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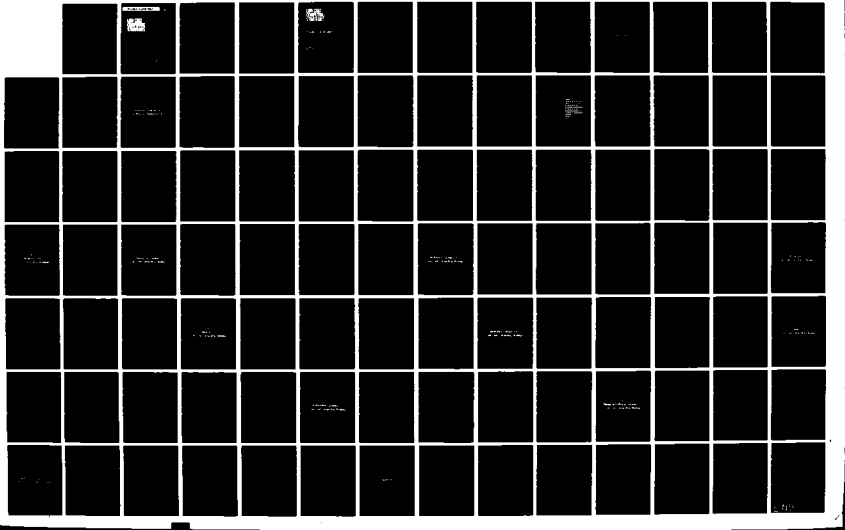

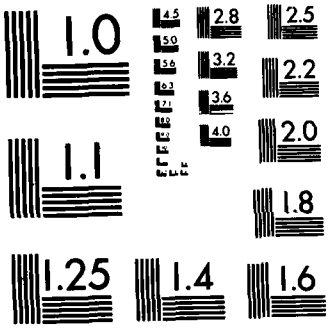

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An analysis of private industry

LOW COST COMPUTING STRATEGIES

Conducted for the Department of Defense

ARTHUR YOUNG

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

This report presents findings and conclusions resulting from a survey of private industries low cost computing strategies. This analysis was undertaken by the Arthur Young Company for the Directorate of Information Resources Management (Comptroller).

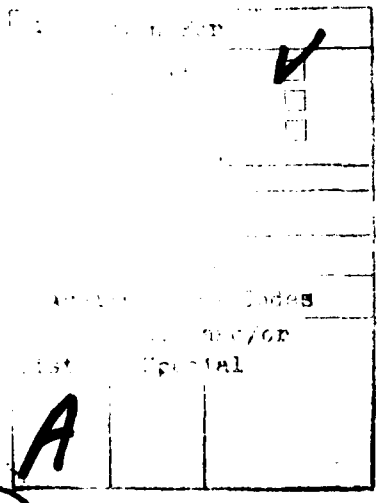
The information presented provides DoD with background data to be used during the formulation of a DoD management policy for low cost computing. The objectives of this study were;

To access the management and acquisition practices being used by nine large private sector corporations in the area of low cost computing equipment.

To identify and analyze the corporate support structures being used to support micro computer users.

To determine whether the findings of this study have applicability to DoD.

The report is presented in three chapters. Chapter I provides an introduction and background to the project conducted by Arthur Young and Company for the Directorate of Information Resources Management. Chapter II presents a summary analysis of our findings in private industry. It includes a discussion of the parallel progression of technology and management structures designed to take advantage of technology, focusing on the implications of our private industry strategy findings. The final chapter, Chapter III, contains more detailed discussions of the strategies adopted by each of the nine companies.



LOW COST COMPUTING STRATEGIES

An analysis of private industry

November 30, 1982

Mr. William H. Leary, III
Deputy Director,
Information Resources Management Systems
Office of the Assistant Secretary of
Defense (Comptroller)
Room 1A658, The Pentagon
Washington, D.C. 20301

Dear Mr. Leary:

When microcomputers were first introduced, the focus of vendors was primarily on individuals who would purchase the low cost systems for home, entertainment or small business applications. The application of microcomputers in large organizations is a relatively new topic of concern, both for vendors and for the large organizations themselves. Recognizing the fact that the Department of Defense (DoD) is the largest organization in the Federal government, with the largest group of "white collar" workers, or executives, managers, professionals, and clerical staff, in the country's work force, the Directorate for Information Resources Management Systems contracted with Arthur Young & Company to explore the potential role of microcomputers in DoD.

One portion of the resulting project has involved an analysis of private industry corporations to determine how they are addressing the management of low cost computing systems. The objectives of the survey were to identify approaches to microcomputer use in large private organizations and the management strategies employed, and then to evaluate their applicability to DoD. Our analysis of private industry strategies is summarized in the following key findings:

(1) Microcomputers are generally acknowledged in private industry as an area of computing technology that demands the attention of management. Individuals responsible for information systems policies and programs need to take an active role in managing microcomputers.

(2) A key concern of management is to identify and understand the needs and opportunities for microcomputers throughout the organization. Management also needs to find out where microcomputers are already in place.

(3) The most common microcomputer support strategy entailed the establishment of a central microcomputer group composed of individuals with technical backgrounds in information processing and a particular interest in the emerging technology of micros.

(4) The user initiative in acquiring and commitment to using microcomputers is generally viewed as not only good but essential for successful system integration.

(5) Many companies have established a list of recommended microcomputer systems and have negotiated volume purchase order agreements with the vendors selected.

(6) The majority of the organizations agreed that the need to exchange information drives the need for compatibility among systems, which determines the level of management attention required.

(7) Most companies believe microcomputers can enhance productivity. They have not, however, adopted a systematic approach to the analysis of functions suitable for automation through microcomputers, nor have they assessed rigorously the levels of productivity, efficiency and effectiveness of the staff before, during and after installation of microcomputer systems.

(8) A key concern of private industry is the need to educate all segments of the work force in the potential opportunity and potential problems associated with widespread acquisition and use of microcomputer systems.

(9) Private industry companies generally group responsibility for all information systems under a single management structure. This organization permits the development of a consistent, integrated policy for data processing, office automation and telecommunications systems.

(10) Major microcomputer hardware and software vendors indicate that the market is becoming more segmented according to buyer categories with a significant new focus on the professional staff of large organizations, and a shake-out is anticipated among both microcomputer hardware and software companies.

The summary findings in private industry lead to one general conclusion: private industry is just beginning to explore the potential for integrating low cost computing technology. Microcomputer technology, itself, continues to develop. There is little debate over the importance of the new technology, but full assimilation of the impacts of the technology and effective exploitation of microcomputers still lie in the future.

New management concepts and structures are necessary to respond effectively to the technological opportunities presented by microcomputers. In the report delivered with this letter, we present some preliminary management hypotheses to build a framework for discussion of an effective strategy for integrating low cost computing technology throughout DoD.

Arthur Young & Company appreciates the opportunity to work with the Department of Defense on this analysis of private industry. We look forward to assisting on the important task of developing a low cost computing management strategy. If you have questions about the report or need additional information about our findings and analysis, please contact the Project Manager, Ms. Rhoda W. Canter, at (202) 828-7000.

Very truly yours,

ARTHUR YOUNG & COMPANY

BY: Henry J. Steininger

Henry J. Steininger
Partner

I.
Introduction

I. INTRODUCTION

Rapid technological advances in the information processing arena are ushering in a new era, which some are calling the information age. Within all the major segments of information processing -- data processing, office automation, telecommunications, and information dissemination -- technological innovations have introduced enormous new potential. These innovations have far-reaching implications for the management of information resources, including the people, equipment, procedures and systems necessary to process and provide information as well as the information itself..

In order to focus on the broad management implications within a particular environment, the Directorate for Information Resources Management selected the area of low cost computing, specifically microcomputers, to study in depth. This area of technology has experienced the most rapid advances in capability of any in information processing. The power, speed, easy use and broad span of applicability of microcomputers have brought to information processing technology a whole new community of users, new market dynamics, new applications for automation and opportunities to enhance productivity. The powerful capabilities of microcomputers are, furthermore, available for well under $10,000 and, in most cases, under $5,000. With the current pace of improvement in microcomputers, information processing capability equivalent to that provided by some large mainframe computers will soon be available in desk top units. This area of technology, therefore, provides a useful case study for the broader analysis of information resource management policies and programs.

The purpose of this report is to present an analysis of the strategies for implementing microcomputers adopted by nine private industry companies. The report is presented in three chapters. Chapter I provides an introduction and background to the project conducted by

Arthur Young & Company for the Directorate of Information Resources Management. Chapter II presents a summary analysis of our findings in private industry. It includes a discussion of the parallel progression of technology and management structures designed to take advantage of technology, focusing on the implications of our private industry strategy findings. The final chapter, Chapter III, contains more detailed discussions of the strategies adopted by each of the nine companies.

The remaining sections of this introductory chapter pro ide a brief discussion of the background for the project, the purpo of the private industry analysis and the methodology we followed.

1. BACKGROUND FOR THE PROJECT

The rapid advances in the technological capability of microcomputers have generated interest throughout the Department of Defense (DoD). All three military services, as well as the Office of the Secretary of Defense, are addressing the need for a low cost computer system policy. Low cost computing encompasses micro, mini and super-mini computers which can be acquired within the current delegated procurement authorities, $50,000 for sole source procurements and $500,000 for fully competitive procurements. Advances in microcomputer technology present an opportunity to enhance productivity on a broad scale. Along with the opportunity, however, comes an inevitable series of management concerns. In order to take advantage of the opportunity and resolve the management concerns, the Directorate of Information Resources Management initiated a project with Arthur Young & Company to explore the potential impact of low cost computing on DoD.

The project has been conducted in phases. During the first phase, Arthur Young & Company examined low cost computing technology developments and trends and their implications for DoD. A preliminary

series of management issues and concerns was identified. The second phase has encompassed the analysis of private industry strategies, as well as an assessment of current strategies in DoD. In the third phase of the project, Arthur Young will work with OSD and the military services to develop a comprehensive low cost computing strategy for DoD.

2. PURPOSE OF THE ANALYSIS OF PRIVATE INDUSTRY

The Department of Defense is the largest organization in the Federal Government. No other agency or private industry company equals it in annual expenditures, number of employees, number and location of facilities or diversity of operations. It is possible, nevertheless, to draw parallels between the largest private companies and DoD. The challenge of managing size and diversity in a very large organization differs only in extent, not in principle, from the challenge of managing the largest organization.

Some of the parallels between large, private industry companies and DoD are obvious. Both have multi-billion dollar operating budgets and both have worldwide operations. The more important parallels for the purposes of analyzing low cost computing strategies are the ones that can be drawn between DoD and private industry organization and management structures, and between the military and private industry work forces.

DoD is organized into autonomous service units with their own management hierarchies, all of them working together as the Department of Defense. A significant number of private industry companies are organized similarly. Parallels between the DoD and large, private industry company work forces can also be drawn. Most large companies have, like DoD, an extensive work force encompassing all major labor categories. The companies can provide a cross section, then, of executives, managers, professionals, technicians, clerical workers and

laborers and can demonstrate how low cost computing has affected the different groups.

In addition to these parallels, the large organizations share with DoD a strong dependence on information processing for successful operation. The difficulties of information processing in diverse, worldwide operations are also shared.

3. METHODOLOGY FOR THE ANALYSIS OF PRIVATE INDUSTRY

Because of the parallels between DoD and large, private industry companies, OSD requested that Arthur Young & Company arrange visits with selected companies to see whether they had developed strategies for implementing microcomputers and whether these strategies could effectively be adapted for government use. A methodology was developed first to select approximately ten appropriate companies and then to conduct interviews with company representatives.

Companies were selected on the basis of the following characteristics, closely related to the parallels with DoD discussed above:

- Size
- Extent of operations
- Revenues
- Dependence on information
- Organization structure
- Diversity of work force.

Other considerations included our knowledge of particular microcomputer initiatives within candidate companies. We did not wish to exclude all companies that had not developed a microcomputer strategy, particularly if the companies had purposely avoided establishing a strategy. We did, nevertheless, look for some companies where we knew programs had been established.

A final key consideration in selecting companies to visit was securing the agreement of the company to discuss microcomputer strategies with us. In most cases, we identified a senior information systems policy official as the primary contact within a company. We assumed these individuals would either have responsibility for establishing microcomputer policy and programs or would be able to refer us to the appropriate contact. The assumption proved to be correct.

The interview process with the final nine companies selected varied somewhat, depending on the number of persons and the amount of time the companies were able to spend with us. We used a standard interview guideline, provided in the appendix to this report. The questions served only as a guideline, and the particular concerns or initiatives of the individual companies dominated our discussions. In most cases, we were able to interview only the persons responsible for information systems policy, not users or other data and word processing professionals.

* * * * * *

This chapter has provided information on the background for the low cost computing project and on the purpose of our analysis of private industry strategies. The chapters that follow present a summary analysis of private industry findings and implications and discussions of the individual strategies implemented in nine companies.

II.
Summary Analysis of Findings in Private Industry

II. SUMMARY ANALYSIS OF FINDINGS IN PRIVATE INDUSTRY

When microcomputers were originally introduced in the marketplace, the focus of vendors was primarily on individuals who would purchase the low cost systems for home, entertainment or small business applications. The potential role of microcomputers in large organizations is a relatively new topic of concern, both for vendors of the systems and for the large organizations themselves. The microcomputer systems have, in general, first appeared in large organizations when individual employees have requested them or have brought in their personal computers to use in the office. The extent of this activity has led in many organizations to interest and attention from management, specifically from managers responsible for overall information systems policy. This Chapter of our report presents a summary and analysis of our findings in private industry.

1. SUMMARY OF FINDINGS IN PRIVATE INDUSTRY

The private industry survey, which was intended to be representative rather than exhaustive, included visits to nine companies. The industries represented by these companies were:

- Automotive
- Banking
- Electronics
- Insurance

. Metals and Mining

. Oil.

An industry profile of the companies is provided in Exhibit II-1. In the paragraphs that follow, we present summary findings for the private industry survey. More detailed discussions of the strategies adopted by individual companies are provided in Chapter III of this report.

(1) Microcomputers are generally acknowledged in private industry as an area of computing technology that demands the attention of management. Individuals responsible for information management policies and programs need to take an active role in managing microcomputers.

The private companies are all experiencing, to some degree, decentralized acquisition of personal and desk top computers. The demand for the systems initiates with end users and, frequently, the systems can be acquired without involving information processing professionals. Management has determined that attention to this situation is necessary to achieve an effective balance between user enthusiasm and the benefits to be derived from experimentation on the one hand, and the potential for inappropriate and uninformed acquisition and use on the other. Management has further recognized that existing automation policies and programs do not address all of the issues raised by microcomputers. Most organizations are in the process of developing, or have already developed, microcomputer policies or strategies.

(2) A key concern of management is to identify and understand the needs and opportunities for microcomputers throughout the organization. Management also needs to find out where microcomputers are already in place.

Private Industry Survey
Company Profile

INDUSTRY		1981 REVENUES (In Billions)	TOTAL EMPLOYEES (In Thousands)
Automative	(1)	37.0	494.5
Banking			
	(1)	11.0	40.5
	(2)	8.0	33.3
Electronics			
	(1)	2.7	37.0
	(2)	25.0	40.5
	(3)	8.5	145.0
Insurance	(1)	14.2	51.6
Metals, Mining	(1)	3.6	35.8
Oil	(1)	65.5	206.4

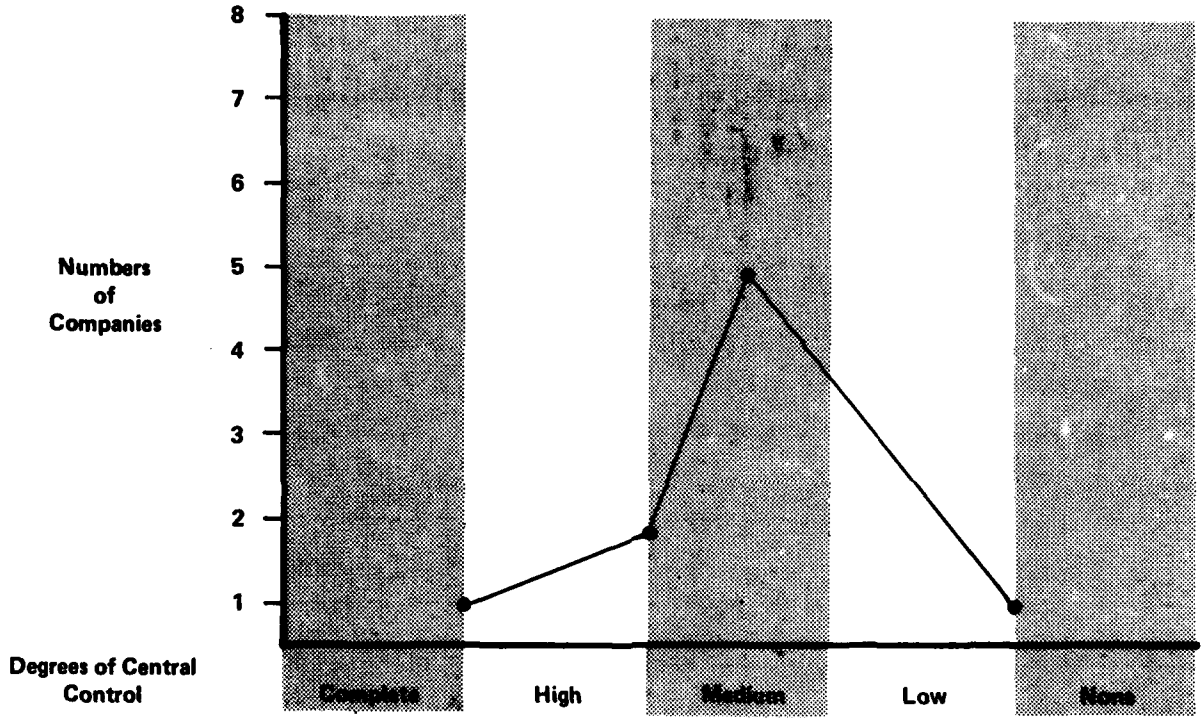
Because the early acquisition of microcomputers has been user-initiated, management is, in many cases, unaware of the number and type of systems in the organization and how they are being used. Most micro acquisitions fall far below any cost thresholds for reviews and reporting procedures. Little long range planning can be done until requirements throughout the organization are known. Many organizations have, therefore, developed programs designed to give users incentives for communicating with central information processing policy groups about what they are doing. These incentives range from negotiating volume purchase order agreements with vendors at advantageous rates, to providing consulting services to users on equipment and software selection, issuing user newsletters, providing training and implementation assistance and, in a few cases, providing a full range of centrally designed and supported software offerings.

The private industry companies we talked with have stressed the importance of an attitude of support on the part of the central information processing group. Users must be convinced that the goal of the central group is to provide assistance, not to seize control. Exhibit II-2, following this page, indicates the degrees of central control maintained by the companies over microcomputer acquisition and use. The distribution of companies, not surprisingly, is normal, with the majority of companies in the moderate range and only one each in the high and low ranges.

(3) <u>The most common microcomputer support strategy entailed the establishment of a central microcomputer group composed of individuals with technical backgrounds in data processing and a particular interest in the emerging technology of micros</u>.

The responsibilities of this group varied somewhat, but generally included:

Degree of Central Control Over Microcomputer Acquisition and Use



- Monitoring technology trends and maintaining current information on hardware and software for microcomputer systems;

- Evaluating hardware vendors and negotiating volume purchase agreements for the organization as a whole;

- Providing assistance to users in system selection, and trouble shooting during operations and maintenance;

- Evaluating microcomputer software and selecting packages to be offered as part of a standard system to users throughout the company;

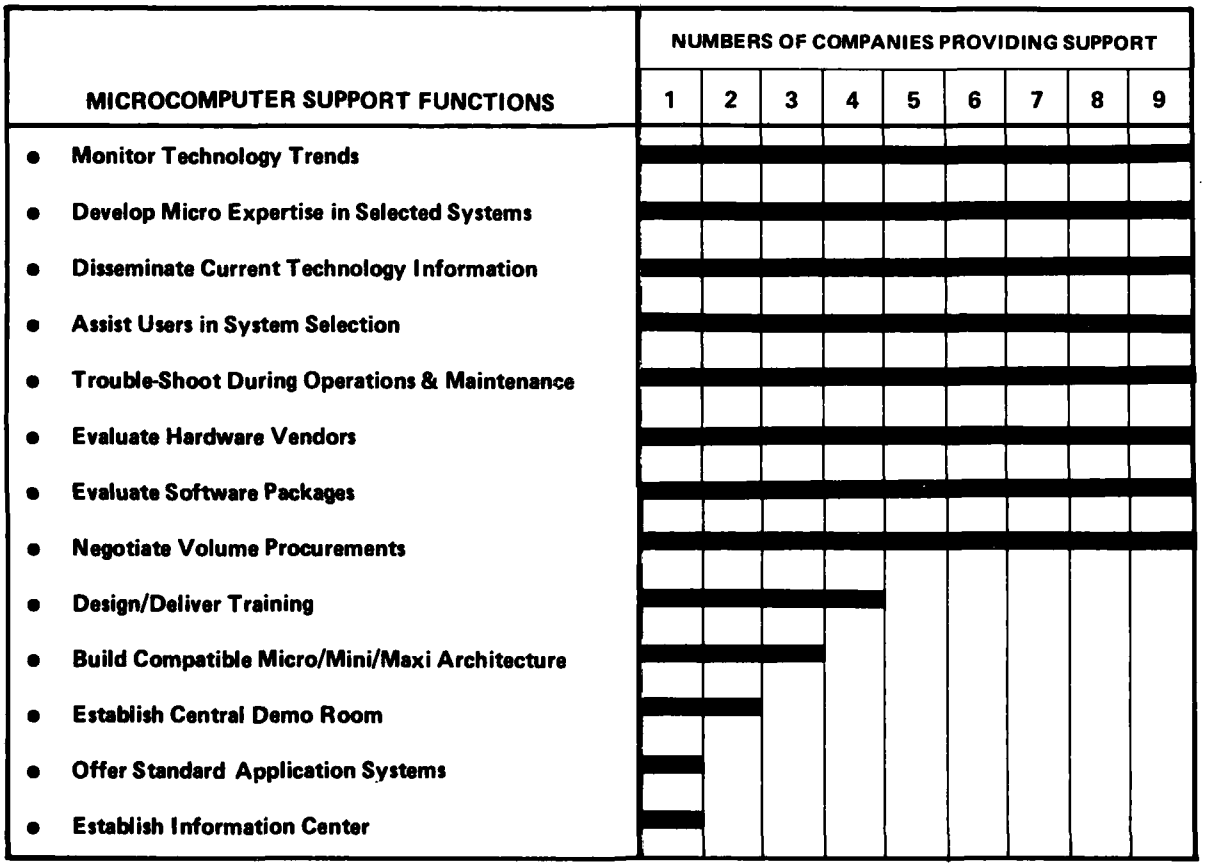
- Establishing a centrally located demonstration room to serve as a laboratory for the central group's monitoring and evaluation activities, as well as a training facility for executives and managers;

- Establishing an information center to provide users advice and access to computing support of all kinds, and

- Designing and providing training courses for the different levels of users in the organization.

Exhibit II-3, following this page, indicates the types and frequency of microcomputer support structures we found in our survey of private industry. There is a marked similarity in the functions performed by the central systems group in the companies surveyed. Nearly two thirds of the functions identified are provided by all nine companies. Several of the companies that do not currently offer support in the remaining functions plan to do so in the near future.

Microcomputer Support Structures



(4) The user initiative in acquiring and commitment to using microcomputers is generally viewed as not only good but essential for successful system integration.

The majority of the organizations we visited believe users must want the systems for them to be effective and must play a significant role in defining their requirements and operating their systems. Few groups have attempted to define applications for the microcomputers to be installed throughout the company whether or not the potential users have expressed an interest. The strength of the microcomputers has been their arrival as a businessperson's solution to a business problem, rather than a data processing solution to a user problem.

A description of the distribution of microcomputer management roles and responsibilities we found in our survey is provided in Exhibit II-4. The exhibit lists the traditional roles associated with the automated systems life cycle and indicates for each role how many of the companies surveyed have assigned responsibility for that role to the systems group, to users or to both (shared). The exhibit displays a significant shifting of roles traditionally performed by the systems group to the users. The shift is most striking in operations and maintenance of the microcomputers, which the majority of companies have assigned exclusively to users. In all other areas except long-range planning, procurement negotiation and post-installation review, more than half of the companies have given users either full or shared responsibility.

(5) Many companies have established a list of recommended microcomputer systems and have negotiated purchase order agreements with the vendors selected.

The goals of this approach are:

Microcomputer Roles & Responsibilities

ROLES	NUMBER OF COMPANIES ASSIGNING RESPONSIBILITY TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	9	0	0
Requirements Analysis	0	5	4
Hardware Selection	2	2	5
Software Package Selection	1	2	6
Procurement Negotiation	7	0	2
Application System Development	1	4	4
Installation	3	4	2
Training	4	3	2
Operations	0	9	0
Maintenance	2	7	0
Post-Installation Review	8	1	0

- To encourage widespread system compatibility;

- To avoid duplicative system and vendor evaluation by users;

- To achieve the cost savings available with high volume purchases and the added benefit of the special attention vendors tend to give large accounts, and

- To limit the range of systems that must be supported with in-house expertise.

It is interesting to note that most of the companies who have established lists of recommended microcomputers do not enforce user selection from the list. Users may make their own choices. One of the factors users must weigh, however, is the guarantee of informed central support for recommended solutions, versus the absence of support or lack of expertise available for other system selections.

(6) <u>The majority of the organizations agreed that the need for compatibility among systems is driven by the need to exchange information, which determines the level of management attention required</u>.

The need to share and exchange information makes compatibility necessary, both for the microcomputer systems and for the information to be shared. The majority of the organizations are achieving some system compatibility indirectly through high volume procurement agreements with vendors. Most of the companies have established rules and regulations addressing levels and methods of access, utilization and update for some of the information maintained in the corporate data bases. The information which has been addressed is considered critical to company operations and generally includes financial

records and customer or client records. Little has been done thus far to establish rules and regulations for exchanging and managing information maintained outside these standard systems on the microcomputer systems.

Microcomputer systems, then, fall into two categories with widely divergent characteristics: standalone systems, which require only minimal attention from management because they are, for all intents and purposes, the personal tool of their owners; and communicating systems, which require far greater attention. Most organizations have recognized that the only appropriate central management concern with the standalone system is to make sure the user has sufficient information to know whether he wants communications capability, to make a good selection for his needs and to be able to use the system.

(7) Most companies believe the new technology can enhance productivity. They have not, however, adopted a systematic approach to the analysis of functions suitable for automation through microcomputers, nor have they assessed rigorously the levels of productivity, efficiency and effectiveness of the staff before, during and after installation of microcomputer systems.

Although there is a general belief that gains in productivity can be made (estimates range from 10 to 200 percent), supporting data are slim or nonexistent. In the private sector, management has largely relied on an intuitive assessment of the potential of the systems as the basis for making an investment decision. This practice suffices for the private sector, because the net effect of the investment decision is reflected in the company's profit and loss statements.

With only a few exceptions, the central information

processing groups do not have complete or specific information on the applications users are implementing on their microcomputers. While this observation seems, at first, to indicate a failure on the part of the central group to maintain awareness of company-wide computing needs, the underlying reason for the lack of application information is probably the versatility of the microcomputer systems.

The nature of applications changes with the introduction of micros. The traditional applications running on mainframes are complex and relatively static. Their primary purpose has been methodical recording, processing and reporting of routine business information. The microcomputers, on the other hand, are more suited to ad hoc information processing, tailored to individuals' needs. The specific applications run on these machines tend, then, to be both diverse and, compared with mainframe applications, perishable. The central information systems group has a need to know the demand for categories of processing tools, such as spreadsheet analysis, among users. It is the business functional groups, however, that need to know specific applications of the analysis tools.

(8) A key concern of private industry is the need to educate all segments of the work force in the potential opportunity and potential problems associated with widespread acquisition and use of microcomputer systems.

The major segments in need of some type of training or education include:

- End users who need or want the systems or already have them and need assistance in using them effectively;

- Information processing professionals who have limited their

expertise to mainframe systems and who may be prejudiced against the micros;

- Managers and end users who need to be made aware of the capabilities available and how to select systems for specific functional areas; and

- Senior executives who need to understand the potential overall corporate impact of microcomputers as well as the specific tools available for their own use.

Each of these groups has a different baseline of knowledge and expertise. The goal in all areas is to achieve a level of computer literacy that will encourage intelligent and productive use of all available computer technologies.

(9) Private industry companies generally group all of their information processing systems into one management structure. This approach permits the development of consistent and integrated policies for all office systems, with coordination among data processing, office automation and telecommunications professionals.

The companies in most cases have a central information systems group with the responsibility for establishing all automation policy and programs. While the central information systems group frequently includes subgroups of individuals with particular skills in and responsibilities for the different categories of systems, the companies view these subgroups as parts of a whole which must be managed together. The components of the central information systems group are not always the same in the companies we visited, but they generally include selections from the following:

- Advanced Technology
- Data Base Administration
- Software Applications (may be broken further into specific application groups such as engineering systems, manufacturing systems)
- Office Automation
- Data Center Operations
- Communications
- Strategic Planning and Programs.

The fact that the companies have not segregated their information systems policy groups enables them to address comprehensively the implications of technological advances which are drawing data processing, office automation and communications closer and closer together.

(10) Major microcomputer hardware and software vendors indicate that the market is becoming more segmented according to buyer categories with a significant new focus on the professional staff of large organizations, and a shake-out is anticipated among both microcomputer hardware and software companies.

Until recently, competitors could generally be grouped in three categories: vendors of large data processing hardware or software, word processing systems vendors and vendors of personal computer systems. The distinctions among these groups are vanishing as more and more of the large companies introduce a

full range of systems. There is a definite trend toward integration of office automation with data processing and telecommunications.

This trend initiated with technological advances and has been encouraged by vendors hopeful of capturing a larger share of the market. These changes have a dramatic impact on the capabilities offered to users. The pace of change and potential for enhancing business operations are, at the same time, appealing and confusing. The market now appears to be divided into different buyer groups, targeted by different vendors. The major microcomputer buyer groups include large organizations, small businesses and home buyers. The greatest potential market is believed to be the large organization office systems. Several companies are emerging as clear leaders in hardware and software. These companies have developed strong marketing approaches for products which are attractive both from a technical and from a user support standpoint. The anticipated market turmoil means additional care will be required to assess the long-term viability of vendors prior to making major acquisitions.

2. ANALYSIS OF THE IMPLICATIONS OF OUR FINDINGS

The summary findings in private industry lead to one general conclusion: private industry is just beginning to explore the potential for integrating low cost computing technology. Microcomputer technology, itself, continues to develop. There is little debate over the importance of the new technology, but full assimilation of the impacts of the technology and effective exploitation of microcomputers still lie in the future.

The major implications of our analysis of private industry are:

- A closer working relationship between end users and information processing professionals will be required in order to plan for and use microcomputer technology successfully;

- Greater coordination is needed among the three major segments of the information processing professional community, data processing, office automation and telecommunications, to make effective use of new technologies;

- There is an increased need for information processing support services to be provided outside the traditional information processing organization, directly within functional business segments of companies;

- An increasing concern over compatibility of information and software will replace the former concern with hardware standardization;

- Rapid advances in microcomputer technology and the frequency of new product offerings on the market have generated a requirement for large organizations to establish a method and structure for continuous monitoring and assessment of advanced technology;

- Through the continuous assessment process, equipment and software products of particular importance for the organization can be selected and processed before users have recognized the need. The products are then readily available for installation when the need is expressed;

- There is a significant increase in the need for education of end users and all categories of information processing professionals in the application and management of the new, low cost technology.

A pattern of stages of microcomputer technological advance and their integration in large organizations is beginning to emerge. The technology has progressed from the successful production of the first microprocessor chip, to 4-bit micros used primarily for entertainment, and on to the 8-bit personal computers. The majority of the private industry companies are currently concentrating on using these 8-bit machines. In the meantime, both technology and vendor marketing strategies are focusing on the potential for the 16- and 32-bit machines in sophisticated architectures with significantly greater capabilities.

User industries are still reacting to technological advance, not influencing it to any great extent by developing strong, specific demands. Technology, which is largely in the hands of the microcomputer manufacturers, is still the driving force in influencing low cost computing.

It is interesting to consider the trends in microcomputer technology and growth in connection with Richard Nolan's theory of data processing growth in organizations. ("Managing the Crises in Data Procesisng," Harvard Business Review, March-April 1979.) The theory, based on Nolan's analysis of numerous private industry companies, identifies six stages of growth from the arrival of the first computer in an organization through fully mature management of data resources. The six stages of growth are Initiation, Contagion, Control, Integration, Data Administration and Maturity. Nolan also identifies four critical areas of growth and tracks a consistent growth process for each area as an organization moves from Initiation toward Maturity. The growth processes occur within Nolan's four critical areas, User Awareness, DP Planning and Control, DP Organization and Applications Portfolio. The growth process is tracked by descriptions of key characteristics within each of the four areas, which change for each of the six stages.

While the model is intended to accommodate data processing growth *regardless of changes in technology or in management theory*, the phenomenon of microcomputers may not be accurately reflected in the stages. One possible explanation for this fact is that microcomputers do not first arrive in an organization as a recognized part of the data processing function.

Consider Exhibit II-5, following this page. The exhibit displays a scenario focusing only on microcomputer processing growth in an organization. Nolan's six stages remain valid. Because the new microcomputer technology is introduced by users, however, the growth processes of the four critical areas change. The roles of users and data processing professionals are somewhat reversed. In the data processing growth model, the DP organization acquires all technical expertise and computing resources. The organization's management then establishes controls on data processing. In the microcomputer processing scenario, technical capability is acquired by the users

SIX STAGES OF MICROCOMPUTER PROCESSING GROWTH

GROWTH PROCESS	Stage I Initiation	Stage II Contagion	Stage III Control	Stage IV Integration	Stage V Data Administration	Stage VI Maturity
Applications Portfolio	Limited Individual Support	Proliferation	Analysis Tools—Standalone	Applications Access Corporate Data Bases	Pilot Tests of Productivity Enhancement Tools in Functional Areas	Application Integration
DP Organization	Micros Considered Toys	Divided: Technical Interest and Perceived Threat	Micro Planning Groups Initiated	Micro Expertise Developed	Full Micro Support Groups Formed	
DP Planning and Control	None	Monitoring Begins	Effort to Learn Extent of Micro Use	User Incentives Established	Strategic Planning For Micro/Mini/Maxi Architecture	Integrated DP/User Management
User Awareness	"Pioneers" Acquire First Micros	User Enthusiasm and Demand Expands	Widespread Demand—Confusion	Begining Reliance on DP Advice	Functional Groups Analyze Needs	

EXHIBIT II-5

first and then by the DP organization, where controls are later instituted to channel growth.

Nolan also identified benchmarks to pinpoint the status of a given organization in its progression through the six stages of data processing growth. Personal computing first appears as a benchmark in Stage 4, Integration. The level of personal computing then remains constant at five per cent throughout the subsequent stages. Mini and microcomputer processing also originate in Stage 4 at five per cent, progressing to 15 per cent in Stage 5 and 25 per cent in Stage 6, Maturity. The rapid advance of microcomputers in our current information processing environment suggests that these benchmarks need to be revised and increased. A close examination of the growth model in the light of current technology trends raises a more significant question. Is Nolan's Stage 6, Maturity, a limit which is approached but never reached, a final plateau for organizations, or is it instead the final stage for the traditional data processing function which, when it reaches maturity, emerges as a new entity with a new life cycle?

For the purpose of discussion and to assist in our analysis of low cost computing strategies in private industry, consider the different model in Exhibit II-6, following this page. The model displays the parallel growth in technology and in the management structures designed to take advantage of the prevailing technology.

The technology growth line focuses on key advances which influence the management structures rather than on a detailed series of technological events and breakthroughs. The progression of management structures highlights the changing focus of management. Early data processing organizations were concerned primarily with managing hardware and optimizing its performance and utilization. The information systems organization, which appears still to be the dominant organization in our analysis of private industry, focuses on optimizing software applications for the organization.

THE PARALLEL GROWTH OF INFORMATION PROCESSING TECHNOLOGY AND MANAGEMENT STRUCTURES

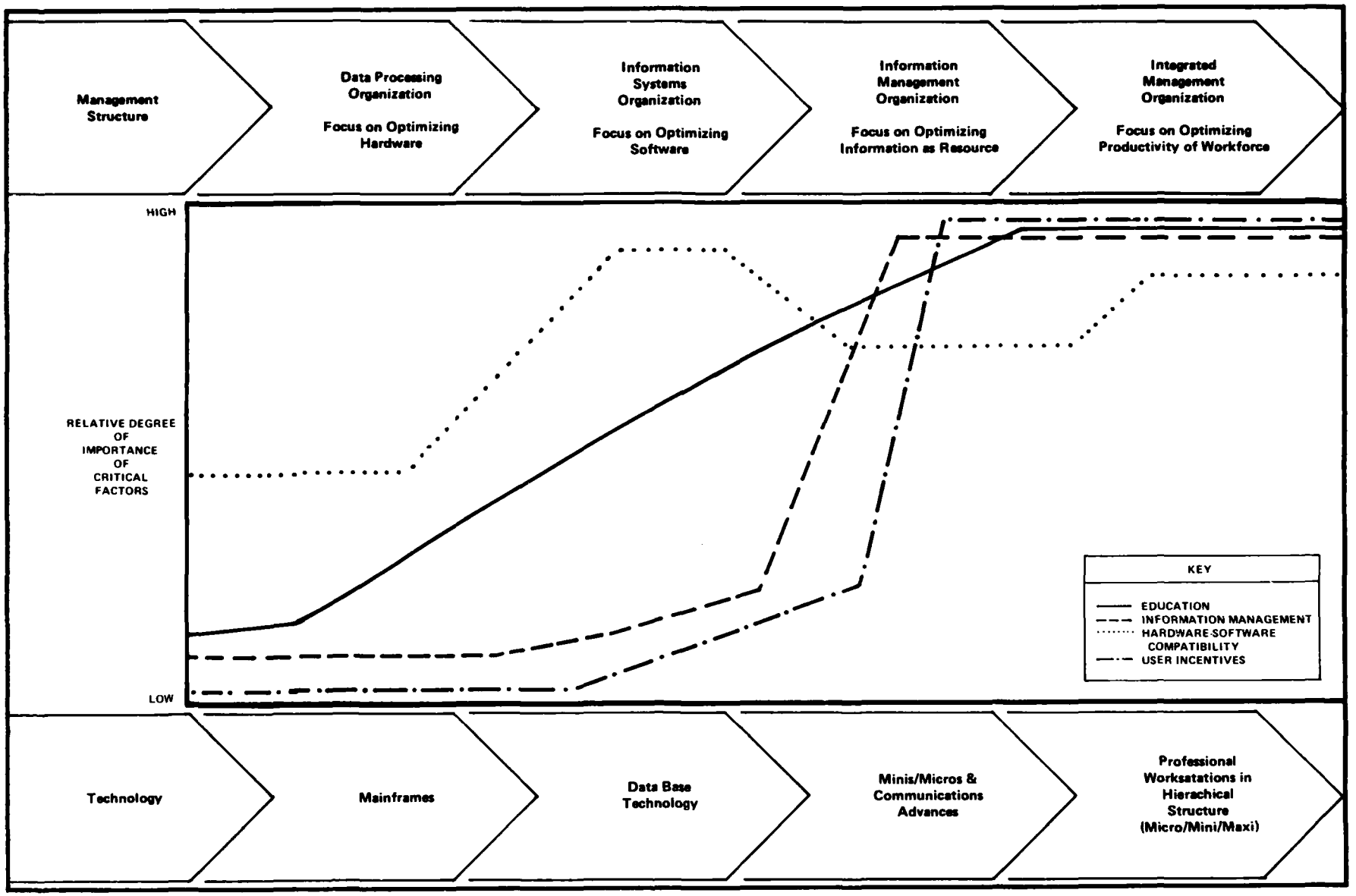


EXHIBIT II-6

A more recent concept in information processing management is the information management (or information resource management) organization. The primary concern of this management structure shifts from hardware and software to focus on the actual information generated and used by an organization. The optimization of information as a resource, that is, ensuring its consistency, timely availability and accuracy while avoiding redundancy, becomes more critical than optimizing hardware and software. We have found this concept to be in its infancy in practice among the companies we visited. The theory behind the management structure is sometimes understood and espoused, but execution of the theory lies in the future.

The final management structure in the progression in Exhibit II-8 (though not necessarily the ultimate management structure) displays yet another primary concern. The integrated management organization is designed to focus on optimizing the productivity of the work force through information processing. The concerns for hardware, software and information continue, but they are addressed in relation to the individual and his needs. The management structure is called integrated, because it reflects the achievement of a much closer parity of knowledge about systems and about business functions between end users and information processing professionals. Separate management structures for functional business segments and information processing are no longer necessary. They are, in fact, detrimental to a company's performance.

The capabilities needed and demanded from information processing change radically in this stage. When the primary need was for relatively static and methodical information recording and reporting systems, the mode of centralized information processing was appropriate. With changes in technological capability come changed demands. Individuals now realize they can have automated tools to assist them in processing information on an ad hoc basis to support job performance. Both the majority of the information processing

capability and the management responsibility for it must, therefore, be integrated with the business functional groups.

Displayed between the parallel growth of information processing technology and management structures in Exhibit II-6 are trend lines indicating the relative degree of importance of several factors we found to be critical in private industry low cost computing strategies. Each of the factors is discussed below.

- Education - The need for education shows a dramatic increase as a company moves toward an integrated management structure. In the past, knowledge of technology was confined to information processing technicians. End users have gradually required more knowledge to function effectively. With the advent of microcomputers, the need for education of all levels in the organization, from clerical workers through executives, and all functional groups, both end users and information processing professionals becomes critical. The companies have in many cases recognized the need, but have just begun to provide the education.

- Information Management - The importance of managing information grows similarly as technology advances into microcomputers and hierarchical networks. The private industry companies we visited have done little to address this critical need thus far. Unless attention is paid to the information management issue, the companies can expect widespread information discrepancies, costly duplication and incompatibility.

- Hardware - Software Compatibility - The importance of compatibility among hardware and software within an organization varies with the stage of technology and management. When microcomputers are first introduced, the

real need is for compatibility of information, not necessarily compatible systems. As an organization moves into networking micros with other micros and with mainframes, however, compatibility once more becomes critical.

- Communication and Interaction Among Users and Data Processing Professionals - The importance of providing incentives for users to communicate with and rely on the information processing management structure for guidance in acquiring systems does not become highly critical until microcomputers are introduced. The low cost and ready accessibility of the micros cause a sudden increase in company computer resources about which central management knows little, if anything. Management needs to know what users are doing, whether they have acquired systems and how they are being used. This information may influence significantly the overall plan for automation throughout the company. Our analysis of private industry highlights the critical need for incentives to encourage users to communicate their needs for and uses of micros.

This analysis has demonstrated that private industry is just beginning to take advantage of the potential of microcomputers and to develop effective management strategies. The impact of the technology on information processing growth in organizations is extensive. New management concepts and structures are necessary to respond effectively to the technological opportunities presented by microcomputers.

This chapter has introduced potential management concepts which may provide a framework for an effective strategy for low cost computing technology in large organizations. The two most difficult and long-range problems facing management are the integration of the

microcomputers into the overall technology structure and the integration of technology applications into the functional work areas. The preliminary management hypotheses presented have an important impact on the focus of the low cost computing strategy and on the pace for implementing that strategy.

III.
Private Industry
Low Cost Computing Strategies

III. PRIVATE INDUSTRY LOW COST COMPUTING STRATEGIES

In this chapter we present more detailed discussions of the low cost computing strategies we found in private industry. The corporations we interviewed in some cases requested that their names be withheld from publication. We have therefore provided a brief description which characterizes each corporation to demonstrate how it relates to the characteristics of DoD rather than naming the companies.

1.
Insurance Company
Low Cost Computing Strategy

1. INSURANCE COMPANY LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is one of the world's largest insurance and financial services organizations, with worldwide operations in property-casualty insurance, life insurance, health care and investment management. Its combined corporate characteristics are as follows:

- Total Assets - Over $29 billion
- Total 1981 Revenues - Over $11 billion
- Total Employees - Approximately 40,500.

The corporation encompasses two major companies. The company we visited is organized with three corporate groups reporting to the President: Marketing, Claims and Operations. The Operations group includes all systems personnel and all transaction processing personnel. The central system design and data processing group is comprised of approximately 1,000 individuals, 30 middle managers and 10 key managers reporting to a Senior Executive Vice President.

(2) Strategy for Implementing Low Cost Computers

The company has developed a strategy for supporting personal computing and office automation in general. The strategy was developed through experimentation. When the company first considered office automation in 1975-1976, the approach they adopted was the same used for traditional system development. The office, they discovered, is not one system to be automated but a group of loosely coordinated subsystems. A great deal of customization was necessary for different user groups. For example, their actuarial groups needed graphics to support development of charts, while legal groups needed communicating

word processors to handle constant modifications to legal documents. The skills required of support staff for the different office automation subsystems also varied substantially. This discovery led to the current strategy. In order to identify the needs of the company, the central group encouraged user groups to acquire outside support on a timesharing basis. The most common applications were thereby identified, as was the cost of outside services. The corporate group then had the information necessary to design a responsive, cost-effective option in-house.

The company now supports centrally a series of product offerings to be run on microcomputers operating in a timesharing mode with the company's central mainframes. The offerings include common elements such as electronic mail, point to point communications, a calendar system, graphics and an electronic spreadsheet. Three languages, API., BASIC and FORTRAN, are supported. A more advanced series of product offerings is supplied to groups who master the initial systems. Custom needs are addressed individually.

The company has established a consulting group to respond to all personal computing needs. The group is comprised of six individuals with technical backgrounds in systems and skills in the area of human factors. The consulting group was established to help users, who are called clients and are treated as clients. The consulting group's role is to listen to the clients and help them wade through the myriad options available to them. There is no charge for consulting services. The consulting group relies (as does the company as a whole) on the profit motive to attract clients. They negotiate contracts with microcomputer hardware suppliers which lead to significant price reductions. While users do not have to adopt the company's offerings, they must justify their decisions and their resulting financial performance in the budget review process. It is significant that the company does not dictate a solution, either software or hardware, to users. They make available an attractive software option, support all

LOW COST COMPUTING STRATEGY SUMMARY
INSURANCE COMPANY

EXHIBIT III-1

STRATEGIC GOAL	To Enhance the Efficiency of Operations Through the Use of Small Computers as a Decision Support Mechanism

DEGREE OF CENTRAL CONTROL
High-Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis			X
Hardware Selection			X
Software Package Selection	X		
Procurement Negotiation	X		
Application System Development			X
Installation		X	
Training	X		
Operations		X	
Maintenance		X	
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	YES
Build Compatible Micro/Mini/Maxi Architecture	YES
Establish Central Demo Room	YES
Offer Standard Application Systems	YES
Establish Information Center	NO

hardware on which that software will operate, assist free of charge in the areas of requirements analysis and vendor negotiations and, in general, exist not to control the acquisition and use of microcomputers but to provide guidance where it is wanted and needed. They believe they are, therefore, able to achieve visibility where written policy could not and have a good understanding of what user groups are doing with the low cost computers.

The personal computers are viewed by the company as a decision support mechanism. Their importance is determined not by their dollar value but by their potential impact on operations and information. They can be standalone or communicating. The company has two networks, one for voice and one data network which accesses the corporate data base. The personal computers may access the data base, but may not update corporate files. Information is viewed as the primary corporate asset, and the update procedures are highly controlled.

In a risk management analysis conducted recently, the company determined that 50% of the applications supported on the company's mainframes were critical, 50% were not. The personal computer offerings were considered critical because of the psychological dependence on the tools the systems provide.

2.
Electronics Company A — Low Cost Computing Strategy

2. ELECTRONICS COMPANY A - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is a large group of companies with significant operations in the areas of electronic appliances and equipment, communications equipment, and electronic industries materials manufacturing, among other business products. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - $2.66 Billion
- Total Employees - 37,000.

The corporation is highly decentralized in operations, with a central corporate headquarters, which we visited. The information systems group within the corporate headquarters reports to a Corporate Vice President who is responsible for all data processing and communications (both voice and data) activities. The central group reporting to the Vice President consists of:

- Data Center group of 50
- Corporate Systems Services group, responsible for software applications activities of 25
- Advanced Technology group
- Data Base Administration group
- Computer Resource Acquisition Oversight group
- Computer Deployment group.

The latter four groups are composed of a total of 18 professionals. Because the company is, by design and philosophy, highly decentralized, there are information systems staffs in many of the company's 21 major divisions. The extent of the staff is determined by the division management group.

(2) Strategy For Implementing Low Cost Computers

The company believes there are two major mistakes that can be made with microcomputers. The first is to ignore them; the second is to exert too much control.

The company's central systems group has identified four microcomputers which are approved for use, as needed, throughout its very decentralized operations. The four were selected primarily on the availability and quality of service provided by the vendors. Both hardware and software are procured centrally, but the company believes in decentralized management and does not enforce uniformity. User groups, who are called customers of the central systems group, can actually purchase whatever hardware systems they want outside of the four on the company's approved list. The central group does not attempt to dictate solutions. It will provide whatever assistance it can to customers regardless of their choice of systems. It cannot, however, maintain a comparable level of technical competence in all systems options.

Software is more tightly controlled than hardware, except for standalone micro users. One member of the central systems group monitors software packages full time and evaluates their applicability for the company. However, even software solutions are not dictated. Subgroups of the company (which are companies in their own right) need not use even such standard systems as the centrally supported general ledger package. The central corporate group identifies standards for interfaces with these systems. So long as a subgroup's information

LOW COST COMPUTING STRATEGY SUMMARY
ELECTRONICS COMPANY A

EXHIBIT III-2

STRATEGIC GOAL	To Encourage and Support Appropriate Use of Microcomputers and Other Office Automation Tools in a Micro-Mini-Maxi Network

DEGREE OF CENTRAL CONTROL
Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection		X	
Software Package Selection			X
Procurement Negotiation			X
Application System Development		X	
Installation		X	
Training			X
Operations		X	
Maintenance		X	
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	YES
Establish Central Demo Room	YES
Offer Standard Application Systems	NO
Establish Information Center	NO

arrives in a form compatible with the corporate system, they can use whatever system they like.

The central group's preferred approach is for customers to come to them with functional problems or applications they need and let the central group worry about choosing the best hardware and software for the job.

The company has recognized two major categories of users: those who have a defined problem that can be resolved on a microcomputer operating by itself within a single department or office, and those who need access to the corporate (or maxi) data base and systems. The vast majority of users fall in the latter category, even if they originally believe themselves to be in the first category. The microcomputer users who need access to the maxi data base obtain it through timesharing services from the corporate data center. The primary mission of the central systems group with regard to the micros is to make communication with the mainframes easy. Extract programs are written centrally, and customers do not necessarily understand the intricacies of the process through which information or processing services are provided them. The microcomputers can both access and update the company's central files. There are high boundaries of security around critical files, including three levels of sign-on. The company relies on "footprints," or the usual security logs of access, so that unauthorized use can be identified if it occurs.

The central systems group has established a demonstration room for the office of the future. Unlike most of the company's systems efforts, this office of the future project is a centralized activity. It incorporates electronic mail and many other office automation capabilities. The architecture of the office of the future is maxi-driven, with multiple types of devices communicating via the central mainframe. The company does not have and does not anticipate having local area networks. The central systems group sees no role for itself

in local area networks and prefers the flexibility available with the maxi-driven concept. The demo room will be used to train top executives in new technologies, particularly microcomputers. The company has found that the best way to train its executives has been not to overtrain. Their executives have done best when given enough information to get started on their own, and the privacy to experiment without embarrassment. When the executives have worked with the systems for a while, they become confident and start teaching others.

The company has a strong users' community, not just for microcomputers but for all systems users. They meet formally each quarter, share information and applications and will soon have a newsletter. There are two groups who meet separately, users and data processing or technical personnel.

Microcomputers have proved attractive to company users and the central group alike because the machines tend to limit the solution to a problem and therefore get the job done quickly. The company has found that this benefit can lead to problems, however, if data processing professionals are not careful to ensure compatibility among micros and the company's more powerful systems. The problems occur when the micros "run out of gas," or are outgrown by the applications running on them. The company's microcomputers are not suitable for processing massive amounts of data unless they can communicate with a larger mainframe. The company believes it is important to institute reviews of microcomputer use - not in the interests of controlling use, but to identify successes and failures for learning purposes.

3.

Oil Company — Low Cost Computing Strategy

3. OIL COMPANY - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is one of the largest oil companies in the world, with significant operations in energy exploration and production, refining and marketing, chemical operations, retail merchandising, paperboard packaging and real estate operations. Its combined corporate characteristics are as follows:

- Total Assets - More than $34.7 billion
- Total 1981 Revenues - More than $68.5 billion
- Total Employees - 206,400.

The parent corporation encompasses three different corporations. The one we visited is the largest of the three. It has a central corporate systems group comprised of the following groups:

- Advanced Technology
- Data Base Administration
- Software Applications
- Data Center and Communications
- Office Automation.

(2) Strategy For Implementing Low Cost Computers

The company puts microcomputers into the broader category of office automation. It has recognized that there is no way anyone can

LOW COST COMPUTING STRATEGY SUMMARY
OIL COMPANY

EXHIBIT III-3

STRATEGIC GOAL	To Lead the Inevitable Advance of Personal Computers in the Company through Providing Advice and Support to Users

DEGREE OF CENTRAL CONTROL
Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection			X
Software Package Selection			X
Procurement Negotiation	X		
Application System Development		X	
Installation			X
Training	X		
Operations		X	
Maintenance		X	
Post-Installation Review	X	X	

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	YES
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	YES

the basic systems to report on current levels of productivity and to implement office automation systems to enhance productivity. The company believes this process will necessitate a retraining of the total workforce. The responsibility for this massive training effort has yet to be assigned.

The company holds planning meetings periodically for the management science personnel. Newsletters are issued intermittently on office automation, and an effort has been made to make staff members aware of training opportunities by publishing an extensive catalog of training options.

The company supports pilot projects for applied research in office automation systems, which can be conducted anywhere in the company. They have established a personal computing center to evaluate and demonstrate the hardware and software available.

The company has had no difficulty among the data processing staff through the office automation initiatives. For those individuals who are not interested in the microcomputer technology, there remains more than enough work to do on the basic large-scale business systems. Many of the data processing staff, on the other hand, have acquired microcomputers on their own. These individuals have taken the lead in the office automation area.

The impact of office automation on the clerical staff has been significant. The company made an offer a few years ago to all secretaries to train them to become programmers. Of the approximately six hundred secretaries, fifty responded. Three were eventually selected and trained. The same offer was made recently, and, of the six hundred, four hundred secretaries expressed an interest in becoming programmers. The company feels the increase in interest is a direct result of their familiarity with word processing systems. Word processing in the company has grown approximately seventy percent per year for the last two years.

4.
Bank A —
Low Cost Computing Strategy

7. BANK A - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is one of the world's largest international banking and financial services institutions. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - $14.21 billion
- Total Employees - 51,600.

The company is highly decentralized. There are two major categories for the information systems support groups, which parallel the business division of the company, retail banking and institution banking. The information systems function follows regional divisions, with separate groups for North America, Europe, South America, Hong Kong and the Middle East.

(2) Strategy For Implementing Low Cost Computers

The company is using microcomputers extensively but has adopted no standard corporate policy related specifically to microcomputers. The only policy that applies is the requirement that individual profit centers expense microcomputers when they are purchased. Line managers are responsible for the profit and loss of their centers, and the results of a microcomputer purchase go immediately to their bottom lines. The company, then, relies on existing management policies and the strong incentive of the profit motive to govern decisions on microcomputer acquisition and use. Throughout the company the decision to acquire micros has been a business decision made by business persons, not by technicians. The company believes the strength of the microcomputer implementation effort lies in this fact. The company wants the implementation to be field-driven, even to the point of

hiring microcomputer specialists. If a profit center wants a staff member with these special skills, the center will recruit or train that staff member.

The company, which is very decentralized is most respects, has adopted the philosophy that microcomputers are similar to hand-held calculators. They believe microcomputers should be used and thought of as extensions of the human mind. While microcomputers will, probably within five years, become more universal terminals, operating within the company's communications network with standard downloading of information and applications that can be controlled locally, the company believes the more critical need for microcomputers now is individual support.

The company, nevertheless, encourages certain concepts and characteristics in connection with microcomputer implementation without assuming central responsibility. They do negotiate volume procurements with micro hardware vendors, but not yet with software vendors. The concept of clearing houses at the regional level is encouraged, primarily to support the exchange of ideas and applications among users. The use of a standard operating system is encouraged so that compatibility will be possible.

Entry level personnel are required to be proficient in using automated spreadsheet software, just as they must be in mathematics, reading, writing and other basic skills. The company has not seen a change in the personnel mix at the professional level, nor does it anticipate one. It believes most people will have the necessary expertise in personal computing when they are hired. The clerical staff, on the other hand, has been affected dramatically, and microcomputers will extend that impact further.

Applications are not developed centrally, because the company does not believe central software development would be useful at this

LOW COST COMPUTING STRATEGY SUMMARY
BANK A

EXHIBIT III-4

STRATEGIC GOAL	To Encourage Acquisition and Use of Microcomputers as Individual Support Tools, Letting the Profit Motive Serve as the Control Mechanism

DEGREE OF CENTRAL CONTROL
Low

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection		X	
Software Package Selection		X	
Procurement Negotiation			X
Application System Development		X	
Installation		X	
Training		X	
Operations		X	
Maintenance		X	
Post-Installation Review		X	

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

time. The company wants users to build things. While the company acknowledges this policy may lead to some duplication of effort, it believes the cost to control and eliminate the duplication would be greater than the cost of having the duplication.

The company has more than forty data centers worldwide. There are three standard technology bases, adjusted to meet local requirements. These systems are fully integrated. The company is currently working on developing a worldwide data base, which will eventually be accessible by microcomputers. The company does have certain critical systems, accounting and customer records. Any application that touches these systems is reviewed by the company's controllers.

The company has been more successful in integrating microcomputers overseas than in the United States. The reason for this difference is the extensive existing investment in large mainframes in the U.S. Data processing professionals who work with the larger hardware have tended to suppress acquisition and use of the micros, which they consider to be limited and umimpressive.

The company, in summary, sees many benefits from microcomputers which can best be realized through a period of decentralized growth. If there is a problem with this approach, the company says, it is ignorance of what is actually occurring in microcomputer use in the field due to the company's decentralized approach. There may be duplication of effort, may be incompatibility, and the company may well be missing cost efficiencies by purchasing duplicate copies of software. But the company does not have sufficient information on what is taking place to institute controls. The company further believes the cost of control would outweigh the benefits.

5.
Electronics Company B — Low Cost Computing Strategy

5. ELECTRONICS COMPANY B - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The company develops, manufactures and markets a wide variety of products in the generation, transmission, distribution, control and utilization of electricity and related technologies. Its operations are international, with combined corporate characteristics as follows:

- Total 1981 Revenues - Nearly $25 billion
- Total Employees - 40,500.

The company is decentralized in its operations, but it does have a strong corporate staff. The corporate computer systems organization has responsibility across the entire company. It is segmented into areas such as Engineering Systems, Manufacturing Systems, Office Automation and Distributed Processing, each headed by a data processing professional with specific responsibility for the area.

(2) Strategy For Implementing Low Cost Computers

The group responsible for microcomputers and other small systems has not adopted a formal policy for their acquisition and use throughout the company. The company does, however, have a strong program and guidelines for users to follow.

The central systems group has negotiated corporate purchase agreements with most of the major vendors of microcomputers. No inventory of equipment is maintained. The approximate dollar value of purchases in this area has been seventy million dollars per year. The central group's goal is to be supportive of users who have an interest in acquiring the small systems rather than inhibiting these users. The objectives of the group are to keep the company out of

major disasters, to provide information and guidance whenever possible, but to let local user groups handle most aspects of acquiring and operating the systems. The central group also assists in problem solving for personal computer users. They receive five to ten calls a day from users seeking assistance. They keep in touch with users, although no formal reviews are conducted.

The implementation of small systems has been approached on an individual basis. The company believes the user must want the system for it to be effective. The users are responsible for identifying their needs and justifying their requests for microcomputers to the central group. User requests are reviewed centrally. The company has not made it difficult for a user group to obtain a system, but the users must make a valid case for acquisition. The company has felt no need to offer incentives or disincentives to potential user groups, nor to organize prototype system implementations. The central group offers limited assistance in the areas of planning and requirements analysis by publishing guidelines on uses for microcomputers. The area of acquisition and equipment selection is where most of the central group's support activity occurs. Implementation, operation and maintenance are all the responsibility of the user group.

The company has focused primarily on standalone microcomputer systems. The central group does not recommend coupling the micros and does not emphasize operation in a shared resource mode. They do not believe the technology is adequate in these areas. The micros do, however, interact with the mainframes and microcomputers to communicate and transfer files. The company has experienced many problems with incompatibility. They believe these problems can be worked out, but they take time and are sometimes difficult.

The central group recommends software packages for user groups as preferable to user development of software. They have standard recommendations for spreadsheet applications, graphics, word

LOW COST COMPUTING STRATEGY SUMMARY
ELECTRONICS COMPANY B

EXHIBIT III-5

STRATEGIC GOAL	To Assist Users in Acquiring and Using Microcomputers in a Standalone Operating Mode and in Avoiding Major Systems Problems

DEGREE OF CENTRAL CONTROL
Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection			X
Software Package Selection			X
Procurement Negotiation	X		
Application System Development			X
Installation		X	
Training		X	
Operations		X	
Maintenance		X	
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

processing and communications. Negotiating software license agreements has been difficult for the company. This area has been a problem, particularly when the company must deal with very small software vendors. These small vendors often have poor or confusing language in their license agreements, according to the company.

The central group also develops software applications for use throughout the company and will be doing more central development for the micros, particularly for communications. The most effective area of use the company has found thus far has been support for analysts who routinely deal with information in spreadsheet format. The company believes it is important to make the systems available to these analysts because of the great potential for saving time and increasing accuracy.

The company has not yet established training programs for microcomputers, although they do have many course offerings in word processing. The overall impact of microcomputers on the company is believed to be positive. The dangers perceived in widespread user involvement with the systems have not proved to be as bad as many had predicted. The company believes it is important for data processing professionals not to overreact to user ideas and decisions, which should all be part of the company's learning process. If computer professionals are perceived as being negative in any way, the company says, the users will find ways to go around them and will, therefore, lose the benefit of their expertise. The company believes the most effective role for ADP professionals is to be helpful.

6.
Bank B —
Low Cost Computing Strategy

6. BANK B - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is among the largest international banking and financial services institutions. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - $8.02 billion
- Total Employees - 33,278.

The corporate systems group is comprised of approximately one hundred and twenty people. The systems group is divided into three major categories:

- Staff Support - This group plans reviews, provides advice and counsel to management, monitors advanced technology and handles contract administration matters;
- Direct Services - This group provides consulting, programming, training and hiring services to the user community;
- Strategic Programs - This group administers strategic programs in areas which are determined to be of critical importance to the company. Current programs are in the areas of telecommunications, management information systems, office automation and security.

(2) Strategy For Implementing Low Cost Computers

The company has shifted from completely centralized data processing operations twelve years ago, to decentralized data

processing in the mid-to-late seventies, and is now revising its approach to one of decentralization of operations with central control. This overall corporate philosophy has been applied to the area of microcomputers as well.

The systems group has adopted a formal system life cycle methodology, a series of fifteen books that contain systems policies. All systems activities, including microcomputer acquisition and use throughout the company, are supposed to be approved by the corporate systems group. In fact, the company says, this approval process is not always followed. The central group does have a consulting and direct assistance role, but the user groups do not always request assistance or accept recommendations. The company, then, has more policy than it exercises.

The role of the central group with regard to microcomputers has been one of helping the users whenever possible, with advice, volume procurements and technical assistance, but not insisting on control. The systems group has determined the company should give individuals microcomputers if the machines can enhance the individual's productivity. Microcomputers are treated like desks, chairs and calculators in this approach. In these instances, the microcomputers are viewed as tools, operating in a standalone processing mode. In the standalone mode, the company believes there is minimal need for control or discipline on the part of the central systems group. The objective is to foster individual creativity. The role of the central group is one of providing support and education or training.

Should a system develop from individual to corporate-wide support potential, it graduates to a level where significantly more discipline is required. These systems become corporate standards, including such systems as payroll and accounting. The company believes any system having an impact on the information contained in the standard systems must also be subject to rigorous discipline.

LOW COST COMPUTING STRATEGY SUMMARY
BANK B

EXHIBIT III-6

STRATEGIC GOAL	To Foster Creative but Cost-Effective Use of Micro-computers, Gauging the Level of Control Needed by the Systems' Impact on the Company

DEGREE OF CENTRAL CONTROL
High-Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection		X	
Software Package Selection		X	
Procurement Negotiation	X		
Application System Development			X
Installation		X	
Training		X	
Operations			X
Maintenance			X
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

While the company has not yet put this policy into operation, the systems group's planned policy for microcomputers is to have the central systems group identify the recommended corporate microcomputer options for the most likely applications. When users request assistance, then, the systems group will be able to say, "We have seventeen options for you. Here are the advantages and costs of each. You make the selection that suits your needs." The company is establishing a microcomputer support center to assist users in selection and to support training.

The central systems group anticipates some changes in the approach to enforcing existing policies. While they do not wish to police user groups, they will be setting up some stronger prohibitions than have been used in the past. They will adopt a three-tiered approach, consisting of:

- Support
- Declaration of Guidelines
- Enforcement.

Support will be provided without restrictions so long as user groups do not get themselves into major difficulties. Guidelines will be formally issued for areas where problems are frequent or extensive. Enforcement of guidelines will be pursued in selected instances.

The key issues the company sees with regard to microcomputers are system compatibility, and the potential for users to acquire inefficient solutions without knowing they are doing so. In the area of compatibility, the point was made that systems from all sorts of vendors can technically be made to communicate. There is a tendency among technicians to see this fact as an opportunity and challenge. Rather than adopt a standard selection for the company, the technicians

would prefer to pay a premium cost to develop compatibility in-house. The issue involved with users selecting their own solutions without the advice of data processing professionals is more subtle. User management, disillusioned with the level of support provided by central data centers, may acquire systems of their own. Because they have something more than what they started with, user management is delighted. The company believes the efficiency of the individual solution, however, is not measured or considered in comparison to what could be provided.

7.
Automotive Company — Low Cost Computing Strategy

7. AUTOMOTIVE COMPANY - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is one of the world's largest producers of motor vehicles, with international operations in passenger cars, trucks, parts and accessories, defense, and diversified products. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - Over $37 billion
- Total Employees - Approximately 494,500.

The company's information systems group at the corporate headquarters is headed by the Executive Director for Systems. Subgroups reporting to the Director include:

- Systems Services Department of 70 professionals
- Communications and Processing group of 300
- Operations Systems Planning and Development group of 25-35
- Corporate Planning and Control of 12
- Operations Research of 15
- Finance and Staff Support of 25.

There are approximately 2,800 professionals in information processing related positions worldwide.

(2) Strategy For Implementing Low Cost Computing

The corporation has yet to adopt an explicit policy for low cost computing. However, they have been engaged in an extensive trial program which is providing the impetus for the development of a formal low cost computing implementation strategy.

The general corporate computer environment is characterized by guidance, review, and audit being conducted at the corporate level; central design, planning and large scale processing sites residing at the division level, with little other than data processing operations being performed at the plant level. Plant managers are not given a great deal of freedom in pursuing independent automation objectives. Most automation activity follows functional lines. Divisions are permitted to develop whatever application software can be produced in-house. Reviews are required for large-scale acquisitions of commerical software packages and for all hardware including word processing. The company relies on the budget process together with the profit motive as the real factors governing use of computers. Automation planning heretofore has been totally decentralized. A top level policy review and a consolidated plan are being undertaken this year. The overall management philosophy is to help people avoid major mistakes but not paralyze automation initiatives.

Microcomputers are viewed as professional work stations (not personal computers) and are being employed in a variety of applications the company believes to be profitable. Professional work stations, generally, must pay back on the investment in one year, according to company guidelines. The company has been successful in achieving the one-year pay back period. The most common and widely used combination is the standalone micro supporting a spreadsheet package for financial analysis. The selected microcomputer hardware and software package are fully supported by the data processing group. The company anticipates significant strain on the data processing group unless structural adjustments are made to maintain the present level of user support as the popularity of the micro grows.

LOW COST COMPUTING STRATEGY SUMMARY
AUTOMOTIVE COMPANY

EXHIBIT III-7

STRATEGIC GOAL	To Explore the Value of Microcomputers as Professional Workstations by Extensive Pilot Testing

DEGREE OF CENTRAL CONTROL
Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis			X
Hardware Selection	X		
Software Package Selection		X	
Procurement Negotiation	X		
Application System Development			X
Installation	X		
Training		X	
Operations		X	
Maintenance	X		
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

Users are not required to use the services of the data processing group. If a decision not to use the central group is made, the user group must provide its own support and must justify the decision and the resulting economic performance. The corporation has negotiated a number of attractive firm-wide contracts with hardware suppliers at considerable discounts. These contracts have been compelling incentives for users to adopt company recommended solutions. The company presently has six contracts with word processing vendors (down from 15) and is conducting negotiations with a microcomputer firm for 5,000 units, with options for several thousand more. These actions are consistent with and reenforce the firm's overall push for greater commonality of hardware and systems.

8.
Metals and Mining Company — Low Cost Computing Strategy

LOW COST COMPUTING STRATEGY SUMMARY
METALS & MINING COMPANY

EXHIBIT III-8

STRATEGIC GOAL	To Serve as a Mild Inhibitor to User Initiative in Acquiring Microcomputers While Establishing a Place for the Systems in the Company Network

DEGREE OF CENTRAL CONTROL
High

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis			X
Hardware Selection	X		
Software Package Selection			X
Procurement Negotiation	X		
Application System Development	X		
Installation	X		
Training		X	
Operations	X		
Maintenance	X		
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	NO
Build Compatible Micro/Mini/Maxi Architecture	NO
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

8. METALS & MINING COMPANY - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is one of the country's largest producers of primary aluminum, with international operations in ore, chemicals, mill products, (sheet, plate, and foil), construction materials, electrical and packaging products. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - Over $3.6 billion
- Total Employees - Approximately 36,800.

The information systems group in the corporate headquarters is headed by a Director. The corporate staff includes approximately 120 members in Automation, Operations and Support, responsible for data processing operations and maintenance of existing systems, and 130 members in Automation Analysis and Implementation, responsible for new system development. The company is organized into divisions, each with its own information systems staff. The total number of professionals at the division level is approximately 250.

(2) Strategy for Implementing Low Cost Computers

A few years ago this company initiated a massive reorganization of its ADP program, moving from a highly centralized operation to a largely decentralized environment. At the time, its central design agency, with its then existing capacity, was faced with the equivalence of a 30-year backlog if they extended automation into all of the areas requiring coverage. An analysis was conducted of the company's approximately 50 plants which were classified by scale as small, medium or large, with an appropriate computer architecture selected for each classification.

The only company-wide standard systems are a uniform account structure, a customer order control system and a combined payroll and personnel management system. Approximately eighty per cent of the workload of a given data processing installation is devoted to local needs and locally defined applications. While there is virtually unlimited freedom to automate any function or application as long as it is written in COBOL (not required in throwaway applications), there is a very strong concern for a company-wide, compatible network architecture. All hardware requests, including word processing, require the approval of the central systems group. Activities are encouraged to share software whenever it is possible to do so.

The corporate level data processing group is responsible for the ADP planning process and ensures the integrity of the network. The company describes this group as functioning as a mild inhibitor to channel and pace expansion. They provide support in implementing even the smallest of systems. All new systems acquisitions are reviewed after a brief trial period of operations to validate performance for technical and cost efficiency.

The company is just starting to become involved in low cost computing. It has profiled its professional work force and divided it into six categories based on the nature of the activity they are engaged in. The company intends to develop a strategy that will permit every staff member to have direct access to whatever information he or she needs to perform daily business activities. The goal is to improve productivity by a factor of two in a 10-year period.

9.
Electronics Company C — Low Cost Computing Company

9. ELECTRONICS COMPANY C - LOW COST COMPUTING STRATEGY

(1) Industry Characteristics

The corporation is among the world's largest with significant operations in the areas of electrical generating, transmitting and distribution equipment, electrical industrial apparatus, appliances, aerospace and defense equipment, among others. Its combined corporate characteristics are as follows:

- Total 1981 Revenues - $8.51 billion
- Total Employees - 145,000.

The corporation is comprised of five major companies. The one we visited includes all companies and divisions of the corporation with products in the areas of learning and leisure, construction, community development and defense. The total 1981 revenues of this company were $2.5 billion, with total employees of 18,600. The information systems group for the company is headed by an Information Systems Director. His central staff includes a Manager of Office Technologies and staff members with expertise in personal computers, communications and records management. Below the headquarters level, the company is organized into business units comprised of plants or divisions in the same kind of business. The business units have their own Information Systems Directors, responsible for local computer operations, programming and planning. The level of professional staff at each of these units ranges from 6 to 25.

(2) Strategy for Implementing Low Cost Computers

The company has initiated a major project to enhance productivity by means of office automation, including using microcomputers as support tools. The targets for the productivity improvements are all

personnel in the roles of managers, professionals and clerical workers. The company's goal over the next three to five years is to increase revenues from $2.5 to $4 billion, with a relatively modest increase in personnel from 18,600 to 20,000. The target for productivity improvement is ten per cent per year.

The productivity project was begun within the company's information systems group on a pilot basis. Corporate management gave the group the authority to proceed with the project without demanding proof that it would be cost-effective. The central systems group formed a project team whose objectives are to:

- Evaluate work stations and emerging office technologies
- Evaluate the expanded use of personal and functional data bases
- Determine the feasibility of an integrated office system
- Determine the benefits of applying office technologies
- Develop recommendations.

Applications of the new technology which the company believes have proven their utility thus far include:

- Records Management
- Telephone Dictation
- Word Processing Communications
- Facsimile Transmission

LOW COST COMPUTING STRATEGY SUMMARY
ELECTRONICS COMPANY C

EXHIBIT III-9

STRATEGIC GOAL	To Examine the Potential for Improving Productivity by Using Microcomputers as Professional Workstations in Pilot Test

DEGREE OF CENTRAL CONTROL
Medium

MICROCOMPUTER ROLES AND RESPONSIBILITIES			
ROLES	RESPONSIBILITY ASSIGNED TO		
	SYSTEMS GROUP	USERS	SHARED
Long-Range Planning	X		
Requirements Analysis		X	
Hardware Selection			X
Software Package Selection			X
Procurement Negotiation	X		
Application System Development			X
Installation	X		
Training	X		
Operations		X	
Maintenance		X	
Post-Installation Review	X		

MICROCOMPUTER SUPPORT STRUCTURE	
SUPPORT FUNCTIONS	PROVIDED?
Monitor Technology Trends	YES
Develop Micro Expertise in Selected Systems	YES
Disseminate Current Technology Information	YES
Assist Users in System Selection	YES
Trouble-Shoot During Operations & Maintenance	YES
Evaluate Hardware Vendors	YES
Evaluate Software Packages	YES
Negotiate Volume Procurements	YES
Design/Deliver Training	YES
Build Compatible Micro/Mini/Maxi Architecture	YES
Establish Central Demo Room	NO
Offer Standard Application Systems	NO
Establish Information Center	NO

- Intelligent Copiers
- Audio Conferencing
- Electronic Mail
- Voice Message Switching
- Computer Output to Microfilm.

Still in the experimental stages are the following applications for the new technology:

- Personal Computing
- Access to Corporate Data Bases
- Teleconferencing
- Electronic Filing
- Micrographics.

Within the personal computing category, the company will be examining automated support for functions such as communications, electronic work sheets, project management, word processing and personal programming. A variety of personal computing aids have been made available in the areas of business, engineering, mathematics and statistics.

The company has identified the characteristics of standard user work stations. The work stations will be connected to the company's data center network. User work stations adapted to the engineering, marketing, finance and manufacturing environments will have access via

controllers to the Factory Data Center, Group Data Center and Corporate Data Center.

Appendix

QUESTIONS FOR POLICY GROUP

1. What is your organization's policy with respect to small computer systems? Does the policy reflect movement to a long-range goal or concept of operations?

2. How was the policy established?

3. Is there any formal policy personnel or committee governing the use of low cost computers? If there is, under which organizational line is such entity?

4. Is there a steering committee or task force set up for this particular application, and how is the group selected?

   - What mix of skills?
   - What are the roles and responsibilities in the overall control structure and the implementation of the application?

5. Have mechanisms been put in place to encourage or discourage the use of small systems? If so, what are they and why were they put in place? If not, why not?

6. What have you decided is the most appropriate pace for introducing small systems? Why?

7. Are there procedures and guidelines set up for use of low cost computers? Who establishes them?

8. Through what stages are these procedures and guidelines applicable?

   - Planning
   - Requirements analysis
   - Acquisition and equipment selection
   - Implementation
   - Operation.

9. How do you enforce your policy and procedures?

10. What is the organization's standard with regard to:

- Data
- Software
- Programming languages
- Communications
- Security.

11. What is the normal procedure for obtaining approval for acquisition?

12. Do you think that the current acquisition procedure and control structure are adequate? If not, why not? How could the procedures and structure be improved?

13. Do you have a formal systems life cycle management process? If so, please describe.

14. Are software packages purchased or developed in-house?

15. Is there a software coordination effort to promote sharing of resources and avoid duplication of effort?

16. Who has responsibility for the following activities as they relate to small systems:

    - Identifying where small systems are needed
    - Analyzing specific requirements for the systems
    - Selecting and acquiring equipment and software
    - Training
    - Operating the system
    - System maintenance
    - Software development and maintenance
    - Vendor liaison
    - System security
    - Compliance reviews.

17. Has the introduction of small systems created any organizational changes? If so, what are they?

18. Does your company consider information to be a resource for all potential users with legitimate needs for the information? Are individual functional or application managers who are the source of certain types of information considered the owners of that information?

19. Have you adopted a formal Information Resource Management (IRM) program?

20. What functions are contained in your IRM program - standards, training, planning, etc.?

21. Does the program encompass information maintained outside of automated management information systems?

22. Do you place a monetary value on your company's information resource? If so, how do you determine the value?

23. What issues or problems have you encountered in pursuing your IRM program? What advantages have been achieved?

24. Have you made any major changes in your IRM program direction, scope or pace since you began? If so, what are the changes and why were they made?

25. Please provide a copy of the following, if available:

    - IRM implementation plan
    - Current IRM policy and procedures documents or directives
    - IRM organization structure and reporting lines
    - IRM staffing level
    - Skills required of IRM staff.

QUESTIONS FOR DATA PROCESSING

AND

WORD PROCESSING PROFESSIONALS

1. How are small computers or word processors being used in your company?

2. How many small computers or word processors have been acquired? Which types of systems have been acquired?

3. What is the approximate dollar value of the systems? Are all systems operational or does the company maintain an inventory for new and replacement systems?

4. What are the goals and objectives for using small systems in your company?

5. What configurations and architectural designs are being used? Are the systems operating in a standalone, shared resource or shared logic mode? How do the small systems interact with the mainframe or with minicomputers?

6. How does the company determine which arhcitecture to use for the different applications?

7. Why was this approach taken? What are its benefits? Do you have a long range plan for using small systems? Are you installing prototype systems to move toward an overall goal?

8. Which companies supply your small computers and word processors? Do you have more than one type of machine? Do the machines interface with each other?

9. What size are the small systems? What peripherals are or can be linked to them?

10. What software packages and programming languages are available? Is there a DBMS?

11. How have the small systems affected the demand for service from the central data or word processing function?

12. How have the capacity of the mainframe and the mainframe workload been affected?

13. Were there any major problems in implementing the small systems?

14. What benefits have been achieved from implementing the small systems?

15. Were special training programs provided to data and word processing professionals? If so, please describe. Were they useful? If not, are there plans to develop programs?

16. Who has responsibility for the following activities as they relate to small systems:

    - Identifying where small systems are needed
    - Analyzing specific requirements for the systems
    - Selecting and acquiring equipment and software
    - Training
    - Operating the system
    - System maintenance
    - Software development and maintenance
    - Vendor liaison
    - System security
    - Compliance reviews.

17. Why have these responsibilities been delegated in this manner?

18. Has the introduction of small systems created any organizational changes? If so, what are they?

19. Are software packages purchased or developed in-house?

20. Is there a software coordination effort to promote sharing of resources and avoid duplication of effort?

21. What formal guidelines, procedures or policies exist for small computers or word processors? May we have a copy? If so, please attach.

QUESTIONS FOR USERS

1. How are small computers being used in your functional area? Have the areas of use or the level of use expanded since the system was installed?

2. When were the small computers first installed and over what time period were your functions made operational?

3. What is the operating budget for the implementation of small systems in your area? Has it increased or decreased over the implementation period?

4. How many people are involved in the implementation? Which departments or organizational units are included? What is the skill mix of the persons involved?

5. Why did you decide to purchase small systems? How was the decision made?

6. What computers and/or software did you buy and where did they come from?

7. What are your goals and objectives in using small computer systems?

8. What are the major problems you faced during the system selection and implementation process?

9. What are your major successes or benefits from the small systems?

10. Do you have a sample implementation plan or schedule? If so, please attach a copy.

11. Were training programs developed for users? If so, were they useful? Please attach training materials if available. If training programs were not developed, should they have been?

12. Who has responsibility for the following activities as they relate to small systems:

    - Identifying where small systems are needed
    - Analyzing specific requirements for the systems
    - Selecting and acquiring equipment and software
    - Training
    - Operating the system
    - System maintenance

- Software development and maintenance
- Vendor liaison
- System security
- Compliance reviews.

END