the cost justification of office systems. This was because office systems were in the grey area between office products and computer systems. Users went to the vendors because of need, usually word processing, and the vendors accomodated them by providing the ammunition to justify their products. IS organizations did not get involved and in most cases did not want to be involved with "typewriter substitutes." The cost of the first systems was not high enough to draw undue attention to them, so the vendors entered the office. In most cases multiple vendors' products appeared and, until the entrance of personal computers and the demand for access to the mainframe computer, IS stayed away. Now the sins of omission by IS are coming back to haunt them.

  - Multiple vendor environments with incompatible products are causing concerns.

  - In many companies vendors are still playing a major role in justifying office systems.

- The vendor's role appears to have changed. With the ever-increasing role of the IS organization in the office systems selection and implementation process, the vendor has been relegated to the same role as other systems product and service providers. Where vendors do attempt to justify their product for their customers, service is the key benefit. The vendors still emphasize IS organizations' previous lack of interest and failings in supporting the end user. The vendors are using the strategy of being an extended IS resource to the information systems organization. There is, however, healthy skeptism in both the IS and user communities regarding vendor promises. Thus, overwhelmingly, the vendor's role is to sell products, and the organization's role is to justify systems. (There is a possible exception, and that is IBM. In its ubiquitous presence in data processing centers, IBM is also being used as a

EXHIBIT IV-5

PRODUCTIVITY MEASUREMENTS

PRODUCT	MOST FREQUENT RESPONSE	SECOND MOST FREQUENT RESPONSE
Word Processing	Industrial Engineering / No Measurement*	Reduced Manpower
Electronic Filing	No Measurement*	Time/Space Savings
PBX	No Measurement*	Time Savings
Video Conferencing	No Measurement*	Time Savings
Data Base	No Measurement*	Value Added
Fourth Generation Languages	No Measurement*	Value Added
Decision Support Systems	No Measurement*	Time Savings
Electronic Mail	No Measurement*	Value Added
Facsimile Machines	No Measurement*	Time Savings/Reduced Backlog
Information Center	Time Savings/No Measurement	Reduced Backlog
Personal Computers	No Measurement	Value Added/Reduced Backlog
CAD	Time Savings	-

* No productivity measurement performed

consultant in the office. One company in particular was turning over the analysis and selection of office systems solutions for its organization to IBM.)

4. FUTURE PLANS

- Section I of this chapter discussed the growing awareness of new concepts such as knowledge-based and expert systems, in the office. The proliferation of personal computers and the growing use of information centers has resurrected corporate data base studies. Unlike their unsuccessful predecessors, these studies focus on and provide extracts from corporate data bases used in production. The production data may reside in different locations and may use different data base managers, but the information required by office systems, especially by decision support systems, is being extracted and made available to authorized users. The IS organization is the primary resource for these studies, but users are taking an active role too.

- It is becoming clear that the implementation of office systems requires consideration of the organization's objectives as well as those of departments and individuals. Office systems are being studied in most organizations, and again the IS group is taking a leading role. Senior management usually instigates the study. The reasons for study can range from personal curiosity to management edict to reduce paper, with office systems being the means to accomplish the goal.

  - These studies can produce corporationwide office system prototype systems. The primary justification for these systems is to determine the system's impact on the whole organization. Executive sponsorship of these studies and systems is imperative; without it, precious resources may be spent selling the systems to the wrong users and ferreting out tangible benefits.

- Decision support systems can be viewed as the genesis of the expert systems of the future. In order to develop these systems, the decision-making process

must be investigated and models developed and tested to determine if indeed computer-aided decisions are possible, practical or even desirable.

- INPUT's research has shown that these studies are beginning, and IS organizations may be involved. Unfortunately, IS involvement is usually focused on hardware and software selection and then only at the conclusion of the study, whereas the IS organization should become an active participant in them from the outset. Its systems analysis expertise and awareness of the cost, information, and technological requirements of decision support and expert systems are required throughout the study. Exhibit IV-6 summarizes the use of information, office, and decision studies and the IS organization's involvement in these studies.

B. CASE STUDIES

- The remainder of this chapter describes two case studies.

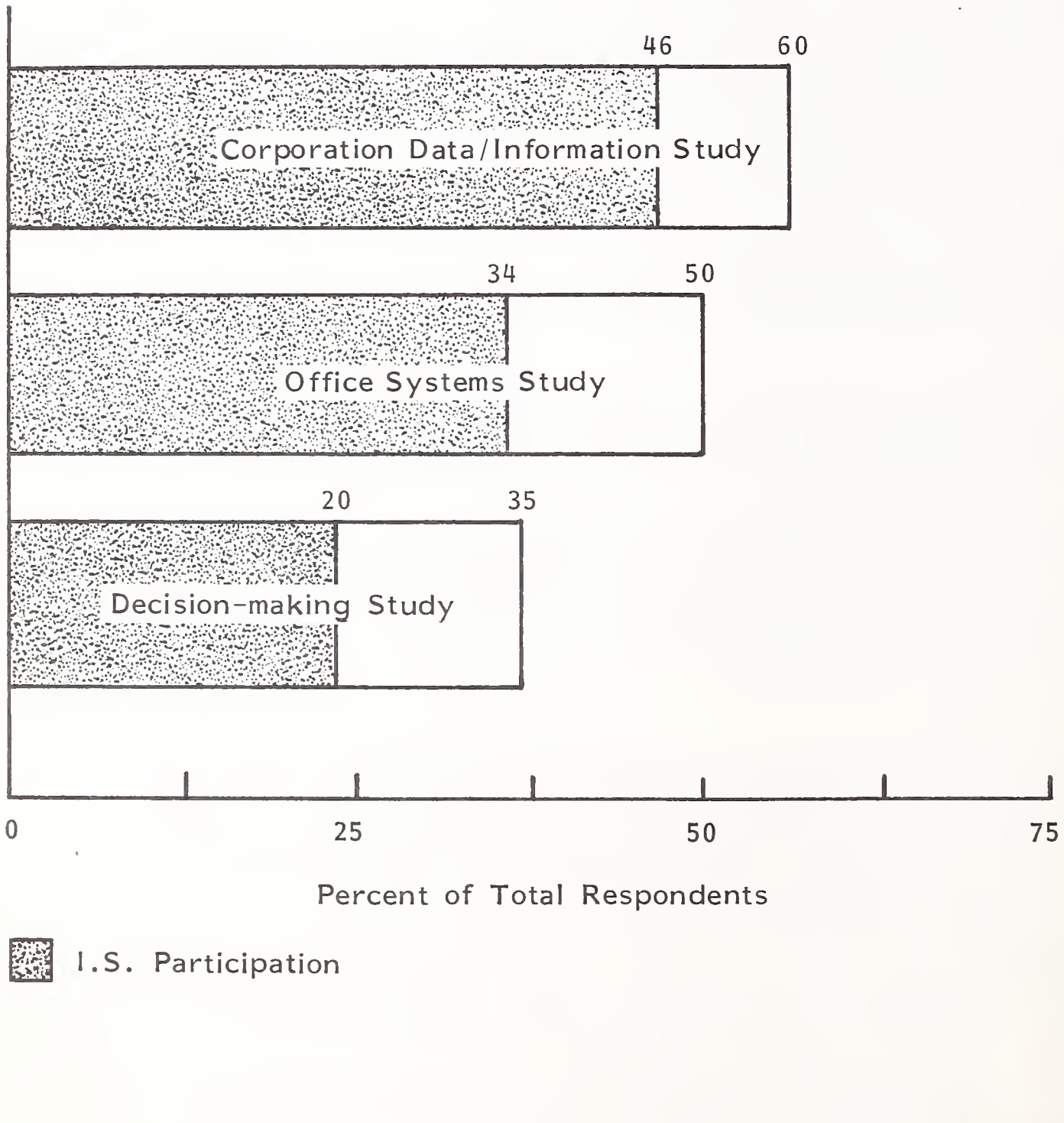
  - Case study A describes a multibillion dollar holding company's approach to cost justifying office systems. It includes a description of a pilot project used to develop corporate guidelines as well as the guidelines themselves.

  - Case study B is Stanford University. Stanford is one of the leaders in the implementation and integration of office systems. In this case INPUT describes the approaches used to justify more advanced office systems.

- These two cases contrast justification techniques for the lower performance levels (case A) to the higher ones (case B). It provides insight into the problems associated with cost justifying the entire spectrum of office systems.

EXHIBIT IV-6

I.S. PARTICIPATION IN OFFICE-SYSTEMS-RELATED STUDIES



1. CASE STUDY A

a. Background

- The subject of this case study is a multibillion dollar, multicompany holding company. The corporate division of the organization provides service and support for each of the operating companies. The corporate systems group is responsible for data processing and systems support for all corporate units and acts as an advisor to the operating companies' systems departments.

- The corporate systems group established a corporate office program to provide advice concerning the value of office systems. One of the major strategies of this program was to conduct controlled experiments to develop techniques to anticipate cost savings and value-added benefits for office systems.

- These experiments range from word processing installations to one of the most advanced teleconferencing installations in the country. These projects may initially be underwritten by corporate systems for integrated applications, but the ongoing justification responsibilities remain with the user department. The equipment used for each experiment may vary.

  - One department uses HP3000 minicomputers for graphics, word processing, and decision support. There are 20 users in five locations using this system.

  - Three other departments are using Four Phase equipment for word processing and accounting applications. There are over 60 users of this system, and its use is expanding.

- There were two pilot projects that were created, in part, to establish cost justification guidelines for office systems. Ideally, a prototype for justifying these systems could be developed.

- New users would learn how to justify office systems. They would also understand the expectations of management with approval authority.

- Corporate finance would have a basis for judging requests for appropriations and for making educated decisions on systems that are often difficult to justify.

- These projects had common characteristics.

  - Organizations:

    . Each was within the corporate division.

    . Each was physically located on a single floor.

    . Each project included managerial, professional, clerical, and support staff. The number of users exceeded 30 for each project.

  - Systems:

    . Dedicated word-processing-based systems were installed for all secretaries and selected managers, professionals, and support staff.

    . Dedicated personal computers were assigned to selected managers, professionals, and support staff.

    . Dedicated multifunctional workstations were assigned to selected professionals.

  - Word processors, personal computers, and professional workstations were also placed in common areas for use by the entire staff.

- Functions:
  - Word processing.
  - Records processing.
  - Graphics.
  - Electronic mail.
  - Electronic filing.
  - Distributed printing.
  - Personal computing.

- To better understand the evolution of the companies' cost justification guidelines, it is appropriate to study the techniques used in one of these pilots.

b. Pilot

- The department used for this pilot consisted of 20 professionals and 23 clerical staff. It was organized into four functional groups: one of the groups was the conduit for most of the outside communication and correspondence. This group communicates extensively with each of the other groups. Each of the other groups, however, is self-contained and does little outside or intradepartmental communication.

- The primary interests of this department and its reasons for participating in the pilot were:

  - To reduce clerical and administrative workloads and costs while remaining responsive to its users.

  - To expand communication with its users and within the department.

  - To optimize the use of technology to reduce backlog of administrative projects.

- The departments' products were mostly texts and included major reports with graphics. These reports had severe time restrictions. The department also produced many form letters to its users. There were below average computational requirements, although normal budget and financial reporting were required.

- The corporate systems group goals for the pilot were:

  - To determine and document cost justification guidelines that could be used by the corporation to evaluate and justify installations of office systems.

  - To provide the opportunity to study the impacts of office systems on non-data processing users, particularly on professionals and managers using the technology.

- To arrive at cost justification and productivity measurement guidelines, the focus was the department work groups rather than individuals. Questionnaires and interviews were gathered before the pilot began and after it was completed. Thus a comparison of the working environment, output, and user perceptions could be made.

- The areas of potential cost savings were:
  - Graphics.
  - Reduced document turnaround.
  - Reduced overtime.
  - Reduced contract and outside labor costs.
  - Improved responsiveness of correspondence.
- The cost benefit measurements used in the pilot were categorized as follows:
  - Hard dollars.
    . Salaries.
    . Overtime.
    . Outside services.
    . Additional temporary personnel.
    . Other administrative expenses.
  - Office functions.
    . Jobs.
    . Sources and flows of information.

  - . Problem areas.
  - . Changes in activity (i.e., the application of time savings).
- Business strategy - meeting organizational objectives.
- Quality of working life.
  - . Employee loyalty.
  - . Morale.
  - . Job satisfaction.

- The premise used in the pilot was that productivity improvement could be equated with time and cost savings. The difficulty of measuring time and cost savings of professionals was identified. The task of measuring the change in professional productivity was to be accomplished by measuring the change in productivity of the organization. Tangible benefits included cost, time, labor, and facility savings. Intangible savings focused on management's perceptions of quality of product, effectiveness of operation, and customer satisfaction.

- Even though the intangible benefits were important, the justification used in the pilot focused on hard dollar benefits. In the case of this pilot, the tangible benefits were more than sufficient to justify the system. These benefits arose from the following tasks:

  - Graphics preparation.
  - Text preparation.
  - Forms preparation.

- Document/information retrieval.

- Collaborative work.

- Budgetary and data analysis.

- The costs for the pilot included all hardware and software, installation, maintenance and depreciation. The result of the analysis of costs versus tangible benefits was an after-tax rate of returns of nearly 40% and a payback period of approximately two years.

- The tangible benefits were primarily reductions in personnel and operating expenses. The intangible benefits, although not included in the justification, included:

  - Improved turnaround time for documentation.

  - Improved response time for user requests.

  - Improved quality of written material.

  - Perceived increased productivity.

  - Perceived increased job satisfaction.

- The success of this pilot prompted the corporate systems organization to develop a cost justification document that provided guidelines for both the decision maker and the people responsible for compiling the information on which the decisions were based. The next section discusses the cost benefit methodology used by this company and is based on its cost justification guidelines document.

c. Guidelines

- The first step of the justification process is to identify the business problem and determine if office systems are the appropriate solution. The corporate systems group identified typical business problems and listed the type of office system solutions available. It also emphasized that technology does not solve all problems and that it will alter the way people work in the office.

- After the problem is identified and an office systems solution appears appropriate, the guidelines recommend a study group be established to determine the affected areas of the organization. The study should include the office and its products (output) produced by departmental work groups. These products include correspondence, reports, documents, forms, meetings, services, presentation materials, and files.

- Each product can be defined by its component tasks and functions. Tools used for collecting data include activity logs, questionnaires and interviews.

- Cost identification is the next step required. First, the current cost of the department or work group must be determined. Then the additional costs associated with new office systems must be determined.

  - Traditional office costs:

    . Personnel costs.

      - Professional.

      - Support.

    . Overtime personnel costs.

    . Contract labor costs.

  - Current equipment costs.
  - Facility expenses (e.g., office space).
  - Outside services costs.
  - Training.
  - Travel.
  - Office supplies.

- New office systems costs:
  - New equipment including all supplies and installation.
  - Remodeling and additional space.
  - Furniture.
  - Additional training.
  - Learning curve.
  - Software and hardware maintenance.
  - Hardware depreciation.

- It was recommended that costs be attributed to office-produced products that were identified in the organizational study. Consolidating the data collected for each product, the total hours and dollars for each product could be obtained. This information was used in the justification of the office system. Exhibit IV-7 summarizes this collection technique.

EXHIBIT IV-7

WORK GROUP PRODUCT TASK WORK SHEET

(PRODUCT) TASKS	PROF. HOURS	CLERICAL HOURS	FUNCTIONS	
			Professional (type and hours)	Clerical (type and hours)
Planning				
Consulting				
Collecting Data				
Preparing Draft				
Reviewing/Revising Data				
Corrdinating				
Obtaining Approvals				
Disseminating				
Maintaining Records				
(Other Tasks)				

Type of Functions

(Continued)

1. Typing
2. Dictating
3. Transcribing
4. Filing
5. Duplicating
6. Distributing
7. Printing
8. Communicating
9. Data Processing

EXHIBIT IV-7 (Cont.)

WORK GROUP PRODUCT
SUMMARY WORK SHEET

PRODUCTS[1]	PROF. HOURS	PROF. COSTS	CLERICAL HOURS	CLERICAL HOURS	TOTAL PRODUCT COSTS
Correspondence					
Reports					
Documents					
Forms					
Reviews/Briefings					
Presentation Materials					
Graphics					
Files					
Total					2

[1] Product examples; products and mix will vary by work group.

[2] Total cost of products should equal personnel costs excluding overtime.

- The offset to the additional expense of office systems was quantified benefits. These may include:
  - Overtime reductions.
  - Contract labor reductions.
  - Reduced outside service costs.
  - Headcount reductions.
  - Time savings.
  - Increase in department's output.
  - Elimination of current equipment.
- Intangible benefits that may not be direct sources of justification should also be considered.
  - Increased control over one's work.
  - Increased job satisfaction.
  - Increased organizational flexibility.
  - Improved skills.
  - Availability of more discretionary time.
- The above research was preparatory for the calculation of costs and benefits. It simply compared current costs to the proposed costs and benefits.

The goal was to maximize the net benefits; that is, the present value of the benefits should exceed the present value of the costs. All relevant costs should be identified and values should be assigned to as many benefits as possible.

- The current costs were assembled in a unique manner. All personnel costs were associated with the key office products. Thus, for each product, the professional time required was multiplied by its hourly rate, yielding the professional's cost to produce this product. Similar calculation was performed for support staff. The hourly rate was either assigned by the finance department or derived from the median professional salary and benefits. The cost of creating the key products of the department and miscellaneous products should equal the actual personnel costs, not including overtime. The premise of this technique was that the cost of employees' time should equal the cost of the work they produce. Exhibit IV-8 summarizes the current cost calculation.

- Next, the potential costs of the new system are listed. The costs should include quantifiable benefits. These costs should be itemized in the same manner as the current cost calculation above. The key products should be listed with estimated hours and costs. There should exist a reduction in the cost of producing most of these products due to the installation of the new system. In addition, new key products may be produced due to the time savings produced by the system. These new products should be included in the product list. If more output is produced with the same resource due to the proposed system, a value-added benefit will occur. This benefit must be quantified and entered into the cost benefit calculation.

- In addition to the key products and their values, it may be possible to assign values to other anticipated intangible benefits. This valuation may be based on the importance of the benefit to the business objectives. The projected benefits should be ranked in order of importance, with weights assigned to each. The dollar amounts and weights should be clearly labeled as well as the analysis used to determine these numbers. If no dollar value can be deter-

EXHIBIT IV-8

CURRENT COSTS

Personnel Costs[1]	$____
Overtime Personnel Costs	____
Contract Labor Costs	____
Current Equipment Costs (including maintenance, etc.)	____
Facilities Costs	____
Outside Services Costs	____
Travel Expenses	____
Office Supply Costs	____
Other Costs	____
Total Operating Expenses	$____

[1] Personnel Costs = $\sum_{1}^{n}$ [(Prof hrs_n x Prof cost) + (Clerical hrs_n x Clerical Costs)]

Where n = number of products

Prof hrs_n = number of professional hours spent producing product n

Prof cost = Professional hourly rate (includes employee benefits)

Clerical hrs_n = number of clerical hours spent producing product n

Clerical cost = Clerical hourly rate (includes employee benefits)

mined, the benefits should still be included for consideration in the final decision. Exhibit IV-9 summarizes the new system cost calculation.

- A cash flow summary listing the costs and benefits over the economic life of the system determines if the new system is cost justified. This company's accounting department has assigned the useful life for office system equipment at five years. All costs and benefits were to be reported in the year they occur. In addition, the company believes that the following analysis may probably be required:

  - Payout period calculation: the number of years required for the cash flow to reach zero.

  - Present value calculation: the time-adjusted benefit over time-adjusted costs.

  - Break-even analysis: this analysis should be applied when the tangible benefits do not seem to justify the project. This analysis can help the decision maker to determine if the intangible benefits are sufficient to offset the shortfall caused by inadequate tangible benefits.

d. INPUT's Evaluation

- This company's cost justification guidelines are very good at the lower performance levels (hardware/software and human-to-computer dyad) and at least addresses the issues involved in the higher levels (work unit networks and institutional).

  - The focus is on industrial engineering techniques of the office functions. The company does not fall into the trap of counting keystrokes but does quantify the time to prepare office products.

EXHIBIT IV-9

COST WITH NEW SYSTEM

Personnel Costs	$ _____
Overtime Personnel Costs	_____
Contract Labor Costs	_____
Current Equipment Costs (including maintenance, etc.)	_____
Facilities Costs	_____
Outside Services Costs	_____
Traveling Expenses	_____
New Equipment and Associated Costs	_____
Other Indirect New Costs	_____
Office Supply Costs	_____
Other Costs	_____
Other Tangible Benefits Not Included in Above Costs	($) _____
Value Added[1] and Other Intangibles	($) _____
Total New Operating Costs	($) _____

[1]Based on calculations of key product costs, including new products

- The office product technique addresses the business of the work unit if not the corporation as a whole. The problem with this analysis is that it assumes that most of the products are paper oriented and are required. It is possible that some of these products could be either eliminated or delivered via another media (electronically).

- The focus on the work unit is better than studying the individual but does not address an institutional solution. The scope of the guidelines is at the departmental level and, as such, does a credible job. To truly derive maximum benefit from office systems, however, the entire institution must be considered.

- The suggested techniques of quantifying or at least identifying intangible benefits elevates the cost justification process above pure industrial engineering and provides an awareness of the true potential of office systems. It is also encouraging that economic justification can include intangibles. The use of break-even analysis to determine the amount the intangible benefits must contribute to justify a system is an excellent technique.

- The overriding weakness of most cost-justifying techniques is also present here: too much time and money can be spent justifying instead of implementing. It may not be an exaggeration to say many cost justification exercises cost as much as the systems they try to justify.

- The business decision involved in implementing new systems must include the opportunity costs the system may present. The value-added techniques of this company's guidelines address this issue to some extent. However, cost savings are limited by the costs involved, whereas the opportunity costs may be significant. This analysis does not emphasize the opportunity aspects enough.

- Finally, the basis for the guidelines is word-processing-based systems. Electronic mail, filing, decision support, and artificial intelligence systems were

minor parts of the pilot that was the genesis to the guidelines. Thus the guidelines are a good tool for office automation justification (automating current office procedures) but are of very little help in justifying office-of-the-future applications (new products and services that cause fundamental changes to existing office systems and procedures).

e. Summary

- This corporation used detailed cost benefit analysis for justifying its office systems. The guidelines they developed provide techniques for data collection and a means for translating that data into meaningful financial information.

- The guidelines were derived from the cost/benefit experience of two pilots each comprised of over 30 users. The actual "hard dollar" benefits derived from the pilots were the basis for the guidelines. Since the guidelines were founded on actual experience rather than on theory, they were accepted by both users and managememt.

2. CASE STUDY B - STANFORD UNIVERSITY

a. Organizational Environment

- This case focuses on the techniques used to justify systems in the higher performance levels (PL-III and PL-IV).

- Stanford was selected as a case study for cost/benefit of office systems because of its recognized leadership in the implementation of advanced office systems and the efforts it is making to integrate such systems. For example:

  - The Stanford campus was an early test site for Ethernet.

  - Stanford has organized and hosted international seminars on advanced office systems.

- Terminals were installed for managers a number of years ago, and the results have been evaluated.

- The synergy of electronic message service, data base technology, and modeling has been recognized.

- In addition, Stanford is a recognized leader in artificial intelligence (AI), and it is INPUT's opinion that AI will play an extremely important role in advanced office systems.

- Most advanced office systems work at Stanford has been initiated within the administrative area by the Center for Information Technology (CIT). This has resulted in critical examination of such efforts by both the academic and research sides of the university. (This scrutiny is analogous to that received by a corporation's headquarters from operating units of a business enterprise except that the university has the benefit of "in-house" experts in computer science, business administration, and various related academic disciplines.)

b. Office Systems Status

- In 1980 and 1981 Stanford established a set of standards for word processors to insure that they could communicate with one another. At about the same time, electronic mail service was initiated among senior administrators through a system called Terminals for Managers.

- An extensive and complex set of work unit networks is currently in existence and under development.

  - On campus, a wide variety of word processing, data processing, and administrative workstations along with a variety of personal computers and minicomputers cluster or communicate directly with large-host systems (IBM 308Xs). The current network, which grew out of the

earlier Ethernet experiment, will be replaced by a wideband computer and video network (SUNet), An entirely new telephone system is also in development.

- Many faculty and staff members currently work from home terminals linked to the central computer facilities through the public-switched network, and the explosive growth in the use of private personal computers promises (or threatens) substantial extension of this local off-campus network. Stanford has held talks with the city of Palo Alto, which is contemplating a CATV network with the thought of possible interconnection with campus facilities.

- The Stanford network currently interconnects with other university networks and value-added common carriers. Interinstitutional work unit networks are being initiated in various disciplines (and for exchange of administrative information), and information of importance to the academic community is regularly exchanged between state and federal legislative centers.

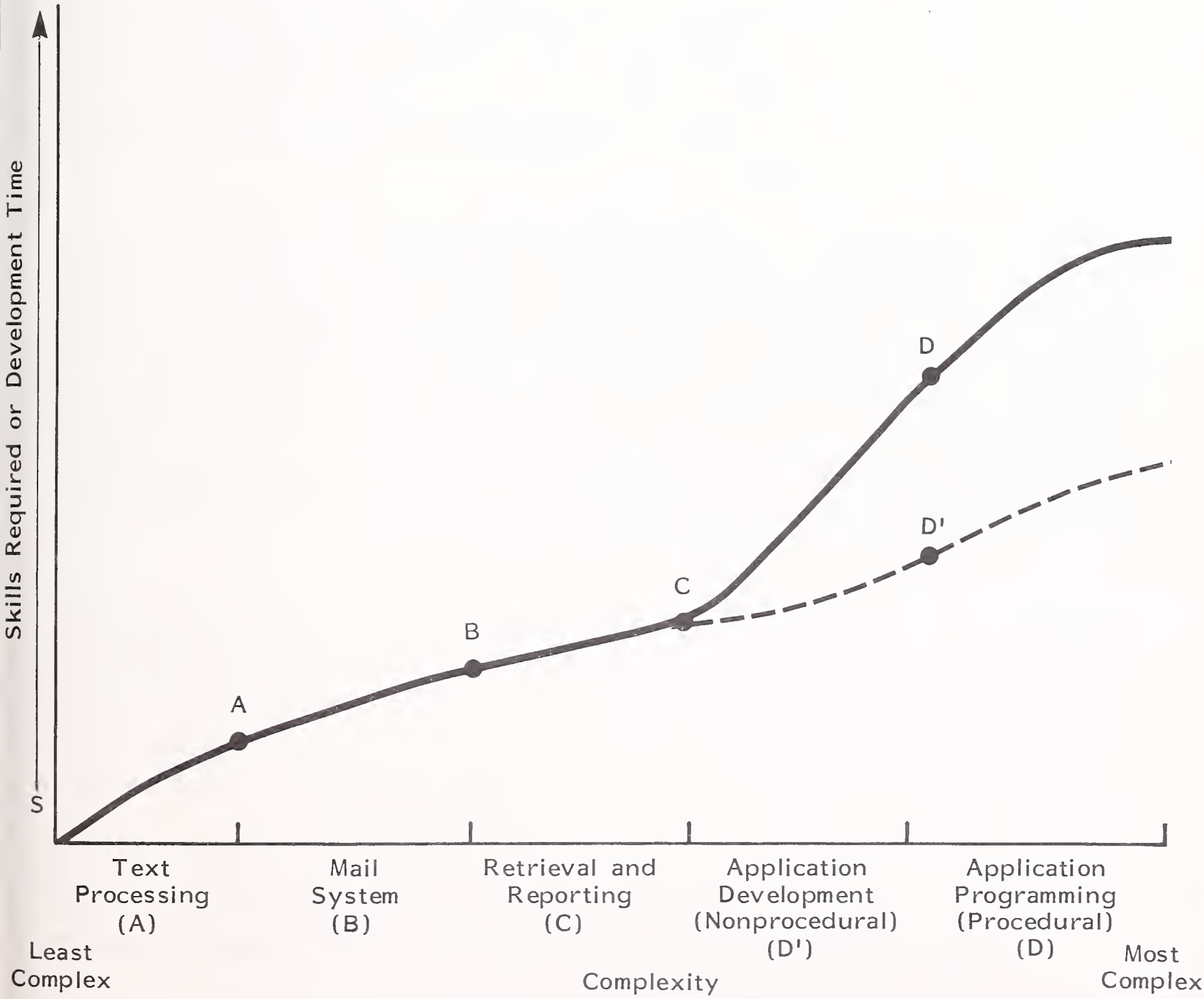
- Physical and organizational offices are beginning to be realized as the network grows, and the significance for productivity at Performance Level III goes well beyond conventional office automation systems.

- The term "computer literacy" is popular in the academic environment (especially among information systems personnel who recognize the impact the alternative must have on faculty and staff members), and while it seems somewhat affected, it is founded on in the perceived skill levels of end users of office systems, as shown in Exhibit IV-10.

  - Fundamental functions such as text editing, electronic mail, and retrieval require only rudimentary skills that can easily be learned, but end users who wish to bring up even simple applicatons will need substantial skills if required to use procedural languages.

EXHIBIT IV-10

END-USER SKILL LEVELS



- Recognizing the trend toward end-user applications development as a logical extension of office automation, Stanford standardized on an internally developed fourth-generation DBMS (SPIRES) in preference to a currently supported third-generation system from a commercial vendor. The distinction between the two systems was essentially the nonprocedural language incorporated in SPIRES.

- It should be noted that the horizontal axis represents development time (as well as skill required) and can therefore be interpreted as a measure of productivity. However, the chart is intended only as a rough indication of the impact of non-procedural languages and makes no attempt at calibration.

- Stanford makes extensive use of various models in computer-based administrative support systems. These range from a simple model to project changes in the balance sheet based on sources and uses of capital, to one being developed for a cogeneration plant (steam and electricity) that involves both engineering and financial trade-offs (consideration is being given to providing excess power to neighboring communities). The importance of such models at Performance Level IV (PL-IV) become apparent from public statements of the Vice President of Business and Finance at the university.

  - Of the model used for updating the long-range financial forecast of the operating budget, he states: "Use of this model (and submodels) has become so routine at Stanford that it is not challenged - even when adverse results are forthcoming. The data are often challenged, but seldom the model (some challenging of the model is desirable), and virtually never the concept of modeling itself."

  - On the general use of models for financial planning (decision support), he states: "Modeling is pervasive with us. Indeed, I can't imagine how we could get along without it."

- Therefore, specialized models to support analysis and decision making at Performance Level IV have been developed and are in routine use by administrators at Stanford.

- While Stanford has standardized on word processing systems and the central DBMS, selection of model systems (minicomputers, small business systems, or microprocessors) is essentially left to the end user, with CIT serving in an advisory capacity. This has resulted in the support of a variety of such systems on the network.

c. Cost/Benefit Experience

- CIT, which is the information systems function for the university, has left the cost justification of office products to end users, and personal computers have proliferated in use without either the benefit or restriction of cost/benefit analysis. In addition, CIT has had little influence over the installations of computer systems in the academic and research functions of the university. However, the installed campus network and associated services from central host computers have been the subjects of intense scrutiny, not only from the administration that it serves, but from all of the vice presidents (and their associated operating departments).

- Network growth is a logical extension of end-user requests for additional communications capability. For example, terminals used for text editing are cost justified by end users, and a request for another line to the central facility is considered cost justified by those responsible for managing the network. To a certain degree this philosophy of end-user cost justification based on the willingness to pay is supported by the experience with home terminals where users frequently saw fit to have a separate line installed even at their own expense. It is assumed that if users are willing to pay (either out of the budget at work or as a personal expense) they must be receiving benefits to offset the costs.

- CIT knew that systems personnel (going back to early use of ARPA net) used electronic message services extensively. Therefore it was concluded that this service had value, and CIT personnel had their own feelings about the value since most of them had access to such service. However, the shift of emphasis from clerical employees in the office to managers and professionals did not come at a time when any body of quantitative cost/benefit data was available to support terminals for managers.

- Not surprisingly, administrative managers at Stanford were not willing to budget for terminals based on CIT's intuitive feeling that they would find some use for them. Trying to explain how terminals could be used, and drawing parallels to early telephone systems (Stanford delayed the installation of a telephone in the president's office for 10 years because the wires would mar the beauty of the campus), did not convince a sufficiently large number of managers to support even a pilot project.

- The conclusion was reached that meaningful, quantitative cost justification of terminals for managers was not possible prior to actual installation, and to a significant degree this remains the consensus of CIT opinion. The decision was made that a pilot project would be supported by CIT. This project was called Terminals for Managers (TFM), and the following is a brief project history.

  - It was determined that sufficient terminals would have to be installed to make the project meaningful, and it was decided that 80 was the minimum number. (This conclusion was based on the need for a certain critical mass to make any communications system effective.)

  - Sufficient time was also considered essential, and it was decided that the terminals would be provided free for one year (from August 1980 to August 1981), at which time the project would be evaluated.

- Originally 80 senior-level administrators were given TFM accounts with an additional 27 added from November 1980 to May 1981. Concurrently, other university personnel with access to terminals, and a number of individuals at other universities and research centers, were taught to use the system and began to use it.

- TFM provided for memos, reports, and other forms of written communications to be entered into the system (control host oriented) from one terminal and read and processed (filed, forwarded, and replied to) from another terminal. The system did not require users to know a special language, and it provided prompting.

- CIT was committed to provide free use of the TFM accounts through August 1981, and of the 107 university administrators who participated, all but four kept their accounts open until that time. (In addition, well over 100 administrative terminals for TFM use were added during the period of the pilot study. All of these terminals were charged directly to their users.)

- The 107 subsidized users have been the subject of rather intense evaluation, and their patterns of use continue to be monitored now that they are paying for service. The results of this evaluation will be presented in the next section of this case study.

- Cost justification for the fourth-generation DBMS was directly related to resource utilization - both the cost of the system's machine resources and the benefits that users received.

  - The conclusions reached concerning conservation of costs were as follows:

    . There were members of the technical assessment group who felt the most important consideration was to conserve the machine

resource (minimize PL-I costs, which would improve productivity at that level).

. Others felt that technical staff resources were the most important resource to be conserved (minimize cost at the PL-III work unit responsible for developing, installing, and maintaining the DBMS).

. Most of the technical assessment group felt that human resources in the use of the systems were the most important ones to conserve (improve productivity at the PPL-II human-to-computer dyad). It was felt that concentrating on ease of use at the end-user level would have positive second-order effects on other resources, including machine resources.

. In other words, the DBMS was selected primarily to conserve end-user skills and to permit easy access to computer power and data bases. (The hope was that the sharp increase in skill level and time depicted in Exhibit IV-10 between C and D could be flattened to D.)

- The assessment group also established a three-year financial forecast that provided a cost benefit analysis of three alternatives: a) proceeding with the support of two DBMSs, b) standardizing on a third-generation DBMS (already installed), and c) standardizing on SPIRES (a fourth-generation DBMS). The three-year forecast based on anticipated applications development and conversion efforts indicated the following:

  . Making the third-generation DBMS the primary application development tool would increase costs by 10% (or $2 million) over unrestricted use of both systems.

- Using SPIRES would decrease costs by 16% (or $3 million) under using both systems.

- This results in a spread of 26% (or $5 million), which Stanford could directly attribute to the productivity of a fourth-generation over third-generation DBMS, and very specifically to the impact of a fourth-generation language on productivity at PL-II.

- Faced with such overwhelming cost benefits, and considering the fact that the commitment to achieve these benefits rests to a large degree with CIT, it is not surprising that Stanford elected to standardize on SPIRES.

d. Organization Evaluation

- Stanford's evaluation of DBMS standardization and its modeling effects can best be gauged by the fact that the university emphasizes its administrative support systems, and points with pride to the favorable impact they have had. Once again quoting Mr. Massy (Vice President of Business and Finance): "Data base management systems, models, word processing networks, and electronic mail are having a profound impact on the substance and style of university administration." He then goes on to state this is due to three forces:

  - "Increased budget pressures, on campus and with respect to research sponsors, that make increased efficiency imperative."

  - "A recognition that change in management styles, and in general more professional management, is needed."

  - "The availability of new and powerful tools and the deployment of trained personnel who are capable of adopting the tools as needed and using them in the university environment."

- This is essentially a statement of the need for both efficiency and effectiveness through the application of computer/communications technology to improve productivity in the administration of the university. Massy goes on to discuss the DBMS decision, modeling, and computer networks as being significant steps toward improving productivity - especially in communicatons (PL-III). Yet another quote states: "Networks of computers, terminals, and word processors - and electronic mail - are having major effects on communications. Together, these effects will rival those of the telephone a hundred years or so ago."

- Stanford's overall reaction to advanced office systems is that they are essential in improving the administration of the university. Stanford believes it is definitely headed in the right direction. The TFM project because of its very nature was subject to intense scrutiny at the end of the trial period, and it is the only comprehensive evaluation of an installed system that was available (although the DBMS decision was documented in considerable detail).

- The TFM project was evaluated by a group of representatives from the following organizations: Stanford Institute of Communication Research, School of Education (Anthropology and Linguistics), Graduate School of Business (Computing and Information Systems), Engineering-Economics Systems Department, Department of Communication, and CIT. This evaluation resulted in the following:

  - The answers to six research questions concerning use of the system revealed the following:

    . TFM participants sent and received a mean of 4.5 messages per day and spent an average of 45 minutes processing their messages.

- The system is used primarily by the administrators rather than by their secretaries (in other words, the professionals and managers are actually using the keyboards), and the use is primarily for direct communication and not for transmitting paper messages.

- More than half the participants reported decreased paper and telephone traffic, and a growing (but small) number of them reported significant reductions.

- Most users expressed satisfaction with the operation of the system, and its advantages were deemed worthwhile, but a small group felt that it had more disadvantages than advantages, with the primary disadvantage being that use of the system became a status symbol.

- The average daily cost of the system was $4.83 per terminal (calculated on use of participants TFM account even though they were not billed). This figure may be considered a cost of provided service by the central computer facility.

- Those who used the system heavily (the range of use was quite wide) reported the most benefits from use, but, unexpectedly, increased experience with the system did not lead to either increased use or reported benefits.

- Participants were not asked specifically about actual cost savings or improved productivity, and the evaluators did not attempt to apply any quantitative measures of these benefits. Indeed, when questioned on the subject a member of the CIT staff observed the following:

  - Quantitative measurement of cost benefits would have been too painstaking, and no one would have believed the results anyway.

  - One TFM user reported the elimination of a position as a result of using the system, but the evaluation group doubted that it was really a direct result of TFM.

- Based on the qualitative change in communications patterns and the general acceptance of TFM, the evaluation group recommended the following:

  - The continuation of TFM.

  - Continued measurement of TFM use.

  - Further, more detailed study of TFM use and users.

  - Network expansion both inside and outside the Stanford community.

- Since the original evaluation of TFM the following has occurred:

  - TFM has continued, and has grown in use to the point that it is an accepted fact of life. In fact, CIT is considering providing the basic message service (on campus) free to anyone who wants to subscribe (this assumes subscriber bears the expense of network connection - terminals, line use, etc.). This would be justified based on the following:

    - On-campus telephone service is not billed on a per-call basis.

    - On-campus mail and messager service is not billed separately but is included as a general administrative service.

  - Since electronic mail systems (EMSs) are comparable to the above they should be treated in the same fashion - as an accepted communications service.

- The original TFM users group continues to be tracked in terms of use, with the following results:

  - Use tends to remain relatively stable for individual users after only brief exposure to the system. (In other words, after the first few months, the user establishes a pattern of use that does not change significantly over time.)

  - Changes in rates (based on network billing changes) may have a temporary effect on overall use, but total use rapidly increases to traditional patterns (based on message traffic) regardless of increased cost per message.

  - The wide range of people using the system continues to be a surprise and doesn't seem to follow organizational patterns. (Management style seems to be more important as a determinant of use, and it is changing.)

  - Expansion of the network is automatic once a critical mass is reached, and reaching the critical mass was assured by starting with the executive level (the president of the university was in the original TFM group).

  - Once the critical mass is achieved, there is no need to enhance EMS; it will grow on its own. (This was surprising to the developers who had assumed immediate enhancement would be necessary in order to attract new users.)

- Users of the system tend to extend the use of the system from messages to correspondence to reports. (In other words, managers and professionals will prepare their own correspondence and reports in final form rather than using secretarial services in what seems to be a natural evolution.)

- Despite the fact that EMS seems to attract new users in its own right, additional services are considered attractive and are being added to the system.

e. INPUT's Evaluation

- INPUT continues to track office systems developments on the Stanford campus, and as mentioned in the introduction to this case study, endorses the integrated approach that CIT is taking. The following comments primarily address concerns with evaluation and cost justification and not with the systems themselves.

- The cost justification given for the selection of the DBMS was probably given in good faith and was necessary in order to achieve desirable standardization. However, the following should be noted:

  - The projected savings effected by adopting SPIRES will be impossible to confirm because of the complex variables involved.

    - If the total budget dollars objectives are met, there will be no way to prove that the alternatives would not have achieved comparable (or even better) results.

    - If the targeted costs of using SPIRES are exceeded, there will always be the convenient excuse available on all systems development projects, that is, that the requirements changed (or that accounting inadequately measured costs).

- Of more concern, from INPUT's point of view, is the failure to address the potential cost of permitting end users to develop their own applications. There seems to be a popular conviction today that the most productive and cost-effective alternative is for end users to develop their own systems. This concerns INPUT for the following reasons:

  . What is cost effective for the information systems function as a work unit (PL-III) may represent a mere transfer of increased costs to another work unit (end-user department), and result in lowered productivity at the institutional level (PL-IV).

  . The assumption that the most valuable resource to conserve is always the human resource (as opposed to hardware resources) is not necessarily valid despite the fact that hardware vendors consider it axiomatic.

  . If the extended use of a fourth-generation DBMS results in the necessity for a large-scale system, the resulting cost savings could disappear quite rapidly.

  - While INPUT believes the decision to standardize on a fourth-generation DBMS was probably sound, the cost justification is open to some criticism.

- The evaluation of TFM satisfied two major assumptions INPUT has established for measuring productivity improvement:

  - The system was generally accepted and used by the managers in lieu of other communications (correspondence and telephone).

  - The volume of paper in the office was observed to decrease.

- Both of these measures would indicate that TFM did improve productivity among its participants and that the recommendations of the evaluation group were sound.

- The concerns we have are that the continuing evaluation has not gone far enough. Regardless of how painstaking quantitative measurement might be, it is worthwhile in order to develop data for future advances in the system. Time is valuable whether or not it is accepted as a general measure of productivity (cost justification). It is unfortunate that more effort has not been made to refine the quantitative measurement of the system, if only to support the more intuitive judgments that work is being done better and faster.

V VENDOR EXPERIENCE AND STRATEGIES FOR OFFICE SYSTEMS COST/BENEFIT ANALYSIS

V VENDOR EXPERIENCE AND STRATEGIES FOR OFFICE SYSTEMS COST/BENEFIT ANALYSIS

- This chapter examines the office systems vendor's perspective on cost justification. These vendors have played a major role in justifying office systems in some companies. They have also been involved in the justification process from the seller's viewpoint. As a result, it is useful to examine their perspective on cost/benefit analysis.

- In this chapter:

  - Section A discusses the vendors' internal justification methods. Since vendors also have offices, they too must justify office systems.

  - Section B discusses the vendors' evaluation of their customers' justification techniques.

  - In section C, the vendors identify what they consider to be obstacles to justifying office systems.

A. COST/BENEFIT METHODS USED INTERNALLY

- Although vendors are confronted with some of the same problems users are in cost justifying office systems, there are significant differences:

- Most vendor management is preconditioned to accept the premise that human resources are expensive and hardware is cheap. Once this general marketing gambit is accepted, the only problem is to find the cost justification - it is assumed to be there. (Ideally, this is what the office systems salesman attempts to do in an account - get management to start with the assumption that hardware is the answer and then cost justify it.)

- There is flexibility in the cost justification procedure to provide for prototypes, test beds, and show cases for their own equipment.

- Research into the general area of office productivity is usually designed to prove a specific point about the vendor's product (or proposed product), and, of course, any cost justification is specifically related to existing manual systems and not to competitive systems.

• Despite the obvious bias in favor of office automation and the specific vendor's products, some curious things occur with internal vendor cost/benefit analysis.

- During the course of this research, three vendors (Bell Norther, Xerox and IBM) reported specific instances where word and text processing systems proved more costly than conventional methods of report preparation. The reasons are as follows:

  . The human interface of a relatively complex text processing system was deemed too clumsy (PL-II), and the system itself had slow response (PL-I).

  . In one case, it was stated that such shoddy reports were submitted that substantially more time was required by both word processing personnel and the principal preparing the report.

(The implication was that "get it right the first time" is not such a bad idea in certain PL-III work units.)

. There was a general warning that centralized word processing facilities could result in turnaround problems and adversely impact the productivity of principals. (A classic example of maximizing efficiency in one work unit and affecting productivity in another.)

. It can be concluded that even vendor research has proved that office systems do not automatically improve productivity.

- A more complicated situation has occurred with IBM's internally developed Advanced Administrative System (AAS), which has been used as a showcase office system for nearly two decades. It is worthy of some brief analysis as an illustration of potential technological traps at all performance levels. Essentially, the history is as follows:

. The announcement of the IBM System/360 product line in 1964 resulted in paperwork problems (orders, manufacturing schedules, shipments, billing, etc.) of unprecedented magnitude for IBM. It was obvious installed batch systems would not handle the load.

. IBM did not have a satisfactory data base system at the time, but ISAM was being promoted as a corporate standard for internal systems implementation.

. ISAM had unsatisfactory performance characteristics, and the internal systems development group insisted on developing AAS using BDAM.

- As the years roll by, AAS is growing into an exceptionally complex system with many millennia of systems development hours invested. And, as we all know, IBM has grown substantially as a company with corresponding increases in transaction rates.

- In the mean time, IBM has also developed IMS, which is recommended to customers for use in high-volume transaction-oriented environments.

- There are those in IBM who sincerely feel that what is good enough for the customers should be good enough for IBM (usually they are in their first few months of a headquarters assignment), and it has repeatedly been suggested that AAS should be redesigned and implemented using IMS.

- Detailed analysis of the cost of such conversions leads some to believe that there could be a disasterous (and possibly catastrophic) impact on productivity at all four performance levels.

  - Specifically, it is doubtful that IBM currently has processors with enough power to drive an IMS-based AAS (PL-I), that users of the new system could be trained and still keep up with day-to-day work (PL-II), that operating work units could continue to function during the conversion (PL-III), or that even IBM could afford the expense (and risk) of such a conversion (PL-IV).

  - Since AAS is not as fully integrated as some office systems that are now technologically possible, the message seems clear: design your system carefully; it may be your last chance.

- Internally installed vendor systems, whether theoretically production or frankly prototypes, are important because they reveal the type of cost justification that vendors will attempt to use in selling their systems.

- The IBM-documented prototype of "An Office Communications System," which appeared in the IBM Systems Journal (Volume Eighteen, Number Three, 1979), is as professional as any analysis INPUT has seen, and it is recommended. In attempting to quantify benefits the following approach was taken:

  - The fundamental assumption is summarized as follows: "The key to this analysis is the premise that time is of value and time savings represent potential benefits to the company."

  - The time savings estimates that were obtained from the IBM prototype were as follows (see INPUT's report, Impact of Office Automation on Productivity, for a detailed profile of this office):

    . Based on potential time savings of 5% to 25% for principals, cost savings of $141 to $703 per month (per principal) were projected.

    . For secretaries, the time savings range of 15% to 35% was translated into potential cost savings of $169 to $394 per month.

  - Unlike in the factory, where it is openly recognized that automation reduces the number of employees, in the office the impact of automation on white-collar workers is considered a sensitive issue (thus the current emphasis on office productivity rather than on cost savings). IBM is tactful in its presentation of its conclusions: "It is management's decision, quite likely at the executive level, as to the way in which these potential benefits are to be realized. Among the choices are the following methods:

    . "Expanding mode: This method operates either by increasing the labor input, but at a rate less than the growth or output, or by holding the labor input constant, but increasing the output."

  - "Steady-state mode: This method consists of either holding the labor input constant, but increasing the quality of the output, or reducing the labor input and holding the output constant."

  - "Contracting mode: This method operates by reducing the labor input at a rate greater than the cutback in output."

- It is not difficult to imagine some rather colorful responses from the late labor leader John L. Lewis if he had ever been confronted with such delicate wording.

- Most vendors are well aware of the difficulties of measuring office productivity and of achieving their benefits, even if the cost savings can be adequately demonstrated. The vendors' job, as they conceive it, is to help their customers recognize the general benefits of office systems and how to cost justify them to the degree required by the circumstances.

- To this end, it is desirable for certain axioms to be established and accepted without question, and it is surprising how many basic truths exist concerning computer technology. Exhibit V-1 lists a number of axioms that vendors would prefer to have accepted before any cost justification is attempted.

  - The list of axioms and comments could be extended indefinitely, and those presented are only for purposes of illustration.

  - There is an element of truth in each axiom - otherwise they would not be so widely accepted - as shown, however, all are subject to question.

  - Most vendor-prepared cost justifications support such axioms, but they should not be accepted at face value.

EXHIBIT V-1

VENDOR-PREFERRED AXIOMS WITH COMMENTS

Axiom:	"Computers should be used to make money, not to save money."
Comment:	This goal was established in the late 1950s or early 1960s, even before the term "management information system" was coined. It is significant because it downplays hard cost justification and directs attention toward less quantifiable objectives. It takes away the negative connotations of eliminating jobs.
Axiom:	"Computer systems are always more cost effective than manual systems."
Comment:	This idea sometimes leads to buying computer systems that are more expensive than the manual systems they replace, and it frequently ignores less expensive solutions that could have been effected by improving manual procedures.
Axiom:	"Office workers are technologically deprived because the investment in their equipment is less than that in blue-collar and agricultural workers' equipment."
Comment:	The difficulties in defining office productivity (much less the impact of technology) were described in Impact of Office Automation on Productivity; comparable productivities gains per investment dollar cannot be assumed.
Axiom:	"Information is a corporate asset with definable and measurable value."
Comment:	The value of information is more difficult to assess than office productivity since the information is only of value if it results in improved productivity at Performance Levels III & IV.
Axiom:	"Just give white-collar workers computer access, and they will automatically become more productive."
Comment:	They may also spend most of their time "fighting the system" or doing unnecessary analysis at great expense because the capability is there.

B. THE VENDORS' VIEWPOINT OF CUSTOMERS' METHODS

- Since vendors recognize the difficulties in cost/benefit analysis of office systems (especially of the advanced variety), they realize customers will have difficulty even if they accept the vendors' axioms. In recognition of the inadequacy of customer efforts to cost justify integrated office systems, office systems vendors have invested substantially not only in internal efforts but in consulting firms' multiclient studies on managerial/professional productivity.

  - Some vendors felt the multiclient studies were too general to be meaningful, but other clients have adopted the results to both supplement and complement their customers' cost justification efforts.

  - The implication is that customers either cannot do their own cost justifications or that their effort would be too expensive or time consuming.

  - The alternative to customer cost justification is to accept the vendors' or consultant's generalized cost justifications and to have faith that they apply in specific cases.

- The approach taken can be illustrated by vendor use of a substantial (and well publicized) multiclient productivity study that was conducted by Booz-Allen and Hamilton Inc. The approach taken by a major computer/office systems vendor in using the study is as follows:

  - The general, potential cost savings by industry through use of office systems (based on time savings, as were the IBM prototype systems) are used as a base.

  - The gross savings per knowledge worker ranged from $7,400 per annum in insurance companies to $9,800 per annum in government.

  - The IBM estimates for principals ranged between $1,692 to $8,436 per annum, so the Booz-Allen estimates seem to be at the high end of the scale.

- The rhetorical question, "Could you use these estimates?" is then asked of the potential customer, the probable answer to which is "yes." This is followed by, "Would anyone believe you?" with the preferred answer being "Probably not."

- It is then pointed out why generalized studies are not appropriate for cost justification, but that doing it right would probably cost $5,000 to $10,000 per employee. (In other words, the cost justification study would consume approximately one year of potential savings.)

- It is then pointed out that cost justification can be done wisely in the following manner:

  - Build on prior studies. Don't reinvent the wheel.

  - Customize procedures to fit your situation.

  - Be conservative.

  - Start with small-scale implementation to reduce risk.

- A cost justification workbook, which operates as follows, is then recommended.

  - A department is selected and compensation and staffing data are selected.

  - An activity profile for the department is obtained for the personnel.

  - The time savings is calculated based on accepted studies.

  - Cost savings and payback periods are then developed based on the above, both the one-time and the recurring costs of the vendor's office system.

- The question is then asked, "Does the time savings provide an attractive return?"

  - If the answer is "yes," the recommendation is to stop estimating and start implementing.

  - If the answer is "no," the recommendation is to collect data on additional benefits of office automation.

- The additional benefits proposed are those listed in Exhibit V-2, and the following is recommended by the vendor:

  - Collect the necessary data to support these additional benefits (how this is done is less clear, but sign-off from department management is suggested).

  - Recalculate the costs and benefits.

- Then the question is asked, "Is the payback period now acceptable?"

EXHIBIT V-2

ADDITIONAL BENEFITS OF OFFICE SYSTEMS

- A TIME SAVER
- A REVENUE GENERATOR
  - Faster Customer Service
  - Better Information on Inventories
- A COST REDUCER
  - Better Control Over Payables/Receivables
  - Reduction of Equipment Costs
  - Better Analytical Tools
- A LINK TO DATA PROCESSING OPERATIONS
  - Accounting
  - Inventory Control
  - Order Entry
  - Management Information Systems

  - If the answer is "yes," it is suggested once again that you stop estimating and start implementing.

  - If the answer is "no" it is suggested you try another department.

- The recommended ways of saving time are comparable to those in the IBM study except they are more succinct:

  - "Slow down hiring new staff."

  - "Assign additional duties."

  - "Transfer staff to other departments."

  - It is again noteworthy that the unthinkable seems to be that employees could actually be released - this "ostrich-like" mentality causes the use of such terms as "transferred out" or "fired." (At least they could add "if possible" to the last alternative.)

- The recommended cost justification procedure outlined above relates back to the vendor axioms illustrated earlier and can be useful if you are willing to accept the potential cost savings from the vendor-supported office productivity study. The approach is designed primarily to shorten the time required to cost justify and install the system, and it obviously benefits the vendor.

- There is also a feeling among both vendors and end users that the information systems function can be a real bottleneck in getting an office system installed. A recent article, "The Politics of Automating a Planning Office;" Planning, June 1983, Volume 49, No. 6, well illustrates both end-user feeling and some vendor strategies. (Planning is the publication of the American Planning Association.)

- The case study is presented to provide IS management with the end user's point of view of office automation and cost justification.

- The setting is the planning office for Broward County, Florida. The trials and tribulations of the office occur in dealing with the central information systems division (ISD) and using IBM-developed planning models.

  - In order to justify its purchase of a PDP 11-44 from Digital, the planning department had to make an end run around ISD - a maneuver that will be of interest to many planning agencies.

  - The problems with the IBM models (which have cost several hundred thousand dollars) were that the supporting data bases could not be maintained, the assumptions were not accurate, and five planners and technicians were required to spend weeks interpreting the results.

  - The cost of running the model was $60,000 a year - inadequate as it was.

- ISD was deemed to be unresponsive to the situation until a change of regulations required abandoning the IBM model. At this time ISD recommended paying a consultant $70,000 to develop the new model. The planning office then decided they wanted to develop their own, at which point a tremendous political struggle ensued.

  - The reactionary response of ISD was to veto the procurement of the hardware to prove to the upstart planners that it dodn't pay to make ends run around the only team in town.

  - After a protracted battle, the planning office won because ISD had a poor track record and could offer no plan to provide adequate service for new users.

- The installation of the planning office system was based on $65,000 budgeted for data processing services and $90,000 in personnel costs to maintain the old model that was being replaced.

- This planning officer offers advice to other planning departments on how to select and cost justify their own systems. Some of this advice is rather curious:

  - The first axiom for anyone preparing to install a minicomputer system in a planning office is to use it first to solve repetitive, labor-intensive tasks such as typing, processing applications, and retrieving files.

  - Vendors are then classified into those emphasizing COBOL (IBM, Burroughs, and NCR) and those having computers especially designed to process complex numerical and statistical data with FORTRAN as the preferred language (Digital, Hewlett-Packard, Prime and Harris).

  - The need for both time-saving and real-time operating systems is also mentioned as a requirement.

  - Therefore, routine office automation applications are recommended as the initial cost justification for installing systems with sufficient power to support managerial and professional personnel with modeling and graphics. This emphasizes the fundamental historical difference in vendor's concepts of distributed data processing. The conflict between distribution of substantial processing power on minicomputers, and retention of strong host control over the nodes extends to office systems. The economics require careful analysis, and vendors obviously have a vested interest in the solutions they have to sell.

C. OBSTACLES TO JUSTIFYING OFFICE SYSTEMS

- The difficulty vendors perceive in justifying office automation systems depends heavily upon their orientation and product line. These difficulties account for current market resistance. This is summarized in Exhibit V-3.

- Vendors, as usual, break down into two camps: IBM and all others. The justification for office systems essentially breaks down as follows:

  - The SNA planned approach to distributed processing with strong central host control of data and information. The top-down approach.

  - The bottom-up approach of automating the office and thus tying systems together.

- Depending on where you start, the other becomes an obstacle. For IBM, the problem remains that it must compete against itself with distributed processing, office products, and now entry level systems.

EXHIBIT V-3

OBSTACLES TO COST JUSTIFICATION

	OBSTACLES
Executives	Feeling Disenchantment with past efforts in management information systems Belief that time savings cannot be converted to cost savings Failure to understand or accept "axioms"
Information Systems	Difficulties in cost justification Investment in current systems Lack of understanding and/or interest Inadequacy and difficulties of establishing information (data) requirements to support the systems
End Users	Procedural aspects of cost justification Information systems involvement Investment in current systems Reorganizations and restrictions of work units Fear of technology and human factors

VI CONCLUSIONS AND RECOMMENDATIONS

VI CONCLUSIONS AND RECOMMENDATIONS

A. EVALUATION OF COST/BENEFIT TECHNIQUES

- Value-added approaches to office system justification are becoming more prominent. Offices are able to perform their functions and meet their business objectives more and more effectively.

- The detailed cost benefit analysis is still a prominent part of office systems justification. Management still requires that costs and benefits be spelled out in detail. Although this is important, the time and cost involved can sometimes approach the cost of the systems that the analyses are attempting to justify.

  - Many organizations are using prototype systems to determine the true costs and potential benefits of office systems. This method can demonstrate to management the system's specific benefits for that organization.

  - INPUT's Impact of Office Systems on Productivity describes the difficulty of measuring productivity in the office. The research demonstrated that the measurement becomes more difficult as one progresses to higher performance levels. The importance of critical mass cannot be overstated. Communication systems that have inadequate numbers and types of participants will not realize their true benefits.

- Many successful office systems have been installed without detailed cost benefit analysis. This implies that these systems have been pre-sold to management with the benefits being either to solve a business problem or to satisfy a business objective. In either case, management believed that it was worth the risk to install the system without a detailed cost benefit analysis. "It makes good business sense to install the system" is an argument made by some managers today. Although this may be the exception, it cannot be discounted.

- The problem with cost benefit analysis is that it is usually only performed at preinstallation. Where analysis is performed, it usually is in the form of questionnaires to the users asking their perception of their performance.

- The slower than expected rate of acceptance of office automation systems can be viewed as management's skepticism of justification techniques. Office systems are still viewed as a discretionary item for many organizations. Too often, systems are justified in isolation without a view to the organization's needs. The "one-two" approach will not work for systems and products in the higher performance levels. The true benefits of office systems derive from the work unit network and institutional performance levels. These can only be justified by looking at the organization as a whole. The growing use of corporate office, information, and decision studies is encouraging. These studies could lead to the development of office systems that truly help organizations to meet their business objectives.

B. MANAGEMENT REQUIREMENTS FOR JUSTIFICATION

- Management's requirements for justification are based on their personality, the company personality, and the manager's position in the organization. Middle management and below will be more interested in solving operational

problems and will identify more readily with Performance Levels I and II (hardware/software and human-to-computer dyad). Upper management will be looking to more strategic issues and will be more inclined to systems justified by intangible benefits that may solve corporationwide problems and help satisfy organizaton goals.

- Management's attitudes toward office systems vary greatly.

  - Some managers are very conservative. They require the same justification for office systems as for any capital acquisition. They require present value and cash flow analysis of both costs and benefits. Intangibles are interesting, but the bottom line is what counts. Cost displacement is the order of the day. If tangible benefits cannot be demonstrated, the system cannot be justified.

  - Other managers are aggressive. They believe that the cost of certain systems cannot be justified by tangible benefits but are worth the investment risk because of intangible benefits. Video conferencing, for example, offers some tangible benefits in reduced travel costs, but these benefits do not compensate for the substantial costs of installing the system. Companies interviewed who had or were installing video conferencing believed that the system would greatly improve communications and that their company should therefore have it. Because this belief was held at the most senior levels of the organization, video conferencing was installed.

  - A hybrid approach is also in use. In this approach, systems are cost justified using solely tangible benefits. All intangible benefits are documented and itemized as part of the analysis. If a shortfall should occur, a break-even analysis is developed, and management then determines if the intangible benefits are sufficient to assume the risk of implementing the system.

- Management is also aware of operational problems. Case Study I in Chapter IV demonstrated a department that had a severe backlog in correspondence and report preparation. Management wanted to solve the immediate problem and they "believed" that word processing oriented would solve the problem.

  - They were willing to participate in a pilot program to solve the operational problem, however, and if other office systems could be introduced at little additional cost they were willing to try them. The overriding reason for any interest in this pilot was to solve an operational problem. Solving that problem was the only benefit in which they were interested. Tangible benefits could be identified but only as the elimination of future staffing and overtime needs.

  - No one can tell if without the system all the projected staff increases and overtime would have occured. The actual tangible benefit was that the backlog was reduced, and the department's users were happier. In other words, the operational problem was solved.

C. RECOMMENDATIONS

- Know your decision maker. Justification implies convincing someone that an office system is necessary. Management's expectations and biases must be taken into consideration. It is just as wrong to spend too much effort unearthing tangible benefits for management that is uninterested in the number of keystrokes saved as it is to assume the benefits are self-evident to management whose interest is only in hard dollar savings.

- Use prototype systems. The benefits derived from work unit networks and institutional performance level systems are very difficult to quantify. These systems also vary by the user community. Prototype systems will demonstrate the true potential of these systems and allow their users to enhance their productivity in measurable ways.

- Be sure, however, that the prototype is of significant size to truly demonstrate its potential. Lack of critical mass can destroy a network-based system before its potential can be realized.

- Be sure the participants in the prototype have a need that will be satisfied by the prototype. Unwilling participants can destroy not only the prototype but the possibility for using office systems in other areas of the organization.

- Treat vendors as marketers. Vendors have made significant inroads into the office. In some cases they have prepared cost benefit analyses for the users. This was because users' distrusted IS and IS was uninterested in office systems. The vendor's role is changing, as it must. Vendors are a source of good information on benefits and especially on costs. They are obviously biased, but as long as the bias is recognized their information can be used in analysis. The vendors' job is to sell their product. Utilize their knowledge to help with the cost benefit analysis but do the analysis yourself.

- Don't measure the wrong things. As office systems mature, more knowledge-based systems will be implemented. The purpose of these systems is to improve decision making - not to increase the number of decisions but to improve decisions. The role of the system in the decision making process will also be hard to measure. Office systems will be a tool for the office worker, especially for the professional and managerial worker. Like pencils, they are only as good as the person using them. Therefore, do not oversell the system or promise benefits that depend on its user. Office systems are opportunity systems; justification is better focused on satisfying business goals than on solving operational problems.

- Participate in studies. The growing use of studies of information and of office and decision systems is a positive sign. It indicates that a top-down approach will become a greater part of office system solutions. It is imperative that

the IS organization participate in, if it does not lead, these studies. It is very important to be aware of the perceived benefits of the systems under consideration. IS organizations should not fall into the trap of thinking these studies, particularly decision modeling, is not in its purview. Ultimately it will fall into the lap of IS because it requires computing and access to corporate data.

- Consult, don't justify. Office systems are primarily for the user community. The benefits derived are derived by the user, not IS. Obviously, IS must be involved and may install these systems. But the user will only feel responsible for the system and its benefits if they justify it themselves. Guide and assist, but let users do their own cost justification.

- Cost justification of office systems is actually justifying a business decision. All the factors of business decision making come into play. Tangible costs and benefits are important, but so are the opportunity costs and intangible benefits. Wherever possible, justify office systems based upon their potential impact on corporate objectives. The ultimate goal should be to satisfy these objectives.

APPENDIX A: DEFINITIONS

APPENDIX A: DEFINITIONS

- OFFICE SYSTEMS - Includes both office automation and the "office of the future." Office automation is defined as the application of a set of products and services to improve existing, paper-based office systems and procedures. Office of the future describes the application of new products and services , such as video/teleconferencing, that will cause fundamental changes in existing office systems and procedures.

- COMPUTER CONFERENCING - Computer-based interactive messaging among multiple participants.

- KNOWLEDGE-BASED SYSTEMS - Contains an unstructured set of facts and inference rules for determining new facts. In knowledge bases, relationships between facts are determined as needed, not in advance. Data bases store all information explicitly whereas the bulk of the information in a knowledge base is inferred from a few basic facts using the inference rules.

- EXPERT SYSTEM - Knowledge-based systems that carry out problem solving over a narrow range of expertise. Expert systems can be thought of as artificial intelligence systems built on top of knowledge bases. For example, there are medical expert systems that are used for diagnosis in internal medicine.

APPENDIX B: QUESTIONNAIRE

Methods of Cost/Benefit Analysis for Office Systems Questionnaire
Definitions & Examples

QUESTION NUMBER

2. Electronic Filing - Magnetic or optical media, software and hardware.

3. Phone Systems - PABX, CBX, answering devices (hardware only).

4. Teleconferencing - Remote conferencing that uses images & graphics.

7. User-oriented Languages - "Fourth-generation languages," FOCUS, RAMUS, NOMAD, etc.

8. Decision Support - Systems as well as strategies; products include EXPRESS.

18. A. Computer Conferencing - Interactive messaging among multiple participants.

B. Knowledge-based Systems - Artificial intelligence systems, e.g., PROLOG LISP, INTELLECT.

C. Expert Systems - e.g., Medical Diagnostic Computer System.

D. Fifth-generation - Attributed to the Japanese "super computer" that incorporates artificial intelligence systems.

This questionnaire will provide information for a major research report on white collar productivity and justifying office systems. The report will identify areas of possible productivity improvements at all levels of the organization and the role of computer/communications technology in that improvement.

PART I

For each of the following products and systems, the following four questions will be asked:

A. Who has responsibility for evaluation, selection, and installation? (If no responsibility, answer A, then skip to next product.)

B. How are the products cost justified?

C. How is productivity measured?

D. How do vendors cost justify their products?

1. Word Processing Systems

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

2. Electronic Filing Systems

   A. _____

   _____

   B. _____

   _____

   C. _____

   _____

   D. _____

   _____

3. Phone Systems (e.g., PBX,

   A. _____

   _____

   B. _____

   _____

   C. _____

   _____

   D. _____

   _____

4. Video Conferencing

   A. _____

   _____

   B. _____

   _____

   C. _____

   _____

   D. _____

   _____

5. Robotics

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

6. Data Base Systems (Mainframe Only)

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

7. User-oriented Languages (e.g., FOCUS)

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

8. Decision Support Systems

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

9. Electronic Mail Systems

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

10. Facsimile Systems

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

11. Information Centers

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

12. Personal Computers

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

13. CAD/CAM Systems

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

PART II

14. Evaluate your management's (non-IS) awareness of office systems:

    5 = very aware, 1 = unaware_____

15. Evaluate management's satisfaction with your company's systems:

    5 = very satisfied, 1 = dissatisfied _____

16. Evaluate management's role in the office system justification process:

    5 = very active, 1 = passive _____

17. Has there been a change in management's interest in office systems during the past 12 months? ☐ Yes ☐ No

    Explain:_____

    _____

    _____

PART III

18. For the following, rate your impression of their impact on "white collar" productivity.

	Enthusiastic	Interesting	Blue Sky	Who Needs It	No Knowledge
A. Computer Conferencing	☐	☐	☐	☐	☐
B. Knowledge-based Systems	☐	☐	☐	☐	☐
C. Expert Systems	☐	☐	☐	☐	☐
D. Fifth-generation Computers	☐	☐	☐	☐	☐

PART IV

For the following topics, the following questions will be asked:

A. Is this study being performed?

B. By whom?

C. Your opinion of the study?

19. Corporate Data/Information

A. _____

B. _____

C. _____

_____

20. Office Procedures & Systems

A. _____

B. _____

C. _____

_____

21. Decision-making process of any function or organization (goal to develop models that support decision making).

A. _____

B. _____

C. _____

_____

PART V

22. What do you think can be done to measure and/or improve "white collar" productivity? _____

_____

APPENDIX C: PROFILE OF INTERVIEWED COMPANIES

APPENDIX C

PROFILE OF INTERVIEWED COMPANIES
NUMBER OF RESPONDENTS BY SIZE AND INDUSTRY OF COMPANY

INDUSTRY	REVENUES/ASSETS		Total
	$1 Billion & Over	Under $1 Billion	
Industry	5	-	5
Process Manufacturing	8	-	8
Banking and Finance	3	3	6
Services	1	2	3
Utilities	7	4	11
Other*	4	6	10
Total Respondents	28	15	43

* Includes insurance, medical, transportation, and education industries