EDP ANALYZER

SEPTEMBER 1978
VOL. 16, NO. 9

THE AUTOMATED OFFICE: PART I

The automated office field is just beginning to emerge. A few conferences have been held on the subject, a growing number of firms are actively experimenting with office automation, and a barrage of new products is expected soon. We have been watching the field for about one year. In this report and the one next month, we will present our findings. These two reports are intended to provide 'early warning' for data processing management about a significant new trend. We see the automated office field heavily impacting how all companies will use computers in the future.

Just what is the automated office? It is known by several names: the office of the future, the automated office, the electronic office, and others. Basically, the automated office is a new, structured way of handling business documents and person-to-person communications. It refers to the investment of capital in electronic office equipment, which is connected to a communication network thus forming an integrated, multi-function, electronic office system within a company. In its broadest use, the automated office includes not only this intra-company office network but also connection to an external network for electronic communication with the outside world.

For many companies the introduction of word processing equipment, to aid in the generation of paper communications, might be thought to be their first move toward a more automated office environment. However, as the term is currently being used, the automated office is not a group of stand-alone word processing systems but rather an integrated system. The various components are interconnected by a communication network, possibly using the same data network facilities that we discussed two months ago.

The basis for the automated office is this electronic network. It might connect, say, the following services: word processing for the generation of formal and informal correspondence, electronic message system for person-to-person electronic communication, facsimile for rapid document and graphic transmission, electronic 'file cabinets' for document storage and retrieval, and links to various corporate files and outside services. All of these services would be accessible from electronic work stations. We shall give a more complete list of the possible components of such systems later in the report.

Implicit in the automated office is the use of computers — computers for controlling every facet of the system. So the automated office is really a multi-function, integrated, computer-based communication system that allows many business communications to be performed in an electronic mode. Proponents say that this new communication mode will enhance paper and voice modes, rather than totally replace them.

In addition to these technical considerations, a study of the automated office also includes social and organizational aspects. People in the field say that the automated office will alter work habits by changing the way employees communicate with each other. They say it will change the office environment by allowing greater flexibility in where and when people can work. And they say it will affect the organizational structure by changing, for example, criteria for promotion and compensation.

The automated office thus is more than the addition of newer, computerized business application packages. It is a new office environment, based on electronic communication. It will eventually change the way in which offices are run.

The purported reason for installing the automated office is to increase the productivity of office workers, particularly managers. Proponents in the field point out that management's modes of gathering and disseminating information and making decisions so far have not been much affected by the computer. Most managers still depend primarily on word-of-mouth communication. The automated office will have quite an impact on how managers perform their jobs in the future, and this will increase their productivity.

In our research on this subject, we found that companies fall into three categories: 1) those companies that now operate in an automated office environment, 2) those companies that are now actively planning for their future office environment, and 3) those companies that have not yet thought about their office of the future.

Those companies in Group 1, which operate in an automated office environment now, can do so because they have access to a data network that has the following three properties. First, the network allows cost-effective transmission on a per-message basis, with switching costs exceeding transmission costs. Second, the network uses a standard transmission method. This standard is accessed either through the use of one standard type of terminal/computer equipment or through the use of network interface processors. The processors convert messages received from a variety of computers and terminals into the network standard. And third, the network provides efficient message handling capabilities.

An example of a network with these three properties is ARPA Net, which has nodes in the continental United States, Hawaii and London. We have discussed the ARPA Net in past issues (such as the November 1971 report) and we shall have more to say about its characteristics later in this report.

When using ARPA Net, individuals in these automated offices are able to enter, store, query, and distribute data and text in an electronic mode, rather than in a paper mode. Communications with other individuals on the network are entered and retrieved through computer terminals using electronic files. Thus, co-workers may be in the same building or across the United States; it makes no difference. So, a data network, with the accompanying message and file handling facilities, makes an automated office environment possible today.

We found that the only companies in Group 2 (those that are planning for their future office environment) are the very large corporations. We know of fewer than 20 such companies in the United States that have formally organized task groups to perform the initial planning for their office of the future (but we suspect that this number is growing daily). Very large companies are often the leaders in using a new technology, because the costs can be so large. Since no integrated office systems are now available on the market, only very large companies have the resources to plan for and develop such systems. Some of these companies that we know of are doing just that, by working with vendors to develop specifications for prototype systems.

Group 3—that is, those companies not yet thinking about the impact of the automated office—consists of everyone else. While it is true that many companies now have word processing systems, computer-output-microfilm (COM) systems, and even company networks, we do not consider these stand-alone installations as constituting an automated office, unless evolutionary integration of them has been planned. It is the coupling of such diverse systems into a computer-based communication system that differentiates the automated office from such stand-alone systems. And, as we mentioned, there are no such integrated systems yet on the market.

To illustrate the progress made thus far toward the automated office, we talked with the people at the Information Sciences Institute of

the University of Southern California and the people at the Exxon Corporation. ISI is one of the major nodes on the ARPA Net, so we would classify them in Group 1—they now operate in an automated office environment. Exxon Corporation is representative of the companies in Group 2 — they are actively planning for their future office environment.

Information Sciences Institute

Information Sciences Institute (ISI) is a research institute of the University of Southern California. ISI was formed six years ago to do research on the information sciences. It now has 85 employees and is located in Marina del Rey, California, a suburb of Los Angeles. Since its beginning, ISI has operated in an automated office environment, with a CRT terminal on every employee's desk. We noted three key elements in their integrated office system: (1) access to a cost-effective data network, (2) an in-house, interactive computing facility, and (3) use of inexpensive, intelligent CRT terminals.

Access to a cost-effective data network. ISI is one of the main computer centers (nodes) on the ARPA Net. With their four DECsystem-10 (DEC 10) systems, operating under TENEX, they are one of the largest suppliers of TENEX resources to the net. Being connected to the net, ISI employees have electronic access to all other people using the net. There are currently thousands of users on ARPA Net, many of whom are working on U.S. government contracts that are related to the research at ISI. So communication among ARPA Net colleagues is most often done using terminals rather than by voice or paper correspondence.

An in-house, interactive computing facility. Being a large supplier of computing power for ARPA Net allows ISI to provide a variety of in-house services at a reasonable cost. The DEC 10 equipment is very efficient in an interactive environment, so ISI uses it to provide word processing, information storage and retrieval, and message distribution facilities for its own internal use. The application packages used for performing these services are: XED and NLS for word processing, and MSG and Hermes for message distribution. (NLS and Hermes are available on the market; see Reference 1.) Almost all text and data generated at ISI are stored in electronic (soft copy) form, rather than in paper (hard copy) form. These include: memos, messages sent and received, research drafts and papers, personal calendars, and software.

Electronic files for storing these messages can be created using any header—for example, project name, correspondent's name, subject, or month. Thus they look much like paper file folders. Retrieval can be by these file headers or combinations of key words. Paper copies of stored items are made only for distribution to non-ARPA Net individuals, or for creating final copies of research project papers.

For their hard copy needs, ISI provides three printing options. Requests for these options are made through the CRT terminals. The least formal is the high speed computer printer option. This is used for personal listings of files and paper drafts, for example. The second option is two-color, electric typewriter-quality printing in a single font. This option is used for correspondence to non-ARPA Net users and for hard copy records. The most formal option is computer controlled printing. It allows mixing 26 fonts, right margin justification, and other features. This option is used for publishing research reports and other formal output.

Use of inexpensive, intelligent terminals. The offices at ISI look similar to most offices, except that each desk has a CRT terminal in its primary position. And there is a notable absence of stacks of paper. The terminal consists of a keyboard, a 10-key pad, a CRT screen and a self-contained micro computer. Two secretaries share an office, and there is one off-line typewriter in each such office—but these are rarely used, we were told. All other hard copy facilities are centralized. Operating in this environment requires no changes in corporate organization, they say. Secretaries perform pretty much the same duties as they would in a non-automated office. But the automated office does change the way the employees communicate.

The CRT terminal serves for entering, editing, filing and retrieving information electronically; but it has also become the major communication support tool at ISI. As such it is used to replace most paper memos and letters and some voice telephone calls, business travel and informal co-worker voice conversations. So while the use of

these other communication forms has decreased, the actual amount of communicating has increased, we were told, because of the convenience of the electronic form.

As an example of their automated office environment, the procedures used in a typical research project at ISI were described to us. This project involves ISI and three universities—one in Texas, one in Pennsylvania, and one in northern California. All research findings and results, plus all software and other messages concerning the project, are stored electronically. Thus, they are accessible to all project members at all times via the ARPA Net. Some information is created at one site and duplicated at the other sites; but more often only one current copy is maintained.

There is daily sharing of information, with each site keeping abreast of the progress at the other sites. This avoids duplication, and it also increases competition, we were told, because the researchers can see when activity is occurring elsewhere. This environment also reduces the not-invented-here syndrome. In fact, the atmosphere is so collaborative that the centers take turns publishing the shared results, rather than each center publishing its own version of the results.

At ISI they are very happy with their automated office environment. Since they started with this automated environment when ISI was first formed, they had fewer problems getting people to change their old ways of working. Some of the secretaries say that they can produce two to three times as much work by keeping information in the soft copy form. Further, communication among researchers is more efficient with the file management capability and the data network communication facility.

Exxon Corporation

Exxon Corporation, with headquarters in New York City, is an international integrated petroleum company. Its revenues of over $54 billion rank it as number two in the 1978 *Fortune* directory of the 500 largest U.S. industrial corporations. The company employs some 126,000 people worldwide.

Since about one-half of these employees work in the company's many offices, a number of people at Exxon's headquarters became interested in the subject of the automated office. So in 1975, the manager of the administrative services department initiated a three-month study. He wanted to see where the various technologies—ones that could apply to the automated office—were going and what action Exxon should take relative to its own office operations.

The study confirmed that the technologies, such as the micro computer, could indeed have a significant impact on future office systems. And it pointed out that a co-ordinated planning approach was needed, if the potential benefits were to be gained. So in late 1975 the advanced office technology (AOT) team, consisting of three people and a manager, was formed to begin working on the concepts for Exxon's automated office. This effort is jointly sponsored by two departments—the administrative services department and the mathematics, computers and systems department.

The team was able to call upon technical data processing support when it was needed. In addition, there were a number of prototype installations of new technology within Exxon that the team could study. These included optical character recognition, interactive graphics, distributed logic word processing, and electronic mail systems. Also, projects to improve office procedures and methods were underway, some aimed at making use of the new technologies.

Gradually, the AOT team began to develop a 'future scenario' for their automated office. This scenario envisioned that Exxon office workers (both 'users' and 'support' personnel) eventually would have access to an integrated information system with two major characteristics. For one thing, the system would provide a hierarchical network of information storage and retrieval facilities. And secondly, office workers would be able to generate and distribute messages electronically throughout Exxon operations worldwide.

But to implement such an integrated system would impose a tremendous challenge. The problems that the team foresaw included getting employees to accept the new technology, ensuring compatibility among regions, evaluating the available technology, developing the necessary methods and procedures, and co-ordinating a large number of both short-range and long-range projects. And, of course, the new systems had to be cost justified.

The planning for office automation at Exxon is going through the project management phases of technical review, exploration, developing functional specifications, system design, implementation, and follow-up. During the second phase, exploration, the team identified three important gaps in the technology that will influence the development of the automated office environment.

The first of these gaps is the need for automated indexing coupled with information storage and retrieval capabilities for non-structured information—for instance, letters and administrative messages. Today's products are too complex and not friendly enough. What the team seeks is sophisticated content indexing that can be used on a distributed basis.

The second gap is the need to electronically capture printed information that has been generated outside of Exxon. Optical character recognition is the potential solution, but the team has found only one OCR machine on the market today that is able to read mixed font and graphical information. And the price is such that it could not be justified for every office.

The third gap is the need to capture verbal information, before it is printed. Exxon would like to see a voice recognition system for dictation that would digitize, display, and process the spoken word. Such a system could largely replace key entry, if the costs were low enough. But the team feels that the costs of such systems will not be low enough for some time yet (if ever). In the meantime, offices will have to continue to use keyboard entry, OCR, etc.

A fourth problem area—not really a technological nor an economic gap, but something that still needs to be done—is the terminal interface problem. Word processing terminals now on the market will only communicate with like machines. For Exxon's needs, all of its office equipment must be able to inter-communicate.

Some of these gaps and problems can be solved within Exxon, the team feels. But some, particularly the last three, will probably require expertise from outside Exxon for their solution.

When we talked with Exxon, the team was just beginning the third phase, the development of functional specifications based on user needs. Toward this end, the team has been meeting with various regional and operating components of Exxon, to make them aware of the project and to gain their support. These organizations are quite autonomous, so the team is selling its concepts by pointing out current office costs and expected future benefits.

In fact, people in regional and affiliate offices *are* now asking for advice and guidance from the corporate team, we were told. But each such group is proceeding with its own definition of needs and implementation effort. Exxon hopes and expects that the work of the corporate planning team will achieve compatibility among these efforts. Office automation offers a tremendous potential for increasing office productivity. This planned, phased approach hopefully will achieve such benefits.

Is the automated office inevitable?

Within the past year we attended two seminars on the automated office jointly sponsored by the American Institute of Industrial Engineers (AIIE) and the Management Education Corporation (MEC). AIIE/MEC has published an extensive notebook for each of these seminars (Reference 2). Each contains reprints of pertinent articles, copies of slides used by the speakers, and in a few cases, complete texts of seminar speeches. We found these notebooks useful in assessing the state-of-the art of the automated office field.

The major questions we hoped to have answered at the seminars were: "Is the automated office inevitable? What are the major components of an automated office? And what planning steps should be taken to better insure a smooth transition to an automated office?" In the remainder of this issue we shall discuss the first two questions. Next month we shall present an approach for managing the transition to the automated office.

The need for the automated office

Just as the invention of the typewriter 100 years ago revolutionized the office, the systems approach of the automated office will eventually reshape how offices work. Alan Purchase of SRI International (Reference 3) states that while office costs used to be 20-30% of the total costs in a company, they have now grown to 40% to 50% of all costs. Rising salaries plus the need to process more information means that these costs are growing at geometric rates. And companies

are becoming aware that they need to identify and control office costs and improve office productivity. Office automation will provide the help of technology that labor-intensive offices so badly need to increase productivity, says Purchase.

The rationale for the automated office centers around the need to increase the productivity (efficiency and effectiveness) of all office employees. But even more specifically, the need exists to increase the productivity of managerial employees. Harvey Poppel (Reference 4) reports that 40% of a typical manager's time is spent on mail processing, telephone calls and business travel. These activities all deal with unstructured person-to-person communication. Yet, management communication has been virtually unaffected by previous technological advances, Poppel says.

Management still relies heavily on word-of-mouth communication, based mainly on face-to-face meetings and telephone conversations. Henry Mintzberg (Reference 5) states that, based on his and others' studies, managers favor the verbal media, spending 66-80% of their time in oral communication.

So in order to improve managerial productivity, the automated office will need to improve the efficiency and effectiveness of these unstructured business communications. To see how such an impact could occur, let us review the limitations of current communication modes.

Limitations of current communication modes. Face-to-face communication is the most powerful information exchange mode, but it is also expensive. Finding a common meeting place and physically getting to that place are expensive and disruptive of the office routine. And the participants are usually unavailable during the travel and meeting time. Another disadvantage, Murray Turoff (Reference 6) points out, is that meetings are often dominated by one person—the most outspoken participant, the boss, and so on.

Voice telephone communication is also disruptive, and the call is often not completed on the initial contact attempt. Telephones do not let managers control their own time, Turoff says. And, when the conversation is over, there is no written record of the discussion. Recollection is left up to the participants' memories. This is also often true of meetings. Any minutes that do occur are incomplete and not available immediately.

Letter communications do provide written records, but they are slow and not totally reliable. Retrieving letters from paper files is tedious; also, paper files are not very secure.

So all three communication modes leave something to be desired. Proponents of the automated office say that communication in an electronic environment will provide the needed speed, written record, convenience, control, and security lacking in the current communication modes.

Improving support for the information dissemination and decision-making activities of management is where the real payoff in office automation lies. Burns (Reference 7) notes that information loses its value over time. Hence, the speed-up of the flow of information, plus the direct, ready access to that information, is what is needed. And with organizations becoming more complex, managers need to communicate more than ever.

If the automated office components can supply these needed communication and information supports, then the automated office will be inevitable. However, the key to its successful use lies in its planning and introduction. A conglomeration of stand-alone systems that has evolved over time will not provide the integration necessary to allow convenient communication and information access for management's needs. This level of integration requires direction from the top corporate level. So say the proponents.

Benefits of the automated office

It has been said that the office is a place where employees go to suffer a variety of interruptions. Advocates of the automated office give a number of benefits that they believe will make this sad-but-true definition less true. The automated office is said to: (1) give added control to employees, (2) increase information and people accessibility, (3) provide real-time visibility for managers, (4) provide added office structure, and (5) control office costs.

Give added control to employees. James Carlisle (References 2 and 8) pointed out at a seminar that currently the office is a *place*. Office workers must be at that place at a specified time

in order to work, in most cases. Once there, these office workers, particularly managers, have little control over their working day, because they are continually being interrupted. These interruptions occur because current office communications are *simultaneous*. They require that the people converse at the same time. We would include as 'interruptions' such things as telephone calls, co-worker conversations, company meetings, administrative procedures, business travel, and fact gathering.

In the automated office environment, Carlisle says, many of the formal and informal business communications will become *non-simultaneous*. Through the use of a terminal or work station, a worker will be able to 'call' another person and have the message stored electronically—even verbal messages, if digitized voice telephones are used. (We will describe some research in this area below.) The recipient will be able to hear or see, and respond to, that message when it is convenient for him to do so. The two need not converse at the same time.

This non-simultaneous environment will increase workers' control, says Carlisle. Employees will be able to decide when to receive their messages, thus they will have fewer interruptions. This facility brings an added benefit, we were told. With employees choosing the time when they want to receive messages, they will be in a more receptive frame of mind to give better, more reflective, responses than if they had been interrupted. People who use the ARPA Net tell us that the electronic message environment definitely does increase the quality of the messages as compared with messages generated using simultaneous voice or paper communication modes. Thus, the added control of one's workday time increases the quality of communications.

Increased information and people accessibility. With files, messages, and data stored electronically, the office will become a *system*, not a place, says Carlisle. And it will be accessible via a terminal from almost any place at any time.

Based on experience in the ARPA Net, it has been found that the increased accessibility to information and people has a number of benefits. For one thing, time has a different dimension. People 'work' and send messages to one another at any time of the day or night, knowing that the recipient will very likely receive, and probably respond to, the message within a few hours. The inconvenience of trying to communicate across time zones disappears. A person in London does not have to wait until 5:00 p.m., say, to contact a person on the West Coast of the United States (where it is 9:00 a.m.).

We had an interesting experience with this new time dimension ourselves. One day we put in a conventional telephone call to Carlisle, who uses computer message services for most of his business communications. We were told by his secretary that he was out of town and that he would contact us the next day. (Carlisle tells us that 72% of all simultaneous telephone calls are not completed on the initial try, so we think this is a typically frustrating example.) After we hung up the telephone, his secretary entered a message into his file, using her terminal, stating that we had called. Less than two hours later, we received a call from Carlisle. He apparently had viewed his message file using a portable terminal during a work break and called us. Having expected to wait at least one day for a response, we were amazed at this two-hour response time from someone who would normally be incommunicado for such informal business communications. We are told that response times of less than two hours across three time zones are very common in the electronic environment. So the accessibility of information as well as people does reap a time benefit in the automated office environment.

Provide real-time visibility for managers. George Simpson, at one of the seminars we attended, pointed out that easy access to electronic information will make the work of employees more visible to others. Managers will be able to view project files and other communications easily, and on an impulse basis. This gives them real-time access to knowledge about the status of projects, without interrupting other employees. This is an example of downward vertical visibility.

The automated office also provides upward accessibility for employees lower in the organization. Using the 'copy' mode in electronic message systems, employees can easily duplicate messages and send them to their superiors. This facility gives them the ability to make their work and

ideas known to people in higher levels, whom they previously had little access to. Some people fear that employees will abuse this capability and begin to clutter up those other files with extraneous correspondence. However, people we have talked with, who work in an automated office environment, say that this is just a typical office discipline problem; it can easily be handled with an appropriate message to the offender. These people say that they like having the facility for sending messages to higher levels of management, which was not so acceptable in the typical office environment.

Provide added office structure. Simpson contends that the structuring of the work environment is the dominant factor in increasing office productivity. He related the following example at the seminar. In the current office environment, a secretary types at the rate of 2.5 words per minute (wpm), due to interruptions, corrections and retyping. If that secretary becomes a typing specialist, and is placed in a supervised environment, such as a word processing center, then her speed will increase to 5 wpm. If her work is measured, as well as supervised, she increases to 18 wpm. And if she is supervised, measured, and given incentives, then her productivity goes up to 25 wpm.

Extending this concept to other office workers, Simpson says that if employees know that their work is visible to their supervisors, and if there is an incentive structure in their office, then their productivity will increase. Simpson says that this can happen *without* changing employee work relationships or supervisory structure. Both of these types of changes would cause trauma and should be avoided. What would be changed would be the equipment, which connects to a network that structures the office environment. Thus, he says, the system would provide the structure as well as take over some of the more tedious office tasks.

Based on what we saw at ISI, Simpson's contentions seem plausible. At ISI neither the working relationships nor the supervisory structure has been changed because of the system. What has changed is the employees' mode of communicating with one another. Non-simultaneous typed electronic communication has replaced some simultaneous verbal communication. In the future, with the advent of non-simultaneous verbal communication facilities, some keyboard entry will undoubtedly be replaced with stored verbal messages. So the structure of communications at least will change, and this will impact office productivity.

Control office costs. Purchase (Reference 3) points out that office costs really are now out of control, and that companies are recognizing this fact. Office workers now account for 22% of the U.S. labor force, and office operating costs have doubled in the last ten years. Office costs are increasing at the rate of 6-8% a year, and yet productivity is increasing at only 4% a year, he says. Pugh (Reference 3) states that top management is going to have to look at the cost of handling paperwork in the office the same way that it views data processing and the factory. So far management has not done that, he says. And that is why the service sector shows these annual increases in cost, while annual unit labor costs in the manufacturing sector have been steadily declining.

Purchase states that factories achieve cost savings by investing capital to replace labor in production. This has not been done in offices. The average investment in capital equipment per office worker is about $2000, as compared to $25,000 per manufacturing employee. He predicts that by 1985 the expenditure per office employee will grow to $10,000 or more.

With expensive office systems coming onto the market, companies will begin to study their true office costs, to see whether the use of such systems is justified. The larger corporations now doing such studies are not releasing the figures that they are uncovering, but they are actively pursuing the development of electronic systems. That indicates that they have discovered their office costs to be large enough to justify studying such systems. As mentioned earlier, Purchase estimates that office costs are now 40% to 50% of a company's total costs. So the need to control office costs is real, and the automated office field promises to help by investing capital on systems to replace labor costs.

Problems with the automated office

At the seminars that we attended, the two questions attendees most wanted answered were:

"How do we get to the automated office?" and "How do we get managers to use these new systems?" Unfortunately, no one has yet evolved to a totally automated office from a traditional office. So the entire field is groping for answers to these questions, which pose a challenge to the field.

The man-machine interface. How to get managers to use an automated system is a very fundamental question in the field today. The proponents of the automated office consider it to be *the* stumbling block. No one seems to know if management will use the systems that are envisioned. Many designers feel that most managers will not use a system that requires them to type. So these designers are developing non-typing entry and retrieval devices, such as voice activated terminals and functional push-button consoles. Probably no one type of 'terminal' will satisfy all managers. Terminals other than keyboard types will not be available soon, so near-future systems will depend on typing at a keyboard as the man-machine interface.

The one point that we heard most often made by seminar speakers was that automating the office requires a humanized approach—that is, giving managers equipment that they will feel comfortable using. People in the field do not think that data processing technicians have solved this problem. The man-machine interface, both the equipment and the software, is a crucial ingredient to the success of the automated office, and it is currently one of the central problems.

Getting to the automated office. Next month we shall discuss some steps that companies are now taking to manage the transition to the automated office. What the speakers at the seminars emphasized was that no one has gotten there yet, so no one really knows how to do it so as to cause the least 'upheaval' in the office. And whereas management might decide quite readily to automate a factory, automating their own office is a completely different matter. They are fearful of having their work become more visible, they are fearful of losing their secretaries, they are fearful of machines, and they are fearful of change in general. The steps taken to plan for and implement the office of the future must minimize the 'upheaval factor' and deal with this fear of change, proponents say.

Simpson states that different types of changes cause varying degrees of employee trauma. Equipment changes *per se* cause little or no trauma, he says. Procedure changes along with equipment changes will cause some trauma. Work relationship changes and supervisory changes can cause a great deal of trauma, so they should be avoided as much as possible. Simpson recommends making only equipment changes, and letting the usage of the equipment cause the organization to change.

Costs of future office systems. All predictions that we have seen say that automated office systems will be very costly. As mentioned, Purchase believes that by 1985 some companies will have spent $10,000 per office worker on capital office equipment. Supposedly these system costs will replace personnel costs; however, the equipment costs would be capital expenditures while the personnel cost savings would most likely be future cost avoidances. We see no current machine-for-people cost replacement. In addition there will be planning, introduction and training costs. These systems need to mesh as nearly as possible with the current office environment, or the personnel trauma will cause them to be unused.

So, is the automated office inevitable? The proponents say, "Yes, because of the increasing information competition between companies, because of the rising costs of office workers, and because of the slowness and unpredictability of current communication methods." How a company handles its information is now recognized as being essentially as important as how it handles its money. Speed of information communication is becoming more crucial to business success. Today's communication methods and office environments can not cope with these needs. And the lure of increased managerial productivity is forcing at least the largest companies to seriously investigate large capital expenditures for future automated office systems.

On the other hand, cynics say, "Those future systems will never be used. There is no way that you can force management to type instead of talk. Managers will go right on using verbal communication and decision making methods to get their work done. They do not want to learn to use machines and they do not want their inefficiencies to become so visible to others. So they

will block the use of these systems." Hopefully, careful planning and introduction will diminish this type of reaction.

These two viewpoints—of the proponents and of the cynics—represent the central argument going on today about the automated office.

System components of the automated office

Most of the attention in the automated office field so far has been paid to the various system components of future offices (as opposed to the likely organizational impacts of these systems). The possible system components are as diverse as one can imagine, and they read like a science fiction scenario. The following is a list of the components that we have come across. This list is by no means exhaustive, but it does point out the myriad of choices that face automated office planners. Many of these components do not exist yet but, we are told, someday they will.

We classify these components in four information handling areas: information generation, information distribution, information storage, and information query. These represent the basic information needs of the office. The list is a mixture of types of components—hardware, software, transmission means, etc.

AUTOMATED OFFICE SYSTEM COMPONENTS

Information Generation
- Voice activated input devices
- Multi-function intelligent work stations
- Two-way cable home television
- Handwriting entry devices
- Graphical input devices
- Word processing
- Portable radio telephone
- 'Intelligent' telephones with digitized voice

Information Distribution
- Distributed data networks
- Integrated communications (word/data/graphics/voice/image)
- Store and forward communications
- Computer message systems
- Smart facsimile devices (combined with OCR)
- Computerized branch exchanges (CBX)
- Micropublishing (computer typesetting from microforms)
- Intelligent copiers/printers
- Automatic typesetting
- Multi-media tele-conferencing
- Electronic bulletin boards
- OCR interfaces
- Electronic funds transfer systems (EFT)

Information Storage
- Electronic message files
- Computer output microfilm and updatable microforms
- Multi-media digitized storage
- Automated personal calendars
- Automated information storage and retrieval systems
- Automatic message content indexing systems

Information Query
- 'Personal assistant' services via software
- Bibliographic search services
- Automated training techniques
- Interactive graphics
- Data base management systems (DBMS)
- Electronic pointers (light pen, mouse)
- Specialized information services
- Simple English query/retrieval languages
- Decision support systems

We are not able to discuss each of the above components at this time, since some are still in the early stages of development. So we will discuss the four information handling categories and indicate where the field now stands in each of them.

Information generation

In the information generation area, only the word processing terminals are in general use today. Some other types of input devices that do exist, such as the handwriting entry and graphical input devices, are quite expensive. And the rest are only in development at research laboratories.

In the February and March 1977 reports we discussed how word processing has impacted the creation of paper business communications. And currently, that is all that most word processing machines are being used for. Very few are being used to distribute information in electronic form, because these machines generally do not interface with one another. This interfacing problem is currently a major stumbling block for implementing word processing networks within companies.

Although sophisticated word processing terminals exist, and are in use by office workers, there is a lot a conjecture about whether managers will use them. Thus, there are a number of various types of management work stations now being developed.

We heard an interesting presentation by Stephen Boies of IBM (Reference 2b) about a store-and-forward voice system using a Touch-tone telephone. The system initially requires the user to learn only seven two-digit combinations in order to record, send, and file spoken messages. As users desire to perform more functions, such as annotating received verbal messages, sending messages at specific dates and times, and creating levels of message privacy, they can do so by learning up to 40 more two-digit codes. The system records and plays back the messages verbally, but the messages are stored digitally. Comments can thus be added or deleted in the middle of a message, or messages can be sectioned, indexed and retrieved by section, and so on. This is an experimental system in use at the IBM Thomas J. Watson Research Institute.

So, although word processing technology now makes keyboard entry quite sophisticated, it is not clear that managers will use these devices. Further, non-keyed information generation is not yet here. The big question is: What types of entry devices will managers feel comfortable using?

Information distribution

There is a lot of activity going on in the area of information distribution. We have reported on several of these areas within the past two years. There is the activity in public packet networks, which we discussed two months ago. There is work in computer message systems, which we discussed in April 1977, and there is electronic funds transfer, discussed in October 1977. The underlying question in information distribution is: What types of network facilities will be available to businesses?

Much of the knowledge now being applied to the electronic information distribution area has been derived from work on the ARPA Net. So we shall make a slight digression and briefly describe the ARPA Net. We think that this information will be helpful to companies in assessing information distribution offerings.

The ARPA Net. In the mid 1960s the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense began sponsoring work on a data network designed to achieve resource sharing, where the resources included hardware, software, and data bases. ARPA Net is a set of autonomous, independent computer centers that are interconnected using a standard transmission method, so as to permit interactive resource sharing among any of them.

The first four nodes on the network were implemented in 1969. A node is a connection point in the net; it is often a research computer center. The computer at such a center is called a host computer. It connects to the network through an interface message processor (IMP). The IMP provides the standard interface as far as the network is concerned. It also performs all of the message handling functions and controls the routing of messages along alternate paths. There is no central network control computer. The hosts may be of different sizes, from different manufacturers and of different generations. A terminal IMP, or TIP, is a version of the IMP for connecting terminals to the net.

Messages on the net are transmitted from one node to another in packets, using a distributed store-and-forward philosophy. Each packet contains about 1000 bits. The transit time through the network is in the order of two seconds. The net uses mainly 50,000 bit-per-second communication services between the nodes to achieve this transit time.

Over the years, one of the major uses of ARPA Net has become message distribution. As we noted in the ISI discussion, project team members send both informal and formal messages to one another, whether they are in the same building or across the United States. And they save these messages in electronic files. We know a number of other people who have access to the ARPA Net; they use their terminals regularly for reviewing messages from others on the network. So the net has become a tool for non-simultaneous, informal communication. This is a very important use that automated office designers hope managers will take advantage of in the future.

Design issues. Information distribution involves both intra-company and inter-company communication. Many authors point out that future distribution facilities will allow integrating five communication modes—data, voice, graphics, image, and word—using the same communication link. Broadband communication services will transmit these various types of information

in a digital form. In order to take advantage of this capability, companies will need to install broadband intra-company networks that also handle this diversity of media. The large companies that are planning for their future office environment are doing this. They are planning the design of intra-company networks that also can connect to public data networks. We see a lot of development activity in the communication distribution area, so it is well worth watching.

Information storage

In the information storage area the computer message systems used for distribution also have file storage capabilities. These provide files with user-identified headers. This approach seems to meet the needs for individual employee message files. But several future office planners we talked with see the need for much easier retrieval languages and more sophisticated message indexing systems, based on automated word content analysis. This would make possible the querying of very large files and data bases, which may be necessary, for example, for satisfying government regulations. The 'file folder' approach of current message systems is not sufficient for this type of use.

One interesting development in the information storage area is the prospective use of video disks. They are now available on the consumer market for recording television programs from a television set. Thomas Kohler (Reference 9) states that video disks are an attractive future digital storage medium, because each disk could store at least 10,000 million bits of information and provides a 0.1 second access time. He notes that video disk peripherals for mini computer systems are now under development.

Information storage is a crucial ingredient in the office of the future. We expect to be hearing about new developments in the near future.

Information query

The information query category contains both the tools for querying electronically stored information as well as specialized information services. Some of the tools listed above, such as electronic pointers and interactive graphics, are presently considered frivolous in the business world. But this may not always be the case. Such sophisticated tools may well become very helpful in assisting employees manipulate and interact with electronic information.

We would expect a myriad of specialized information services to become available as the automated office becomes a reality. Many of these would be simply electronic replacements for current services, such as business periodicals, instructional courses, industry status reports, etc. For example, we reported on bibliographic search services in October 1975; these could be considered electronic replacements for paper bibliographic listings. The problem with these services today is that each service has its own searching protocol and filing structure, and these are difficult for the occasional user to remember. Trying to use two or more systems can be confusing.

In the future we would expect specialized online information services to provide protocol interfaces that office workers could more easily use and remember.

This then is an 'early warning' on the current state of the automated office field. We gather that there is a great deal of product development work now going on in the computer, communication, and office fields. Also, a growing number of large companies are moving toward a more automated office environment.

Next month we shall continue this discussion by presenting some steps for managing the transition to the automated office, to make the evolution occur with the least amount of employee upheaval as possible.

REFERENCES

1. Packages in use at ISI that are available on the market:
   a) NLS is available through Tymshare, Inc., 20705 Valley Green Drive, Cupertino, Calif. 95014.
   b) Hermes is available through Bolt, Beranek & Newman, Inc., 50 Moulton Avenue, Cambridge, Mass.
2. AIIE/MEC seminar notebooks (AIIE Seminars, P. O. Box 3727, Santa Monica, California 90403); price $50.00 each:
   a) The automated office, September 1977.
   b) Automating business communications, January 1978.
3. *Business Week* (McGraw-Hill Building, 1221 Avenue of the Americas, New York, New York 10020), June 20, 1975, pp. 48-70. This is a group of four articles entitled: (1) The office of the future, (2) Putting the office in place, (3) A market mostly for the giants, and (4) The paths to the paperless office.
4. Poppel, Harvey L., "Information resource management (IRM)—A new concept," a paper given at the 1976

National Computer Conference; it is not in the proceedings. A summary of the paper may be obtained from the author, who is Senior Vice President, Booz Allen and Hamilton, Inc., 245 Park Avenue, New York, New York 10017.

5. Mintzberg, Henry, "The manager's job: Folklore and fact," *Harvard Business Review* (Soldier Field, Boston, Massachusetts 02163), July/August 1975, pp. 49-61; reprint $3.00.
6. Turoff, Murray, "The future of computer conferencing," *Law Office Economics and Management* (165 N. Archer Avenue, Mundelein, Illinois 60060), pp. 235-247, November 1977; price $15.
7. Burns, Christopher, "The evolution of office information systems," *Datamation*(1801 S. La Cienega Blvd., Los Angeles, California 90035), April 1977, pp 60-64; price $3.
8. Carlisle, James., "Evaluating the impact of office automation on top management communication," *Proceedings of the 1976 National Computer Conference* (AFIPS Press, 210 Summit Avenue, Montvale, New Jersey 07645), pp. 611-616; price $50 paper, $15 microfiche.
9. Kohler, Thomas R., "Optical videodisc technology," *Proceedings of the 1977 Annual ACM Conference* (ACM, 1133 Avenue of the Americas, New York, New York 10036), pp. 266-270; price $21.00 prepaid.

Prepared by:
Barbara C. McNurlin
EDP Analyzer Staff

SUBJECTS COVERED BY EDP ANALYZER IN PRIOR YEARS

1975 (Volume 13)

Number

1. Progress Toward International Data Networks
2. Soon: Public Packet Switched Networks
3. The Internal Auditor and the Computer
4. Improvements in Man/Machine Interfacing
5. "Are We Doing the Right Things?"
6. "Are We Doing Things Right?"
7. "Do We Have the Right Resources?"
8. The Benefits of Standard Practices
9. Progress Toward Easier Programming
10. The New Interactive Search Systems
11. The Debate on Information Privacy: Part 1
12. The Debate on Information Privacy: Part 2

1976 (Volume 14)

Number

1. Planning for Multi-national Data Processing
2. Staff Training on the Multi-national Scene
3. Professionalism: Coming or Not?
4. Integrity and Security of Personal Data
5. APL and Decision Support Systems
6. Distributed Data Systems
7. Network Structures for Distributed Systems
8. Bringing Women into Computing Management
9. Project Management Systems
10. Distributed Systems and the End User
11. Recovery in Data Base Systems
12. Toward the Better Management of Data

1977 (Volume 15)

Number

1. The Arrival of Common Systems
2. Word Processing: Part 1
3. Word Processing: Part 2
4. Computer Message Systems
5. Computer Services for Small Sites
6. The Importance of EDP Audit and Control
7. Getting the Requirements Right
8. Managing Staff Retention and Turnover
9. Making Use of Remote Computing Services
10. The Impact of Corporate EFT
11. Using Some New Programming Techniques
12. Progress in Project Management

1978 (Volume 16)

Number

1. Installing a Data Dictionary
2. Progress in Software Engineering: Part 1
3. Progress in Software Engineering: Part 2
4. The Debate on Trans-border Data Flows
5. Planning for DBMS Conversions
6. "Personal" Computers in Business
7. Planning to Use Public Packet Networks
8. The Challenges of Distributed Systems
9. The Automated Office: Part 1

(List of subjects prior to 1975 sent upon request)

PRICE SCHEDULE

The annual subscription price for EDP ANALYZER is $48. The two year price is $88 and the three year price is $120; postpaid surface delivery to the U.S., Canada, and Mexico. (Optional air mail delivery to Canada and Mexico available at extra cost.)

Subscriptions to other countries are: One year $60, two years, $112, and three years $156. These prices include AIR MAIL postage. All prices in U.S. dollars.

Attractive binders for holding 12 issues of EDP ANALYZER are available at $6.25. Californians please add 38¢ sales tax.

Because of the continuing demand for back issues, all previous reports are available. Price: $6 each (for U.S., Canada, and Mexico), and $7 elsewhere; includes air mail postage.

Reduced rates are in effect for multiple subscriptions and for multiple copies of back issues. Please write for rates.

Subscription agency orders limited to single copy, one-, two-, and three-year subscriptions only.

Send your order and check to:
EDP ANALYZER
Subscription Office
925 Anza Avenue
Vista, California 92083
Phone: (714) 724-3233

Send editorial correspondence to:
EDP ANALYZER
Editorial Office
925 Anza Avenue
Vista, California 92083
Phone: (714) 724-5900

Name_____

Company _____

Address _____

City, State, ZIP Code_____