Information
Services
Program
(ISP)

# Information Systems Program

## 1987 Annual Planning Report

INPUT®

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DECEMBER 1987

# INFORMATION SYSTEMS PROGRAM

# 1987 ANNUAL PLANNING REPORT

INPUT®

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# 1987
# Information Systems Planning Report

## CONTENTS

# Abstract

The requirement to track the major trends within computing is one of Information Systems' (IS) toughest and never ending challenges. Each year brings new capabilities, new technology, and new lessons for IS management. Through its Information Systems Program's Annual Planning Report, INPUT works to support IS management in meeting this challenge.

Throughout 1987 INPUT has analyzed the major issues, technology trends, and application trends of each industry sector. Now in its Annual Planning Report, INPUT draws on industry-specific research, the individual Information Systems Program studies, and its ongoing research into the vendor markets to provide a concise summary of the issues and trends IS is, and must be addressing, to achieve success as the 1980's draw to a close.

The report describes the forces driving IS and identifies the major issues facing IS. These issues are defined, the related trends identified, and objectives for IS provided. In addition the report looks at key, new technologies and identifies where the IS technology and architecture planning function should concentrate, and provides an assessment of budget and development staff resource allocations. The 1987 Annual ISP Planning Report will help prepare IS management for the years ahead.

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# Exhibits

# I

# Introduction

# I

# Introduction

## A

## Overview

The annual ISP Planning Report draws together INPUT's research into, and assessment of the information systems (versus the business) environment faced by Information Systems organizations in 1987 and 1988. The analysis that follows in this cross-industry summary and in each of the industry sector reports provides a focused look at the ever-changing world in which IS strives to contribute to the strategic and operational success of its parent organization.

The report identifies the key driving forces, the fundamental issues, and the impacts of new technology as they affect the principle objectives of Information Systems in its role of serving the organization. Also presented are trends in the applications area and an analysis of budget expenditures.

The ISP Planning Report consists of this cross-industry summary and fifteen individual sector reports on each of the following industries:

- Banking & Finance
- Discrete Manufacturing
- Distribution–Retail
- Distribution–Wholesale
- Education
- Federal Government
- Insurance
- Medical (Healthcare)
- Process Manufacturing
- Services
- State & Local Government
- Telecommunications
- Transportation
- Utilities
- Other Industry-Specific

Please note that the industry sector reports are produced and distributed separately throughout the year.

Each report segment is organized as outlined below, and Exhibit I-1 shows how the Major Issues are categorized.

- Major Issues
  - Driving Forces
  - Information Systems Issues and Objectives
  - Impact of New Technology
- New Applications
- Budget Analysis

EXHIBIT I-1

**ISSUE HIERARCHY**

| MAJOR ISSUE SECTION | FOCUS | TIMEFRAME |
|---|---|---|
| Driving Forces | Strategic | Over 3 Years |
| Issues | Tactical | 2-3 Years |
| Objectives | Operational | 0 to 2 Years |

INPUT's objective is a simple one: to help IS management plan for and successfully implement computing technology for the benefit of its parent organization. While the objective is simply stated, accomplishing it is a never-ending task and this report is just one of the tools provided.

## B

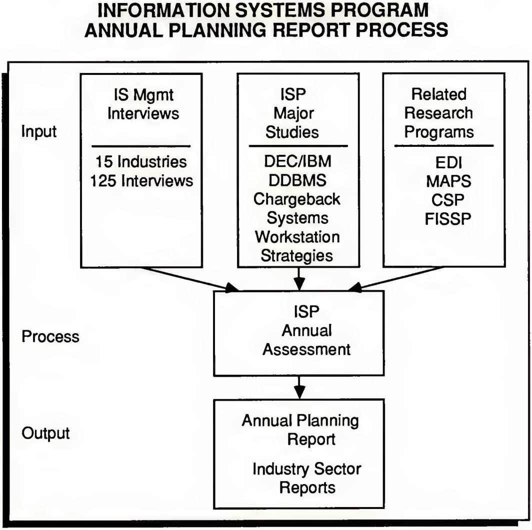
## Research Methodology

The annual ISP Planning Report draws on research from a number of sources as depicted in Exhibit I-2.

First, a series of in-depth interviews are conducted with eight to ten organizations within each industry sector for a total of over 125 interviews in 1987. The interview questionnaire encompasses plans, budgets, the role of technology, critical issues, and direction over the next five years.

Second, the ISP Annual Report draws on the research performed in support of the past year's major studies. During 1987, INPUT's ISP

EXHIBIT I-2



program has looked in great detail at the following critical topics:

- *Distributed Data Base, An Early Look* - an introduction to a new data management technology that is intended to gain control of distributed data.
- *DEC Versus IBM, 1987-1992* - a comparative look at these two companies' business and product strategies over the next five years.
- *Chargeback Systems* - a business assessment of this age-old IS management issue.

- *Workstation Strategies* - an assessment of the impact of technology (the PC and the Intelligent Workstation) on the standard business systems terminal.

- *Guide to EDI Implementation* - a guide to help new and prospective users of EDI understand and evaluate available options.

Third, the Planning Report draws on INPUT's ongoing research into the vendor markets. The vendor-oriented programs provide an in-depth look at the current and future impacts of technology on the plans of IS organizations over the next few years. The related INPUT programs are:

- EDI - Electronic Data Interchange
- MAPS - Market Analysis and Planning Service
- CSP - Customer Service Program
- FISSP - Federal Information Systems and Services Program

Included in Appendix A is a list of recent INPUT research reports that may be of interest. The research behind many of them contributed to this report.

# II

# Major Issues

# II

# Major Issues

## A

## Driving Forces

Throughout 1987 and again in 1988 the information systems function finds itself in the position of playing an ever increasing role in the future success of its parent organization while doing so under the challenge of managing more complex technology and a tight budget.

Exhibit II-1 identifies the cross-industry strategic forces driving most IS organizations today. They are:

EXHIBIT II-1

### INFORMATION SYSTEMS DRIVING FORCES

- Rising Expectations of Senior Management
- Expanding Wealth
- Cost Sensitive Business Environment
- Ability to Conceptualize More Complex Applications
- Growing Interaction Between Large Corporations
- Unstable Organizational Environment

- A business management that recognizes the value of IS and is setting very high expectations on how it will contribute to the overall business success.

- A wealth of new and more powerful technologies that provide new and at times too many alternative approaches. The result is growing com-

plexity of the organization's information network with a resultant appearance, if not actual loss of control over the flow of data.

- A business climate, while relatively stable and growing, that places significant pressure on the IS budget.
- An increased ability to conceive, define, and develop information applications that are much larger, more complex, and more integrated and important to the business. The result is often a stretch for the internal development function and the increasing use of professional services companies to develop the most critical applications, which must then be integrated into the internal organization for support.
- The growing interaction between large organizations as the benefits of Electronic Data Interchange become recognized. This phenomena is bringing with it new pressures and new opportunities for IS to contribute to an organization's success.
- A changing business climate resulting from mergers and acquisitions. These dramatic changes in structure are forcing an added dimension to the IS strategy. Being prepared to integrate another IS environment is a design requirement not even considered only a few short years ago. The situation is quite common today in a number of industry sectors.

## B

## Issues & Objectives

A cross-industry assessment of the issues and objectives facing today's large Information Systems organizations identified the six fundamental topics listed in Exhibit II-2. In this section of the ISP Annual Report each of these topics will be reviewed in terms of its respective "elements," "trends," and the related "objectives" required for success. The "elements" are the current status and activity relative to the particular topic, the "trends" are the current or projected response, and the "objectives" are the goals IS should set for itself. Each topic is summarized in an exhibit.

EXHIBIT II-2

### INFORMATION SYSTEMS
### MAJOR ISSUES - 1988 & BEYOND

- Data Management
- Connectivity
- Integration
- User Involvement
- Development Productivity
- Business Contribution

### 1. Data Management

For the past several years information systems organization have struggled to put in place an environment of "data management" that would administer what is now commonly recognized as a corporate asset - the corporate data base. The level of success runs from marginal to moderate. There are few IS executives or managers of Data Administration that will claim they have the needed tools and level of management support they believe is required to achieve true control over the organization's data.

Now as the late 1980s approach, this fundamental area of IS is about to undergo a major evolutionary step. A step that will challenge even the most prepared Data Management function.

EXHIBIT II-3

**MAJOR ISSUES - DATA MANAGEMENT**

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| Physically Distributed Data | Move to RDBMS | Learn RDBMS |
| Growing User Access | Adopting DBMS on Distributed Systems | Train the User on RDBMS |
| Multiple DBMS Technologies | Renewed Move to Data Dictionaries | Select a Standard for Each Level |
| Inadequate Data Control | | Strengthen Data Processes |
| Growing Management Focus - Data as an Asset | | |

#### a. Elements

The critical elements of today's data management situation are:

- A growing population of distributed processors responsible for maintaining segments of an organization's data, but commonly doing so without the benefits of a data base management system (DBMS).

- Increasing access and use of this data by the end user both in analysis and in integration into departmental systems–it is common for management to receive related data and information through more than one channel.

- Data Management functions and data base systems that suffer from inadequate internal controls–from either a procedural or technological viewpoint; e.g., ineffective data dictionaries or a lack of company-wide policy on data administration.

- The growing use of more than one type of DBMS within a single information network, including more than one type of data model (e.g., hierarchical and relational).

- A growing awareness of data's value to the organization with the resultant increased focus from senior management.

### b. Trends

Against this environment of change and challenge most IS organizations are addressing the situation as follows:

- Aggressively moving to test and adopt Relational DBMS technology in the hope it will help control user access, speed systems development, and provide a more flexible basis for expanding information use within the organization. The user seems to be able to comprehend the relational data model.

- Adopting DBMS systems, in particular relational DBMSs, for use on distributed and departmental computers. Those IS organizations with a wide use of distributed processing are, or soon will be moving to make DBMS use common on minicomputers.

- Reactivating the push for data dictionary technology at all levels. Many of the newer relational DBMS offerings include an "active" (and integrated) data dictionary that will provide the data administration required. The prepared data management function will use this capability to gain administrative control of the data bases that will reside on the distributed/departmental systems.

### c. Objectives

The above suggests the following objectives for today's data management function.

- Learn and experiment with the relational model - it will bring with it new approaches to data base design.

- Get whatever data dictionary technology that is in use up to date.
- Use the introduction of DBMS technology on the distributed/departmental systems as a means to regain administrative control over the data on these computers.
- Select a standard RDBMS for each level of computing.
- Organize and conduct training for end users of distributed/departmental computers in the fundamentals of "relational database design." (Note: to do this successfully IS must first gain its own first hand experience.)

### 2. Connectivity

Second among the fundamental issues facing IS is the topic of connectivity. Today's user commonly has a PC as the preferred workstation, knows and is reasonably comfortable with the "PC interface" to computing, and sees the PC as a standard interface to all computing environments.

Recent INPUT research in the report on Workstation Strategies showed that the PC population commonly equals or exceeds that of dumb terminals, and that the personal computer has placed the terminal on the desk of the manager. Now that managers are using the PC they want dearly to be part of the network. This same research also found that over 50% of the PCs currently installed are now connected to the organization's network.

EXHIBIT II-4

MAJOR ISSUES - CONNECTIVITY

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| More PCs Than Terminals | PCs Commonly Connected | Standards for Connectivity |
| PC is the Manager's Terminal | PC Interface as Standard | Info Center in Charge |
| Bi-Directional Data Transfer | PC as Deptartmental System Workstations | Programmable Workstation Preference |
| Power of the Workstation Growing Quickly | LANs Evolving Slowly | |

### a. Elements

The critical elements of the connectivity topic are:

- Most organizations now have, or soon will have, more personal computers than dumb terminals. INPUT believes the era of a "programmable" terminal as the standard network workstation has arrived.
- The PC has put the "terminal" on the manager's desk, something that did not commonly occur with the dumb/single function terminal. Managers at all levels are now being exposed to the data network.
- The bi-directional transfer of data between various levels of a tiered network structure is now common. The movement of chunks of data around the organization is a way of life creating a new set of management concerns.
- The power of the PC (workstation) will only grow, both in its processing capability and in its data storage capability. More and more data will be stored and processed at the workstation.
- The PC interface is now accepted as the desired standard, whether connected to the mainframe, mini, or in a LAN. As PC interfaces become more graphically oriented the pressure on mainframe-based solutions will grow. The end solution will be to place the "technological support" for the interface at the workstation level with the user being able to tailor the interface within defined corporate standards to his or her particular requirements. All workstations will have some level of local programmability in the near future.

### b. Trends

Reacting to this environment of growing populations of PCs and the drive for connectivity, IS is:

- Commonly connecting the PC population to the network and quickly making it the workstation of choice. The policy of one workstation per desk is leading to the replacement of terminals by personal computers.
- Moving slowly on LANs after the early attention and experimentation. IS is having to learn how to integrate them into the overall network. A PC on a LAN quickly needs access to the "center" of the information network as well.
- Using PCs as the "workstation of choice" for departmental applications. By installing the departmental system with programmable workstations a future change is avoided. In many cases the PCs are already in place and the departmental mini is being installed to provide

more power and control in response to new local computing requirements.

- Striving for the PC interface as the standard. Many PC software companies are building mainframe versions of their products to ease the flow of data and speed the connectivity of PC and host.

- Looking for the "seamless" PC-to-Host interface. Already software is on the market that claims a seamless interface–the user is unaware of where the PC system is obtaining the data requested.

### c. Objectives

The above suggests the following objectives:

- Establish the standards required to achieve one workstation per desk.

- Assign responsibility for the human/computer interface to the end-user computing function (both for computing and office automation). They and the end user have each other's ear.

- Adopt programmable workstations for new applications.

## 3. Integration

Perhaps the most complicated and expensive challenge facing IS is that of integration. The 1980s have brought multiple levels of computing, distributed processing, multiple hardware and software vendors environments, and more. Now as the end of the 1980s approaches, there is a new pressure for tying it all back together. It is INPUT's assessment that the challenge of integration will occupy IS resources for a long time to come.

EXHIBIT II-5

MAJOR ISSUES - INTEGRATION

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| Multi-vendor Environments | Dist'd Processing Strategies | Standards, Standards, Standards |
| Computer-to-Computer Data Transfer | Vendor Support for Standards | Pressure the Vendor |
| Larger, More Complex Applications | Purchase Decisions Tied to Integration | Educate the User |
| Data Transfer to Outsiders | Outside Expertise<br>EDI | |

### a. Elements

The critical elements impacting integration are:

- The prevalence of multi-vendor environments. The push to distribute and purchase versus develop the application has led to multi-vendor, complex environments. Having two or more types of distributed and personal computers is not unusual.

- The existence of multi-vendor environments has not dampened the desire for computer-to-computer data transfer. This need continues to grow and with it the pressure for simplification and standardization.

- Today's applications are larger and more complex, often crossing multiple computers and heterogeneous environments.

- The growing requirement to routinely transfer data to outside organizations is becoming common and introduces a new element to the integration equation.

### b. Trends

The following is occurring on a common basis:

- The adoption of distributed processing as a principle element of an IS strategy is now common. While perhaps an obvious statement, it helps crystalize the magnitude of the integration challenge.

- Migration of many of the principle vendors to common standards is helping with this challenge. While the big boys (IBM and DEC) talk about their own approaches being the only way, both are making inter-vendor communication easier.

- Purchasing the application solution remains a mainstay of most IS strategies, however the ability to integrate with what is already installed in a network is now a critical factor in the evaluation process.

- Meeting this challenge is proving to be more than some IS organizations are equipped to do and they are looking outside for the expertise required.

- Electronic Data Interchange is becoming a component of many IS strategies and programs.

### c. Objectives

IS's objectives in the area of integration need to be:

- Standards, standards, standards!
- Place the pressure on the vendor.
- Help the end user who wants integration to understand what is involved.

### 4. User Involvement

The end user phenomenon is now a number of years old and in most instances is moving into a new phase of maturity. Fourth generation languages have been in use for three to five years and the personal computer has been common in large organizations for at least four years.

User involvement has begun to take on a much broader role in the information systems environment of many organizations, stretching from demands for more power at the desktop to the active participation in the selection of departmental systems and software. Users at all levels of the organization are increasingly comfortable with the PC interface, and while their expanded knowledge makes them more aware, it has also shortened their patience.

EXHIBIT II-6

MAJOR ISSUES - USER INVOLVEMENT

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| Management is the User | More Power at the Workstation | Strengthen End User Computing Function |
| Appetite for Data | Access to Data | |
| Dept'l Computers vs PCs | Defining Own Environment | Flexible Standards |
| Applications Without Rules | Developing Own Applications | Education about Application Development |
| Power User's Growing Influence | | Education about IS Strategy |

### a. Elements

The critical elements of the current end-user computing situation are:

- Management is now the user. In many organizations at least 25% of the management uses a PC that also functions as a terminal.
- The experienced (power) user is now common. His knowledge creates greater expectations and he demands greater influence.
- Departmental computing systems are common, be they mini- or LAN-based. The need for administrative control of the local processing is now very significant and an increasing problem.
- The user's thirst for data is proving unquenchable–the application backlog has not diminished; it has changed in character, and in some instances become more invisible.
- The user is building applications (not just using productivity tools) and usually doing so outside the context of a formal process.

### b. Trends.

The key trends in user involvement are:

- More and more power is migrating to the desktop and the end is not in sight. The price- performance ratios continue to drop and more powerful multi-tasking environments are already available.
- Gaining more and easier access to data is a reality and as the data begins to go both directions the need for control is being recognized.
- Creating one's own environment and permanent applications is becoming the prerogative of the user.
- With the growing user experience base there is also a growing resistance to change. Once users are comfortable with a technology it can be difficult to get them to move forward over time. Their focus is on the work at hand. Consequently, they are not likely to make the investments required to avoid the inevitable and time consuming enhancements and upgrades.
- Making computing technology decisions is no longer the sole right of IS. The user at all levels, is expressing an opinion and influencing the decisions.

### c. Objectives

This suggests the following objectives for IS in dealing with the user:

- Continue to strengthen the role of the end-user computing function.

- Give the end-user computing function responsibility for office automation, and all end- user computing (PC, mini, and Mainframe).

- Provide user standards that permit reasonable flexibility.

- Concentrate on strategy and tactics that prepare the user for greater involvement.

- Expand user education to cover data management, application development, and IS planning.

## 5. Development Productivity

The fifth fundamental issue facing IS is that of Development Productivity. All of the advances of the 1980s from Fourth Generation Languages to distributed processing and, of course, the personal computer, have not caused a decrease in the infamous applications backlog. Many companies comment that the backlog is higher today than a few years ago, if in fact there is any way to measure it.

In addition, over this period the size and complexity of many applications have also increased. Today, it is becoming common for an application to include elements that stretch across multiple platforms and functions. While a particular application may not be closely integrated with other applications today, it is likely that it will be in the future. The result is a need to consider an overall applications "architecture".

### a. Elements

This all adds up to a renewed priority for the long-standing problem of application development productivity. The elements of today's development productivity issue are:

- The focus is on Applications Development, not just programming, as well as the broader issue of applications architecture.

- The underlying infrastructure of applications is changing rapidly. Today they include decentralized but integrated networks, new data base technologies, and heterogeneous environments.

EXHIBIT II-7

## MAJOR ISSUES DEVELOPMENT PRODUCTIVITY

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| Focus on Development & Architecture | Addressing Entire Process | Study CASE-Don't Jump Too Fast |
| Infra-structure Changing Rapidly | Many CASE Tools - No Proven Leader | User involvement in Large Applications |
| Control Over Development Changing | 4GLs Not the Long-Term Answer | Set Rules for User Applications |
| Impact on Installed Processes & Applications | Go Slow Attitude | User Education on Planning for Computing |
|  | Professional Services Companies Leading the Way |  |

- Control over who directs and performs development is changing. The user is taking a strong role in many major applications and often actually developing departmental applications.

- Today there are many more computer-aided development tools. However, IS is concerned about the impact that adoption of these tools might have on the current development process, and the installed application portfolio.

- Furthermore, looking at new ways of doing development continues to run afoul of the "maintenance" challenge. Maintenance continues to consume over 50% of the development resource and is a constant source of productivity concerns.

### b. Trends

The principle trends in development productivity are:

- Addressing the "entire" applications development process from cradle to grave, and placing emphasis on the early design phases and maintenance versus the automatic generation of code. INPUT's surveys indicate that this is the primary thrust. This is the approach of those companies giving the issue a serious look.

- Many new CASE (Computer-Aided Systems Engineering) technology products are already on the market, but without a "proven" leader. This makes it a gamble for a large development organization to adopt one, given the cost of implementation and training. Many of the products are in the early development phases and the benefits of potential AI enhancements remain to be realized.

- While use of Fourth Generation Languages continues to expand, they are not viewed as the long term solution. Concerns over future maintenance requirements of systems developed with this technology are an issue with many IS executives.

- Much of the early effort in new application development productivity methodologies is coming from professional services companies that face a great competitive pressure to deliver. In some instances these firms are now packaging their own CASE technology and planning to bring it to market. These firms may well prove to be the leaders in the development of new productivity approaches.

- A go slow attitude is being adopted by most organizations.

### c. Objectives

For most IS development organizations today's objectives should be:

- Continuous monitoring of the evolving CASE technologies in order to determine the proper time to jump in.

- Increased emphasis on user involvement in large application projects.

- The establishment of standards and processes for user-managed applications development.

- The development of expanded user education programs to include training on planning for effective systems implementation and management.

## 6. Business Contribution

Increasingly, IS is being looked upon as an innovator in the development of business strategy, as well as an implementer of both <u>strategic</u> and <u>tactical</u> business systems. This phenomena has been growing for a

number of years, changing both the corporation's view of IS and IS's view of itself. Above all other issues confronting the IS function, this is perhaps the most difficult to deal with because it forecasts the shift of the function from the role of staff and/or service to that of planner and executor of business strategy.

EXHIBIT II-8

## MAJOR ISSUES - BUSINESS CONTRIBUTION

| ELEMENTS | TRENDS | OBJECTIVES |
|---|---|---|
| Senior User Influence | IS Executive Stature Grows | Assume Strategic Role |
| Greater Return on Investment | Increased Business Justification | Expose Senior Management to Technology |
| Business Knowledge of Developers | Use of Outside Development Firms | Monitor Competition's IS Program |
| Senior Management Expectations Growing | | Pro-actively Consider Outside Experts |

### a. Elements

The elements concerning IS's contribution to the business as we enter the end of the 1980s are:

- The influence of interested senior user management continues to grow. They are taking a stronger role in the decision process for major application decisions as the cost and business importance of those applications grows.

- The pressure for a greater return on the IS investment remains steady.

- The business knowledge required of the leading application developers is much greater.

- The expectations of senior management are growing and are unlikely to diminish as they gain more sophistication in understanding the potential business opportunities offered through information systems technology.

### b. Trends

The trends are:

- The stature of the senior IS executive is continuing to grow. A recent *Information Week* survey found 63 out of the top 100 Chief Information Officers carried the title of Vice President or higher.
- The growing business implications of many of today's information systems decisions are forcing more business-like approaches to evaluating IS investment strategies.
- The growing size, complexity, and integration requirements of today's applications is increasing the frequency with which even major corporations turn to outside organizations for project management and implementation.

### c. Objectives

IS objectives towards this issue remain:

- Take a more active role at the strategic level.
- Expose senior management to new technology and its potential.
- Monitor the competition's IS strategies.
- Consider and pro-actively search for outside sources which might more effectively support the development and implementation of new systems.

## C

## Summary

INPUT believes that 1987 as much as any year marks a debarkation from the past for the information systems function. Most IS groups now have significant experience with traditional data base technology, an active and reasonably successful end-user program, and a three-tiered processing network that is at least loosely connected. It is upon this foundation that the future will be addressed. The demands in 1988 and beyond will include:

- Ever-increasing pressure for flexibility within the IS function.
- Increased focus and measurement of IS by senior management.
- Significant emphasis on tying the network together.
- A prominent role in business strategy.

- Emphasis beyond that experienced to date on data management.

Exhibit II-9 characterizes this debarkation with INPUT's recommended list of "changes in emphasis" for IS management. As the next five years pass, the basic responsibilities of the Information Systems organization will shift :

- From Data Processing to Information Flow
- From Information Quantity to Information Quality
- From Automation of Process to Improvement of Process

Many IS organizations are already on their way while others have yet to begin this journey. Those that are successful will find themselves part of a competitive and industry-leading organization.

EXHIBIT II-9

## INFORMATION SYSTEMS RECOMMENDED CHANGES OF EMPHASIS

1987 -1992

- Data Processing → Information Flow
- Information Quantity → Information Quality
- Automation of Process → Improvement of Process

# III

# Impacts of New Technology

# III

# Impacts of New Technology

The second half of the 1980s has brought with it a growing menu of technology and processing options to meet the requirements of todays' organization, large or small. The result has been a complex computing network for many organizations and the presence of the computer in almost every nook and cranny of today's modern organization. The challenge this brings to IS is at times immense, both to *keep it running* and to *provide a portfolio of alternatives* to accommodate an increasingly unpredictable future.

In 1987 the technological developments identified in Exhibit III-1 have added to the options and the challenges for IS.

EXHIBIT III-1

## TECHNOLOGICAL DEVELOPMENTS OPTIONS AND ISSUES

- Data Base-Relational & Distributed
- Workstations
- Networking
- Electronic Data Interchange
- Managing Technology

## A

## Data Base

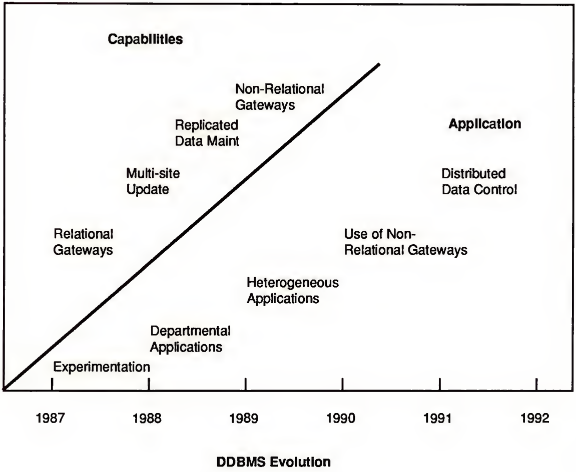
1987 brought two key developments in the data base arena. First, the maturing and acceptance of the Relational Data Model; and second, the availability of the first Distributed Data Base Management Systems. INPUT projects that DBMS-based application development will not be the same from this point forward.

The next few years will see:

- Data Base systems of all kinds actively and commonly used on all three tiers of the computing network with significant transfer of data between levels.
- A shift to relational DBMS (RDBMS) as the principle technology for applications where data access and analysis is the primary objective.
- The use of RDBMS technology for many lower volume transaction systems. (And performance improvements will bring a growing use in higher volume applications.)
- RDBMS become the principle, if not sole DBMS technology used on the mini and PC tiers of the network, and will quickly replace the file-oriented environments on today's distributed and departmental systems.
- RDBMS be accepted and understood by the end user who will actively use RDBMS technology in PC and mini applications.
- Early but real efforts to build "distributed" data base applications where a single data base is spread across multiple platforms. ( Exhibit III-2 from the report, *Distributed Data Base - An Early Look* provides a forecast of the evolution and application of distributed DBMS technology.)
    - At first these applications will use homogeneous environments at the mini and PC levels.
    - Later they will begin to interact with mainframe relational and traditional DBMSs in a heterogeneous environment.

EXHIBIT III-2

## DDBMS - THE NEXT FEW YEARS



INPUT believes that by 1990 the data base environment of most large organizations will have changed dramatically, bringing with it a growing concern and requirement for a stronger data management program. INPUT's research into distributed data base technology in 1987 identified a number of "critical success factors" applicable to this new technology. These factors are included in Exhibit III-3 and apply directly to IS's early use of "relational" as well as "distributed" DBMS systems.

Successful implementer's of these DBMS technologies will use a carefully planned approach that acknowledges the inevitable learning curve.

EXHIBIT III-3

### DDBMS - CRITICAL SUCCESS FACTORS

1. Learn relational DBMS technology
2. Audit the data administration function
3. Do a controlled experiment
4. Use a homogeneous DBMS environment
5. Involve a mature end user
6. Use a geographically dispersed application
7. Select a non-strategic application

## B

## Workstations

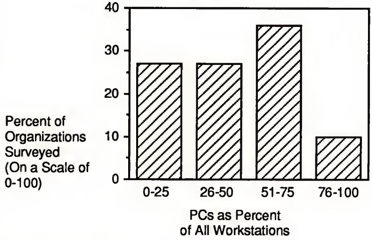
1987 finds the workstation environment in a state of change. Populations of PCs now exceed those of traditional terminals in many organizations. PCs in growing numbers are being tied into the network. And new workstation technologies are becoming available (e.g., multi-tasking PCs and affordable intelligent workstations derived from those used in engineering).

AS INPUT's study on *Workstations Strategies* found, almost half (46%) of the companies surveyed have more PCs than they do dumb (traditional single-function) terminals. Refer to Exhibit III-4.

EXHIBIT III-4

### WORKSTATION TRENDS

### PERSONAL COMPUTER AS A PERCENTAGE OF ALL WORKSTATIONS

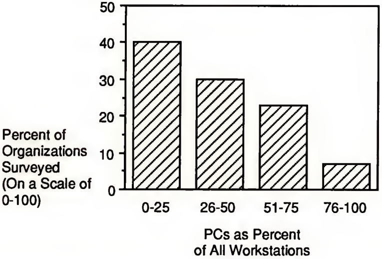


This same report also looks at the number of personal computers as a percent of the user population. The results of that question are in Exhibit III-5 and show that 30% of the organizations surveyed already have at least one PC for every two users.

EXHIBIT III-5

## WORKSTATION TRENDS

### PERSONAL COMPUTER AS A PERCENTAGE OF USERS



The movement to an intelligent (programmable) workstation as the standard is well underway and "one workstation for each white collar worker" is truly the objective of some progressive organizations. The impacts of this trend over the next few years will include:

- The PC interface becoming the standard man/machine interface with a growing graphics element. This will be followed by the introduction of PC/host integrated applications with "seamless" interfaces.
- The PC becoming a multi-tasking computer with slow but continued evolution of the end user's skill at utilizing this new capability.
- The use of the PC (or highly intelligent workstation) as the dominant multi-purpose workstation, with the traditional "dumb" terminal being utilized only in high volume or specialized data entry-oriented applications.
- The introduction to the general systems environment of very powerful intelligent workstations (both OS2 and UNIX based) that permit users the data access and power required in large integrated applications.

By 1990 the standard man/machine interface will have become much different in character than that of the mid 1980s. The user will have facile access to computing at all levels of the network and will frequently use multiple levels at one time without truly being aware of it.

## C

## Networking

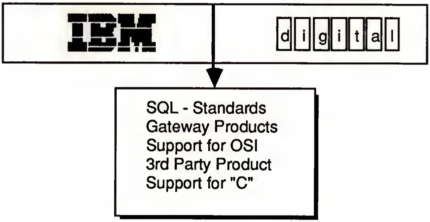
Today's networks are much more complex than those of just two to four years ago. They include the distributed, departmental, and personal computer, and support user executed data transfer as well as access. Yet the level and availability of standards and tools to integrate and manage these complex networks is lagging the demand.

Fortunately, the next few years are expected to bring improvements in this area. The network management task will not become less complex, just more achievable.

- Major vendors are beginning, if not openly at least in practice, to recognize that they must facilitate the integration of multi-vendor environments. As Exhibit III-5, from the report, *DEC Versus IBM, 1987-1992*, points out, both of these leading vendors are setting or accepting a growing number of standards that will make the multi-vender network environment more manageable.

EXHIBIT III-6

### NETWORKING - THE COMMON GROUND



SQL - Standards
Gateway Products
Support for OSI
3rd Party Product
Support for "C"

- The next generation of PC operating systems will provide the basis for a more manageable and integrated "PC as the workstation environment."

- The establishment of industry standards supporting peer-to-peer communications, including IBM's efforts in this area, will provide an improved basis for network management and expansion.

- The increased use of data base technology at the mini and PC levels will simplify data transfer and management.

The "network is the system" today, and in the future. Increasing the ease of the user's access and use of the network is a top priority.

## D

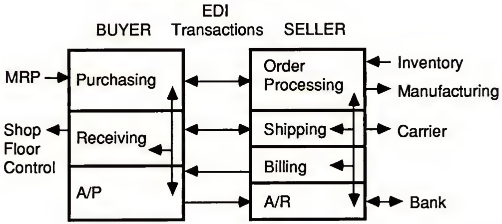
## Electronic Data Interchange

INPUT's program on Electronic Data Interchange (EDI) has identified a real and growing movement towards one of the emerging frontiers in the information systems arena. The spread of EDI by major US and international companies is having a ripple effect on companies of all sizes.

EDI, defined as the computer to computer exchange of inter-company business documents and information, offers significant opportunities to streamline business relationships. Exhibit III-7 provides an example of the applications (opportunities) that exist for EDI and the number of "players" one organization can find itself working with once the goal for use of EDI is established.

EXHIBIT III-7

**EDI APPLICATIONS**



Some of the implications for IS include:

- A working relationship with the IS organizations of vendors, customers, and even competitors in the effort to establish standards and transfer documents.

- A goal to remove the paper document from the interface with outsiders (sometimes even before the "piece of paper" is removed from an internal interface).

- The definition and propagation of standards that can in turn cause impacts on internal information systems.
- The influence of external business partners on the internal IS and business strategy.

Companies having significant information-based relationships with their business partners will, if not already, have their IS and administrative practices impacted by this growing phenomena, which offers major opportunities for IS to serve its organization strategically. As Exhibit III-8 suggests, EDI is "The Wave of the Future." The successful implementers of this technology will find themselves with multiple applications, easier access to information, working with more than one EDI software/communications standard, and working with data as well as other media (e.g., voice, graphics, video).

EXHIBIT III-8

**EDI**
**"The Wave of the Future"**

- Applications
- Enhanced Services: E-mail, E-forms,Data Bases
- Internetworking
- Media (Data, Graphics, Voice, Video)

## E

## Managing Technology

Managing, understanding, and applying technology, has been a primary focus of IS for the past two decades. Throughout the mid 1980s this challenge has gained new dimensions. The evolution started with the establishment of complex three-tiered computing networks and the increasing involvement of the end user. More recently, the growing interest of senior management in utilizing IS technology for strategic advantage has added to the challenge.

Today, the existence of a manager of technology planning and/or architecture is quite common. No longer can the IS executive respond tactically to new technology and satisfy senior management's expectations.

The next few years will offer these challenges and opportunities to those who take advantage of the growing number of technological alternatives.

- Perhaps the primary challenge will be withstanding the second guessing of senior management and the user on the technology planning process. It will require a strong- willed and skillful person.

- The creation of reasonably detailed strategies at all levels for hardware and software along with supporting standards will be essential, from workstation strategies to DBMS.

- Understanding the business of the organization and applying IS technology to its strategic betterment will become the primary focus. This is a significant change from applying technology to record what is going on in the business.

- More and more the technology will be in the hands and under the control of the user community. Their attitudes and priorities towards technology can be quite different yet valid. They may resist change at one point while insisting on change at another. Flexibility will be a key element of IS's management style.

As Exhibit III-9 points out, IS management must focus on technology integration and management of the information systems and support processes. These challenges require very different skills yet both are the underpinnings of success in the years to come. The manager of technology/architectural planning will be one of the most critical assignments in IS over the next five years. It is a full-time challenge for the best of the breed.

EXHIBIT III-9

## IS MANAGEMENT FOCUS

| AREA | NEED |
|---|---|
| Technology Integration | Infrastructure<br>Data Management<br>User Interfaces |
| Management of IS | Productivity of IS<br>Simplification of Support<br>User Managed Development |
| Strategic and Advanced Systems | |

# IV

# New Application Trends

# IV

# New Application Trends

INPUT surveyed the plans of 125 development organizations to determine what their priorities were for 1988 and beyond and to learn how the development resources would be allocated. The results of these interviews are contained in this and the corresponding chapters in the industry sector reports.

## A

## Application Trends

Each of the industry sector reports provide insights to the trends in applications specific to that sector. For example, in Banking they are centered in the areas of automation, and supporting the aggressive merger and acquisitions activity; in Insurance they are focused on helping the agent and the client understand the insurance products available; and in Education they are supporting an expanded role for the IS organization.

Each industry has its respective priorities, yet there are some cross-industry trends that are summarized in Exhibit IV-1.

EXHIBIT IV-1

### NEW APPLICATION TRENDS CROSS INDUSTRY SUMMARY

- Electronic Data Interchange
- Business Analysis and Management Tools
- Purchasing Package Software
- Strategic Applications
- RDBMS On the Minicomputer (Mid) Level

- Electronic Data Interchange (EDI) is a factor in banking, discrete manufacturing, distribution, process manufacturing, and transportation.
- Business analysis and management tools from decision support to expert systems seem to be a factor in every sector.
- Purchasing package software is a common occurrence today with some industries expending over 40% of their development budgets for package solutions.
- Strategic applications is the focus of most organizations as management looks to IS for a competitive advantage.
- The use of DBMS technology at the distributed/departmental systems level is a priority of all organizations with progressive computing strategies. Those that have installed numerous minicomputers are now trying to address the data control problems before they get beyond reach. RDBMS technology will likely become the tool.

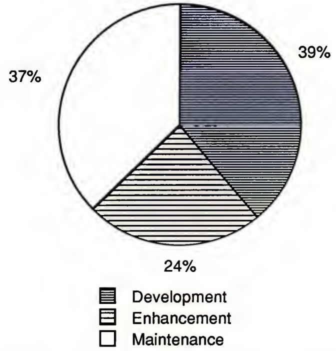
## B

### Development Resource Allocations

Exhibit IV-2 summarizes how internal application staffs will be allocated across all industries. On average 61% of the development resource is being spent on supporting current applications (maintenance plus enhancements). This leaves only 39% available for new systems.

EXHIBIT IV-2

**ASSIGNMENT OF APPLICATIONS DEVELOPMENT STAFF**



- On an industry-by-industry basis the allocation to support current applications does not vary a great deal with a high of 65% (State & Local Government) and a low of 44% (Distribution-Wholesale).

- The maintenance allocation ranges from a low of 20% (Process Manufacturing) to a high of 52% (Discrete Manufacturing), but for most industries was between 30% and 40%.

- The enhancement allocation ranges from as low as 14% (Distribution-Wholesale) to a high of 36% (Process Manufacturing).

- The highest allocation to new development was 56% (Process Manufacturing) while the lowest was 31% (Banking and Finance).

It can be understood why the focus of development productivity includes maintenance as a critical area of concern.

INPUT also looked at the source of application development by industry to determine the amount of software package purchasing and external development activity. The responses from the industries fall into two groupings.

*Group 1*

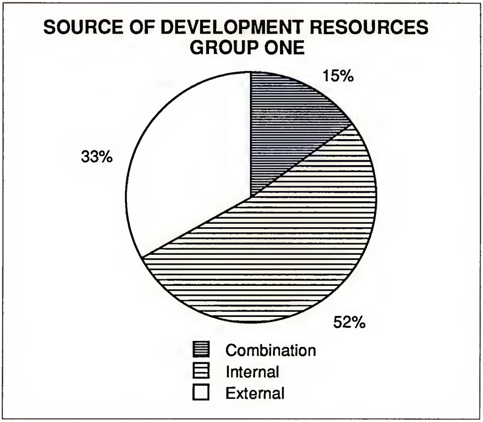
The first group divided their development sourcing between External, Internal, and a Combination of External/Internal. They did not specifically identify the amount of software purchases. Principle industries in this group are Banking & Finance, Education, Medical, Utilities, and Other.

Exhibit IV-3 shows that these industries are sourcing 33% of their development with external firms and another 15% as a combination of sourcing.

- The Medical industry leads the way sourcing 60% from the external sources, as that industry goes through a period of major change and increase in the use of information systems.

- The Banking & Finance, Education, and Utilities industries all have allocations to internal sourcing that closely approximate the average of 52%

EXHIBIT IV-3



*Group 2*

The second group segmented their development sourcing between Package, External, and Internal. This group included industry sectors such as Discrete and Process Manufacturing, Distribution, Insurance, Transportation, and State and Local Government.

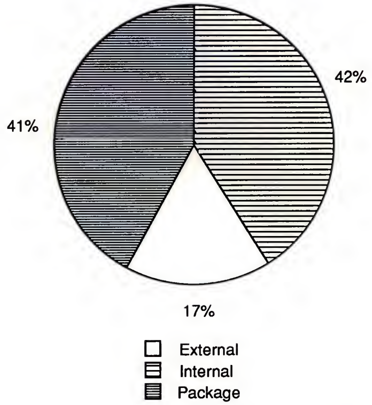
Exhibit IV-4 summarizes these development sourcing plans. On the average they will source 42% of their development through software packages, 41% internally and 17% using external development firms.

- Manufacturing leads the way in package software sourcing with the Process sector at 61% and the Discrete sector at 57%. Both of these sectors have aggressive application plans that can only be achieved in the desired timeframe through the use of purchased solutions.
- The Insurance industry is also very aggressive in outside sourcing but depends more heavily on external development companies. They plan to allocate 26% to external professional services and 37% to package software.

A closer look at the trend in each industry is available in the individual industry sector reports.

EXHIBIT III-4

## SOURCE OF DEVELOPMENT RESOURCES
## GROUP TWO



# V

# Budget Analysis

# V

# Budget Analysis

Once again INPUT has asked the IS function of over 125 organizations for the makeup of their annual budget and a category by category look at the projected changes. The results of that survey are detailed in each of the industry sector reports. An overall look is provided in this chapter of the Annual Report.

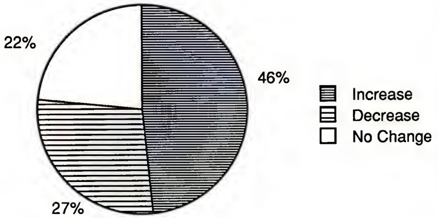
## A

## Overall Budget Trends

Exhibit V-1 shows that, in spite of continued pressure on budgets in general and the IS budget in particular, 46% of the companies surveyed project an increase in their IS budget compared to the current year's budget, while 27% project no change and the final 27% project a decrease.

EXHIBIT V-1

IS BUDGET 1987 VS 1988



As will be seen later in this chapter, the increases spread across many of the budget categories and vary significantly by industry. The IS budget is no different than any other functional budget today. It is under significant pressure to increase the return for each dollar spent and to contribute directly to the success of the organization.

What isn't shown by this data is the growing percentage of an organization's IS expenditures that are contained directly within the operating department's budget. It is INPUT's belief that if the total computer-related expenditures were obtainable for the organizations surveyed the percentage projecting an increase would be appreciably higher.

## B

## Current Expenditure Levels

Exhibit V-2 provides the distribution by percent of expenditures for the IS budget in 12 categories including Personnel, Hardware (with five subcategories), and Maintenance for each of the industry sectors. The exhibit allows a quick cross-industry comparison and indicates the range of differences between industries. For example:

- Personnel expenditures range from a low of 27.9% in the Service industry to a high of 48.2% in Education.
- The relative variation in the Mainframe Hardware category is even greater, with a low of 5.4% in the Telecommunications industry to a high of 26.3% in the Service sector; however, the majority of the industries range from about 8% to 12%. The Telecommunications industry has significant Other Hardware expenditures while the Service industry uses mostly a two-tier hardware strategy and has minimal Minicomputer expenditures.
- Telecommunications expenditures is another category with a very wide spread from 22.8% in Transportation and 18.3% in Insurance to 4% or less in the Education, Service, and Other sectors.
- Purchasing software is a common and growing practice. The industries doing so aggressively are Service with 14.1% of its budget allocated to External Software and Medical at 9.2%. Transportation and Banking & Finance are at the low end with 3.7% and 2.8% respectively.

Much has been written about the growing expenditure levels for Micro and Mini computer hardware. INPUT's survey would support that claim, but points out that in only one industry (State & Local Government) does the Micro expenditure level exceed that for Mainframes. Comparing the Minicomputer expenditures to those for Mainframes, INPUT found the two equal in the Education sector, almost equal in Telecommunications, and the Mini expenditures lower in all other sectors. A number of industries spend only about 1% on Minis indicating a limited distributed processing strategy.

EXHIBIT V-2

## CURRENT IS EXPENDITURE LEVELS
## (Percent Budget)

| Industry Sector | Person-nel | Hardware | | | | | | Data Comm | Ext Soft-ware | Prof Serv | Soft-ware Main | Hard-ware Main | All Other | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Main | Mini | Micro | Mass Stor | Other | Sub Total | | | | | | | |
| Banking & Finance | 40.1 | 8.2 | 1.2 | 5.0 | 5.4 | 6.5 | 26.3 | 10.2 | 2.8 | 1.7 | 0.9 | 8.3 | 9.7 | 100.0 |
| Discrete Manufacturing | 46.0 | 9.4 | 3.7 | 4.9 | 3.0 | 3.6 | 24.6 | 13.4 | 6.2 | 0.5 | 2.2 | 4.6 | 2.5 | 100.0 |
| Distribution-Retail | 41.8 | 12.1 | 1.2 | 8.8 | 1.5 | 0.6 | 24.3 | 12.9 | 6.1 | 1.0 | 3.2 | 5.8 | 4.9 | 100.0 |
| Distribution-Wholesale | 44.5 | 18.4 | 4.4 | 7.5 | – | 1.1 | 31.4 | 6.5 | 6.7 | 1.0 | 3.4 | 4.3 | 2.2 | 100.0 |
| Education | 4.2 | 6.7 | 6.7 | 5.3 | 4.2 | 0.6 | 23.5 | 3.7 | 7.3 | 0.3 | 2.4 | 8.3 | 6.3 | 100.0 |
| Federal Government | 22.5 | 5.6 | 3.7 | 1.1 | 2.2 | 9.3 | 21.9 | 5.8 | 2.7 | 18.1 | 2.7 | 6.9 | 19.4 | 100.0 |
| Insurance | 34.1 | 14.3 | 1.8 | 5.0 | 5.1 | 5.9 | 32.1 | 18.3 | 5.5 | 2.4 | 1.7 | 4.8 | 1.1 | 100.0 |
| Medical | 38.2 | 7.9 | 5.5 | 2.6 | 3.3 | 8.8 | 28.1 | 8.1 | 9.2 | 0.4 | 1.0 | 5.8 | 9.2 | 100.0 |
| Process Manufacturing | 39.8 | 10.3 | 4.2 | 4.6 | 5.0 | 1.8 | 25.9 | 7.7 | 7.7 | 1.9 | 3.0 | 8.0 | 6.0 | 100.0 |
| Service Industry | 27.9 | 26.3 | 0.5 | 8.9 | – | 9.6 | 45.3 | 3.1 | 14.1 | 0.9 | 4.0 | 2.7 | 2.0 | 100.0 |
| State & Local Government | 29.5 | 10.0 | 8.9 | 18.7 | 5.5 | 0.2 | 43.3 | 9.9 | 5.7 | 1.1 | 0.3 | 1.2 | 9.0 | 100.0 |
| Telecommunications | 32.1 | 5.4 | 5.2 | 2.8 | 1.5 | 12.0 | 26.9 | 5.3 | 7.2 | 5.6 | 1.6 | 1.3 | 20.0 | 100.0 |
| Transportation | 47.2 | 14.9 | 1.1 | 1.3 | 0.7 | – | 18.0 | 22.8 | 3.7 | 0.4 | 0.0 | 0.0 | 7.9 | 100.0 |
| Utilities | 36.3 | 12.2 | 6.6 | 4.3 | 2.9 | 2.2 | 28.2 | 4.8 | 6.5 | 4.5 | 3.4 | 9.3 | 7.0 | 100.0 |
| Other Industry Specific | 44.0 | 13.0 | 6.0 | 6.0 | 4.0 | 11.0 | 40.0 | 4.0 | 4.6 | 1.4 | 1.5 | 1.5 | 3.0 | 100.0 |

## C

## Forecasted Budget Changes

Exhibit V-3 provides a comparative look at the forecasted percentage change in budget categories for each of the industries. As with the budget breakdown in the last section we can again see significant variation across industry.

- Those industries forecasting significant increases include Insurance at 9.6%, Services at 10.8%, Telecommunications at 12%, Transportation at 10.3%, and Other at 10%.

- Only one industry forecasts a decline, Utilities at a modest negative 0.2%, but as noted in Section A, 27% of the companies (from all industries) forecasted a decline. In addition, the Distribution-Retail sector forecasts no change overall.

A look at the individual budget categories points out significant, but perhaps not surprising, variation. For example:

- Forecasted changes in Personnel expenditures range from a low of 1.1% in the Distribution-Retail industry to a high of 15.3% in Insurance. The Insurance industry is one of the few industries that seems to be adding IS personnel on a broad basis.

- Changes in Mainframe Hardware expenditures range from a decrease (-) of 9.7% for Utilities to an increase of 18.8% for Service. The Transportation industry is also forecasting a high increase at 16.4%.

- Significant increases are also projected in the Mini and Micro Hardware categories in a number of industries:

    - Mini–Telecommunications at 17.2% and Insurance at 12.6%.

    - Micro–Service at 18.8%, Insurance and Discrete Manufacturing at 15.1%, and Process Manufacturing at 12.6%.

- A final expenditure category of note is Professional Services. While the actual expenditure as a percent of total budget is relatively small (refer to Exhibit V-2) the forecasted changes are often significant. These changes support the reported trend for companies to go outside for help on major programs.

EXHIBIT V-3

## IS EXPENDITURE LEVELS - FORECASTED PERCENTAGE CHANGES
## 1987 VS 1988

| Industry Sector | Personnel | Hardware | | | | | | Data Comm | Ext Software | Prof Serv | Software Maint | Hardware Maint | All Other | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Main | Mini | Micro | Mass Stor | Other | Sub Total | | | | | | | |
| Banking & Finance | 1.8 | 6.1 | 3.0 | 8.1 | 6.2 | -2.0 | 2.6 | 8.1 | 4.8 | 1.5 | 6.4 | 3/0 | 1.6 | 2.6 |
| Discrete Manufacturing | 6.0 | 10.9 | 6.2 | 15.1 | 8.0 | 3.5 | 7.6 | 10.2 | 4.2 | -10.0 | 3.0 | 8.8 | 5.2 | 7.6 |
| Distribution-Retail | 1.1 | -1.5 | -2.0 | -1.0 | -2.0 | -2.0 | 0.0 | 6.0 | -1.4 | -2.5 | 0.0 | 0.0 | -1.0 | 0.0 |
| Distribution-Wholesale | 2.1 | 1.5 | 1.0 | 1.0 | 0.0 | 3.9 | 2.7 | 6.0 | 12.7 | 0.0 | 0.0 | 4.4 | 1.8 | 2.7 |
| Education | 2.6 | 2.1 | 3.5 | 3.9 | 2.0 | 1.1 | 3.6 | 5.2 | 12.6 | -0.7 | 1.9 | 4.5 | 2.5 | 3.6 |
| Federal Government | 3.6 | -3.1 | 8.3 | 5.6 | 9.1 | -4.1 | 2.5 | 6.7 | 15.0 | -1.6 | -6.2 | -4.7 | -1.0 | 2.5 |
| Insurance | 15.3 | 1.3 | 12.6 | 15.1 | 3.0 | 0.6 | 9.6 | 10.3 | 10.0 | 3.5 | 7.0 | 10.0 | 9.6 | 9.6 |
| Medical | 7.5 | 3.1 | 3.0 | 6.5 | 4.8 | 1.0 | 5.7 | 7.3 | 6.5 | 8.0 | 5.2 | 7.0 | 7.0 | 5.7 |
| Process Manufacturing | 5.2 | 12.1 | 9.0 | 12.2 | 8.0 | 2.0 | 7.2 | 4.6 | 4.5 | -1.0 | 1.0 | 10.0 | 9.2 | 7.2 |
| Service Industry | 2.7 | 18.8 | 0.0 | 18.8 | 0.0 | 17.8 | 10.8 | 10.9 | 8.8 | 2.4 | 4.5 | 0.0 | 2.5 | 10.8 |
| State Local & Government | 2.9 | 5.0 | -0.6 | 1.3 | 19.2 | 65.6 | 4.2 | 5.0 | 9.0 | -9.1 | 3.2 | 2.6 | 6.5 | 4.2 |
| Telecommunications | 3.7 | 15.7 | 17.2 | 11.5 | 4.6 | 22.3 | 12.0 | -12.0 | 19.0 | 14.1 | 0.6 | 16.1 | 17.0 | 12.0 |
| Transportation | 10.2 | 16.4 | 8.5 | 7.1 | 0.0 | 0.0 | 10.3 | 4.0 | 6.0 | 8.4 | 0.0 | 0.0 | 11.1 | 10.3 |
| Utilities | 2.5 | -9.7 | -4.2 | 2.5 | 3.0 | -2.4 | -0.2 | 4.9 | 8.3 | -6.6 | 3.5 | -11.2 | 0.0 | -0.2 |
| Other Industry Specific | 7.0 | 7.0 | 8.0 | 1.0 | 10.0 | 13.0 | 10.0 | 10.0 | 22.0 | 8.0 | 19.0 | 22.0 | 5.0 | 10.0 |

## D

## Summary

INPUT believes that the IS budget, what it contains and how it is forecasted to change is primarily impacted by the individual company's IS strategy. At the same time comparing the breakdown of a company's budget and budget trends with that of the same and related industries provides a check and balance.

IS is often under significant budget pressure. In a centralized environment the budget often represents 2 to 4% of a company's operating expenditures and is typically the corporate function with the largest individual budget. Justifying that budget and its elements is a challenge that will not diminish in the future.

A

# Appendix: Related Reports

# A

# Appendix: Related Reports

From the Information Systems Program

- *Distributed Data Base Management*
- *Dec versus IBM. 1987-1992*
- *Workstation Strategies*
- *Chargeback Systems*
- *Network Services Directions*
- *Impact of CD Rom on Information Systems*
- *Distributed Processing Services in the Teleprocessing Environment*
- *Departmental Systems and Software Opportunities*
- *IBM Operating Systems Strategies*
- *Micro-Mainframe–Corporate Impact*
- *Micro-Mainframe–Software Planning*
- *Integrating Office Systems into the Organization*

From the Electronic Data Interchange (EDI) Program

- *U.S. Electronic Data Interchange Services, 1987-1992*
- *EDI In Western Europe*
- *A Guide to EDI Implementation*

From the Market Analysis and Planning Service Program

- *Information Services Industry Forecast, 1987-1992*
- *Future DBMS Markets, 1987-1992*
- *Network Integration*
- *Commercial Systems Integration Implementations*
- *On-Line Data Base Markets, 1987-1992*

From the Customer Service Program

- *User Service Requirements: Third Party Maintenance*
- *User Service Requirements: Software Support*

# About INPUT

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

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs. Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning, This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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