PERSPECTIVE FOR THE OFFICE OF THE FUTURE

Don Tapscott
David Macfarlane
B-N Software Research, Inc.
522 University Ave.,
Toronto, Ontario
M5G 1W7

ABSTRACT

Office automation is beginning to transform the ways people and organizations work. This paper argues that the greatest potential for office automation is in the augmentation of the knowledge worker. This can be achieved through better information management, decision support and communications. However, there is no adequate methodology to perform measurements in these areas. Nor are there methodologies to design and implement integrated systems which can meet user needs and resolve the "people" and "organizational" problems. As a result, office information has centred on increasing typing efficiency through word processing. This detour from the applications where the really substantial benefits can be found must be corrected through a new perspective on office automation. The paper outlines such a perspective.

UN APERCU DU BUREAY DU FUTUR

RESUME

L'automatisation dans les bureaux transforme le fonctionnement des organisations et des employés. Le but de cette étude est de prouver qu'en augmentant les connaissances des employés vous augmentez le potentiel d'automatisation. Afin d'accomplir ceci, vous devez offrir un meilleur programme de communication, une participation aux décisions et une meilleure gestion de l'information qui est disponible. Toutefois, il n'existe pas de méthodologie adéquate pour l'accomplissement d'une telle tache. Et l'intégration d'un système qui rencontre et les besoins des opérateurs et les problèmes d'organisation n'a pas encore été trouvé ou inventé. Le résultat en est que nos efforts ont été concentrés à développer la méthode de reproduction de documents ce qui augmente l'efficacité de la dactylographie. Cette étude tente de prouver que l'automatisation est la réponse à plusieurs problèmes qu'envisagent présentement les bureaux d'affaires.

1.0 INTRODUCTION

This C.A.I.S. conference takes place on the eve of the 1980s - a decade which promises to bring about very profound and far reaching changes in the office and office work. These changes, which have already begun, will transform many of the ways in which people and organizations work.

You've all heard the terms - the office of the future, office automation, the office of tomorrow, the office revolution, office information systems. Douglas Englebart, one of the pioneers of computing science calls it one of the most significant new industries of the century (Englebart 1978). It has been compared to the computer revolution itself.

A recent example of the momentum that is building in Canada is the national "Office of Tomorrow" conference and exhibition that was held in Toronto in February this year. Over 600 delegates from companies and organizations across Canada attended 3 days of sessions discussing the opportunities and problems of moving towards the Office of the Future. In addition to listening to speakers on a wide range of topics, the people attending were inundated with a barrage of materials, presentations and exhibitions by over 100 vendors of the latest office automation hardware, all eager to capture a part of this exploding market.

An article in the Globe and Mail this year put it this way:

> "A multi-billion dollar race is underway to be the first through the door of the automated office of the future.
>
> "But none of the 70 or so companies involved can say with certainty exactly what that office will look like, or even when it is likely to materialize. At this point all they know is that when the market for fully integrated office systems materialize - probably in the middle 1980s - they all want to be there. And with good reason.
>
> "By 1982, according to Quantum Science Corp., a New York based market research company, the market for such office related equipment as high-speed printer, photo-typesetting machines, long distance facsimile communications gear and word processing terminals should reach $15.1 billion annually." (Globe and Mail 1979)

However, for many organizations, the first steps on the road towards the Office of the Future have been frustrating. Many more

organizations have been reluctant to take the first steps. And while the opportunities are great, evolution towards the future is fraught with problems which no one had anticipated.

In this presentation, I will give an overview of the changes which are taking place - their origin, nature and opportunities posed by them - as well as the main obstacles and pitfalls which have arisen.

2.0 THE ROOTS OF OFFICE AUTOMATION

According to the EDP Analyzer,

> "...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 communications 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.
>
> "...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 basis for the automated office is (an) electronic (communication) 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." (McNurlin 1978)

Why is all this happening?

The momentum towards the Office of the Future is rooted in recent significant technological developments which have occurred simultaneously with an acute need to augment the productivity of the white collar worker. Let's look at three aspects of this.

Technological Developments

Recent technological advances in two main areas have provided the basis for office automation.

The first area is chip technology. Moore's law states that the number of electronic components that can be placed on a single silicon chip doubles each year. We are now employing at least a thousand times more computing power than we were twelve years ago. Twelve years from now we will be using a thousand times more computing power than we are using today. Such explosive growth is changing the economics of data processing beyond recognition. Moreover, the continuing gains in microprocessor technology and microelectronics in general are beginning to provide the processing capacity required for office automation, at a cost which enables that capacity to be beneficially applied. For example, the cost of main memory has decreased 10 times in the last 4 years - from $300,000 to $32,000 for a million bytes.

The second area is telecommunications and a growing trend to interconnect various kinds of computer hardware with telecommunications systems. Relatively primitive data communications facilities of the 60s have evolved today into communications network architectures which make it easy to connect various pieces of equipment to a communications network. These network architectures and the resulting capacity to move electronic information easily, quickly and inexpensively are leading to entirely new uses of computing and electronic communications - a key use being office automation.

These technologies and others are converging to provide the technological prerequisites for office automation.

Technological developments provide, however, only the material basis for office automation. It is because these developments correspond to a growing need for the fruits of technological change, that office automation has flourished. There are several aspects to this need.

The Rising Costs of Office Work

Paul Strassman, a leader in the field, has explained that in the past 20 years white collar labour has been the fastest growing component of the workforce in every industrialized country. Yet this sector shows tiny increases in productivity compared to the industrial and agricultural sectors of the economy where the need to make appropriate capital expenditures has been understood (Strassman 1976).

Estimates, according to Michael Zisman of M.I.T., for average capital investment per office worker range from $2,000 to $6,000. By comparison, the average capitalization per factory worker is $25,000. (Zisman 1978) At the same time, according to a Stanford Research Institute study, between 1960 and 1970, industrial worker productivity in the U.S.A. rose 83% while white collar productivity increased only 4% (Purchase 1976).

Over the past decade, written communications and related cost increases have combined to push office costs from 20-30 percent to 40-50

percent of the total costs of most businesses. In Canada there are over 6 million white collar workers involved in some form of word processing, clerical work, administrative support, professional or management work (Revenue Canada 1978, Statistics Canada 1978). By the middle 1980s the number of secretaries/typists will have tripled since 1960, if current trends continue. And by 1985 it has been estimated that the knowledge worker will outnumber the production worker by 3 to 1 (Bridel 1979).

The bottom line of all this is that a lot of money is being spent on a lot of people (a growing proportion of the work force) who now need tools to be more productive.

Information Management, Decision Support and Communication

Managing the information resource, both in terms of information-cost management and enhancing access to pertinent information is moving into focus for more and more organizations. This is especially true of information-intensive organizations like insurance companies, banks, credit card organizations, government social service agencies, research companies, and income tax departments. Some kinds of operating information loose their value over time and a delay in assembling the right proposal, the complete answer or the appropriate files can mean a missed opportunity (Burns 1977).

As organizations have grown and become more complex and data processing has enabled rapid measurement of performance from various sources, the need to decrease the amount of data and increase the amount of usable information which the knowledge worker is exposed to has never been greater. Moreover, this information must be communicated. The problem of information management can be summarized as the activity of getting the right information to the right people at the right time in a cost effective manner.

A new field of management/behavioural science known as Decision Support Systems focuses on managers' decision making activities and the use of computer-based technology to support them in complex and unstructured tasks.

Peter Keen and Charles Stabell explain Decision Support this way:

> "It has been recognized for some time that systems to assist managers in relatively complex and nonprogrammable activities are different from the structured decision systems that have been developed for the more operational tasks in the organization. There has been relatively little exploration of the implications of these differences. Management Information Systems field is technical and prescriptive. Decision Support requires a behavioural and descriptive grounding." (Keen 1978)

Linking both areas of information management and decision support is communication effectiveness. Most knowledge workers spend a majority of their time communicating. Henry Mintzberg of McGill University who conducted one of the most thorough and complete investigations of managerial work found that managers spend 66-80% of their time in oral communication (Mintzberg 1973). A study we performed at BNSR had similar results. Both technical-professional and managerial staff spent a majority of their time in oral communication; on the telephone, and face to face in meetings. Harvey Poppel reported that 40% of a typical manager's time is spent on mail processing, telephone calls, and business travel. Activities like this are all forms of relatively unstructured person-to-person communication, which, as Poppel says, has been virtually unaffected by previous technological advances (Poppel 1976).

Mintzberg was struck during his study...

> "...by the fact that the executive I was observing - all very competent by any standard - are fundamentally indistinguishable from their counterparts of a hundred years ago (or a thousand years ago, for that matter). The information they need differs, but they seek it in the same way - by word of mouth. Their decisions concern modern technology, but the procedures they use to make them are the same as the procedures of the nineteenth-century manager. Even the computer, so important for the specialized work of the organization, has apparently had no influence on the work procedures of general managers. In fact, the manager is in a kind of loop, with increasingly heavy work pressures but no aid forthcoming from management science." (Mintzberg 1975)

Mintzberg's observations summarize the problems of information management, decision support and communications effectiveness which confront the contemporary manager, and more generally, knowledge worker. These problems and the urgent need to ameliorate them is propelling more and more organizations towards the Office of the Future.

A 1978 study performed for Steelcase Inc. by Louis Harris and Associates indicated the remarkable changes in office work. Of the national American sample, 54% of office workers now use some kind of data processing, telecommunications, or electronic equipment on the job. In the last 5 years, 54% have seen their offices redesigned; 57% have changed jobs within the organization; 72% have acquired new jobs or responsibilities; and 73% have had to learn new skills on the job (Harris 1978). This gives just a taste of the massive changes that are beginning to take place.

3.0 TECHNOLOGICAL COMPONENTS OF THE OFFICE OF THE FUTURE

While it is impossible to adequately describe existing technology or even predict how it will evolve, it is useful to try and review the main technological components of office automation. The following outline is divided into capture, storage, retrieval and communication of information. Additionally, since the lines between the technologies are becoming less and less distinct, there is a final section on integration. (Figure One)

Information Gathering and Capture

Currently word processing is the most sophisticated text entry technology in the office. Quite often perceived as an end in itself, it does little to make any striking impact on the cost-effectiveness of the overall office. However, once an office's textual material is captured in an electronic form by a word processor, the door is open to many possibilities.

Other manual input technologies include modified keyboards, perhaps more suitable for managers and professional staff. Tymshare's Augment system uses a chord keyboard with five keys and a mouse positioning element which the operator uses to point to parts of the screen. This concept is possibly the pre-cursor of the XEROX 850 'CAT'. There is a rich debate on whether or not non-typists should be given special hardware with limited functions, or should be trained to use the more conventional, yet flexible typewriter-like terminals. We cannot enter into such a discussion here.

For text that is already on paper, optical character recognition equipment is available that can read clear copies of typed material. And at the front of the quickly developing input technology is the voice translation concept that is yet to prove itself outside of very limited applications.

Information Storage

Many developments in storage technologies are reaching the market. At the hardware end, bubble memories, (medium fast, compact, and cheap) and charge-coupled devices, ('CCDs': very fast, block oriented, and cheap), are starting to be used in marketed devices to bring new capabilities to the user. For example, Texas Instruments sells a small portable terminal containing bubble memory.

Furthermore, newly developed optical disks can hold as much data as twenty-five magnetic tapes error free and for at least ten years (Kenney 1979).

At a higher level, computers can handle text storage as well as they handle data. Electronic filing of messages, documents or keys to

manual files can greatly increase the usefulness of stored information. If every document that a manager dealt with was indexed by the main storage system, s/he could at any time get to the item s/he wanted by naming the date, topic, author, or phrase used in the text. This would be possible for any message, memo, report or other text that was captured in electronic form. Other special sets of information stored in a widely accessible computer would aid conference room and other resource bookings, managers' appointment calendars, phone lists, acronyms and jargon, etc.

Data processing techniques, such as computer output to microfilm, have their place in larger offices that have high volume or long term storage needs.

Information Retrieval

This is where the great processing strengths of the new technologies comes to the fore. The value of information depends on its use, which in turn depends on getting the information when you need it. Once documents are created by entry machines of some sort, they can all be stored electronically and then accessed by English-like commands using a query system of a textual data base management system. The paperless office is a long way off, but techniques such as this will reduce the amount of paper required, since it won't be necessary to make and file document copies for later reference.

More sophisticated query systems become management design support systems, and more specialized systems provide administrative support to secretaries for their information needs.

The design of the human interface is important here as well. Interactive graphics enable communications to go beyond mere letters on a page. Terminals and systems that handle text as structures rather than linear words (such as the NLS-AUGMENT system available from Tymshare) fit in more with the way we actually think and compose.

Information Communication

Once again, taking simple word processors and adding communication creates a new application, in this case an electronic messaging capability. The age of the network is upon us, as we have computer networks (packet and circuit switched), communicating word processor networks, electronic mailbox networks, telephone networks, and even facsimile networks. A new Canadian network, Facscan, will store and forward facsimile messages to and from any type of machine, performing the input, conversion and delivery functions without human intervention.

Another recent technological development is fibre optics which provide the highest volume capacity in a light, flexible cable. Using laser light and sophisticated interface electronics, (e.g. a heterojunction electroabsorption modulator for a neodymium- yttrium-aluminum-

garnet-fibre laser!), fibre optics can carry thousands of signals with low loss and without static interference across the room, or soon, across the country. Satellite systems will enable companies to have their own ground stations that will connect them into a world-wide transmission/broadcast network.

In communications research, the U.S. Navy is developing a transmission device that would be capable of directing a signal through the middle of the earth with only a 1% signal loss. This new technique uses atomic particles called neutrinos, and requires a massive tank of water to detect the beam that might carry about one character per eight second burst. Still in its earliest development stages, the beam can not be stopped by any known material, and may fill a need for top security transmission (Hindin 1978).

Finally, for the human readers of all this information, computer driven photo-typesetters can produce book quality copy from text entered by that same word processor mentioned above.

Information Integration

As you can see from these examples, a new dimension of impact is reached when two technologies are merged to create a new application. The eventual goal is the total integration of all aspects of information technology.

If one takes communication as the base line, a digital network providing voice, image, and textual information to office and home over fibre-optic links is already existent. Bell Canada has an operational field trial in Yorkville, Toronto, that is providing telephone service, conference TV, remote video surveillance, video retrieval service, simulated cable TV service and other facilities (Banks 1978).

From a different standpoint, taking processing as the base line, multi-function support of word processing, electronic messaging, electronic filing and retrieval, data base and decision support systems will produce an environment for productive work for manager's, secretaries and professionals alike.

4.0 THE POTENTIAL: AUGMENTATION OF THE KNOWLEDGE WORKER

Depending on whom you talk to, office automation holds different possibilities. Major vendors of word processing hardware emphasize the savings to be made through increased clerical efficiency. Some management scientists hold that the Office of the Future will bring about increased productivity of managers.

A more comprehensive view is that the greatest contribution of the changes beginning to occur, will be the augmentation of the abilities and effectiveness of the knowledge worker. This refers to the application computer power and telecommunications to help those who work

with their minds process, manage, retrieve and communicate information.

Such an emphasis is at variance with the industry trends, which centre on cutting costs through the application of word processing technology to typing. More and more, however, leaders in the field of office automation are coming to the conclusion that the quest to reduce the number of keystrokes by an organization's secretarial staff is basically a wild goose chase. As Howard Anderson, President of the Yankee Group recently put it: "Word processing is the silliest form of office automation." (Anderson 1979) Or as James Carlisle, President of Office of the Future Inc. put it: "Word processing is to (office) automation what key punching was to management information systems - only the tip of the iceberg." (Carlisle 1977). The reason for this is simple. Word processing addresses itself to less than five percent of total office costs.

Alan Purchase and James Bair of the Stanford Research Institute illustrate this point by looking at US white collar labour costs. They show that the secretary-typist's costs amounted to only 6% of total labour costs. They then examined the distribution of daily activities for secretary-typists and showed that the actual time spent typing was approximately 20% of the 7 on-the-job hours. Thus, typing accounts for approximately 1.2% of white collar labour costs of US businesses. Their conclusion was that the leverage for office automation is not in typing (Bair 1978). Comparable data regarding expenditures on secretary-typist costs in Canada is not available. However, our research at BNSR indicates that it is reasonable to estimate that 20% of a secretary-typist's day is actually spent typing. (Figure Two)

Three-quarters of total office labour costs are spent on the knowledge worker (Bair 1978). It is the managers, administrative support personnel, engineers, scientists, operational researchers and other professional and technical people working with their minds, who are the fastest growing sector of the overall labour force. And it is in the augmentation of their abilities and effectiveness that the greatest potential of office automation is contained.

We can see this by reviewing three of the related problems mentioned earlier.

Information Management

Office automation provides more effective media for storing and organizing information. It can enable the rationalization and control of the information resource which is consumed by the knowledge worker. Pertinent information can be more accessible, in greater quantity, increased variety, higher quality, more usable in a "live" form, and more timely. Time, especially "critical time" like the day or hour or 5 minutes before an important meeting can be saved. Individuals will be able to interface more effectively with the knowledge base to access, reorganize and capture pertinent information. And, in general, through

the use of office technology, the ability of the human intellect to process information rapidly and effectively can be extended.

Communication

By enhancing communication among people and organizations, the productivity of the knowledge worker can be augmented in striking ways.

In addition to more and faster communication tailored to the needs of users, office communication systems can increase the metabolism of an organization in ways which are not yet fully understood. Bair attempts to show how electronic mail can save a knowledge worker 2 hours per day by reducing shadow functions, notation time, media translation time and interpretation, wait and recycle time. In Canada such savings would translate into somewhere upwards of $5 billion per year. A number of writers have discussed the communication benefits of computer mail (Bair 1978, Carlisle 1977, Turoff 1977, and Uhlig 1977).

A by-product of existing electronic mail systems appears to be the growth of communications infrastructures within the organization. Communications become more structured and planned. Carlisle has shown how communications can become "non-simultaneous". A recipient of a communication sitting at his/her terminal will be able to hear or see, and respond to a message when it is convenient to do so. This has a number of benefits. Fewer interuptions increases worker's control; employees can receive a message when they are in a frame of mind to give it a better, more reflective response; the quality of messages improves over less structured verbal communications; shadow functions caused by things such as busy telephones can be reduced; the office becomes less of a place, and more of a system as people can send messages to one another at any time and often at various locations: as a result there can be greater flexibility in where and when people work (Carlisle 1977). Electronic mail also provides a permanent, searchable stored record of all communications. There can be automatic distribution of communications to appropriate persons. The list goes on and on.

Decision Support

Office automation can enable the construction of a supportive systems environment in which decision-making and problem solving can be transformed. This can include more of the right people becoming involved, more management feedback and control, increased use of pertinent information, more rapid dissemination and implementation of decisions, and so on. A related concept is that of the "Firm of the Future" a phrase coined by Gruber and Miles in the book, The New Management, (Gruber 1976). They argue the case for the organization of an environment of experienced-based managers supported by research-based staff specialists who provide quantitative information necessary for effective decision making.

Englebart, through his experience with one of the most advanced

automated offices today (Augmented Knowledge Workshop) has noted multiple levels of synergism at work. It is useful to quote him at some length:

> "The synergistic effect of integrating many tools into one coherent workshop makes each tool of considerable more value than if it were used alone - for instance, the value of teleconferencing is very much greater when the participants are already doing a large proportion of their everyday work on line, so that any of the working material is available for selective citing and accessing, and when the users are already at home with the basic techniques of preparing and studying on-line material and of organizing and finding related passages.
>
> "And at another level, the synergistic effect of integrating many augmented individuals into one coherent community makes each element of augmentation of considerable more value than if it were applied just to support its one individual - this is derived from the collaborative communication capabilities as applied through extended organizational methods to integrate the augmented capabilities of individuals into augmented teams and communities.
>
> "And finally, for any application of significant power - of which augmentation of (a)...project would be a good example - the adaptability and evolutionary flexibility of the computer communication system is extremely important. The working methods of individuals will shift markedly as they settle into use of a comprehensive workshop, and with these new methods and skills will come payoff potential for changes and additions to their workshops - a cycle that will be significantly active for many years to come. A similar cycle will be even more dramatically evident at the organizational level." (Englebart 1977)

The end result of the augmentation of knowledge work is increased organizational productivity. However, as automation is introduced we are beginning to see many more far-reaching changes.

An enterprise's entire organizational structure may be modified. One example is the company which discovered regional offices were unnecessary once a communication system enabled the head office to communicate directly with branches. New functions, and activities are being created. Career paths, especially for women, are changing. Reporting structures are changing, as in the case of Citibank. The company is using an office communication system to increase the manager's span of control from 7 to 9 employees, with a projected savings of $15

million per year. The nature of knowledge work is starting to be transformed. Even goals and objectives of organizations are changing, as companies find their office information and communications systems open up new markets. One example is the evolution of credit card companies into the mail order business.

All of this sounds quite euphoric. No review of the potential of office automation would be complete without showing the dark side of that potential. Office automation holds the potential for better information management, communication and decision making along with increased job satisfaction, quality of working life, opportunities for growth and freedom for millions of Canadians. But, as Carlisle has pointed out, it also holds the potential of alienation, the stifling of creativity, job fragmentation, dehumanization of communications, regimentation and the 1984 horror of monitoring all electronic communications (Carlisle 1977).

Burns has added another cautionary note:

> "... The associated risk is that these systems [office of the future] tamper with the most sophisticated process I know of - the office. Although we take it for granted, it is the product of 200 years of development and refinement, and changing it will require our best systems planning skills." (Burns 1978)

On a broader scale, the Office of the Future poses very profound questions regarding the nature and the future of western society. While the discussion of these is beyond the scope of this paper, several can be mentioned. Bair notes the effect of increased white collar productivity and possible labour reduction on unemployment. "If increased productivity means unemployment, we have a 'catch 22' effect." On the other hand he suggests there are problems with a shorter work week. "If increased productivity can support a shorter work week, what will happen to inflation?" He concludes that the social and economic implications of office automation may outstrip the ability of contemporary society to deal with them (Bair 1978). The implications of office automation for transforming the quality of working life for women have been discussed by numerous authors (Purchase 1976, McCallum 1979). Other writers have suggested that office automation will lead to a massive rise in unionization of white collar workers, as workers organize to protect themselves from the deleterious effects of technological change.

The character and results of office automation will depend on who is driving it and what generalized design methodology and implementation strategy they employ. Which brings us to the main problems which must be confronted.

5.0 THE PROBLEM

The main obstacle to the Office of the Future can be summarized as follows: there is no adequate methodology or way of assessing the automation needs of an organization, designing and implementing systems which correspond to those needs, and measuring their effects.

This problem is reflected in many ways. The science of measuring managerial effectiveness, office communication and the augmentation of knowledge workers is in its infancy. Howard Anderson put it well: "How do you measure management effectiveness? In decisions per fortnight?" (Anderson 1979). Because of this, office automation has been derailed into the limited domain of word processing, where lines per hour can easily be counted. Most organizations will not make investments in technology which cannot be cost-justified in hard dollars. As a result, the marketing strategy of all the major vendors of office automation focuses on selling word processing hardware which can be cost-justified on a short term basis. Because of this the Office of the Future has taken a full scale detour away from the technologies and applications where the really substantial benefits are to be found.

It is quite remarkable to watch how this dilemma becomes posed concretely at conferences on the Office of the Future. Researchers, behavioural and management scientists tend to speak of the advantages of electronic mail, office information systems and so on. The vendors on the other hand extol the virtues of stand-alone word processors as a way of cutting costs. In the middle tend to be bewildered users, inundated on the one hand by scores of vendors with iron to sell, and scolded by consultants and researchers on the other, saying word processing is a waste of time.

Most organizations, in the search to cut costs end up relying on the word processing vendors and purchase hardware which becomes an expensive obstacle to office automation in the high payoff areas. So far, most organizations which have attempted to go beyond word processing are either the corporate giants like Exxon, Chrysler or Citibank - all of which can afford to make a risk investment in the hope of making qualitative gains - or research/consulting companies which have an interest in selling expertise and experience in this area.

Another way the lack of a comprehensive office systems methodology is reflected is that there is little understanding of the human element or "people issues" of office automation. In a recent survey by the Diebold Office Automation Program, the researchers found that this was the most frequent concern of organizations which were venturing into the new technology.

Carlisle put this well: "Too many computer-based systems have already been designed on the basis of technological breakthroughs and innovations which were insensitive to the limit of man's rationality and

the social needs which must be met within organizational structures." (Carlisle 1977)

At the Office of Tomorrow Conference in Toronto this year, one speaker made a stunning comment that is typical of those who approach office automation from an exclusively technological perspective. He said people in the office "will have to adapt to the technology and not expect the technology to adapt to them." The truth, of course, is precisely the opposite. Technology must be humanized. It must be built, interpreted, organized and introduced in such a way that it meets the needs of people and organizations. It must not only make organizations more productive, but it must improve the working lives of those in them. If this cannot happen, experience has indicated that there will be no Office of the Future. A few examples are illustrative:

- One technologically-perfect word processing system crashed because the operators could no longer take coffee breaks together. They became hostile to the system and through lack of motivation and co-operation they sabotaged it.

- It has been found that many managers, especially women who were formerly secretaries, resist having an electronic mail terminal on their desks. Lack of understanding about the origins of this problem and how to resolve it has obstructed automation programs.

- Centralized word processing systems have been found to increase typing efficiency. But in many cases the increase in shadow functions and other wasted time of knowledge workers getting material in and out of word processing centres resulted in a decline in productivity. Lack of appreciation of the "people issues" led to a system which <u>increased</u> efficiency while <u>decreasing</u> the organization's overall productivity.

- An automated system was introduced in one office of a company and readily and enthusiastically accepted by the workers. The same hardware never got off the ground in another department of the same company because of the way in which it was presented to the workers.

- A company was able to 'unfreeze' an office and successfully introduce a system. But they did not know how to institutionalize the change, or 'refreeze' the new system. They did not know that a system is most vulnerable once it is running. The system failed.

These are just a few of hundreds of examples which make the point: office systems must be designed and implemented in such a way that they can genuinely meet user needs and take fully into consideration the human and organizational factors and constraints of the situation. If not, the result will be inappropriate or inflexible over all system designs; unrealistic expectations; worker perceptions of a 'hostile' rather than a 'friendly' system; inadequate procedures, guidelines and system controls; and in general, user alienation and system collapse.

6.0 TOWARDS A NEW PERSPECTIVE ON THE OFFICE OF THE FUTURE

A number of researchers, consultants and organizations are working towards a new perspective on office automation. Some of the leaders in this endeavour have been referred to in this presentation. I would like to finish by summarizing such a perspective. It:

- Recognizes that user information and communication needs, not technology should drive office automation.

- Emphasizes augmenting the knowledge worker rather than increasing typing efficiency.

- Is a multi-disciplinary perspective, incorporating information science, management science, behavioural sciences, interior design and others.

- Takes into consideration the human factors in system design and implementation.

- Recognizes that the revolutionary change of office automation must take place in an evolutionary manner, and cost-justified at each stage.

- Emphasizes user participation and involvement from the onset.

- Seeks to develop tools and analytical procedures to obtain valid and reliable measures of pertinent activities, functions, processes and attitudes in the office milieu.

- Strives to be scientific in its research and methodology - utilizing experimental procedures, statistical analyses, modelling and simulation techniques.

- Is not purely empirical, but draws upon theory in areas such as organizational development, socio-technical systems theory, industrial psychology, strategic planning, operational research, etc.

- Keeps abreast of current technological advances but relies on no one vendor.

- Emphasizes the need for carefully planned education and training of users along with continuing system review and refinement.

These are some of the aspects of the kind of perspective which is needed to enable office automation to achieve its positive potential. More and more leaders in the field are turning to such a perspective. The task is to continue to build on the methodology which it contains and the experiences required to help its realization.

REFERENCES

Anderson, Howard. "Cost Effective Office Automation for Today's Management." from the verbal presentation to the National Conference on the Office of Tomorrow, Toronto, February 13 - 15, 1979.

Bair, James H. "Communication in the Office of the Future: Where the Real Payoff May Be." Paper given to the International Computer Communications Conference, Kyoto, Japan, August 1978. p 2-3.

Banks, Frank M. and Stuart MacLaurin. "Bell Canada puts fiber optics in the field." Telephony. p 23-. December 18, 1978.

Bridel, Robert J. From his introductory remarks to the Office of Tomorrow Conference, sponsored by Canadian Office magazine. Toronto, 1979.

Burns, J. Christopher, "The Office in the 1980's", Information Systems in the 1980's, Arthur D. Little. Inc. p 21 - 34, 1978.

Burns, J. Christopher. "The Evolution of Office Information Systems." Datamation, p 60 - 61 April, 1977.

Carlisle, James. "Evaluating the impact of office automation systems." Proceedings of the N.C.C., 1977.

Englebart, Douglas C. "Toward Integrated, Evolutionary Office Automation Systems" in Proceedings of the Conference on Engineering Management in the Computer Age. Denver, Colorado. p 63 - 64. 1978.

"Automated Office of the Future is Goal of Multi-Billion-Dollar Race." in the Globe and Mail, Toronto, Ontario. January 4, 1979.

Gruber, W. H., and John. S. Miles., The New Management. McGraw-Hill, Inc. New York, N.Y. 1976.

Harris, Louis and Associates, Inc. The Steelcase National Study of Office Environments: Do They Work?. 1978. Available in Canada from Steelcase Canada Ltd. P.O. Box 9, Don Mills, Ontario. M3C 2R7.

Hindin, Harvey J. "Will atomic particles communicate?" Electronics. p 73 - 74, Vol. 51, No. 17, August 17, 1978.

Keen, Peter G. W., and Michael S. S. Morton, Decision Support Systems: An Organizational Perspective. Addison-Wesley. Don Mills, Ontario. p vii. 1978.

Kenney, George C., et al. "An optical disk replaces 25 mag tapes." IEEE

Spectrum, p 33 - 38 February, 1979.

McCallum. "Good secretaries are hard to find as jobs call for more management skills." Globe and Mail. Toronto, March 5, 1979.

McNurlin, Barbara C. "The Automated Office: Part I". EDP Analyzer, p 6. September 1978.

Mintzberg, Henry. The Nature of Managerial Work. Harper and Row, New York, N.Y. 1973.

Mintzberg, Henry. "The Manager's Job: Folklore and Fact." Harvard Business Review, July - August 1975.

Poppel, Harvey L. "Information Resource Management (IRM) - A New Concept," a paper given to the 1976 N.C.C.. Cited in McNurlin 1978.

Purchase, Alan and Carol F. Glover, "Office of the Future." Stanford Research Institute Business Intelligence Program Guidlines No. 1001. April 1976.

Revenue Canada. Taxation Statistics, 1978 Edition, Analyzing the Returns of Individuals for the 1976 Taxation Year.

Statistics Canada. Employment Earnings and Hours, Catalogue 72-002 Monthly, October 1978.

Strassman, Paul A. "Managing the Costs of Information." in Harvard Business Review (U.S.A.). Vol. 54, No 5. p 133 - 42 September 1976.

Turoff, M. and Roxanne Hiltz. "Meeting Through Your Computer." IEEE Spectrum. p 58 - 64. May 1977.

Uhlig, Ronald P. "Human Factors in Computer Message Systems," Datamation, p 121 - 126, May 1977.

Zisman, Michael D. "Office Automation: Revolution or Evolution." Sloan Management Review, p 2 - 3 Spring 1978,

CONVERGING TECHNOLOGIES

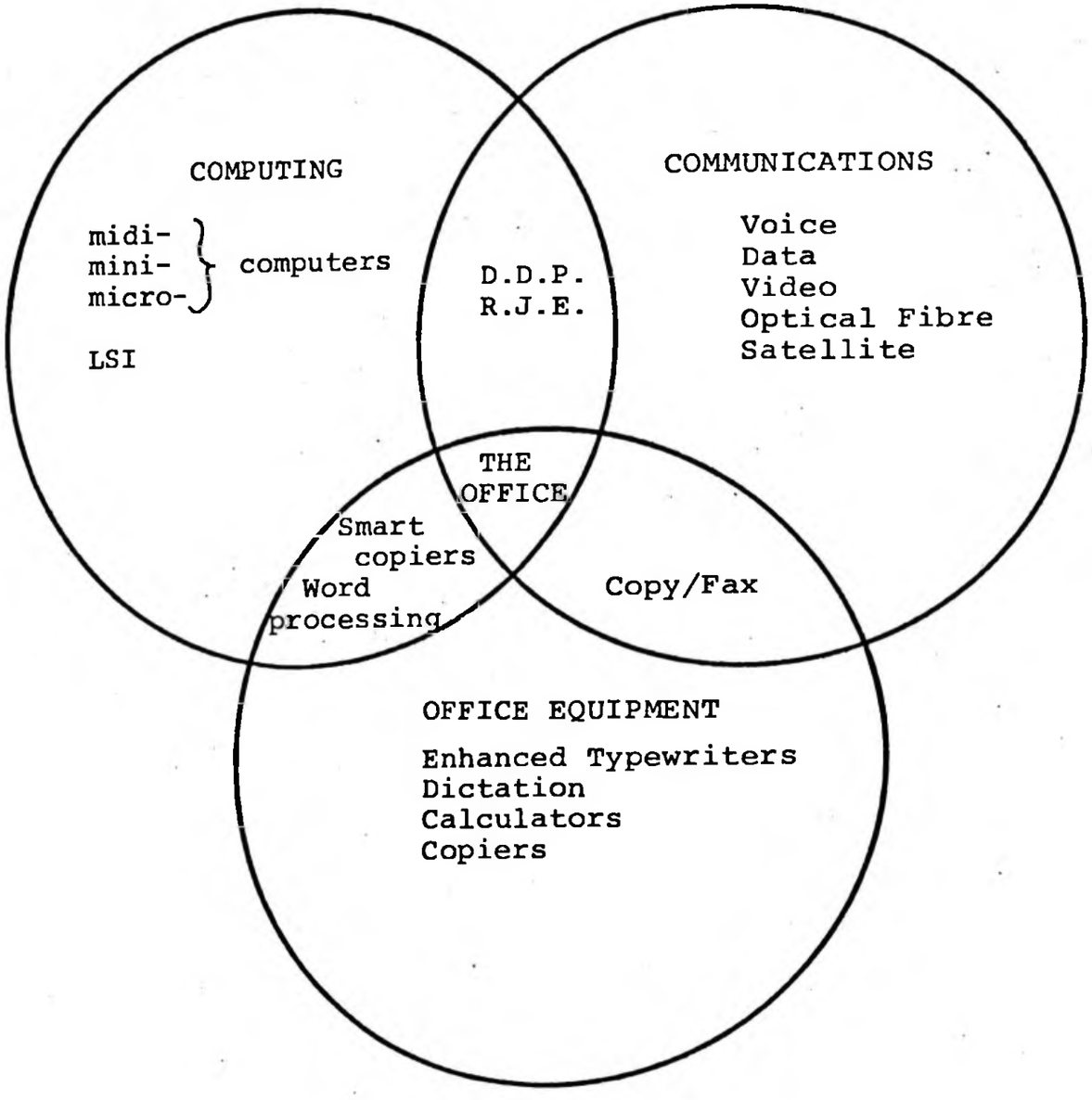

Figure 1

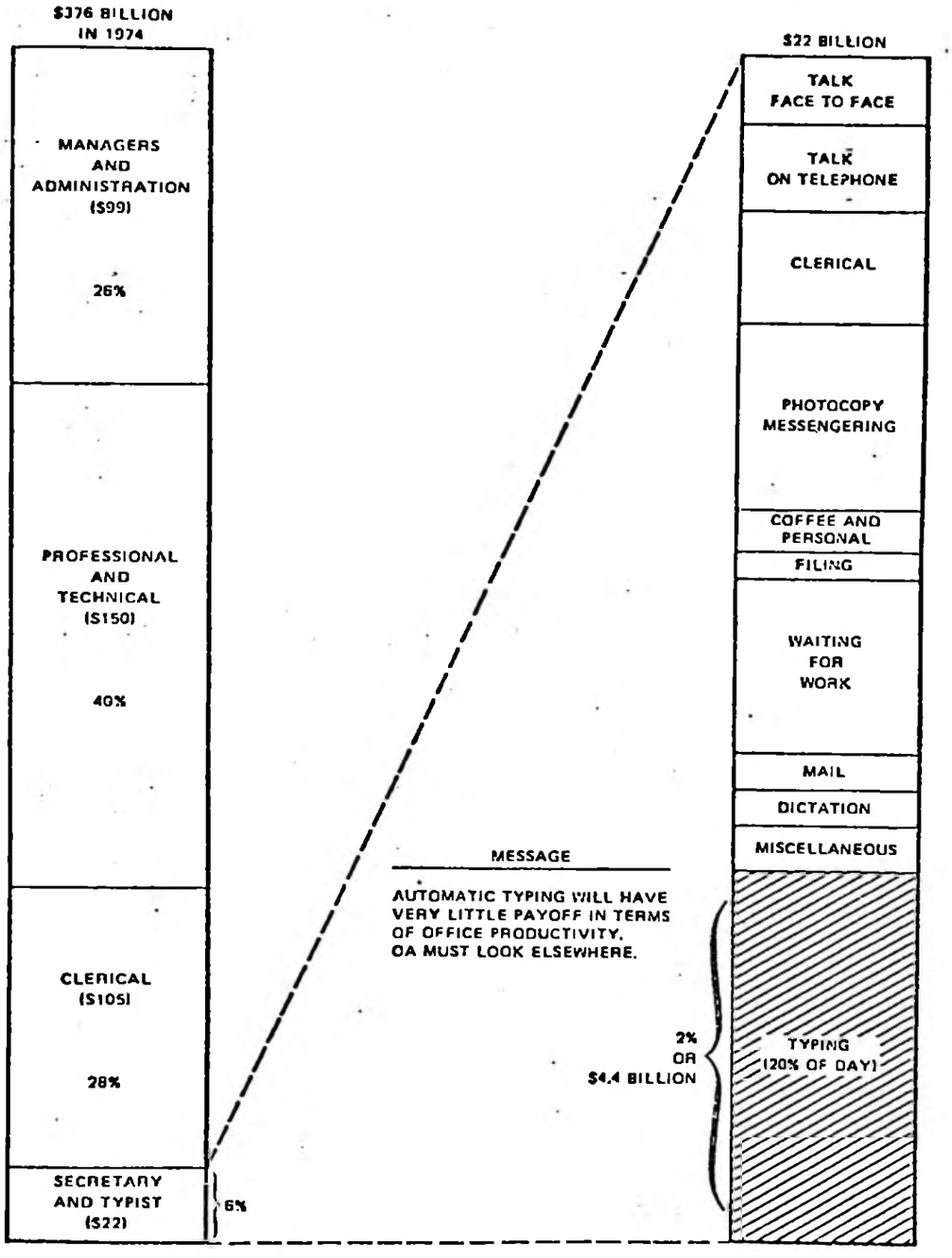

FIGURE A-2 LABOR COSTS FOR TYPING RELATIVE TO TOTAL OFFICE LABOR COSTS
(From Statistical Abstracts of the U.S., 1975)

FIGURE 2 BAIR, 1978

Figure 2