OFFICE AUTOMATION OPPORTUNITIES: A guide for the '80s and beyond

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Advanced office systems have been regarded for many years as offering great potential. In the 1970s there was a false dawn of interest in such applications, with many forecasters anticipating a "revolution in the office."

The office revolution proved much easier to write about than to achieve. Those actually responsible for planning and implementing systems found many obstacles confronting them. Not least of these was the difficulty of building systems that were clearly relevant to the needs of those who would use them and the development of satisfactory criteria for investment.

A decade of experience has now been acquired, sometimes painfully. Throughout North America and Europe, advanced office systems are in use. The opportunities are better understood. A body of expertise has been developed. It is now possible to identify in a *practical* way policies and procedures that lead to successful systems.

Office Automation Opportunities analyzes the experience of the past decade and provides a platform for future development. It sets out a recommended method of system planning, detailed enough to be adopted by any organization but sufficiently flexible to be adapted to individual needs. It also highlights one of the key questions surrounding advanced office systems, namely organizational responsibility. Who, in a large and complex organization, is — and who should be — responsible for advanced office systems? In some organizations the Management Information Systems (MIS) function is regarded as the obvious source of expertise in any area of computer applications. But advanced office systems opportunities sometimes arise in areas which are exceptionally sensitive and close to the end user. The MIS function is not always well qualified to operate in such sensitive areas. In some instances, attempts are now being made to lessen MIS involvement in office systems.

This report is a guide to the unfolding opportunities in office automation. It provides a new perspective on the issue of assessing benefits, and supplies detailed guidelines for planning and monitoring office systems. It analyzes implications for both users and suppliers and provides a guide to the state of the art of office system technologies and applications.

The report is presented in two parts:

Part I: A guide to assessing and exploiting the new opportunities in office automation

Part II: A guide to the state of the art of office system technologies and applications

Research Methodology

We have been monitoring the main developments in computer, communications and office systems since 1977. This report is based upon research conducted for both users and suppliers of office systems. Specifically, we have drawn on:

— 115 case studies of office system users, 30 in the United States and 85 throughout Europe.

— A survey of 3000 users of office systems in the United States.

— Interviews with suppliers and key industry observers.

— The interim results of office systems pilot trials carried out in the UK under the auspices of the Department of Trade and Industry.

— Desk and telephone research in the United States and Europe.

The results of this research, coupled with the practical experience and insights accumulated by us over many years of work for both users and suppliers, provide the basis for the contents of this report and the approaches and recommendations it puts forward.

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THE OMNI REPORT SERIES

OFFICE AUTOMATION OPPORTUNITIES: A guide to the '80s and beyond

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THE OMNI GROUP

The Omni Group (a Butler Cox company) is a leading consulting organization specializing in all aspects of office automation. As such, it is uniquely qualified to guide corporations through the intricacies of planning and implementing the office automation strategies most appropriate for their specific needs. The Omni Group's staff are expert consultants in the fields of word- and data-processing, telecommunications, network design and staff training. The firm has worked extensively with both vendors and end users of office technology. Studies and programs Omni undertakes range from short reviews of existing office systems to complex, detailed analyses of corporate automation requirements.

Omni offers services in four main areas: user consultancy, vendor consultancy, research and publications.

Consulting services for user companies include:

—Professional productivity analyses

—Strategic planning assistance

—Office systems diagnostics

—Support staff audits

—Telecommunications assessments

—Professional and secretarial training

—Implementation assistance

Consulting services for vendor companies include:

—Vertical market packages

—Product launch projects

—Sales training

—Competitive analysis studies

Office systems research projects include:

—Multi-client research

—Customized market research

Publications, suitable for both vendors and users, include:

—Public report series

—Newsletter

—Special supplements

—Book series

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PART I

A GUIDE TO ASSESSING AND EXPLOITING THE NEW OPPORTUNITIES IN OFFICE AUTOMATION

This first part of our report is concerned with providing our readers with a guide to understanding and exploiting the new opportunities presented by office systems. It describes and discusses methods, approaches and guidelines. It discusses areas of concern to MIS departments. It is written primarily with users and potential users in mind, although key issues affecting suppliers are also addressed. It does not delve into technology issues in detail, unless this is essential to illustrate a point or explain significant trends in an organizational or industry context.

Structure

There are six chapters in this first part of the report.

In Chapter 1 we provide a description and analysis of the current status and the expanding scope of office systems. We discuss how the trend towards wider scope and more complex office systems is affecting the traditional information systems power base in user organizations.

Methods of assessing the benefits of office systems are discussed in Chapter 2. After describing conventional methods we present a new approach designed to enable organizations to assess the role of, and the opportunities presented by, office systems in the wider context of organizational objectives.

In Chapter 3 we present a comprehensive office systems planning approach that reflects the trend for office systems to become of group- and organization-wide importance. Specific aspects of the planning process are discussed in detail, and extensive checklists are provided.

In Chapter 4 we describe control methods that can be used to monitor the use of existing office system installations. We also discuss issues relevant to internal auditing of office systems.

Chapter 5 presents a selection of user experiences in the form of case histories, illustrating different aspects of the practical issues that are involved when office systems are introduced and used.

In Chapter 6 we discuss a range of issues of particular importance to suppliers, such as market forecasts, user purchasing preferences and profiles of some of the main office system suppliers. We apply a technique specially developed by Butler Cox for market forecasting to predict the pattern of adoption of office system applications. Many of the issues discussed in this chapter are likely to also be of interest to user organizations.

CHAPTER 1

THE EXPANDING SCOPE OF OFFICE SYSTEMS

Early advocates of office systems sought to achieve in administration the same kinds of productivity gain that had been secured in the factory. Word processing was the favored tool because it was the best understood. The approach was "bottom up": start with clerical and typing staff, and move on later to professional and managerial staff.

This approach yielded some early and worthwhile advantages, especially when the organizational set-up ("typing pools") and the mix of work (bulk standard mailings or repeatedly drafted texts in which most of the text remains unchanged) favored word processing. But it was soon discovered that the typical office (insofar as it exists at all) contains many different kinds of worker doing many different kinds of work. In a factory, the introduction of a single integrated system may render obsolete the work of dozens or even hundreds of workers. In an office, the scope for such blunt instruments was found to be much narrower.

Once the early candidates for word processing had been mopped up, office systems were partially stalled. There was no obvious, single follow-up application. Progress had to be sought on a number of fronts and simultaneously.

After some years of relative stagnation, the scope of office systems is now expanding more rapidly. A greater number and variety of applications are used by more and different types of office worker in many new types of office environment. There are, of course, differences from organization to organization and from country to country. But our research indicates quite conclusively that the first stages in the development of office systems are now coming to a close and that office systems are becoming of organization-wide importance.

As this trend develops, the responsibility for managing and controlling office systems is increasingly shifting towards central MIS and data processing departments, which are not always prepared or equipped to deal with issues that, although superficially similar to their traditional areas of concern, require a different approach and different solutions.

In this chapter, we describe and discuss these trends and their implications.

THE GROWING IMPORTANCE OF OFFICES

The office is very much the focus of the so-called service economy. During the period following World War II, the US became the world's first service economy — that is, the first nation in which more than half of the employed population was not involved in the production of food, clothing, houses, automobiles or other tangible goods. The US has since been joined in this trend by most of the developed countries, as can be seen from Figure 1.1.

Figure 1.1 The international service economy

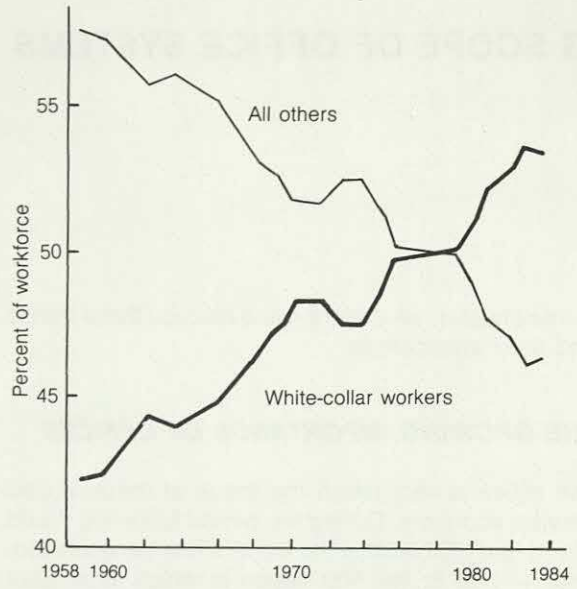
Country	*Civilian employment by sector (percentage of total)*			
	Agriculture	*Industry*	*Services*	*Total (thousands)*
Canada	4.9	24.9	70.2	11,140
France (1984)	7.9	33.0	59.1	20,941
Germany	5.5	41.3	53.2	24,685
Italy	10.7	34.1	55.2	20,431
Japan	7.4	35.4	57.1	58,139
Spain	18.5	32.2	49.3	10,341
UK (1984)	2.7	34.7	62.6	23,705
US	2.9	28.1	69.1	106,732

(Source: OECD 1985)

As the service economy has grown, so has the proportion of white-collar workers (the growth of the US white-collar workforce is dramatically illustrated in Figure 1.2). Most of these workers are office workers and a continuing growth in the office population can confidently be predicted over the next ten years.

The number of office workers today is very large indeed. In Europe there are about 6 million secretaries and typists, 20 million managers and professional

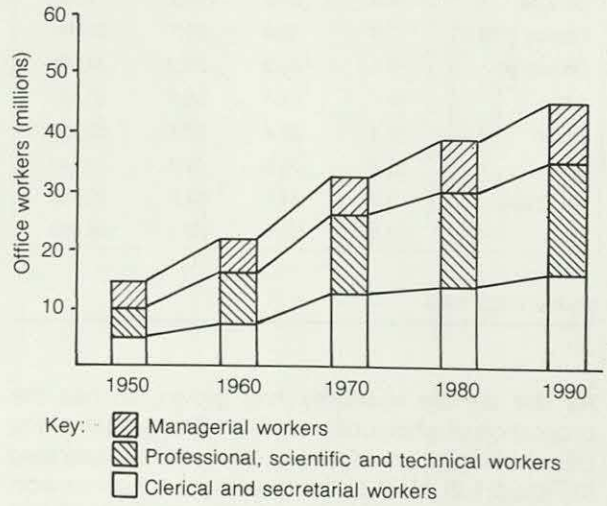
Figure 1.2 Growth of the US white-collar workforce



(Source: P. A. Strassmann 'Information Payoff' 1985)

staff, and 11 million clerical workers working in offices (excluding non-office-based staff such as sales staff). The figures for the US are similar (see Figure 1.3), and the total office workforce in these categories amounts to a total of over 40 million in the US and about 37 million in Europe. Slightly over 50 percent of these work in establishments that employ less than 100 workers in total, so many of the offices will be quite small.

Figure 1.3 Growth and composition of the US office workforce



THE GROWTH IN OFFICE SYSTEMS USE

The growing importance of the office to the economies of the Western world has made it a natural target for computer manufacturers eager to exploit this potentially huge and largely untapped market. The growth in the use of office systems has, however, been slower than many over-optimistic observers foresaw when the technology first began to take shape during the 1970s. But we have found many indications that this is now changing.

Penetration of office workstations

One reason advanced to explain why office systems were slower to develop than some forecasters expected is the problem of achieving critical mass. Some important developments were, it was argued, feasible only when a high proportion of users had access to a workstation. One crucial finding of our recent research is that the penetration of workstations in Europe is higher than many people suppose, while the penetration of the US market is so deep that in certain markets the suppliers may soon have to consider the possibility of saturation.

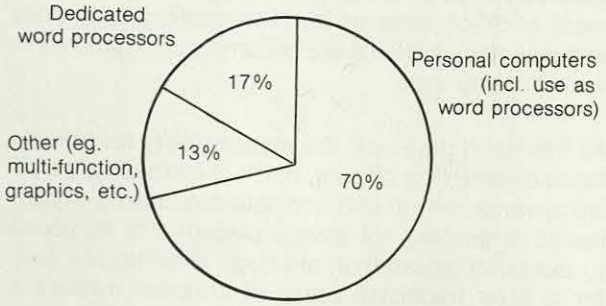
We estimate that in Europe there were around 2.5 million office workstations in 1984, the equivalent of about one for every 15 office workers. The corresponding ratio for the US is about one for every 4 workers. These figures do not include computer terminals linked to mainframe computers for data processing purposes or dumb terminals used to access databases, but they do include dedicated word processing stations and personal computers.

The breakdown of current types of office workstation for Europe in terms of these main categories is shown in Figure 1.4. The breakdown reflects the recent and still continuing growth in the use of personal computers. However, we estimate that between two-thirds and three quarters of these personal computers were installed primarily for word processing purposes, although many of these are subsequently also used for other purposes.

National variations

In terms of the level of penetration and the types of application, our research indicates that, as a rule of

Figure 1.4 Breakdown of the types of office workstations in Europe



thumb, the United States is at least one year ahead of the United Kingdom in the use of office systems, and the United Kingdom is about one year ahead of the rest of Europe. These differences are illustrated in Figure 1.5, which shows the relative penetration of office workstations in the office workforces of the United States, the United Kingdom, and other European countries.

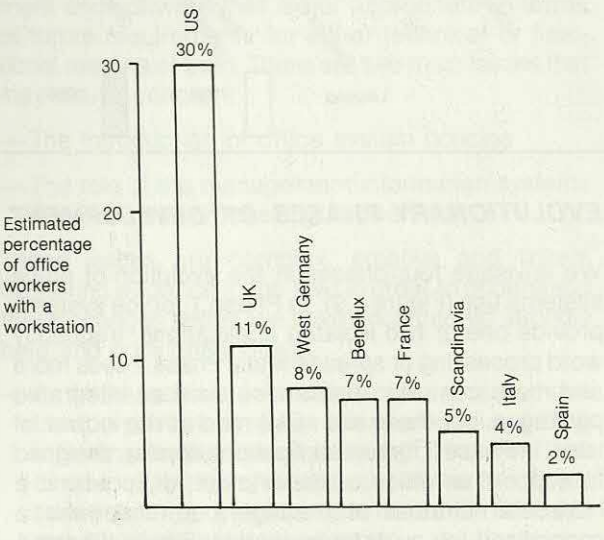
The reasons why the United States is ahead of the United Kingdom in the use of office systems include the following:

- Most of the major office system suppliers (such as IBM, DEC and Wang) are US companies. These companies usually introduce new products into the United States before entering other markets.
- There is a greater difference between labor costs and office system costs in the United States. In other words, labor costs are higher in the United States than in the United Kingdom, and office system costs are lower.
- The US office system suppliers have a large, stable home market for their products. In comparison, the European market is diverse and more difficult to enter.

The United Kingdom leads other European countries in the use of office systems for the following main reasons:

- The early popularity of home computers in the United Kingdom has increased management awareness of information technology.
- British companies can use US office systems software and manuals without translation.

Figure 1.5 A comparative analysis of office workstation penetration in Europe and the United States for 1985



- US office system suppliers tend to use the United Kingdom as the entry point into the European market.

Increasing level and variety of use

Our research indicates that the level of use of office systems will increase significantly over the next few years. However, growth in usage level will be different for different types of office staff and different types of organization.

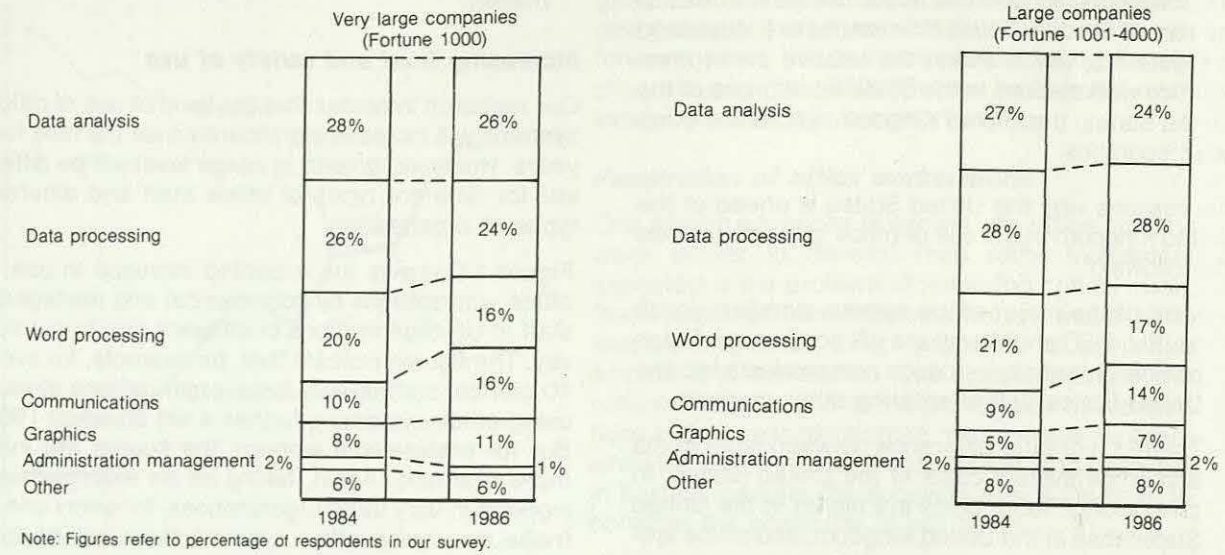
Figure 1.6 shows the expected increase in use of office workstations by both clerical and managerial staff in US organizations of different size in our survey. The figures indicate that, for example, for every 10 clerical staff in very large organizations already using office systems a further 4 will do so by 1986. But for professional workers the figures are even more dramatic. Again, taking as an example such workers in very large organizations, for every one of these now using office systems there will be four users within two years. These rates of increase reflect, of course, the already high penetration of office workstations among secretarial and clerical workers, especially in larger companies, and the fact that relatively few managers and professionals are, as yet, users of office systems.

Figure 1.6 Expected increase in use of office systems by secretarial/clerical and professional/managerial staff in US organizations of different size over next two years

Type of staff / *Size of organization*	*Secretarial/ Clerical*	*Professional/ Managerial*
Very large (Fortune 1000)	40%	292%
Large (Fortune 1001-4000)	61%	169%
Small	46%	159%

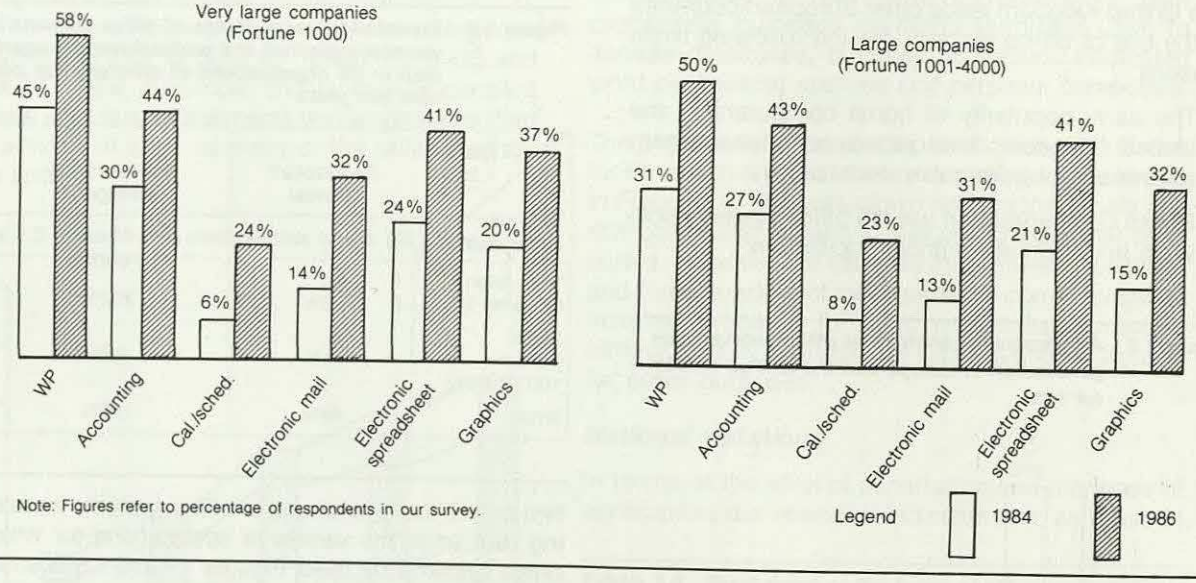
Not only is the level of use of office systems increasing, but so is the variety of applications for which office systems are used. Figures 1.7 and 1.8 illustrate the extent of use of different office system applications by clerical and professional/managerial staff, respectively, in the largest organizations that we researched in the US. Perhaps not surprisingly, most of the office systems applications used by managers and professionals are associated with data analysis (budgeting, statistical analysis, modeling and other typical spreadsheet applications). The prime application area for clerical and secretarial staff is, by contrast, associated with text processing tasks. However, the figures clearly indicate that an increasingly wide range of applications are used by most office workers.

Figure 1.7 Relative importance of office system applications for professionals and managers in US companies (present and expected)



Note: Figures refer to percentage of respondents in our survey.

Figure 1.8 Use of office system applications by clerical staff in the US (present and expected)



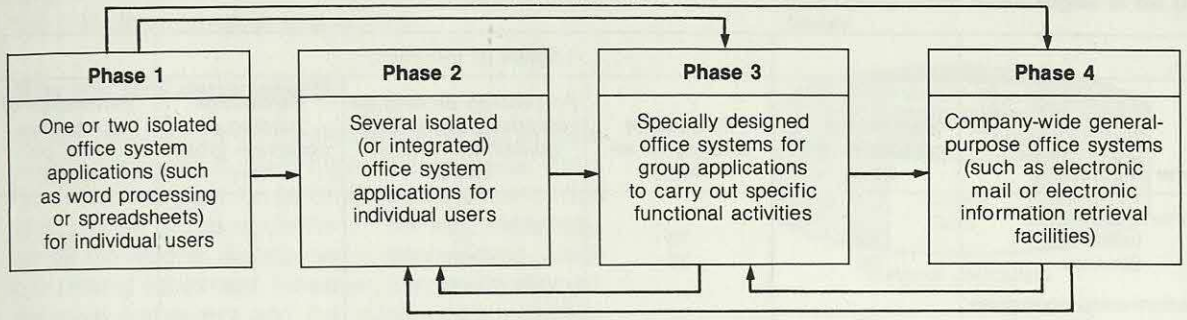
Note: Figures refer to percentage of respondents in our survey.

In summary, especially in smaller organizations there is still scope for increasing the level of word processing use by clerical staff. But in many organizations the emphasis, in terms of growth areas, is shifting from word processing and other individual applications such as spreadsheets to a wider range of applications and to managerial and professional tasks. We have found a similar trend among leading-edge organizations in Europe, and it marks, in our judgement, the end of one stage in the evolutionary cycle of office systems and the beginning of the next — the move from individual to group systems.

EVOLUTIONARY PHASES OF DEVELOPMENT

We envisage four phases in the evolution of office systems use (Figure 1.9). In Phase 1, office systems provide one or two isolated applications, frequently word processing or spreadsheets. Phase 2 sees more and more complex applications such as integrated packages, but these are still aimed at the individual user. In Phase 3, group applications appear, designed to support an office or department, or to permit a horizontal stratum of managers to undertake a specialized job such as budgeting. Finally, Phase 4

Figure 1.9 The evolutionary phases in the use of office systems



sees a large base of terminal and workstation users provided with "piggyback" company-wide office systems that depend on achievement of a critical mass of users. Examples include an electronic mail interface for users who already have a workstation or terminal, and access to data processing systems.

It would be simplistic to assume that organizations necessarily move forward through these phases in the order shown. They do not. We have shown various linkages to illustrate this point, and any one organization could be in more than one phase at a time. Nevertheless, we believe that during the next five years we will see a general move from Phase 1 to Phases 2, 3 and 4.

THE INCREASING SCOPE OF RESPONSIBILITY FOR OFFICE SYSTEMS

As organizations move from individual office systems towards group-wide applications, the question of who is responsible for office systems becomes an increasingly pressing issue. A major concern is that, as individual systems and applications proliferate, they may leave the organization with a legacy of equipment and software that is not appropriate in terms of future requirements for either technical or functional reasons or both. There are two main issues that may cause concern:

—The introduction of office system policies.

—The role of the management information systems (MIS) or data processing department.

These issues are complex, emotive and linked. Gathering evidence in the field in order to understand these changes better, we have encountered strongly held and conflicting views:

—An MIS executive: "As usual, our end-users have tried to go it alone, have succeeded in spending a fortune for little tangible benefit, and now look to us to pull their chestnuts out of the fire. It will take years to put right. In the meantime, MIS will prove convenient scapegoats."

—A senior executive in a marketing function: "For three years we made undeniable progress, led by people who understand the need because they work in marketing. Several experiments were launched and valuable experience gained. Then our MIS director became involved. He used his contacts with our mainframe computer supplier (who was missing out in office system sales) to convince the CEO we were on the wrong path. End of progress. The MIS department has imposed rules, procedures, approvals . . . Do it our way or not at all, is the message. Bureaucracy triumphs again."

These two executives work for the same company.

Office system policies

Our research in Europe and in the United States indicates that large organizations are more likely to have a coherent office systems policy than smaller organizations. In Europe, the formulation of office system policies, particularly personal microcomputer policies, has enabled MIS departments to control the introduction of office systems, and to avoid the piecemeal proliferation of incompatible products. There is considerable evidence to suggest that many North American organizations have, until quite recently, failed to exercise this degree of control. An analysis of the percentage of United States companies that had office system policies by late 1983 is given in Figure 1.10. But, as we shall discuss later, the situation in the United States is now changing.

Our research indicates that two distinct types of office system policy are being adopted by large organizations. The first type consists of guidelines to control the purchase of office system products (such as preferred suppliers for microcomputers, word processors, local area networks and applications software). These guidelines may be supported by policies that encourage potential users to adopt them. For instance, systems support may be provided only for the preferred products; access to mainstream systems may be limited to those products and systems

Figure 1.10 Analysis of United States companies with office system policies

		Scope of the policy			
Type of company	*Percentage of companies with policy*	*Percentage binding on all levels*	*Percentage binding on corporate group with guidelines to other levels*	*Percentage binding on corporate group only*	*Percentage of companies with no policy*
Fortune 500					
Industrials	59	18	24	9	40
Services	58	26	19	3	39
Medium-sized companies (over 100 staff)	35	14	9	2	65
Small companies (10-100 staff)	23	23	0	0	75

All figures are percentages of the full sample

that fall within the guidelines; and justification procedures may be enforced more rigorously if office system products do not conform. Most large organizations that have an office systems policy have introduced guidelines to control the purchase of office systems.

The second type of policy is based on the active promotion of office systems through the creation of office system plans, pilot trials and large-scale implementations. Only a small minority of large organizations have adopted this second type of policy to any significant degree, although many organizations have experimented with small-scale office system plans and pilot trials. (According to one survey in the United Kingdom, 32 per cent of the organizations studied had carried out at least one office system pilot trial.)

In most large organizations in Europe, MIS staff are responsible for the introduction of office systems, although other staff may be involved in this process to a smaller extent — for example as members of an office systems steering committee. A survey carried out by the Policy Studies Institute in the United Kingdom found that MIS staff were solely responsible for office systems in 61 per cent of the 189 organizations studied, and shared this responsibility with others in the remaining 39 per cent of the sample. In the United States, our survey found similar results, with interdepartmental committees responsible for defining office system policies in about one-third of Fortune 500 organizations.

Many organizations have established special support groups to be responsible for the implementation of office systems and the support of office system users. In most cases, these support groups form part of the management services or computer department.

In Europe, in almost all the organizations we investigated, the equipment specified in office systems policies was chosen by technical specialists, usually the MIS or DP department. Where those concerned were not members of such departments, they always had substantial previous experience in computing, most commonly in scientific timesharing. Because of their backgrounds, these staff tend to stress the importance of issues other than cost and functionality — issues such as compatibility and the availability of long-term vendor support.

The role of the MIS department

Our research has found a consistent trend for the responsibility for office systems to shift away from the traditional administrative departments that used to select typewriters and photocopiers and towards central MIS or data processing departments. We have also identified differences in the way in which US and European MIS departments have handled the issue.

In Europe, most MIS departments realized early on the need for coherent policy that would prevent an uncoordinated proliferation of office systems equipment throughout the business. They also recognized that office managers and administrative departments normally could not cope with the technical and infrastructure questions. Therefore MIS departments in Europe took on responsibility for office systems much earlier than their US counterparts. This may only be so, however, because of the later introduction of office systems in Europe. European business had time to observe the course of office systems in the US, and to realise their significance and the importance of coordinating their introduction into its organizations.

By now, though, our research indicates that MIS departments in the United States are beginning to take control of office systems, in this instance following, rather than leading, their European counterparts. Figure 1.11 shows the results of our US survey of who

is responsible for purchasing office systems in the largest companies and illustrates the importance of the MIS department in this respect.

Why the MIS department?

As word processors — the first kind of office system — first appeared, in many organizations it was often the office manager or purchasing department that took charge of this equipment. This was especially so for standalone, as opposed to shared-logic, word processing equipment. However, the proliferation of personal computers and the increasingly complex and sophisticated requirements of users meant that the typical office or purchasing manager was ill-equipped to handle the new office tools. In particular he often lacked both the technical experience and the organizational stature required. At the same time most MIS departments began to regard the new pieces of technology as being in their domain. As a consequence the MIS department took over.

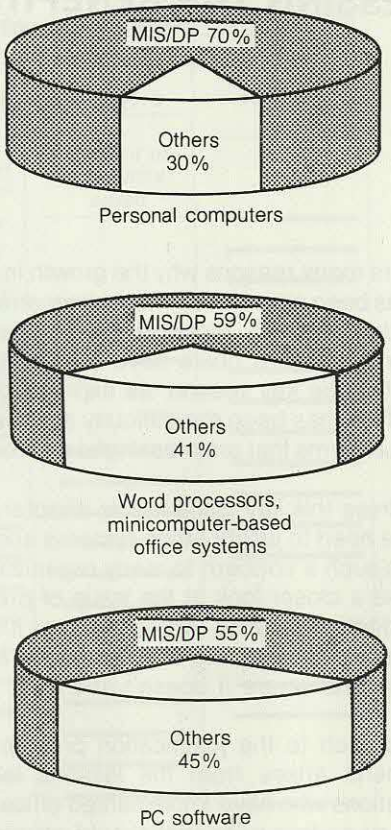
The rationale frequently espoused for this takeover is that office systems are, at the end of the day, nothing but data processing for the office worker. Subscribing to this attitude can, however, be very dangerous, as it ignores fundamental differences between an office systems and a data processing environment. In particular:

- —Office systems are a tool for the office worker. Using an office system is not the purpose of his work, whereas for data processing staff, using the equipment is.
- —Office workers often have considerable discretion over whether and how they use an office system.
- —Usage of office systems is relatively low and irregular compared to data processing operations.
- —Office systems can directly affect the content of the work of office workers, which may lead to new job descriptions and even loss of status.
- —Office systems users are more numerous and tend to be organizationally and often geographically dispersed.

For these reasons the organizational and human aspects of office systems should not be underestimated by MIS directors and DP managers. Conceptually office systems may be merely an extension of data processing facilities into the office; for organizational, functional and human reasons, they are not.

The importance of user involvement in office systems planning and management has to some extent counterbalanced the increased authority and spending power of the MIS department, especially in European organizations we researched. Thus, centralized control of the MIS department is loosening in response to growing pressure from key user groups, and organizational changes are being introduced to improve and increase user input into MIS planning. The most successful office system installations we have identified are almost invariably those in which significant user involvement is present from the early stages.

Figure 1.11 The influence of the MIS/DP departments in purchasing office technologies in the United States



Note: The analysis refers to the degree of purchasing influence in very large companies (Fortune 1000) in our survey.

SUMMARY

The increasing scope of office systems presents a new challenge to users of the technology. Increasingly, we are seeing the MIS department taking on the role of meeting this challenge and managing office systems. Yet the issues involved are often different from those encountered in traditional MIS environments. The following chapters address these issues and describe approaches to their resolution.

CHAPTER 2

ASSESSING THE BENEFITS OF OFFICE SYSTEMS

There are many reasons why the growth in office systems has been slower than most observers predicted a decade or so ago. Higher than anticipated equipment and software costs have contributed significantly, but the key reason, as expressed by users themselves, has been the difficulty of assessing the benefits in terms that are meaningful and measurable.

We address this key issue in this chapter. We consider the need to justify office systems and examine why it is such a concern to many organizations. We then take a closer look at the issue of productivity, the traditional way to approach the justification problem, and discuss the circumstances in which it can work and where it doesn't and why.

The approach to the justification problem that we recommend arises from the lessons learned by organizations who have implemented office systems. It is based on four rules that should govern thinking about office systems investment:

—Think *objectives* first, then consider solutions or methods.

—Think *front office*, as well as back office.

—Think *big*, but start small.

—Think *real*, not pilot or trial.

The aim of this agenda of "rules" is for organizations to be able to break out of the circularity and vagueness so often associated with the process of justifying investment, to prevent expensive mistakes and, in particular, to ensure against missed opportunities.

THE NEED TO JUSTIFY OFFICE SYSTEMS INVESTMENT

Most, but not all, organizations require office systems to be formally cost-justified. Research in Europe and the United States indicates that over 75 per cent of large organizations carry out cost justification exercises for major investments in office systems. Payback periods of between two and four years are normally specified.

Where individual or small office systems are introduced, it often simply makes no economic sense to insist on a formal cost justification exercise. The time spent by managers authorizing and monitoring such small investments can easily equal or even exceed the actual cost of the system.

But where the investment in question is of a large scale — or where the proposed investment is small, but is the first of many similar investments — the costs can be enormous and management will need to satisfy itself that the investment is worthwhile. Although our research indicates that rules for cost-justifying office systems are generally less stringent than for traditional data processing, we believe that this situation is likely to change, and management is beginning to look for real quantifiable benefits, usually in the form of productivity gains.

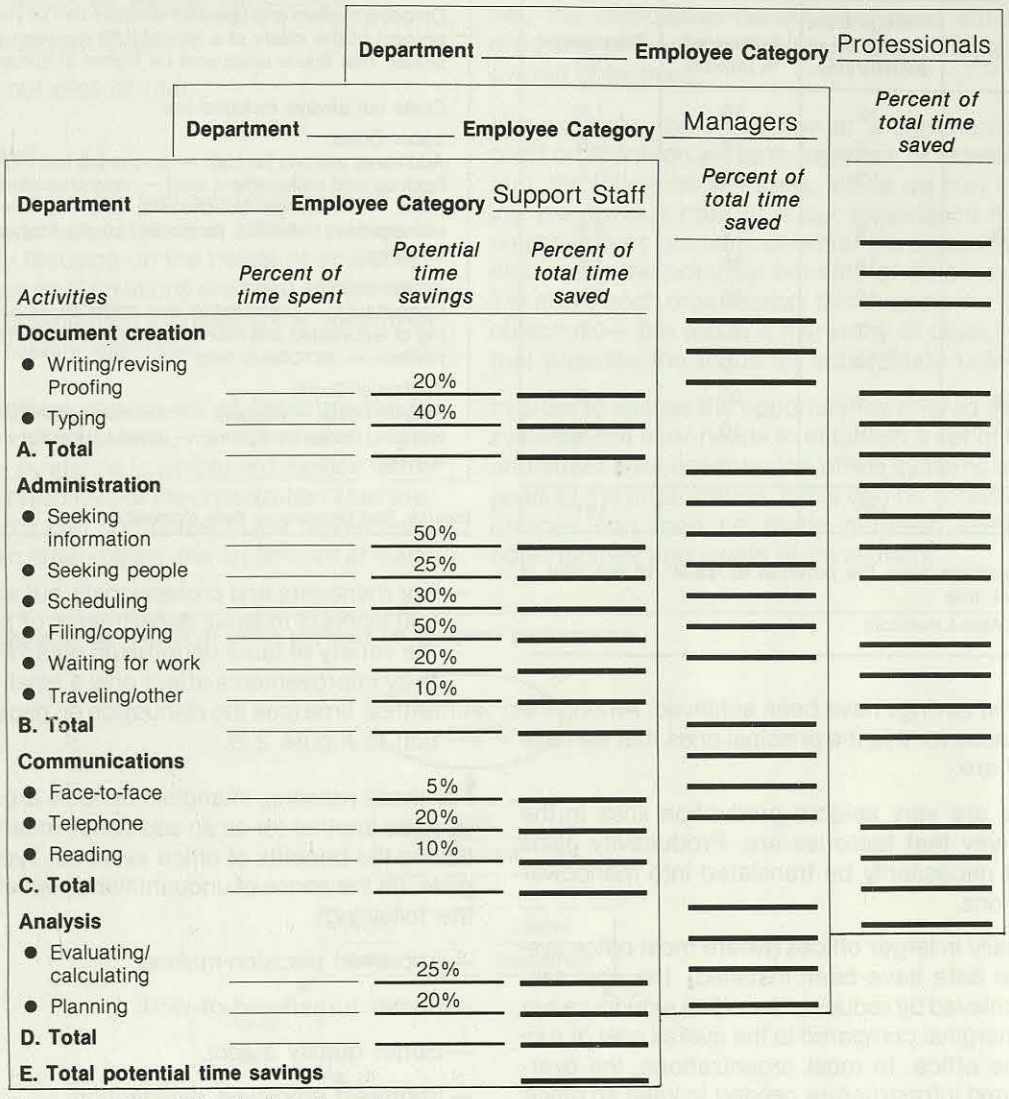
However, for the reasons that we discuss in the next section, productivity measurement in the office systems environment is not necessarily, or even usually, a satisfactory way of assessing potential benefits.

THE PRODUCTIVITY ISSUE

Much of the thinking to date on office systems has concentrated on the idea that increasing capital investment in the office will raise productivity. Many studies have analyzed how time is spent, and hence, the areas where productivity could be improved have been identified. As an example of the methods used, Figure 2.1 illustrates typical time savings analysis sheets that can be used to estimate possible benefits from office systems. The potential time savings that may be achieved are usually based on "benchmarking" exercises.

For example, the now-classic study by Booz Allen & Hamilton resulted in a picture of work patterns for different types of office staff in a sample of companies. Assumptions were made about the likely increases in productivity that could result from the application of office systems to each type of activity. From a knowledge of how office staff spend their time and an estimate of the time reductions contributed by the office systems, potential time savings were computed. Figure 2.2 (page 12) shows the breakdown

Figure 2.1 Typical time-savings analysis sheets



Department _____ Employee Category Professionals

Department _____ Employee Category Managers

Department _____ Employee Category Support Staff

Activities	Percent of time spent	Potential time savings	Percent of total time saved	Percent of total time saved	Percent of total time saved
Document creation					
• Writing/revising Proofing		20%			
• Typing		40%			
A. Total					
Administration					
• Seeking information		50%			
• Seeking people		25%			
• Scheduling		30%			
• Filing/copying		50%			
• Waiting for work		20%			
• Traveling/other		10%			
B. Total					
Communications					
• Face-to-face		5%			
• Telephone		20%			
• Reading		10%			
C. Total					
Analysis					
• Evaluating/ calculating		25%			
• Planning		20%			
D. Total					
E. Total potential time savings					

(Source: Booz Allen & Hamilton/Data General)

of management time, and the potential impact of office systems on each of the manager's activities.

A notable aspect of this result is the spread of time saved over the various functions. The office system would have to be successfully applied to *all* the functions to achieve the full 15 per cent. The 70 per cent reduction in time spent on automation of the single largest element, "searching/retrieving", for example, would yield productivity benefits of only 6.3 per cent.

For other types of staff, the picture can be different. Secretaries, according to various studies, spend anywhere from 15 to 40 per cent of their time typing, with telephone and filing both at the 5 to 10 per cent level. Clearly, the word processor can have an immediate impact on secretarial productivity. In a typing pool, this impact will be even more significant. (A good number of studies have confirmed that the average improvement in typing productivity as a result of using word processors in typing pools is between 20 per cent and 50 per cent.) However, these improvements depend on the type of work involved. Thus, standard letters and long reports are well suited to word processors, and productivity gains of as much as 200 per cent have been reported. Memos and nonstandard letters do not normally offer such gains, and productivity improvements as low as 10 per cent can be expected.

There is no doubt that very impressive productivity gains can be achieved using this approach. However, the experience of many users we have studied has been that despite very real *productivity* improvements

Figure 2.2 Impact of office systems on management time

Activity	*Average time spent on activity (%)*	*Estimated % impact*	*Time saved (%)*
Meetings	12	10	1.2
Travel	6	10	0.6
Filing	2	20	0.4
Searching/ retrieving	9	70	6.3
Writing	16	10	1.6
Telephone	12	20	2.4
Reading	7	10	0.7
Planning	4	0	0
Mailhandling	4	20	0.8
Calculating	10	10	1.0
Other	18	0	0
Total	100		15*

*ie office systems have the potential to 'save' 15 per cent of management time.

(Source: Booz Allen & Hamilton)

Figure 2.3 Underestimating office systems costs

On-going system and operational costs can be more than 30 percent of the salary of a typical (US) manager and professional. This figure could well be higher in Europe.

Costs not always included are:

Labor Costs:
Additional training for staff — on-the-job training — training back-up and replacement staff — new procedures development — meetings for planning and implementation — management time for employee counselling and morale boosting.

Implementation Costs:
Consultants — organisation and methods — parallel running of automated and manual systems — security and audit reviews — temporary help.

Technical Costs:
System costs — supplies — communications links — software — desks — lighting — power supplies — air conditioning.

(Source: Paul Strassmann, Xerox Corporation)

no real *cost* savings have been achieved. Among the many reasons for this the principal ones that we have identified are:

—Offices are very seldom production lines in the same way that factories are. Productivity gains cannot necessarily be translated into manpower reductions.

—Especially in larger offices (where most office systems to date have been installed), the cost savings achieved by reducing the office workforce are often marginal compared to the overall cost of running the office. In most organizations, the overheads and infrastructure needed to keep an office cannot be easily and quickly altered to reflect a reduction in the number of office workers.

—Irregular or unpredictable workloads often mean that managers are reluctant to cut staff, even where they could do so, for fear of future bottlenecks.

—Hesitation to introduce the technology often leads to both conventional and automated methods being used in parallel, which can nullify any productivity gains achieved by using the technology.

—Costs associated with the introduction and use of office systems can be much higher than anticipated, counterbalancing the savings achieved from productivity gains. These may include higher equipment costs, training and maintenance, or manpower costs arising from the need to manage the new system, as detailed in Figure 2.3.

—For managers and professionals, but also for clerical workers in small departments or businesses, the variety of tasks undertaken mean that productivity improvements affect only a small proportion of their time (see the discussion on page 10 in relation to Figure 2.2).

For these reasons, intangible benefits are frequently used as another (or as an additional) means of establishing the benefits of office systems. Typical 'intangible' (in the sense of unquantifiable) benefits include the following:

—Improved decision-making.

—Faster turnaround of work.

—Better quality output.

—Improved employee satisfaction.

—More thorough analysis of data.

—Additional time to do other work.

The difficulty with all of these types of benefits is that they cannot be readily assessed against the cost of the office system (that is, they cannot readily be stated in monetary terms), and they do not give a good basis for deciding how much the investment should be in the first place, or indeed, where the investment should be made.

A DIFFERENT WAY TO APPROACH COST JUSTIFICATION

We describe and discuss in the remainder of this chapter a different way of addressing the issue of how to justify investment in office systems. The approach is based on four ground rules:

—Think *objectives* first, then consider solutions and methods.

—Think *front office*, as well as back office.

—Think *big*, but start small.

—Think *real*, not pilot or trial.

Objectives first

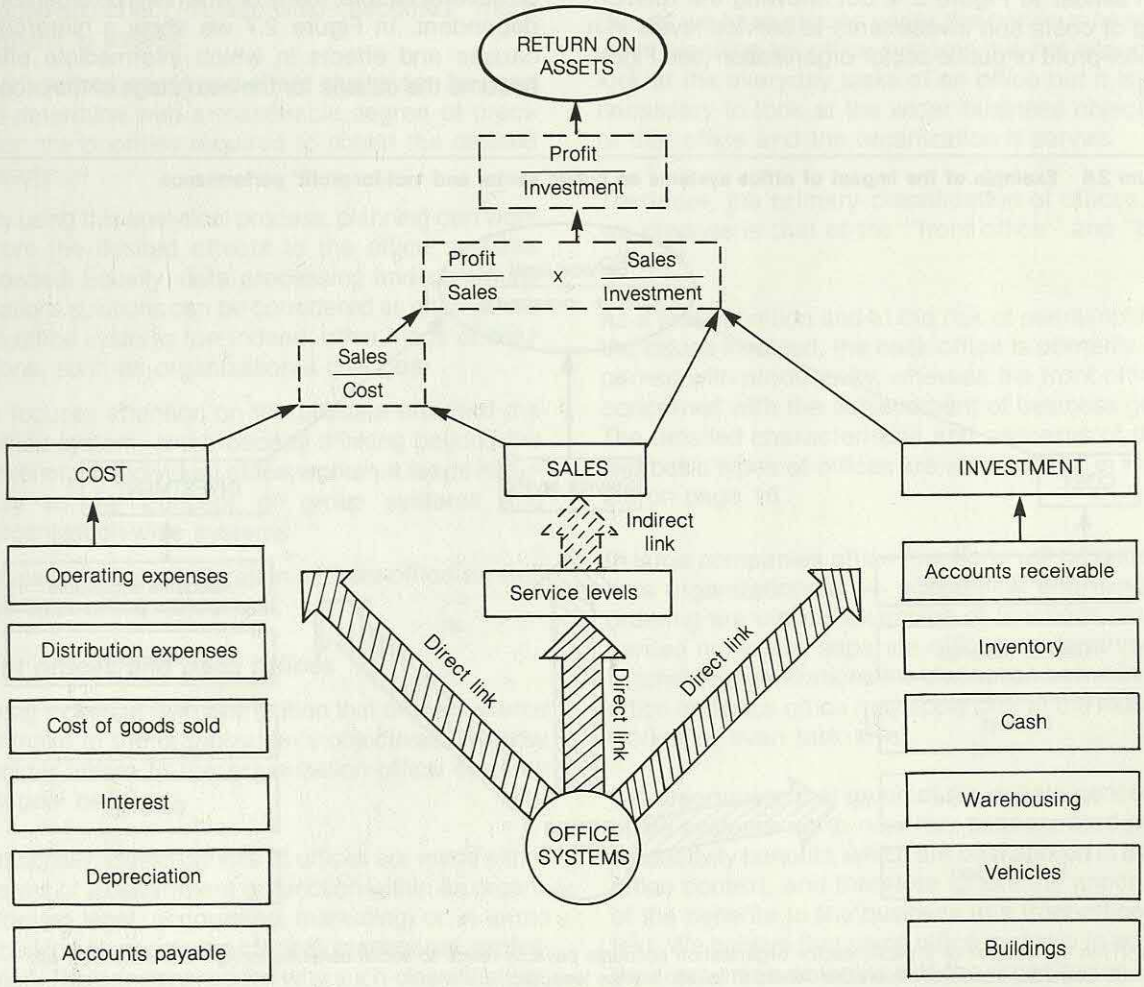
Searching for needs for technical solutions is still fairly typical when investment in office systems is considered. By focusing on the needs or objectives instead, the technical solutions are seen in their context and their contribution to meeting the objectives can be more readily assessed.

Although objectives can be set at departmental or group or even individual level, we recommend beginning at the top, by stating in simple and explicit terms what the main objectives of the organization itself are. If office systems can contribute to the higher level objectives of an organization, the arguments at lower levels within the "objectives hierarchy" become almost redundant. The point is that whereas at lower levels within that hierarchy, benefits may be marginal, the cumulative benefits achieved across the organization can still contribute significantly to the overall objectives.

For example, the objectives of a commercial, for-profit organization will be to increase, or at least maintain, the return on its assets. While we may be stating the obvious here, it is our experience that this objective does not normally enter the argument when discussing the potential benefits of office systems. Yet in any such organization, this must be the primary objective — the top of a hierarchy of objectives — that provides the focus for subordinate objectives.

In order to assess the opportunities offered by office systems, the user needs to establish a set of cause-and-effect links between the office systems and the goals of the organization. If this can be achieved, the choices can then be made between investment opportunities and levels of investment.

Figure 2.4 Example of the impact of office systems on company performance

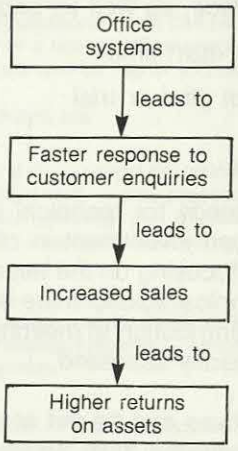


We illustrate this process with a simple schematic (Figure 2.4 on page 13) relating the costs, sales and investments to the returns on assets achieved by such a profit-oriented business. The schematic shows an example of how investment in an office system might affect the return on assets either directly or indirectly. First, the office system may improve productivity, thus reducing operating costs. It may also improve the accounts receivable function, perhaps by speeding up collection through sending earlier, and regular, reminders to customers. These are two examples of direct potential benefits of office systems. The office systems may also impact sales (and thus enhance the return on assets), but in this schematic, they do so indirectly, through improvements in service levels (for example, by responding more quickly to requests for quotations).

In each case we need to establish a causal link between the office systems and the elements that contribute to the corporate objective. For example, Figure 2.5 shows one such link, and shows explicitly the intermediate steps.

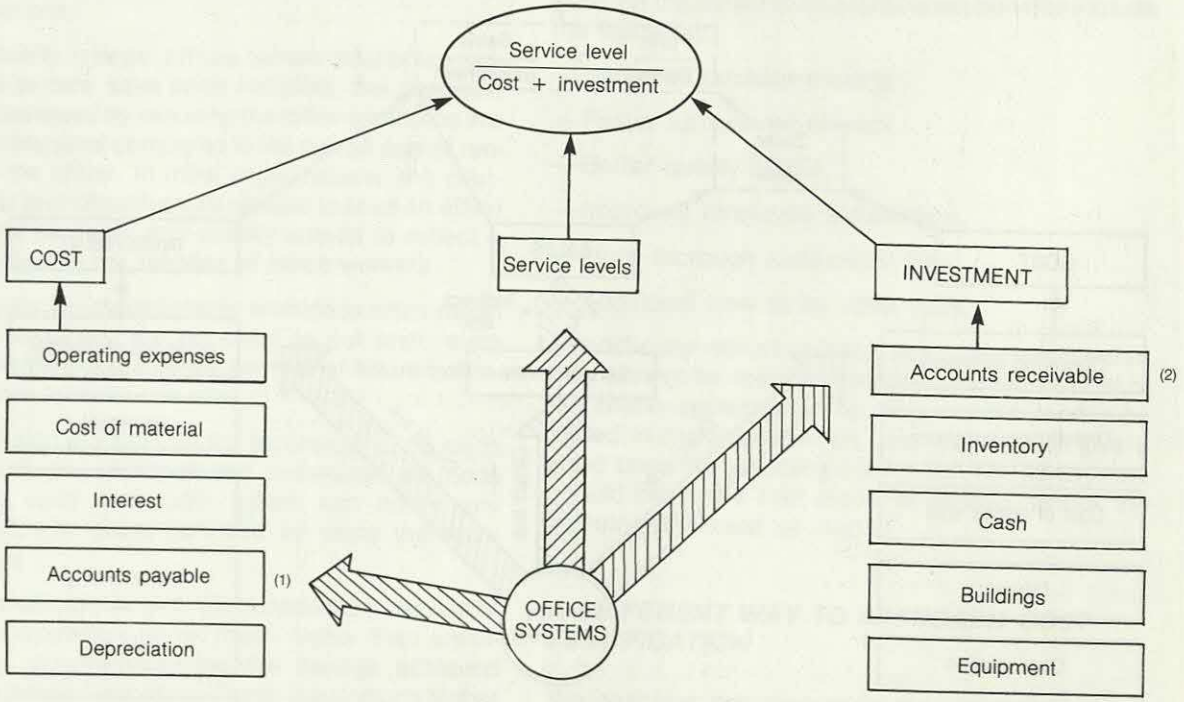
To further illustrate this point, we include an illustration similar to Figure 2.4, but showing the relationship of costs and investments to service levels in a not-for-profit or public sector organization (see Figure 2.6).

Figure 2.5 A causal link example



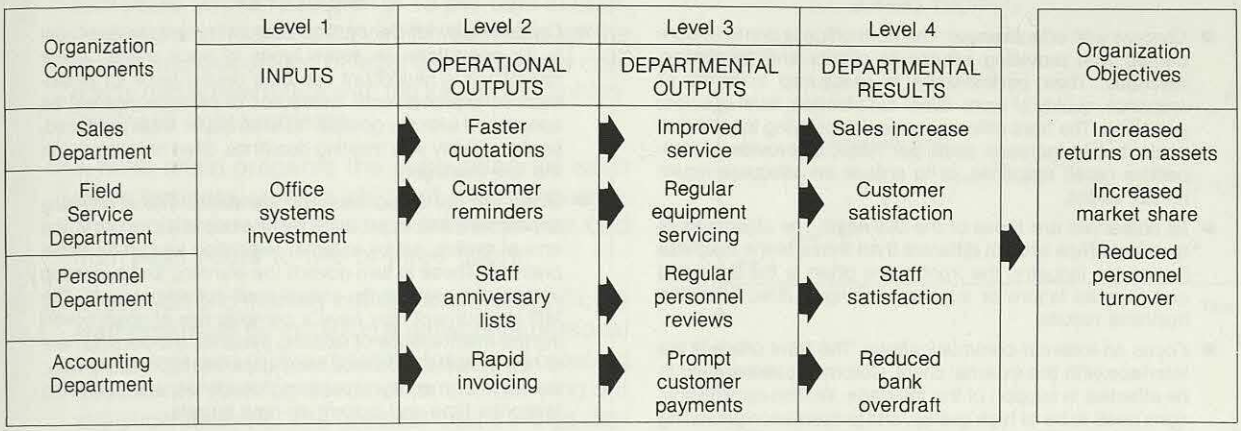
Generally, some intermediate factors are required. It will quickly be realized that there can be many such cause-and-effect links, making up several cause-and-effect "chains," and the ultimate impact can depend on several factors, many of which will be organization-dependent. In Figure 2.7 we show a hierarchy of causes and effects in which intermediate effects become the causes for the next stage of the process.

Figure 2.6 Example of the impact of office systems on public sector and 'not-for-profit' performance



Notes: (1) In the context of a public sector organization accounts payable refers to social benefits, foreign aid, subsidies, etc.
(2) Likewise, accounts receivable refers to taxes, license fees, etc.

Figure 2.7 The cause-and-effect hierarchy concept



There are several points to be noted about this process:

- At the operational levels, the impact is more readily assessed. Once we get beyond these levels, the cause-and-effect relationship becomes more difficult to assess.
- Well-defined cause-and-effect chains can be used to determine with a reasonable degree of precision the priorities required to obtain the desired results.
- By using this analytical process, planning can work from the desired effects to the office systems needed. Equally, data processing and communications solutions can be considered as alternatives to office systems (or, indeed, other kinds of solutions, such as organizational changes).
- It focuses attention on the ultimate effect of the office system, and broadens thinking beyond the level of the individual office worker. It leads naturally to the concept of group systems and organization-wide systems.
- It leads to a consideration of front-office as well as back-office objectives.

Front offices and back offices

Having looked at the contribution that office systems can make to the organization's objectives, we now consider where in the organization office systems may best be used.

Traditionally, classifications of offices are made either in terms of a department or function within an organization (eg legal, accounting, marketing) or in terms of the kind of worker (eg clerical, managerial, professional). The principal reason why such classifications have been so popular is that they do have the merit of providing the manager responsible for office systems with a clearly defined, "self-contained" work area within which to introduce and test office systems.

But, as we have argued under the previous heading, when planning for office systems it is not enough to look at the everyday tasks of an office but it is also necessary to look at the wider business objectives of that office and the organization it serves.

Therefore, the primary classification of offices that we propose is that of the "front office" and "back office."

As a first definition and at the risk of oversimplifying the issues involved, the back office is primarily concerned with productivity, whereas the front office is concerned with the achievement of business goals. The detailed characteristics and concerns of these two basic types of offices are summarized in Figure 2.8 on page 16.

In large companies office functions will be quite distinct organizationally — accounting and filing and ordering are classic examples of functions that are carried out within separate offices or departments. In smaller organizations the distinction between front office and back office may apply only at the individual worker or even task level.

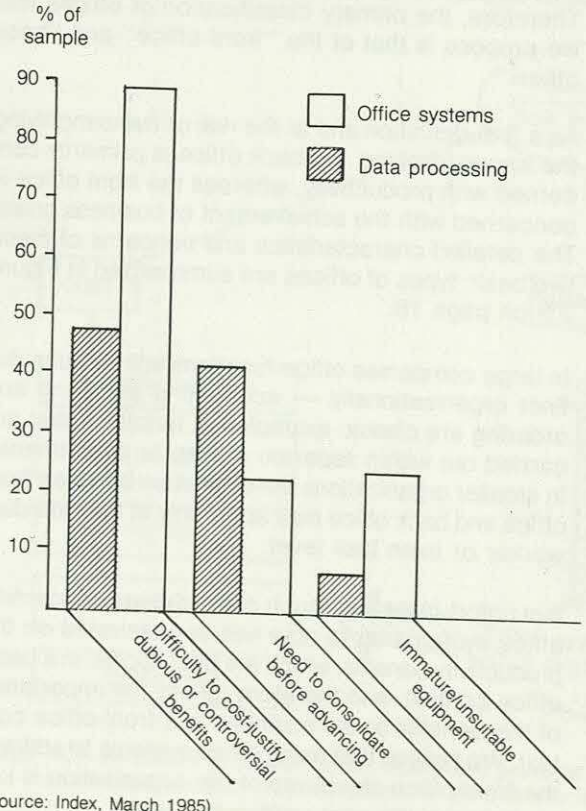
It is unfortunate that much of the debate concerning office systems up to now has concentrated on the productivity benefits, which are best applied in a back-office context, and therefore ignore the importance of the benefits to the business in a front-office context. We believe that using office systems to address the front-office objectives of the organization is key to resolving the cost-justification issue.

Figure 2.8 A comparison of the objectives of the front office and the back office

FRONT OFFICE	BACK OFFICE
• *Concern with effectiveness:* The front office is primarily concerned with providing service to clients and generating revenues. Their performance is measured in terms of response, quality of work, client satisfaction, level of sales, and so on. The front office manager is not trying to minimize costs, but to increase sales per head, to provide a competitive repair response, or to ensure an adequate return on tax audits.	• *Concern with efficiency:* The back office emphasizes cost in its operations. In some types of back office, where reductions in headcount can be a driving force for investment in improvements; measures of performance will be concerned with the cost per invoice or per letter produced, or alternatively with meeting deadlines, often negotiated with the line managers.
• *Its objectives are those of the business:* The objectives of the front office are not different than those of the business (in service industry, the front office often *is* the business) and thus its failure or success impinges directly on the business results.	• *Goals are set by policies and standards:* The accounting department has to produce results based as monthly and annual cycles, set by external regulation and professional practice. These in turn govern the planning and budgeting cycles, and perhaps the annual audit activities as well. The MIS department may have a complex mix of goals covering the maintenance of existing systems, the development of new systems for several client departments, meeting daily, weekly and monthly processing deadlines, and achieving response time and system up-time targets.
• *Focus on external communications:* The front office is the interface with the external client. Communications need to be effective in support of this interface. Written communications need to be of high quality, and presentation (including the use of color, typesetting) can be important. There is little control over the form or timing of client communications and sufficient capacity and flexibility must be available to respond in a timely fashion.	• *Focus on internal communications:* The back office is primarily concerned with a closed set of "clients", the other offices within the business.

Figure 2.9 offers a good illustration of how the issue of benefits and cost justification of office systems should be taken in conjunction with the back-office/front-office classification; the figure shows the results of a recent UK survey of constraints on office systems investment. Twice as many respondents see cost justification difficulties and dubious or controversial benefits as a constraint for office systems investment as for data processing. The point is that whereas data processing systems impinge primarily on the back office, office systems may impact either back offices or front offices, or both. Therefore, the traditional methods of cost justification that apply to data processing systems do not necessarily or usually apply to office systems. (Indeed, even within data processing systems, effectiveness and contribution to the business are emerging as prime measures of success.)

Figure 2.9 Constraints — office systems and data processing



(Source: Index, March 1985)

We now discuss the benefits of office systems for back offices and front offices in greater detail.

Benefits of office systems in the back office

Our definition of the "back office" states that it does not normally provide services directly to the clients of the organization, or deal with them directly. The potential benefits of office systems in the back office are very much tied to the concept of increasing productivity and efficiency.

Applying computers to automate entire office functions is the approach used by traditional data processing analysts, but by its nature it tends to work best with specialized functions such as accounting, personnel record-keeping and payroll.

Improvements in back-office productivity rely on identifying a particular business function amenable to automation (often because of a repetitive, data-handling aspect), or groups of individual workers who dedicate a large proportion of their time to one activity which could be enhanced through the use of an office system.

Many organizations we have researched have been able to demonstrate real and impressive productivity gains in back-office environments. For example:

—The legal department of a large life insurance company increased its workload by 30 per cent over four years, with a reduction of 15 per cent in staff. An electronic mail system which speeded up the review and discussion of legal casework and contracts and agreements was the key tool in achieving these improvements.

—A hotel chain prepares the accounting for each day's business using a string of minicomputers. The original time to do the work has been reduced from eight hours to two or three hours.

—A research and training institute avoided significant staff expansion by installing a network of personal computers and minicomputers for use in creating documents, revising documents, and carrying out statistical analysis. The greatest cost savings derived from the initial keyboarding and revision of research papers, newsletters and brochures. Researchers do much of their own manuscript typing (secretarial revision is carried out later).

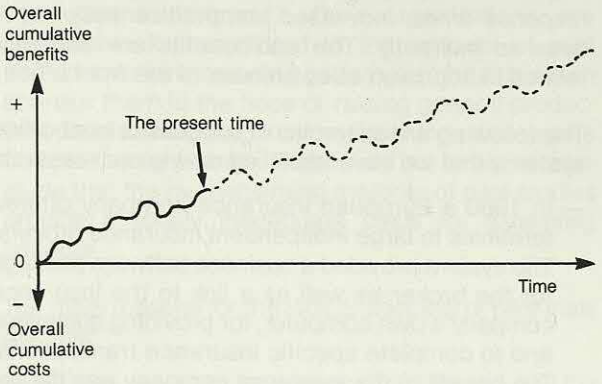
—For the training department of an 18,500-employee engineering and construction company an office system incorporating word processing, graphics, and laser printer output provided a 40 per cent productivity increase in the production of training materials.

A natural consequence of improved productivity (which means reduced service times for tasks undertaken on behalf of other departments of the organizations) is reduced backlogs, and hence improved internal services, and indeed this was a benefit mentioned by many organizations we researched.

As a rule of thumb, the cost-benefits to be expected from back office systems over a period of time are shown in Figure 2.10. The figure indicates that as each such system is installed, a modest cost-benefit may be achieved, although some systems may cause a decrease in the cumulative quantitative benefits because they only provide qualitative benefits. Similar cost-benefits can be expected to continue as systems continue to be installed, as illustrated by dotted line in Figure 2.10.

It is important to understand this typical cost-benefit pattern associated with a back-office system. In financial terms it is probably best described as worthwhile but unspectacular. We will describe below other kinds of office system which are harder to define and perhaps riskier too, but which (if successful) produce far more spectacular benefits. Because it is easy to categorize all kinds of vastly different applications as part of "office automation," it is easy to raise expectations which are quite unrealistic. One important lesson from a decade of experience is to understand *what kind* of opportunity has arisen, and what pattern of cost-benefit is likely to be associated with it. The ability to deliver what is expected depends upon the correct management of expectation.

Figure 2.10 Cumulative cost-benefits of office systems designed to improve back-office performance



Note: The small decreases in cost-benefits relate to office systems with qualitative benefits that cannot be fully cost-justified.

Benefits of office systems in the front office

The front office serves the clients of the organization. In the services sector, the front office often comprises most of the business itself. Professional offices (lawyers, engineers, auditors), marketing and sales offices, and insurance claims processing departments are some examples of this kind of office. As we explained earlier, real-life offices are not always neatly divided into types (especially in smaller organizations), but we are concerned here with the office whose main function is dealing with the clients of the organization. As described in Figure 2.8 certain characteristics apply to this type of office:

—The concern is with effectiveness.

—The office objectives coincide with those of the business.

—The focus is on external communications.

We observed earlier that surveys and studies of office systems benefits have concentrated on how office staff spend their time, in the belief (a) that reducing time spent on certain types of tasks will increase productivity and (b) that generic "universal" office systems solutions can be developed (or already exist) that can be applied to these tasks. This is a valid approach to the search for productivity. As we mentioned in our previous section on back-office systems benefits, productivity gains can be achieved in this way, as well as through the traditional data processing approach of automating key functions that "cut across" the office.

What needs to be emphasized is that productivity improvement (*efficiency*) can result in improved *effectiveness* (through reduced backlogs, improved response times, increased competitiveness), but it does so indirectly. The end-benefits are normally related to improved effectiveness of the front office.

The following are examples of successful front-office systems that we have identified during our research:

—In 1980 a European insurance company offered terminals to large independent insurance brokers. The system provided a business software package for the broker as well as a link to the insurance company's own computer, for providing quotations and to complete specific insurance transactions. The benefit to the insurance company was the tie-in with its products and an opportunity to increase its market share. By mid-1984, 200 brokers had installed the system. Two points should be noted: The external orientation of this system, and the reaction of the competition. Similar systems were rapidly offered by other insurance companies, and eventually the brokers themselves launched their own, independent bureau service. The insurance companies are now considering establishing an industry-wide service for brokers.

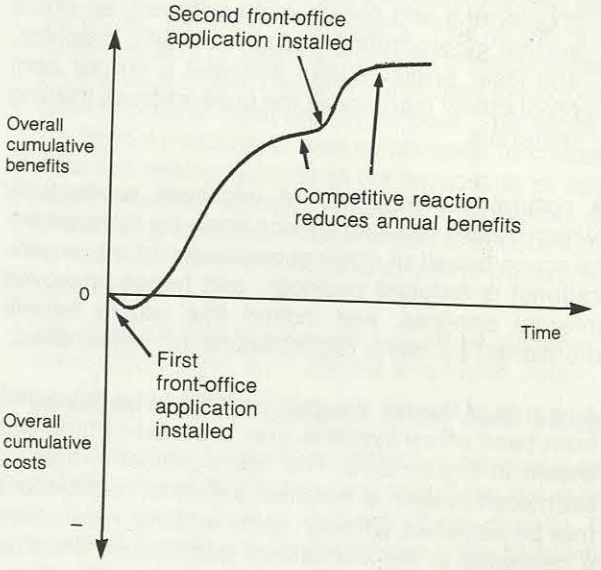
—A US bank uses a speech synthesizer to respond to daily inquiries by the finance managers of its business customers, who want to know their firm's exact account balance, in order to make accounts payable decisions. The benefit is the reduction in the number of telephone calls handled by personnel in the bank's cash management service department.

—A US beer distributor provided portable computers to its salesforce to increase the accuracy of invoicing and ordering. Previously, the 40 sales staff had been making as many as 500 errors a month in making out invoices and balancing their collection books, as well as spending an average of one and a half hours per salesperson to close out the books daily, and the errors created extra work for the accounting department. Using the portable (briefcase) computer, salesmen enter product numbers and quantities, and customer invoices are printed immediately. The problems described were virtually eliminated, and the salesmen can concentrate on the customers rather than on the paperwork.

—A European stockbroker installed personal computers for the traders, providing word processing and spreadsheet capabilities. The personal computers are linked to a minicomputer, as are the workstations used by the secretaries providing back-office support to the traders. The minicomputer is further linked to a computerized typesetting system for preparing analyst's reports for client distribution. The system has helped in speeding up analysis and the process of developing reports. This is a good example of a system that has delivered both front office and back office benefits, as significant productivity improvements in the secretarial office were also reported.

Again, as a rule of thumb, we visualize the benefits of front-office systems as following the pattern shown in Figure 2.11. In this illustration we assume that the benefits from the first application installed will decrease as other companies in the same industry install their own automated systems as well. This will not always be the case, since in many marketing situations, there could well be large one-time short-term benefits. In particular, it could be of continuing advantage in say, gaining additional market share. This figure is intended to be to a similar scale to that of figure 2.10 (referring to back offices) to emphasize the point that these applications have the potential to provide much greater benefits than those intended for back office environments.

Figure 2.11 Cost-benefits of two front-office systems



Thinking big, but starting small

By identifying the overall objectives to be achieved, as we have discussed, the organization considers the wider ("big") benefits and implications of office systems. This then, can provide the framework within which individual projects that serve the objectives are considered. The approach works as follows:

—The organization uses the overall objectives to be achieved with office systems as a framework for policies and guidelines within which individual projects are assessed and cost-justified.

—Detailed cost justification is not carried out for the total and ultimate office systems plan, but only for individual projects within that plan.

The individual projects chosen initially should preferably:

—Involve front-office objectives.

—Affect key activities that are very relevant to the job of the users.

—Not rely on critical mass of users.

—Be capable of being assessed in terms of achievement against objectives within a short time — say, a year or less.

—Have the support of users.

—Have the support of top management.

As a rule, this will normally mean that specific as opposed to wide-purpose applications are chosen initially:

—Specific applications. These are designed to meet the requirements of a particular office or business function. Examples include systems designed to prepare engineering estimates, to provide reminders about contract renewal dates or to act as sales aids. They may, but need not, be derived from mainstream data processing applications.

—Wide-purpose applications. These use computer-based technology to improve office activities common to many office workers. Examples include electronic mail, database access and videoconferencing.

Whether an application is specific or wide-purpose depends to some extent on the type of office worker involved. Word processing, for example, would be a specific application for typists and secretaries but a wide-purpose application for managers and professionals.

The point is that in the early stages of office systems development, it is best from a cost justification perspective to begin with specific applications that provide a quick relatively easily measured return on investment. Wide-purpose applications can then follow. Their costs will be more marginal as they will often be add-on applications with an existing workstation base already present. This stage is generally reached when 15-30 per cent or more of staff use office workstations regularly. (This may explain why wide-purpose applications are already more common in the United States, where workstation penetration is higher than in Europe.)

Thinking real, not pilot or trial

We now reach a point in our report when we must make a direct and carefully considered assault on received wisdom. The greatest advantage of the declining cost of hardware, runs received opinion, is that pilot studies become a feasible proposition. Whereas in the 1960s a DP system had to be built in its entirety before it could be tried out, today we can buy a limited amount of equipment and stage a controlled experiment. Many organizations are philosophically committed to the concept of pilot implementation, including government bodies which sponsor them in the hope of raising general productivity levels and giving their national industries some competitive advantage. Regretfully but firmly we conclude that the overwhelming majority of pilot studies provide a totally inadequate basis for assessing benefits.

The main reasons for the lack of success of pilot trials are that:

—Neither users nor top management usually feel the necessary commitment because the system is only a trial.

—Suppliers may not feel committed either, because they are aware that there are no real business purposes behind the trial and that they may be spending support effort on a system that may not proceed beyond the trial stage.

—Standards and procedures are difficult to enforce.

—There is often a need to maintain two systems (conventional and office systems) in parallel given that there is usually no commitment to the system after the end of the trial.

—The scope and duration of the trial is normally preset, which leads to inflexibility and, in particular, an inability to react to feedback and changes.

—Trials are often overambitious and concentrate on many aspects of office systems, all at the same time and before users are really ready.

As a result, any cost-benefit analysis from such trials will usually be of dubious value and reliability. To illustrate these points we reproduce in Figure 2.12 the results of a set of office pilot trials conducted in the UK under the auspices of the Department of Trade and Industry. Although some of the benefits sought when the trial was started were achieved, the overall picture is a disappointing one.

The conclusion is obvious: Pilot trials are not a satisfactory way of assessing the benefits of office systems. If a learning exercise is required, it is preferable to organize a few in-house demonstrations by suppliers, attend seminars or recruit outside experience. But only a "real-life" installation that is relevant to corporate and individual objectives can be a realistic base on which an organization can develop its office systems. If this is done using the "building block" approach that we described under the previous heading, an organization will be able to build up experience while at the same time achieving real benefits.

Figure 2.12 Benefits sought and obtained in a selection of UK office systems pilot trials

	Site											
	A		B		C		D		E		F	
	Sought	Gained	Sought	Gained	Sought	Gained	Sought	Gained	Sought	Gained	Sought	Gained
SAVINGS												
Reducing document production costs	√	?					√	√	√	√		
Reducing overloads							√	?				
Eliminated duplicated information system	√	min					√	x	√	some		
Reduce staff levels	√	√							√	√		
Reduce consumables												
Save space									x√	xx	√	xx
WORK EFFECTIVENESS												
Efficient processing administration					√	some						
Reduce routine non-productive activity	√	min			√	?	√	√				
Reduce interruptions — general							√	x				
Reduce interruptions — phone					√	x						
Better use of time	√	some					√	some	√	√	√	√
Online problem solving							√	x				
Quicker document output			√	√	√	√			√	√		
More individual control					√				√		√	
Less re-typing	√	some			√	√			√	√		
Re-use of material	√	some			√	√			√	√	√	√
More delegation					√	?						
TEAMWORK EFFECTIVENESS												
More available information	√	√	√	x			√	min				
Faster information and opinions	√	√					√	√				
Establish common information — goal	√	min	√	x	√	√	√	min				
— contact lists					√	?						
More accurate information												
More awareness of activities and programs							√	min				
Reduced mis-filing					√	x						
Improved drafting cooperation					√	√						
Faster access to information	√	√	√	x	√	√						
Reduced record keeping	√	min			√	x						
Better job satisfaction												
More time for late stages of work cycle					√	some						
Faster feedback					√	√	√	min				
Faster communication			√	√			√	some				
Less formal communication					√	?						
MANAGEMENT EFFECTIVENESS												
Better management control	√	min					√	?			√	√
Improved branch and financial cost							√	some				
Documents more timely									√	√		
OUTPUT												
Increased workload					√	?					√	√
Fewer missed deadlines					√	√			√	√		
Better service to population	√	min							√	√		
Proper use of public funds on services	√	some										
Faster feedback to customers and supervisors											√	√
More consistent documents			√	√			√	√	√	√		
Clearer documents									√	√		

Key: √ = considerable extent
some = some extent
min = minimal extent
? = uncertain
x = not at all
xx = situation made worse
x√ = not sought but unexpectedly obtained

(Source: DTI Pilots: Interim Report, The Economist Informatics, 1985)

CHAPTER 3

PLANNING AND IMPLEMENTING SUCCESSFUL OFFICE SYSTEMS

Over a period of thirty years or more the data processing community has evolved a methodology designed to bring the planning and implementation of data processing projects under its control. This methodology now exists and is widely used. While data processing projects do still go wrong occasionally, the explanation is that the methodology is simply not used — or used incorrectly — not that it does not exist. For most of the period in which advanced office systems have been sought, no equivalent methodology actually existed. The tried and tested tools for the control of data processing projects could be applied to office projects, but they often proved of limited value.

As we have already shown, MIS departments are becoming more concerned with office systems. If they wish to discharge this responsibility effectively, it is essential that they develop and apply suitable planning and implementation tools. Moreover, this must be done quickly. The evolution of planning tools for office systems over a thirty-year cycle is not going to be good enough.

The development and adoption of the planning tools outlined in this chapter is a serious and challenging management task, involving both management time and cost. But it is a key task for any manager becoming seriously involved in office systems, whether or not he or she is a director of MIS. Without such a planning framework, success will be a hit-and-miss affair, with consequent risks for both the individual and the enterprise.

In this chapter we have tried to make our recommendations both specific and flexible — not an easy task. Everyone is agreed on the necessity of an office systems strategy. So far, little has been published on *how* to achieve such a strategy. To remedy this deficit, we feel that concrete suggestions are in order. Hence the specificity of our approach.

Office systems are continually evolving, as is the understanding of their capabilities and potential. Users do not need, or even want, a monolithic plan for office systems that acts as a constraint on action, rather than providing a positive environment in which successful office systems can be identified, planned and implemented. We present a planning approach in this chapter, based on the experience of users we talked to and on our own field experience. The allocation of responsibilities for planning and implementation is also discussed.

We also consider in detail specific aspects of the planning and implementation process:

—The search for office systems opportunities.

—Presenting the business case.

—Cost-benefit analysis.

—Selecting a supplier.

—Specifying requirements to suppliers.

—Detailing the program for action.

—The physical office environment.

—Wiring options for office systems.

—Installation.

—Training and education.

We also present an analysis of how the human aspects of technological change can be addressed.

Having discussed the different facets of the planning and implementation process, we suggest a practical way of getting started — the office systems conference.

METHODOLOGIES FOR PLANNING OFFICE SYSTEMS

The requirements for a workable office systems planning method may be summarized as follows:

—The planning method must allow for shifts in goals and systems, to reflect experience gained in the organization and changes in the available technology.

—It must provide room for a mix of standard office solutions and custom-built systems. Where necessary, it must provide for office systems that complement the information systems of the organization.

—It should take advantage of the individual manager's enthusiasm and commitment and encourage initiatives within the organization. Different rates of advance should be possible.

—A wide spectrum of potential office systems applications must be provided for, from radical applications that involve major resource commitments and risks, to operational improvements that reduce costs and improve productivity.

We discuss three kinds of office system planning methods in this section.

—Productivity-focused planning

—Information systems planning

—Two-level planning.

We argue that while the former two methods can be applicable in certain narrow circumstance, the last — two-level planning — represents the approach most suitable for comprehensive office systems planning.

Productivity-focused office systems planning

Office systems planning methods currently in use tend to focus on achieving productivity improvements. Their starting point is usually an analysis of how time is spent by office workers, and they target office systems at the most labor-intensive activities, thus identifying the potential time savings to be made. The inherent strength of these methods is that they provide a rational, analytical route to identifying office systems that pay off. Their weakness lies in the built-in assumption that office systems are only about productivity, a weakness that we have discussed in detail in the previous chapter.

Information systems planning

Information system planning methods are now well established and might appear to offer an alternative approach to more comprehensive office systems planning. Two well-known methods are the Critical Success Factors method and IBM's Business Systems Planning method:

—*Critical Success Factors*. This is a method for eliciting user requirements. Users are asked to define the factors that are critical to success in performing their business functions or making decisions. The information needs critical to achieving success are then identified and used as a starting point for planning the information systems.

—*Business Systems Planning*. This is a methodology developed by IBM. Information requirements are derived from the objectives of an organization in a top-down fashion by starting with overall business objectives and then defining business processes (e.g. purchasing, quality control). Business processes are used as the basis for data collection and analysis exercises in which executives are asked to specify key success factors and to identify problems. Logically related categories of business processes and data are then identified and related to business problems. Following the definition of an information architecture, application priorities are established and databases planned.

The primary purposes of these information system planning methods are to define an overall information system, to specify a portfolio of applications and databases, and to define the detailed information requirements for each application. The approach reflects the way in which traditional data processing works, aiming to automate entire business functions. However, in the context of office systems, this approach is not usually the best, as it often makes more sense to automate that 20% of office work that yields 80% of the benefit. Also, the information requirements of office systems represent more than just data — they also include text, voice and graphics. These considerations limit the use of information systems planning techniques in the office systems context.

There is, however, one aspect of information systems planning that is applicable: the shift to distributed systems, which we discuss under the next heading.

Two-level office systems planning

The shift to distributed systems (the diffusion of systems throughout the organization with more local autonomy and control over systems) and the integration issues created by increasing penetration and proliferation of information systems have revealed shortcomings in the old central planning processes. To avoid the rigidities and the complexities of coordination, there has been a shift to establishing an appropriate framework, or "architecture," within which detailed planning can take place.

Organizations are finding that the first priority of successful information systems planning is getting the architecture right, but relying on individual operating units to identify the projects that will meet their business needs.

This approach is also applicable to office systems planning, which has an important user-driven, or bottom-up, component.

The planning approach we recommend is derived from this thinking and is, therefore, a two-level one:

—First, the organization sets out a broad definition of aims and tasks and specifies the target areas for office systems. We call this the master plan.

Figure 3.1 Comparison of office system planning approaches

	Productivity-focused office systems planning	*Information systems planning*	*Two-level office systems planning*
FOCUS	Productivity improvements	Business information systems	The organizational/technical framework for individual projects
OUTPUTS	— Potential office system applications — Costs and benefits — Implementation plans and budgets	(Depends on method used) will usually include: — Applications portfolio — Database project(s) — Development priorities — Development plan and budget	— Technical architecture — Business considerations (control, investment, etc) — Organizational responsibilities — Areas in which development work will be undertaken — Outline investment and development plan
COST-BENEFIT ANALYSIS	Based on assessments of individual time savings and analysis of staff and system costs	Based on a range of business benefits, assessed against system development and operating costs	Investment rules specified for all projects — each project assessed individually
APPLICABILITY	Planning general-purpose office systems with some degree of inter-linking	Planning information systems	Planning all types of office system. Provides for integration/interface with information systems

The technical architecture, the business rules, and the organizational framework are a part of this step, which has as its underlying objective the creation of an environment that will facilitate the individual projects.

— Next, the individual office system projects are undertaken to meet specific needs as and when they are identified. Each project must be consistent with the master plan.

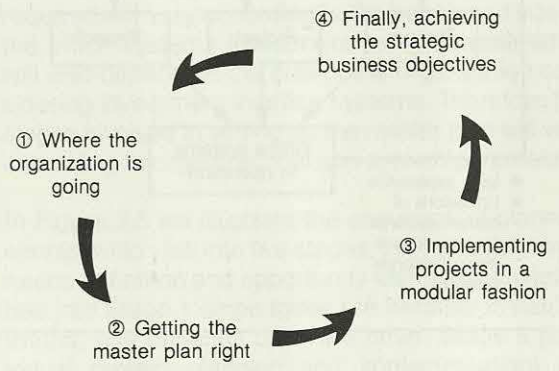
Some of the more important differences between this approach, productivity-focused planning, and information systems planning, are shown in Figure 3.1.

This type of two-level plan is becoming increasingly common in data processing, office systems and telecommunications. The main reasons are that a good master plan allows for initiative and flexibility at the local and end-user levels, while recognizing the broader concerns of the organization, the total investment involved, compatibility and communications requirements, and the deployment of technical resources.

The philosophy behind this approach is: Think big, start small, which we discussed in Chapter 2 in the context of assessing benefits. Having established the master plan, the organization can proceed with considering specific projects that are consistent with the objectives set out in it. The process is illustrated in Figure 3.2.

Individual projects can be tested against the overall rules and criteria set out in the master plan. Some of these projects will be approved, some not. The aggregate of specific projects is then the total portfolio of office systems.

Figure 3.2 Thinking big, starting small and the role of the master plan



For larger projects a formal feasibility study will usually be required. For smaller projects more informal methods of assessing their feasibility will often be more appropriate.

The master plan will also evolve under the pressure of business needs and as a result of technological developments. We show this in Figure 3.3. The result is planning, rather than plans, and the flexibility to react to changing circumstances as they arise.

The elements of the master plan

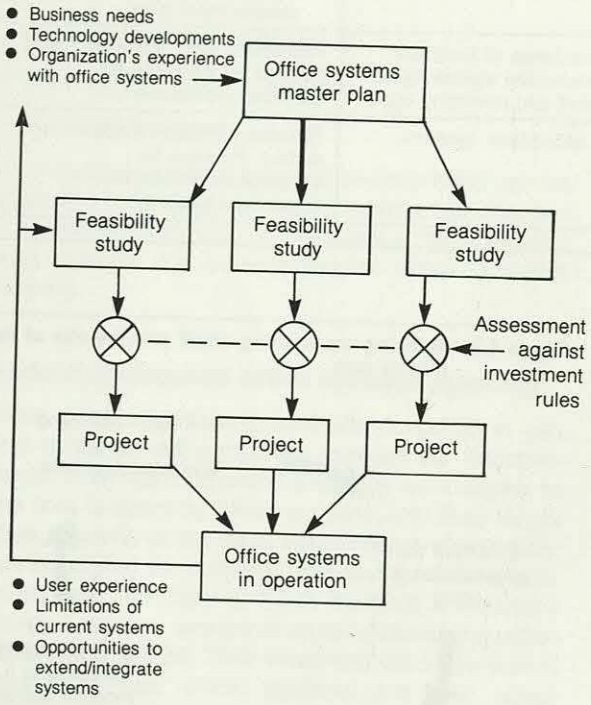
The master plan can be seen as a process that comprises two elements: one resolves the strategic issues involved for the organization, and the other provides the planning infrastructure for the future. Figure 3.4 illustrates this in schematic form.

The strategic element

The strategic level divides readily into four steps:

— ***Defining the organization's needs***. The various long- and short-term goals of the organization are identified in this step. These should include any threats posed by competition, constraints due to resource or technical shortcomings, and any other key issues that might conceivably be resolved in some way by the use of office systems.

Figure 3.3 The logical planning cycle



— ***Identifying the office system opportunities***. These are the ways in which office systems could be used to meet the organization's needs. This is an iterative process, as the search for opportunities works both top-down, starting with the organization's objectives, and bottom-up, starting with potential technology solutions.

— ***Establishing the development priorities***. Some opportunities provide a greater payoff than others. Some cost more, or are riskier and more complex, or depend on the prior implementation of other system components. The approximate costs and benefits, and system interrelationships, need to be worked out to allow decisions to be taken on development priorities.

— ***Developing a program for action***. This planning element is not intended to produce a detailed step-by-step plan for every office in the organization. At the same time, the desired results will not happen by themselves.

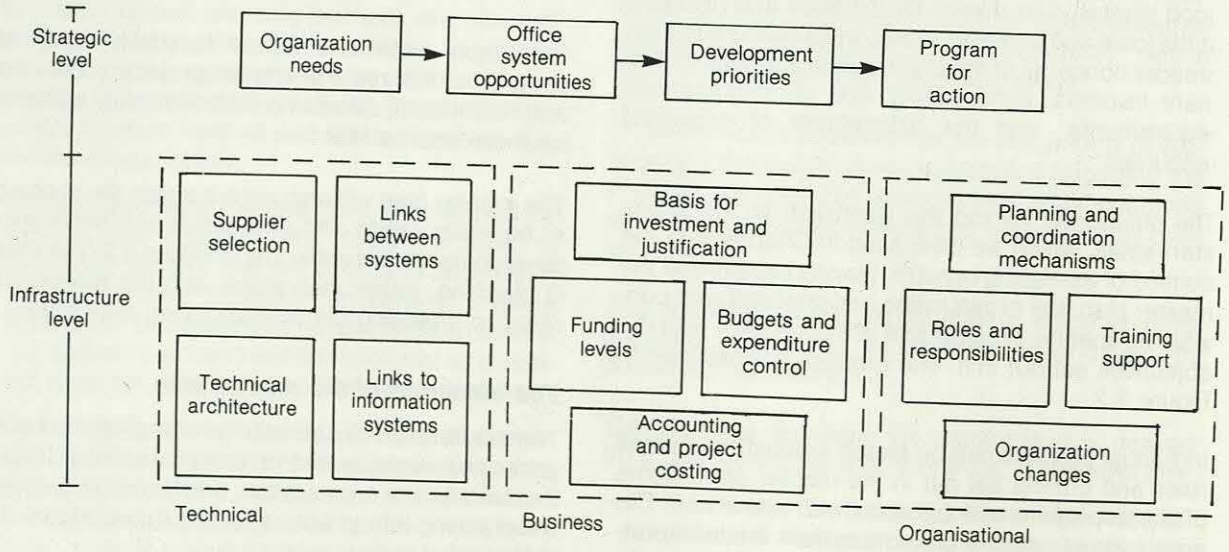
The program for action is concerned with setting up the essential infrastructure (technical, business, organizational) and with setting out the work program for the first planning period (for the first 12 to 18 months for example) in overall terms.

The infrastructure element

The other part of the master plan provides the blueprint for the infrastructure. A good infrastructure will allow considerable flexibility at the individual office or group level in terms of types of system and applications; this will depend on:

— The significance of office operations to the business of the organization.

Figure 3.4 The components of the master plan



— The size of the organization, the number of departments or work groups and the composition of the workforce.

— The experience of the organization with office and information systems and the available in-house resources.

— The relative autonomy of managers within the organization, and the diversity and geographic scope of its operations.

— The scope for and impact of office systems.

— The level of sophistication of the plans for office system technology.

— The need to link the systems with one another and with the information systems.

We have already referred to the three infrastructure areas that need to be considered: technical, business, organizational. The principal issues involved in each of these areas are as follows:

— *Technical infrastructure*. The key issue here is the requirement for and the ability of office systems to link and fit together (both with one another and with the organization's information systems), their ability to grow over time to meet user needs, and the ability of suppliers and in-house technical staff to provide support. The need to meet these requirements has led many users to choose a one-supplier policy. However, the organization may pay a considerable premium for such a policy, which is not necessarily warranted by the benefits achieved.

  Nevertheless, there may be a case for choosing such a policy, or for limiting the number of suppliers. A statement of policy on supplier selection, and any requirement for MIS/data processing (or the responsible manager or steering group) to approve exceptions, should be part of the master plan infrastructure. Standards for equipment, telecommunications and software (including operating systems) should also be included in this part of the master plan.

— *Business infrastructure*. The basic thrust of the master plan will in many cases be a mixture of front-office and back-office projects, the former designed, for example, to give a competitive advantage and to improve directly the service offered to customers and clients, and the latter designed to improve productivity and to achieve cost savings.

  The master plan must specify the rules for investment in these projects, how they are to be paid for, the pricing of common internal services and the payback periods.

  Equally important, the master plan should establish the funding levels (what it is worth to the organization to take up the opportunities identified, in order-of-magnitude terms) and how budgets and expenditures and the measurement of benefits will be controlled.

— *Organizational infrastructure*. The mechanisms for planning and coordinating the master plan will need to be set up and roles and responsibilities assigned. Some reorganization may be required. At its simplest, this may require only the setting up of a small project team to provide training and support, or an expansion of the existing technical support team in the data processing department to cover office systems. But some strategic front-office applications may require a major restructuring of customer services, or marketing and sales departments. For example, a factor often underestimated by technical planners is that the organizational effort required for such restructuring may be as great as or greater than that needed for the technical infrastructure.

Scale of the master plan

The summary above provides an outline of what is involved in setting up a master plan. The level of effort required will vary according to the scope and size of the office systems investment being considered. It will also depend on the size of the organization considering investment in office systems. Therefore the stages involved in setting up the master plan will vary according to organizational and system parameters.

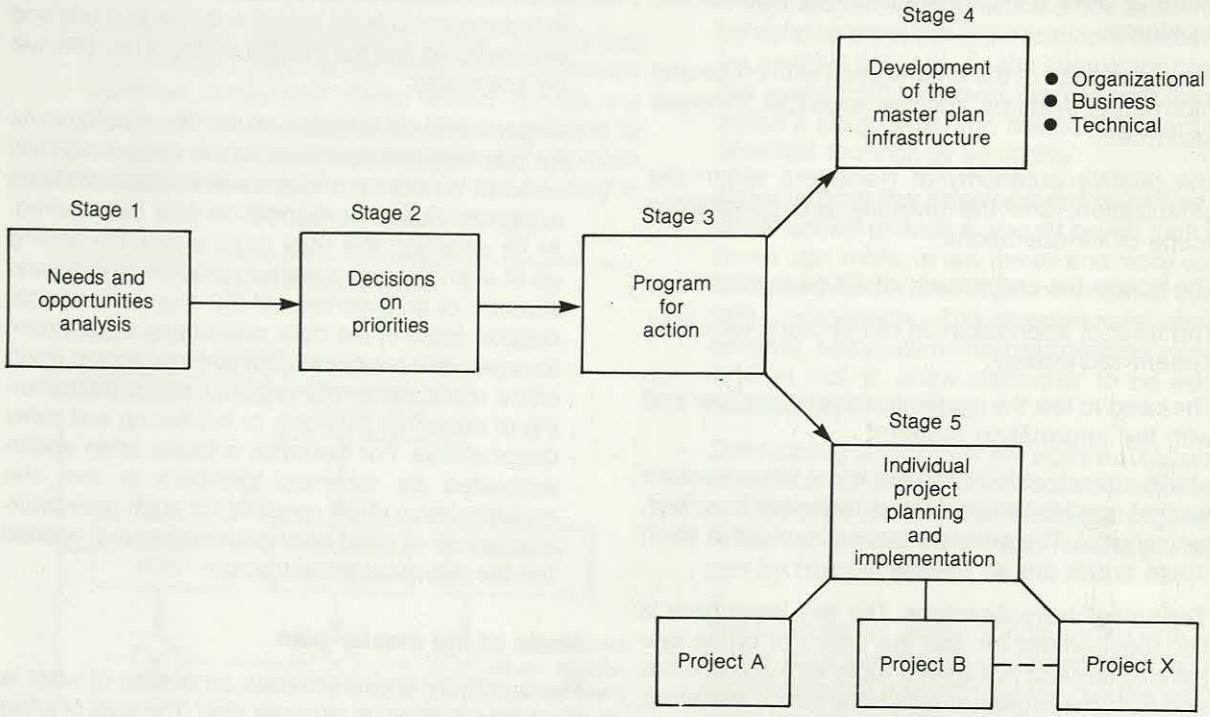
In Figure 3.5 we illustrate the sequence of planning events, which fall into five stages. We have combined needs definition and opportunity identification activities into Stage 1 since these are iterative in nature, that is, one depends upon the other. Stage 5 (individual project planning and implementation) will usually start while the master plan is still being finalized, and so is shown as taking place in parallel with Stage 4 (development of the infrastructure).

These different stages are flexible to some extent, and can be omitted, or combined, depending on the scale of office system envisaged. A total office system plan for an organization would require moving through all the stages we have described in a complete and thorough fashion.

However, a simple expansion of an existing base of office systems will not normally require a fresh look at the strategic needs of the organization; the focus is more likely to be on improved ways of using the systems already in place.

Likewise, where the existing office systems are to be linked to the information systems (to provide an additional channel for access to the management information systems, for example) only technical

Figure 3.5 Stages in office systems planning



infrastructure issues will normally be involved, and the effort required to produce a master plan can be modified accordingly.

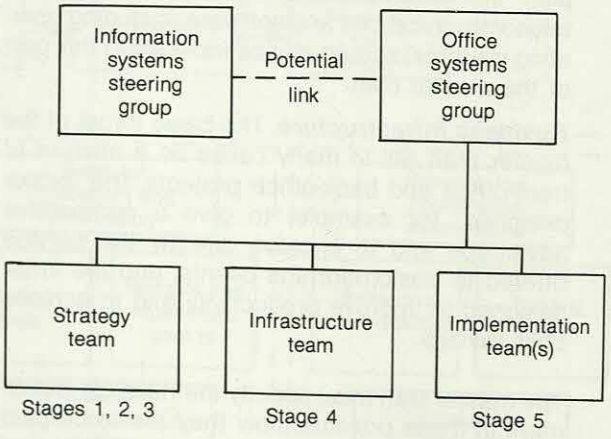
Similarly, small and medium-sized organizations, or individual departments, can usually combine some of these stages or scale down the effort and elapsed time required. No elaborate intermediate reviews are really necessary in the smaller organization, because there are fewer organizational interests involved, and agreement can be more readily reached, say by individual discussions leading up to a single meeting at which all parties can agree on what is to be done, rather than by setting up separate teams. In a larger organization, this process usually takes much longer, and the intermediate reviews are essential to gaining the necessary commitment by all parties.

ASSIGNING RESPONSIBILITY FOR PLANNING AND IMPLEMENTATION

In this section we describe how a medium to large organization might set about developing a master plan, and implementing its office systems. The elements of the approach we recommend are all applicable where group-wide or larger scale office systems are planned. As we discussed in the preceding section, smaller scale office systems plans will not necessarily require so sophisticated a planning approach.

As a result of our research, we are convinced that getting the organization right for doing the job is just as important as having the right plan. One way of setting up an organization for an office systems planning project is shown in Figure 3.6. Three teams are envisaged, although for smaller projects the different responsibilities may be assigned to just one or two teams or even individuals.

Figure 3.6 Organizing for office systems planning



Note: Number and size of teams will depend on scope of plan and organization size.

— *Strategy team.* This team concentrates on the ultimate objectives that the office system will be designed to achieve. The strategy team should ideally be user-led.

— *Infrastructure team.* This team is concerned with resolving the technical, business and organizational issues. Ideally this team will be led by someone with strengths in both office systems and systems and telecommunications issues generally, and who is familiar with the technical standards and policies of the organization.

— *Implementation team(s).* A series of user-led teams would be responsible for implementing the individual projects. MIS and data processing departments will normally contribute technical expertise to the individual projects.

A separate steering group will be desirable for very large plans, both to oversee the activities of the teams described above and to provide a formal link to the data processing/MIS department or DP systems steering group.

The responsibilities of the planning, infrastructure and implementation teams are different in type and scope from those of the office systems steering group. The respective roles and tasks are set out in Figures 3.7 and 3.8.

Not all organizational cultures are comfortable with steering groups and committees, and some see these concepts as bureaucratic, to be eliminated or kept in check where possible.

Whether or not such a culture is strong within an organization, it is essential that the steering group avoid adopting a bureaucratic stance, or taking on the job of challenging proposals put forward to it. In a sense, it should not steer at all, but act as a feedback mechanism and as a facilitator, to "get things done." It is very easy for individual users to focus on a narrow front, and to ignore the organization's broader objectives. The members of the steering group should wear "the corporate hat."

Figure 3.7 Responsibilities of the planning, infrastructure and implementation teams

- The teams have both management and technical responsibilities.
- The teams are responsible for the production of the end-products of each stage, to the required level of quality, and within the specified costs and timetable.
- Business-level (budgets, schedules) and technical-level plans must be prepared and submitted to the office systems steering group or responsible manager.
- Periodic progress reports must be submitted and variances accounted for.
- The teams must coordinate with users and with other teams.

Figure 3.8 Responsibilities of the office systems steering group

The prime role of the steering group is to ensure that the broader interests of the organization are recognized and to provide a link between top management and the various user and technical interests involved. It therefore:

- Oversees the total office systems activity.
- Reports to or coordinates with the information systems steering group (as appropriate).
- Appoints managers to direct and coordinate the various planning and implementation activities.
- Makes recommendations to top management on opportunities, priorities and investment.
- Reviews the results of each stage.
- Ensures sufficient resources and access to information.
- Above all, concentrates on the aspects of office systems projects that are of strategic importance to the organization.

SPECIFIC ASPECTS OF PLANNING AND IMPLEMENTATION

In this section we cover some of the more critical aspects of planning office systems. In each case we provide a brief commentary on the critical issues involved, together with a checklist of points to be considered.

The search for office system opportunities

In Chapter 2 we outlined the principles of assessing office systems opportunities in terms of organizational objectives. A simple way of subdividing the work is to look at the possibilities from three viewpoints:

— New ways of doing business.

— Improvements to the business itself.

— Technological opportunities (starting with the solutions).

Figure 3.9 suggests some of the points to be considered under each of these headings. These should be considered only as an indication of the many opportunities available, as each organization will have different requirements, objectives and constraints.

Presenting the business case

Once the opportunities have been identified and assessed, a business case must be prepared to support the action proposed, to enable decisions to be taken on priorities, and to set out what we have called the infrastructure issues. The business case will refer to the technical and organizational issues that need to be resolved (these may explain why some choices have had to be eliminated, or account for delays in implementation of projects, for example), but its

Figure 3.9 Potential office system opportunities: points to consider

NEW WAYS OF DOING BUSINESS:

Could office systems be used to address the restraints and limitations that make the organization vulnerable, impede its full effectiveness, and hold down its economic results?

— Could they reduce fixed costs?

— Could they help cope with varying volumes?

— Could breakeven volumes be reduced?

Are there opportunities to change external business relationships or to shorten distribution channels by introducing electronic links?

Can the geographic scope of services offered be extended?

Are there new ways of reaching customers or responding to customer needs, using office systems?

Can present services be substituted for by office system-based services?

Could office systems be used to extend the effective operating hours of the business and extend the services offered to customers?

IMPROVEMENTS TO THE ORGANIZATION ITSELF:

Does the office workforce contribute any significant value to the products and services of the organization?

— How could the office systems be used to enhance this added value?

— Are there opportunities for cost reductions?

— Can productivity be improved?

Can the management control over the organization's operations be enhanced by office systems?

— Are improved internal communications the answer?

— Will management decision-making be enhanced?

Are there changes possible in the grouping of internal services?

TECHNOLOGICAL OPPORTUNITIES:

Do new groupings of office system products and services offer potential benefits?

— Document production? Integration of text, graphics and data?

— Voice response, voice messaging?

— Document transfer?

Can wider access to information systems be provided to users in the organization by linking them to the office systems?

Can PBX systems be used to link office systems?

Do mobile communications or portable office systems provide a means to make field staff more responsive to customer needs or to streamline paperwork and office communications?

Are there better ways of presenting information to managers using graphics?

primary purpose is to present as completely as possible the advantages of the proposed course of action. In addition, attention must be paid to the steps that should be taken to ensure success (for example, "are changes required in the present accounting systems to track the costs and impacts of the office systems?") and to the provision of adequate support.

As we have discussed in Chapter 2, judging the benefits of investment in office systems is not an easy task. Unlike the factory, there is no strong tradition of efficiency improvement in the office, and office output is not as easily measured.

Figure 3.10 summarizes the elements of a comprehensive business case for a major office systems effort. Most of the points covered are also applicable to smaller programs of investment.

Cost-benefit analysis

A special aspect of the presentation of a business case is the identification of the benefit and cost elements that should be considered.

An extensive list of elements is given in Figure 3.11. The following points should be considered in making use of this list:

— Changes which benefit one part of the organization may incur costs in another.

— Judgement will be required in allocating benefits. It may be necessary to test the sensitivity of the results to changes in these allocations.

— It will not be possible to measure all elements in similar terms (eg money). Some costs and benefits cannot be evaluated in specific terms — for example, disruption of office routines during implementation.

Selecting a supplier

The office system business is still very much a technology-driven business. All suppliers are not equal, nor are their products equally suitable to every application.

Therefore, choosing a one-supplier strategy can be risky and can result in the user paying a premium when equipment and software has to be adapted to a purpose for which it is not ideally suited. At the same time, a one-supplier strategy has the advantage that few decisions have to be made by the user organization on technical architecture issues, since these will be made for him by the supplier.

In either event, the nature of computer technology makes it very difficult for the user to switch suppliers, because of the enormous investment in equipment and software of only limited compatibility (and sometimes none at all) with other equipment and software on the market. Selecting the "right" supplier therefore can be a key decision in any office systems plan, because it may close off many future options.

The major points to be considered in selecting a supplier are summarized in Figure 3.12.

Specifying requirements to suppliers

Figure 3.13 provides a checklist of contents for an office systems requirement, to be sent to potential

Figure 3.10 Checklist — presenting the business case

ESTABLISHING THE PAYOFF

Are the systems investments explicitly linked to the goals of the organization?

Is it clearly explained what specific benefits will result from the various aspects of the investment?

Are the payoffs quantified? Is their sensitivity to different levels of systems investment examined (e.g. if only half the systems are installed, how does that impact the pay-offs)?

Is the overall program of investment required explained in full?

How long will it take to realize the full payoffs?

EXPLAINING THE MASTER PLAN

Is there a summary of any organizational, business and technical issues that need to be addressed?

Are there options described to address these?

Are all recommendations explained and justified?

Are the long-term implications explained?

ITEMIZING ALL COSTS

Are the full costs (one-time and recurring) itemized? Are investments in people included?

— training?
— parallel systems operation?
— support?
— external assistance?
— temporary personnel?
— back-up personnel training?
— management time?

Do the costings include "hidden" costs such as purchasing, suppliers, communications, power, building layout changes, cabling, power and telephone connections, office furniture, and trade union negotiations?

PROPOSING ACTION

Is an overall plan of action proposed?

Are responsibilities and roles clearly defined?

Does the plan include existing office systems?

Does the plan deal with office system capacity and any projected saturation due to normal growth (particularly important for networks and other shared resources)?

Are schedules and budgets established?

Does the plan indicate the extent and timing of the resources required for each project (where these have been proposed):

— during development?
— during operation?

Have checkpoints been provided for?

ESTABLISHING DECISION CRITERIA FOR INDIVIDUAL PROJECTS

Are basic project selection guidelines established regarding desired return on investment? Impact on service levels?

Are there formal criteria for determining project priorities?

Are there criteria for authorization of expenditures? Are there different approval levels required for different levels of cost?

MEASURING SUCCESS

How will success be measured?

Is it necessary to establish a benchmark based on today's performance?

Does the present accounting system need to be adjusted to enable office system costs and results to be accurately measured and tracked? Are new systems necessary?

PROVIDING TECHNOLOGY, EXPERTISE

Where is the technology and expertise to come from?

Will there be a preferred-supplier policy?

How are advanced areas of technology to be tackled?

Are there proposals to develop expertise in-house for critical aspects of the office systems?

Figure 3.11 Checklist — cost-benefit analysis

The classic cost-benefit analysis attempts to express both cost and benefits in the same terms so that the relative advantage of a course of action can be assessed. This will not always be possible (or even desirable) for office systems. It is essential however to clearly establish the beneficial effects of the office systems (preferably in quantitative terms) and to establish the corresponding cost of achieving these benefits.

TYPICAL BENEFITS	COSTS
Time savings	**One-time costs**
Productivity improvements	Equipment
Service improvements	Software
Reductions in work-in-progress	First-year software maintenance
Cost savings	Installation
Reductions in accounts receivable	Initial training
Increased market share	Custom software development
More prospects converted to customers	File conversion
Increased geographic scope of business	Parallel running
Shortened distribution chain	Building facilities
New products and services	Power, air-conditioning
Increased return on assets	Cabling
Increased profits	Shipping
Flattening of management structure (fewer middle managers)	Insurance
Reductions in meetings, travel time, travel expenses	Learning time
More effective deployment of field sales, field service staff	Management time (negotiations, supervision, morale)
Reductions in queues, service times, for customers/clients	Audit review (if accounting systems involved)
Reduced cost per transaction	Temporary help
Higher quality of service, take-up of benefits (social agencies)	Consultants
Higher number of outputs produced per period and/or reduced cost of planned outputs	Purchasing, legal
	Systems analysis
	Data processing (if links to be established)
	Setting up cost and benefit
	Tracking systems and procedures
	Recurring costs
	Hardware maintenance
	Software maintenance
	Software licences
	Supplementary systems analysis, consulting, training, etc.
	System manager, operators
	Supplies
	Share of business overheads

suppliers. It is advisable to send requirements at this level of detail only, to a short list of suppliers. Not only is it costly for the supplier to respond to complex requirements documents, but he will also put in a better effort and be more responsive if he knows that he has a reasonable chance of obtaining the business.

Suitable ways to develop a short list of suppliers include:

— Search of published case studies and trade journals to identify a suitable list. The existing data processing system supplier should be included among the potential candidates if links to the information systems are required.

Figure 3.12 Checklist — selecting a supplier

ONE SUPPLIER OR MANY SUPPLIERS?

Does the organization have the technical know-how to deal with the potential integration problems arising from more than one supplier?

Can one supplier meet all the organization's needs?

Is there a premium to be paid for dealing through one supplier?

THE SUPPLIER'S BUSINESS

Is the supplier committed to the office systems business?

How long has the supplier been in business?

How big is the supplier? Is there local support? Is the supplier going to be around for the lifetime of the system?

How effective is the supplier's maintenance and support operation?

THE SUPPLIER'S STRATEGIES

How broad is the supplier's involvement in office systems?

Does the supplier have an office systems architecture that allows for integration of his present and future products?

Does the supplier conform to Open Systems Architecture or IBM's Systems Network Architecture? What about other standards such as Ethernet, IBM's Document Interchange Architecture (DIA), etc?

THE SUPPLIER'S PRODUCTS

Does the supplier have the software and hardware combinations required to meet user needs?

Is software readily available from third parties to meet specific user needs?

What stage of their product life-cycle have the products reached? Will they become obsolete or be superseded in the near future?

Can the products be readily "fitted in" with existing office systems, data processing systems and voice communications systems?

— For a large project, sending a brief questionnaire to a large number of suppliers and developing a short list based on the responses.

— Investigating the solutions implemented by other users in the same industry (eg the organization's competitors) and inclusion of their suppliers in the short list, based on recommendation.

In principle the requirements themselves should be expressed in terms of what is to be done rather than how it is to be done. This may, however, not always be possible. For example, where standards for communications or operating systems software are already in place, these place inherent constraints on the requirements.

A further consideration is the extent to which individual requirements itemized are mandatory or desirable. It is important for the supplier to know this distinction so that different options can be quoted, where appropriate.

Detailing the program for action

Projects tend to acquire their own momentum, and it is essential to control this to ensure that results are being achieved that are consistent with the original expectations.

Figure 3.13 Checklist — specification for suppliers

BACKGROUND TO REQUIREMENTS

— Why this specification
— Brief company background
— Importance of system

BASIC REQUIREMENTS

— Business purpose of the office system
— Scope (users, locations, functions and data included)
— What the system is

APPLICATIONS REQUIREMENTS

— Standard applications packages
— Applications to be developed
— Workloads, growth rates, processing cycles, etc
— Links to other systems
— Reliability, responsiveness required (should be kept realistic)

HARDWARE AND COMMUNICATIONS REQUIREMENTS

— Number of workstations
— Peripherals (storage, printers, etc)
— Links required
— Standards applicable (eg organization standards, links to other equipment, compatibility with systems, software)

SUPPORT REQUIREMENTS

— Training
— Installation
— On-going support, maintenance

COST INFORMATION REQUIRED

— One-time and recurring costs
— Cost of optional items
— Cost of future expansion
— Need for building changes, power, air-conditioning, etc.

SUPPLIER INFORMATION

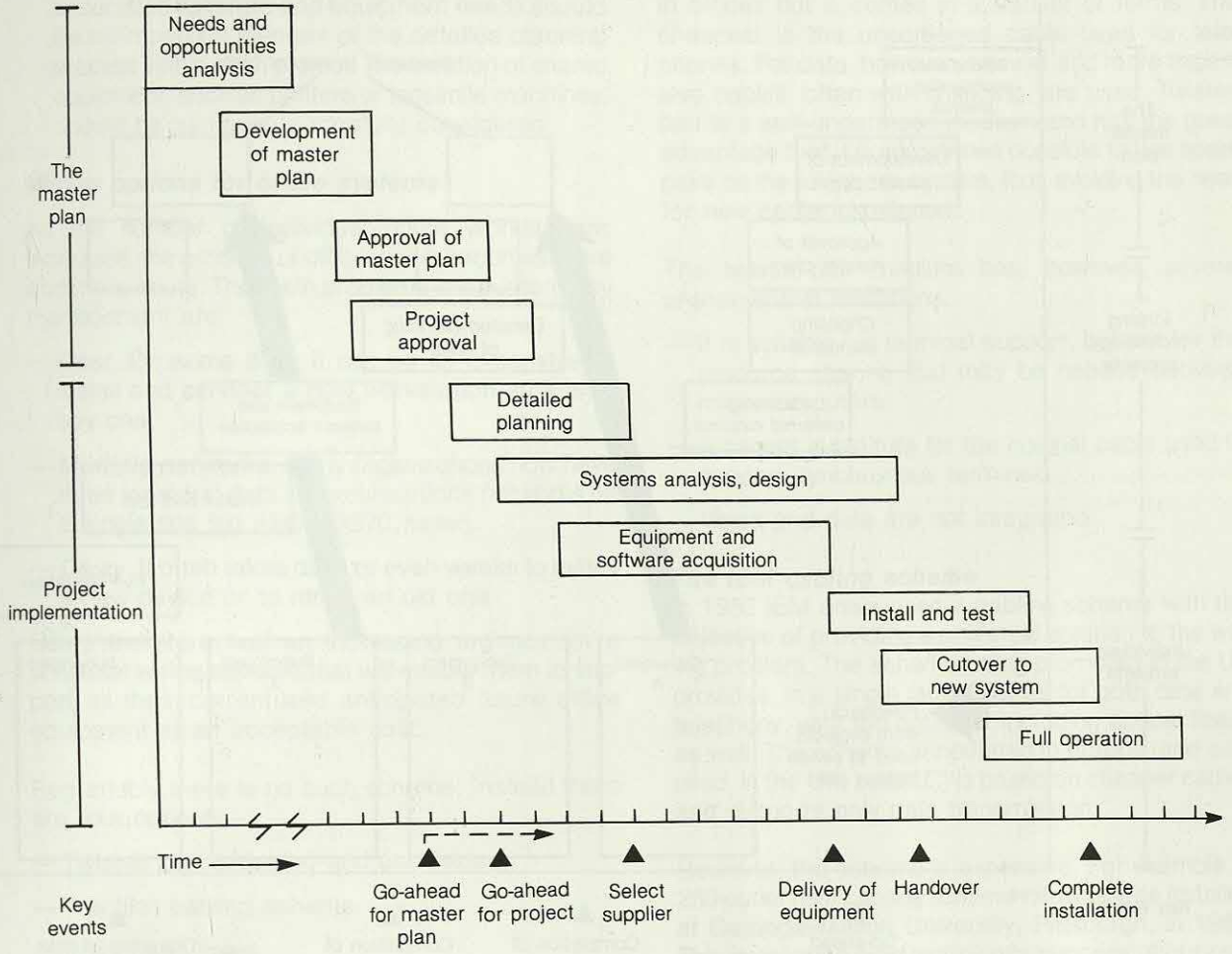
— References
— General information (eg size, history, geographic spread)

ADMINISTRATION

— When a response is required
— How proposals will be reviewed and the criteria for making a decision
— Whom to contact for further information, clarification

A sequence of the typical activities involving the program for action is shown in Figure 3.14. No indication of the actual time involved is shown, since this will vary considerably for different types of project. This type of "linear" approach is often subject to criticism because it can lead to long periods before any payback is received. For this reason the timeframe may be telescoped by starting

Figure 3.14 A sequential approach to planning for a large office system project



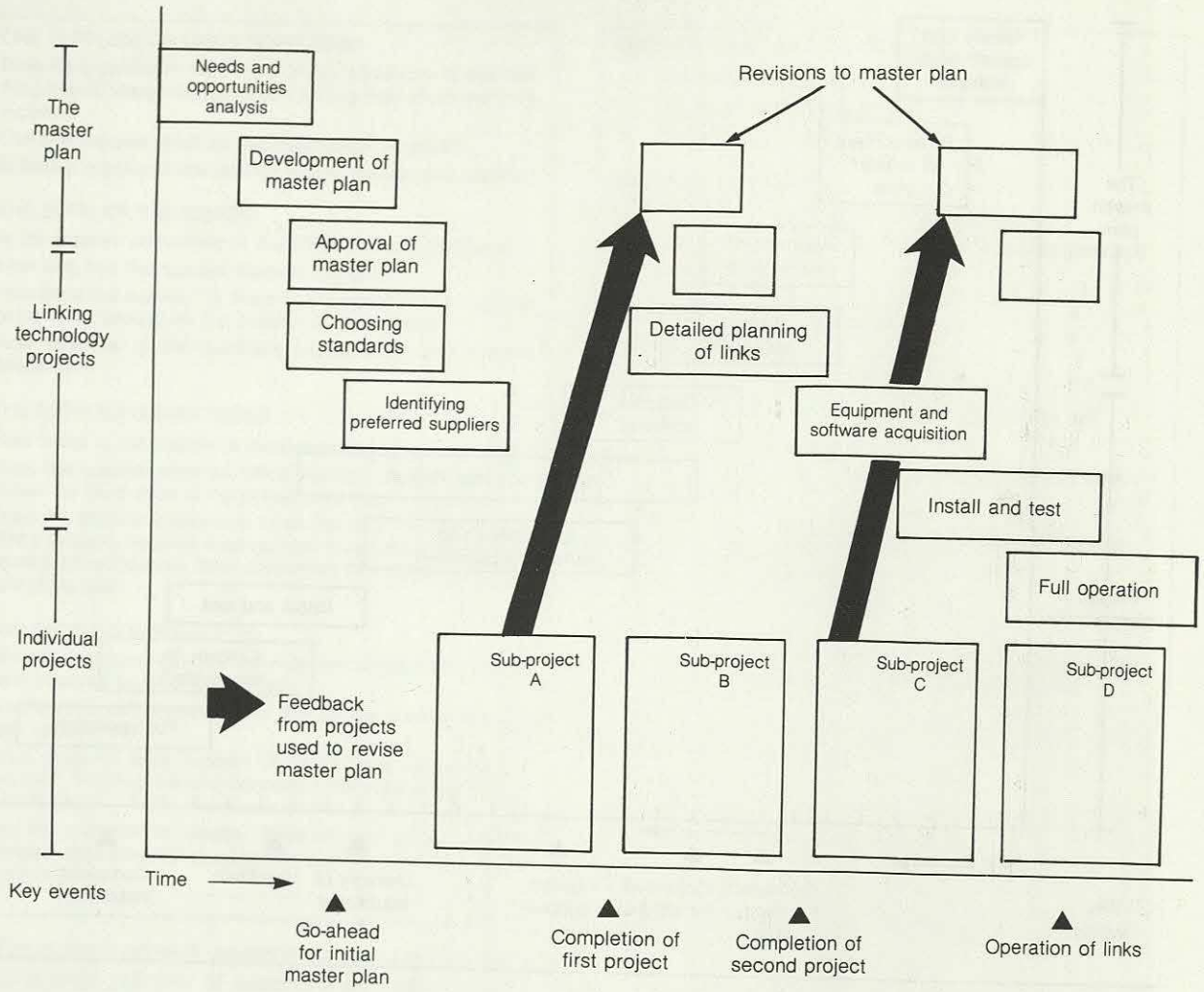
several sub-projects before agreement on all details of the master plan is reached. Figure 3.15 shows a parallel schedule of this type.

The difficulty with this approach is the risk of an early implementation that turns out to be a technological dead-end, or that is found to be inconsistent with the directions determined during development of the master plan. For these reasons, these early projects should be limited in scope, and a very short payback period should be specified.

Detailed implementation planning for the individual office projects or sub-projects is similar to that for traditional data processing projects. Project activities should be broken down to a sufficiently detailed level to enable progress to be tracked and responsibility assigned. As a rule of thumb, activities should not be broken down to less than about two weeks, or the equivalent of 10 working days. The following major activities and events should be planned and prepared for in some detail:

- —Definition of working procedures and methods.
- —Purchase, delivery, testing and installation of all equipment, software and communications facilities.
- —Physical installation and building changes.
- —Purchase of office furniture, supplies, and other miscellaneous smaller items.
- —Planning of the timescale for the work.
- —Assignment of responsibilities and reporting structure.
- —Budgets and expenditure control.
- —Criteria for assessment of the success of the project.
- —Provision of training and education.
- —Coordination with other departments, customers, data processing and so on.

Figure 3.15 A parallel approach to planning for a large office system project



The physical office environment

While complaints from office workers about the working environment in which their office systems are installed might be perceived as a symptom of their resentment of change, it is nonetheless true that the physical office environment is a major concern for many office staff and an issue periodically raised by unions and staff representatives. Our experience with users indicates quite conclusively that where the office system is perceived as being genuinely relevant to the task of the workers and where it helps them achieve their objectives, ergonomic considerations are seldom a problem. However, there are several main points that may need to be considered:

— ***Ergonomics***. An adequate working surface, adjustable equipment positioning and good seating are perhaps the three most important aspects of desktop ergonomics. The importance of these requirements is generally accepted for word processor operators and clerical staff. Managers and professionals are often forgotten, however.

— ***Air quality***. Air-conditioning is no longer the problem it once was as most office systems are fairly robust in this respect, although disk drives and printers can be sensitive to temperature and humidity changes. As a general rule, an office temperature of between 20°C and 22°C is advisable, with a maximum humidity of 50 per cent.

— ***Lighting***. Display terminals should be positioned so that glare or reflections from lighting and windows are avoided. Some glare shielding for lights and control over daylight (using curtains, blinds and so on) may be required.

— ***Noise***. Acoustic covers (cumbersome though they are) are essential for impact printers in offices. Laser printers are relatively noiseless.

— ***Space***. Proper space planning is probably the most important ergonomic factor in achieving success-

ful use and acceptance by users. Planning for space allocations, work-flow arrangements and associated furniture and equipment needs should be an important element of the detailed planning process within each project. The location of shared equipment, such as printers or facsimile machines, should be particularly carefully considered.

Wiring options for office systems

As the number of individual office workstations increases, the problem of office wiring becomes more and more acute. The main problems encountered by management are:

— ***Cost***. On some sites it can be as expensive to install and connect a new workstation as it is to buy one.

— ***Multiple networks***. Many organizations now have three (or more) data communications networks on a single site (eg ASCII, 3270, telex).

— ***Delay***. It often takes days or even weeks to install a new device or to move an old one.

Users therefore feel an increasing urgency for a universal wiring scheme that will enable them to support all their current and anticipated future office equipment at an acceptable cost.

Regrettably there is no such scheme. Instead there are four options:

— Twisted pair (shielded and unshielded).

— The IBM cabling scheme.

— Broadband cable.

— Ethernet-type systems and other proprietary local area networks.

A summary of the advantages and disadvantages of these technologies is given in Figure 3.16 and their characteristics are discussed below.

Twisted pair

Twisted-pair cable is the most common cable found in offices but it comes in a variety of forms. The cheapest is the unscreened cable used for telephones. For data, however, heavier and more expensive cables, often with shielding, are used. Twisted pair is a well-understood medium and has the great advantage that it is sometimes possible to use spare pairs on the telephone system, thus avoiding the need for new cable installation.

The twisted-pair medium has, however, several characteristic limitations:

— It is suitable for terminal support, but not for the resource sharing that may be needed between microcomputers.

— It cannot substitute for the coaxial cable used to support synchronous terminals.

— Voice and data are not integrated.

The IBM cabling scheme

In 1983 IBM announced a cabling scheme with the objective of providing a universal solution to the wiring problem. The scheme being promoted in the US provides, in a single jacket, wires for both data and telephony, with the option of including optical fibers as well. The scheme announced in Europe (and supplied, in the UK, by BICC) is based on cheaper cables and supports only data transmission.

However, the scheme is expensive. For example, a 250-outlet IBM cabling scheme network was installed at Carnegie-Mellon University, Pittsburgh, in 1983. The installation was technically successful but cost $400 per outlet. The University has calculated that it would cost between $7 million and $9 million to wire the whole campus and that 40 rooms would have to be used as wiring closets. As a consequence, it is currently reconsidering its commitment to the cabling scheme.

Figure 3.16 Comparison of local cabling options

Feature	*Telephone cable*	*Shielded twisted pair*	*IBM cabling scheme*	*Broadband*	*Ethernet*
Material costs	Low	Moderate	High	Low	Moderate
Labor costs	Low	Moderate	High	Low	Low
Can individual offices be pre-wired?	Yes	Yes	Yes	Yes	No
Do individual offices have to be pre-wired?	No	No	Yes	Yes	No
Terminal-to-host costs	Low	Low	Moderate	Moderate	High
Micro-network costs	n/a	Moderate (proprietary)	Moderate (Pronet)	Moderate	Moderate

Broadband cable

Broadband cable systems comprise a tree of coaxial cables, usually with frequency converters and network management equipment at the cable head-end. Major manufacturers such as General Motors have been installing broadband networks in their factories for 20 years and they have an established place in factory automation.

With careful planning, a broadband cable installation need not be expensive. One large UK organization quotes approximately $30 per office as the cost of wiring a modern office building. Once in place the cable can carry almost any mix of data, text, image, voice and video. Broadband cable is also the medium required to support IBM's new PC Network, a fact that will doubtless encourage many organizations to consider it more seriously. This requirement is having a similar effect on suppliers — Apple is now discussing support for the Macintosh with Sytek, the supplier of the IBM PC Network. Broadband systems do require fairly skillful planning and management, however.

Although the wiring and installation for a broadband system need not be expensive, the electronics often are. As a consequence, a broadband LAN is more expensive than a baseband system operating at the same speed and providing the same functions. However, under favorable conditions a broadband system may be cost-competitive with a switched twisted-pair network.

Ethernet

The greatest advantage of Ethernet is that it is now both a de jure and a de facto standard. There are now 200 suppliers, offering a wide range of products ranging from minicomputer interfaces to public network gateways. Thousands of Ethernets have now been installed worldwide. Against this background, the arguments about the relative advantages and disadvantages of the actual technology are of no consequence.

A majority of the installed Ethernets are used to support resource sharing between personal computers, and Ethernet is now the leading LAN for microcomputer networking. Ethernet is also a viable option for terminal support. Although badly matched in purely technological terms, there are now many successful terminal networks based on Ethernet.

Proprietary local area networks

In addition to the broadband and Ethernet LANs discussed above, there are proprietary LANs provided by a wide variety of suppliers. These products may be divided into two groups: those delivered as integral parts of an application system and those designed as communications products.

— Systems-based LANs

Systems-based LANs have been devised to support resource sharing between attached computers. These computers may be ordinary personal computers, or machines specialized for applications such as office automation or computerized design. They are thus a necessary, though often minor, part of the total computer system.

These LANs are often poorly designed from a communications viewpoint, with little thought having been given to wiring and management aspects. And they are almost all non-standard. However, despite this, they include some exciting technologies and form the basis of some very successful installations.

— Communications-based LANs

Communications-based LANs have been designed to support the terminals that have already been installed in user sites. They fall into two groups:

— Inexpensive systems which allow a small number of terminals to be connected in a limited area. These products can be very cost-effective, provided that their limitations are accepted.

— Highly functional, and expensive, systems which are usually well engineered, but are not often cost-effective.

Installation

The first installation of office systems facilities usually represents the beginning and not the end of the total undertaking. Even so, the installation is likely to be spread over weeks or even months.

The following activities will normally need to take place before the system is fully installed:

— Purchase and delivery of all office systems equipment and facilities.

— Purchase and delivery of all physical environment facilities (eg furniture, sundries).

— Purchase and delivery of other equipment such as communications equipment.

— Physical installation of infrastructure facilities (wiring, power, desks).

— Definition of timescales for installing the equipment and detailed allocation of responsibilities.

— Provision of training and educational facilities including the ordering/preparation of manuals.

— Modification of standard equipment or facilities, where required.

— Definition of working procedures.

— Testing of equipment and facilities.

The number of queries and problems is likely to be highest immediately after an office system has been implemented, and the training staff and analysts should be continuously available to provide help and advice during this period.

Office systems will usually be introduced in a phased manner, with the number of users increasing steadily with time. Such a phased implementation can cause either an initial lack of the required critical mass to make the systems really useful or an imbalance between related user groups. These effects should be recognized quickly, and suitable action should be taken to overcome the problems. One possibility is to hold a limited amount of equipment and facilities in reserve, so that unexpected imbalances can be overcome quickly. Holding some equipment in reserve may also be advisable in medium-sized or large installations so that a rapid response can be made to any equipment failures, particularly during the early stages of an implementation.

Training and education

Figure 3.17 provides a checklist of points to consider in drawing up plans for the training and educational activities associated with an office systems implementation.

Figure 3.17 Checklist — training and education

How much training will be provided by in-house staff and by the supplier?
How will on-going training of back-up and replacement staff be handled?
Who will conduct the in-house training and where will they be trained?
What range of training is required? How many need to be trained? When must training be completed?
What about user manuals and documentation? Are there existing in-house standards to be followed? How much tailoring of supplier manuals is required?
Will advanced users (who have adapted quickly to the facilities) be used as "experts" to provide support to other users, in an informal on-the-job advisory capacity?
How will "keyboard-resistant" staff and managers be encouraged to overcome their fears and prejudices?
How will day-to-day advisory support be provided once formal training is completed?

MANAGING THE HUMAN IMPACT OF TECHNOLOGICAL CHANGE

Our comments on planning up to now have concentrated on preparing the business case to be presented, on setting up a master plan to govern the on-going development of office systems, and on several specific aspects of planning. The human motivation side of planning is another important aspect to be considered. Office systems are more susceptible to problems in human motivation than traditional data processing because of the greater variety in the types of users and the often significant degree of discretion users have in deciding whether and how they will use the systems.

There is a school of thought that suggests involving employees at the initial planning and testing stages, to get early commitment from them. This is an attractive idea, but its success depends on the history and culture of the organization. It is not always the best approach, as staff may attempt to exploit the situation, taking advantage of minor problems to reject the new systems completely, before the systems have had a chance to prove their benefits.

Before going on to a description of the approach that we propose, it is helpful to consider briefly the shortcomings of traditional approaches to managing the human element of office systems implementation.

The shortcomings of traditional approaches

Essentially, the shortcomings of the traditional approaches result from their technical emphasis, and the imposition of the chosen solution upon the users. This manifests itself in several ways:

- —The designers put most effort into the technical aspects of the system, such as screen dialogues, communications protocols, performance prediction, and so on.
- —When deadlines are tight and corners have to be cut, the human aspects are often the last items in the planned list of activities that are considered. These activities are concerned with testing, training and other user-related tasks and, although last in planning lists, are essential to ultimate success.
- —Existing work organization and job content are not seriously challenged. Manual procedures in offices have a tendency to become more complex over time, and the exceptions that gave rise to the complexities in the first place have been long forgotten, while the procedures, forms and methods live on. The result is that the new systems are expected to fit the organization without any changes. Moreover, users often ask for 100 per cent automation, not realizing that automating the 20 per cent of the work that requires 80 per cent of the effort is often the best approach.
- —Systems are not consciously planned to provide feedback and to permit change if necessary. Plans are rigid and inflexible and only allow for one possible outcome.
- —Training and education are limited to one-way communication from designer to user.

Involving people in the process of change

Despite the shortcomings of the traditional approach, designers and planners have usually paid at least lip-service to involving "users" in the process of design and implementation. These "users" are normally the managers and supervisors in the offices concerned. But even where other types of employee are involved, this involvement has often just taken the form of interviews to ascertain out how the job is done today, not how the job is to be redesigned. This is perhaps an extreme view, but most managers will recognize the familiar elements of the traditional analyst's approach in this description.

We now know that effective technological change requires the involvement of those affected. Change then becomes something that they are part of, something that belongs to them, and something that they want to succeed. Small problems then become challenges, rather than insurmountable obstacles. The end-user will become a source of ideas rather than a source of complications. In practice, however, involving users is seldom easy:

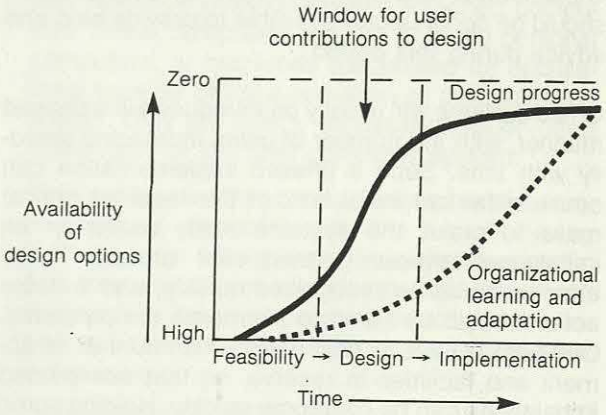
- —There are penalties to be paid in involving users, mainly in time and cost increases. The discussions take time, conflicts and disagreements need to be resolved, and everybody involved needs time to learn to work together positively and productively.
- —Users have a job to do, and working on planning a new system, however exciting and interesting, lessens the time they have to do their jobs, thus increasing the pressure on them.
- —The user organization's values may run counter to participative approaches of this kind. Not all supervisors and managers will be comfortable with a constructive approach to resolving difficulties that arise.
- —User expectations may be raised too high. Designers and planners may end up with a "wish-list" that is impossible to meet.

The short answer to these difficulties is that, despite them, user involvement is essential to the success of an office systems project and that new ways must be found to overcome them.

Two available approaches

There are two approaches that meet the requirements outlined for user involvement. The first is what might be called the participative approach, where end users and their managers and supervisors are included in the design process and in steering the progress of planning and implementation. The overall aim is to encourage users to participate throughout the design process, creating a "window" for user contributions to the design. This approach is illustrated in Figure 3.18.

Figure 3.18 Organizational learning in the typical participative approach



Main characteristics:

- Design process: phased (typically into feasibility, design and implementation).
- Design mechanisms: user participates at design-team and steering-group level.
- Organizational learning and adaptation processes: throughout the design process.

(Source: Adapted from K. D. Eason, *Behaviour and Information Technology*, April-June 1982)

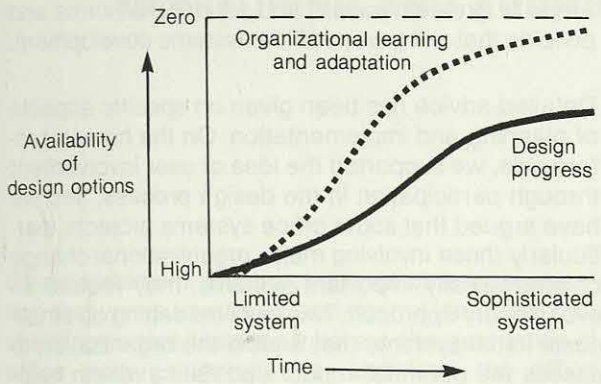
The second approach suggests that user involvement should extend beyond the participative approach described above and should also incorporate limited use of small-scale systems that provide a learning environment for users, whose experience is then fed back into the design process. This concept is illustrated in Figure 3.19. Learning is then an evolutionary process, as a series of individual projects allows the organization to reduce the options gradually, and home in on the right kind of system for its needs.

The approach that is adopted depends on the type of application being considered. We recommend the following guidelines for choosing between these two approaches:

For conventional (back-office) systems applications the degree of technological change demanded of the organization is not so great — and the impact on the organization may well be limited. The participative approach will function adequately in this context, and the involvement of users at this level should be sufficient to achieve commitment. Provided that the changes are explained in terms of what they are going to do for the organization and the benefits to the users, and by downplaying the technology aspects, it will be possible to motivate staff to *want* office systems.

Strategic or front-office systems, or systems that mean major changes in the way the business objectives are to be achieved and the nature of the work

Figure 3.19 Organizational learning in evolutionary systems development



Main characteristics:

- Design process: an evolutionary process preserving flexibility for change.
- Design mechanisms: regular feedback from users to design team.
- Organizational learning and adaptation processes: evolutionary and continuous.

Source: Adapted from K. D. Eason, *Behaviour and Information Technology*, April-June 1982

people do, will usually require the second, evolutionary approach. In this case the specific impact of the office systems themselves is unclear to most users. The organization not only wants to gain the commitment and involvement of users; it needs to find out what the systems are capable of, how they can best be used, how they fit in with existing systems, and so on. We therefore believe that the evolutionary approach can be an appropriate approach in this type of situation.

A word of warning, however. Trial systems and pilot systems can be used as an excuse to bypass normal business investment rules. The organization becomes gradually and unknowingly involved in a project that grows and grows, and it suddenly finds itself irrevocably committed, financially at least, to a major office systems project. Therefore, although the "learning" element in initial office systems projects needs to be acknowledged, such projects should have other, clear, objectives as well. They should be carefully controlled, have a clear start and end, be designed to achieve specific goals, be of short duration, and be evaluated formally so that the lessons can be learned and applied to subsequent projects.

GETTING STARTED — THE OFFICE SYSTEMS CONFERENCE

It is our intention that this section of our report should be as practical in flavor as possible, leading directly to improvements in the planning and implementation processes. If an individual manager or group of managers is enthusiastic about the proposed approach, how should the next steps be taken?

One possibility is to run an internal office systems seminar or conference. This is a device for focusing attention on the issues and presenting a range of options to decision makers. Suitably modified, this is a valuable starting point for even the smaller organization or for a department in a larger organization. The ground for such an internal meeting needs to be very carefully prepared, since otherwise the event may do more harm than good. Suppliers will, if requested, provide demonstration facilities. Outside consultants will provide a guest speaker if needed. But the host organization must retain full control of the event. Think through the objectives of the seminar carefully. What decisions (if any) need to be taken? Which attitudes need to be challenged? Which strengthened? Very careful preparation is required for such a meeting. In terms of internal public relations, it must be seen as a serious and systematic policy review, possibly leading to an important change in pace and direction.

There are two criteria by which the seriousness of the event will be judged. Does senior management, at an appropriate decision-making level, support and attend? And have the members of the team sponsoring the event (whether from MIS or elsewhere) put in sufficient preparatory effort? Those sponsoring the event should present clear, well-thought-out papers on the key topics, with good visual aids and summary notes handed out after the event. The papers sent

Figure 3.20 Draft agenda for internal office systems conference

Day	*Session*	*Speaker*	*Topic*
One	1	Top manager	Why this event matters
	2	Internal/external expert	New opportunities in OS
	3	Project leader	Where we stand today
	4	All (forum)	Unfulfilled needs/ competitive threats
	5	Planner	Towards better systems
	Evening		Demonstrations
Two	1	Project leader	The master plan
	2	Planner	The infrastructure plan
	3	Project leader	Benefits available: case studies and lessons learned
	4	Top manager	Where do we go from here?

out before the event should clearly indicate the scope and purpose of the event, but should not include masses of preparatory reading. It will not be read.

The role of the outside speaker is limited. An industry guru may do a useful job in raising awareness and widening horizons, but he or she will contribute little to establishing a base for new policies, just as a result of one talk.

Figure 3.20 sets out a draft agenda for a two-day seminar, which should be taken only as a starting point for adaptation.

SUMMARY

In this chapter we have described a flexible approach to planning the implementation of office systems. It is designed to provide room for growth and initiative at the individual office level. At the same time, through the mechanism of a master plan, as we have chosen to call it, the organization can focus its efforts on the areas of greatest payoff, and set out the norms and policies that will govern office systems development.

Detailed advice has been given on specific aspects of planning and implementation. On the human factors side, we supported the idea of user involvement through participation in the design process, and we have argued that some office systems projects, particularly those involving major organizational change or strategically important systems, may require an evolutionary approach. This involves setting up small-scale initial systems that enable the organization to assess the potential impact and fulfil a role in helping people in the organization to learn about the technology, to come to terms with it and to use it effectively.

CHAPTER 4

MONITORING AND AUDITING THE USE OF OFFICE SYSTEMS

Office systems present a challenge to any organization that wants to monitor and control their use. This challenge arises from the inherent characteristics of office systems themselves, and from the office environment in which they operate:

—Because office systems are distributed on desktops throughout the organization, responsibility for their efficient operation tends to be diffused.

—Office systems costs include a large fixed component, and as a result management attention tends to be focused on the acquisition costs.

—Except in large-scale clerical operations (such as those in banks and insurance companies) work measurement and predetermined work standards are rare in offices. Versatility is encouraged, and the organizational relationships are more dynamic than they would be in a factory, for example. Therefore any measurement is more difficult, and the results limited in applicability.

—Office system users, particularly managers and professional users, have a good deal of discretion in when and how they use a system.

This chapter presents an approach that takes these characteristics into account and suggests how monitoring and control methods can be applied to existing office system installations.

In this context, we also consider the task of the internal auditor who is given the task of evaluating management's performance with regard to office systems, and the type of audit criteria that might be applied.

It should be emphasized that in many instances comprehensive methods are not required and there may be a danger of using overmeasurement as a substitute for clear, well-defined objectives. Setting clear objectives and measuring a limited but relevant set of criteria is important despite the fact that for most user organizations, the use of office systems is still in its early stages. But this very newness of office systems makes it all the more important to learn from any experience gained already, however limited.

THE PROBLEM OF CONTROLLING OFFICE SYSTEMS

Controlling the acquisition process and work measurement are both valid approaches to controlling office systems, but they do not fully address all the control requirements normally specified by management, namely:

—Effectiveness

—Efficiency

—Economic acquisition

These requirements are illustrated in Figure 4.1 and summarized below, together with the control methods appropriate to each.

Effectiveness

Effectiveness is concerned with the contribution of the office systems to the goals of the organization. Does the system meet its objectives? Is the value received consistent with the cost of the system investment?

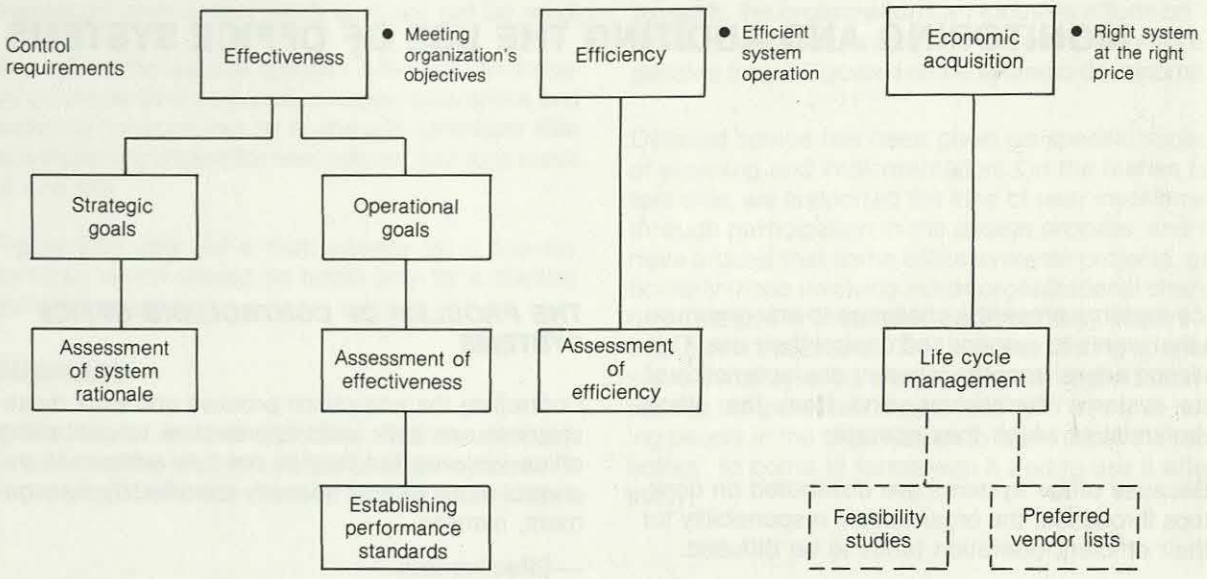
The control requirements for effectiveness can be subdivided into two groups: strategic goals and operational goals, as illustrated in Figure 4.1. The strategic goals are the business goals to which the system is to contribute: increased share of a customer's orders, improved clerical productivity, and so on. The operational goals are related to more immediate system parameters such as the backlog of documents for word processing, electronic mail messages sent/received and time spent on different system tasks.

The control methods for effectiveness are:

—*Assessment of system rationale:* A periodic review that examines the basic rationale for the continuing existence of the system in relation to the strategic goals set by the organization.

—*Assessment of effectiveness:* This form of assessment, which may be periodic or on-going, monitors the performance of the system. Performance standards need to be established for this purpose. These will be baseline standards, established ideally when the system was first installed,

Figure 4.1 Relationship of control methods to management's control requirements



or subsequently, by reference to other systems or to published standards.

Efficiency

This requirement is concerned with the efficiency of the system. Could the same results be achieved at lower cost? Is the system properly utilized?

The control method here, *assessment of efficiency* of office systems' operation, is concerned with access to the system (are some of the workstations underutilized?), with system operational practices (backup of files, hours of operation), and with the cost and effectiveness of maintenance services, technical support, training, and so on.

Economic acquisition

Economic acquisition requires correct management of the office system life cycle, and acquisition of equipment, software and related services under terms and conditions favorable to the user organization. Is the need for the system clearly identified, and are the specifications defined in such a way that the acquired system will meet user needs in an economical manner? Is the maintenance service cost-effective?

The appropriate control method is *life cycle management*. This is an on-going process that begins with the initial identification of the need for a system and ends with disposal of the system at the end of its useful life. Current management practice focuses on two aspects of life cycle management, the feasibility study (which establishes the economic and technical justification for the system) and preferred vendor lists (which is the visible part of a policy that seeks to ensure compatibility between systems, and to simplify and improve the purchasing procedures for office systems). We have shown these in dotted boxes in Figure 4.1.

Each of the control methods is described in detail in the following sections.

ASSESSMENT OF SYSTEM RATIONALE — BALANCING COST AGAINST VALUE

In this type of assessment a general view of the system is taken, in an attempt to decide if the benefits received are worth the cost to the organization. Figure 4.2 summarizes the issues involved and the basic questions to be asked.

This type of assessment is usually carried out periodically, and may be triggered in a number of ways. A reorganization, replacement of obsolete equipment, a cost-cutting exercise, new management — these are all circumstances that may lead to the re-examination of the basic rationale for the continuing existence of the system.

In many ways, this kind of exercise can be looked at as a 'reverse planning' exercise. In Chapter 3 we described in some detail the steps required to prepare an office systems plan. These steps included the identification of potential opportunities and the development of the supporting business case. Here, the system is already in place. We are attempting to

Figure 4.2 System rationale issues

Type of issues	*Basic assessment questions*
Systems rationale (Is the value received worth the cost?)	Are the original reasons for the system still valid? Are the results achieved by the system consistent with the original intentions and the intended impacts and effects?
Impacts (What results have been achieved?)	What has happened as a result of installing the system? Does it duplicate, overlap or work at cross-purposes with other systems?
Goals achievement (Has the system performed as expected?)	Did the system meet its original objectives?
Alternatives (Is there some different approach that is less costly or better for doing the job?)	Are there more cost-effective alternative systems? Is there a non-systems alternative?

Figure 4.3 Steps in conducting an assessment of system rationale

1. Understand the system and the environment in which it operates.
2. Identify the purposes of the assessment and the factors which have triggered it; identify the intended users of any recommendations.
3. Establish the assessment criteria.
4. Determine the measures to be used, the data available, and the need for any additional data collection.
5. Collect data, and summarize and analyze the results of comparisons and assessments.
6. Examine alternatives to the system.
7. Formulate conclusions, qualify these in terms of the conditions that limit their applicability, and discuss and review the conclusions with the users.
8. Develop recommendations.

construct a business case that will either justify the continued existence of the system or suggest an alternative, should the result of our assessment be unfavorable.

The steps involved in an assessment of this type are listed in Figure 4.3. It should be emphasized that the concern of this assessment is not with current operational practices, but with questioning whether the whole effect of the system is beneficial. The reason there is less concern with detailed improvements but that if the whole operation is questionable, then its day-to-day efficiency (no matter how high) is irrelevant. And if an alternative is to be adopted, the existing procedures may be superseded in any case.

The steps involved in the assessment are described in more detail below.

Understanding the system

The first step is developing a good understanding of the system and the office environment in which it operates. This process involves (a) identifying the background and general structure of the system, (b) checking the general consistency of the system with its objectives, (c) determining the relationships between the system and the business results it is intended to produce, and (d) confirming these details with the responsible manager(s).

Identifying the purposes of the assessment

The users, the purposes and the triggering factors for the assessment all influence the focus of the work. For example, some users may require a greater level of precision and more tangible evidence of the results than others.

Establishing the assessment criteria

Ideally this step should comprise two stages. In the first stage the concerns expressed by the various users or recipients of the assessment results, as they relate to the value of the system and its cost to the organization, are translated into specific criteria. In the second stage these criteria are discussed with the users so that priorities can be assigned and the relative importance of the criteria established.

Determining the measures to be used

At this point the way the contribution of the system is to be assessed needs to be determined. If the original purpose was to, say, increase the success rate of customer quotations, or to reduce the effort required to produce monthly statistical reports, then the need is to know how results can be measured, or in the absence of direct measures, what proxy measures can be used. The latter may take the form of operational measures (eg time now taken to turn around a quotation, compared to the pre-system conditions) if the impact on the business is too difficult to measure, or where a direct cause-and-effect relationship between the system and its intended effect is too difficult to establish. If such data are not readily available, then a data collection program may need to be set up. This will usually take the form of a "snapshot" of the current performance and costs. In the absence of any norms or previously established standards (and this is a typical situation), the performance will have to be assessed against current needs.

Analyzing the information

Once the information has been collected and any additional survey completed, it must be analyzed to provide answers to the questions addressed by the assessment.

This analysis may include the following types of issue:

— Describing the office workers and sites included.

— Referring to the sources of information used and their reliability.

— Specifying the assessment criteria, which might be in tangible or intangible terms.

— Relating the system to the impact it has achieved (intended or unintended) and to its original goals.

— Estimating the effects of the system and its value.

— Identifying the reasons for the effects achieved (or the failure to achieve effects).

— Relating the costs to the value received from the system.

— Generalizing the results to the total set of workstations/systems, if only a sample was looked at in detail.

Examining alternatives
Where the balance of cost and value is unfavorable, alternatives need to be identified. Specific questions that need to be considered here include:

— Can the system be eliminated altogether?

— Does it do more than is necessary for its basic purpose?

— Are the standards achieved really necessary?

— Could the system be replaced by an external service or be combined with a system elsewhere in the organization?

— Does the system duplicate an activity carried out elsewhere?

Formulating conclusions
The results of the assessment are assembled and documented. They are reviewed and discussed with the users of the assessment.

Developing recommendations
The typical assessment of system rationale provides recommendations for further action where necessary. In particular, a study of the effectiveness of system operations may be suggested. This is the subject of the next section.

ASSESSMENT OF EFFECTIVENESS

The assessment of effectiveness is designed to determine how well the operational goals of the system are being met. Any assessment of effectiveness and productivity will be concerned with performance measurement and with establishing performance standards.

As a general rule, the scale of benefits expected should considerably exceed the cost of undertaking the assessment of effectiveness, which can be substantial.

Steps to be followed in assessing effectiveness

The steps in the assessment follow a logical pattern, but it must be emphasized they may lead to setting up permanent systems for measuring performance, and they may therefore represent an on-going commitment. The steps are summarized below; Figure 4.4 illustrates the relationship of these steps.

Understanding the system
The system's role in the user organization is clarified. The organizational relationships and paper flow are documented. Forms and sample inputs and outputs are collected.

Establishing the operational goals
User goals are identified and translated into operational goals. These are verified against the original system objectives.

Determining which operations to measure and what parameters to use
A choice of measures is made which best reflect the operational goals. This means deciding what operations shall be measured and identifying units of work that can easily be counted. Figure 4.5 provides a sample of parameters that could be used.

Selecting a standard
A standard is required for each operation. Service levels, productivity and quality control all require that norms be established. Where such norms were not established at the time the system was set up, there are two choices available: Predetermined standards can be used (based on data for several hundred offices that provide standards for typical office operations — these have been developed by several office systems consultants), or standards based on estimates or post-production measurements can be used (this requires that a baseline study be made to accumulate performance data).

Collecting performance data
Survey forms and interviews are used to collect performance data for each of the parameters. The size of the sample and the length of time over which data are collected depend on the reliability required and the scope of the assessment.

Setting up a reporting system
Supervisors of large operations may want a continuing means of measuring how well staff are performing against the standards, or compared with previous periods. This requires regular production reports normally limited to a few key parameters. This will not be required in all cases.

Figure 4.4 Assessing the effectiveness of an office system

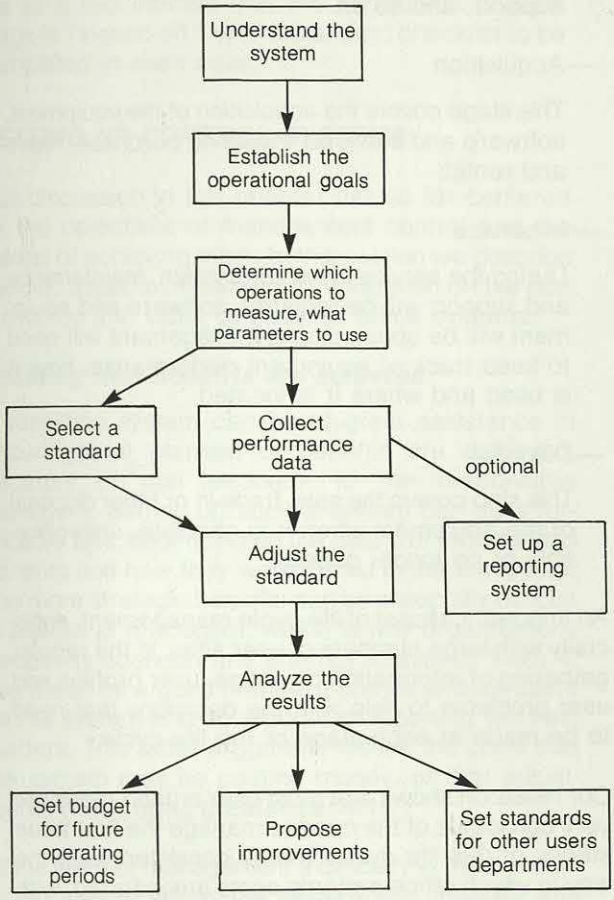


Figure 4.5 Sample parameters of office systems effectiveness

Productivity
- Hours worked per activity
- Documents completed
- Requests for information handled
- Number of records processed
- Revisions to spreadsheet file
- Client contacts in period
- Overtime worked
- Idle times

Service levels
- Work backlogs, work in process at key points
- Time to process transactions
- Hours of the day when service provided
- Ratio of worst delay to average delay
- Time to handle priority cases

Quality control
- Number of recycled transactions
- Proportion of spot-checked transactions
- Number of spot-checked transactions with errors
- Complaints received

Adjusting the standard

Before using the standard, allowances need to be made for personal time and other variations peculiar to the office or organization being measured.

Analyzing the results

The result of an analysis of performance data and of standard performance levels are assessed. Significant differences are analyzed in detail so that explanations for variances can be prepared. Actual details of the analysis will vary with the operational goals and parameters used. Three subsequent steps may follow.

—Setting targets for future operating periods. The results of the assessment can be used to set targets for future operating periods, either to maintain existing performance or to improve performance.

—Proposing improvements. Detailed analysis may reveal ways in which the system could be improved, either through new equipment and software or by changing user procedures.

—Setting standards for other users or departments. The assessment provides the basis for new or revized standards. These can be used for planning purposes or for assessing other users and departments.

ASSESSMENT OF EFFICIENCY

The emphasis of an assessment of office system efficiency will be on:

—The cost and effectiveness of support services.

—The efficiency of operational practices.

—The provision of access to the system.

The benefits are not likely to be major in terms of financial savings, but improvements could affect effectiveness quite significantly.

Actual levels of equipment utilization are frequently a secondary issue in assessing the efficiency of office systems, unlike the data processing environment, where this is a major concern.

The issues typically to be considered when assessing office system efficiency are listed in Figure 4.6.

LIFE CYCLE MANAGEMENT

Any individual office system can be considered to have a life cycle consisting of five stages, as illustrated in Figure 4.7. Each of these stages must be properly managed, and decisions must be supported by good information if value is to be obtained when

Figure 4.6 Checklist — Points to consider in reviewing system efficiency

Support services
Are systems adequately documented?
What are the training policies for new staff?
What maintenance services are provided?
Is technical support available to users?
Are tests made of new software packages before distribution to users?
What is the cost of support services?
Could it be reduced?
Is the level of support services consistent with real user needs?

Operational practices
Are file back-up procedures in place?
Have security needs been addressed?
What arrangements have been made for emergency repair, or provision of replacement equipment?
Is equipment insured?

Provision of system access
Are there sufficient workstations to meet user needs?
Are they convenient to user work locations?
What are the hours of operation for common services (electronic mail, voice mail, and so on)?
What about access to printers, other peripherals?
Are there superfluous workstations?
Could alternative access be provided at less cost?

acquiring equipment and software. Each of these stages is described below.

—Definition of needs

The basic need for the system should be clearly defined in terms of what it is going to do for the organization. The level of the need must also be defined (how many offices will be affected, for instance).

—Specifications

The specifications translate the needs into a description of the system that is required to meet those needs. They define how many workstations will be required, where they will be located, the software (standard and nonstandard), on-going support, and so on.

—Acquisition

This stage covers the acquisition of the equipment, software and services, including purchase, lease and rental.

—In-service

During the service life of the system, maintenance and support will be required, software and equipment will be updated, and management will need to keep track of equipment performance, how it is used and where it is located.

—Disposal

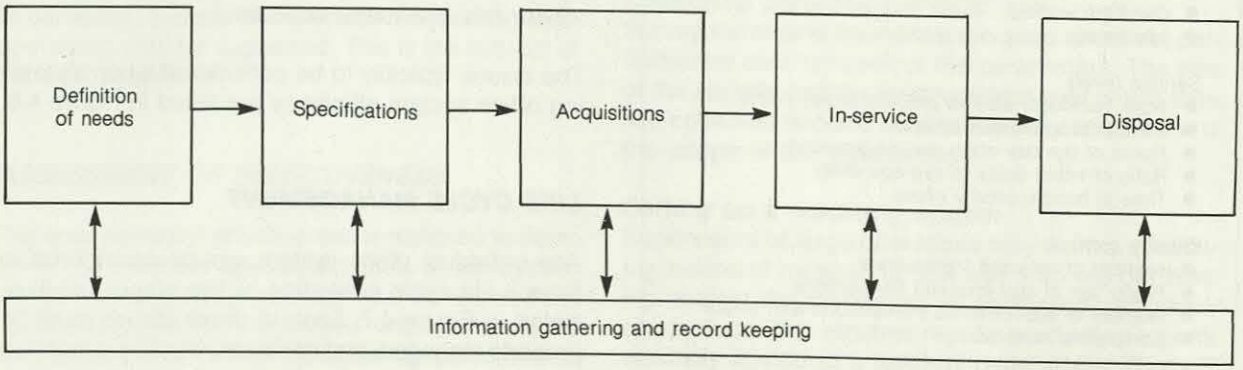
This step covers the sale, trade-in or other disposal of the equipment when it is obsolete, unserviceable or no longer needed.

An important aspect of life-cycle management, especially with large numbers of user sites, is the regular gathering of information on usage, user profiles and user problems to help with the decisions that need to be made at each stage of the life cycle.

Our research shows that most user organizations are very conscious of the need to manage the first three stages of this life cycle. This is consistent with the way in which office systems costs are incurred, with a high fixed cost at the acquisition stage. The areas most in need of attention are the provision of repair and maintenance services, and keeping records of the performance and utilization of systems, particularly personal computer-based systems.

How can control be exercized effectively over the system life cycle? The answer is straightforward: the organization needs to recognize the existence of the stages we have described, and to take steps to

Figure 4.7 Life cycle of office systems



ensure that procedures are in place to govern the management of each stage. These could be as simple as a requirement that the conclusion of each stage is "signed-off," with a standard checklist to be completed in each case.

SETTING UP CONTROL SYSTEMS

Our discussion in this chapter has so far centered on the objectives of management control and the means of achieving them. In this section we describe specific aspects of gathering information on the performance and value of installed office systems.

Ensuring that benefits are achieved

A reporting system can be of great assistance in ensuring that planned-for benefits are achieved, because of the feedback to the responsible managers. Setting up such a system can be a formidable task, depending on the nature of the intended benefits and how they were stated in the first place. The more strategic benefits can be especially difficult to assess in retrospect, which is why organizations frequently abandon any attempt to assess them. It might also be argued that the money is already spent on the system and no amount of reporting will help matters. This latter argument misses the point that the system may be costing money, or that adjustments might bring greater benefits.

At the heart of management's difficulty in these cases is the way in which the system was justified and planned in the first place. If the prime system benefit was stated in such general terms as "improving customer service levels," then management faces a difficult task indeed. A proxy, or substitute measure such as "number of messages sent/received via the electronic mail system" would be more readily assessable. Therefore, the answer lies in expressing the system objectives in precise terms. These will not always be measurable in a strict numerical sense, but should certainly be visible, or capable of being assessed, even if only subjectively.

The manager seeking to set up a reporting system to ensure that benefits are being achieved has two options (which may both be applied):

- Periodic surveys of (say) customers or staff to determine whether improvements have been observed in the target areas. These surveys can be on a sample, and can ask respondents to rate the results using a scale. By compiling the results and comparing the results for each period, the responsible managers can determine if the planned-for benefits are being achieved.
- Direct measurement of results or, where appropriate, use of an operational measure such as work backlogs.
- Formal performance measurement exercises. As an example, we illustrate in Figure 4.8 the steps that are normally undertaken where an external team carries out the study. In this case measurement is concerned with secretarial and clerical activities. The range of data collection methods that may be used is shown in Figure 4.9 and the results that may be achieved are described in Figure 4.10. Such a study would normally lead to recommendations for remedial action and might lead to major changes in the system or its replacement.

Quality control

Quality control is normally intended to control the incidence of errors. For example, in office paperwork there are several ways in which errors can arise. The frequency of occurrence will vary, and there may be a question about exactly what constitutes an error in a particular office operation. For example, the impact of spelling errors might be relatively minor in an invoice, whereas a numerical error might be very significant indeed.

There are three parts to any effort to control quality:

- A decision must be made on what is to be checked. This poses a question of the impact of errors. If the impact of errors is very great then a large sample (perhaps even 100 per cent) needs to be checked. Few quality control reviews cover 100 per cent of the items processed, and a sample is nearly always used.
- Work needs to be spot-checked. This is normally done by the supervisor, in accordance with a predetermined frequency.
- A formal quality audit of work may be carried out, usually by the internal auditor or the organization-and-methods group. If financial records are involved, the external auditors may audit a transaction sample and review system controls.

The need for quality control can be much reduced in an office systems environment, particularly for applications that involve numerical data. By designing appropriate transaction controls into the system (eg using batch controls) errors in key fields can be detected upon input. The system could maintain price lists and customer address details, reducing the possibility of error. Such controls are commonplace in data processing systems.

Because office systems are not always formally designed in the same way as data processing systems, managers should be sensitive to the possible lack of these controls and the consequent potential for error. For example, clerical staff may use a microcomputer-based data management package (such as dBase II) to maintain records about clients.

Figure 4.8 Carrying out a sample study of office system performance

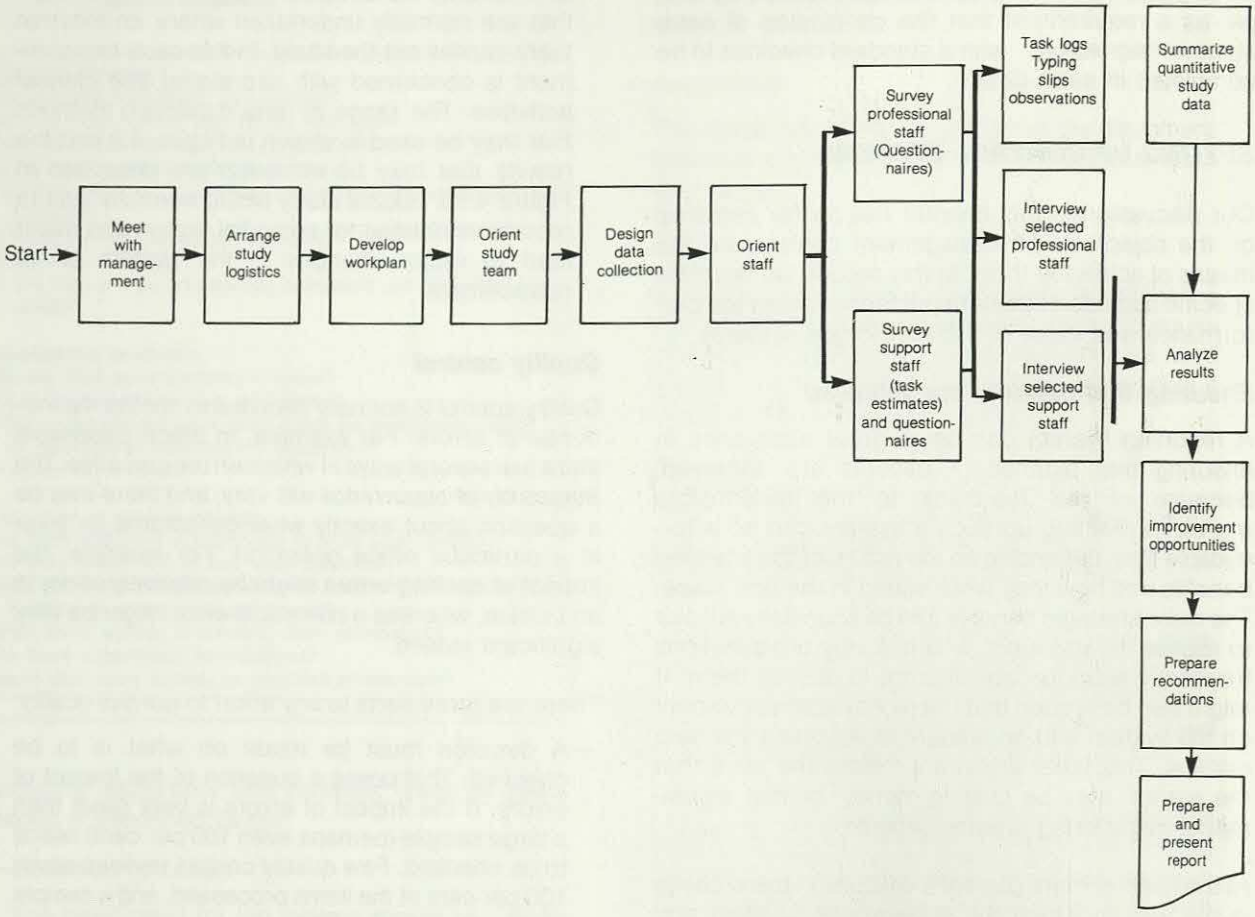


Figure 4.9 Summary of forms used in a typical performance measurement

Use	*Name*	*Purpose*	*Completed by*	*Frequency*
Data collection	Principal questionnaire	Obtains qualifiable and quantifiable data regarding the services provided by secretaries and clerical staff	Professionals	One time
	Secretarial/ clerical staff questionnaire	Solicits secretaries and clerical staff observations and comments about their daily work activities	Secretaries/ clerical staff	One time
	Task estimate sheet	Determines, a priori, how the secretaries and clerical staff estimate their workweek is spent	"	One time
	Daily task log	Records time spent on tasks each day	"	Daily
	Typing slip	Records time, volume, priority, document type, and input source of all typed material for establishing document profile and productivity	"	Daily for each document typed
	Observation sheet	Records observed activity of secretaries and clerical staff according to established schedule	Study team	Daily
	Interview guides	Provide a standard structure for obtaining specific information from interviews with secretaries, supervisory staff	"	Each interview
Tabulation	Summary sheets	Data submitted by survey participants for summarization and tabulation	"	

Figure 4.10 Typical results of a performance measurement study

- *Staffing allocations and costs:* derived from salary and staff information provided by the department liaisons. Other target areas analyzed/developed from this information could be:
  - — Overall department support costs
  - — Professional-to-secretary and clerical staff ratio
  - — Cost per professional
  - — Average annual salary
  - — Profile of permanent/temporary help.
- *Distribution of secretarial and clerical staff time:* derived from the daily task logs. Staff equivalents and costs for the distribution of time are derived by analyzing/comparing staff costs with time distribution. In addition, the following subject areas are highlighted under this heading:
  - — Breakdown of activities, eg, clerical, secretarial, document production, other, etc, and definitions
  - — Unit costs by activity
  - — Allocation of staff by time distribution (number of workers by activity).
- *Professional/secretarial and clerical staff time estimates:* derived from the task estimate sections of the staff questionnaires. This can be used to compare staff estimates to actual distribution of time from daily task logs. Also included under this heading are:
  - — Comparison of task logs and estimates
  - — Professional/secretarial perception of how time is spent
  - — Agreement/disagreement and validation of task log data
  - — Any perceptions which directly apply from interviews.
- *Service levels:* derived from the task logs. Typical areas that would be highlighted are:
  - — Backlog of work (average, daily variations)
  - — Turnaround time to respond to external requests for information, and to complete support tasks (e.g., typing). This will be classified by type of work and priorities.
- *Profile of typed documents:* derived from a typing slip summary. It provides an overview of all documents produced. It is used to assess:
  - — Turnaround requirements (from professional questionnaires)
  - — Volumes of high/standard/low priority work
  - — Satisfaction with typing support (from questionnaires)
- *Observed distribution of time:* derived from an observation summary. It provides observations on time distribution and identifies idle/away from desk time. Areas under this heading would include:
  - — Cost of away from desk/idle time
  - — Validation of results from task logs.

The only verification may be visual inspection of the screen as information is entered, or an inspection of a printout of the file contents. Spot checks by a supervisor may therefore be desirable so that the likelihood of errors can be assessed, and reduced.

Policies and procedures and their limitations

The institution of organizational policies and procedures is designed to set out the ground rules for certain aspects of the management of office systems. Thus, one of the most frequently used such policies we found in the course of research was the use of preferred vendor lists. The intention of the organization in this case is usually to enable office systems to be mutually compatible. For example, a policy we have frequently encountered prescribes that only personal computers compatible with the IBM Personal Computer may be acquired. To ensure that such a policy is carried out, the purchasing department may have instructions to review all purchase orders, and to refer purchase orders for other types of personal computer to the MIS manager. This procedure is designed to implement one component of the organization's office system policies.

The use of formal procedures is well suited to ensuring that system life cycle management is effective, particularly in the early stages of needs identification, specification of the equipment, and acquisition. Later stages of the life cycle are less visible, and any procedures are correspondingly difficult to enforce.

On the question of effectiveness and efficiency controls, formal procedures can be used to specify the circumstances under which assessments will take place and their frequency and scope.

There are, however, limitations in the use of such procedures:

- —They are applicable only to certain aspects of the control of office systems, as we explained above.
- —Procedures depend on cooperation in all parts of the organization, and their effectiveness may well be highly dependent on the status and power of the department that issues them or is responsible for seeing that they are enforced.
- —The procedures may be seen by departmental managers as conflicting with their own objectives. With office systems, individual expenditures on items such as personal computers can be relatively small. Therefore departmental managers may decide to bypass normal purchasing procedures to achieve an immediate short-term objective.
- —Management is usually aware that there is a risk that general policies concerning the effective use of applications or the economical acquisition of office systems may result in specific procedures that are counterproductive if rigorously applied in every circumstance. Unfortunately, the response to this problem tends to lead to bureaucracy by making the procedure more complex, with various exceptions and eventualities taken care of by subclauses, footnotes, and so on.

The use of budgets for control

A budget is a specific plan of action against which progress can be measured over the period the budget

applies to. The focus of the budget is on the cost of the office system rather than on the results.

However, it is possible, by dividing up the costs by project or by program, to determine how costs are being incurred, and to use cost targets for these items as a means of control. In reality this will only work fairly if all office expenses (including staff) are included in the budget and the cost calculations. Thus, the impact of the office system on total office costs can be assessed. If certain goals are associated with different office system projects, progress towards these goals can be assessed, usually qualitatively, providing input for a management decision on the value received.

Figure 4.11 shows two examples of such a budget. One of the projects shown in the example is document production. A target for monthly costs is set at the beginning of the budget period, and in the first example, these costs have been exceeded. However, the "results" column shows that two-thirds of documents are being turned around in less than one day, which provides management with feedback on the results achieved in non-monetary terms.

The key rationale behind the use of budgets for control purposes is that a budget focuses on costs. If some of the desired results can be expressed in the same terms (e.g. staff savings and expense reductions), then this is very helpful. However, simply categorising costs into meaningful line items can help by making these items more visible. Management is then in a better position to examine what has been achieved.

As an alternative, an office system budget can be used in conjunction with work measurement, with the work items set out as targets to be achieved (usually in terms of volumes to be processed), as in item B in Figure 4.11. Cost may not even be included in this case.

ISSUES FOR THE INTERNAL AUDITOR

In this last section we consider the issues facing the internal auditor (or external consultant) who is to review the management of office systems in a user organization.

Such audits are commonplace in the data processing environment. Top management relies on an internal audit to verify the effectiveness of internal controls and the reliability of data processing results. This role is a logical extension of the internal auditor's traditional role. However, the job of the internal auditor has changed. Internal auditors can no longer audit "around the computer" because so many of the controls that ensure the accuracy and completeness of data processing are built into the systems and cannot be viewed and verified through direct observation. Many organizations now routinely involve internal auditors in the design and evaluation of these data processing systems and controls and standard approaches and techniques have been evolved for this purpose. Auditors (and their management consulting offshoots) typically rely on computer audit specialists to advise organizations in these matters.

Many computer audit techniques are directly applicable to office systems, particularly where numerical data or accounting data are to be processed. Because of the packaged nature of most office systems applications, controls cannot be readily built into the systems themselves, and reliance may have to be placed on controls incorporated in manual procedures.

Figure 4.11 Example of a project or program budget

Item	*Current month*			*Year to date*			*Results Achieved*
	Budget	*Actual*	*Over (Under)*	*Budget*	*Actual*	*Over (Under)*	
Projects/Programs							
A. Document production	$10000	$11500	$1500	$50000	$58000	$8000	— 2/3rds of documents turned around in less than 1 day.
B. Monthly sales reports	$3000	$2500	($500)	$15000	$12500	($2500)	— Ready by third working day etc.
. . . other items							
Total							

The internal auditor's work in this area can be summarized as the appraisal of checks and controls used in office systems for processing financial data.

These are the *processing controls*, and the classic statement of audit objectives is as follows:

—To ensure the completeness of data processed by the system.

—To ensure the accuracy of data processed by the system.

—To ensure that all data processed by the system are authorized.

—To ensure the adequacy of audit trails.

Internal audit departments have also traditionally checked many other aspects of the organization's activities, which are neither strictly financial nor connected with the assets of the organization in the accounting system. Therefore the financial/accounting audit may be a prelude to formulating a case for reorganization, or it may follow a major reorganization to determine whether the sought-for benefits have been achieved. Such an audit typically includes:

—Checks on the effectiveness of managers.

—Checks on their compliance with company or professional standards.

—Evaluation of the reliability of management data.

—Evaluation of the quality of performance of duties.

—Recommendations for improvements.

This type of examination is variously called a management audit, an administration audit or an operations audit.

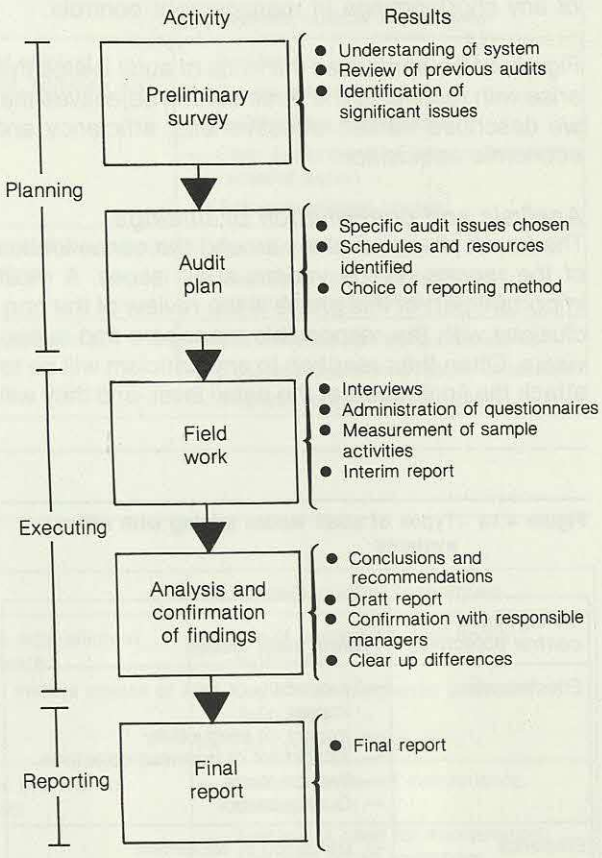
A recent development of this type of audit has achieved prominence in public sector organizations. This is known as the "value-for-money audit," and in very simplistic terms, it can be described as the public sector's substitute for a profit-and-loss sheet, because it attempts to assess directly the management of the organization.

The ideas behind value-for-money auditing are applicable to office systems for this very reason, in that it can be difficult to draw up a profit-and-loss sheet for the office system. Therefore the audit approach we describe here draws extensively on the concepts of value-for-money auditing. Our emphasis is on the audit of management and administration of the office systems.

Phases of an office systems audit

The overall audit of the office system described here consists of five phases. Figure 4.12 illustrates these five phases and the results of each phase.

Figure 4.12 Phases of an office systems audit



Preliminary survey
The first phase of the audit is the preliminary survey. This is intended to produce an understanding of the office system objectives, working methods and procedures, any previous reviews and audits, and the financial and organizational aspects (costs, users, documentation, manager responsible, technical support, and so on). The survey results in a summary of the main audit issues, their scope, and their relative importance. These issues are the criteria that will be used to judge whether the office system is being managed properly.

Audit plan
The audit plan sets out the detailed approach to examining the audit issues. The scope of the audit examination has been narrowed down at this point and all subsequent effort should concentrate on the specific audit issues. The audit plan specifies tasks, schedules, interviewees, sampling schemes, and dates and choice of reporting method.

Field work
In the third phase, the members of the audit team examine the issues selected. Typically, the audit team is working to gather evidence to support any

comments that will be made at the reporting stage, and to further clarify the audit issues and the impact of any shortcomings in management controls.

Figure 4.13 summarizes the kinds of audit issues that arise with respect to the three control objectives that we described earlier: effectiveness, efficiency and economic acquisition.

Analysis and confirmation of findings

The fourth phase revolves around the consolidation of the reports on the various audit issues. A most important part of this phase is the review of the conclusions with the responsible managers and supervisors. Often their reaction to any criticism will be to attack the final report at the detail level, and they will (quite naturally and legitimately) use any errors of fact to invalidate the overall findings. Thus it is essential to meet this problem head-on by ensuring that the basic facts are right before the final report is prepared. The managers who are being criticized may well still disagree with the conclusions drawn from the evidence, but at least the evidence will not be in dispute.

Final report

This phase includes the final presentation of the audit findings and recommendations for any remedial action. It will also include any follow-on work required to respond to the comments of the person or persons who commissioned the audit (usually top management).

Figure 4.13 Types of audit issues arising with office systems

Management control objectives	*Typical audit issues*
Effectiveness	— Availability of data to assess system impact — Impact on productivity — Attainment of business objectives — Service levels — Quality control
Efficiency	— Utilization of equipment — Back-up procedures — Access to equipment — Time taken to effect repairs, remedy software problems
Economic acquisition	— Management of the system life cycle — Definition of why the system is needed — How suppliers are selected — Provision of training and maintenance

Control techniques

It is perhaps stating the obvious to say that the auditor is concerned with learning lessons from what has happened rather than with pointing the finger at the guilty. If, for example, there are surplus microcomputers in the offices of the organization, the auditor will be concerned to find out why this has happened. It could be that the original need was overstated (in which case the planning procedures may need to be corrected) or that there has been a reorganization (in which case the equipment should have been identified as surplus and offered to other departments or otherwise disposed of).

In short, the auditor is concerned with the control techniques being used to ensure that the control objectives are being met. Although specific audit issues will vary from organization to organization, in Figures 4.14 to 4.17 we provide guideline lists. These cover the three areas of control objectives discussed — effectiveness, efficiency and economic acquisition, and a fourth which we have called management of office systems, covering planning and organizational issues.

Figure 4.14 Audit issues — effectiveness

Audit issues	*Control objectives*	*Appropriate control techniques*
Effective office systems	— To ensure that office systems meet the needs of the organization	— Specifications documented and signed-off — Liaison with users throughout development and implementation — Periodic review of office systems already installed
System rationale	— To ensure that office systems are only installed where justified by the relative costs and benefits involved	— Cost-benefit analysis of office system proposals — Management review of proposals

Figure 4.15 Audit issues — efficiency

Audit issues	*Control objectives*	*Appropriate control techniques*
Operating practices	— To ensure reliable and efficient operation of equipment, software and telecommunications	— Problem log — Configuration control — Maintenance procedures — Clear assignment of responsibilities for remedial action — Software change control
Quality assurance	— To maintain quality control over output, files, procedures, back-up	— Periodic review of system controls — Quality control responsibilities assigned to an individual/group
End-user operations	— To ensure effective operation of systems by end-users	— Documented operating procedures — Technical assistance readily accessible — Training courses for end-users

Figure 4.16 Audit issues — economic acquisition

Audit issues	*Control objectives*	*Appropriate control techniques*
Equipment and software	— To ensure economic acquisition of equipment and software	— Use of competitive bids and/or negotiation — Use of bulk purchases to obtain discounts — Life cycle management
Maintenance	— To ensure economic provision of maintenance services	— Periodic review of maintenance contracts — Analysis of need for maintenance contracts for all equipment
Support services (training, consultants, etc)	— To ensure economic provision of support services	— Specification of work in terms of results to be achieved — Use of fixed-price contracts
Telecommunications services	— To ensure economic provision of telecommunications	— Periodic review of telecommunication needs and service contracts

Figure 4.17 Audit issues — management of office systems

Audit issues	*Control objectives*	*Appropriate control techniques*
Office systems planning	— To ensure that plans are in place — To provide criteria for selecting projects	— Long-term plans — Office system investment criteria
Organization of office systems support	— To provide adequate resources	— Office systems budgets included in departmental budgets — Support skills requirements periodically assessed
Office systems administration	— To provide control over projects and visibility of office systems costs	— Costing system — Personnel time reporting and allocation
Office systems standards	— To ensure that effective methods are followed in the development, implementation and operation of office systems	— Formalized project management process — Documented policies
Audit and evaluation	— To ensure periodic assessment of office systems activities	— Post facto audit of new systems — Periodic reviews

CHAPTER 5

THE USER EXPERIENCE — OFFICE SYSTEMS IN PRACTICE

In this chapter we present a selection of case histories of user experiences with office systems.

The chapter comprises four sections. First, we summarise the lessons that can be learned from the experiences of the users whose case histories are described in the remainder of the chapter. In the first set of case histories we describe how the use of office systems has evolved in leading-edge organizations, and how the management structure has developed in parallel. We then consider case histories that shed light on the issue of benefits and the associated problems of benefit measurement. And finally, we focus on the area of applications in the communications area, where much current new development and thinking is taking place.

This chapter contains thirteen case studies and a report on a national government's program to encourage innovation in offices. Some overall lessons emerge.

Progress involves change
Organizations may need to change both current policies and management responsibilities to achieve controlled progress in the office.

In the early stages of development, departmental managers and staff set the pace in developing new systems. They also accept responsibility for the costs and benefits. As this process gathers momentum in different departments, the level of aggregate cost and the risks of proliferating, incompatible sub-systems both become obvious. One crucial lesson from our case studies is that management action to deal with this problem needs to be early, decisive and firm. In most cases the task of generating the necessary policies is given to the MIS or DP function.

Users need support
In all but the most insignificant implementations, users need support groups. This support may be much more basic and fundamental than is often supposed. Ad hoc support teams are still used, but increasing use is made of information center personnel.

Progress takes longer than expected
The process by which managers and staff absorb systems and make them their own is complex and much more time-consuming than systems people expect. Managers and professionals often have discretion over what they actually use, and cannot easily be hurried or harried. In some installations we have studied, fast-track methods have been tried. Large numbers of devices are deployed on desktops. In the evidence we have collected, there is no basis for concluding that such "technology-push" methods achieve faster results than the "user-pull" approach.

Cost displacement is irrelevant to some applications
We have demonstrated that different kinds of office system applications generate radically different cost-benefit patterns. It therefore follows that no single yardstick of cost-benefit appraisal is useful in every case. Applications with a specific functional target, such as word processing or document production, usually fall into the back-office category. They often produce clearly identified cost reductions.

In other application areas, such as electronic mail, tangible cost savings have been harder to pinpoint and may in any case be somewhat irrelevant to the main purpose. Certain savings may be achieved by reduced use of traditional telex, telephone or facsimile. But the real benefits of electronic mail lie elsewhere, in such fields as better decision-making or faster response to clients.

Communication is a big problem
The inherent incompatibilities of hardware and software — not only between different suppliers but also within one supplier's product range — become apparent when they are to be linked.

The most widespread tactic to deal with linkage problems is to limit, by means of approved supplier lists, the number of vendors whose products can be acquired. But even where such lists are created and respected, communications problems still arise. The continued growth of the office systems market depends more heavily upon the availability of adequate communication facilities than upon any other product factor.

Every answer creates new questions
Once embarked upon the hunt for profitable office systems, user organizations find that the trail is never-ending. A proportion of the planning team's time needs, therefore, to be devoted to scanning a very distant horizon. Short-term actions need, as far as possible, to ease rather than obstruct transition to longer-term objectives. Even a dim perception of the distant goals is better than none.

Believe only half the promises
Not all technical solutions are equal to the task. Suppliers still overreach themselves and fail to deliver as promised. The technical capabilities required within the customer's organization in order to make progress are still considerable, and are designed to compensate for skills lacking in the suppliers' repertoire.

There is no universal solution
No single method of planning, developing and implementing office systems is right for all cases. The individual enterprise, with its own organization, markets, products and culture, faces problems which are distinctive to itself. Nevertheless, a planning framework (such as that described in Chapter 3) can form the nucleus of a successful approach.

THE EVOLUTION OF OFFICE SYSTEMS IN LEADING-EDGE ORGANIZATIONS

In this section we present case histories that show how office systems applications evolve and how the organization's policies and management structures develop to meet the changing circumstances. The applications described here are encountered in many organizations, but each organization has its own approach. We first present three contrasting approaches to strategy development: a formal office systems strategy, a multilevel strategy and a user-pull strategy.

A formal office systems strategy — Pilkington Brothers

This case study illustrates how a formal strategy can be used to guide the development of office systems.

The head office of Pilkington Brothers plc is at St Helens, Merseyside, UK. The main business activities are the manufacture of glass and associated products. The major operating divisions are Pilkington Glass Ltd (including Triplex Safety Glass and Flat Glass), Fibreglass Insulation, Fibreglass Reinforcements, Opthalmic and Electro-Optical. The Electro-optical division includes Leenshire Ltd (Winchester), suppliers of color display and process systems products, while Pilkington Fibreoptic Technology (St Asaph) manufactures optical fiber cable and electronic interfaces.

In early 1982 Pilkington, having monitored new product developments for a year, published a strategy for company office automation. The key features of the strategy included:

- —A building block approach, giving each department flexibility to progress according to its needs and resources.
- —The use of standard products, eg word processors, facsimile and videotex, that do not need programming, customizing or large specialist support functions.
- —Avoidance of reliance on any one manufacturer.
- —The use of shared resources, such as electronic filing.
- —The use of local area networks for communicating within and between groups.

Essentially, the strategy was designed to enable management in the divisions to take responsibility for the development of their own office systems.

One of the first steps was to set up working groups and management groups within each department, as well as central resources. A central Office Systems Development Unit was created, to provide day-to-day guidance and assistance in evaluating, selecting and installing equipment.

Development of current office system applications
The major current system under implementation is the Datapoint ARCNET Local Area Network (LAN) in the headquarters of Pilkington Glass Ltd at St. Helens. Pilkington have been developing and using office system facilities for a number of years and in September 1984 Pilkington Glass began the implementation of an integrated LAN with a whole range of networked applications, such as personal computing services, word processing, electronic messaging and mail, information retrieval, telex, interlinking personal computers and electronic communications with other information sources and locations.

The development of the system is broadly divided into the provision of two distinct facilities. One is the network of shared personal computing resources with each individual workstation providing for the requirements of individual users. The other is the provision of stand-alone micros and applications packages where the main requirement is for powerful "desk top" computing by accountants, planners, etc, but linked to the network resource for occasional use; information retrieval, messaging, and so on.

The networked facilities encompass access to both shared spreadsheet-type applications software and to corporate data residing on the mainframe systems. The users' requirements vary considerably both in

type of information and in the method of presentation. The Chief Executive, for example, has indicated that he would like access to seven graphical representations of the company's performance as his principal control information. Providing that information from mainframe databases and programs presents difficult problems of data manipulation and transfer to the network.

Software such as Focus has proved to be a productivity tool of immense power, enabling exchange programs to be completed, in some cases, in just two hours.

The office systems team continues to work closely with the users to determine the specific design requirements and most appropriate on-line access to corporate data: for example, snapshots of pages of data versus the downloading of file segments.

Factors which have contributed to success

Pilkington Glass regards the office automation project as a major success within the systems development program. They attribute this success to a series of factors:

—Organization: The project has benefited from a desire for total involvement and control by the headquarters management team. This desire has led to the formation of a Pilkington Glass Limited Office Automation Steering Committee under the chairmanship of the Personnel Director and involving management from the related user departments. Technical and implementation support was provided by the Office Systems Development Unit and other specialist functions of the Group Management Services Department.

—Requirements definition: The next key factor was the methodology and attention to detail given to the requirements definition. The methodology was designed and implemented by the office systems team. It comprised a requirements survey which was divided according to job function, that is, secretarial, professional, manager or executive support. The output of the requirements specification was a fully documented account of the functionalities of the system indicating the user priorities. This was broken down to the most appropriate technology that Pilkington considered met the business need. The users were able to make a significant contribution to the technology selection, because of a major effort by the office systems team to inform and to "market" internally the technologies available. They believe that supplier demonstrations would not have brought about the same success due to an implicit disbelief of suppliers' claims related to their own products.

—Selection of equipment: The final factor that made a significant impact was the structured approach taken in the equipment selection procedure. It was felt that the majority of office systems selections were supplier driven, rather than requirements driven. The office systems team was able to measure each facility against the supplier's solution. They began with nine manufacturers and performed an exercise related to "must meet" criteria such as function and usability. Finally, the remaining suppliers made both technical and user-oriented presentations to the office systems team and Divisional Committees respectively. This resulted in the selection of the Datapoint ARCNET solution.

The system has been costed in two phases. Phase I, which is already implemented and includes 24 workstations cost approximately $160,000 and is aimed predominantly at the secretarial/typing functions in order to establish an "electronic culture" within the organization. It does however include selected "pilot" management and professional users.

The second phase scheduled for installation in the current year will comprise a further 30 workstations of varying capability across the range of users.

The justification for Phase I was based on a planned benefits return of $60,000 per annum. One typical example of the kind of savings planned was the decentralization of the telex function which should result in a saving of $20,000 per annum. Further hard cash savings are achievable from word processing productivity and the avoidance of central bureau facilities for "overflow" work.

A half-year audit has recently been carried out (using questionnaires to all current users) resulting in favorable indicators of actual and potential achievement. The total savings are not achievable until sufficient workstations are installed (critical mass) and all the office system facilities are being effectively used.

The company agreed upon a set of management objectives that would act as a yardstick for measuring both quantifiable and unquantifiable returns from office system projects. Office systems is now consciously being applied to achieve the following:

—To expand the effective office location to include home, hotel or customer's office.

—To make facilities available for 24 hours rather than eight hours a day.

—To permit high-speed access to information held on computer files, rather than in locked filing cabinets.

—To make better use of executive management resources by automating the routine functions; this

allows these users to spend more of their time on work that directly affects the business.

—To improve communications, response to customer queries, management control information upwards, and decision support information.

—To provide a better understanding of available options, allowing time to experiment with variables to reach improved decisions.

Cost benefits in the above areas have not been measured but there is confidence that the project will make a significant contribution to each of the objectives. Phase II will permit a better quantification and qualification of these benefits.

The experience gained in Phase I has identified the type of problems that can arise. Some are specific to the office system project, others of a more general nature. For example:

—The complexity of mainframe-network information transfer was underestimated.

—The time needed to train users to a sufficiently high level to benefit from the new facilities was also underestimated.

—Finally, the analysis of the existing environment was insufficient both in terms of method and physical ergonomic factors eg noise and space factors.

To maximize the return from the office system facilities a critical mass of users is needed. For instance, the electronic mail facility will not be used until sufficient numbers of workstations are installed. This will occur during Phase II of the office systems project.

A multi-level strategy — Chase Manhattan Bank

This case study describes how a major office systems user set up different levels of planning and decision-making, consistent with the scope of the office systems involved.

With 36,000 employees and $81 billion of assets, Chase Manhattan is the third largest bank in the US. It has over 300 branches, 50 major international subsidiaries and 600 correspondent bankers.

In 1979, Chase Manhattan made a commitment to develop its office automation arena to the extent that in 1983, it invested $40 million in office automation.

By October 1982, Chase Manhattan had developed a strategy which described office automation as "a means to an end, the end being a streamlined and improved business environment. People, information and resources are clearly the core resources for Chase office work."

The first issue to be addressed was whether to centralize or decentralize office systems decision-making. The company resolved this issue by developing an innovative tier-system approach, which directly involved individuals contemplating automation of their departments. It was structured as follows:

—Tier 1: Projects needing a corporate-wide strategy and corporate-level implementation.

—Tier 2: Projects needing corporate-wide strategy, but which are implemented at the sector level, eg arranging access to databases.

—Tier 3: Projects needing only corporate guidelines and standards, with their implementation accomplished independently by the user sectors, eg individual professional workstations.

This approach provided the foundation for widespread and rapid office systems penetration in the bank.

Chase Manhattan considered several areas to be crucial to success, including:

—Interpersonal communications.

—Executive, professional and administrative support.

—Environmental and human factors.

—Networking access.

The company also placed a great emphasis on projects that provided the earliest productivity gains, namely:

—Expanding administrative support.

—Developing an electronic mail system with a high level of penetration among users.

—Tailoring executive support to unique business needs.

Today Chase Manhattan's office system base is substantial. It embraces both Wang and IBM systems, with 1,700-2,000 personal computers from these suppliers; a Wang OIS and a Wang VS; a Wang Mailway electronic mail system with 3,000-4,000 mailboxes; and a Wang network.

Four areas in particular are worthy of note: word processing, electronic mail, videoconferencing and personal computing.

Word processing

Originally the precursor to Chase Manhattan's office systems effort, the word processing system is the second largest Wang system in the US. The word processing program is now complete.

Electronic mail

Chase Manhattan installed electronic mail facilities to overcome communications problems between Chase's overseas operations, especially the

US-Europe link. Originally the bank used a pouch mail system with a four-day turnaround period. The present system, based on Wang's Mailway electronic mail package, provides overnight turnaround. The electronic mail strategy is 30 to 40 per cent completed with 3000 to 4000 mailboxes in place, some of which are used by more than one person. For example, in smaller subsidiaries, such as in Sweden, 12 to 15 people share one mailbox.

Videoconferencing

The company has invested a lot of effort in investigating the potential of videoconferencing. This technology was extremely expensive, however, at $500,000 per room in 1983. According to Chase Manhattan, it is not really a technology where there is room for experimentation, because of the high costs involved.

The project did not go ahead as planned in 1983 because:

— The cost of $1 million for two rooms was perceived as being too high.

— The executives who use videoconferencing are at a higher level than, for example, those who use electronic mail. Videoconferencing would have required changes in the way in which the bank carries out its business at this level, and consequently a great deal of detailed planning was required that could not be undertaken at the time.

In the last two years, however, the bank has begun to understand these issues much better. Also, costs of this technology have dropped. As a result, the bank is again investigating its use.

Personal computing

The bank was well placed for the 1984 personal computer boom. It developed a "Computer Store", which had the task of installing recommended personal computers in user sites and providing service only for these.

At first, selected key staff from each sector were given a demonstration of the personal computers and a range of software packages.

Since Chase is large in size and buying power, personal computer suppliers were able to grant volume discounts. Also, by buying in volume the bank was able to channel the interest of its staff into the personal computers it wished to support, rather than allowing its employees to buy any of the wide range of potentially incompatible units. Today, Chase Manhattan has 1,700 to 2,000 personal computers installed.

Chase Manhattan is now looking at integrated voice/data terminals, has made some investment in voice store-and-forward systems, and has established a local area network linking four of the bank's downtown Manhattan facilities.

A "user-pull" strategy — Lederle Laboratories

This case study illustrates how a user organization relied on "user pull" to develop its office systems facilities, and describes an interesting voice-mail application.

Lederle Laboratories, located in Pearl River, New York, is a manufacturer of pharmaceuticals and over-the-counter drug products. With revenues of nearly $1 billion, it is the largest subsidiary of American Cyanamid. Approximately 4000 people are employed at the Pearl River site, with roughly 1000 of them involved in office work.

Lederle's Medical Research Division (MRD) has led the corporation in computer technology and applications ever since 1977, when it bought a Digital mainframe and a five VAX super-minicomputers. In 1978 MRD bought DECMATES for its word processing center. The early 1980s saw the widespread adoption of desktop microcomputers in the division, as these became commercially available and desirable.

The personal computer influx allowed end users to develop their own applications. But it soon became clear that the personal computer spread held the potential for unnecessary duplication — of both information and processing resources. A mechanism was needed for central control of information systems, that would at the same time allow the business groups autonomy to develop and implement their own office system applications.

Lederle's response to managing the proliferation of personal computers is indicative of the company's philosophy, and reflects how the company has since organized to meet its information requirements. The corporate Information Services group issued vendor-of-choice lists for personal computers and word processors. These included the vendors with whom Lederle was already doing business; microcomputers that could interface with the installed base of equipment; and the names of vendors who could reasonably be expected to remain in business after the expected shakeout in personal computer manufacture. The lists included IBM, Digital and Hewlett-Packard for personal computers and IBM, Digital, Micom, Wang and Xerox for word processors. The list for personal computers has since been amended to include Wang and Compaq.

In 1981, management consultants were retained to conduct a strategic planning study for information systems within the Cyanamid Group. This study helped to initiate the thrust toward further decentralizing Information Services (IS) functions. Each of

Cyanamid's business groups was given its own IS group, who had responsibility for implementing its own programs. Central control for IS planning and administration was placed in the corporate IS group. An office automation committee was established in 1982, consisting of members from Information Services and some end users.

No single body has responsibility for the full range of office automation activities and applications at Lederle. Telex and facsimile services are provided through a corporate services wire room, while print and photographic services are handled through a corporate service center. The company has not yet integrated data and voice systems, but it plans to introduce digital switching for voice and data communications in the near future.

Like many organizations, Lederle has had to reexamine its approach to providing office services in the light of technological developments. In the case of word processing, an office services group, reporting to the company's manufacturing arm, has traditionally maintained responsibility for typewriters and "general-purpose office equipment." Yet the development of high-level electronic typewriters has blurred the distinction between these devices and word processors, which fall into the domain of the corporate Information Services group. To clarify the distinction, Lederle has adopted the policy that all typewriters with communicating capabilities should be considered word processors.

This provides a sensible criterion for distinguishing between components that can and those that cannot be linked to office systems. However, because purchase orders for different types of typewriters are sent to different offices, there is still the potential for uncoordinated equipment purchases. Lederle has established a document management advisory committee to help resolve these issues.

Generally, the decentralized approach to office systems has worked well for Lederle, especially in the research areas, where end users and Information Systems staff work together developing and testing new applications. At present Lederle uses a variety of office systems, including an automated project management system, a word processing center with two satellite systems, distributed word processing and personal computing, electronic mail and computer-assisted information retrieval. Preliminary trials have been conducted in new applications such as voice mail and local area networking.

Voice mail applications

Pharmaceutical companies have been leading users of voice mail, especially in field sales, where traveling agents need good links with their base. In September 1983, Lederle conducted a pilot study in voice mail. Users were provided with access to a time-sharing service through their standard pushbutton telephones.

Each user has a voice mailbox, which can send, receive, reply to and redirect voice messages. Messages may be sent with a single call to one voice mailbox at time or to a group of voice mailboxes. When a user receives voice messages, he has the option of discarding them, saving them, replying immediately or redirecting them to others who may need the information.

The users have responded in various ways to the voice-mail system. The field sales support staff was highly enthusiastic about the system. These agents had previously relied on telephone and written messages for communications with their home office, with delays resulting from "telephone tag." Voice mail allowed them to keep informed without reducing time spent on sales activities. Clinical field agents were equally positive about the application, which they used for communicating between hospitals or universities where clinical studies were being conducted and the Pearl River research offices.

Outside the field sales and clinical area, however, user response to voice mail at Lederle was more restrained. Since about half of Lederle's income is derived from international sales, MRD relies on a high volume of international communications. These are currently handled through long-distance telephone communications, written messages sent by special couriers and electronic mail (using Tymnet and VAC-Mail). Voice mail has not yet been linked to international telephone systems, which limits its applicability for this group.

Even so, Lederle's information system management hopes to bring the voice-mail system in-house, because of the applications success in the clinical and field sales areas. The IS staff is also exploring the possibility of linking voice mail to the PBX, once the company upgrades from their current AT&T Dimension to digital switching.

ASSESSING AND SUPPORTING USER NEEDS

The three preceding case studies described how organizations adapt their strategy to meet their needs for control and management of office systems development. Equally important is the establishment of user needs and the provision of effective user support for development. Organizations are increasingly looking to their MIS/DP departments to provide this support.

A favored channel for support is the Information Center, and we have chosen case studies of Gulf

Research and Development and the Midland Bank Group to illustrate how this form of support works. But we begin by describing how the Netherlands government approached the problem of establishing user needs.

Establishing user needs — Netherlands Government

This case study describes how a user participation method was applied to the identification of office system user needs. Office systems present unique problems for the analyst, as standard data analysis techniques used by systems analysts for data processing applications are not always readily applicable. One of the reasons for this is that office systems handle both text and data (and in some instances, voice and graphics, too). Another reason is that the functions performed by office workers are often ill-defined and involve a certain amount of discretion on their part as to how the functions of the job are carried out. This case study describes how the Dutch government has approached the issue.

In the Netherlands, the Ministerie van Binnenlandse Zaken (Ministry of the Interior) is responsible for automation throughout the Government. The ministry is involved in coordinating information technology as well as being responsible for operating two large computer centers. Initial efforts in the office systems area were undertaken on a pilot basis, the objective being to transfer experience and systems to other areas, once the pilot efforts were complete.

One major project was the development of a specially designed system for document handling, a major activity in many larger public sector organizations, as well as in large private sector organizations which have wide dealings with the public, such as insurance companies.

To give an idea of the scale of the project, about 6000 letters are received daily by the Ministry of Housing and Physical Planning, and a budget of about $6 million was established for the project.

The pilot project, which was called DOCSYST, was undertaken by the Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of Housing and Physical Planning). A major supplier (Philips) was involved in the project, as well as the Ministry of the Interior.

The scope of the document handling system was quite broad:

— Registration of incoming and outgoing mail.

— Document production.

— Document transfer.

— Document archiving.

— Management of text production.

The basic approach to analyzing user requirements involved the setting-up of working groups for each class of application. These included one or two systems analysts and a representative group of office workers familiar with the requirements. The forum for development of the user needs was a series of short courses and the simplified definitions of the requirements were employed. The latter was done in such a way that the resulting requirements definition could be applied to other organizations subsequently — that is, the requirements definitions had to be kept general.

The main findings were:

— User participation worked very well in defining the functional needs, but not much more than that. Many of the details and technical issues still need to be resolved, especially the question of how systems will be inter-linked.

— The user participation resulted in a critical look at all aspects of their work and resulted in improvements not directly related to the system.

— It is virtually impossible to foresee the time that will be taken by users to understand and learn; this made it difficult to plan activities in which users were involved.

— Problems of internal rivalry emerged, as some users were better than others at this type of work, and at taking advantage of the system facilities.

— The user's everyday tasks still needed to be undertaken in parallel with their work on the working groups, and this created conflicts in priorities.

Gulf Research and Development Company

Gulf Research and Development Company (Gulf R&D) in Pennsylvania, is the wholly-owned research and development company of Gulf Oil, which recently merged with Chevron.

The company employs over 1000 people, around 70 per cent of whom are professionals — engineers, geologists and other scientists. The microcomputer population is almost as large, with 1000 mostly IBM Personal Computers and plug-compatibles. Some of the micros are front-end dedicated terminals for Hewlett-Packard (HP) machines; the staff use these for specialist research. The personal computers are configured on a Sytek local area network and terminals link in via IBM's System Network Architecture (SNA). About 90 to 95 percent of the personal computers are linked by a gateway to mainframes.

Responsibilities of the Information Center

Gulf R&D's Research Information Center was set up

in 1980. About two-and-a-half years later it introduced personal computers to the company and started developing an office systems strategy. The Information Center also supports an in-house time-sharing service.

The Information Center was started as a group of seven people — a small and self-sufficient group, intentionally so. The group acts as a rather democratic advisor: users put their business case forward to their own managers, and the Information Center provides technical advice and approval (or veto on technical grounds).

In December 1983, there were only 100 personal computers, one-tenth of the number installed today. With an IBM-HP policy, there is now only a sprinkling of other manufacturers' equipment. The most commonly used software packages are Lotus 1-2-3, WP and dBase II. Gulf R&D has installed IBM's Professional Office System (PROFS), which incorporates an electronic mail facility.

Midland Bank Group

The Midland Bank Group is one of the principal commercial banks in the UK. The group has almost 50,000 employees in the Midland Bank plc and almost 20,000 in other companies. As a group it has invested heavily in telecommunications and computing to provide improved service to customers — corporate, personal and international — as well as achieving greater operating efficiency and lower costs. A notable example has been the development of its own voice and data telecommunications network: MIDNET is a private fully integrated digital network for voice and data. It supports banking and other Group networking requirements, both in the UK and internationally via gateways.

Midland Bank Group recognized the need to treat word processors, standalone microcomputers and mainframe personal computing tools as one user facility. A section called "Personal Computing" was set up to manage this area. Personal Computing deals with personal computers and other means of providing computing facilities to managers, professionals and other end-users within the Midland Bank. Its role is that traditionally associated with an information center but it also provides users with a service called "Microguide" created in late 1982. Microguide is designed to:

- —Give advice and guidance to users.
- —Develop packages and models as required by users.
- —Produce new policy statements on hardware and operating systems.
- —Consider and prepare for the implications of microcomputers for users.

The size of the Microguide support group is quite modest. It started with one staff member and expanded to four plus an external consultant within two years.

Essentially, Personal Computing is organized along the lines of the products and technology supported, with a distinction made between the mainframe data access, microcomputers and their associated software tools, and the provision of electronic mail services through local office system clusters (based on Burroughs equipment) and via international services.

ACHIEVING BENEFITS

In this section we describe three case histories of organizations whose experience sheds light on the issue of where and how the benefits of office systems can be achieved and measured.

Productivity in document production — Westinghouse Electric Corporation

This case study illustrates how in-house publishing techniques made a major difference in productivity and speeded up revisions and changes to technical documentation.

The Technical Data and Training Systems Department of Westinghouse Electric Corporation produces 250 technical manuals each year. These support advanced weapons systems and other high-technology products, primarily for the US Department of Defense.

Until 1984 the manuals were prepared in a highly labor-intensive fashion: engineers prepared handwritten manuscripts, which were then passed on to other employees for production — typing, editing, illustrating, proofreading and so on. These 200,000 pages annually involved over 250 people.

A major problem was that the work took place at the same time as the products were developed. As a result, product engineering changes often forced major revision of the manuals. In addition, specification guidelines laid down by the US Department of Defense needed to be adhered to. For these reasons technical changes were introduced in 1984 to automate the production of manuals, and the department installed Xerox (8010) Star Information Systems and Xerox laser printers. The systems are linked through an Ethernet local area network.

Several factors contributed to the decision to automate:

—The need to reduce the number of staff involved in preparing documents.

—The need to incorporate engineering changes quickly into the text and still meet schedules.

—The requirement to produce text and graphics on one system.

—The need for both authors and editors to edit text and graphics on an ongoing basis.

—The desire to remain competitive both by improving product quality and by satisfying customers' long-term needs.

Westinghouse required professional workstations, with sufficient capacity for the high volume of production and with sophisticated graphics and text software.

A pilot trial was carried out in two phases. First a basic system was tested in a controlled research environment. The results were satisfactory, and the trial was extended with 22 Xerox Star systems. These proved highly successful and the rest of the department was equipped in subsequent phases.

At the time of writing the Technical Data and Training Systems Department had 57 Star systems, with around 80 more on order for the near future. (This will be the equivalent of one Star unit for every three engineers.) Three separate Ethernets have been set up, and there is little downtime — the system is available 99 per cent of the time.

The Westinghouse engineers are mostly well satisfied with their system. Oddly, the older engineers were the first to become enthusiastic.

The benefits of the Westinghouse department's automation are seen as follows:

—A reduction in manual activities and staff overhead.

—Major productivity improvements, measured in pages produced per employee. The company expected only six per cent improvement; the actual improvement is an impressive 40 per cent, which will save millions of dollars over the next five years.

—Seventy per cent of all graphics can now be produced on the system, with another 30 per cent coming from a sophisticated CAD system, which is merged into the Xerox network.

—Paper flow is much easier to control. Revisions can be made easily, as the author records all changes and is much helped by a global word search capability.

According to Westinghouse, a systematic, structured approach was the key to success. The team had carefully planned the shift to automation — the activities, timeframes and any ramifications. An integral part of this plan was the phased introduction of equipment and a steady monitoring of each phase. Another key factor was the selection of hardware that was right for their particular requirements. Finally, standardized approaches at all stages were another major factor for success.

Successful data processing may limit office systems potential — Mutuelle d'Assurances de Commerçants et Industriels de France (MACIF)

This case study shows that a successful data processing installation in a highly clerical office operation may limit the immediate potential for office systems technology.

MACIF is a large French insurance company specializing in insuring businesses and their employees. It employs some 3500 people, scattered across France in its 11 regional centers and its 250 offices. MACIF is a mutual insurance company and so does not operate a network of agents: all its employees are full-time members of staff and are paid directly by the company.

The company's data processing department uses only IBM equipment — eight IBM 4341, one IBM 3083 and one IBM 4381, all at the head office level. Most of the software is developed in-house by the central data processing staff and is then offered to the regional centers.

MACIF's policy is to set an upper limit for data processing expenditures. At present, this limit is 10 per cent of general overheads or two per cent of the company's annual turnover.

For the current year, the total data processing budget represents some 1.7 per cent of the projected annual turnover, and 8.5 per cent of general overheads.

The regional centers are linked to the individual regional offices through a private network plus TRANSPAC (the French packet-switching service).

The company's employees use the mainframe host computers directly by means of computer terminals. This obviously reduces the need for stand-alone micros and word processing equipment. So it is not very surprising that office automation systems have a low profile. The company has, nonetheless, some word processing equipment, some 27 videotex terminals and just two personal computers (IBM PCs).

The company has, however, some 2500 computer terminals in total; 2400 of these are in the regional offices, with IBM, Thomson, ITT, Memorex and Olivetti being the predominant suppliers. Most of the company's applications are in the areas of administration and text processing.

The personal computers, purchased in December 1984, are used by senior statisticians at head office level. Their applications include LOTUS 1-2-3, database access and word processing.

MACIF has been focusing its attention on developing its mainframe computing facilities, rather than office systems and is at present undertaking a study of the feasibility for installing printers in all local offices. It also aims to reach a penetration, within the next two to three years, of one terminal per employee. The company is, however, planning to run an office systems pilot scheme with the ultimate objective of installing just one workstation per regional center.

MACIF has set up a data processing and an office systems study group, which include union representatives and which develop and revise the "plan informatique" (information technology plan) — the company's twice-yearly assessment of its data processing and office system policies.

Overall, the company relies heavily on its mainframe computing facilities, which cover all of its major applications, and it is likely to continue along this path for the time being. MACIF realizes that office systems are seen to be important to many companies. But they also believe that the nature of MACIF and the small number of applications needed will mean that office automation will not become a significant part of the company's activities, at least for the immediate future.

A large-scale effort to determine benefits and costs — the UK Department of Trade and Industry pilot trials

A milestone effort to determine the benefits and costs of office systems is currently nearing completion in the UK, in the form of 21 pilot projects supported by the Department of Trade and Industry (DTI). In this case study we briefly summarize some of the results of these trials and describe the interesting approach taken by one of the pilot system users, the Export Credits Guarantee Department, to use low-cost videotex technology as a vehicle for office systems applications.

The objective of the trials was to stimulate the advance of office systems in the UK. The scheme was originally announced in mid-1981, and the first trials started in March 1982. Each trial was scheduled to last 24 months, and on the present schedule the latest-starting trials finish about December 1985; the final assessment of results will take until mid-1986. Thus the duration of the entire scheme is about five years.

For each trial, the DTI provided about $350,000 to cover the loan of hardware and software, consultancy, evaluation of results, and so on. The trials have all been in the public sector and include government departments, local government, utilities (gas, electricity, telephone), and other public bodies (such as the BBC, the Science and Engineering Research Council and the Leicestershire Constabulary).

The trials have been the subject of extensive reporting in the UK trade press, and conferences have been held periodically to report on the results.

Before summarizing the lessons learned about the costs-and-benefits question the trials were intended to answer, it is worthwhile making the following general comments:

- The focus of the pilot trials has been on equipment that suppliers can deliver today, not on state-of-the-art.
- Today's products in this context include word processing; electronic mail; document storage, retrieval and filing; and a mix of minicomputer, mainframe, videotex and microcomputer technology.
- Since the pilot trials began in 1982 there have been many developments in office systems, and what was new then is often quite widely used now.
- Many of the products supplied were initially found to be inadequate for use in an end-user environment because of unreliability, exacerbated by delays in delivering equipment and inadequate design and testing, although there were exceptions, of course. One of the conclusions reached by a report on six of the trials was that, apart from word processors, office system products are still immature and cannot yet be tailored closely enough to the needs of individual users.

The environment of a subsidized pilot trial is clearly an unrealistic one in many respects. Both supplier and user are learning, and mistakes will inevitably be made. Also, the pilot trials were, to some extent, about exploring new ideas; therefore, there were bound to be failures and difficulties. In addition, the large amount of subsidy provided probably means that projects of only marginal potential benefit will have gone ahead that would not have been undertaken in the stricter commercial environment.

Bearing in mind the comments made above, the lessons learned from these pilot trials may be summarized as follows:

- Cost benefits through savings in clerical staff are likely to be realized only after three to five years.
- User organizations found it hard to put a price on such intangible benefits as "high quality documentation produced according to a given schedule". Because the trials were in the public sector, it was inevitably very difficult to quantify benefits.

—Training users takes time and costs money, but extensive user involvement from the early stages of introduction is vital if commitment is to be achieved.

—Links to mainframe computers and databases are very important. The investment in existing mainframe software should not be ignored; indeed, it should be taken advantage of wherever possible.

—Although productivity levels did improve in general, word processing was a notable success in this respect. However, there appears to have been an unintended emphasis on word processing applications in the pilot systems, probably because of difficulties in implementing more "advanced" applications.

—User project teams and user support teams were perceived to be expensive to run. In all but the smallest installations, support teams of up to three people were common, and costs of support were put at about $1100 per user per year.

—Other hidden costs were also incurred, such as additional terminals, extra software development, cabling, air conditioning and supplier support and training.

—There was a marked shortage of available skills in the office systems field.

—It was unclear from the trials whether office systems increased job interest or actually reduced it.

Despite the pitfalls, the pilot trials are perceived to have been valuable by most of the suppliers and users who participated. They have stimulated interest in the UK in office systems, but perhaps the unique environment in which they operated (public sector, heavily subsidized, very long time frames) limit the lessons that can be learned. Nevertheless, the points made above do reflect points we have made elsewhere in this report about the need for new methods of assessing benefits.

Export Credit Guarantee Department (ECGD)

This case study of an individual UK Department of Trade and Industry pilot trial shows how low-cost videotex technology was used for an office system application.

The case study is also of interest because it emphasizes the need to build on the existing mainframe systems investment. In this case, a failure to meet the requirement for full linkage with the existing mainframes has led the user organization to take an alternative route for the subsequent development of a department-wide office system.

The ECGD is a UK government department with 1800 staff at its nine regional offices and headquarters in both London and Cardiff. The department has two main roles:

—It provides insurance cover to exporters which reimburses them against nonpayment for goods or services by overseas buyers.

—It provides guarantees to banks that provide finance to exporters.

The ECGD has used data processing since 1965, first with batch systems and then, in the last seven years, using on-line transaction processing systems.

In 1982, the ECGD installed a GEC videotex system as part of the UK Department of Trade and Industry (DTI) Office Automation Pilots Program. The DTI provided about $350,000 and the ECGD purchased additional hardware and provided the staff to manage and develop the system.

Two main groups of users were identified early on: all senior managers (30) and the entire staff of a London Project Division (35 staff). Word processing operators and trade unions representatives also have access to the system. All users have a personal videotex set on or near their desk.

In January 1984, the ECGD extended the videotex system beyond the scope of the pilot project, even installing a set in the office of the Minister of State for Trade. There were soon over 100 videotex sets and four word processors on the GEC system.

The most impressive aspects of this system are:

—The responsibility given to users to maintain the databases.

—The automatic generation of frames from information residing on an IBM mainframe.

—The use of a report generator to produce reports held on videotex frames.

—The small number of support staff needed to operate the system.

The main applications provided on the GEC system are as follows:

Case control. Perhaps the most innovative feature of the ECGD system is a database that contains information about overseas projects. Users have direct control from their terminals over the definition of the data structure: its input, maintenance and access. Outside intervention comes in two forms:

—The system operator provides videotex frames with blank fields for new cases, and deletes lapsed cases.

—The project team provides specific software needed for the calculation and the reports.

A diary system. The diary system was originally intended for use by senior managers but was extended to other users. It was a particularly successful feature, with 50 to 60 sessions per month per user.

Departmental and country information. This database supplies the general terms and conditions under which the department can provide cover for each of 220 overseas markets. It also contains a wealth of statistics summarizing the department's financial performance in each market and the overall position.

A message facility. Simple message handling between users is being upgraded to allow features such as circulation of lists, acknowledgement of receipt and an interface with telex and teletex.

Many of the features of the GEC system were enhanced during 1984. For example, the word processing system was linked to videotex so that documents (eg country policy notes) can be prepared on a word processor and then automatically transferred to videotex. Before, the country statistics could only be transferred in batch.

However, a key requirement of the ECGD was the ability to work the videotex terminals as a window into the IBM mainframe, not by emulating standard IBM terminals, but as full videotex terminals. This requirement could not be met by the GEC-based system as it could not be used effectively for interactive communication with the IBM mainframes. Consequently, the ECGD will not be expanding the videotex-based system. The ECGD has decided that its existing investment in IBM software (including System Network Architecture communications products) is so great that it makes sense to standardize on this supplier's software. In summary, the pilot has performed well, but it was too limited as a system for information gathering within the department because of the difficulties in communicating with the mainframe database.

COMMUNICATIONS AND OFFICE SYSTEMS

Many applications in office systems rely heavily on communications. The following five case studies describe interesting examples of what can be done in this area, and the kinds of benefits that can be achieved.

Enhancing external communications — a West German law firm and Lincoln National

These two case studies show how electronic messaging can enhance communications with clients and customers.

A West German law firm

Although it is small in comparison with some of the other organizations described in this report, the experience of this West German law firm provides useful lessons for any potential user of office systems. It is a particularly good example of how professional users can benefit from office systems.

The firm uses office systems extensively and successfully in running its legal practice. Because of regulations governing law firms in Germany, this case history must remain anonymous.

While the firm is smaller than some of the other organizations discussed here, it is one of the largest law firms in West Germany, with some 25 partners, a number of associates and over 100 employees.

The firm has a strong commercial practice, and much of its work is international. Its typical clients are the German subsidiaries of large, multinational companies, which it advises and for which it executes legal transactions. The firm has few private clients.

In common with other law firms, this firm is very information-intensive. Because of the nature of its client base, efficiency and quality of work are particularly important, as are good communications facilities.

In 1980, the firm installed its first system: a Wang WP25 office system. Further systems were added later and expanded as required. The hardware base at present consists of the original WP25 with three terminals, and an OIS 140 office system, also from Wang, which has 21 workstations. The OIS 140 is now the main system.

Standard Wang software is used for word processing, and the different applications are based on packages supplied by Wang. The office systems are used mainly for word processing and communications.

Some of the applications used involve some tailoring of the word processing system, and several standard text elements have been set up to be integrated into word processed documents. However, significant programming was involved, but the work could be carried out by a legal professional in the firm.

The firm has a digital telephone exchange, supplied by Siemens, which allows the firm to keep sophisticated records of telephone costs. It also uses a high-speed telefax system (by MDS) which transmits at 20 seconds per page, and at slower standard speeds as well.

Each secretarial office has one word processing terminal, shared by two secretaries. The word processing facilities are used for long documents, for docu-

ments that are required repeatedly and for all telex/teletex documents. Ordinary typewriters are used for other types of text. Some of the word processed text segments have been used over 1000 times. One of these segments has saved about 500 hours of lawyers' time alone, not to mention the savings in secretarial time for keying the text.

The secretaries usually enter and correct text, but about half of the legal professional staff also use the word processing workstations themselves for minor corrections, some occasionally and some on a regular basis.

The word processing system is closely integrated with an electronic mail system. This law firm uses an internal mailbox system, but, more importantly, it has also linked its word processing system to the West German teletex system.

The internal mailbox system is not considered to be very useful so far. To make it so, a terminal would be needed on every lawyer's desk, but for now such a move cannot be justified by the law firm.

The external link with the teletex system is far more important and successful. Messages can be entered and sent by a secretary directly from her desk through the word processing system. This facility has been used extensively: in the first five months of 1985, 3000 messages were sent in this way, to clients, colleagues and other business contacts. About one-third of the recipients were within West Germany, one-third in the US, and the remainder in other countries.

A survey of major law firms in West Germany indicates that between 0.9 per cent and 3 per cent of their turnover is spent on information technology. The expenditure of this law firm is within these limits. The firm believes its investment has already been fully justified, simply by the following factors:

— As mentioned above, up to 500 lawyer-hours have been saved by one standard text segment alone.

— There have also been important savings resulting from the link between the word processing stations and teletex. Before the teletex link was introduced, one telex terminal was dedicated to outward-going telexes and was busy sending telexes between eight and twelve hours a day. Avoiding the rekeying of the texts of telex messages has released time equivalent to about one-and-a-half secretaries for other, more important tasks. The law firm estimates that the teletex facility has repaid its cost after only two years.

— However, as important as the commercial savings are the benefits in quality and speed which have been achieved. Both are important to a law firm and are perhaps best illustrated by an instance where two lawyers, each in a different city, worked together on a brief, each writing a part of the document and exchanging drafts via teletex. The lawyers were faced by a particularly tight deadline, and the office systems allowed them to beat the deadline by writing and editing the brief, printing it and getting it to court, all within a few hours.

This law firm has had a very good experience with its office system and believes that it has been a great success. The firm has clearly identified four factors which it believes have contributed to this success:

— The inherent quality of the chosen system.

— The decision to deal with only one supplier for hardware, software, maintenance and any other aspects relating to the system.

— The choice of a standard, well proven system, rather than an "exotic", technologically pioneering system.

— The motivation and interest of those involved with the system, which is so strong that even the training is now carried out by the law firm itself.

Lincoln National Corporation

This case study illustrates how an external electronic messaging service is used to link a major insurance company to its clients.

Lincoln National is the fifteenth largest insurance company in the US. It employs 35,000 staff at its headquarters in Fort Wayne, Indiana, and a further 35,000 in other offices.

The company has broadened its internal electronic mail system to enable its many clients to link into it via a national private network.

Lincoln moved into the office automation arena six years ago. It started by developing an internal system encompassing word processing, electronic mail and personal computing. This has evolved into the present Prime-based system using standard "dumb" terminals. Users are linked into the Prime system using a local area network. The initial 30 terminals have grown to 17,000 in early 1985, and they are used by 25,000 staff.

Lincoln first used an internal electronic mail system — MCI — which provided either hard copies or electronic transfer and receipt of information. Responding to requests by staff, the company then decided to give users the chance to communicate externally as well. For this purpose MCI Mail Link was used, a specification developed by MCI Digital Information Services. This is a forerunner of an electronic message network interface standard, known as X.400, which is now under development. X.400 provides access to other public and private message networks,

and to TWX/telex terminals. It also links with laser-driven printers that output hard copy messages for delivery to those without terminals. MCI agreed to use Lincoln National as one of two test sites (the other was Citibank).

Users decide in what timeframe they want the mail delivered — by normal post, overnight, in four hours, by telex or electronically. The costs vary according to the choice.

Although most users like the system's new ability to communicate outside the company, the cumulative costs of sending letters at $2 to $3 each are quite significant. However, an internal survey at Lincoln suggests that productivity improvements of 12 to 20 per cent have been achieved. Also, using the electronic mail link is the only way for letters to be delivered within four hours.

The extended office — Stuart Pharmaceuticals

Stuart Pharmaceuticals uses office systems to enhance the effectiveness of its field sales force.

The company is a wholly owned subsidiary of ICI, the largest industrial company in the UK. Stuart has been in existence for about 10 years, during which time it has established itself as the second largest pharmaceutical company in the UK. Its products are manufactured in ICI factories. Stuart has about 40 head office personnel and about 65 sales staff scattered through the UK.

Office systems applications at Stuart are principally electronic mail, inter-office links and remote terminal/ mainframe ordering via videotex. But one of the most interesting applications has been to provide the field sales force with viewdata/microcomputer terminals for administrative support and for reporting back to head office management. The project was started at the end of 1983 and was completed in June 1985, several months ahead of schedule.

Stuart Pharmaceuticals decided to involve all the potential users of the sales and marketing information system at the earliest possible stage. To achieve this objective a number of "attitude surveys" of all the sales personnel were carried out. The first survey was aimed at identifying the user perception of the usefulness of having a terminal available in the home. Initially the users' response was mixed: reaction varied from indifference to great enthusiasm.

Next, Stuart Pharmaceuticals created a project team, which consisted of both less enthusiastic and enthusiastic respondents. As the project developed, some of those least enthusiastic at the outset became the genuine "champions" of the system.

The major investment was in the supply of terminals to the salespeople and the establishment of a system network.

As a result of introducing the new system, there has been a noticeable improvement in communications between head office and the sales force. However, the initial phase affected only about one-eighth of the field sales force. As the system is extended to all the planned users, benefits are expected to increase. (This latter phase was completed in August 1985.)

Document transfer systems for internal communications — a major US engineering company

This case history describes how document transfer technology can be applied to internal communications.

This company (which must remain anonymous for confidentiality reasons) started its office systems effort in 1980 with a project in its information services group, which handles company-wide and scientific data processing services. The aims of the office system project were to create documents, to send mail electronically, to prepare schedules, to analyze spreadsheets and to create personal files — all on one system.

IBM's menu-driven Professional Office System (PROFS) software was chosen because, at the time, the company felt it had both the widest range of software and the greatest potential for expansion. It also allowed the company to keep its existing terminal base (over 2000) in place.

PROFS was installed in a phased manner as follows:

- —The pre-prototype phase, which had eight users in March 1982.
- —The prototype phase, lasting from October to November 1982, which had 30 users.
- —After that the system grew more rapidly until the current level of nearly 3500 users was reached.

The company now uses IBM 3279 color terminals, IBM 3287 dot matrix printers, IBM 7436 letter-quality printers, IBM 6670 laser printers running under the VM/CMS operating system and mainframes, which were upgraded to the present IBM 3083 system.

There are, at present, 1400 users in the main office and over 2000 across the corporation. The loading system averages about 200 users at a time — and it is strained at peak times.

PROFS is used for internal mail between different departments within the corporation.

Each department was given the chance to assess the system, and then made requests to participate.

During the prototype phase numbers were limited deliberately by a rigorous approval process. Later, however, departments were free to enter the system if they wished.

Reportedly, one of the major barriers to the system's success has been the lack of direct involvement and support by upper management. In particular, senior managers in the finance and administration areas resisted the introduction of new technology.

Another major problem was lack of coordination over supplier selection. For example:

— One department uses Digital VAX equipment with All-in-one software. An interface between the VAX and IBM system was effected later, through DEC gateways.

— There are a large number of Wang users in the company. PROFS use is billed to each department monthly, and is an expense item, whereas Wang equipment is bought by each area, and is therefore a capital cost, not an operating cost. This policy makes PROFS more expensive for the user and therefore affects the extent of its use. (The company hopes to interface the Wang OIS system with PROFS through the Wang VS systems and two Wang VS have been bought for this purpose. Software for the interface has only recently become available.)

The company has not yet measured the detailed benefits of PROFS and electronic mail. It has carried out two preliminary assessments, however, with a view to measuring benefits more precisely in the future:

— The collection of information on the activities and benefits achieved by other companies' office systems projects.

— A survey of all professional staff within the company, in line with Booz, Allen & Hamilton methodology (to measure the impact of the system on users' productivity).

CHAPTER 6

THE KEY ISSUES FOR SUPPLIERS

This chapter is concerned with issues of primary interest to suppliers, but users will also have a keen interest in the future direction of the market for a developing technology like office systems. The future of the user's office system investment depends on what suppliers do next, and on what happens in the marketplace, as this can affect the compatibility of the user's systems, his choice of technology, as well as other important decisions.

The chapter begins with a description of the methodology used in preparing the market forecasts we have developed specially for this report. The forecasts present a picture of a steadily growing market in both the US and Europe but with a gradual saturation of the market around 1990. We look at the implications of these forecasts and trends. For example, what must happen if projected growth rates are to be achieved? Will installed office systems need communications capabilities? What will the revenue picture look like? How will market saturation impact suppliers? The increasing penetration of office systems in organizations will also have consequences in the user environment, which could in turn impact suppliers. We look at these consequences. We then review the leading suppliers and take a look at the issues associated with IBM's current domination of the office systems marketplace. We end the chapter with a summary of our recommendations for suppliers.

There are, thus, seven sections in this chapter:

—The market forecast methodology.

—The market forecasts for Europe and the US, 1985-1991.

—Issues raised by the forecasts.

—The increasingly structured user environment.

—Leading office systems suppliers.

—IBM — threat or opportunity?

—Key market development issues and recommendations.

THE MARKET FORECAST METHODOLOGY

We drew upon three main data sources for our research:

—115 face-to-face case studies conducted in the US and Europe usually involving interviews with the data processing person most closely involved in office systems, and in many cases, with several end users in the same organization as well.

—Related studies carried out by us, and recently published office systems market figures for the US and Europe.

—Some 3000 interviews of representative users of office systems that we carried out in the US. These covered such topics as current and forecast penetration of office systems within organizations, desirable features of workstations, communications plans, and the impact of office systems on the structure of user organizations.

The preparation of our forecasts depends on two concepts:

—The use of the US market as a "precursor" of the European market.

—A model for the take-up of office systems technology by office workers.

The precursor concept

It is generally accepted in the computer industry that events in the US are often precursors of events in Europe. There are several possible explanations put forward for this. Three common explanations are (a) later introduction of products in Europe by US suppliers, (b) different cost-benefit ratios, and (c) more forward-thinking and less cautious managers in the US. The adoption time difference can be expected to vary, depending on the technology involved and the size of business. For instance, there will usually be a shorter time-lag between the US and Europe for larger businesses.

Our research indicates that office practice is fairly uniform in developed countries and thus that it is reasonable to use data for the US office systems market as the basis for European forecasts, particularly at the aggregate forecast level, where country-to-country variations are less important. The time-lag between the US and Europe (as measured by the time taken to reach an equivalent penetration level) varies in practice between one and three years.

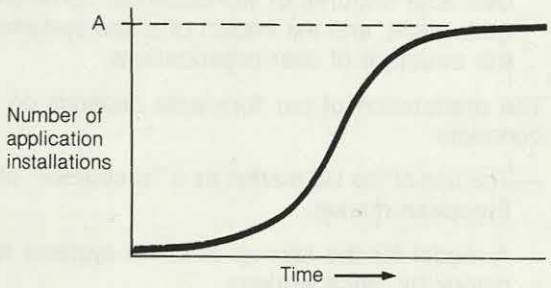
The take-up of office systems technology

Most of the office systems that will be purchased over the next few years will be for first-time users, that is, users who do not already have an office workstation. Thus, in developing forecasts for the next few years, we need to be able to forecast the time it will take for these potential users to adopt office systems, the maximum penetration of systems among office workers, and the pattern of growth in use over the period of interest.

This will enable us to predict how long present rates of growth in the office systems market are likely to be maintained and, more importantly from a strategic planning viewpoint, when the market is likely to mature, or become saturated.

We have found in our research in the information technology field that the take-up of new applications follows a predictable pattern of growth which can be represented by the so-called logistic, or S-curve. Figure 6.1 shows a typical S-curve.

Figure 6.1 The growth pattern of first-time adoption of IT applications



The number of office workers who will eventually have an office workstation is represented by the dotted line "A". This will normally be less than the total number of office workers, as there will be some proportion who will never use a workstation. Take-up of office systems can be expected to start slowly. At this stage the concept is a new one, the products are still being developed, and users have little experience. This is succeeded by a period of fast growth (such as the one we are going through now) as office systems rapidly proliferate among users. It is during this stage that annual sales to new users will peak. Subsequently, as more and more of the potential users install workstations, the rate of new installations will slow down, until the final stage of saturation is reached, where all the potential users will have a workstation.

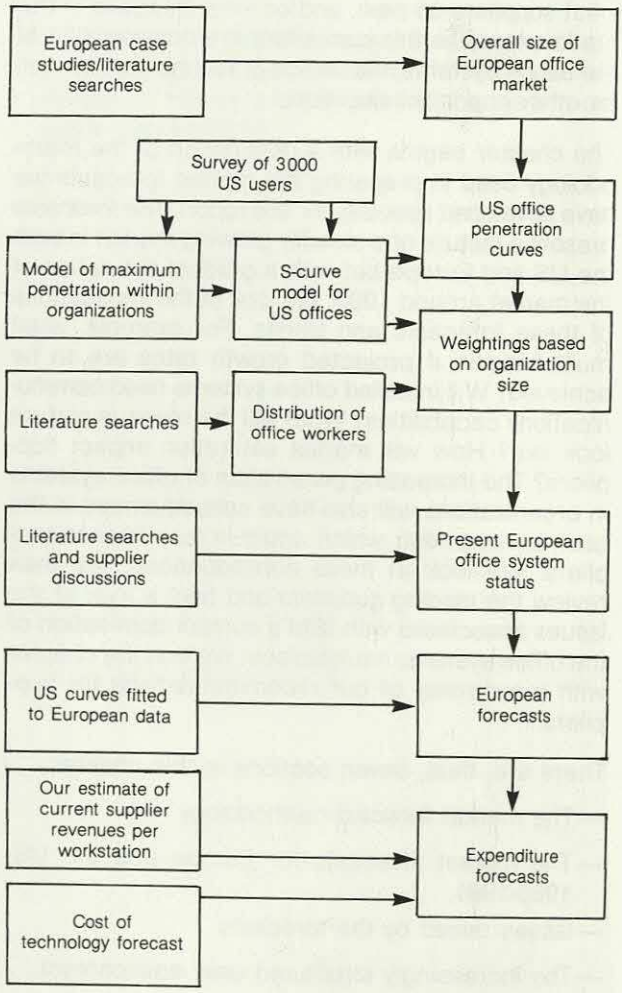
For office systems, this growth pattern is actually a two-stage process:

— Each organization goes through the process of installing its first office system. This adoption process is a slow one, and it may be several years before every (or nearly every) organization has installed its first system. Smaller organizations tend to be the last to take this step.

— Once an organization has taken this initial step, other installations follow rapidly within the organization until saturation point is reached.

Subsequent new users will come only through general growth of industry or the formation of new organizations or through expansion of the organizations themselves. Expenditure on office systems will, of course, continue as a result of the installation of replacement systems (as the existing base becomes obsolete) and through the purchase of additional features and software.

Figure 6.2 Market forecast methodology



In order to forecast office system penetration it is necessary to estimate the maximum proportion of the population of users that will use the system (line A

in the figure), and the slope of the curve at a reasonably advanced stage of penetration (eg 15 to 20 per cent). Our US survey figures provided us with the means to estimate these parameters for the US market, and to apply the results to the European market.

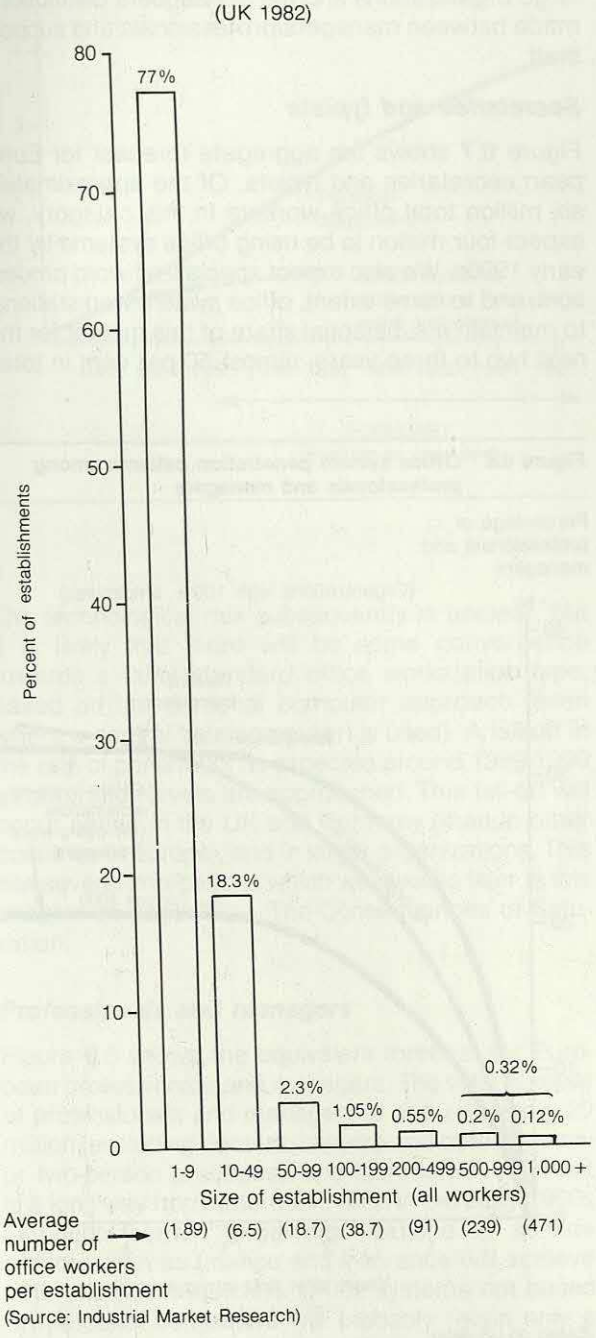
Figure 6.2 illustrates the steps in the methodology we used.

The literature searches were used to develop an overall picture of the European office workforce. The US survey results provided the estimates for the S-curves. These were supplemented in two ways. First, there are substantial differences in the level of adoption (or penetration) achieved at a given point in time between those organizations with more than 100 employees and those with less than 100 employees (usually referred to as "small" organizations). The proportion of organizations falling into the two categories was estimated and the resulting aggregate curve computed. (Figures 6.3 and 6.4 show the proportion of UK organizations of different sizes and the proportion of office employees in each group.) Second, the maximum penetration within organizations was estimated using US survey figures.

The current penetration of the European office workforce was estimated from literature searches and discussions with suppliers. Individual country shares were calculated by calibrating estimates of time-lags within Europe with published data.

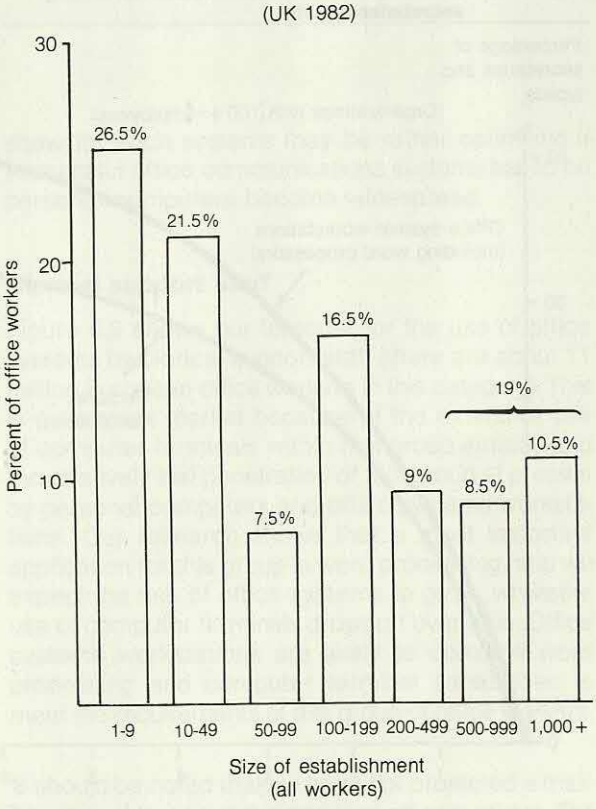
Expenditure forecasts were developed using these penetration figures, a forecast of the rate of decrease of the cost of technology, and our own estimates of current supplier revenues per workstation.

Figure 6.3 How office workers are distributed — 1



(Source: Industrial Market Research)

Figure 6.4 How office workers are distributed — 2



(Source: Industrial Market Research)

MARKET FORECASTS FOR 1985 TO 1991

The survey data that we gathered in the US enabled us to estimate the maximum penetration of office systems among two groups, secretaries/typists and managers and professionals. (The take-up of office systems by clerical support staff has been too low to date to allow reliable estimation of a corresponding figure for this group.) The results are shown in Figures 6.5 and 6.6.

The survey asked respondents to differentiate between personal-computer-based office systems and "dedicated" office systems, including word processors, minicomputers and shared-logic systems (systems where office workstations share disk drives and so on — the Wang OIS system is an example). These differences are shown in the estimates.

It should be noted that these figures are overall averages for the organizations concerned. Not many organizations will have an equal mix of personal computers and office system workstations — the similarities in maximum penetration reflect the roughly equal share of the desktop market of these two technologies at this time.

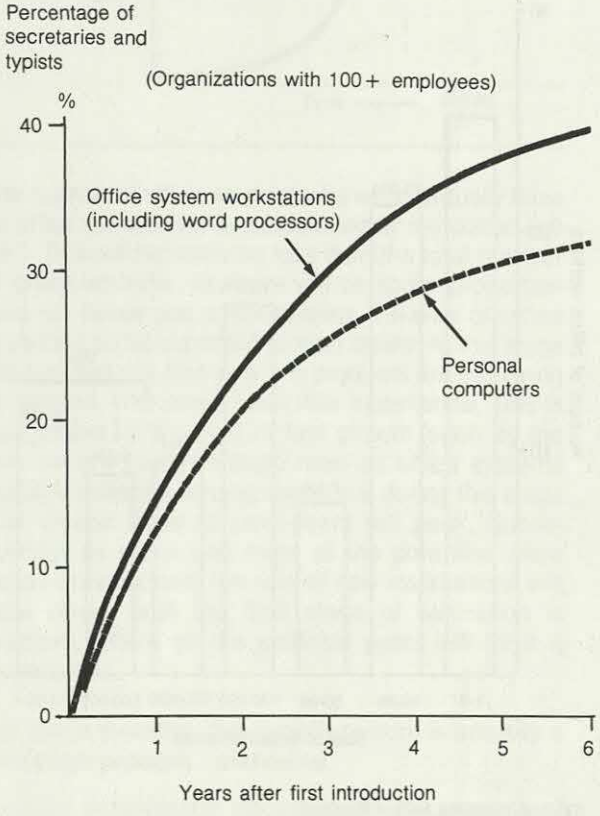
The gradual take-up of office systems among secretaries and typists reflects the predominance of stand-alone units which allows take-up to proceed more slowly.

Among managers and professionals, a rather different pattern emerges — many office system workstations will be connected to minicomputers and the take-up will be very rapid, as the marginal cost of additional workstations will be lower. Fortune 1000 companies show a different picture here, and the penetration of office system workstations is markedly lower. It is likely that this lower penetration is due to the more structured (and formal) nature of these very large organizations and the consequent distinctions made between managers/professionals and support staff.

Secretaries and typists

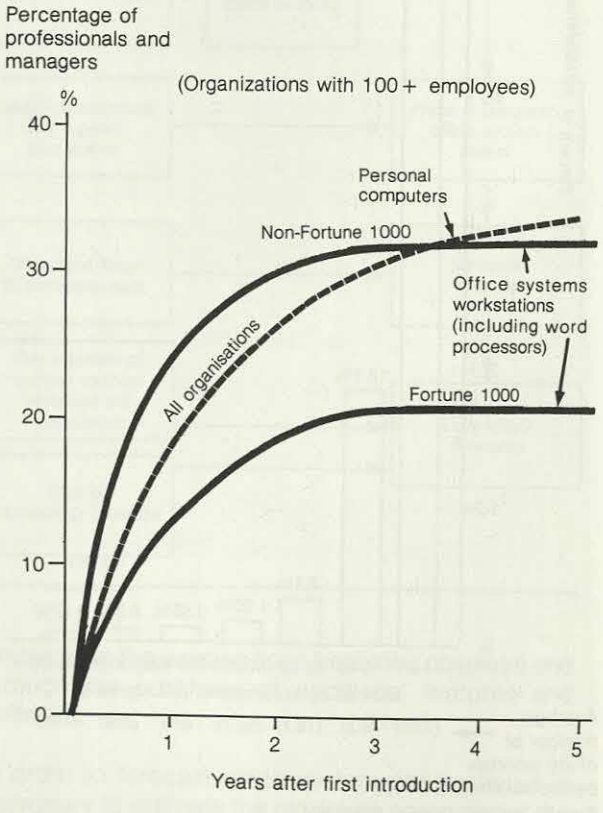
Figure 6.7 shows the aggregate forecast for European secretaries and typists. Of the approximately six million total office workers in this category, we expect four million to be using office systems by the early 1990s. We also expect specialized word processors, and to some extent, office system workstations, to maintain a substantial share of this market for the next two to three years, almost 50 per cent in total.

Figure 6.5 Office system penetration patterns among secretaries/typists



(Based on US data)

Figure 6.6 Office system penetration patterns among professionals and managers



(Based on US data)

Figure 6.7 Forecast of European secretaries'/typists' use of office systems

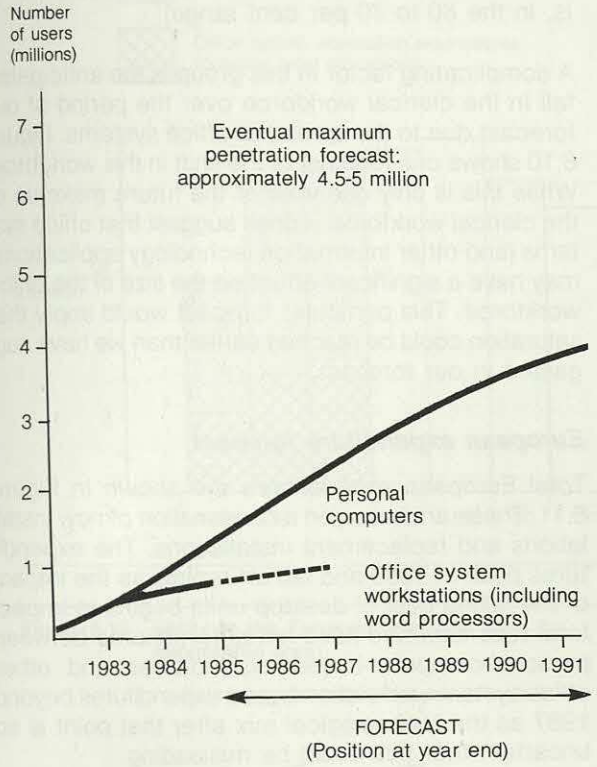
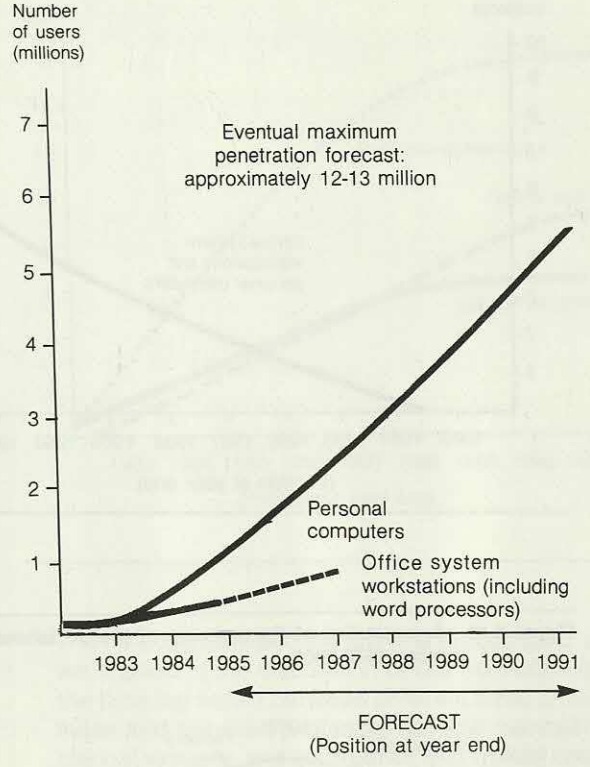


Figure 6.8 Forecast of European professionals'/managers' use of office systems



The technological mix subsequently is unclear, but it is likely that there will be some convergence towards a fairly standard office workstation type, based on the personal computer approach (even where a central 'minicomputer' is used). A fall-off in the rate of penetration is expected around 1989-1990 as saturation levels are approached. This fall-off will occur earlier in the UK and Germany (than in other countries in Europe), and in larger organizations. This has several implications which we discuss later in this chapter on page 76 — The Consequences of Saturation.

Professionals and managers

Figure 6.8 shows the equivalent forecast for European professionals and managers. The total number of professionals and managers is approximately 20 million (excluding doctors, lawyers and others in one- or two-person practices), and this market segment is a long way from saturation, even in the early 1990s (although certain large organizations in service sectors such as finance and insurance will achieve saturation quite quickly). Office systems not based on personal computers will probably retain only a small proportion of this market. In fact, the figure we show for such systems may be rather optimistic if successful office communications systems based on personal computers become widespread.

Clerical support staff

Figure 6.9 shows our forecast for the use of office systems by clerical support staff (there are about 11 million European office workers in this category). This is a complex market because of the extensive use of computer terminals within this group already and the relatively low penetration of this group at present by personal computers and office systems workstations. Our research shows that a most important application for this group is word processing, and we expect the use of office systems to grow, while the use of computer terminals drops off over time. Office systems workstations are likely to combine word processing and computer terminal capabilities to meet the requirements of this group of office workers.

It should be noted that we have not projected a maximum penetration of this group of office workers. The present computer terminal population in Europe is estimated to be of the order of three million, however,

Figure 6.9 Forecast of European clerical staff use of office systems

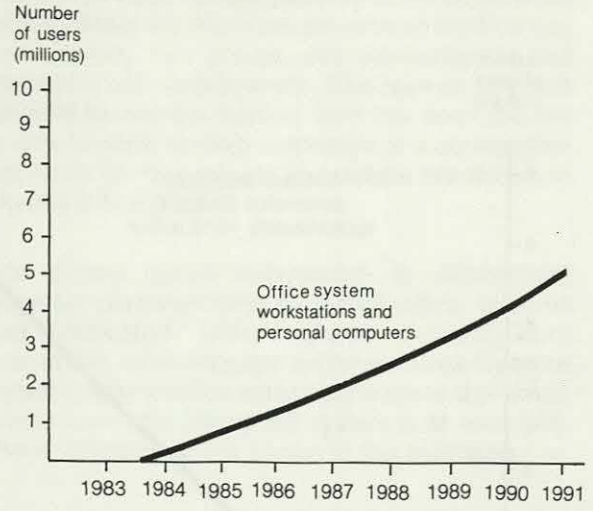
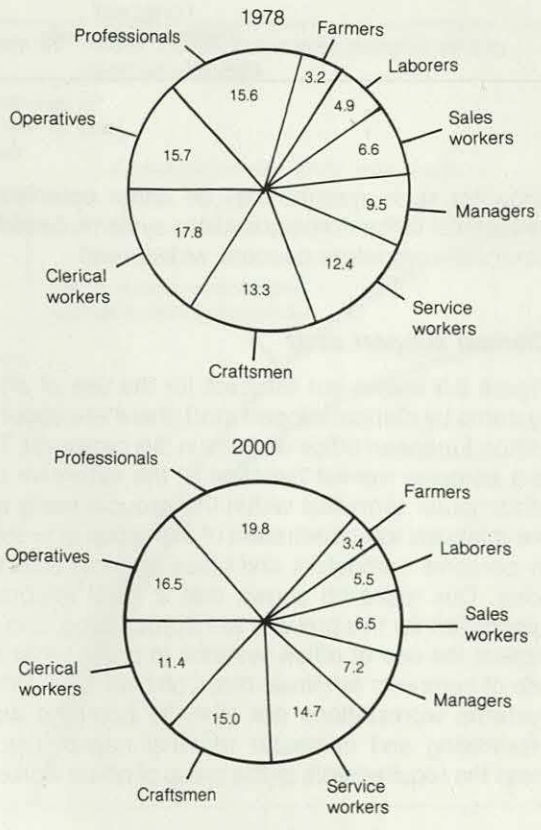


Figure 6.10 A projection of the make-up of the US labour force 1978-2000



(Source: S. Leontiff/The Guardian, February 7, 1985)

and with some replacement of these by office systems workstations over the period, the saturation level is not likely to be very much different from that for professionals/managers and secretaries/typists (that is, in the 60 to 70 per cent range).

A complicating factor in this group is the anticipated fall in the clerical workforce over the period of our forecast due to the spread of office systems. Figure 6.10 shows one forecast of the shift in this workforce. While this is only one view of the future make-up of the clerical workforce, it does suggest that office systems (and other information technology applications) may have a significant effect on the size of the office workforce. This particular forecast would imply that saturation could be reached earlier than we have suggested in our forecast.

European expenditure forecast

Total European expenditures are shown in Figure 6.11. These are based on a combination of new installations and replacement installations. The expenditures peak in 1989 and fall off rapidly as the impact of the falling cost of desktop units begins to impact total revenues. We have not differentiated between personal-computer-based expenditures and other office system workstation-based expenditures beyond 1987 as the technological mix after that point is so uncertain that this could be misleading.

European country-by-country market shares

Figure 6.12 shows the share of European installed market on a geographic basis. We see certain markets (eg Spain and Italy) rapidly gaining a share of the market more representative of their share of the total office population, from a current position where they lag well behind the UK (the leading adopter of office systems in Europe).

US office systems forecast

Figure 6.13 shows our forecast for these three groups of office workers in the US. As we indicated previously, saturation of these groups can be expected much earlier in the US than in Europe.

ISSUES RAISED BY THE FORECASTS

The following issues are raised by these forecast figures:

— The forecasts show continual increases in the penetration of workstations, but do not tell us what these workstations will be used for. Will the profile of applications in use remain constant, or if it is going to change, how is it likely to change?

Figure 6.11 Forecast European office system expenditures

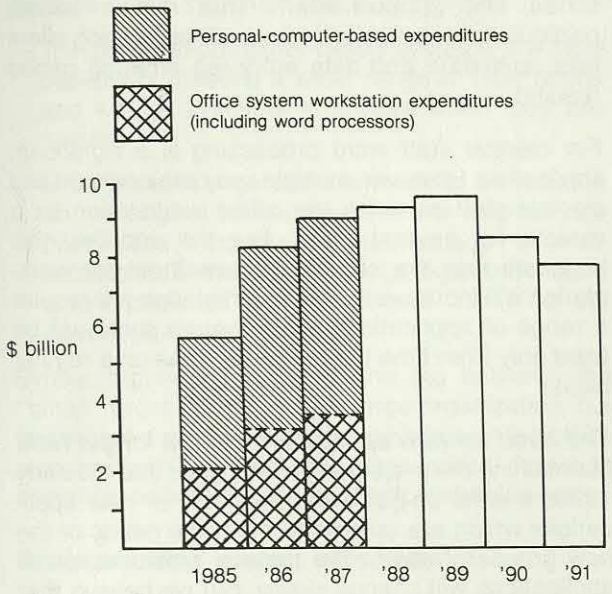


Figure 6.12 Shifts in the European installed base by geographic area

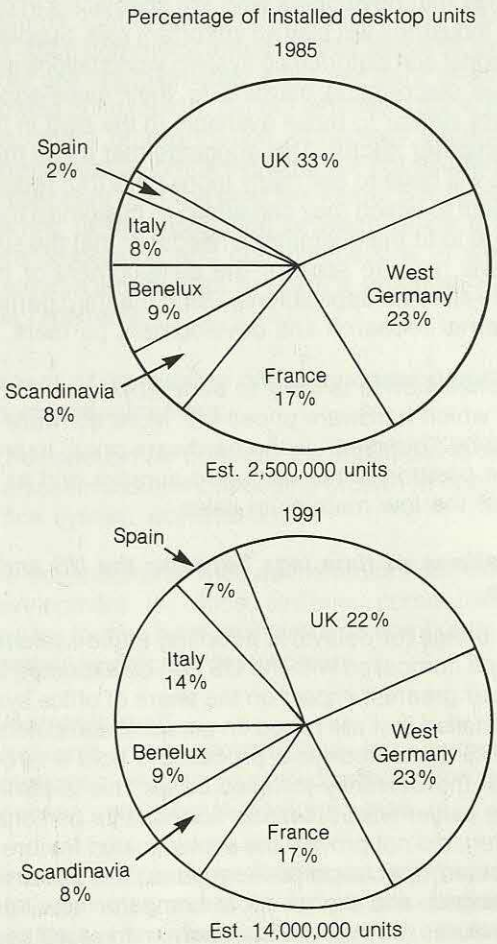
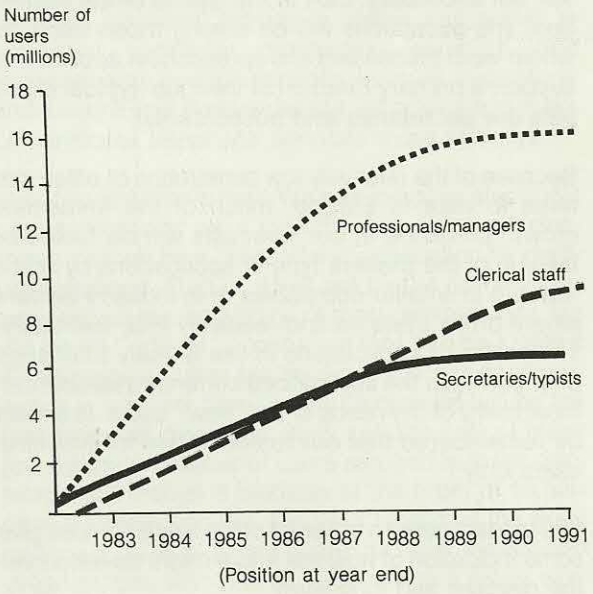


Figure 6.13 Forecast of US office systems usage



—The time lag between the US and Europe (and, as we implied in the discussion of our methodology, the time lag varies between different sizes of business and between professionals and managers, clerical workers, and secretaries and typists) could mean that the type of technology used will differ between the groups of office users. What differences might be anticipated, and how will they affect suppliers?

—Are office systems expenditures significant in terms of total expenditures on computer technology? Will they grow in importance in future?

—The continuing spread of office systems appears certain to lead to increased demand for communications between these systems. What does this imply for the technology and for suppliers?

—The forecasts show an eventual "saturation" of the user market. What are the consequences of this, and should the supplier take any early action?

—There has been an apparent slump in the computer industry, particularly in the US. Can this be reconciled with the growth forecasts shown here for office systems?

We address these questions in the following paragraphs.

The future profile of office system applications

We stated earlier in this report that we believe that the applications software used in offices will necessarily become more specialized over time, with the more general-purpose applications (such as word

processing and spreadsheets) remaining an essential, but secondary, part of the typical office installation. The exceptions will be among those users for whom word processing and spreadsheet applications support a primary function of their job (typical examples are secretaries and accountants).

Because of the relatively low penetration of office systems to date in Europe, much of the immediate growth predicted in our forecasts will be fueled by take-up of the present type of applications by office workers in smaller companies or in industry sectors where office systems find relatively little use today. The profile of applications in use is likely to change only slowly, as the applications currently available can meet many of the needs of the "new" users. (It should be remembered that our forecasts are for first-time users only.)

The present pattern of use of office systems does give some indication of how the future might develop over the medium and long term:

The medium-term outlook for applications
Our research shows that professionals and managers use office systems primarily for data analysis and data processing applications. Data analysis applications include:

—Spreadsheets.

—Projections/forecasts.

—Modeling/simulation.

—Decision support.

Data processing applications include:

—Accounting.

—Budgeting.

—Payroll.

—Inventory.

—Report generation.

—Databases.

Other important application areas are graphics, word processing and communications. Communications and graphics are seen as the main growth areas for this group of office workers, and we would expect communications to be the basis for some shift in application types in the medium term, that is, in the 1985-1990 timeframe.

For secretaries and typists, the primary application will continue to be word processing, but this is likely to extend into more complex document production (such as the area of "in-house publishing"), and they may begin to take over more routine system tasks from managers. We have already found some evidence in our US research that managers are increasingly delegating office systems tasks to their secretaries and support staff. This makes sense, particularly for on-going tasks such as keeping client lists up-to-date and data entry (eg entering period results).

For clerical staff word processing is a significant application. However, multiple uses are common and clerical staff perceive the office workstation as a vehicle for several tasks. For the supplier, this suggests that the software expenditure per workstation will increase as each workstation will require a range of applications (even though some will be used only from time to time rather than on a regular basis).

The need for new applications in the longer term
Maintaining the projected growth rates into the early 1990s means on-going development of new applications which are tailored to meet the needs of the new groups of users. The general cross-section of applications will change slowly, but we believe that specialized applications will be the key value-added component that will justify the office systems investment.

It is likely that developers who are specialists in particular industries will play an important role. Suppliers of personal computer/office system workstations cannot give discounting margins to their value-added resellers similar to those available in the past in the minicomputer sector. This suggests that these third parties will have to sell many more units (but reduce the extent to which they can afford to customize their software to fit the customer's needs) or that the suppliers will have to sponsor the development of the industry-specific applications, using the third parties as external research and development partners.

One consequence is likely to be a slowdown in the rate at which hardware prices fall. More software is likely to be "bundled" in the hardware price, to protect the position of the hardware supplier and as a result of the low margins in sales.

Implications of time lags between the US and Europe

The time lags (or delays) in adopting office systems in Europe compared with the US can be expected to have their greatest impact on the share of office systems installed that are based on personal computers. In the US dedicated word processors hold a large share of the currently installed base. This is partly because earlier word processor software for personal computers did not provide the sophisticated features of dedicated, special-purpose systems. This situation has changed, and the personal computer now has more features, so that the European market will see a smaller take-up of dedicated systems. This implies

that Europe will be a much smaller market for suppliers of minicomputer-based and dedicated, special-purpose office systems. This is because:

—The personal-computer-based systems are now capable of meeting a wider range of user needs and will be available in Europe when they are needed.

—Growth within organizations tends to be focused on the original technology (and the original supplier). The "traditional" technology is well-established in the US and can be expected to form a solid basis for expansion there. This is not the case in Europe.

Similar arguments apply to the lag between the "small" organization and the large organization, but to a lesser extent — the ultimate scale of the office system installation will also be a critical factor in choosing between the competing technologies.

Scale of office system expenditures

Our research shows that external expenditures (excluding internal manpower and overheads) by European organizations on information technology currently amount to approximately $70 billion per annum. This includes computer technology, office systems, (data) telecommunications and PBXs, but not voice communications. Office systems expenditures are approximately eight per cent of this, and growing quite rapidly, but our estimates show that the total share of information technology expenditures represented by office systems will not exceed about ten per cent over the next five years. Because of the blurring of the distinction between office systems, data processing and communications, it would be misleading to attempt to make a projection beyond this timeframe.

Impact of increasing office systems penetration on communications

In this section we consider the implications for communications of the continuing growth in numbers of office system workstations.

We see electronic mail as the most significant new development in office systems communications. Access to data held on mainframe computers will be another significant development.

Electronic mail

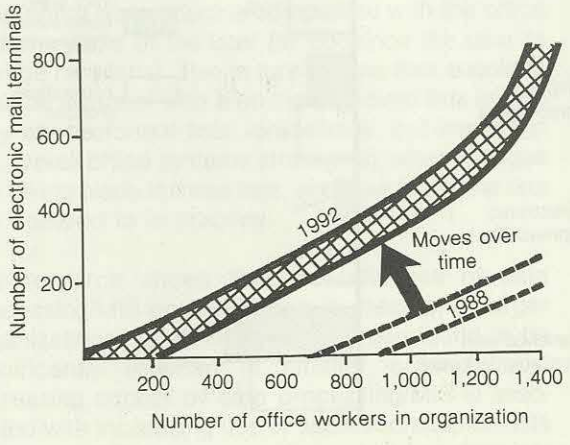
Electronic mail growth falls into two distinct categories, electronic mail depending on external services and internal electronic mail.

External electronic mail services. External services are now widely available and we are confident that a steady, if unspectacular, growth rate will be achieved. The reason we are cautious about the growth rate of external services is that there are several competing technologies. Existing telex and facsimile services provide a viable alternative to (external) computer messaging services, and improvements in voice services (such as voice store-and-forward and simpler dialing) will continue to make conventional telephone services more effective.

In-house electronic mail. We see in-house electronic communications as a growth area. In-house electronic mail will be a "secondary" application for many organizations. That is, it will not be the primary purpose behind the installation of most desktop units, but will be an "add-on" application that can be justified if low marginal costs are involved. The size of organization is relevant here (larger companies will be the first to install electronic mail) and the critical mass (the minimum number of users required to make electronic mail viable) is probably of the order of 15 percent of office workers. Figure 6.14 shows the likely pattern of take-up by size of organization. Initially only organizations with 500 to 1000 or more office workers at an establishment are likely to adopt electronic mail (15 percent of this number would be about 75 to 150 workstations). Over time, these numbers will increase, and smaller organizations can also be expected to install electronic mail. We expect that some proportion of workstations will be installed exclusively for this purpose, as the user may have no other need for an office system but will nevertheless need to be connected to the electronic mail system.

How soon will internal electronic mail systems take off? Based on this assumed 15 percent "threshold," the typical European office should become a target for electronic mail around 1988 (when 3 million of the 20 million professionals and managers have workstations). In the US, this threshold will be achieved

Figure 6.14 Pattern of electronic mail take-up by size of organization



earlier, probably around 1986. Given the disparities in take-up between organizations, the variation will be considerable. On this basis, real growth will begin in Europe in the 1988-1990 period and continue perhaps until the mid-1990s. We estimate eventual penetration of the office system base to be of the order of 50 to 70 percent.

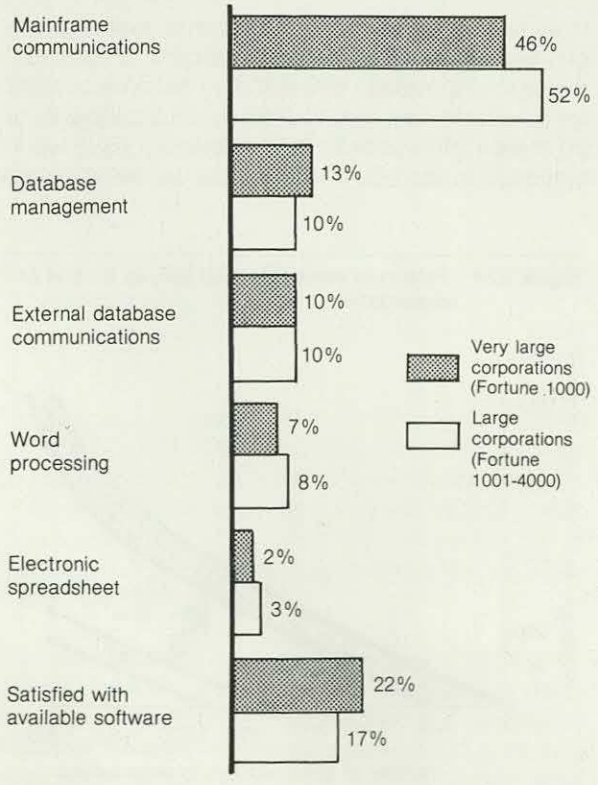
Mainframe communications

According to our US survey figures, mainframe communications needs more improvement than any other available application (50 per cent of respondents were dissatisfied with the current facilities for mainframe access software, compared with dissatisfaction levels of between 2 and 13 per cent for other types of software — see Figure 6.15). Terminal emulation is only an interim solution, as users are looking not only to access the mainframe data, but also to make use of the data in local, personal-computer-based applications. The results of our US survey indicate that 60 per cent of professionals and managers using office systems would find access to the mainframe highly useful. This represents a reasonable estimate of the likely penetration of this type of link among these office workers.

Role of the PBX

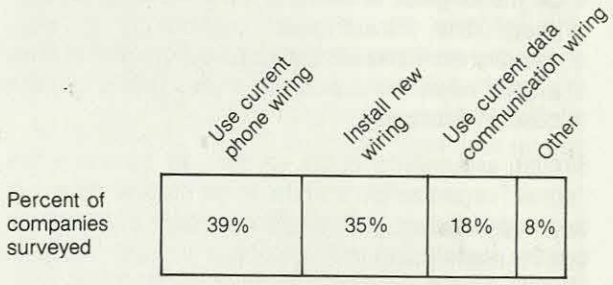
How will internal office communications be implemented?

Figure 6.15 Least satisfactory applications software



Telecommunications managers show divided preferences (see Figure 6.16). The strong preference for the use of current telephone wiring (nearly 40 percent of our respondents) indicates that PBXs will be the chosen means of internal office communications for many users.

Figure 6.16 Wiring preferences for office communications



Summary: A confused communications picture

Communications between office systems and to external systems are, for a variety of reasons, becoming more critical to continuing growth of the market. Temporary solutions are available to meet many needs, but users are not satisfied with these. For the time being it looks as though only the largest suppliers can afford to take a firm position. Others will be forced to provide a mixture of capabilities until the winning standards emerge. Up to now, cabling has been a secondary concern (primarily because of the low penetration of workstations). It may turn out to be the deciding factor in many organizations. If so, the PBX will become more prominent as a basis for office communications than industry watchers have been predicting to date.

The consequences of saturation

Our projections show some potential for saturation of certain segments of the market. At this point we believe that the following segments are likely to approach saturation within the next three years:

— The secretary/typist group in organizations with over 100 employees.

— Professionals and managers in large organizations in the US and in some parts of Europe (eg the UK, Germany, Benelux, and Sweden).

For the supplier the approach of saturation means that competition will become more severe, with applications becoming fairly standardized and the buyer's attentions focused on price and value-for-money rather than on the applications themselves. Suppliers with small market shares will come under pressure as economies of scale come to the fore. It is likely that retail outlets will play an important role in distribution, particularly of low-cost units, because of the

commodity-like nature of the standard products, and the ability of retailers to keep selling costs down.

Standardization will be important, as buyers will want their office systems to be mutually compatible.

Reconciling the apparent industry slowdown with our predicted growth figures

Our forecasts show that the take-up of office systems has now passed the initial "fast" growth stage, and has settled into a steady growth rate. The next major changes should take place around 1988-89 in Europe, and 1986-87 in the US, when saturation will start to flatten the take-up trend, and drastically reduce the annual number of first-time installations.

Nevertheless, we can expect some shifts within this picture, which probably account for many of the difficulties now perceived. The time lag between the US and Europe accounts for the appearance of these problems in the US first. We would summarize our assessment of the situation as follows:

- Deliveries of workstations are now approaching a plateau, and annual growth will stabilize.
- Personal computer installations have been growing more rapidly than the workstation market as a whole because they have been displacing dedicated word processors on the one hand and computer terminals on the other. Their relative share of the workstation market is beginning to level out, however. This will slow down the annual growth rate for personal computers.
- Office systems now being put in place will have a longer effective life than the earlier models, both because of their greater flexibility and because they meet user needs more closely. This will reduce the replacement rate and affect the overall level of installations (which is the sum of first-time installations and replacement installations).
- There is overcapacity on the supply side and downward pressure on revenues per workstation, both because of this overcapacity and because of technological advances. The suppliers likely to suffer in the inevitable short- to medium-term shake-out are non-IBM-compatible personal computer manufacturers (eg Apple) and manufacturers of dedicated word processors (eg Wang).
- The shift away from a word processing emphasis to more complex applications (which require more time for the market to assimilate) could also affect the actual installation rates.

In summary, our research shows that the office systems market is going through a period of adjustment as it settles into a growth pattern more appropriate to the long term.

THE INCREASINGLY STRUCTURED USER ENVIRONMENT

In this section we examine recent changes in the user environment that affect the supplier of office systems.

Our research shows that the user environment is becoming increasingly structured and formalized. This is because of the widespread use of office systems and the growth in investment in these systems. The formalization manifests itself in an increase in control over office systems purchasing (often by the data processing/MIS department) and the use of approved vendor lists.

Our research in Europe and the US shows that the number of organizations with formal policies on eligible suppliers of office systems is growing. These policies are more prevalent among larger organizations. The picture is complicated for conglomerates and other businesses with a loose operating structure — here the operating companies tend to determine policies, and the relationship between size and purchasing policies tends to break down.

The main difference between Europe and the US is that control over office system purchases in the typical organization is established earlier in Europe, and at a lower threshold of installed units. This is because labor costs are higher in the US, making larger investments easier to justify there. It is easier for the data processing/MIS director in Europe to convince top management that corporate policy is necessary and that ad hoc purchases are wasteful and must be controlled or stopped.

What does this mean to the supplier? For most suppliers, this means a two-stage selling process. The supplier must first get on the approved list, and then he must make individual sales to users and departments within the organization. Some suppliers (like IBM) will be an automatic choice for most approved lists. Other suppliers must make a case to be included on the approved list. To do this, the supplier must ensure that his product is compatible with the office systems plans of the user (or convince the user to change his plans). This in turn means that suppliers must be aware of who is on the approved lists (which may not be formal lists, incidentally, but implicit in the overall office systems strategies), what changes are taking place in these lists, and how firmly the lists are adhered to in practice.

Our research shows that the influence of data processing/MIS on purchasing is greatest in larger organizations. This influence has been found to be significantly reduced in smaller organizations. Increasing control by data processing/MIS is associated with increasing use of approved supplier lists and formal office system policies, but one does not

necessarily follow from the other. Data processing/MIS departments often share power with others, including administration departments, end users, office system steering groups, and so on.

To illustrate on these points:

— About 60 per cent of Fortune companies in the US have some form of strategic office systems plan.

— In 80 to 90 per cent of these cases, the plans cover choice-of-supplier issues.

— In US companies with over 100 employees who have approved vendor lists, 80 per cent of office system purchases are made from the vendors on the lists.

— Among the large organizations we surveyed in Europe, over half had clear policies on purchases.

For the supplier, the message is clear. In large organizations, data processing/MIS is a significant office system decision-maker, and the successful supplier will market directly to this group. For medium-sized organizations, the picture is less clear, but data processing/MIS remains an important factor.

THE LEADING OFFICE SYSTEMS SUPPLIERS

In this section we briefly review the positions of some leading office systems suppliers.

IBM

IBM is the leading supplier of office system products and provides a complete range of equipment and software. It has been said in the past that IBM lacks an integrating strategy, and that it has gaps in its product range — such as local area networks. These criticisms are now heard less frequently, as IBM has announced a range of improvements and has issued statements of direction on how the company plans to overcome some of this lack of integration. Personal computers will be able to communicate with IBM's word processing and data processing equipment, and document, file and message transfer will be supported.

Nevertheless, the current picture is confusing, and it is clear that a truly integrated framework will not be available for two or three years. On the past record, users will be prepared to wait.

A potential shortcoming is IBM's choice of its System 36 as the "departmental" machine for users. Its current configuration appears inadequate to support larger numbers of users, and it compares unfavorably with Digital's and Data General's offerings in this respect.

IBM seems certain to continue to set the standards for office systems and to dominate the market for at least the next five years.

Digital

Digital is the major supplier of computer systems after IBM. Its office system offering is ALL-IN-1, an integrated software package that runs on its VAX minicomputer range. ALL-IN-1 has several unique features (eg voice synthesis, allowing text messages to be read out to telephone callers) and has, in the network architecture DECnet, a well-established ability to "fit in" with data processing. Digital supports the Ethernet local network, and has introduced communications software products that link ALL-IN-1 to Wang's OIS system and to IBM and other 3270-type terminals (a standard industry terminal type). Digital has an interface to IBM's document transfer system, DISOSS.

Digital appears likely to do well with larger customer organizations, particularly where "departmental" systems are important.

Data General

This company's CEO integrated office system runs on its minicomputer product line. It is comparable in many respects to Digital's ALL-IN-1, and is claimed to be superior in some respects (eg it is more "integrated"). Data General claims full compatibility with IBM's network architecture (SNA) and document transfer (DISOSS) products and is also pursuing other areas of connectivity such as telex, teletex and packet-switching.

CEO supports IBM PCs (the PC appears as a CEO workstation), and can handle the format codes of documents produced on Wang's word processing systems.

The market for Data General's CEO system appears to be similar to Digital's. Digital's edge may turn out to be DECnet and the large established base of Digital customers, particularly in manufacturing (30 per cent of office workers in the UK are in the manufacturing industry, for example).

Wang

Wang's past record of success has largely been built on its office systems business (about 60 per cent of its revenues come from office systems).

Wang's products include the Alliance 250 office automation system, Office Information Systems (OIS), Wangwriter, and the Professional Computer. OIS and Wangwriter are word processing products. The Alliance incorporates data processing, word processing, audio processing, networking and several standard office system features.

Recognizing the predominance of IBM in the personal computer marketplace, Wang provides a facility for all their own personal computers to run software written for the IBM PC.

Wang has introduced some interesting new products:

—The Professional Image Computer (PIC), based on Wang's Professional Computer, and incorporating image handling. It uses a camera-like scanner to digitize images, a high-resolution monitor, and a thermal printer to print the image. It is quite expensive, even in its basic configuration.

—A voice mail system (Digital Voice Exchange).

—Wang Systems Networking, a set of communication products linking Wang systems and providing gateways to other vendor environments.

In a way, Wang's past success may be the single biggest difficulty the company faces. Wang's present user base will have to make major technological changes to upgrade to Wang's newer products, and to improve links between systems. Our research shows that, as a general rule, users are most likely to switch suppliers at the time of a major technological change. Wang is a leading supplier to the largest organizations (these organizations were among the earliest office systems users), but these are also the major customers of IBM on the data processing side. Thus Wang and IBM have a large customer base in common. These customers may seek to simplify their support problems by switching to IBM when the time comes for a major upgrade.

Hewlett-Packard

Hewlett-Packard bases its office systems on the HP 3000 minicomputer series. Software includes HP Desk Manager (integrated electronic mail, word processing, electronic filing and time management), HP Word, HP Slate and Text and Document Processor for document preparation and editing, plus software for information management, spreadsheet, graphics and charts, and telex interworking.

The company's future efforts appear to focus on integration of the HP 3000 computers, its office software, and the HP 150 touchscreen personal computer, as well as a network (called HP AdvanceNet) that will provide links to other vendors' computers.

Hewlett-Packard has an established reputation for high-quality systems and software that will undoubtedly be in its favor in dealing with the MIS/DP departments who are increasingly "taking charge" of office systems. Nevertheless, it is difficult to see the unique edge that will give Hewlett-Packard more than a modest share of the market. The "fitting-in" strategy adopted (very visibly) by Digital and Data General — two comparable suppliers in terms of the minicomputer technology origins of their systems — appear more likely to give them the lead.

Apple

Apple is by far the most significant of the group of non-IBM-compatible personal computer manufacturers. The company's most significant current product is the Macintosh (there is also a more powerful version, called "Fat Mac"), which set new standards for ease of use and graphics when it was first introduced.

A new product, the LaserWriter, which can produce close-to-letterpress print quality, has been highly praised. A smaller, portable version of the traditionally successful Apple II is also available.

Apple provides a local network that enables the Macintosh to be connected to other like systems and to the IBM PC.

The Macintosh is probably the best example of how companies like Apple can expect to continue in the office systems business. At the time of its introduction, the Macintosh offered several unique features that were very attractive to users, so that its premium price and incompatibility with other systems were not a deterrent. It will be difficult for Apple (or any other manufacturer) to keep inventing completely new products in a maturing marketplace. Thus for Apple to maintain its present (quite substantial) share of the personal computer market in business, the company will have to protect its position by offering enhanced facilities to its existing user base, and by "fitting in" with the corporate office systems market. It could replace standard workstations with more attractive "added-value" units, or alternatively, it could focus on specialized areas such as in-house publishing, electronic mail services, and so on.

IBM — THREAT OR OPPORTUNITY?

IBM is not the only supplier in the office systems business. It is in some respects a latecomer, despite its outstanding earlier successes in typewriters and magnetic card systems. In some industry sectors and geographic areas (such as France, where Apple is the market leader) IBM does not have the leading market position. Nevertheless, IBM does appear to dominate the immediate future of the office system market and the difference between success and failure for other suppliers may well depend on how they react to what IBM does, and the extent to which they can take advantage of the "window of opportunity" that is presented by IBM's dominant position.

We believe that two factors have underpinned IBM's unique success in computer technology since the

mid-1960s. The question is whether these two factors will enable IBM to succeed in the future office systems market:

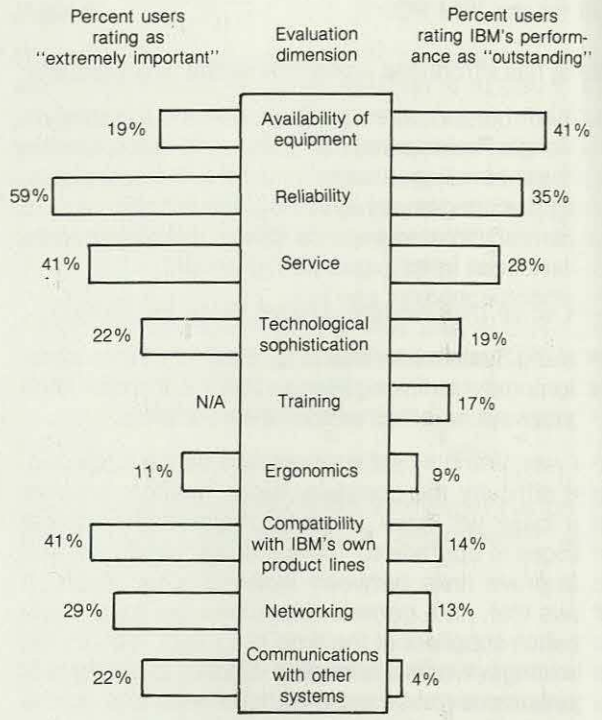
—***IBM has meant compatibility.*** Before the mid-1960s, IBM's large computers were incompatible with everyone else's as well as with IBM's own computers. By providing compatibility between generations of machines, IBM solved at a stroke one of the major obstacles facing users at that time. Knowing that sooner or later changes would be necessary to his hardware, the user had to have the assurance that he had somewhere to go when the time came to make these changes, without the expense of converting his software (usually developed in-house from scratch) and procedures. This compatibility strategy was the beginning of IBM's subsequent successes, even when the promise of compatibility was not always matched by the practice. The tradition of compatibility (and IBM's position in the marketplace) allowed IBM to legitimize personal computers in 1981, with the introduction of the IBM PC.

—***Consistency in marketing.*** IBM has carefully chosen its market segments, and has consistently pursued a policy of profitability in each of these, trimming the marketing effort to match the potential of the market segment. There are no "loss leaders" in IBM's marketplace. Every segment is a winner, and IBM's salesmen are legendary, partly because of this strategy, and partly because of their training and compensation structure.

It is perhaps surprising that we pick on these two factors, and omit after-sales service and support, for example, which is, after all, another of IBM's strengths. However, service and support has more to do with keeping customers than with gaining new ones, and in office systems, we are talking about several million new customers over the next few years. These customers will often be the end users with less initial concern about after-sales service.

We assessed IBM's perceived performance in office systems against the needs of users in our survey. Essentially, we asked users how they rate the importance of service, ergonomics, communications with other systems and so on. We then asked them to rate IBM's performance on the same dimensions. The results for the ratings of "extremely important" to the user, and "outstanding" performance by IBM are shown in Figure 6.17. The differences are quite revealing. Clearly some dimensions are more important to users than others. Ergonomics is not rated as "extremely important" by many users, for example. Thus IBM's low rating (in terms of "outstanding" performance) is not that significant. The most revealing differences are in compatibility, networking and communications. Few users rate IBM's performance as outstanding in these areas.

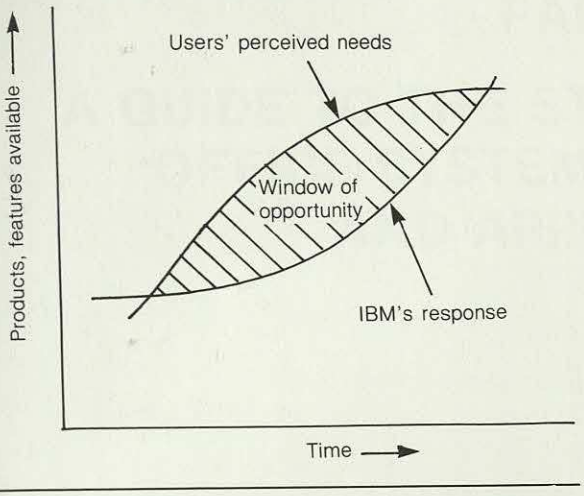
Figure 6.17 How IBM's performance rates against user needs



How can these findings be reconciled with our earlier comments about IBM's success in the market being due in large part to its ability to provide compatibility? We believe that it has been IBM's "umbrella" position and the implicit guarantee (as perceived by users) that it *will* deliver compatibility that has led to its success in office systems. Clearly, users rate its performance in actual delivery of these promises as less than outstanding. In effect, it has been poorly rated on all the dimensions concerned with "fitting in" with the rest of the users' systems. IBM will deliver on compatibility, networking and communications, but, in our view, not in the next two to three years. This creates a window of opportunity for the supplier who is capable of meeting user needs in this area and successfully marketing his products. Figure 6.18 shows this idea in conceptual form.

Unfortunately for all suppliers, the industry has changed since the 1960s. Competition at that time consisted of getting the customer's first order. The user's subsequent investment in software made it too expensive for him to switch later on. Communication between systems was via tape transfer, and distributed systems were (almost) unknown. This situation has changed. Direct communications between computers is commonplace, and distributed systems are the norm. Most office systems are distributed systems in this sense, and many will be linked with data processing and other office systems. Users have to

Figure 6.18 The window of opportunity — "fitting in" with the users' other systems



be convinced that the supplier has solved the problem of "fitting in". Only IBM (and perhaps one or two others) can get away with promises. The rest have to prove that they can do it, and that they have the capability to keep doing it. Since it is in the 'fitting in' area that the opportunity exists, the traditional data processing suppliers such as Digital and Data General have a built-in advantage, as they are perceived as understanding the problems involved.

What does our analysis imply for Compaq, and the rest of the IBM-compatibles? Because of their close association with the IBM-produced equipment, we believe that they will be seen as suffering from the same shortcomings and will have to continue to compete on price and features against IBM. Only if they develop a visibly "different" strategy for compatibility, networking and communications — and this will be very risky for them — can they begin to convince the market that they have a genuine solution for the "fitting-in" problem.

KEY MARKET DEVELOPMENT ISSUES AND RECOMMENDATIONS

In this section we summarize our view of the key issues facing suppliers and offer our recommendations.

Influencing user policies and decisions

Like it or not, the larger users are formalizing their office systems plans and purchasing arrangements. These users are important because of their share of the office workforce and because of their leading role in taking up new applications. Suppliers must decide whether to get onto preferred supplier lists, and whether to aim for IBM or non-IBM sites. In the former case the supplier is going to come face-to-face with IBM and the IBM-compatible suppliers.

The market will need to be segmented into two groups, users with lists and users without lists, and the sales force will need to be able to recognize the difference (and market research should be carried out to help in this). The exceptions need to be recognized and exploited. For example, a specific vertical application might well be exempted from the restrictions of preferred supplier lists and office system strategies.

An explicit marketing strategy aimed at small businesses (where formal policies and strategies will be less common) has attractions for the supplier of office systems that are not IBM-compatible.

Competing in an IBM-dominated marketplace

We believe that a two-pronged strategy is essential:

—Concentrate on a market niche or a product niche (eg portables, forecasting applications, dentists).

—Take aim at the "fitting-in" problem we described earlier.

The market is a volatile one, and entry and survival costs are high, and increasing. Advertising and distribution costs are becoming a very large factor for suppliers. Uniqueness or excellence (or both) will be essential to overcoming the disadvantage that these costs place on the second-line supplier, or on suppliers whose existing strengths are in other areas (such as data processing or communications).

Recognizing the changing needs of the user

Our forecasts show an expanding market. But the profile of this market will gradually change. The very general applications sold to date (spreadsheet, word processing) have owed much of their growth to "cream skimming." They have been easy to sell, easy to understand, and easy to install. The new generation of users will be harder to sell to, their needs will be more and more specific, and because of education and experience, their requirements will be more sophisticated.

Suppliers need to search continually for new ways of applying office technology or of associating themselves closely with the specialized firms who have the industry-specific knowledge. We think that the traditional ways of sharing revenues with these third parties are inadequate. Yet hardware suppliers cannot afford to let the applications suppliers become too independent (although it is possible that this may happen in spite of the hardware supplier's best efforts).

In any event, suppliers should recognize that the growth we are predicting is not automatic. It needs the development of new applications, and marketing to millions of new users. This is the challenge for suppliers in the next few years.

PART II

A GUIDE TO THE STATE OF THE ART OF OFFICE SYSTEM TECHNOLOGIES AND APPLICATIONS

This part of the report explains the relevant technologies, products and services in use in office systems today and interprets current developments and trends. It is intended to put the technology into perspective, so that the manager or user who is relatively unfamiliar with the technology can have an understanding of what the significant developments are, what is a well-proven technology and what is still in the development stage, and where it may be advisable to wait for the technology to mature.

Much office system technology is still relatively immature. For example, despite the claims of many suppliers, the technology can be unreliable and can fail to meet the very high standards of reliability that users expect as a matter of course of (say) the telephone or the typewriter. However, this problem of unreliability can be minimized by careful selection procedures and by close attention to the management of supplier relationships, fault-reporting and servicing.

A more fundamental issue arising from immature technology is the risk of investing in a pioneering development that fails to live up to its promise or that does not conform to the standards that emerge later, leaving the unfortunate user with a legacy of office equipment that locks him into a major re-investment in the future. This is particularly true of developments in communications and software. The relatively short history of computing has taught us at least one lesson: that systems, once in place, are very costly and difficult to change, and seemingly simple decisions on communications and software standards taken today can result in enormous complications for years afterwards. We aim to address the most significant of these developments in this part of our report.

We assume some basic familiarity with the terminology and jargon of office systems and computing technology, but we do provide definitions for less familiar terminology.

The topics addressed are discussed under four general chapter headings of:

—Overall technological trends.

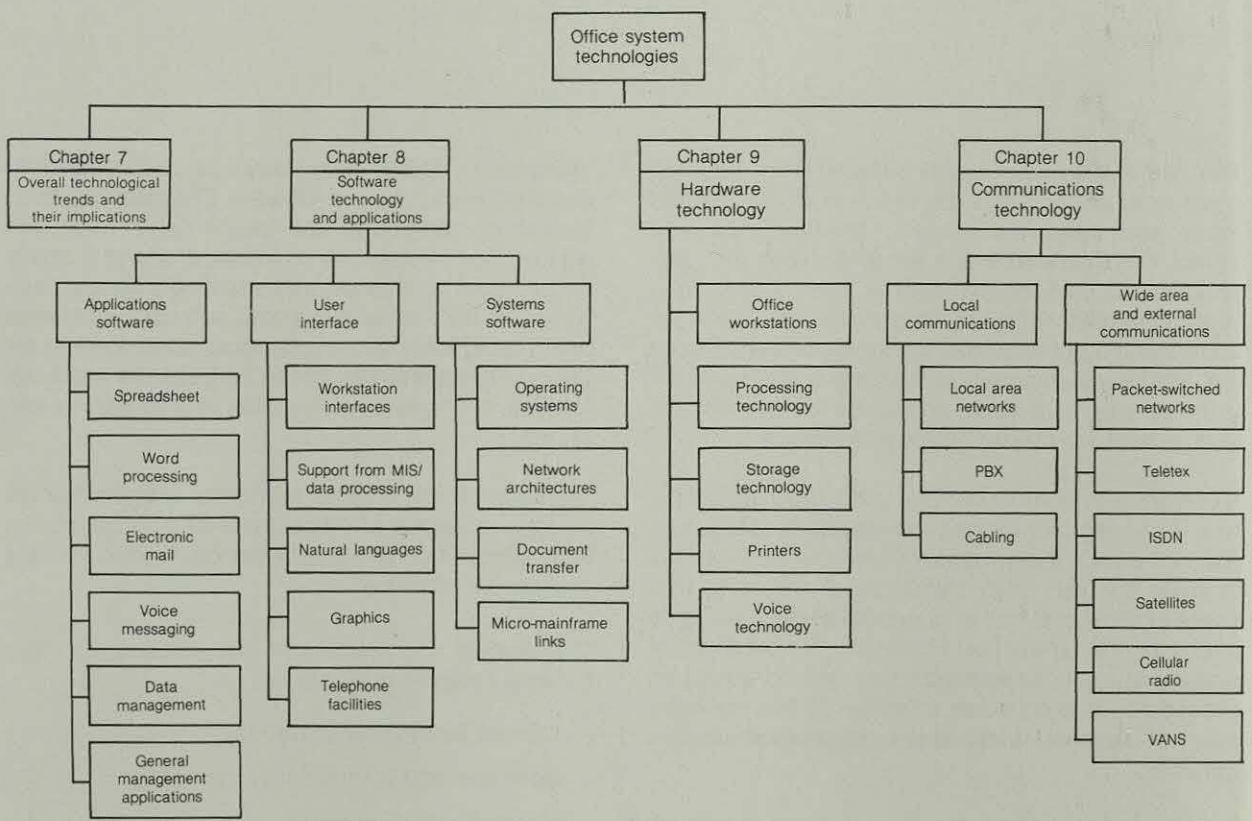
—Software and applications technology.

—Hardware technology.

—Communications technology.

The diagram overleaf shows in schematic form how the content of this part of our report is organized and where different topics are covered.

Structure of 'A guide to the state of the art in office systems technologies'



CHAPTER 7

OVERALL TECHNOLOGICAL TRENDS AND THEIR IMPLICATIONS

The technology of office systems is advancing rapidly along with other computer-based-technologies, and it does not appear that there will be any slowdown for the foreseeable future. These advances lead to new ways of doing things, as well as to continuing improvements in the cost-performance of existing systems. Many users perhaps feel that the continuing streams of new announcements by suppliers merely add to their confusion and that most of the improvements are marginal to real user benefit from office systems. However, some of the potential advances could be very significant indeed for the office system user and thus cannot be ignored in planning for the future, while others may well provide unique opportunities for enhancing business operations.

For example, the ability of office systems to intercommunicate will undoubtedly improve in the future, especially as standards are established and agreed upon. The planner will want to take advantage of these capabilities, but as they will tend to cross organizational lines, he must be concerned with gaining agreement from and assessing the impact of the different organizational interests involved. Similarly, the planner will want to take existing investments in office systems into account, and to plan to incorporate the new developments into these, or at least to plan for a transition from one to the other.

A related concern addressed in this chapter is that of obsolescence: Should users wait for the next generation of equipment or not? How fast a payback should users look for from office systems, to avoid the problem of obsolescence?

OVERALL TECHNOLOGICAL TRENDS

There is a well-established trend for the underlying cost of computer hardware to fall by about a factor of 10 every eight years. The familiar microcomputer is as powerful as many substantial minicomputers of only 15 to 20 years ago and this at a cost of perhaps one-tenth or less. Long before 1995, today's desk-top microcomputers are expected to be as compact and portable as a good-sized hardback book, and cost only a few hundred dollars. The overall cost of computers and office systems is not likely to fall by anything like the same amount but there are good reasons for this, which we discuss in the remainder of this section.

Telecommunications costs fall much more slowly

Telecommunications costs are falling at a much slower rate than computer costs, partly because the electronics component of telecommunications systems is much less than in most computers, partly because of the high intrinsic costs of cabling offices, and partly because of the less competitive environment in which PTTs operate. At the same time, the unit cost of transmitting data has dropped because of the improved performance of newer, more advanced telecommunications systems.

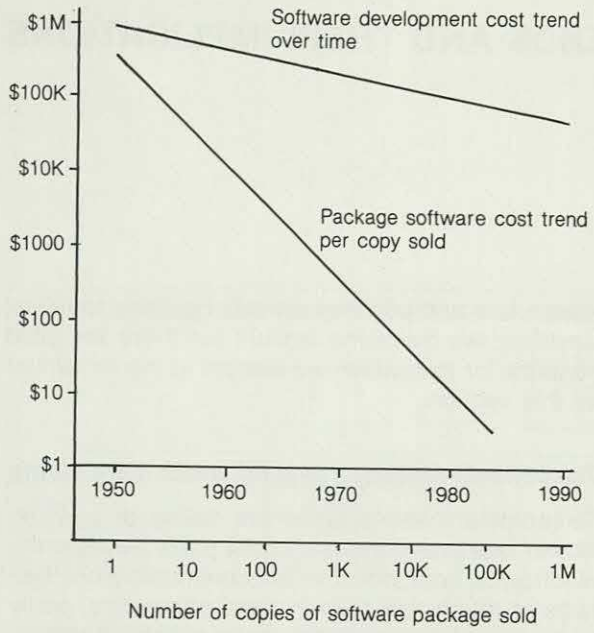
Software is increasing in complexity, and includes high labor cost

Some software costs have actually risen over time, and the on-going costs of program maintenance are well known to experienced users.

Software design and programming remains a labor-intensive activity. Improvements in software development methods (together with better programming environments and standards) have had some impact on software costs but do not compare with hardware cost reductions. A second, more important factor has been the spread of software packages. Software packages do not necessarily involve lower development cost. In most cases, the cost increases because of the higher standard of testing and documentation required. Also, while software packages cost the software supplier virtually nothing to copy, the costs of marketing and distribution can still be significant.

Many microcomputer software packages for business sell for $500 or so, because of the large number of sales over which the development costs are spread. Figure 7.1 shows the relationship between software costs, time, and the number of copies sold. However, software for office systems is likely to become more and more specialized, which will result in higher costs. There are two reasons for this: first because they meet a specialized need, fewer copies of a pack-

Figure 7.1 Software cost trends



age will normally be sold, and second there is additional custom work associated with installing the package.

Peripheral and storage costs remain significant

The heavy reliance of printers and on-line disk storage on electromechanical contact reduces the extent to which prices can fall for items such as storage devices and printers.

On-line disk storage comes in several forms. Traditionally the single-spindle multi-layer 14-inch unit has been used in data processing systems (the current state-of-the-art disk has a capacity of 1266 Mbytes). For minicomputer-based office systems this may remain common, but the standard for office systems is likely to be the five-and-a-quarter-inch Winchester disk with a potential for 300 Mbytes of storage. Improvements in recording techniques will allow denser storage, perhaps resulting in a dramatic change over the next three to four years. The reason is the likely widespread use of "vertical" recording techniques in the future — this refers to the way in which the magnetic domains are oriented on the disk.

Higher-density floppy disks are expected to reach the market soon. Initially these are expected to store around 10 Mbytes per side. A switch from horizontal magnetic recording to vertical recording could increase this capacity by a factor of ten. Personal computers would be able to store 100 Mbytes on a single side of a 9-cm disk.

Likewise, optical disk storage will come into widespread use. Its main disadvantage is that it is currently non-erasable, which limits its applications to archival storage or reference files with limited rates of change. Eventually, however, optical disks may become so cheap that the lack of erasability will not matter. But for the decade to 1995, it does appear that magnetic disks will remain the dominant storage media.

Increasing complexity of systems use places demands on storage and processing capabilities

The more complex "integrated" office systems packages (eg combinations of word processing, spreadsheet and data management) are already straining the capabilities of standard microcomputers. Adding communications facilities demands some level of multi-tasking to enable communications to proceed simultaneously with other work on the office system. This means that the typical workstation of the future will need to be a much faster unit, with more storage capacity, than today's standard. This will offset to some extent the performance improvements arising from the technological advances just described in storage, telecommunications, and software.

A related complication is the implicit demand placed on data processing systems by attached devices. We expect the need for access to corporate data to increase rapidly, and it is a well-established fact that every terminal device (and here we include the office system as a terminal device) accessing the central computer facilities adds to the overall workload and requires the installation of additional processing capacity.

Convergence

The idea of technological convergence first became prominent in the late 1970s. In its original form it identified three then non-cooperating industries (telephones, computers and office machines), and suggested that these were coming to depend on a single technology, and therefore would become for all practical purposes *three branches of a single industry.* Since that time the predictions for the supply-side have come closer to realization. However, in its common meaning, convergence has come to denote something rather different. In a sense, convergence is now seen as the process it really is, rather than the end-result. We are less concerned nowadays with who the supplier is, and more with the practicalities of making the office system (which has largely replaced the office "machine"), the computer, and the telecommunications work together in a meaningful way. To this end Private Branch Exchange (PBX) suppliers are developing units that will support (local) office data communication, microcomputer suppliers are adding a telephone to their processor (sometimes integrated into the workstation, sometimes not), and computer manufacturers, software developers and microcomputer manufacturers are all trying to link their products together.

In short, the present-day concept of convergence sees the three technology areas as becoming three facets of one organizational information system. There are two points that need to be emphasized here:

— ***Information systems are converging***. Ultimately, it is the organization's information systems that are converging, not the suppliers' systems. This may seem like a rather fine distinction to make, since it might be argued that the suppliers' systems must be the "same" in some way before the users' can be. However, this view allows for a "logical" convergence at the information level, which does not necessarily require that a physical convergence take place.

— ***Convergence is a moving target***. Convergence is a moving target, and depends on the point of view taken. Clearly the modern-day supplier sees convergence as a marketing tool, a framework within which new products can be developed and sold. For the user organization, it represents a struggle to superimpose a structure on a group of, perhaps, diverging organizational interests. This whole issue is further complicated by the role of IBM, whose mainframe systems (the descendants of the original 360 architecture), together with the family of communications products collectively known as Systems Network Architecture (SNA), are almost certain to set the standard for commercial data processing for at least another decade.

THE OBSOLESCENCE ISSUE

Technological advances also have a negative side — they can lead to earlier obsolescence of expensive hardware and software. How does this problem arise, and what can the potential purchaser do about it?

It should be emphasized that "early" obsolescence can arise in three ways:

— ***Technological advances***. In the early stages of a new technology, new designs and new methods are introduced in rapid succession. This results in early obsolescence of installed equipment and software.

— ***Market forces***. When a supplier loses out in the marketplace, his products become obsolete faster. Most commonly this happens when another supplier becomes dominant, and his products become the de facto standard (IBM is the classic example). The emergence of industry-wide standards have similar consequences for installed systems.

— ***Supplier strategies***. Suppliers' new products can render their installed base obsolete by offering improved price-performance. Suppliers may not provide technical support for earlier product lines beyond a cut-off date.

Therefore, technological advances are only one of the ways in which the effective economic life of an office system can be shortened, although it should also be recognized that the three factors are strongly interrelated.

The danger for the user is that he becomes paralyzed into inaction through fear of obsolescence, or, as more frequently happens, chooses the dominant supplier as a form of insurance against premature obsolescence.

The user has a means of dealing with the obsolescence issue: the payback period used in assessing the original office system investment. The higher the risk of early obsolescence, the shorter this payback should be. Unfortunately, the peculiarities of current office systems practice make this difficult because most investment in office systems is not assessed against tangible benefits. And furthermore, estimates of rate of obsolescence are subjective and difficult to confirm.

Nevertheless, preparing a formal analysis of every investment in office systems is highly desirable, as it lays out for the benefit of the decision-maker all the relevant factors — at least the decision is not made with eyes closed.

A further factor is the role of a particular investment in the overall system framework of the user organization. For isolated systems intended to support, say, word processing in the sales offices of the organization, an assessment of obsolescence can be made on a case-by-case basis. For the organization's communications links, early obsolescence has many more wide-ranging implications. In this instance, varying the payback period is an inadequate means of coping with potential obsolescence, on its own. The key, instead, is to ensure that the overall architecture is right, so that obsolescence can be coped with as it happens — in other words, it is assumed right from the start that obsolescence will happen.

One of the risks of total reliance on one supplier's standards is that the strategy for dealing with obsolescence is a "made by IBM" strategy. The smaller user may not have much choice in these matters, but the medium-sized and larger user does have a choice.

We can summarize our main points on the obsolescence issue as follows:

— Technical advances are only one factor causing early obsolescence.

— Shortening payback periods is the most direct way of dealing with potentially early obsolescence of office systems.

— Obsolescence should be planned for right from the start.

— Key components of the user's office systems need to be part of an overall architecture.

CHAPTER 8

SOFTWARE AND APPLICATIONS TECHNOLOGY

In this chapter we cover the general area of software and applications under three headings:

—*Applications*, including standard software packages, electronic mail, and the technology used for voice messaging and information retrieval.

—*User interfaces*, particularly graphics, novel user facilities and user-oriented development languages.

—*Systems software*, including operating systems and software for supporting inter-system communications.

APPLICATIONS SOFTWARE

Spreadsheet Packages

The spreadsheet package allows the user sitting at a screen-based workstation to work directly with a matrix of figures. The arithmetic relationships of the rows and columns can be defined in such a way that changes in individual figures can be translated into corresponding changes to column and row totals, for instance. The original Visicalc spreadsheet package has been greatly improved upon, with more recent "integrated" packages allowing data to be passed from a database to the spreadsheet, and the data in the spreadsheet to be passed to software that will produce histograms or pie charts, for example.

Well-known names are Lotus' 1-2-3 and Symphony, Ashton-Tate's Framework, Open Access from Software Products International, and Smart from Innovation Software.

Typical products that merit the "integrated" label are Symphony and Framework. They incorporate word processing and communications functions absent in the more basic Lotus 1-2-3 package, for instance. In practice, current integrated packages have attracted some user criticism:

—These packages are difficult to learn, and have commands that differ from the more basic packages.

—More powerful workstations (eg with more memory and faster processors) are required; the packages strain the resources of more basic personal computers.

—The integrated packages are considered by some users to be compromises that do not offer the same functionality as their stand-alone equivalents (especially word processing packages).

—Merging and manipulating files is difficult.

These shortcomings can be expected to be resolved by subsequent versions of these integrated packages, although the need for more powerful workstations will probably remain.

The spreadsheet package is probably the main application for the microcomputers on the desks of professionals and managers. The survey we conducted in the US showed that 88 per cent of professionals and managers in the largest corporations use their office system for data analysis. The popularity of this type of application has been such that versions have also been developed for mainframes and minicomputers.

The general limitation of the spreadsheet package is that imposed by the memory of the microcomputer, and its (usually) limited capability to access data from other sources (eg data management systems). "Integrated" packages on microcomputers attempt to overcome this limitation. The associated penalty is a limit on the amount of data that can be handled and long response times. If a non-integrated approach is taken, there is the requirement to insert additional instructions, to move data between the data management module and spreadsheet, for example.

Future developments in spreadsheet packages can be expected in two directions: Further integration with other, more complex analysis (eg for forecasting, statistics and operations research) and graphics facilities, and the application of spreadsheet techniques to micro-mainframe links.

We discuss the latter in more detail later in this chapter on page 99.

Word Processing

Word processing is the most developed of office systems applications. Essentially, it provides a facility to

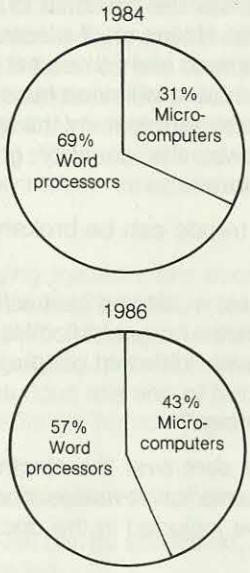
input text, to rearrange, delete, and add to the text, and to print it in the desired format. The earliest word processing applications ran on mainframe computers and were used mainly in specialized environments or as front-ends to composition equipment. The dedicated word processor was the first truly office-oriented system, and it is only relatively recently that word processing packages on microcomputers have been considered as approaching the convenience and flexibility of the dedicated word processor.

While word processors are installed in almost all sizeable businesses today, their penetration of the potential secretarial and typing market is still quite modest (perhaps no more than ten per cent of the European market at the beginning of 1985). Even so, word processors are the dominant form of screen-based office system used by this group of office workers, and their use is expected to continue to grow. Microcomputers with word processing packages are becoming a more popular option as time goes on, although word processors themselves also continue to increase in number. Figure 8.1 illustrates the findings of the survey we conducted in the US, which shows that word processors still dominate as the standard workstation among the secretaries and typists of large US corporations, but that the microcomputer has become a popular alternative.

The benefits of word processors are well established, but tend to be gained at the operational level in the form of productivity improvements among secretarial staff, faster turnaround of typing, and improved typing quality.

Developments in word processing are at present focused on the incorporation of spreadsheet output and graphics into textual material, the production of final documentation to print-quality levels (often called "in-house publishing"), and the transmission of completed output (particularly correspondence) via electronic mail to the intended recipient(s).

Figure 8.1 Use of word processors and microcomputers by secretarial/clerical staff in Fortune 1000 companies



Note: The figures given relate to secretarial/clerical staff who use the the equipment. This use is sometimes on a shared basis.

Electronic Mail Systems

The generic term "electronic mail" refers to any electronic replacement of conventional paper-based mail systems. "Electronic messages" are usually textual, more cryptic and of lower quality than electronic mail. Telex, the most widely used form of electronic message system, was developed in the 1930s and suffers from type-style and speed deficiencies. The new electronic mail systems that are being developed and used today are designed to overcome these deficiencies. They often incorporate sophisticated store-and-forward and filing capabilities, sometimes called electronic mailboxes, where messages addressed to a particular user of the system are stored.

Traditional business communications suffer from a number of shortcomings:

—Telephone conversations can only take place in real time. This leads to a high failure rate (studies show that up to 75 per cent of telephone calls fail to reach the required person) and consequently to considerable wasted effort.

—Postal communications (both internal and external) are slow, with a typical delivery time of at least a day.

—Telex facilities are slow, they have technical limitations, and the remoteness of telex equipment from most users makes telex inconvenient and creates delays and inefficiencies.

In large organizations, a high proportion of mail is originated and distributed within a given site (eg 81 per cent of documents in a recent corporate headquarters study carried out by us) and the bulk of incoming mail is generated from other company locations (75 per cent of documents in the above study). Thus intra-company electronic mail systems can potentially cope with a high proportion of business mail without needing to overcome the regulatory, legal and protocol considerations that are likely to be encountered in the public domain and for inter-company electronic mail services.

As terminal devices become increasingly widespread, electronic mail has the potential to become a

convenient communications medium for many types of message, including messages that might otherwise be carried by the public mail or telex systems. Electronic mail also has the potential to displace some telephone traffic. However, if electronic mail is to become a widespread and convenient means of communication, each user will need his own terminal or access to a nearby terminal. As the market for electronic mail grows, the usability of the facilities provided will improve.

Electronic mail trends can be broken down by two sets of criteria:

— Is the electronic mail to be sent within the organization or to another organization? Is the electronic mail link between different geographic locations, or is it restricted to one site such as a building or group of buildings?

— What is to be sent over the electronic mail link: basic documents or revisable documents? Are graphics to be included in the documents transmitted?

Basic document transfer is relatively simple to implement — the user is interested in sending and receiving documents in an intelligible form, and he is concerned that the document copy which he receives has a layout similar to the original, but he does not require editing facilities.

For external communications, several options already exist to achieve this, from the simple telex option through to the more complex services offered by the PTTs in Europe, and companies like Western Union and MCI in North America. Personal computers can readily be connected to these services through a telephone link. The key factor in the future usefulness of these basic messaging services is the growth in the number of electronic mailboxes. However, the present numbers of even relatively popular services are still quite low, and until these expand and interconnect, electronic mail will be of limited use. To overcome this, electronic mail services generally provide a courier service to hand-deliver messages to non-subscribers, but this clearly limits the effectiveness of the service.

Internal systems for basic document transfer can run on most mainframes and minicomputers and enable users at terminals and personal computers to send and receive messages.

An alternative to computer-based messaging for basic document transfer is facsimile. This can be used for external communications but most often is used in internal communications. For requirements involving graphics, forms, and the like facsimile is the ideal solution.

Standard electronic mail and facsimile are unsuitable for revisable document transfer. In this case both the sender and the receiver want to be able to revise the document, using the text-editing capabilities of their own equipment. This can be done provided that all the workstations are from the same supplier, but this is not always the case. Two approaches to solving this problem are:

— IBM's DISOSS (Distributed Office Support System) or PROFS (Professional Office System)

— Teletex

These two approaches are discussed later in this chapter on pages 97 and 118. We now briefly discuss the use of electronic mail services, in-house electronic mail, the benefits of electronic mail and facsimile systems.

Electronic mail services

Current electronic mail services are generally based on in-house computer systems or on value-added network services (VANS) operated by the PTTs or private bureau services (VANS are described on page 121).

Electronic mail usage is growing rapidly at present, and estimates of the number of mailboxes (user IDs) worldwide vary considerably, but it is probably of the order of 600,000 to 700,000 (the number of user *organizations* is about one-tenth this number). This compares with an international telex subscriber base of 1.5 million.

VANS are expanding rapidly, but because of the number of companies involved, each with its own systems, their subscribers do not all belong to a large, common pool of subscribers with the ability to intercommunicate in the same way as telephone subscribers, for example. Nevertheless, several of the VANS provide access to the telex network, or provide mixed-mode services (eg hard-copy courier delivery) to give more complete coverage to their subscribers.

The use of VANS is frequently a first step for large and medium-sized businesses planning to install electronic mail. For access to international gateways, these organizations are unlikely to eliminate their use of VANS entirely, even after installing an in-house system. The VANS also provide support for document interchange between (relatively) incompatible systems.

In-house electronic mail

Among the organizations we investigated, most in-house electronic mail systems were being constructed on a base of existing terminal and microcomputer users. This leads to ready acceptance of the application, both because of the familiarity of the users with their equipment and because of the relatively low marginal costs involved.

In large organizations our research shows that existing office workstation penetration is quite high (perhaps one for every four or five office staff in the United States, less in Europe). These are the potential users for electronic mail. The "critical mass" of users is of the order of 15 per cent; once this number of terminal users is provided with electronic mail facilities, the rest will tend to join. This suggests that many larger organizations must already be at or beyond the point where electronic mail becomes feasible. Indeed, our research shows that in large organizations in the United States (where workstation penetration is highest) electonic mail is increasingly common.

Electronic mail benefits remain elusive

Electronic mail systems have not yet achieved the levels of acceptance that have been predicted for several years (although this may be changing). The most important reason for this has undoubtedly been the difficulty of justifying the cost. By themselves, such systems are difficult to justify, and in general only businesses with specific communications needs (eg to support widespread or international operations) or organizations with dispersed decision-making processes — such as government, have been able to justify purpose-built electronic mail systems.

Other obstacles have included a lack of understanding of the benefits, uncertainty about standards, and the unavailability of suitable low-cost services.

Facsimile systems

Facsimile systems provide a means of electronically transmitting a copy of a document between two locations. They are particularly useful for documents containing non-textual data, such as diagrams or signatures.

Facsimile systems are generally used between locations of the same business, although PTTs and private service bureaus provide courier-type services (with hard-copy delivery of the transmitted document) based on facsimile. With prices of these units falling, annual shipments are expected to continue to rise. The worldwide installation base is approximately 800,000, with shipments of about 75,000 units annually at present. Problems with facsimile in the past have centered on cost (of the units and of the telephone connections) and copy quality. These have largely been overcome by the use of so-caled Group 3 machines (one page per minute average transmission time), cheaper technology, and use of computer-based techniques to improve reproduction quality. (Standardization is not an issue within the standard groups defined by CCITT standards and many units offer compatibility between groups.)

Voice messaging systems

The telephone is universally used for point-to-point voice communications, but it sometimes suffers from the fact that communication must be in real-time, since, as we mentioned above, up to 75 per cent of all business calls fail to reach the intended recipient at the first attempt. (Highly paid executives spend on average about 14 per cent of their time on the telephone.) To overcome this disadvantage, some attention has been given to enhancing telephone services, and to providing store-and-forward facilities for voice messages (sometimes caled voicegrams or voice mail).

Voice messaging systems are accessed using the telephone handset. Digitized voice messages are stored on magnetic disks, and authorized users are able to record, distribute and retrieve the messages.

The main benefits attributed to voice messaging systems are:

- —Time spent using the telephone is reduced.
- —Telephone use can be scheduled, and interruptions can be avoided.
- —Customers and salesmen can place orders outside office hours.
- —Urgent messages for field staff can be left on the system.
- —Brief reports, memos and diary notes can be dictated for later typing.
- —Secretarial time devoted to arranging meetings can be reduced.

Voice messaging systems are, however, quite expensive: typically around $350 per authorized user. Most systems cost between $100,000 and $500,000. This overall high cost is due to two factors. First, sufficient port capacity needs to be provided to support a large number of users. (Until the critical mass of users is reached, little use can be made of the system.) Second, the amount of online disk storage needed is high. Even using voice compression techniques, 300 megabytes of storage is needed to hold 20 hours of recorded messages. Voice mail systems are, therefore, usually restricted to short messages (typically a few minutes), which can only be stored for short periods.

Voice messaging systems offer many of the advantages of electronic mail (no more telephone tag, 24-hour message deposit, no time-zone considerations). Our research of user organizations shows that field sales staff are among the most enthusiastic users of voice messaging because of these factors. Other office-based users have been less convinced and up to a fifth stopped using the system after a trial period. Voice-messaging systems are used for very short periods per day (less than 10 minutes per user on average). User organizations did not have

up-to-date cost-benefit figures available, and these were usually developed only as a one-off exercise in justifying the system in the first instance.

Voice messaging is frequently provided as an additional function associated with a PBX, with more limited use of multi-function workstations that can process text, voice and data in a similar, digital form. PBX-type voice messaging is in use in the US but has had limited use in Europe to date.

Data management

We use the term "data management" in the office systems context to refer to records processing systems, a type of internal information storage and retrieval facility offered by most office systems suppliers.

These facilities are derived directly from traditional data processing techniques. They provide a simple set of screens that allow the non-technical user to define records, enter data, and retrieve data based on different selection criteria. The simplest applications are mailing lists and telephone directories.

A well-known example of a microcomputer-based data management package is dBase II from Ashton-Tate (a new version, caled dBase III, is a rewrite designed to take advantage of 16- and 32-bit technology). This type of package is quite suitable for developing certain types of applications such as project budget control or maintaining loan records for audit purposes. Packages like dBase II have inherent limitations. For instance:

— Only a certain number of files may be open at one time.

— Minimal error handling is provided.

— Security for data files is very poor.

— Searches can be very slow (eg lasting hours).

Future trends for these packages are towards making them easier to use by the unsophisticated user. (The physical limitations of the microcomputer are becoming less of a problem as the processors become more powerful.) This ease of use can be achieved by means of three features:

— ***Relational databases.*** The data are viewed as a collection of simple tables, making it very easy for the user to define data relationships and to retrieve data from the database.

— ***High level query languages.*** Using non-programming procedures, the user can carry out quite complex retrievals.

— ***Data dictionaries.*** The data dictionary essentially documents the organization of the database. Apart from making the database easier to use, it helps get around the problem that many users have, of failing to manage their databases and data structures properly.

These facilities are not new for most of the established mainframe and minicomputer database management systems — they have been in place for several years now. It is their availability on microcomputers that represents a new step.

General management applications

In addition to the application areas described above, there is a range of other generic applications available on office systems. Typical examples are:

— Diary management for appointments and meetings.

— Action checklists.

— A desk calculator.

— Access to telex.

— Booking meeting rooms and equipment.

USER INTERFACE

Ease of use is a major concern of users of software. Figure 8.2 on the next page shows the results of the survey we conducted in the United States, indicating where ease of use is prominent among the concerns and complaints of users. Even spreadsheet software, which has been a major factor in making computers approachable to users, attracts some negative comment in this regard. And one of the most recent improvements in software, the integrated package, is seen as more difficult to use, rather than less difficult (which was one of its original goals).

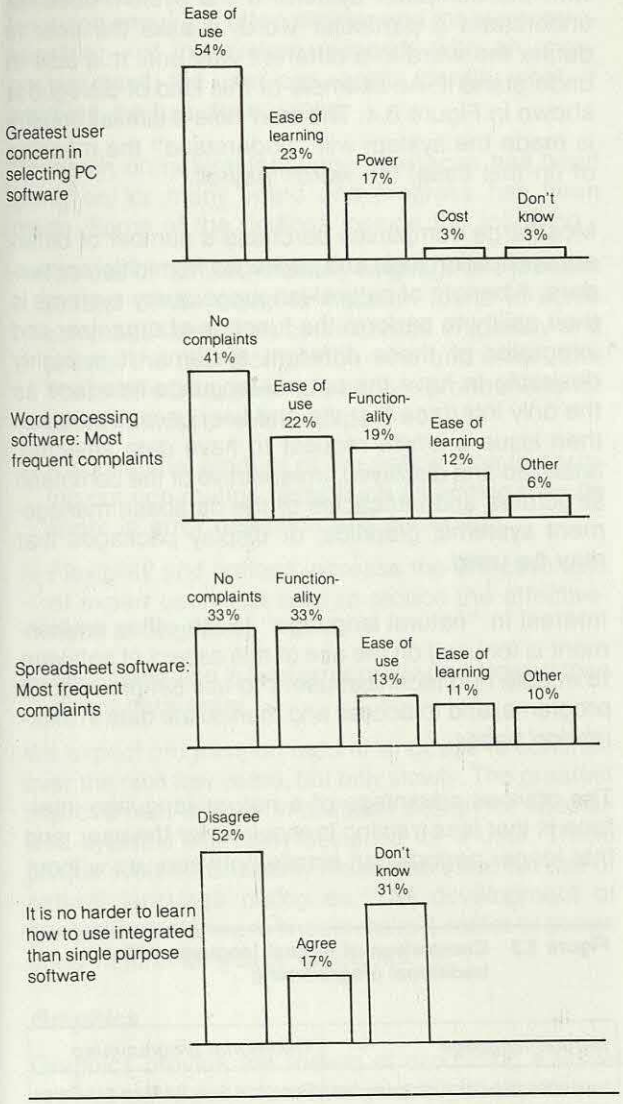
The major technical developments we review in this section are workstation interfaces, natural languages, graphics and telephone facilities.

Workstation interfaces

Trends in user interfaces have more than the one goal in terms of ease of use. The interface must provide for functionality (access to all the functions of the system, with a choice of tools), ease of learning, ease of use, and documentation and explanations of what is going on (eg why something is wrong, what should be done about it, records of what has been done so far so that the user can retrace his steps, and so on). Several features have been introduced that can assist in meeting these goals:

Windows. Windows are an extension of the operating system (see page 96 for a description of operating systems) that allows simultaneous viewing of different outputs and processes. They make it easier for the user to keep track of where he is and what is going on in the system.

Figure 8.2 How important is ease of use?



The Mouse. The "mouse" is a hardware device that controls the movement of the cursor on the screen (achieved by means of a ball in the base of the device which senses movements of the mouse on a flat surface or desktop), and provides a facility for "pointing" at a portion of the screen (achieved by one or more buttons on top of the device that, when pressed, record the screen position pointed to by the cursor).

Software integration. Integrated applications provide the convenience of similar command structures and data formats and reduce the requirement for disk loading and unloading. Redundant data entry can be reduced or eliminated with integrated software through sharing data files or a database. The most recent innovation, the "modeless" package, reduces the distinctions between the various types of use (word processing, spreadsheet, data management, graphics), allowing the user to work with an original document in all modes without transferring the document between the modes.

Icons. Really a specialized form of menu, icons can greatly speed up certain types of interaction, especially when used with a mouse as pointer.

Touchscreen. Not found on many workstations, the touch-sensitive screen bypasses some of the problems inexperienced users have with keyboards.

Desktop metaphor. Icons on the screen are used to represent objects on the desktop, which can be pointed to, moved about, altered, stored and so on.

The mouse/icon/window/desktop metaphor combination represents a move away from the traditional user interface that is simply a higher level of programming using command codes but that avoids the tediousness of menu-based interfaces. The reason for the success of the "mouse" and some of the other facilities is the consistent user interface to a range of facilities. The other advance represented by this combination is the move away from a text or data orientation. In fact, the spreadsheet, tables, and graphics all represent a "higher" level than text and data, but the mouse/icon/window/desktop metaphor combination represents a higher level still. This enables text, data and graphics to be brought together in a natural way. Further advances are likely in image handling, particularly for illustrations, video and photographs, over the next five years.

Support from MIS/Data Processing

Although not strictly a technical trend in the sense of some of the other topics discussed, the introduction of "information centers" and "microshops" has impacted on the ease of use of office systems. Both are attempts by MIS and data processing departments to bridge the gap between corporate systems and the end users. Both assume that the user wants to become directly involved and that what is needed is the right tools (usually in the form of software packages) and some assistance (from trained advisers, usually technically qualified personnel):

The information center. Long established in scientific computing centers, the information center was re-invented more recently, to provide a consulting and service facility for users and to give users access to business-related data. The information center is normally an integral part of MIS/data processing, and many of the software tools are those we describe elsewhere, such as micro-mainframe links and user-friendly mainframe report writers (on page 99).

The microshop. The in-house "shop" for users of microcomputers gives users an area where they can familiarize themselves with the technology, often coupled with the use of training courses, and also

serves to control the acquisition of computer equipment by setting standards, specifying the permissible equipment options, and so on.

Both of these strategies complement the introduction of new technologies. They are most commonly found in larger organizations. Future trends will probably see similar strategies in medium-sized and small companies, but relying more on external services beause of the costs and skills required.

Natural languages

In many large and medium-sized industrial and commercial organizations, the role of computer technology is being re-examined. With the advent of the personal computer, end users are becoming much less dependent on the central data processing department. Increasingly, the question is being asked, "Will computers ever understand normal human language?" Indeed, at least some of the promise of the "information revolution" seems to hinge on the machine's ability to speak and understand the language of people, rather than the reverse.

The languages people speak are called "natural languages." A natural-language system is one that allows a person to interact with a computer by using the same language he uses to interact with another person. Such a system needs to cope with the richness of the language as people use it — along with all its ambiguities — and overcome the typical ungrammatical language that most people use in everyday communication.

The most obvious advantage of a natural-language system is that people do not have to be trained in a programming language before they can program a computer. Given the large number of potential users of computer-based services and the relatively small number of people who can write traditional computer programs, natural-language programs are of key importance. There is another often-overlooked advantage — it is much easier to express a request in natural language than in a formal programming language. By way of example, Figure 8.3 shows the same request phrased in both natural language and in the syntax of a traditional programming command language. It is easy to see at a glance how much simpler the natural language query is to understand, but what surprises many people is the discovery that the enquiry in natural language is actually much shorter than the corresponding enquiry expressed in a programming language.

The underlying reason for this conciseness is that a natural-language system does much more than simply understand the syntax of the language. The system derives much of its usefulness from its understanding of natural language.

This understanding can be enhanced by a dialogue with the computer system. If the system does not understand a particular word, it asks the user to define the word in a different way until it is able to understand it. An example of this kind of dialogue is shown in Figure 8.4. The next time a similar enquiry is made the system will "understand" the meaning of (in this case) the word "payroll."

Most large companies purchase a number of different application tools and packages from different vendors. A benefit of natural-language query systems is their ability to perform the function of organizer and integrator of these different systems. It is highly desirable to have the natural-language interface as the only interface that the end-user uses. Users can then issue a single request to have data selected, analyzed and displayed, irrespective of the command structures and intricacies of the database management systems, graphics, or display packages that may be used.

Interest in "natural language" in the office environment is focused on the use of this aspect of software to enable non-technical users to use simple enquiry programs, and to access and manipulate data in information bases.

The obvious advantage of a natural-language interface is that less training is required for the user, and that longer periods can elapse between use without

Figure 8.3 Comparison of natural language with traditional programming

Natural language	*Traditional programming*
I wonder how actual sales last month compared to the forecasts for people under quota in the South East Region?	Print L name 84 Sep-Act-Sales 84 Sep-Est-Sales 84 Sep-Act Sales-84 Sep-Est-Sales (84 Sep-Act-Sales 84 Sep-Est-Sales/ 84 Sep-Act Sales If Region South East and 84 YTD-Act-Sales > 84 quota

Figure 8.4 A natural language system dialogue

ENTER YOUR REQUEST:

How much was the field force payroll last month?

IN THE LAST REQUEST, I COULD NOT UNDERSTAND "PAYROLL"

ENTER YOUR REQUEST:

When I say payroll, I mean the sum of all salaries. How much was the field force payroll last month?

TOTAL OF MONTH SALARIES $95,146.00

the user forgetting the nuances of a more structured, traditional type of interface. Furthermore, the natural-language enquiry is often shorter and more comprehensible — if the system responds with an unexpected result, the user can rapidly identify what, if anything, he has done wrong.

Research on natural-language interfaces has been going on for many years and progress has been made. Some of the findings include the following:

— The use of familiar, ordinary-language-like phrases instead of the complex notation found in some command languages can increase efficiency and reduce the task completion time and error rate. These effects appear to be more pronounced for users without previous experience.

— A substantial amount of the user's time in carrying out non-routine tasks such as editing may be spent in error detection and correction.

— Flexibility and options increase the effectiveness of expert users but tend to reduce the effectiveness of beginners.

— Menu selection is less error prone (but slower) than direct data entry.

We expect progress on natural language to continue over the next few years, but only slowly. The greatest improvement is likely in dialogue design for specialized systems expressly designed for a user. These unique systems ordinarily make less effective use of natural language dialogues. The development of generalized interfaces should make it easier to design good natural language dialogues.

Graphics

Graphics provide the means of producing a visual representation of information, usually in the form of graphs, charts and illustrations. Essentially, there are three sources of graphics:

— Graphs and charts produced by computer programs and software packages.

— Illustrations and graphics material input using scanner techniques.

— Graphics prepared on a computer-aided design (CAD) system or similar device.

We briefly review the trends in these three areas below.

Business graphics software

Business graphics includes analytical graphics (delivering complex tabular data in the form of easily understandable charts and graphs) and presentation graphics (for preparing slides, videos, overheads or print media outputs).

Spreadsheet packages such as Lotus 1-2-3 do not provide the full range of graphics output provided by the more specialized business graphics packages. Nevertheless, they meet many typical user needs, and illustrate three important trends, towards ease of use, integration with existing databases, and the integration of graphics packages:

— ***Ease of use***. The trend is for all types of software, and particularly graphics software, to be used directly by the office worker, rather than indirectly through data processing specialists. Integrated packages make it easier to choose output options and to preview the finished product.

— ***Integration with existing databases***. The traditional business graphics package took a specially extracted file as its input. Graphics software will increasingly need to interface with conventional database management software.

— ***Integration with software packages***. The typical package now provides some form of graphics output as an option. These graphics capabilities will become more sophisticated.

The leading business graphics packages are still mainframe-based. They fall into two groups, end-user systems (ISSCO's Tell-A-Graf and IBM's Interactive Charting Utility are examples) and subroutine libraries (eg ISSCO's Disspla and Tektronix's Interactive Graphics Library). Cost and the need for fairly powerful processors will limit the extent to which all the features of the mainframe-based packages will be made available on personal computers.

Graphics standards (which determine the ease of transfer of graphics between systems) are a problem area for the user and this will not be resolved for several years, if then.

Scanner techniques

The basic scanning systems are well established and can be used to input illustrations, logos, forms and so on. However, once the image is scanned, it may be necessary to crop, rotate, scale, or change it in some way, and a density conversion may be required to match it with the dot density of the output device (such as a laser printer). One CAD system, the Perq, has been specially adapted by Intran to handle scanned images, with the Xerox 9700 laser printer as the target machine. This is an expensive device, and it is likely that lower-cost CAD systems based on personal computers will be able to carry out similar functions in the future, but the demanding processing required will necessitate using higher-speed processors, and perhaps special function boards.

Costs of future units to scan illustrations, including a CAD-type system for modifying the input, are unlikely to be much less than $20,000. The units should become available in the next three to five years at this price.

Computer-aided design (CAD) systems
Quite modestly priced CAD systems (based on standard personal computers, but incorporating special function boards) are capable of producing original two-dimensional drawings and graphics. Transferring the results to documents is far from simple: incompatible graphics standards, the need for vector-to-raster conversion, scaling, and so on, all make it difficult to carry this operation out satisfactorily, especially in an office environment, where specialized technical skills may not be available. In the next five years, it is likely that the use of scanner techniques will remain the simplest approach.

Telephone facilities

Integration of the telephone and the user workstation enhances the user interface, by using the capabilities of the workstation to improve the telephone facilities. "Integrated voice/data" workstations usually provide telephone directory facilities and the ability to use short codes to dial the desired number, as well as various facilities normally associated with "feature" telephones. A side benefit is the reduction in the "footprint," or desk space, taken up by the combined telephone and workstation.

Integrated units provided by PBX suppliers allow some PBX functions to be used at the workstation level.

Future developments will probably be the gradual extension of the "integrated" concept, particularly for managerial and professional workstations, but the features and benefits will probably be at the technical level, with limited direct benefits to the end user (eg cabling will be simplified, by combining voice and data circuits).

SYSTEMS SOFTWARE

In this section we look at the current trends in systems software, that is, the software that controls the operation of the computers that form the basis of the office system. We cover the software components that manage communications, including network control, transfer of documents, and linking the microcomputer and the mainframe. These are critical to much current development in office systems, and it is their current limitations that pose major problems for office systems users at this time.

Operating systems

The debate on operating systems for office systems tends to center on operating systems for microcomputers.

Mainframe computers, such as IBM's 4300 series, and minicomputers, such as Digital's VAX series (which supports the ALL-IN-1 office system) are well established and are the result of development stretching over many years. These systems support many users, and by their nature, they tend to establish a de facto standard wherever they are installed. The user's basic concern is likely to be with their interfacing capabilities to connect to the organization's mainframe-based data processing systems and office workstations. Consequently the users of these systems tend not to be concerned about their operating systems, as long as they deliver the required functionality and performance levels.

The microcomputer operating system, on the other hand, can vary from machine to machine within the organization, or even within the office; there is considerable variation in the range of software packages available; and the user interface can be difficult to learn. The choice of operating system by an organization also establishes a standard that may be inadequate for the future, if that standard is not widely adopted by the computer industry or if it cannot support the range of facilities available on the next generation of microcomputers. In short, the rapid evolution of the microcomputer creates an uncertainty that does not exist with the mainframe and minicomputer, and the direct impact of the choice of operating system for the microcomputer on the user makes this uncertainty critical.

The most visible competing products for office systems today are MS-DOS (PC-DOS), CP/M-86 (and Concurrent CP/M), Unix, Pick and UCSD p-systems. Of these, Unix is likely to remain a tool for skilled practitioners, though commanding a useful product market. Many Unix features will migrate to other operating systems. Pick and Concurrent CP/M appeal to customers by providing built-in packages and system-building tools.

From the viewpoint of the user the key issues with microcomputer operating systems are concerned with portability of programs and software, uniformity of use across the various systems he has access to, and the ability of the operating system to make the hardware (and network) capabilities readily available to him.

One solution that has been proffered to meet these requirements is Unix, originally developed at Bell Laboratories in 1969/70. In theory, with Unix the same operating system could be run on the user workstation, on the shared minicomputer, and (as one of the operating systems) on the mainframe. In practice, the historical market position of major manufacturers' operating systems on minicomputers and the overwhelming popularity of CP/M, MS-DOS (and their variants) on microcomputers make it very unlikely that Unix will ever be adopted as the standard, although it is expected to retain some share of the market for

years to come. One factor that might help increase the market share of Unix is its widespread use by the smaller US developers of new products.

Fortunately for the user, each of the operating system streams is evolving to give the user the basic operating environment needed, and general-purpose software packages are issued in several versions to fit the mainstream operating systems. Furthermore, the cryptic instructions typical of operating systems are increasingly being hidden by user interfaces that use icons, menus, and natural language "shells."

In these circumstances the user will not be troubled by the complications of individual operating systems. However, portability and uniformity are likely to remain an inherent problem, and only rigorous application of standards policies within organizations will avoid it.

Network architectures

Network architectures provide a structured environment for computer system interconnection. They incorporate rules for interconnection and specify how the software must perform to carry this out. Network architectures are becoming an increasingly important issue for the office systems user with the emergence of requirements for links to the data processing systems, and for links between office systems (for document transfer purposes, for example). There are two main network architecture approaches to interconnection: integrated communications and multi-standard communications.

Integrated communications use an integrated set of standards (a single standard or a proprietary standard), while multi-standard communications require equipment to be interconnected where necessary by using either commercially available products or custom-built solutions.

In organizations where there are strong pressures for business units to work together, data processing systems are largely being built around the integrated communication approach. A recent study we carried out found that 70 per cent of organizations with these characteristics had adopted an integrated approach, while only 15 per cent of other organizations had done so.

This has implications for office systems, because it is likely that such organizations are most likely to look for office system interconnection. This will constrain the choice of office system technology because of the need to be part of the integrated communications, or to be able to connect with the integrated communications. This latter topic is discussed in more detail later on page 99 under the heading of "micro-mainframe links."

Sixty per cent of all the organizations surveyed in the study had adopted an integrated communciations approach. Of these, some 25 per cent had developed their own high-level communications software, and 15 per cent used earlier (pre-proprietary) communications standards. These are gradually being phased out in larger organizations. The remainder (60 per cent) had implemented a proprietary network architecture. The most widely used of these are IBM's System Network Architecture (SNA) and Digital's DECnet. There are several such proprietary architectures, including those offered by Burroughs, Hewlett-Packard, Honeywell/Bull, ICL and Sperry.

The key point for the office system user is that these architectures represent an established framework which offers a solution to the interconnection problem, provided that equipment and software are purchased with this architecture in mind. For the more widely used products there may be more than one supplier of equipment and software.

Future trends in proprietary network architectures may be summarized as follows:

- —There will be a greater emphasis on distributed intelligence.
- —Links will be developed to other than proprietary architectures. In the longer term (five years or more), OSI-based gateways will provide the links between proprietary architectures. (See below for a discussion of OSI and its significance.)
- —An increasing number of suppliers will adopt the OSI standards, although SNA will be a "de facto" standard in the short term.

Significance of OSI standards

Open Systems Interconnection (OSI) standards are a set of standards for interconnecting computers and office systems. The intention of OSI is to allow interconnection between computer systems, regardless of supplier, through the use of internationally accepted communications standards that could be implemented by all computer manufacturers. Although several standards bodies are involved, the formal responsibility for OSI standards development rests with the International Standards Organization (ISO).

For several reasons OSI standards are developed on a relatively long time-scale, while the major suppliers can act quickly to develop their own solutions to network architecture needs. It is in the suppliers' interests to limit the number of architectures, and for small suppliers OSI will present a viable option. OSI offers many advantages to users (eg a wider choice of suppliers, and equipment choice not dictated by the network), but the de facto existence of SNA and DECnet, for example, will make these hard to

displace, particularly if they meet basic user requirements satisfactorily.

In the short to medium term, we expect that electronic mail standards (for messaging and document structure) will be the first OSI standards to emerge. An OSI-based network architecture will not be available until close to 1990, together with OSI-based gateways for interconnecting proprietary network architectures.

In summary, the international efforts to establish OSI standards will become significant to office systems users in about five years, but in the interim, the proprietary network architectures will dominate as the main route to integrated communications.

Document transfer

Document transfer is about moving documents between users and between systems. It goes beyond simple messaging because it also provides the capability of formatting the document at the receiving end (with headings, in columns, indented, and so on) and allows for revision by the recipient. In this way several office workers can edit the same document, or make a series of alterations or amendments to the document.

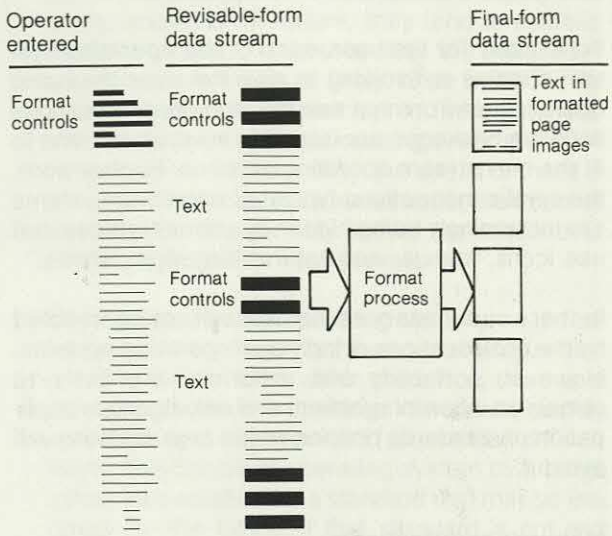
These requirements dictate that document transfer software must be able to separate out the format control parameters, be able to cope with revisions, and format the output of the final document according to the control parameters. This is shown in conceptual form in Figure 8.5.

There are five basic approaches to transferring documents between systems:

- —Disk converters, which take disks and translate not only the media formats but also the document coding so that the document is fully revisable on the target system.
- —Communicating black boxes, which do essentially the same job as the disk converter, but on-line.
- —IBM's host-based document interchange system, DISOSS (see the next section for a discussion of this product). Several suppliers are now adopting DISOSS as a de facto standard.
- —Dedicated document interchange systems, perhaps based on microcomputers.
- —Value-added network services (external services offering electronic mail services with revisable-form document transfer).

Figure 8.6 shows our assessment of the relative importance of these options in the future. We see the most important options being the IBM host-based solution (and its equivalents on other suppliers' equipment) for document transfer within organizations, and value-added networks for inter-organization document transfer.

Figure 8.5 Relationship of revisable-form and final-form data streams



(Source: IBM Sys. J., Vol. 20, No. 1 (1981))

Figure 8.6 Likely penetration of different document transfer options

	Disk converters	*Black boxes*	*IBM host document interchange system*	*Dedicated document interchange system*	*Value-added network service*
Intraorganization, same site	Medium	Medium	High	Low	Low
Intraorganization, different sites	Low	Low	High	Low	Medium
Interorganization, different sites	Low	Low	Low	Low	High

(Source: Based on Computerworld diagram, January 21, 1985)

IBM's DISOSS and PROFS

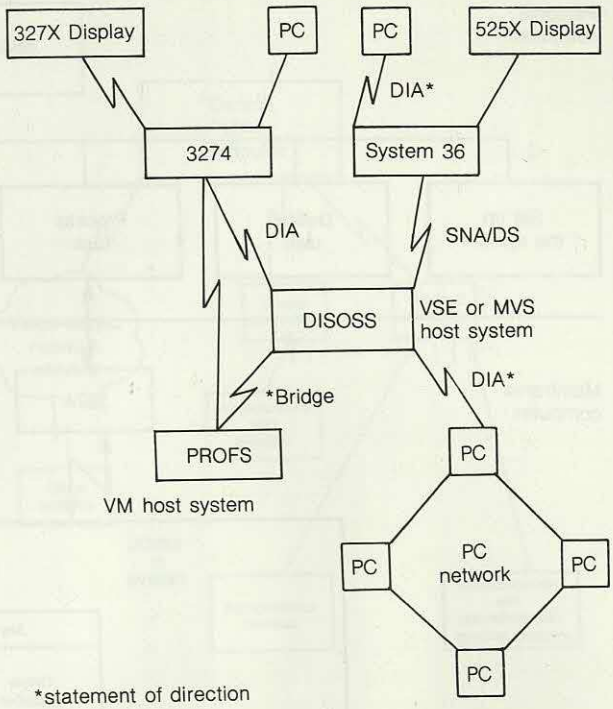
IBM's Distributed Office Support System (DISOSS) provides a basis for revisable-document interchange between systems. It handles filing, retrieval, and internal mailing of text and image documents in a mainframe (host) environment. A key aspect of IBM's system is the Document Content Architecture (DCA). The revisable-form DCA provides for the interchange of editable documents, and it permits formatting parameters, text-processing control, and revisable text to form part of the data stream.

At a different level, the Document Interchange Architecture (DIA) specifies how devices are to interchange intentions and data. It specifies the rules and a data structure that establish the discipline for predictable information exchange between devices, meaning that documents can be transferred from one device or system to another without change in form or coherence.

The key point of interest about DISOSS is the increasing number of other suppliers who have announced or are planning to announce DISOSS support. This implies that DISOSS is becoming a de facto standard for document transfer.

IBM's Professional Office System (PROFS) does not use DCA and DIA and is essentially an electronic mail system that runs under IBM's VM operating system and supports users of IBM's 3270 terminals (the standard computer terminal used on IBM systems). It has the advantage of providing electronic mail to the installed computer user base. It also provides time management (through a calender facility, a meeting schedule and a reminder facility). It does not offer the full range of document transfer capabilities provided by DISOSS. Figure 8.7 shows how the various IBM products are intended to fit together.

Figure 8.7 IBM's office-systems product strategy



*statement of direction

Legend

DISOSS	Distributed Office Support System
PROFS	Professional Office System
System 36	IBM's minicomputer
PC	Personal computer
327X Display	Computer terminal
3274	Cluster controller (for 327X terminals)
525X Display	Computer terminal
DIA	Document Interchange Architecture

(Source: Computer News (May 30, 1985))

Micro-mainframe links

In this section we discuss the software issues concerned with connecting office systems to mainframes. This is usually referred to as the "micro-mainframe link." The problem of linking the workstation on the professional's or manager's desk to the corporate information base on a central computer has only been addressed to a limited extent.

Our research shows that for microcomputers, this link is limited in most cases to terminal emulation, with the user simply using the office system workstation as a terminal to the central computer. Many of the proprietary micro-mainframe links that go beyond simple terminal emulation are designed to give a microcomputer user access to the mainframe databases via the vendor's mainframe computer software (eg accounting or database management software). One example we encountered was capable of downloading data from the general ledger package into a standard spreadsheet package, for modeling and comparison purposes. The company involved applied this process to the annual budget update, calling down the individual general ledger accounts as required. A second user of the same software product found it impractical to use it for budgeting because it could not aggregate the general ledger accounts, and a mainframe financial analysis package was used instead.

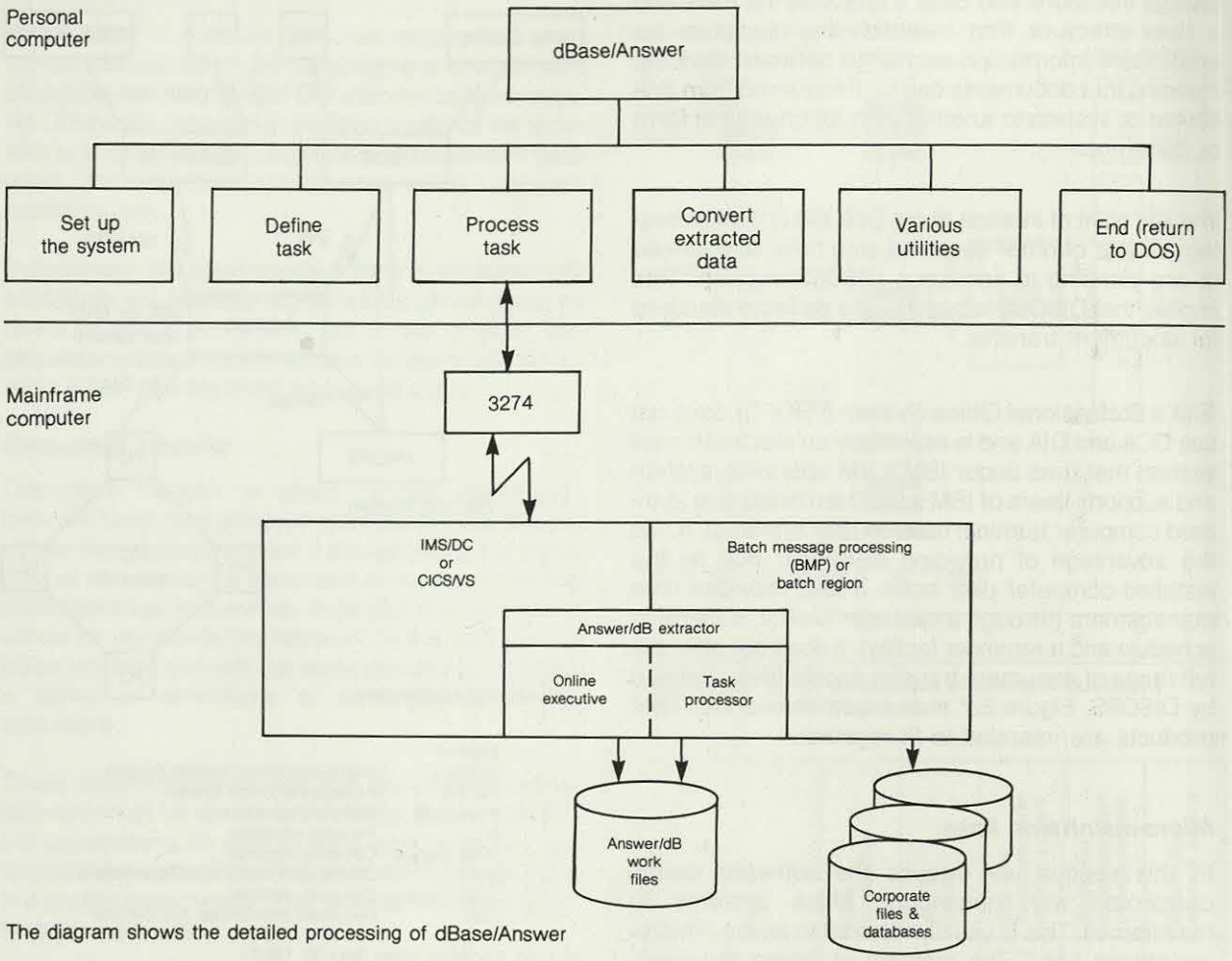
Users of minicomputer-based office systems do not face the same problems in accessing the mainframe. Such systems usually provide features that allow the office user to access data on the mainframe, using the supplier's network architecture and appropriate systems design by the central MIS department.

Downloading data to the office system

Several mainframe software package suppliers (both databases and accounting packages) already provide a downloading feature to microcomputer spreadsheet or to data management packages. For example, Ashton-Tate's microcomputer data management packages (DBase II, for instance) can be linked to Informatics's Answer/DB on an IBM mainframe (see Figure 8.8.)

This presupposes that the requisite combination of software is in use on the mainframe computer. One approach that has been adopted in several organizations is to install a database package with downloading capability in parallel with existing systems.

Figure 8.8 Software components of a specific micro-mainframe link



The diagram shows the detailed processing of dBase/Answer

(Source: Computerworld, June 4, 1984)

The corporate data can then be transferred in the mainframe environment from the main corporate files to the parallel "shadow" files (although this places a burden on the data processing staff).

In our view, the likely developments in this area include:

—Microcomputer-based access to reference files (master files) of standard database packages and accounting packages.

—Use of batch programs to update transaction file summaries periodically for access by microcomputer users.

—Use of "window" features on the microcomputer to allow simultaneous working with local files and mainframe files.

—Support of multiple mainframe environments, but probably through standard methods provided by the proprietary network architecture environments.

What are the problems and when are they likely to be solved? The first problem is cost. Amounts of the order of $50,000 and up are involved in acquiring special-purpose database software with downloading capabilities. Secondly, this type of solution will inevitably take time to implement, and will still require extensive effort to identify the data to be made available and to anticipate what data the user is likely to ask for. And thirdly, there is the problem of data security and integrity.

In the short term, the solution is likely to be the use of standard data processing systems reports as the source of corporate data for office system users. By providing a "special" version of standard reports (or providing a package to the user to extract key data for the standard reports) a simple file transfer, which can be carried out using a terminal emulation package, can be used to download the data.

We expect that it will be four to five years before the more sophisticated methods become widely accepted.

Costs will need to drop considerably from today's levels.

Protocol converters, terminal emulators and VANS

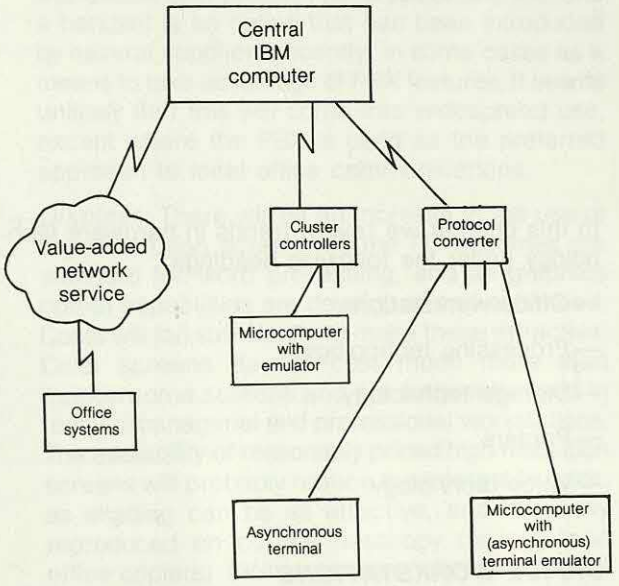
The second of these links is already available today for the IBM mainframe environment. A common type of method uses an IBM 3270 emulator (converter software built into the office system). Alternatively, a protocol converter is used. These devices are designed to link the office system into existing data communications. A typical protocol converter can handle up to 24 workstations, usually at a cost of $300-500 per workstation. In these examples, the protocol converter is set up as in Figure 8.9. The use of a separate device to perform multiple translations is currently the most flexible way of linking different systems, but it is likely that competition will come from suppliers of PBXs and emulators, who will aim to achieve conversion at a lower cost by incorporating the necessary software and hardware into their units.

Most minicomputer-based office systems can readily provide an emulation facility and a link to IBM SNA networks.

On the horizon is an IBM controller that will expand the capabilities of the 3274 cluster controller (which provides for sharing communications between the central computer and a local group, or "cluster" of terminals). The expanded controller could provide a link between the SNA network (and packetized, long-distance networks) and various terminal types, including microcomputers.

IBM already provides the Model 7171 which enable connections between IBM host systems and asynchronous-terminal-emulating microcomputers.

Figure 8.9 Linking the office system as a terminal (today's choices)



A less popular but equally workable solution is to use a value-added network service (VANS) to provide the interconnection. These services are more usually used for file transfers between systems. The user cannot therefore have direct interactive contact with the mainframe, but files can be downloaded to the office systems and accessed independently.

CHAPTER 9

HARDWARE TECHNOLOGY

In this chapter we review trends in hardware technology under the following headings:

—Office workstations.

—Processing technology.

—Storage technology.

—Printers.

—Voice technology.

OFFICE WORKSTATIONS

As the standard office workstation in the late 1970s was the word processing workstation attempts were made to build more functional (but specialized) office workstations. What happened in fact was the introduction of the personal computer as the basis for a professional workstation, and subsequently, as the basis for all types of office systems. A de facto standard was created by the widespread acceptance of the IBM PC, both by users and by other suppliers. Suppliers saw that it was in their interest to ensure compatibility with the IBM PC and to improve upon it where possible.

There seems little doubt at this point that the IBM PC and its look-alikes must be the starting point for any review of future trends in office workstations. The questions to be asked are:

—Is the personal computer in its present form the right solution for future office systems needs?

—If it is the right solution, is it powerful enough?

Since the IBM PC's architecture is open, it is possible to design add-on products and adapter cards for most additional requirements. For example, a larger screen with higher resolution could be added by using a new adapter card with a faster microprocessor and a larger memory. Better keyboards, more powerful disk drives, terminal emulators and input-output devices can be added in a similar manner.

IBM has already created a family of units with specialized functions, the 3270 PC to provide superior terminal performance (with switching between functions), the XT to provide a higher level of overall performance, and the AT which provides multi-user operation.

Specialized workstations

Nevertheless, real alternatives do exist, and it is worth looking at one of these, to see what alternatives are possible. One example is the engineering workstation (usually referred to as a computer-aided design (CAD) system). These workstations have up to 1 Mbyte of main memory, software to manage the sophisticated display (usually 17 inches or larger and with a higher resolution than an office system display), a 32-bit processor, and a detachable keyboard. Many of these systems provide features of large computer systems, such as virtual memory (this means that the practical working memory available to the user can be much larger than the physical main memory, because data and programs can be shifted between the disk storage and main memory as they are required). One system (Apollo's Domain) provides a local area network which allows all the units on the network to share resources, thus creating a larger "virtual" system. The addition of workstations to the network thus increases the processing power available to all users. The cost of such a workstation is of the order of $15,000-30,000, depending on the options chosen (such as hard disk storage, a typical component of the engineering workstation).

The emphasis on processing power of this workstation arises from the need to process complex graphics (and associated engineering computations) at high speed. This does not arise in office systems, except for certain specialized document production applications — for example image processing for illustrations and graphics to be included in documents.

In summary, specialized workstations (perhaps adaptations of engineering workstations) may have an application in the office.

Future development of the personal computer

Figure 9.1 shows a view of how the personal computer (PC) has evolved up to now.

Figure 9.1 Evolution of the personal computer 1978-86

Personal computer technology			
Characteristic	*1978*	*1981*	*1985-86*
CPU performance	0.1 mip	0.5 mip	2 mips
Main memory	64 Kbytes	64-256 Kbytes	512 Kbytes-four Mbytes
Disk storage: per drive	160 Kbytes	360 Kbytes	1.2 Mbytes
Winchester	—	10 Mbytes	20-50 Mbytes
Multi-tasking	No	Little	Standard
Virtual memory	No	No	Yes
Communication	Asynch	Asynch	Local area network
Word length	8-bit	8/16-bit	16/32-bit
Price	$3,500	$3,800	$4,100

(Source: International Data Corporation)

(Source: Computer Weekly, May 30, 1985)

In the future one of the most important developments will be in the provision of improved local storage facilities. The vast majority of installed PCs are floppy-disk-based (and may only have one floppy).

Outside secretarial groups, most users do not manage floppy-disk libraries effectively. Apart from the file names and the management of generations of files (or versions), floppy disks need correct handling and storage. The longer-term needs will be served by local (or nearly local) hard-disk storage. In the next five years this need will be met for the majority of users by a work-group file server, probably linked by a local area network set up for resource sharing. The cost of hard disk storage will continue to decrease, and in the early 1990s office workstations will incorporate some built-in disk storage, as well as removable disk storage.

Integrated software, sophisticated user interfaces, and communications all need additional main memory. The 512Kbytes memory machine will be the standard in the near future and 1Mbyte of memory will be called for eventually.

In some areas it is difficult to predict potential developments with accuracy; we list several here with a brief assessment:

— ***Keyboard changes***: Needs vary, and the full-time word processing operator needs a better-quality keyboard than the standard PC keyboard. Different variants of the standard keyboard are likely to evolve.

— ***Mouse***: For visually oriented displays (using icons or on-screen menus) the mouse has become a popular peripheral device. (The data tablet has performed a similar function for engineering workstations, using a menu template mounted on a digitizing board, or tablet.) The mouse is likely to remain a standard feature in this regard, and will supersede other options.

— ***Telephone functions***: Incorporating voice into the workstations in the form of a telephone link and a handset is an option that has been introduced by several suppliers recently, in some cases as a means to take advantage of PBX features. It seems unlikely that this will come into widespread use, except where the PBX is used as the preferred approach to local office communications.

— ***Displays***: There will be an increase in the use of high-resolution screens as the PC becomes the standard for word processing, and as graphics output capabilities are developed and enhanced. Costs will fall sufficiently to make these attractive. Color screens do not cost much more than monochrome screens and are frequently used in today's managerial and professional workstations. The availability of reasonably priced high-resolution screens will probably reduce the interest in color, as shading can be as effective, and is readily reproduced on current hardcopy devices (and office copiers). "What you see is what you get" is a powerful factor in choosing between options, and until color reproduction and color output become commonplace, the intrinsic value of color screens is likely to remain limited. (We also base this argument on the premise that graphics are primarily for communicating concepts, facts and ideas, rather than for analysis.)

— ***Portables***: Because of the need to keep the size and weight down, portables will probably contain subsets of the features of "standard" office workstations. This will have most impact on displays and on disk storage. In other respects, compatibility should be almost total.

In summary, we see the office workstations as evolving from the present generation of IBM PCs and its look-alikes. Emphasis will be an expanding main memory and disk storage. Displays will be improved, and a variety of add-on options will be available.

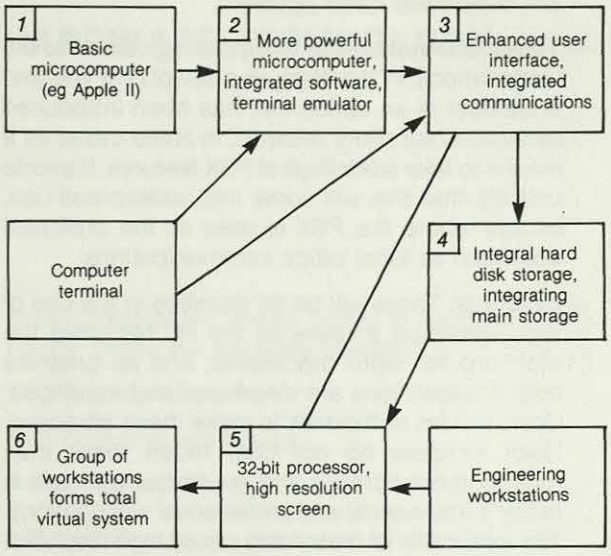
Specialized workstations for illustrations, image-processing and document production will be developed along different lines, and are likely to be variants on engineering workstations.

Figure 9.2 shows the paths of evolution in schematic form.

Workstations in a minicomputer-based system environment

Our discussion of trends in office workstations has taken the personal computer as starting point. But what about workstations in a minicomputer-based system? Such systems do support the use of personal computers but use conventional computer terminals

Figure 9.2 Evolution of the office workstation



as the standard user workstation. In some cases the terminals will have special keyboards — for word processing, for example.

In the short term, it is the connectability of these systems that provides their edge over other approaches. Local area network developments have not proceeded far enough yet to give anything like the same support to a group of users. In other respects, these systems do not offer intrinsically superior facilities (eg word processing, spreadsheet). The long term cost trend is likely to go against the minicomputer-based system providing a full range of office systems facilities. Personal computer costs are falling rapidly and are approaching computer terminal costs, and the relatively high cost of the central minicomputers will rapidly make it uneconomical to use them for personal computer-type functions. However, as integrating links (and to provide access to data processing systems, expensive peripherals and large storage), the minicomputer-based system, and its successors, will still be around in ten years. How much they are used for this purpose will depend on the direction taken by local area network developments.

Workstation costs

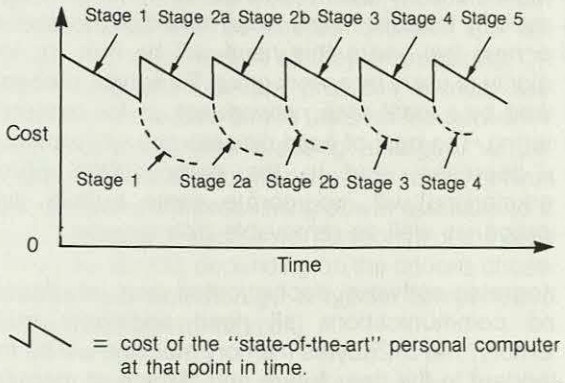
The costs of workstations follows a typical pattern. As a general statement, it is true to say that the costs of "next-generation" workstations follow a pattern similar to that shown in Figure 9.3.

When each advance in workstations is announced, the price typically is high to start with, and falls progressively as competitors launch similar products. When the next enhancements or breakthrough is made and a "next-generation" workstation is launched, it is normally priced higher than the existing products in the market. At this point the prices of these existing products typically drop at a more rapid rate until the price differential widens to a point where they can co-exist in the market, despite approaching obsolescence. This process is repeated again and again to give the pattern shown in figure 9.3.

The cheapest workstation, with a monochrome display, a terminal emulator and a simple microcomputer is likely to cost no more than $150 by the early 1990s. Along with this fall in the price of the cheapest devices, the capabilities of the office workstation will increase. A unit costing $800 will, by the early 1990s, incorporate a 16-bit microcomputer, a range of communications protocols, a high-resolution display, and a built-in hard disk. It will run a variety of general-purpose software packages designed for the office user, and will be able to fit into a range of networks.

The cost of a state-of-the-art office workstation in the early 1990s will probably be similar to that of today's leading-edge personal computer, or no more than $5,000, but incorporating many of the advanced hardware and communications features we have already described.

Figure 9.3 Costs of "state-of-the-art" personal computers

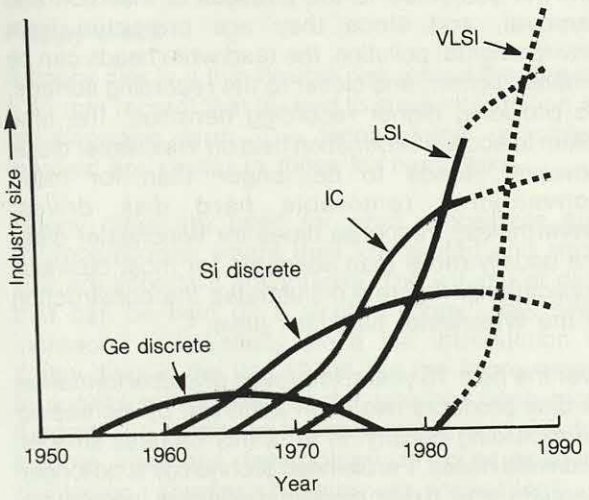


PROCESSING TECHNOLOGY

Semiconductor technology has followed a surprisingly regular seven-year cycle of significant new developments since the invention of the transistor. Each of these developments has resulted in major (usually order-of-magnitude) improvements in the processing power available from a single chip. This cycle of change is illustrated in Figure 9.4.

These changes have two distinct kinds of consequence. First, they make it economically feasible to computerize functions whose automation

Figure 9.4 Cycles of development in semiconductor technology



Ge: Germanium
Si: Silicon
IC: Integrated circuit
LSI: Large-scale integration
VLSI: Very large-scale integration

(Source: Institution of Electrical Engineers 1983)

would not previously have been justified. Examples of this include word processing and optical character recognition.

Secondly, falling costs and the reduced physical size of processors make it possible to incorporate processing power in consumer goods, office machines and system components. Examples of the first two include washing machines, calculators and photocopiers. Examples of the last include intelligent terminals and printers and enhanced disk controllers such as that in ICL's Content Addressable File Store (CAFS).

The falling cost of processors also means that all systems will tend to become distributed, at least internally. Mainframe computers have been "communities" of specialized processors for some time and the same trend has now reached as far as personal microcomputers. By 1991, two-million-instructions-per-second (mips) desktop devices are likely to be available, at the price of today's microcomputers.

Developments in microelectronics continue today, at a greater rate than ever before. The technologies involved have not yet approached the fundamental limits of size or speed imposed by the laws of physics.

STORAGE TECHNOLOGY

In this section we describe five different types of storage technology — semiconductor memory, bubble memory, hard disks, floppy disks and optical disks. We then consider the progress that is being made in the storage of different types of media — data, text, voice and image.

Semiconductor memories

Before 1970, most computer memories consisted of large arrays of ferrite cores. These were tiny rings of magnetic material one millimeter or so in diameter, strung by the hundreds of thousands on grids of wires. Ferrite cores have been largely superseded by new semiconductor memories, thanks to the advent of integrated circuits.

In its simplest form, the semiconductor read/write memory cell consists of one transistor and one capacitor. The value of the capacitance is extremely small but is adequate to store a small electrical charge indicating a binary "1", while the absence of this charge represents a binary "0."The transistor is used as a switch to connect the storage capacitor to a data line when the cell is selected for reading or writing.

However, this type of storage cell loses its stored information each time it is read, and also loses it by leakage of the capacitor's charge. Leakage can take place in as little as a few milliseconds. This kind of memory cell, known as a "dynamic RAM," therefore requires its stored charge to be refreshed about once every two milliseconds, as well as after every read operation. Other designs, called "static RAMs," do not require refreshing, but they incur the penalty of requiring additional transistors, which correspondngly take up more chip area and result in a higher cost per bit. Today, single-chip random-access memories of 64 kbits are commonplace, and 256 kbit devices are available.

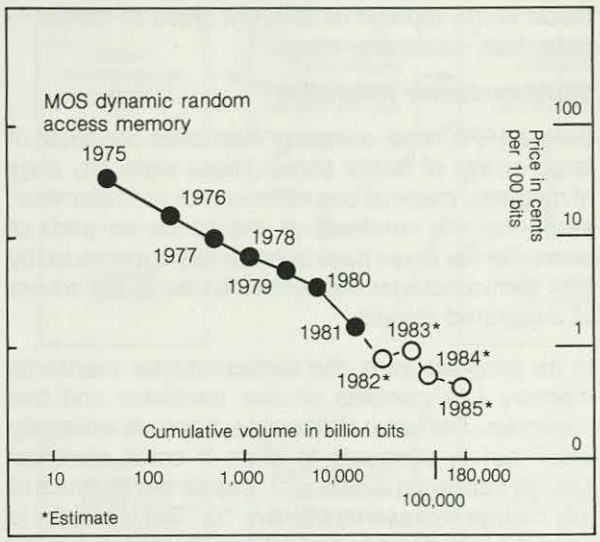
Some applications require random-access memories containing permanently stored information, such as control program instructions or constant data values. A practical example is a pocket calculator's control program, which is never changed. This type of storage is provided by the read-only memory (or ROM). In its simplest form, the storage capacitor of the RAM may be replaced either by an open circuit or by a direct connection to ground, representing a binary "0" or "1" respectively. The desired data pattern is fabricated on the chip itself, and incurs a high initial production cost.

The rapidly falling costs of semiconductor memories have been one of the driving forces in reducing computer technology costs since the mid-1970s (see Figure 9.5 on the next page).

Bubble memory

All the devices described above are random-access memories, in which a desired item of information can

Figure 9.5 The falling cost of computer memory



(Source: The Economists, March 9, 1985)

be addressed directly by its location in an array of other items. A totally different kind of device is the magnetic bubble memory which is often an important component of microcomputer systems.

The magnetic bubble memory is a serial device which cannot be randomly accessed. It exploits a physical phenomenon, the local variations created in uniform magnetic fields in thin films of certain magnetic materials, such as garnet. Both the materials and the physical principles employed are thus very different from those of transistor-based semiconductor integrated circuits (ICs). However, the device can be fabricated on chips of a sort, and it is, therefore, "microelectronic" in the broad sense of the word.

The most attractive application of the bubble memory is to replace small disk and tape memories with a capacity of up to 10^7 bits or so. When produced in quantity, it has a price advantage over small disks of comparable capacity. It has similar performance characteristics, as well as being much smaller and more reliable.

Hard disks

A hard magnetic disk is a round metal plate (about the size of a long-playing record) coated with a thin layer of ferromagnetic material used for recording electronic information. A number of disks are mounted on a common shaft to form a disk pack. Disk packs may either be permanently fixed inside an electronic read/write device (called a disk drive) or they may be removable.

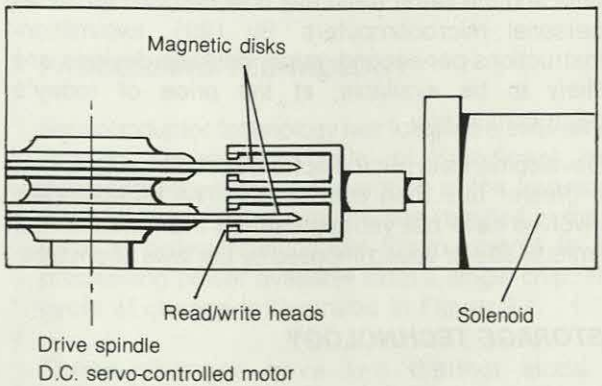
For example, the Winchester hard disk drive, which has one or more disks in a hermetically sealed and non-removable unit, has become a viable alternative to the floppy disk in some devices. Since the disks are not subjected to the stresses of insertion and removal, and since they are protected from environmental pollution, the read/write heads can be smaller, lighter, and closer to the recording surface, so providing higher recording densities. The time taken to access information held on Winchester disks, however, tends to be longer than for more conventional removable hard disk drives. Nevertheless, response times for Winchester disks are usually more than adequate for most business applications. Figure 9.6 illustrates the construction of the Winchester hard disk drive.

Over the past 15 years, improved price/performance for disk products has been achieved by increasing the recording density. In turn, this requires smaller read/write heads. Ferrite-head technology is no longer adequate, and, today, modern disk drives incorporate thin-film-head technology, using very-large-scale-integration (VLSI) chips. The advantages of thin-film-head technology over ferrite-head technology are improvements in performance, capacity and reliability, and easier manufacturing. Thin-film technology will also be used for the recording medium itself.

The dominant electronic mass storage "industry standard" today is, mainly for historical reasons, the 14-inch-diameter magnetic disk. In future, the 5¼ inch Winchester disk with a potential capacity of 300 Mbytes will become the standard, with the single-spindle 14-inch disk being replaced by multi-spindle 5¼ inch disks. The advantages of this arrangement (compared with current 14-inch technology) are:

— Physically smaller units, hence more information can be stored without any increase in space required. This is a major consideration both for large mainframe computer users and for those using desktop microcomputers.

Figure 9.6 The Winchester hard disk drive



— Lower power consumption (5¼ inch disks require less energy to rotate them).

Floppy disks

A floppy disk is a thin flexible disk (about the size of a 45 rpm record) that is used to store information in an electronic form. The technological principles involved are similar to those for hard disks.

Floppy disks are used for word processors and microcomputers where their low weight and small size are important advantages. The volume of data that can be held on a single "floppy" has been increased substantially since the introduction of floppy disks in the late 1970s, but the improvement in access speed and transfer rate has been more modest. The continuing improvement in hard disk and bubble memory technology is progressively displacing "floppies" for business applications.

Optical disks

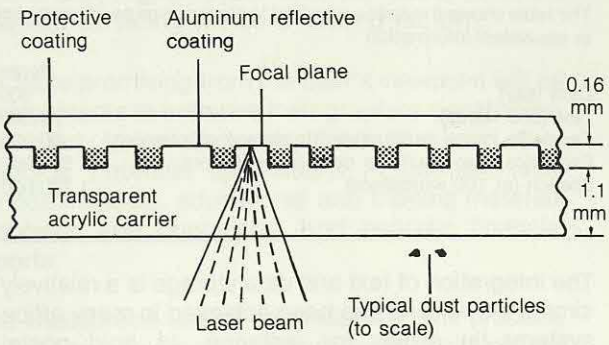
Another storage technology warrants a mention in this report — the optical disk. Current optical disks, have the following characteristics — high capacity, low cost, digital coding system, and the inability to amend recorded data (though data may be added).

A single side of a 12-inch optical disk can store 1 gigabyte of information, which is equivalent to about 50,000 pages of typescript. The time taken to access data, however, is about 135 milliseconds, compared with 33 milliseconds or better for hard magnetic disk drives. Optical disks, therefore, are sometimes unsuitable for applications that require frequent disk access but they are suitable for most archival applications.

The optical disk drive is so called because data is written to and read from the disk surface by means of an optical laser beam. This eliminates many of the mechanical and physical problems associated with magnetic disks. More than a dozen companies now have optical digital recording systems available or under development for use with computer-based systems.

Figure 9.7 shows (in cross section) how information is recorded on an optical disk. The disk itself consists of a thin sheet of clear acrylic backed by a reflective surface. Information is recorded on the disk by burning small pits into the top of the disk. Once the pits have been burned into this top acrylic layer, they are covered with a thin coating of a reflective aluminum material and the whole thing is then sealed in a protective coating. To read the information back from the disk, a low-powered laser is focused onto the pits. These pits (and the absence of pits) represent the information stored in binary form.

Figure 9.7 Optical disk storage



Although the capacity of a single optical disk is impressive compared to hard disks, a steadily increasing requirement for large-scale information storage has led to the development of multidisk optical systems. These systems either allow several disks to turn on a single spindle or adopt a "jukebox" approach. Disk selection time obviously increases the time needed to access information, so most multiple-disk systems also employ magnetic disks as indexes and buffer storage to improve the speed of operation.

For high-volume archival storage of text, data and images, optical disks are already more economic than traditional microfilm or microfiche systems. However, until the disadvantage of being non-erasable is satisfactorily overcome, optical disk storage will be confined largely to archival storage and will not threaten the dominant market position of hard magnetic disks.

Multi-media storage

The rising capacity and falling cost of auxiliary storage makes it increasingly attractive to store images and speech digitally, despite their profligate consumption of storage space (see Figure 9.8 on the next page). Continuous improvements in compression techniques are also making this approach much more attractive for routine business use.

This trend towards improved compression techniques has already made it possible to hold very large facsimile image files online for special purposes, and systems using the digital storage of speech have become commercially available in recent years.

Integration of data, image and voice, however, poses more problems than just the cost of storage, notably in the management of the storage and in retrieval. An integrated filing system must be able to handle records of anything between a few bytes and a hundred thousand bytes in length. It is difficult to maintain optimum efficiency under these circumstances.

Figure 9.8 Storage space requirements of various modes of communication

The table shows the space required to store one page of typescript or equivalent information.

	Bytes
Data (say)	500
Text (250 words)	1,500
Facsimile image (with moderate data compression)	50,000
Facsimile image (without data compression)	500,000
Speech (at 100 words/min)	1,200,000

The integration of text and data storage is a relatively simple matter and has been achieved in many office systems in order, for instance, to hold postal addresses. This integration is increasingly being supported by standard information management and retrieval systems.

The integration of text and facsimile images has already been achieved in the most sophisticated office systems, such as the Wang and IBM image systems. Text, data and structured graphics have been integrated in computer-aided design systems.

PRINTERS

Word processing as offered by personal computer packages and by word processing systems is well established and is unlikely to change drastically over the next several years. What is likely to change is the overall document production process. The availability of lower-cost laser printers will not only raise the general quality of documents (something which word processing has already contributed to) but will also lead to integration of text and graphics and wider application of typesetting, particularly for output intended for customers and for external communications generally.

Attempts have been made to interface data processing (and text processing) systems with typesetting systems for at least 15 years. The attraction of this idea is clear, and benefits accrue to both the originator and to the publisher/printer of the document. For standard published material (reports, monographs, company brochures, directories, annual reports) this has become fairly commonplace.

What is changing is the ability of the office system to produce high-quality output directly that approximates the results of standard printing techniques.

We discuss some of the relevant trends in the following paragraphs.

Printer technology

The traditional line printer, using a revolving drum or chain, or reciprocating train technology, is still responsible for much of the output from large computer systems.

The earliest electrical impact printer was the IBM Selectric golfball. Until 1972, when Diablo Systems invented the daisy wheel, the Selectric was the only letter-quality printer available. The daisy wheel was recognized as more reliable, less noisy and faster than the golfball (55 characters per second compared to 15).

Matrix printers, like the golfball and the daisy wheel, are single-character printers. But, unlike the others, the matrix printer forms each character from a dot matrix. Early matrix printing has been enhanced by the use of electronic control and the addition of a second print-head. Print speeds of 400 to 500 characters per second are now attainable. Further developments have included the use of a single line of needles rather than a matrix, reducing costs. The "infinite matrix" principle has also been invented, whereby the print-head makes successive passes and distributes its imprint so as to make a more perfect letter image. A large number of software products may be expected which make matrix printers into better-quality tools through the use of electronic control and multiple passes. One such is DOODLE, which enables line drawings and diagrams to be entered, edited, stored and printed.

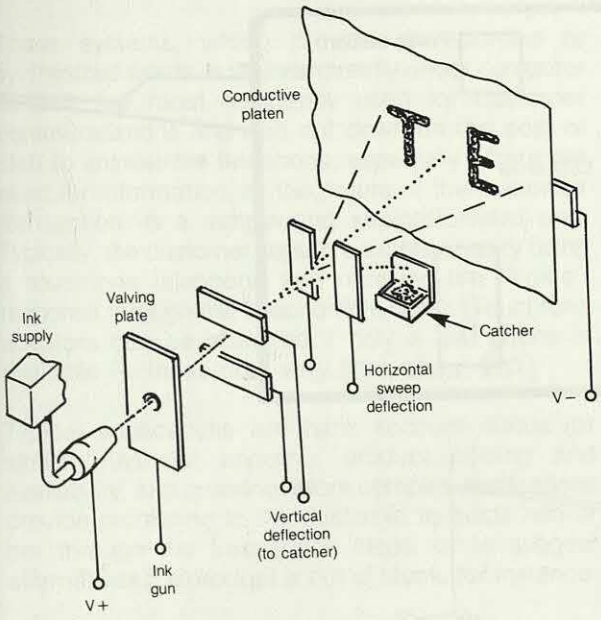
Non-impact printing technologies include ink-jet, xerographic, thermal and electrostatic. All non-impact printers have the limitation that they are unable to produce multiple simultaneous copies. Thermal and electrostatic printers also require special and costlier paper. The so-called "laser" printers use lasers as a light source in xerographic printers (see the next section for a fuller discussion of laser printers).

Ink-jet printers squirt ink selectively from a multi-nozzle print-head. (Figure 9.9 illustrates the principle of operation.) They are quiet and they produce high-quality print. Xerographic printers use the same technology as office copiers. They can run at up to 20,000 lines per minute and can overlay form headings as they print. Thermal printers exploit the reaction of special paper to heat, as selected matrix probes heat the paper's surface. They are small, light, reliable and cheap, although the paper is expensive. Electrostatic printers apply a voltage to create an electrostatic image on sensitive paper, which is then developed with liquid toner. The printer is fast and silent, its quality can be very high, and font flexibility also is good. Electrostatic printers have no moving parts, other than for paper handling.

Laser printers

The "laser" printer is a development of photocopier technology (in practice a laser is only used as a light source in some models, but the term "laser printer"

Figure 9.9 An example of the ink jet principle



is the usual one, and we will use it here). The original laser printers were intended for use as high-volume line printers with a capacity of 100 pages per minute, and as such were usually found in mainframe computer sites in companies with large output requirements. The laser printer, suitably equipped, has the unique advantage that it can be used for graphics and can approximate typeset material. The Xerox 9700, one of the original models, features high-volume output and duplex printing (both sides of the paper), and combines text and graphics under software control. Its main drawbacks for everyday office use are cost ($350,000), a fairly complex procedure to go through to set up and format the output (although for standard document types this can be simplified), and a dot density which is more than adequate for many uses, but which does not provide the very high quality normally expected of typeset, printed documents (such as brochures and books).

Recent developments have included the announcement of a low-cost laser printer (less than $5000 — the exact cost depends on interfacing requirement) suitable for office use. Although print speed is quite high (8 pages/minute) the volume is limited by the printer mechanism to about 30,000 sheets per month in a typical model.

Figure 9.10 on the next page illustrates how one laser printer mechanism works.

It can be expected that these units will be enhanced over the next few years. Likely improvements will be higher-volume throughput and increased dot densities, with print speeds of 10 to 20 pages per minute. In their simplest form, laser printers will undoubtedly displace the standard printer to some extent (but higher costs and the need for more frequent servicing will be a limiting factor).

Far more promising from the user's viewpoint will be developments to enhance their graphics capabilities, particularly to include forms, illustrations, and other graphics. Potential applications include technical service manuals, educational and training material, proposals and quotations, and periodic financial reports.

The widespread use of color displays will probably lead to developments in color "laser" printing, but cost and technical issues will mean that it will be some years before color can be considered a practical option (although we do recognize that it is feasible to produce color output already, using color plotters and ink-jet printers).

Typesetting and composition

Choosing fonts, handling letter and word spacing, layout of pages and illustrations, and so on, are complex activities usually undertaken by graphics-trained professionals. This poses problems for the typical office that plans to typeset its document output — in short, that plans to undertake "in-house publishing."

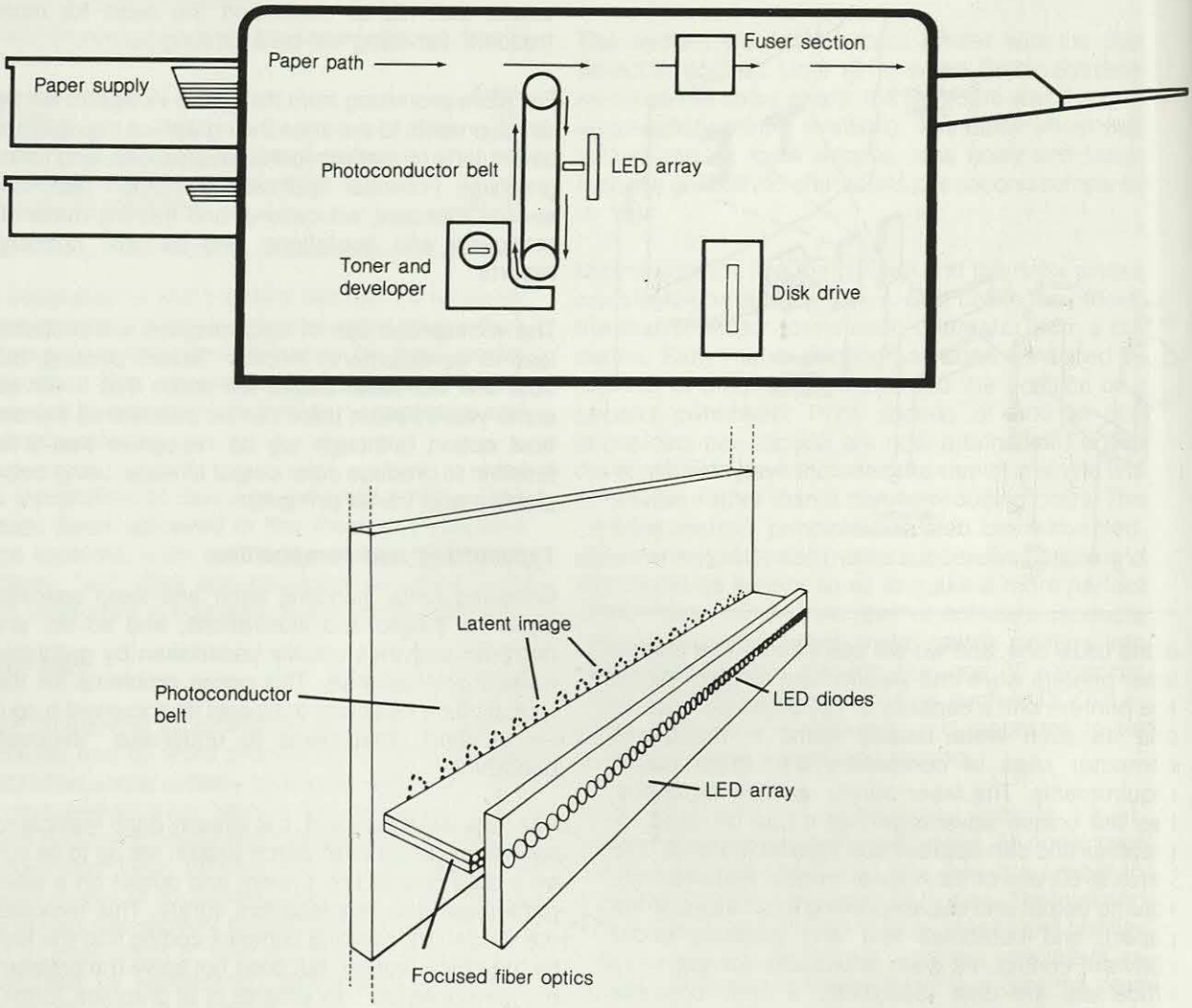
For "standard" layouts, it is already quite feasible to have a predetermined batch stream set up to be run on a data processing system and output on a laser printer with the requisite font library. This removes the burden of inserting complex coding into the text by the office worker, but does not solve the problem of "non-repeated" documents or of graphics, forms, and illustrations.

To some extent, units like the Xerox 8010 and Apple's Lisa and Macintosh go part-way to solving this problem, through the display of the full-page layout. By using a scanner to load in the required illustrations, these can be combined with the text. These units can be operated by the office worker. Some training in graphics and layout will be essential, nevertheless, for the best results to be achieved.

Future developments in laser printers will probably result in more and more functions being built into a processor attached to the printer. This will contain standard fonts, symbols, line drawing capabilities and so on. These features will greatly simplify the demands on the workstation, and will allow the use of non-specialized workstations. High-resolution screens will be required, however, with graphics, to enable details to be checked and edited.

As a result, packaged systems will emerge over the next five years that will allow straightforward word

Figure 9.10 How one laser printer works



Source: Kentek Information Systems Inc.

processor output to be output on a laser printer, with some graphics inserted. The font library will be limited, and pagination, indexing and layout will follow some simple rules. We expect that a series of standard options will be provided to the user for this purpose. This will alleviate the need for graphics and layout expertise.

For more complex work, the present practice of interfacing with typesetting and printing services will continue. The complexities of interfacing word processors and typesetters, page layout, illustrations, and so on should not be underestimated, and are such that extensive expertise will continue to be required.

VOICE TECHNOLOGY

In this section we look at current trends both in computer-generated speech (voice output) and in speech recognition (computer-based analysis and interpretation of voice input). These should not be confused with voice messaging (discussed in Chapter 8), which is the use of the computer to manage and control the recording, storage, and transmission of conventional audio recordings of voice messages.

Voice output

Recent advances in voice output have been directed at synthesis, that is, the production of speech from text using phonemes (prototypical sounds) to construct words, following a set of rules. (This is in contrast to the use of a tape recorder which contains a limited set of messages that can be drawn from as required.) Voice output frees the eyes from looking at a screen, allowing the user to do something else. It also allows telephone access, and instructions can be relayed to the system using a touchtone phone. Voice synthesis chips are quite inexpensive, and a

number of systems are available (eg Digital's DEC Talk) to convert text into speech.

These systems, which provide prerecorded or synthesized words or sounds directly under computer control, are most frequently used for customer communications and can cut down on the cost of staff to answer the telephone, especially where the need for information, or the nature of the customer transaction, is a simple and straightforward one. Typically, the customer keys in a simple enquiry using a touchtone telephone and receives the "voice" response through the telephone handset. (Touchtone adaptors can be attached if only a dial phone is available — these cost very little, about $20.)

Typical applications are bank account status (or similar financial enquiry), product pricing and availability, and ordering. More complex applications provide prompting to the customer to guide him or her through the transaction steps, or to suggest alternatives if a product is out of stock, for instance.

Up to now, the motor, finance and mail order industries have been the largest users of these systems.

Speech recognition

Automatic speech recognition is generally considered to be the most difficult and complex problem in the field of voice processing. Voice synthesis, compression, analysis, encryption, and transmission are all more narrowly defined, and all contribute to the solution of the speech-recognition problem. Some of the world's largest companies (such as AT&T, IBM and ITT), the US Department of Defense, and several universities have been developing speech-recognition technology for years, without the hoped-for degree of success. Despite difficulties, however, steady progress is being made.

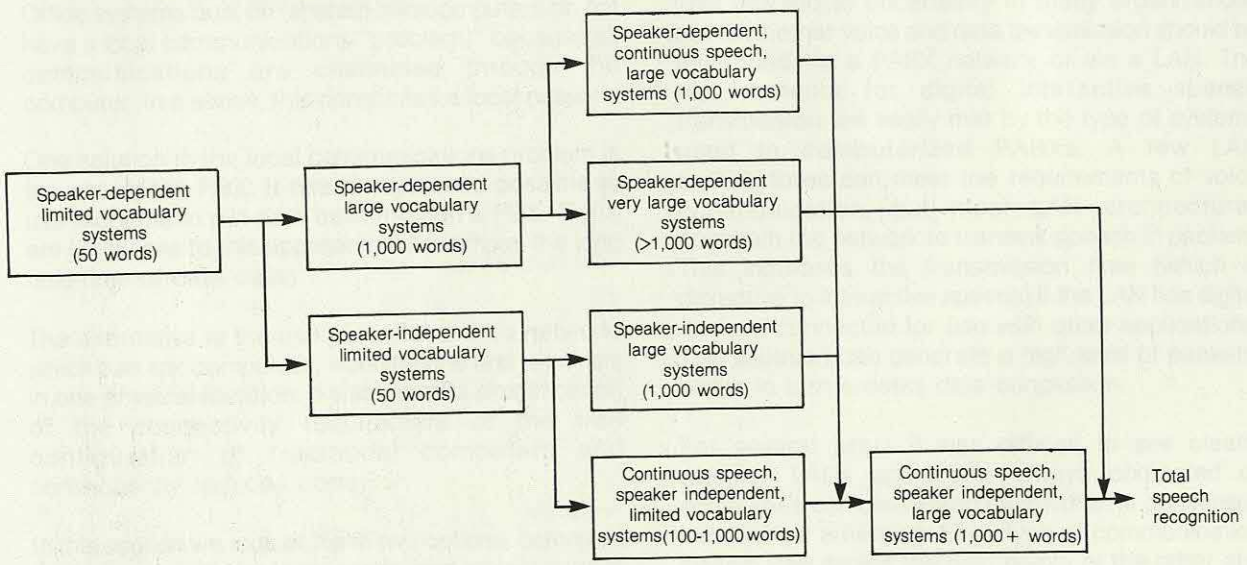
In the past 10 years, in addition to the major companies in the computing and telecommunications field, at least a dozen start-up companies have been founded to develop and market speech-recognition products. Although several have gone out of business, about a dozen companies are represented in the market.

Speech recognition draws on LSI (large-scale integration) and VLSI (very large-scale integration) chip design, signal processing, acoustic-phonetics, natural-language theory, linguistics, mathematics of stochastic (probability) processes, and computer science techniques. Because of its multidisciplinary nature and because many competent minds have pondered the problem for years, we should not expect a sudden breakthrough in speech-recognition capability. Progress will be made, but it will be evolutionary, not revolutionary.

Since normal speech contains many words that are acoustically ambiguous, it is only through the context of words and a knowledge of linguistic constraints that speech recognition can be achieved. There is a great deal of difference between recognizing a few individual, isolated words (a pattern recognition problem) and recognizing continuous speech using a large 1000-word-plus vocabulary (an understanding problem).

Automatic speech recognition means different things in different contexts. Speech-recognition products,

Figure 9.11 Evolutionary stages of speech recognition



capable of understanding isolated utterances, have been on the market for nearly 15 years. ("Isolated utterances" refers to words or short phrases spoken with pauses between them. "Continuous speech" refers to normal speech without pauses between individual words.) Figure 9.11 on the previous page shows the way in which speech recognition can be expected to evolve.

Speech recognition systems differ greatly in technical sophistication, depending on the type of speech input expected. For isolated-utterance input, a variety of signal-processing algorithms and classification schemes have been applied with success. In general, the more care and control exercised by the speaker on speech input, the greater the number of algorithms that work effectively. To reduce costs, some speech-recognition device manufacturers specify that speech input is expected to be carefully enunciated and to consist of isolated utterances, spoken in a noise-free environment, and drawn from a limited vocabulary, and from a "known" speaker. (A known speaker is one whose voice characteristics have been previously analyzed and recorded.) Of the many techniques employed, few have achieved a useful trade-off between cost and the system's ability to cope with imperfect speech. Until this trade-off is found, as a result of both technological progress and better understanding of the speech process, recognition devices will be limited to special applications where speech is the only practical method of input. To be widely applicable, speech recognition systems need to be able to understand vocabularies of more than 1000 words, though rapid continuous speech may not be a prerequisite. (It is easier to train users to speak distinctly than to teach them to use a restricted vocabulary.)

The technology and the understanding of language required for the transcription of general conversational speech far exceeds our current capabilities. A number of suppliers are working towards the development of speech transcription devices, and, by the mid-1990s, cost-effective and useful products (such as automatic speech-input typewriters) will almost certainly be on the market. However, the social acceptability of people talking to machines in an office environment might limit the market for these devices.

In the meantime, the widespread use of speech-recognition systems awaits both dramatic cost reductions and improved capabilities.

CHAPTER 10

COMMUNICATIONS TECHNOLOGY

In this chapter we describe some of the more important recent developments in communications technology, products and services. These developments relate both to communications within one building (or site) and between different sites that may be in distant geographic locations. The products and services that we review are local area networks (LANS), telephone exchanges (PBXs), packet-switched networks, teletex, integrated services digital networks, satellite developments, cellular radio, and value-added network services.

LOCAL COMMUNICATIONS

The proliferation of personal computers has created new communications problems because they were originally designed to operate independently. In very many offices, however, office workers do not work independently, and there is a need for them to transfer information, share data, and so on. In addition, as personal computers become more numerous, the total cost increases; sharing expensive peripherals can be a way to get these costs down, and this creates a further impetus towards communications.

Office systems built on (shared) minicomputers do not have a local communications "problem," because all communications are channeled through the computer. In a sense, this constitutes a local network.

One solution to the local communications problem is the use of the PBX. It has always been possible to use modems to put data calls through a PBX. There are limitations to this approach (for example, the long hold-time of data calls).

The alternative is the use of the local area network, which can link computers, workstations and terminals in one physical location. It also permits simplification of the connectivity requirement of the tree configuration of traditional computers and consequently reduces costs.

In this section we look at these two options, comment on their suitability for local needs, and review current trends.

Local area networks (LANs)

LANs are communications networks which can carry voice, data and text in a restricted geographical area. They are internal to the organization and do not use public carrier lines, although they can be connected to external networks and to private branch exchanges (PBXs).

In the last few years, a wide selection of high-speed local area networks has emerged. These networks allow a number of different devices, such as computers, printers and disks, to be shared by all the terminals attached to the network.

LANs give devices access to the whole capacity of a high-speed channel. To avoid a communications overload, attached devices must make intermittent use of this channel. Consequently, LANs are particularly appropriate for handling the high-speed bursts of traffic characterized by communications between computers.

Although local area networks provide attractive facilities and access to many different digital devices, they do sometimes compete with PABXs, which are now able to provide similar data switching facilities. This has led to uncertainty in many organizations about whether voice and data transmission should be integrated via a PABX network or via a LAN. The requirements for digital interactive speech transmission are easily met by the type of systems used in computerized PABXs. A few LAN architectures can meet the requirements of voice communication, but most LAN architectures constrain the network to transmit speech in packets. This increases the transmission time (which is disruptive to interactive speech) if the LAN has digital devices connected for use with other applications. This situation can generate a high level of packets, which in turn creates data congestion.

For several years it was difficult to see clearly whether LANs and PBXs always competed or sometimes complemented each other. A consensus view is now emerging: Each type of communication system can exploit the best points of the other and recent product offerings are beginning to illustrate

this trend. New digital PBX products in North America use LAN techniques to communicate between nodes. Figure 10.1 shows how a conventional PBX star network can be combined with a high-speed data network. (In this figure each distributed PBX may, for example, serve one floor of a building.)

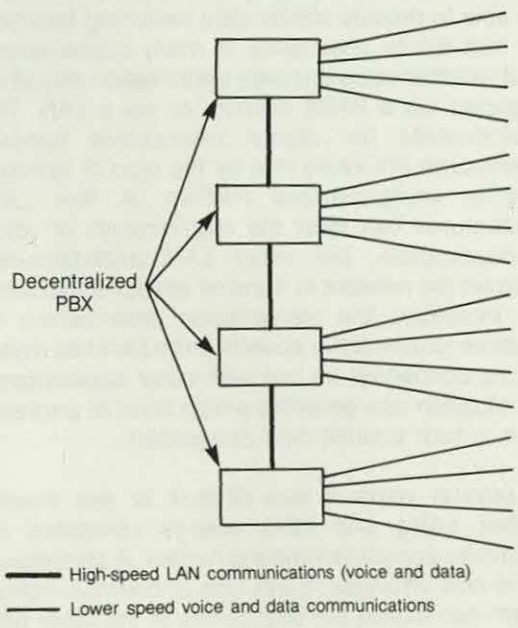
The network options

In practice three possible communication network types exist: single-frequency, baseband and broadband. We comment briefly on the three network types below.

Single frequency. The single frequency option is the traditional approach and is used for telephone and PBX systems; it is fully transparent to user devices. The wiring can be unshielded or shielded twisted-pair cable. There are several disadvantages. Its relatively low speed (about 64k bit per second) makes it inadequate for high-speed data transfer and high-speed graphics. Its susceptibility to electrical interference can cause relatively high data error rates. In addition, troubleshooting and fault isolation can be a problem (although this is a problem that the IBM Cabling System, a shielded cable, attempts to address — we discuss this on page 116).

Baseband. The baseband LAN simplifies the wiring by putting all communication on a single channel in one cable. It works at high speed and allows each connected unit to take turns at transmitting, thus effectively providing the high-speed connecting link.

Figure 10.1 Combined PBX and LAN networks



These systems work very well for smaller installations in a limited office area, and most popular LANs are of this type. Drawbacks include the following:

- —Only a single channel is available. Units take turns at communicating over the relatively high-speed channel, but file transfers or other larger operations can impact other users.
- —Baseband systems are limited to 1500 meters unless repeaters are used.
- —The links, or taps, to wire individual offices are prone to interference.
- —Interfacing with other networks requires special equipment.

Broadband. Broadband communications networks overcome many of these drawbacks by carrying several hundred channels over a single coaxial cable. They can also provide additional video, voice and data channels. With standard cable television repeaters, the network can extend up to about 65 km. However, the need for more complex electronics makes these networks most cost effective in networks that have large terminal populations or encompass multiple buildings, or many floors in one building.

Standard cables are not the only choice available for connecting office systems. Fiber optics are potentially the best medium for a LAN, but because of the lack of a satisfactory solution to "tapping" the fiber-optic link, it has to date largely been restricted to point-to-point applications (eg linking PBXs, or host computers to one another).

Network capacity

Typical numbers of connected workstations for each type of network are currently:

single frequency with PBX	one-to-one connections between several hundred workstations/computers
baseband	10 to 15 per LAN
broadband	100 per LAN
fiber-optic links	2 to 5 per LAN

Future trends

Future trends will see a drop in the size of broadband networks (they will become a practical alternative for LANs with 50 or fewer workstations), and we foresee that they will account for the majority of LAN installations by 1990. The capabilities of fiber-optic links will greatly increase in size and number over the decade, but they will be confined to very large sites, or sites with difficult environments, such as factories or chemical plants.

It is, of course, possible to construct mixed networks, provided that adequate bridges (buffered devices connecting the transmission medium — to be distinguished from gateways which translate the protocols of networking schemes) are available.

The network technologies we have mentioned (broadband, baseband, single frequency) are likely to coexist, each serving a different set of needs, although we see broadband LAN and the mixed broadband/baseband combinations as being the most widely adopted. Figure 10.2 shows how baseband is increasingly being "squeezed" by the other options.

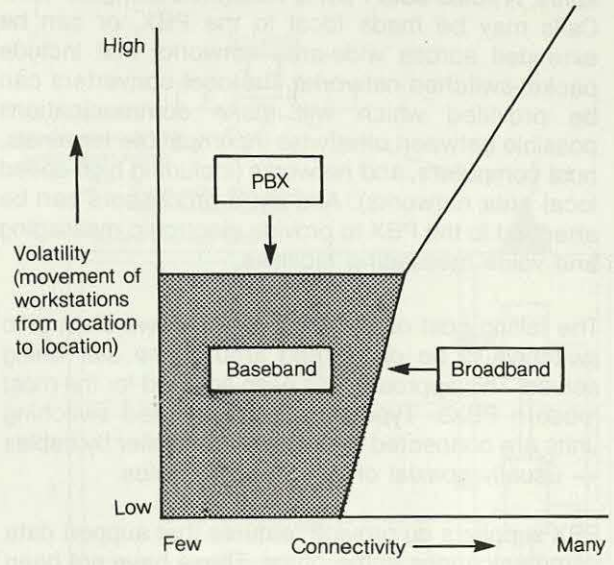
While we have suggested how a choice might be made between the various LAN options purely on the grounds of number of connections and the mobility of workstations, solutions (with appropriate software architectures) are not readily available for all the possible configurations, particularly for connecting standalone personal computers. We offer the following comments in this regard:

- —In the short term (say, until 1988), the mini-computer-based office systems appear to offer the only really satisfactory LAN approach for sizeable groups of personal computers.
- —For smaller clusters, several baseband LAN alternatives already exist which provide an operating environment that allows independent running of spreadsheets, word processor packages, and so on, and sharing of key peripherals. Depending on the supplier, gateways may be available to telex and central computers. IBM does offer a third-party broadband LAN (Sytek's PC Network).
- —IBM will deliver its own effective LAN solution for the PC, perhaps by 1988. We expect it will be the early 1990s before a long-term solution is in place that caters for inter-networking, PC-to-host communications, and full document and file transfer. And, almost inevitably the link to the SNA environment will be a key aspect of its overall operation.
- —The on-going development of ISO standards will create an environment in which users can build up their own fully integrated solutions. This will not happen before the early 1990s in terms of readily available products (because so many of the details of OSI have yet to be agreed) and users must look to some of the options we mentioned previously to meet their more immediate needs.

Private branch exchanges (PBXs)

The private branch exchange (PBX) is the central piece of communications equipment, providing telephone connection between both internal office users and the public network. A PBX differs from a simple switchboard in that it provides additional

Figure 10.2 The squeeze on baseband



functions for the telephone user with the aim of improving service and control over voice communication costs.

The addition of special software (stored program control) to the PBX has provided the user with an impressive array of call-management functions. For instance, "camp-on" facilities that allow the caller to key in his phone extension number for a call-back if the number he has called is engaged; and "follow-me" facilities to redirect calls to another extension.

PBXs are continuously being developed to provide improved voice facilities and compatibility with other office systems and data networks. The most significant of the new voice facilities is the store-and-forward voice message system (also known as the voicegram) which allows speech messages to be stored on the system. To exploit new facilities, PBX suppliers are increasingly moving away from conventional telephones to featurephones which provide function keys and thin-screen window displays.

The new type of telephone handset can be connected to the PBX by digital or analogue means. A digital connection provides the opportunity for end-to-end compatibility with the new digital trunk circuits. A digital channel also uses spare bandwidth for data transmission. As a result, data and voice handling can be integrated into the same circuit and switching system. Many PBX suppliers now offer different terminals of variable sophistication that can be connected together, and to other devices, through PBX products.

The voice-data integrated PBXs that are now available provide independently switched voice and data

circuits. The data circuit can carry data at up to 64 kbit/s. A voice-data PBX is illustrated in Figure 10.3. Calls may be made local to the PBX, or can be extended across wide-area networks that include packet-switched networks. Protocol converters can be provided which will make communications possible between otherwise incompatible terminals, host computers, and networks (including high-speed local area networks). And extra processors can be attached to the PBX to provide electronic messaging and voice messaging facilities.

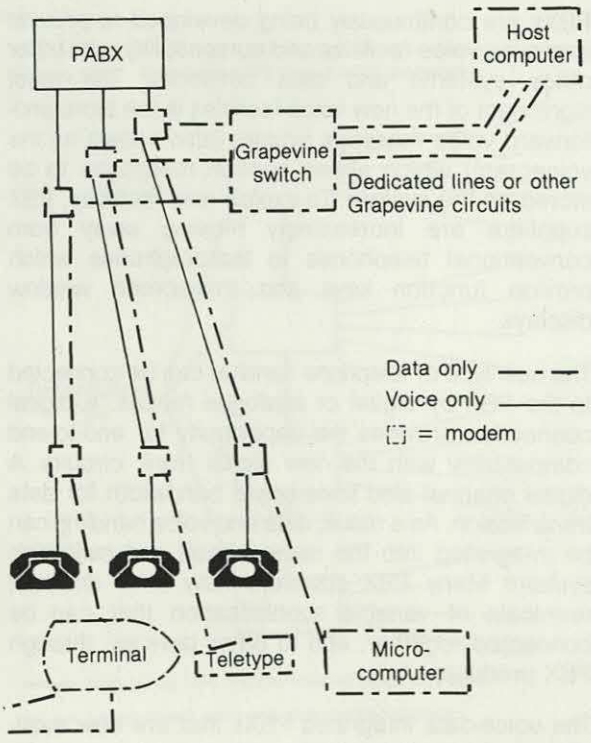
The falling cost of switching logic allows electronic switches to be distributed around the site being served. This approach has been adopted for the most modern PBXs. Typically, the distributed switching units are connected to a central controller by cables — usually coaxial or optical-fiber cables.

PBX suppliers do provide features that support data communications in the office. These have not been widely accepted because of the additional costs involved. (Our own experience is that such applications are very rare in Europe.) There are other objections to PBX use for this purpose:

—Modems are still required for off-site connections.

—The data transmission rates provided (usually 64 kbits per second) are too high to be fully used by most terminals, but are too low for file transfer purposes.

Figure 10.3 The CASE Grapevine network



—High-speed digital transmission cannot be extended to the public telephone network.

PBX suppliers are addressing these issues in the so-called "fourth generation" PBX. The most important feature of this new generation will be the integrated LAN. This will essentially provide the capabilities of purpose-built LANs, but will be integrated with, or have access to, the voice network. In some cases this is already being provided by computer connections (to IBM systems for example), or by providing a Xerox (Ethernet) option, one of the best-known baseband LANs. It seems probable that the PBX and purpose-built LAN will co-exist for several years to come, but the PBX will remain the less popular option for local office systems communications except where:

—Cabling costs and complexities are very significant.

—Other features and fourth-generation PBXs justify their use, and the cost of the integrated LAN is small by comparison.

—Portability within the office environment is important (ie systems move from office to office, and access points must be readily available).

Cabling issues

Cabling issues have risen to prominence recently because of the high costs involved in rewiring older buildings and manufacturing sites, and because of the announcements made by IBM regarding its Cabling Scheme. As always, any announcement by the market leader in computer technology creates a user awareness where before there was little interest. IBM's announcement of the cabling system was no exception. As announced, the Cabling Scheme is a proprietary scheme involving the use of shielded twisted-pair cables that are capable of high data rates, at least over a short distance. The basics of the system include a master wire distribution channel connected to the PBX and the central computer. Twisted-pair wires are run from a patch panel on each floor (in turn connected to the master distribution channel) to the outlets in each office.

The chart in Figure 10.4 shows a schematic of the Cabling System.

IBM has said that its proposed token-ring LAN will use this system. Unfortunately this LAN system is still some way off, and meanwhile IBM's current PC Network product is a broadband (and therefore coaxial cable) system built by Sytek. This broadband product is almost certain to achieve widespread acceptance over the next two to three years and it is difficult to see how IBM will be able to successfully displace it with their own token-ring LAN.

These considerations, together with the high cost of

IBM's Cabling System, suggest to us, that as now constituted, it is not yet a significant development for users.

WIDE-AREA AND EXTERNAL COMMUNICATIONS

In this section we review some of the technologies of most interest to the office systems user. These include:

—Packet-switched networks.

—Teletex.

—Integrated services digital networks.

—Satellites.

—Cellular radio.

—Value added network services.

Packet-switched networks

Public and private switched telephone circuits are widely used for data transmission. However, they suffer from three main disadvantages:

—They have high error rates (up to 0.1 per cent of data bits transmitted are errors).

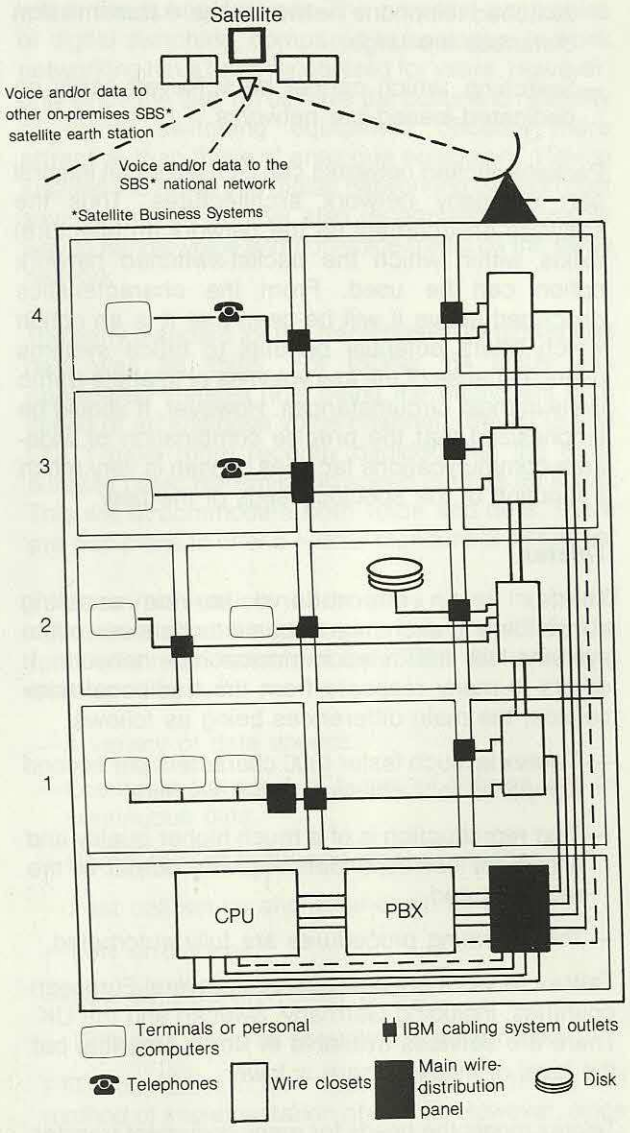
—The total bandwidth of the circuit is occupied for the duration of a call.

—Transmission speeds and call set-up and clear-down are slow.

Data traffic is sensitive to errors and often occurs in short bursts. Error detection and correction is therefore required on data circuits, and economies can be achieved if the capacity of a circuit is shared between a number of users. High transmission speeds are required for many applications (such as file transfers) and short set-up/clear-down times are desirable when small amounts of data are transmitted.

A number of different networking systems address these requirements, and one of the most important is packet switching. The Comité Consultatif International Télégraphique et Téléphonique (CCITT) has defined the X.25 packet-switched protocol for use on public data networks. The CCITT is responsible for developing recommendations for the design and operation of telecommunications equipment and services; members are nominated by national governments. X.25 defines the connection between a terminal or computer and a public data network. It also defines the service offered by the network. Data pass the X.25 interface in the form of packets of not more than 128 bytes of data. Each packet is addressed to another device attached to the network and, as in a telephone system, a connection must be established between the devices before any communication can take place. X.25 packet-switched networks have been developed in a number of European countries, as well as in the United States, Canada, Japan and elsewhere.

Figure 10.4 IBM's cabling system



(Source: Computerworld (October 8, 1984))

The main benefits of packet-switched networks, compared to other data transmission options (the public switched telephone network, leased lines or circuit-switched networks) are:

—Lower transmission error rates.

—Greater flexibility. For example, all packet-switched networks offer speed-matching facilities and enable many devices to be addressed through a single network interface.

—Lower costs, compared to leased lines or circuit-switched networks, where small data volumes are involved; or compared to leased lines or the public switched telephone network, where transmission distances are large.

—Switching, which cannot be achieved easily on dedicated leased-line networks.

Packet-switched networks can be used as an integral part of many network architectures. Thus the software environment (ie the network architecture) exists within which the packet-switched network option can be used. From the characteristics described above it will be seen that it is an option which offers potential benefits to office systems users, because of the low volumes of intersite traffic likely in most circumstances. However, it should be emphasized that the precise combination of wide-area communications facilities chosen is very much a function of the specific needs of the user.

Teletex

Teletex is an international service enabling subscribers to exchange documents between office systems via the telecommunications network. It differs in many respects from the traditional telex service, the main differences being as follows:

—Teletex is much faster (300 characters per second compared to 7 characters per second).

—Text reproduction is of a much higher quality and allows for correspondence-quality output at the receiving end.

—The operating procedures are fully automated.

Teletex services are now offered in several European countries, including Germany, Sweden and the UK. There are services available in North America, but the level of interest there is lower.

Teletex meets the needs for many document transfer applications where only text is involved. Dedicated terminals are also available. Office systems with a teletex interface could readily access the teletex services.

International links are gradually being introduced in Europe and should be available generally in the next 3 to 5 years. Telex gateways are already available that allow messages to be sent to telex subscribers.

Three issues will arise:

—Not all documents currently produced on word processors can be carried on teletex.

—Some more sophisticated in-house systems will be able to transmit more complex documents, but this capability will be available only to the in-house group and to others with compatible equipment.

—For general usefulness, teletex terminals will need to communicate directly with local networks. Initial offerings from the PTTs are likely to be based on standalone terminals, and it is not clear that teletex capabilities within systems (as distinct from a teletex terminal) will be permitted in all jurisdictions.

Thus teletex services provided by the PTTs in Europe will provide revisable document transfer, but at a limited level, while the in-house variants will extend these capabilities.

In November 1980 the CCITT defined the broad parameters of teletex, in terms of the services, the equipment's functional specifications, the character repertoire and coded character sets, the control procedures and the basic transport services. Teletex has the following main characteristics:

—The transport rate (compared to telex) of messages is fast, terminal to terminal. An international transmission rate of 2400 bit/s has been recommended, although individual telephone companies may initially choose a slower rate within their own countries.

—The publication by the service provider of a directory of subscribers is required.

—The basic terminal is a communicating word processor. (Users can normally prepare their messages offline and enter them into the terminal's memory for subsequent delivery by the service.) Since there is a memory at the receiving terminal, message preparation and receipt can take place concurrently.

—The transfer of a teletex message is initiated by the terminal's processor passing the coded text of the message, and the relevant teletex address to its teletex interface. This allows the operator to continue with local processing functions.

—The receipt of a message does not involve operator intervention. The first the operator will know of an incoming message is an indication that it is available for access within the memory.

—To ensure wide compatibility, a set of over 300 characters has been defined; each teletex receiver must be able to display all of these characters, although a teletex transmitter need only generate those characters that are on its keyboard.

—One of the basic requirements of teletex is that it must automatically interwork with the telex service (for the telex character set).

Figure 10.5 shows several ways in which teletex calls could be carried out. For example:

—A local teletex call, from TTX.A1 to TTX.A3. The initiating operator can return to normal office

system tasks once the call is initiated, as the rest happens automatically.

—An international teletex call, from TTX.A1 to TTX.B2.

—A local telex call, from teletex terminal TTX.A1 to telex terminal TX.A2.

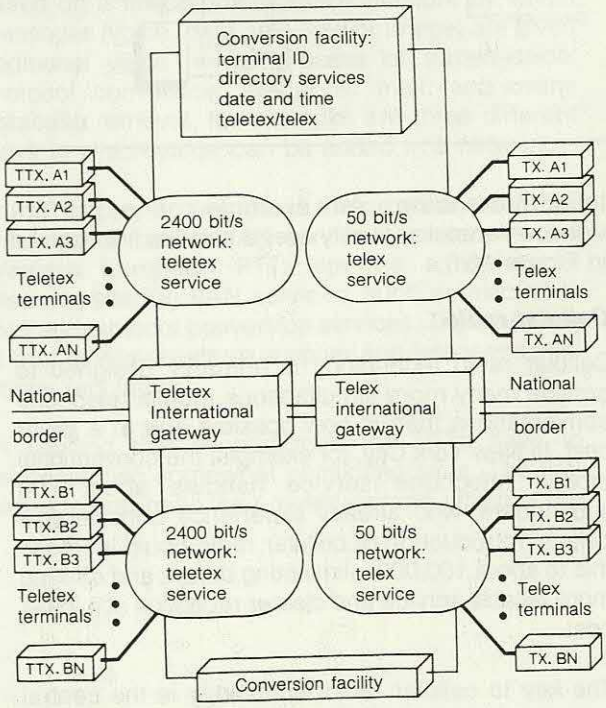
—An international telex call from teletex terminal TTX.A1 to telex terminal TX.B3.

Perhaps the most important aspect of teletex is that it will provide a standard, compatible means of providing inter-company electronic mail services. For the user, it is vital that there be a wide acceptance of the service so that he can reach his clients and customers using teletex. The level of demand for this service, however, has yet to be established — the initial demand has been less than the level expected by many forecasters.

Integrated services digital networks (ISDN)

The digital switching systems appearing on the European markets are partly a result of the research and development programs of the major European suppliers and of the PTTs. In the United Kingdom, for example, British Telecom has, for a decade and more, been developing an integrated services digital network (ISDN) based broadly on its System X exchange program.

Figure 10.5 Teletex service example



(Source: IBM Sys. J. Vol. 22, Nos. 1 & 2 (1983))

An important aspect of PTT network planning is the establishment of digital switching and transmission within the public network. The potential economies of digital switching, compared to analogue, in trunk networking have been recognized for years. However, only since the late 1970s have the costs and reliability of digital switching equipment become more attractive than those of analogue equipment. Having justified the move into digital networking through cost savings, the PTTs have also recognized a possible way to handle voice and non-voice traffic on the same network.

The early standard for the transmission of high-speed data was 56 kbit/s. For ISDNs, 64 kbit/s was considered suitable (this being the equivalent data speed of an analogue voice channel). The PTTs and CCITT have more recently decided that the most suitable basic transmission speed is to be 80 kbit/s. This will accommodate both voice and data. There are also plans to offer a further standard of 144 kbit/s.

Telecommunication authorities are in broad agreement about the general nature of an ISDN. The functional requirements of the ISDNs that are being developed include:

—A variety of data speeds.

—Economic transport of bursts of data as well as continuous data.

—Computerized trunk and local exchanges.

—Fast call set-up and clear-down times.

—Low error rates.

—Low data transfer delay times.

—Different levels of security for transmission.

PTTs may differ in their approach to the timing and method of implementation of ISDNs. However, since voice traffic will, in the foreseeable future, remain the dominant form of communication, developments in digital voice telephony will provide a measure of progress in the evolution of ISDNs.

When an ISDN is fully implemented, each subscriber will have one or more lines. Each line could be connected to a digital telephone, an answering machine, a data terminal, a facsimile device, a computer, or a multifunction workstation. Standard protocols will ensure that messages are delivered only to devices that are able to interpret them properly. It is specifically intended that one ISDN-compatible line should be able to service both a telephone and a data terminal concurrently.

PBXs are connected to ISDN facilities through both 80 kbit/s and 2 Mbit/s links. General-purpose computers will be connected via 2 Mbit/s links. The

ISDN protocols, where practicable, conform to X.21, X.21-bis and X.25 standards.

The ISDN interface provides both circuit-switched and packet-switched access to the local exchange.

In Europe, progress towards digitizing the various national networks is at different stages. The first European administration to commit itself to digitizing its network was the French PTT. The rapid implementation of both digital transmission and switching equipment is reflected in some recent announcements. Thus, only digital switches are now ordered by the French PTT. The United Kingdom PTT (British Telecom) does not expect to install any new analogue switches. The PTTs in West Germany, Italy and Sweden are all committed to plans that will involve a greater reliance on digital switching and digital transmission.

Satellite networks, cable networks, microwave networks, local area networks, and PBX-controlled local networks offer new options for private communication systems. The opportunities arising from digital technology provide new competition for the telephone companies, in both trunk and local networks. Despite this, it is not realistic to imagine that economic pressure and advancing digital technology will combine to erode or destroy the empires of the European PTTs. With their networks already in place and offering vast unused potential, the established carriers are well placed to meet the competition head-on.

Satellite developments

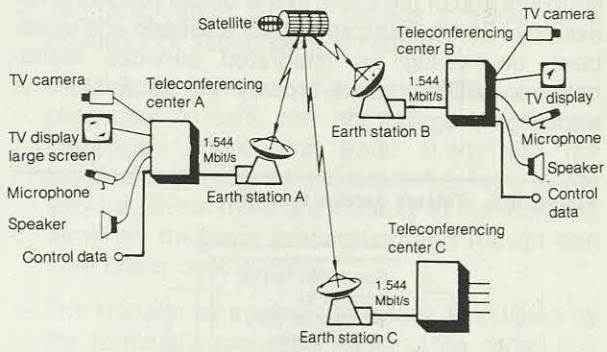
Until 1965, when the first communications satellite was launched, virtually all international telephone traffic was carried by land or submarine cable. Since then, satellites have played an important role in the exponential growth of telecommunications traffic. During the 1960s it was thought that satellites would replace cables for long-distance telephony. But cable technology has made great progress in the face of competition from satellites, and it remains highly competitive. Nevertheless, the demand for telecommunications is growing so fast that demand for satellite capacity is growing as fast as it can be provided.

Telecommunications satellites are used primarily for television transmission and long-distance voice and data communications, and their main users are telephone companies, broadcasters, industry, business and government. Telephone companies lease capacity on the different satellites and serve as common carriers themselves or provide specialist services. For example, the TV industry uses satellites to distribute program material. In North America, extraordinary growth has occurred in satellite-distributed cable TV programming, and the broadcast networks are also using satellites extensively. In general, demand is in excess of satellite capacity.

The use of satellites to meet the needs of private business networks is growing even faster, though it started from a much smaller base. The main market is in larger dispersed organizations in manufacturing, finance and government, and computer service companies.

The future of satellite communications for long distance voice and data traffic, including private network services, seems assured. Although the costs of land-based cable networks will continue to fall, particularly with the widespread installation of optical fiber cable and the digitization of the telephone network, these networks will tend to be used for local traffic and to feed long-distance satellite links. The greatly increased bandwidths and line speeds made available by these technologies may even stimulate the growth of image-based products and services in business, such as slow-scan TV, facsimile and teleconferencing. An example of a current videoconferencing facility over a satellite link is given in Figure 10.6.

Figure 10.6 An example of videoconferencing over a satellite link



Cellular radio

Cellular radio technology is primarily designed to provide many more simultaneous mobile telephone conversations than is now possible and at a lower cost. In New York City, for example, the conventional mobile telephone service handles about 700 subscribers, who already experience considerable delays. Introduction of cellular radio could increase this to about 100,000, eliminating delays and offering more reliable service and clearer reception at a lower cost.

The key to cellular radio technology is the central computerized automatic switching system within a metropolitan or rural area in which the service

operates. The total area is divided into cells, each of which contains a base station transmitting only to radio telephones within its boundaries.

As the user moves from one cell to another the conversation is automatically switched to the next base station by the central switching system. Because it allows frequencies to be re-used, this allows many more calls to be handled within the area, which, theoretically, could always be subdivided into more and smaller cells, providing almost unlimited capability for the system. Figure 10.7 illustrates the cellular radio principle.

Cellular phones can offer automatic direct-dial connections anywhere in the world. The phones can also provide stored numbers for high-speed dialing, and can even be used for data, telex and videotex transmission, via a modem. Although cellular radio technology is usually thought of as a car-based facility, portable phones and terminals can also use this technology.

Cellular radio offers a potential means of supporting mobile office workers, or providing field service workers and sales staff with office services. The simplest application is voice mail. The mobile telephone can be used to leave or listen to voice messages. Or a portable terminal could be connected via cellular radio for electronic mail use.

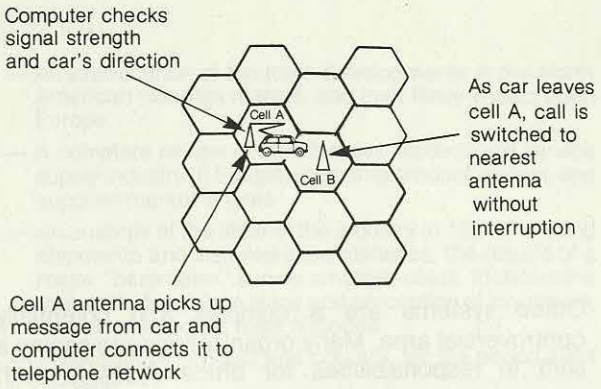
Value added network services

A value added network service (VANS) is a service based on a telecommunications network by which messages (voice, data, text, and/or image) are given additional value in the process of transmission. Protocol conversion, electronic mail, and online database retrieval, for example, are three different ways in which value can be added in a network.

The PTTs play a dual role in the provision of VANS. One role is that of VAN service operators — the Western European PTTs operate a variety of resource-sharing VAN services, such as electronic mail and protocol conversion services. The other role is that of infrastructure supplier and telecommunications regulator.

In fulfilling this second role, the PTTs have to reconcile two somewhat conflicting aims. The first aim is to maximize their revenues from usage of the

Figure 10.7 The cellular radio principle



communications infrastructure — the infrastructure is extremely expensive in terms of capital costs. The second aim is to discourage independent service suppliers from competing directly with them. With these conflicting aims and dual roles, the PTTs tend, perhaps naturally, to take a "self-interest-first" position in approving applications to set up new VAN services.

Despite these constraints, we expect the number of VANS to grow and for them to become increasingly important over the next decade. The future trends in VANS are towards more comprehensive, integrated and intelligent services; they will also move from general services towards specialist services, such as industry-specific electronic ordering systems. Another trend, common in other sectors of the information technology market, is towards greater competition and choice. VAN services for the consumer market (such as property-for-sale databases) are also beginning to emerge.

The evolution of the VAN service market can be illustrated by reference to GTE Telenet. Its first offering linked low-speed asynchronous terminals to host computers. In the past two years, Telenet has introduced a range of services for IBM devices (such as the 3270 and 2780), to allow users to access multiple host computers. Following the trend towards specialist services, GTE now offers (in conjunction with the American Medical Association) a specialized database and electronic mail service to the medical and health-care professions.

CONCLUSION

Office systems are a complex and potentially controversial area. Many organizations are seeing a shift in responsibilities for office systems, with considerable uncertainty as to who is, and who should be, responsible for corporate systems. To resolve these issues and often conflicting priorities, serious policy initiatives must be taken, sometimes requiring the intervention of top management. A good deal of personal and career credibility may be invested in office systems, just as in the case of DP in an earlier era.

In these circumstances the prudent manager will wish to ensure that office systems are properly understood, carefully planned and adequately monitored. This applies especially now, as office systems investment is reaching significant proportions.

Justifying this office systems investment only in terms of possible productivity benefits represents too narrow an approach — office systems have a far greater potential to gain direct business benefits for organizations, if moved to the front office. The most important front-office applications are best identified and exploited by concentrating on key business objectives and the activities associated with achieving those objectives.

The potential scale of the investments need proper planning and management. So far, office systems have developed primarily in a "user-pull" environment. MIS and DP departments will need to play a more prominent role (they already are in many organizations), if organizations are to avoid building a legacy of incompatible systems, unwanted equipment and facilities and, perhaps most importantly, lost opportunities.

At the same time management needs to be aware that office systems demand a different approach and different planning and monitoring procedures than conventional data processing systems. Organizations need to create a corporate environment in which individual users and managers can innovate within a well-defined but flexible framework, if office systems are to achieve their potential.

CURRENT REPORTS IN THE OMNI REPORT SERIES

Information Technology and Cash.
To be issued December 1985
Rising costs and payment volumes and increasing competition have encouraged organizations such as banks and retailers to look to information technology to cut the costs of handling payments, improve service levels and deliver new cash management services.

Electronic payment and cash management services present opportunities to all potential players — banks, retailers of goods and services, hardware suppliers and network services providers.

This report reviews the opportunities offered by the new electronic payment and cash management services. Retailers will be put under pressure by the banks to adopt electronic funds transfer systems at the point of sale (EFTPOS), but could harness it to cut costs or even diversify into financial services themselves. Indeed, an increasing number of organizations involved in retailing are now moving into the banking services arena, thus effectively competing with established banking and credit card services. Half the retailers we surveyed for this study plan to introduce electronic fund transfer systems at the point of sale (EFTPOS) within the next three years.

Corporations can also take advantage of new cash management services and systems to optimize cash utilization and reduce borrowing and transaction costs, and small companies and private investors can use on-line "home banking" services to manage their financial affairs more efficiently. The report describes and discusses the impact of these new systems.

Opportunities in Office Automation:
A guide for the '80s and beyond.
Issued October 1985
Advanced office systems have been regarded for many years as offering great potiential. In the 1970s there was a false dawn of interest in such applications, with many forecasters anticipating a "revolution in the office". But the office revolution proved much easier to write about than to achieve. Those actually responsible for planning and implementing systems found many obstacles confronting them. Not least of these was the difficulty of building systems that were clearly relevant to the needs of those who would use them and the development of satisfactory criteria for investment.

A decade of experience has now been acquired, sometimes painfully. Throughout Europe and North America, advanced office systems are in use. The opportunities are better understood. A body of expertise has been developed. It is now possible to identify in a *practical* way policies and procedures that lead to successful systems.

This report is a guide to the unfolding opportunities in office systems. It provides a new perspective on the issue of assessing benefits, and supplies detailed guidelines for planning and monitoring office systems. It discusses the impact of office systems on the role of MIS departments. It analyzes implications for both users and suppliers and provides a guide to the state of the art of office system technologies and applications.

Videotex in Europe.
Issued January 1985
This report provides

— A review of the current status and likely future outlook for videotex in Europe on a country-by-country basis
— An examination of the main developments in the North American videotex market, and their likely impact upon Europe
— A complete review of the videotex product and service supply industry in Europe, including product reviews and supplier market shares
— An analysis of the state of the industry in 1984, including shipments and installed-base statistics; the results of a major "barometer" survey amongst users, to determine their attitudes, future plans and perception of key issues, and nine selected case histories
— Forecasts by product and country, for the period 1984 to 1988

The report, which is based on extensive and new research amongst suppliers, users and European PTTs, complements and extends the factual information and geographic coverage of Butler Cox's earlier report "Private Videotex Systems — their Selection, Use and Future Prospects."

Information Technology: Its Impact on Marketing and Selling.
Issued December 1984
By 1995, sales and marketing teams will be fighting the competitive battle with new tools. Information technology — using computers, communications and screens — will present the value and utility of products to a wider yet more carefully selected customer base. We face the most important developments in sales and marketing since the advent of TV advertising. Companies who ignore these developments, whose sales and marketing strategies remain embedded in the pre-electronic past, face dwindling market share, rising costs and eventual eclipse. The most knowledgeable companies are planning now, asking themselves this simple but profound question: how do we sell to the institutions and citizens of the information society?

This report examines both current and likely applications for information technology products and services, and identifies the key threats and new business opportunities likely to emerge in the future.

Private Videotex Systems — Their Selection, Use and Future Prospects.
Issued October 1983
This report is a definitive analysis of the European private videotex system market. It surveys the offerings from 62 system suppliers, 60 videotex bureaus and 127 terminal manufacturers and distributors. It describes product and service features, and offers potential buyers guidelines on key selection criteria. It examines how private videotex systems are being applied, and offers a proven application selection and evaluation methodology. It describes 10 representative case histories, from four European countries, and identifies the strengths and weaknesses of videotex, compared with other media and technologies. It analyzes the costs of hardware, software, terminals, and application implementation, operation and support. It also reviews the sources of revenue and benefit that are needed to justify investments in service provision. Finally, the report analyzes the factors which are resulting in evolutionary product changes and to the growth of the market. It identifies and describes the main product generations likely to evolve over the next 10 years, and projects the size of the market for them. The market forecasts are broken down by the main country-market groups, and cover most products and services, by value and volume for shipments and installations.

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