CONCEPTUAL DEFINITION OF AN AUTOMATED OFFICE NETWORK FOR THE FEDERAL GOVERNMENT

JOHN E. KLEINS

PER CONTRACT WITH THE DEPARTMENT OF COMMUNICATIONS,
GOVERNMENT TELECOMMUNICATIONS AGENCY

SEPTEMBER 1980

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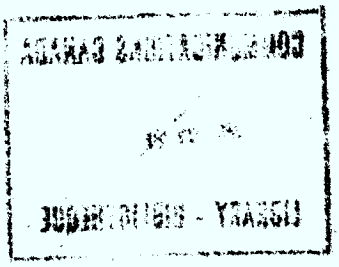

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I. Terms of Reference

The requirements of this contract are listed below, along with the sections in which they are covered.

* Conduct the research required to identify, describe and classify basic administrative tasks in terms which make clear how the tasks are related and how they can be automated with minimum disruption to the user. See

  3.2 Basic office tasks
  3.3 Interrelationship of tasks
  4.2 The challenge
  4.3 Information support logic
  4.4 Automated task management
  6.1 Design considerations
  6.2 Development strategy considerations
  6.3 Testing strategy considerations
  6.4 Implementation considerations
  7.1 An overview
  7.2 Where to start
  7.3 Economic considerations.

* Identify the kind of communications oriented technology becoming available now and over the next five years to automate the tasks identified above in such a way that they will be fully integrated. See

  5.1 Characteristics of the technology required
  5.2 Available technologies
  5.3 Anticipated technologies.

* Identify the types of people who will be directly and indirectly affected by office automation and the manner in which they will be affected. See

  1. The evolution of the information society
  2.1 The office population
  2.2 Unemployment - Yes or No?
  2.3 Arguments in support of office automation
  3.1 The traditional office environment
  4.1 The social orientation.

* Identify the kind of planning capability required by users to launch office automation. See

  8. Planning capability requirements.

II. Method of Approach

* The following major documents and publications related to office automation were reviewed:

1. Chips in the 1980's: The Appliction of Microelectronics Technology in products for Consumer and Business Markets, The Economist Intelligence Unit Ltd. - 57 pages.

2. Dataquest Research Newsletters (A.4. Series related to Word Processing Workstations) - 107 pages.

3. Office Automation Reporting Service reports Jan. - Aug. 1980 - 108 pages.

4. Word Teleprocessing Interface, Carleton University, March 1980 - 138 pages.

5. Open Systems Interconnection: Application Issues Associated with the ISO and CCITT Layered Models, Carleton University, March 1980 - 123 pages.

6. A Compleat Guide to Electronic Messaging, OARS/IDC, Dec. 1979 - 48 pages.

7. Electronic Mail: User Alternatives in the 1980's. Mackintosh International - 123 pages.

8. Electronic Mail in the 1980's, International Resource Development Inc. - 241 pages.

9. Computer Communications Networks of the Future, Strategic Business Services - 123 pages.

10. The Electronic Mail Report, Yankee Group, May, 1980 - 163 pages.

11. The Science Council's Weakest Link, Palda, K.S., The Fraser Institute, 1979

12. Report of the Auditor General of Canada, 1979, Section 10, Management of Telecommunications, pp. 207-217.

13. Information Technology and the Federal Government - A Discussion Paper prepared for the Treasury Board Senior Advisory Committee (TBSAC) by the Information Technology Task Force, March 1980.

14. Minutes of the Public Accounts Committee on June 17, 20 and 26, 1980, House of Commons Issue No. 5.

15. Over 60 articles from current trade publications.

* I attended the First Global Conference on the Future in Toronto from July 20-24. Twenty sessions on Information Management and Communications were attended and 41 taped presentations on technology and the information society, each 90 minutes long, were reviewed.

* Meetings and discussions were held with high technology company executives in California.

* Meetings and discussions were held with users and manufacturers of office automation equipment in Canada and the U.S.

The content of this report is based on a full appreciation of office automation in general, word processing systems in particular, and a good insight into government office needs gained over the past five years under contract to the following departments:

Transport Canada
Industry, Trade and Commerce
Department of Communications
Department of Employment and Immigration
Department of Supply and Services
National Research Council
National Library of Canada.

III. Executive Summary

The second industrial revolution is taking place in the office, unlike the first which took place in factories. Unannounced and for the most part unnoticed, it has taken hold and is now affecting everyone everywhere. It has triggered an entire social transformation. The origin and impact of these events is discussed in the first chapter entitled "The emerging information society".

Neither the impact nor the economies of the information society is understood widely because information as a commodity is still a novel concept, despite the fact that one half of the entire working population of North America is involved in its preparation, collection, handling, processing, production, storage, dissemination and use.

Thus the foundations on which this conceptual definition rests are people and technology. Of these, people are by far the more important because they are the origin of all office work. The objective of this definition is to provide a management perspective on how communications technology can be made available for people to perform office tasks more efficiently, effectively and creatively.

The types of people and how they may be affected are the subjects of Chapter Two. The office population is analyzed and grouped into three major categories:

- those who manage (managerial and administrative),
- those who "do" (professionals, technical and sales people) and
- those who support (secretaries, typists, keyboard operators and clerks).

Their ratios by body count and earnings are:

	EMPLOYEES	EARNINGS
Manage	21%	31%
Do	43%	49%
Support	36%	20%

Unemployment, underemployment and re-employment issues are addressed along with the fact that information volume is doubling every six to eight years. The cost of new technologies is decreasing at a rate far greater than the growth of volume, and the possibility exists that 1980 cost levels can be maintained while coping with the onslaught of faster information growth.

Two opposing views on the effect on employment are presented. Some hold the view that 95% permanent unemployment in 20 years is a possible outcome of the "microcomputer revolution", while others argue that if used for mind support functions, the microcomputer will enable humankind to accomplish tasks heretofore not possible.

For all these reasons it is clear that a large scale change is under way in the office, with a potential impact far more disruptive than that experienced in the automation of the industrial sector.

Arguments are offered in support of office automation: inevitability, necessity, the rapidly growing energy shortage, the fact that major facilities are already in place, and finally, because it offers an opportunity to combat underemployment.

This is not, however, automation as we have known it. A new approach will be needed to cope with the requirements of the office environment of the 1980's, and it is this approach which must be taken if we are to put office automation in perspective.

The office environment, the tasks and their relationships are the subject of Chapter Three. Two mindsets are identified amongst office workers - those who support office automation and those who oppose it. Their postures and the reasons for these postures are discussed, and the point is raised that the latter group may not be working in the office by the time automation arrives.

To understand what to automate, sixteen basic office tasks ranging from analysis and communication through copying and decision making to typing and waiting are identified and grouped into eight major categories. The cost ratios of these grouped tasks in 1980 are:

Oral communication	27%
Analysis and computing	22%
Telephone	18%
Reports and correspondence	15%
Information handling	10%
Typing and data entry	5%
Copying	3%
Dictation	-

The interrelationship of office tasks and their supporting components is analyzed using the organizational structure as the point of departure, since it is what determines the paths along which information flows. Thus it is useful to think of every organizational structure as being paralleled by an information network. Since most organizations are still structured in a hierarchical manner, the tasks and components can be also grouped in a levelized manner.

As one ascends the hierarchy the number of peers decreases and the responsibility increases. The expansion of responsibility is evident when one compares the scope of activity, the magnitude of the tasks and the definition of the task components which characterize each of the four organizational levels illustrated below.

INTERRELATIONSHIP OF OFFICE TASKS

LEVEL	STAFF	SUPERVISOR	MANAGER	EXECUTIVE
SCOPE	Detail	Local	Regional	Global
	Instruction	Objective	Directive	Goal
	Message	Topic	Concept	Idea
	Status	Exception	Comparison	Trend
	Transaction	Activity	Function	Operation
TASKS	Calculate	Analyze	Evaluate	Select
	Perform	Control	Schedule	Plan
	Prepare	Review	Summarize	Synthesize
	Request	Validate	Approve	Authorize
	Sequence	Edit	Assess	Project
	INFORMATION BASE		RESOURCE LIBRARY	
DEFINITIONS	Cost Item	Cost Account	Cost Control	Budget
	Data	Information	Tactics	Strategy
	Document	Report	Summary	Synthesis
	Format	Procedure	Priority	Policy
	Formulae	Rules	Incentives	Results
	Protection	Security	Standard	Authority
	Record	File	Collection	Library
	Steps	Programs	Directions	Aims
	Skills	Skills	Skills	Skills

Each of the four levels of responsibility depicted exists in all organizations, and in a large, centralized structure the levels are clearly delineated. In a smaller organization they may be compressed, with as few as one person taking steps at all levels. This supports the view expressed earlier that the hierarchy can be adequately defined by the three levels "manage", "do" and "support", and provides a clearer perspective from which to view the organization for the purpose of automation design.

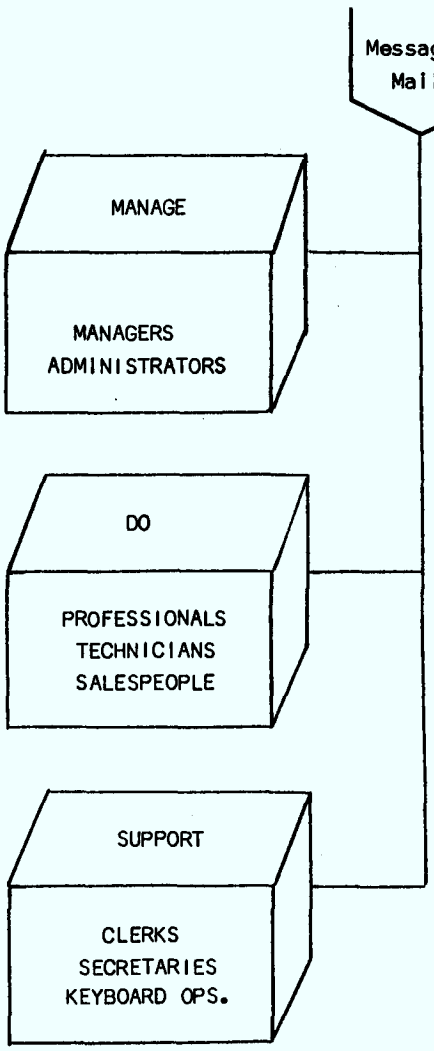
Thus although the hierarchy is a useful tool for analyzing the relationships between office tasks, it need not be a factor in the conceptual definition of an office communications network. However, to be practical one must build on what exists.

The office environment of the 1980's is examined in Chapter Four, beginning with the social orientation. The people who will work in the offices of the 80's are first identified as the young specialists of today and those who are now preparing to enter the working world. The latter group will contribute to the downward shift of the age of the work force which will continue throughout the decade. It will also raise the overall level of education of the work force. By 1982 one in four workers in North America will have a college degree; half of those with college education will be 35 or younger and half of those with only primary school education will be over 50. With opportunities in the managerial, administrative, technical and professional streams rising more slowly than the proportion of workers with advanced education, the potential for alienation and frustration in the office will climb slowly.

The challenge, and the payoff, lie not in developing automated office networks that are a tribute to technology, but in designing and building automated tools for the office that people will want to use. In today's technological and economic environment it is the user who calls the shots. Thus office automation represents the opportunity to reinvest white collar work with a sense of order and purpose. Exploiting this opportunity means commitment to an innovative approach.

A total of 32 sub-processes to office tasks are analyzed in search of common denominators for automation. Of the 32 categories, 20 apply to both the "do" and "support" levels and 14 to the managerial level. Only one managerial function - "approve" - is not performed at the other two levels. A full third - 11 - of the categories are communications oriented and apply to all levels. This is summarized on the next page.

SUB-PROCESSES TO OFFICE TASKS



	COMM	MGR	DO	SUPP
Acknowledge	X			
Act		X	X	X
Allocate		X	X	X
Analyze		X	X	X
Approve		X		
Broadcast	X			
Calculate		X	X	X
Categorize			X	X
Check			X	X
Code			X	X
Decide		X	X	X
Depict	X			
Document			X	X
Edit		X	X	X
Enter			X	X
Expedite	X			
Explain	X			
File			X	X
Format			X	X
Forward	X			
Initiate	X			
Learn	X			
Locate		X	X	X
Prepare		X	X	X
Present	X			
Prioritize		X	X	X
Procedurize		X	X	X
Process		X	X	X
Protect	X			
Receive	X			
Standardize		X	X	X
Transact		X	X	X
	11	14	20	20

Two conclusions can be drawn from the above analysis. First, it is the logic supporting these sub-processes which should be automated, not tasks, transactions or applications on a piecemeal basis as has been the practice in the EDP and text processing environments to date. Any routine transaction or task is then automated simply by assembling these universal logic components into appropriate packages. The microprocessor renders this new approach entirely feasible. Each one of the 32 sub-processes can be tied to an information support logic program accessed through one device, in the same way that cable enables one to tune in on dozens of different television network channels.

Second, since the sub-processes underlying text and data processing are identical, automation of these sub-processes results in the merging of text and data processing. This simplifies the introduction of office automation because the interprofessional bias between data processing, telecommunications and office administrative staffs is removed.

The device needed to function in this new environment would be:

- as simple to use as, if not simpler than, office tools now available;
- able to distribute complete, edited or extracted text to selected or unrestricted readers on demand;
- able to handle at least two different character fonts in at least two different languages concurrently;
- multifunctional - i.e. able to satisfy the basic working needs of secretaries, typists, clerks, technicians, professionals, administrators and managers alike. The device should be able to handle text, forms, data and telecommunications. Ultimately voice, video display, alphanumeric, graphic and pictorial capabilities would be inherent.

Automated task management is discussed using an analogy to the organization and operation of the television networks. It is recommended that this section (4.4) be read in its entirety.

The sections on available and anticipated technologies focus on the fact that while an abundance of technology exists, early acceptance and implementation is not practical since comprehensive automation systems are as yet not available from any one manufacturer nor group of automation companies. This section avoids technological terms and concentrates on the availability of various system components, illustrating what can be accomplished by introducing media switches in some areas of communication. For this reason it is urged that Chapter Five be read in its entirety.

Chapter Six describes automated office network design considerations, stating the major design objectives at a near philosophical level along with pragmatic explanations. Development strategy considerations are offered along with brief descriptions of the five strategy elements tabled. Testing strategy considerations are outlined as well as implementation considerations. It is urged that Chapter Six also be read in its entirety.

Chapter Seven discusses the evolution of information processing and management during the first half of this decade and provides an overview table with status snapshots in 1980, 1983 and 1986. This is discussed according to "who", "what", "where", "how" and "what type" dimensions as well as time frames. Three major elements of a network development program are offered and an economic benefit potential is identified.

The last chapter describes the planning capability required to launch office automation.

It is hoped that a wide variety of interpretations of this document will emerge and be tabled to stimulate the development of many individual plans within the general planning framework. Because this document was intended to serve as input to the planning framework, the traditional summary and conclusions sections are not provided. Nonetheless, it would be worthwhile to focus on a number of the points made in these pages:

1. A new social structure is emerging.

2. Technology is abundant.

3. People (staff and management) are the key.

4. A people system has to be developed.

5. Office automation will not progress far unless management is included in the system.

6. Progress will be very painful unless early acceptance is secured.

7. Acceptance and understanding is best achieved via participation and tests.

8. Economic pressures combined with growth in information volume will soon render current office practices untenable.

9. Resources will be difficult to secure unless savings potentials are significant.

10. Profitable media switching will finance the testing and development if properly planned.

11. Many people on the verge of retirement can help to develop the new systems by documenting the basic procedures they understand well.

12. New system design will require considerable time and synchronization if a standard of any kind is to be achieved.

13. Innovative systems may be more acceptable to the willing specialist and young graduate joining the work force.

14. Actual user requirements must be fed to the industry and to the carrier.

15. Only tests will help determine what these requirements are.

16. Unemployment may not be a concern in the first half of the decade.

17. Underemployment may present a bigger problem.

18. To minimize start-up costs, gain maximum acceptance, and provide early pay-back, a two-pronged approach should be considered:

    1. A switch as soon as possible from the use of costly media such as paper, voice and face-to-face meetings to the use of communicating word processors and computer conferencing should be considered by all departments.

    2. Departments with the special requirements and capabilities outlined in the Testing Strategy Considerations should prepare now to test innovative communications technology and pass the results of these tests on to other departments.

    Thus the next logical step is to proceed with the selection and definition of tests in both areas - media switch and innovation.

CONCEPTUAL DEFINITION OF AN AUTOMATED OFFICE NETWORK

FOR THE FEDERAL GOVERNMENT

1. The Emerging Information Society

We are in the process of transition from an industrial society. Energy conservation imperatives combined with industrial automation and new applications of computer technology are precipitating us into a new dimension - the information society. Three years ago John Kettle observed ("The Executive", June 1977) that "Information is, increasingly, the point and product of our daily lives. A crass, simple measure of it is that the production and distribution of knowledge is today at least 25% of GNP, probably more." Current thinking puts this estimate close to 50%.

This is the context in which the development of office automation networks must ultimately be considered. Thus one can now approach office communications planning from at least these three different perspectives:

1. The narrow view, based on telecommunications but without regard for the substance or origin/destination of what is being communicated. This is the traditional perspective.

2. The broad view, focusing on office automation as both the source and destination of information communicated.

3. The global view, in which the automated office network is regarded as a cornerstone of the emerging information society.

This paper deals with concepts and is therefore written from the final perspective.

It is easier to understand the transition when it is placed in a historical context. Technical innovation has been the driving force behind social transformation. The origin and maturation of technical innovation occurs in three clearly identifiable stages:

1. Work done by humans is replaced by technology.

2. Productivity improvements are achieved and new tasks are accomplished hitherto impossible for human beings.

3. Existing social and economic systems are transformed into new socio-technological systems.

Two major milestones in technical innovation have occurred during the last two centuries and changed our lives. These are:

1. The invention of the steam engine, which affected motive power and
   - replaced human and animal physical labour;
   - amplified physical labour;
   - transformed an agricultural society to an industrial society.

2. The invention of the computer, which affected mental power and is -
   - replacing human mental labour;
   - amplifying mental endeavours;
   - transforming an industrial society to an information society.

Combined with communications, computer technology is now reaching the level of maturity where it can be applied to mind support as the steam engine was applied to muscle support. From its humble start in 1959 with punched card to paper tape conversion, this technology evolved rapidly into non-wired communications by 1969 to meet the needs of the moon shot, and is now digitized and poised to take off.

A number of industrialized nations have recognized the significance of this transition and taken steps to prepare for it. The government of Japan has done so by endorsing and acting upon a blueprint for the information society submitted to it in 1972 by the Japan Computer Usage Development Institute under Yoneji Masuda, now President of the Japan Institute for the Information Society.

Dr. Masuda's blueprint provides insights into the nature and timing of social transformation through technology which clarify where we are and where we are going. In it he proposed that computer technology is evolving in four overlapping stages, each 25 years long:

1.	Development stage	1945 - 1970
2.	Implementation stage	1955 - 1980
3.	Refinement stage	1965 - 1990
4.	Advancement stage	1975 - 2000

During the development stage the first, second and third generation computers were introduced, large scale integration appeared, the minicomputer was developed and the microcomputer was born. The implementation stage saw free standing mainframe controlled systems go into operation. The refinement stage brought front end processors, linked minicomputers, clustered systems, key to magnetic media data entry and CRT displays. The advancement stage began with chip technology, microcomputer application and digitized network technology.

The characteristics of these stages are summarized as follows:

STAGE	USED BY	GOALS	VALUES	SUBJECT	OBJECT OF USE	SCIENTIFIC BASE	INFORMATION SUPPORT
1	Big Science	Defence/ Space	Prestige	Nation	Nature	Natural Sciences	Attain Scientific Goals
2	Management	Gross National Product	Economic Growth	Corporation	Organization	Management Sciences	Pursue Business Efficiency
3	Society	Gross National Welfare	Social Awareness	General Public	Society	Social Sciences	Solve Social Problems
4	Individual	Gross National Statisfaction	Self Actualization	Person	Human Beings	Behavioural Sciences	Intellectual Creativity

In 1980 we are at the crossroads, on our way from the implementation stage with a decade left in the refinement stage, and already recognizing the progress made in the advancement stage.

Dr. Masuda makes the following observations on information and communications:

INFORMATION IS A UNIQUE COMMODITY.

- It cannot be consumed like a product.
- It does not disappear when used.
- It is not depleted when used.
- It remains, it accumulates and increases in value with use.
- Its value is not yet understood.
- Communications is a basic individual right and a prerequisite for many other rights.

When it comes to information, we are all developing countries.

Some futurists foresee the information society evolving further into a learning society in which humanity will achieve the maturity, stability and wisdom to manage its affairs effectively and to be managed. Many foresee social benefits accruing from the application of information technology to which economic necessity compels us. All would agree with Leo Chorne, Executive Director of the Research Institute of America, that "The computer is incredibly fast, accurate and stupid. Man is unbelievably slow, inaccurate and brilliant. The marriage of the two is a force beyond calculation."

Thus the foundations on which this conceptual definition rests are people and technology. Of these, people are by far the more important because they are the origin of all office work. The objective of the definition will be to provide a management perspective on how communications technology can be made available for people to perform office tasks more efficiently, effectively and creatively.

2. Types of People and How They May be Affected

2.1 The Office Population

While no accurate ratios of the distribution and earnings of the office population are available for Canada, a survey conducted in 1979 by Strategic Business Services reports the following distribution in the United States:

	Employees		Earnings	
	Millions	%	US $ Billions	%
Managerial & Administrative	9.3	21.28	223	31.23
Professional & Technical	13.3	30.43	266	37.25
Sales People	5.5	12.59	83	11.62
Secretaries	2.2	5.09	26	3.64
Typists & Keyboard Operators	4.4	10.68	35	4.90
Clerical People	9.0	19.99	81	11.36
TOTAL	43.7	100.00	714	100.00

These can be further subdivided by industrial, commercial, technological, academic, public service and vocational groups. This level of detail renders analysis of office work difficult and unrewarding.

A more fruitful approach is simply to group the office population into those who manage (managerial and administrative), those who "do" (professionals, technical and sales people) and those who support (secretaries, typists, keyboard operators and clerical people). Grouped in this manner, the above information would read:

	Employees		Earnings	
	Millions	%	US $ Billions	%
Manage	9.3	21.28	223	31.23
Do	18.8	43.02	349	48.87
Support	15.6	35.70	142	19.90
TOTAL	43.7	100.00	714	100.00

Only a fraction of the support level has been involved in automation, namely typists, secretaries and keyboard operators (data entry, TWX, TELEX). Furthermore, although the total office automation effort so far has been aimed at 15.7% of the office population, this represents only 8.5% of the earnings.

Since employee earnings represent employer costs, the next area to be considered is the remaining support level - clerks. By adding the clerical people, automation would reach 35.7% of the office population, representing 20% of the costs.

This type of reasoning brings forth objections from managers, who see one third of the office disappearing and only one fifth of the cost reduced. Accusations arise that it is socially irresponsible to introduce office automation because of the potential of serious unemployment.

A concise answer to this concern is suggested here, then an argument is developed for a new approach to office automation which could go beyond pacification of the critics and permit their support to be enlisted.

2.2 Unemployment - Yes or No?

The simple answer to this question is that yes, automation of office work will cause a considerable rise in the number of unemployed.

It has been pointed out that the use of computers in the office to date has created rather than eliminated jobs, but this can only be a temporary situation, resulting from the large numbers of staff required for the care and feeding of second and third generation equipment - programmers, analysts, keyboard and computer operators and so on. Beginning with the mass use of word processing equipment the tide is turning, and we can fully expect to see the bottom drop quickly out of the market for copy, dicta and steno typists, messengers, mailroom staff, filing clerks and teletype operators. Even programmers, analysts and computer operators will be less in demand as applications become more standard and sophisticated and the use of artificial intelligence becomes common.

The encroachment of automation into office routine, though slow to date, promises to take hold more quickly and to become entrenched in a much shorter period of time than was the case in industry, leaving no latitude for organized compensatory action to be taken by management in either business or government. No routine task will escape automation - and that puts a minimum of 20% of the jobs in the typical office on the line. This will have impact, since white collar and supporting office workers now make up 54% of the total work force compared to 29% in industry, and since growing numbers of office workers are unionized. In the public sector, which employs nearly a quarter of all office workers, the level of union membership is high, and at the federal level at least it is virtually 100% of non-management staff.

Some hold the view that 95% permanent unemployment in 20 years is a possible outcome of the "microcomputer revolution", while others argue that if used for mind support functions, the microcomputer will enable humankind to accomplish tasks heretofore not possible. Regardless which of these or a number of less extreme scenarios materializes, it is clear that a large scale change is under way in the office which has a potential impact far more disruptive than that experienced in the automation of the industrial sector. A short time remains for preparatory action which will keep

displaced workers gainfully occupied until the mid decade, but mass retraining and a rethinking of the role of work will be necessary if jobs are to be available for the increasing numbers of such people thereafter. Since, in the words of a senior U.S. Senator speaking to the President of Forecasting International Ltd. in 1971 about the possibility of an energy crisis, "You can't handle a crisis until it becomes a crisis", it seems unlikely that action will be adequate or on time to avoid mass unemployment in the latter part of the decade.

2.3 Arguments in Support of Office Automation

In light of this certain rise in the level of unemployment, what arguments can be made in support of proceeding with office automation? Five categories of reasoning warrant consideration.

a) Inevitability - Automation of office routines is inevitable now that the tools are becoming readily available. A momentum has been created sufficient to overcome the resistance to automation characteristic of the office to date. The strength of this momentum lies in the increasing simplicity and versatility of office automation products and the acclimatization of office workers to computer technology via the consumer and educational environments. The emerging generation of office workers has been exposed to the use of automated tools throughout its schooling and will expect to find such aids in the office.

b) Necessity - Office automation products must be introduced for reasons of both organizational and economic necessity. With 50% of the labour force handling information-related tasks for a living, the amount of information to be processed, manipulated, digested and applied in the office has become unmanageable. The situation will continue to degenerate because the volume of information is now doubling every 6-8 years. The point is reached when manual methods, no matter how well supported by staff, are no longer adequate to provide for information to appear where and when it is needed and in an absorbable form.

As long as economy and productivity remain watchwords of both business and government, the demand for office automation will grow. The cost of human resources is rising ever higher while that of technology drops. As their prices decrease, the versatility and efficiency of office machines increase dramatically, providing productivity improvements and reductions in overheads which will prove irresistible to management. Electronic mail, discussed in detail later, is a good example of the compelling attraction of automation in the office.

At the level of macroeconomic concern there is a strong argument to be made in favour of aggressive effort in the office automation business to counteract the influx of foreign production and spur employment in the manufacturing sector. This argument will gain weight as the 1979 GATT begins to wear away what is left of our competitive edge.

c) Energy Crisis - We are already feeling the effects of fuel shortages, and must prepare for a time, sooner rather than later, when ad lib travel is no longer feasible. The value of communications as a substitute for personal displacement is already well documented and accepted, and is a keystone of the case for office automation. Consider that if each owner of a passenger car were to drive 20 miles less a week, some half billion gallons of gas would be saved in Canada in a year - at a conservative estimate.

d) Major Facilities are Already in Place - The physical infrastructure for inter- and intraoffice communications systems is already in place and used to only 20% of capacity. This means that a major component of the automated office is available without further capital expenditure.

e) Opportunity to Combat Underemployment - Office jobs susceptible to automation are for the most part routine, boring and destructive of motivation. Work of this kind makes no contribution to the satisfaction of the intangible requirements of the individual: the need for the self esteem which comes from participating in an activity one considers useful, the need to develop one's abilities and to express oneself creatively. Yet an increasingly educated work force is more and more expecting its jobs to provide its main source of a sense of social utility.

It is tempting to go so far as to promote the accelerated elimination of routine office jobs as the means of forcing the development of new concepts of work roles, crisis being the only effective stimulus to fundamental rethinking of inappropriate social institutions. Certainly the signs are present that a new concept of work and of job design is urgently needed.

On the other hand there is no reason why people whose jobs have become redundant through technological change need be cast adrift wholesale. There should be nothing inherently unacceptable about a four day week without reduced pay when productivity levels are improved, particularly if the fifth day is used for self development and creative pursuits which would enhance the value of the employee's contribution on the job. The same could be said for a shorter work day.

Automation can play a key role in providing the tools to introduce new creative and learning horizons into the office environment, and thereby to satisfy rising demands for meaningful work. In other words, it has the capacity, if applied with intelligence and foresight, to offset its negative impact of increased unemployment with the positive effect of decreased underemployment.

This is not, however, automation as we have known it. A new approach will be needed to cope with the requirements of the office environment of the 1980's, and it is this approach which we must take if we are to put office automation in perspective. Our next step is therefore to compare the emerging office environment to the one we have known to date, in order to proceed thereafter to a definition of an appropriate technology for the automated office.

3. The Office Environment, The Tasks and their Relationships

3.1 The Traditional Office Environment

Attempts to promote more open dialogue between staff at different levels have had little lasting effect because they have not been backed up by new types of structures or kept pace with evolving management practices. Techniques such as the team approach to problem solving are recognized as having merit but often abort for lack of a mechanism which would permit them to be institutionalized. Thus people revert to isolation and alienation rather than persisting in cooperative effort.

Automation has taken hold in the office, but so far without offering solutions to pressing organizational problems. In fact it has exacerbated some of these, because the automated tools now available are not designed to meet the needs of office workers. Manufacturers compound the problems by perpetuating existing product lines rather than investigating what the office worker really wants and testing prototypes of such tools for human engineering and functional acceptability. Thus routine and technology related problems persist. Much energy is wasted on activities such as media transformation (spoken to written word, handwriting to typewriting, etc.), and adjustment problems such as these mount up:

- excessive turnover of equipment operating personnel due to a lack of adequate job classification and growth path;
- management unfamiliarity with latest techniques to improve performance;
- lack of feedback to operating staff to improve productivity;
- lack of standards and procedures consistent across the organization;
- lack of appropriate training.

We should look at who works in today's offices. Broadly speaking, two groups can be identified:

- Those who were educated and prepared for working life prior to 1955 and whose value systems were thus formed in the pre-secular era. These people are vocal about office automation but will not be affected by it to any extent since they have relatively few years left on the job.
- Those whose value systems have been shaped during the secularization era of the last quarter century (1955-1980). In general, these people are specialists. They will remain on the fringe of the office automation process, implementing but not operating automation systems.

It is worth looking at the first group in some detail, even though they will not be major contributors to office automation, since they are its most vocal critics. These people perceive that they have most to lose from automation, having attained a measure of success and status which is threatened by innovation and change. They recognize that they may be disqualified from advancement by the introduction of new techniques. They are intimidated by the complexity of the automation tools available to date, and their dignity is threatened by the possibility of unemployment or early retirement at an age which formerly brought recognition and status.

The older individuals in this age group have seen the work week contract from six to five days and 48 to 44 then 37 hours in their 25 to 30 years on the job. These individuals have experienced the broadest spectrum of change of any office worker, and are now change weary. They cannot be expected to accommodate themselves to the automated office, nor is it vital that they do so.

The second group has worked during the 60's and 70's, a period in which fragmentation, and specialization have been promoted to the detriment of basic skills and holistic reasoning. Comfortable with the punched card and the pushbutton, they use these primitive automation tools without understanding their purpose. This happens because they have become preoccupied with the puzzle of gaps - generation gap, race, sex, income, technological and other gaps - which detract from their ability to appreciate reality. A hostile anti-management attitude has been observed to be common in representatives of this group interviewed recently.

3.2 Basic Office Tasks

Analysts identify at least 16 basic office tasks when addressing office automation. Listed alphabetically they are:

- analysis
- computation
- communication in person
- communication by message
- communication by telephone
- copying
- correspondence preparation
- data entry
- data handling
- data processing
- decision making
- dictation
- information handling
- report preparation
- typing
- waiting.

Although much has been written about each task, little information is available about their time and cost for the various levels of office employees. The best available information comes from Strategic Business Services, whose studies divide office work into eight major categories covering all the tasks listed above except "waiting". Each category is discussed briefly below.

1. Analysis, computation and decision making - This time is severely impacted by priority interrupts (telephone, meetings, visits, etc.). The management style which uses the team approach requires relatively large groups of individuals to participate in the analysis and decision making process. The popular justification for this approach is the complexity of both business and technical environments. The more plausible explanation is the "infinite diffusion of responsibility" in our society. The group dynamics of this management style are not entirely clear, but the practice is definitely expensive.

2. Report, correspondence and message preparation - This is still the predominant means of "documenting" the outcome of analysis and decision making. Even though a lot of time may be spent on the phone and in meetings, the written document is still king and the only means of establishing binding agreement and consensus.

3. Dictation - The nominal amount of time spent on dictation is indicative of the lack of acceptance by management of modern technology. On the other hand, this may be a solution looking for a problem. The cost of dictating equipment is allocated between report preparation and typing.

4. Typing and data entry - These tasks are combined because both serve as inputs into the office systems and communictions networks. The only distinction is one of medium.

5. Copying - Non-clerical personnel are not considered to be involved in this task because it is assumed (and hoped) that such involvement is minimal. However, it is significant that copiers can be used by all levels of personnel without training or status problems. There is an important clue here for future office automation.

6. Information and data handling - This activity encompasses the physical handling and direction of paper by human beings. Analysis has some element of decision making even among clerical people, but physical handling according to established procedures or directions does not. This distinction becomes extremely important in determining the impact of the automated office on personnel costs.

7. Telephone time - This includes time for looking up numbers, dialling, waiting, taking notes and messages as well as actual conversation. An average of one to two hours is spent on the telephone each day by all categories of office personnel.

8. Oral communications - While it is not possible to determine the amount of useful work accomplished at meetings, it can be assumed that as they grow in size meetings take on the characteristics of the broadcast media rather than those of the telephone. Interaction is severely diminished as numbers grow, since only one individual can talk at a time and a leader is required.

The percentage distribution of office workers' time between each of these categories is summarized below.

TIME DISTRIBUTION OF OFFICE POPULATION BY PERCENTAGE

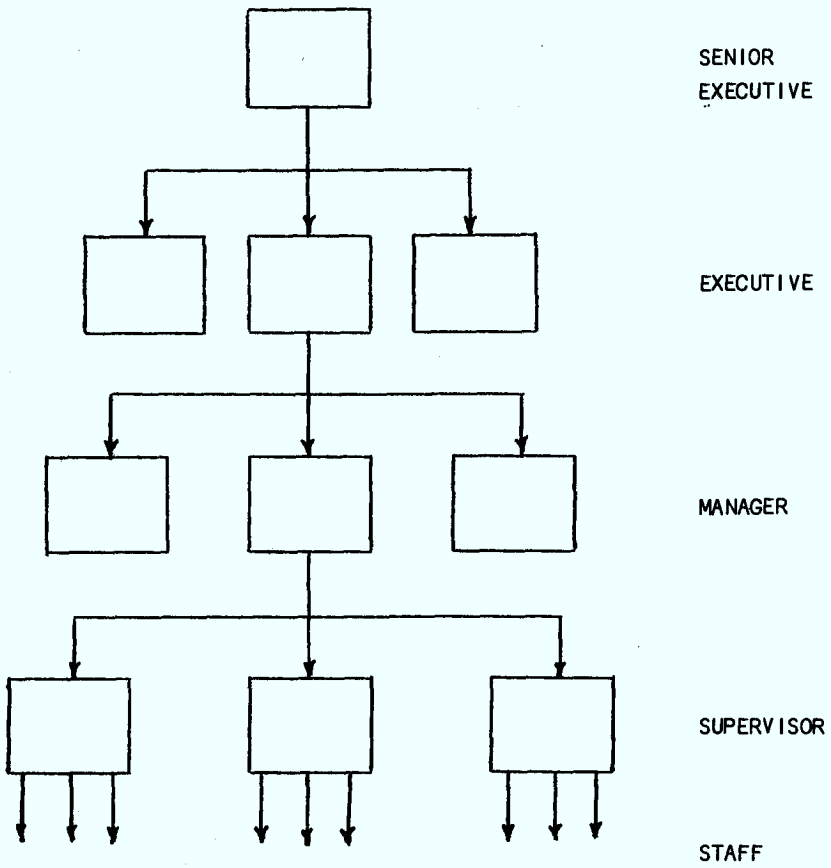
FUNCTION	MANAGERIAL & ADMINISTRATIVE	PROFESSIONAL & TECHNICAL	SALES	SECRETARIES	TYPISTS	CLERICAL
ANALYSIS & COMPUTATION	12.50	37.50	6.25	14.00	5.00	25.00
REPORTS & CORRESPONDENCE	25.00	15.00	12.50	5.00	5.00	0.00
DICTATION	.25	0.00	0.00	5.00	0.00	0.00
TYPING & DATA ENTRY	0.00	0.00	0.00	20.00	37.00	12.50
COPYING	0.00	0.00	0.00	6.25	15.00	15.00
INFORMATION HANDLING	6.25	10.00	0.00	14.00	15.00	30.00
TELEPHONE	25.00	12.50	25.00	20.00	12.50	12.50
ORAL COMMUNICATION	31.00	25.00	56.25	15.75	10.00	5.00
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

SOURCE: Strategic Business Services, 1979

3.3 Interrelationship of Tasks

The method of analyzing office tasks examined in the previous section is useful as far as it goes, but it does not provide any insight into the relationship between tasks. These relationships are the basis for all office communications, so they must be understood before an automated communications system can be designed. The point of departure for understanding the relationships is the organizational structure, since it is what determines the paths along which information flows. It is useful to think of every organizational structure as being paralleled by an information network. Most organizations are still structured in a levelized manner, as shown on the next page:

LEVELIZED ORGANIZATIONAL STRUCTURE



As one ascends the hierarchy the number of peers decreases and responsibility increases. The expansion of responsibility is evident when one compares the scope of activity, the magnitude of tasks and the definition of the task components which characterize each level. For example, one could say that the scope of staff work is detail, while the supervisor deals with immediate or "local" issues, the manager with more than one set of such issues (a "regional" perspective) and the executive with "global" concerns. "Global" has different connotations depending on the size of the organization and its sphere of interest.

Similarly, staff "perform" tasks which are "controlled" by their supervisors, "scheduled" by the manager and orchestrated by the executive to fit a "plan". These tasks consist of components which can also be viewed as levelized. The components provide the clue to what should be automated. For example, while a clerk would deal with a cost item, the supervisor would deal with a cost account, the manager with cost control and the executive with a budget. Each task component is a subset of a corresponding component at the next higher level and thus related to it by a common logic pattern. The following chart depicts the scope of work at each level of the office hierarchy and the interrelationship of office tasks and task components.

INTERRELATIONSHIP OF OFFICE TASKS

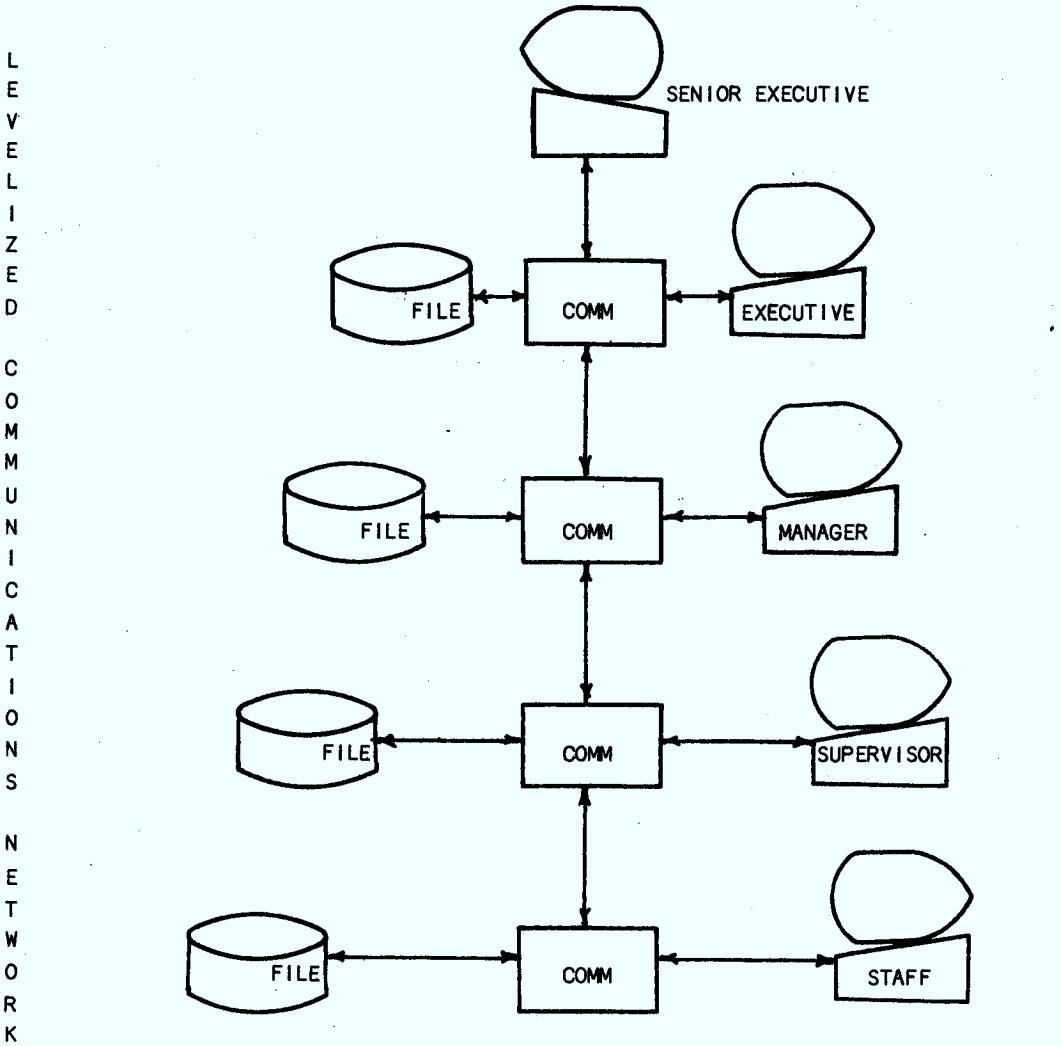
LEVEL	STAFF	SUPERVISOR	MANAGER	EXECUTIVE
SCOPE	Detail	Local	Regional	Global
	Instruction	Objective	Directive	Goal
	Message	Topic	Concept	Idea
	Status	Exception	Comparison	Trend
	Transaction	Activity	Function	Operation
TASKS	Calculate	Analyze	Evaluate	Select
	Perform	Control	Schedule	Plan
	Prepare	Review	Summarize	Synthesize
	Request	Validate	Approve	Authorize
	Sequence	Edit	Assess	Project
	INFORMATION BASE		RESOURCE LIBRARY	
DEFINITIONS	Cost Item	Cost Account	Cost Control	Budget
	Data	Information	Tactics	Strategy
	Document	Report	Summary	Synthesis
	Format	Procedure	Priority	Policy
	Formulae	Rules	Incentives	Results
	Protection	Security	Standard	Authority
	Record	File	Collection	Library
	Steps	Programs	Directions	Aims
	Skills	Skills	Skills	Skills

Each of the four levels of responsibility depicted exists in all organizations, and in a large, centralized structure the levels are clearly delineated. In a smaller organization they may be compressed, with as few as one person taking the steps at all levels. This supports the view expressed in section 2.1 ("The Office Population") that the hierarchy can be adequately defined by the three levels "manage", "do" and "support", and provides a clearer perspective from which to view the organization for the purpose of network design.

Having defined the relationships between tasks, we have the basis for understanding what can be automated and how to do it. As will be shown in section 4.3, a common logic pattern underlies and links all the tasks, regardless of level, and it is this supporting logic which must be automated, not the tasks themselves. Until now it is the tasks which have been automated, with the result that inflexibility, limited applicability and obstacles to communication are inherent in all present automated systems.

When supporting logic components are individually automated they can be grouped (compiled) into a variety of packages (programs) to support the tasks of any organization. Differences in organization structure would not be an obstacle to the use of such an automated system because the basic support logic exists independently of such structures. This is most important, because it provides a means of facilitating transition to the new forms of organization which are beginning to appear as replacements for the hierarchy, and to the decentralized office which operates from the home.

Thus although the hierarchy is a useful tool for analyzing the relationships between office tasks, it need not be a factor in the conceptual definition of an office communications network. However, to be practical one must build on what exists. The foundation for the automated office network is therefore the reporting hierarchy, with each level linked by a communications capability as illustrated in the following chart.



By analyzing the above interrelationships and the hierarchy of office tasks we can establish terms of reference for automation design parameters. We find that many components exist already in the form of software repertoires, albeit incompatible from system to system. It also becomes apparent that ordinary office vocabulary could be adopted for use as a support program compiler and levelized to suit the hierarchies of responsibility.

There also exists a wide range of incompatible hardware. This hardware supports high level languages which are not compatible from make to make either, but the differences for the most part are nominal among EDP systems where software cross-compilers are frequently used to achieve program portability. This, however is not the case with current word processing systems, where compatibility is almost impossible to achieve and the basic logic structures are unnecessarily complex.

Analysis thus far indicates that in order to achieve a certain plateau of universal intelligence to automate office tasks the following should be considered:

1. Common repertoire of words used in routine office work
2. Grouped and levelized to match tasks and responsibilities.
3. Logic supporting these words as a subset of an overall logic structure.
4. Tutorial logic to support prompting and learning.
5. Alterations to logic patterns to support different requirements.
6. Selection routines for retrieving logic patterns and their subsets from the overall structure.
7. Intermediate logic to achieve hardware and peripheral compatibility.
8. Matrix and table structures to achieve code compatibility.
9. Locating and formatting logic to display information on the screen or print according to specific co-ordinates.
10. Communications support logic.

4. The Office Environment of the 1980's

4.1 The Social Orientation

There is a consensus among futurists, professional forecasters, planners, business people and academics that the 1980's will see an adjustment in the relative importance of organizational goals, with personal growth and development placed side by side with profit as the raison d'être of business. This new alignment of priorities will be necessary to provide a social safety valve as the point is reached when only a fraction of the time of part of the population is needed to provide all the goods and services we can consume. It will be supported by increasing awareness that "growth" and "productivity" need not be defined in material terms only, but can be equally applied to the development and efficient use of human capacities.

The framework for such a change is seen as a "learning and planning society" in the words of Willis Harman of Stanford. The overall objective of such a society will be to promote individual growth, awareness and creativity. The evolution of social institutions would be a major contributor to the achievement of this objective. Learning and planning, Harman points out, are "activities which contribute to human fulfilment and social betterment; are humane, nonpolluting and non-stultifying; and can absorb unlimited numbers of persons not required for other work." In such an environment both individuality and consensus will be valued, and business will become more accountable to the public and its own employees. Harman likens this development to that of the democratic system of government in the United States in the mid 18th century: We are moving toward business "of the people, by the people and for the people - business deriving its just powers from the consent of all those whose lives are affected by it."

The people who will work in the offices of the 80's will be the specialists of today and those who are now preparing to enter the working world. This latter group will contribute to the downward shift of the age of the work force which will continue throughout the decade. It will also raise the overall level of education of the work force. By 1982 one in four workers in North America will have a college degree; half of those with college education will be 35 or younger and half of those with only primary school education will be over 50. With opportunities in managerial, administrative, technical and professional streams rising more slowly than the proportion of workers with advanced education, the potential for alienation and frustration in the office will climb steadily.

On the other hand, the new generation of office workers will demonstrate total absence of formal training in value systems and logic. This will inhibit their ability to define an appropriate working environment and will give rise to the need for more on-the-job orientation in such techniques as problem solving, some of which are susceptible to automated teaching. As consciousness of the need to conserve resources increases, casual replacement of personnel will not be tolerated. The learning process will become personalized and a permanent part of the work environment, with each student selecting his or her own subject areas, speed of progress and method of approach. There will be pressure for the freedom to "do one's own thing".

Office workers will be motivated by the awareness that they have a legitimate stake in the organization, regardless of their formal level of responsibility. They will want to have a say in shaping the direction followed by the enterprise, or at least an understanding of the process by which such directions are formulated. This trend has long been evident in West Germany, where workers occupy legislated seats on company boards, and is becoming apparent in North America.

These demands for both individual freedom and a say in the affairs of the organization will be difficult to reconcile on a large scale, and will subject existing organizational structures to unprecedented strains. It will be necessary to develop new forms of organization structure which maintain a hierarchy of responsibility but permit leadership and degree of responsibility to change from task to task, and allow for widespread participation in the establishment of organizational goals.

4.2 The Challenge

The challenge, and the payoff, lie not in developing automated office networks that are a tribute to technology, but in designing and building automated tools for the office that people will want to use. In today's technological and economic environment it is the user who calls the shots.

Thus the first step in automated office network planning is to identify potential users and what they do. It is then possible to define the capability needed to automate office work and how this capability can be developed.

Much has been said and written about user requirements, but results have yet to materialize because system designers lack:

- understanding of the basic transactions performed in the office;
- the ability to synthesize these transactions; and
- the ability to express the common logic patterns underlying all office work.

The basic requirements are simple, but obscured by a maze of superficial complexity. The approach taken here is to focus on the underlying simplicities and from these select the promising areas of pursuit.

Because this approach was not recognized in the EDP environment, the capabilities of the computer have been applied to producing mountains of undigestible information at high speed and entirely out of context. The "EDP approach" has become so entrenched that the understanding of processes and procedures has been largely lost and adjustment to new circumstances obstructed.

Thus in many instances 1980's data processing technology is still applied to data processing practices of the 1960's operating according to procedures written during the late 1940's. Given that business and government environments have changed beyond recognition during the past three decades and procedures have not been updated, it is understandable that managers cannot manage, planners cannot plan, doers cannot do and support staff do not know what they are supporting. Office automation represents the opportunity to reinvest white collar work with a sense of order and purpose. Exploiting this opportunity means commitment to an innovative approach.

4.3 Information Support Logic

Most office workers perform tasks at more than one level from time to time and all are potential users of automated office tools. There are common denominators to the work done in the office at each level of responsiblity:

Management acts, allocates, approves, analyzes, calculates, decides, evaluates, expedites, initiates, instructs, quantifies, validates and COMMUNICATES.

Doers acknowledge, analyze, allocate, calculate, classify, circulate, code, edit, prioritize, process, reconcile, transact (e.g. fill forms, proofread, tabulate, compare, check) and/or prepare, disseminate, report - and they COMMUNICATE.

Support staff enter, index, sort, collate, allocate, distribute, retrieve, file, possess keyboard dexterity, and COMMUNICATE. This is the only level thus far supported by office automation.

Aside from the consistency of work at each level, a common set of sub-processes underlies work at all levels. These sub-processes are listed alphabetically below along with synonyms, and are depicted in the chart following. Note that the "do" and "support" levels employ the same sub-processes, and that managerial sub-processes differ only in number from those of other levels. There is, of course, a marked difference in the complexity implied by a sub-process as one moves from one level to another. "Allocate", for example, does not mean the same to a senior executive as it does to a clerk. The portion of "allocate" which can be automated is however identical regardless of level. The communications oriented sub-processes are common to all office workers.

- To acknowledge, confirm or respond to a request or order is a communications oriented sub-process which may be carried out at any level of responsibility.
- Act, activate and commit describe functions common to the work of managers, doers and support staff alike.

- The same is true of allocate or assign. The nature and magnitude of the resource allocated will differ from level to level, but the form of automated support possible will remain constant.

- Likewise to analyze or evaluate is performed at all levels, although the complexity of the analysis will differ.

- To approve or authorize is a management function.

- To broadcast or circulate is a communications oriented function which may be performed at all levels.

- To calculate, summarize or tabulate is a function common to all three levels, but to categorize, chronicle or group is a function of doers and support staff only.

- This is true also of check (compare, proofread, reconcile, scrutinize, verify) and code (classify, index).

- To decide is a function common to all levels.

- To depict, draft or sketch is to communicate visually and is therefore classified as a communications function.

- To document, note or record is allocated to "do" and "support" levels only, while to edit, alter, extract or revise is common to all three levels.

- To enter, update or post refers to support staff activity only.

- To expedite or follow up and to explain, prompt or teach are communications functions.

- To file or store and to format are processing activities normally performed at the "do" and "support" levels only.

- To forward, send or transmit, to initiate or instruct and to learn are all essentially communications functions.

- To locate, find or search are elements of the same activity performed at all levels. This applies also to prepare (dictate, listen, read, type or write).

- To present, display, report or show is a communications oriented activity.

- To prioritize, to procedurize and to process (collect, sort, handle) are all activities common to each level.

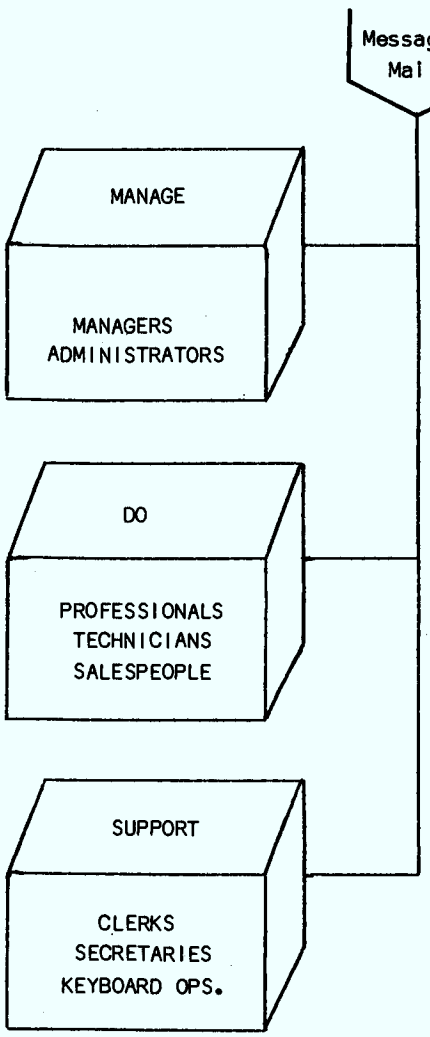
- To protect, exclude or secure is a communications oriented activity, as is to receive or retrieve.

- To standardize and to transact are functions common to all three levels.

Of the 32 categories, 20 apply to both the "do" and "support" levels and 14 to the managerial level. Only one managerial function - "approve" - is not performed at the other two levels. A full third - 11 - of the categories are communications oriented and apply to all levels.

All of the above is summarized in chart form below.

SUB-PROCESSES TO OFFICE TASKS



	COMM	MGR	DO	SUPP
Acknowledge	X			
Act		X	X	X
Allocate		X	X	X
Analyze		X	X	X
Approve		X		
Broadcast	X			
Calculate		X	X	X
Categorize			X	X
Check			X	X
Code			X	X
Decide		X	X	X
Depict	X			
Document			X	X
Edit		X	X	X
Enter			X	X
Expedite	X			
Explain	X			
File			X	X
Format			X	X
Forward	X			
Initiate	X			
Learn	X			
Locate		X	X	X
Prepare		X	X	X
Present	X			
Prioritize		X	X	X
Procedurize		X	X	X
Process		X	X	X
Protect	X			
Receive	X			
Standardize		X	X	X
Transact		X	X	X
	11	14	20	20

Two conclusions can be drawn from the above analysis. First, it is the logic supporting these sub-processes which should be automated, not tasks, transactions or applications on a piecemeal basis as has been the practice in the EDP and text processing environments to date. Any routine transaction or task is then automated simply by assembling these universal logic components into appropriate packages. The microprocessor renders this new approach entirely feasible. Each one of the 32 sub-processes can be tied to an information support logic program accessed through one device, in the same way that cable enables one to tune in on dozens of different television network channels.

Second, since the sub-processes underlying text and data processing are identical, automation of these sub-processes results in the merging of text and data processing. This simplifies the introduction of office automation because the interprofessional bias between data processing, telecommunications and office administrative staffs is removed.

The device needed to function in this new environment would be:

- as simple to use as, if not simpler than, office tools now available;
- able to distribute complete, edited or extracted text to selected or unrestricted readers on demand;
- able to handle at least two different character fonts in at least two different languages concurrently;
- multifunctional - i.e., able to satisfy the basic working needs of secretaries, typists, clerks, technicians, professionals, administrators and managers alike. The device should be able to handle text, forms, data and telecommunications. Ultimately voice, video display, alphanumeric, graphic and pictorial capabilities would be inherent.

4.4 Automated Task Management

While no universal inventory of office tasks is available, the broad categories have already been identified in section 3.3 ("Interrelationship of Tasks"). The remainder of those which are repetitive and routine can be identified and catalogued through practical tests and close cooperation with employees.

Section 3.3 listed tasks according to level of responsibility. For example, "calculate" is a task performed by staff and logically linked to "analyze" at the supervisory, "evaluate" at the managerial and "select" at the executive levels. It will be remembered that because these tasks are telescoped in small organizations, three categories of office employee, and therefore three levels of task responsibility, are sufficient for analysis.

Tasks can be broken down into transactions, each of which is, as pointed out earlier, composed of a common series of sub-processes which are themselves supported by the same information logic. Being universal, this supporting logic can be combined into packages (i.e. compiled into programs) with which any routine task can be automated.

Tasks can also be aggregated into activities, activities into functions, and functions into operations. It has been noted that every organization operates by means of an information network of some type. This is particularly true of the office, where information is the basic working material. Thus it is also appropriate to group functions according to their relationship to the following basic building blocks of any network:

- Data Base Processing and Control (DPC)
- Communications Processing and Control (CPC)
- Information Processing and Control (IPC).

These building blocks are discussed in more detail in section 6.1.

By situating the task in a hierarchy one can begin to understand how the overall management of tasks can be automated. An analogy to familiar experience, namely the organization and operation of the television networks, will make the picture clearer still. The elements of the analogy are as follows:

The TV network	= Network building block (DPC, CPC, IPC)
The TV station	= Function
The TV program	= Activity
The TV show	= Task
An act in a show	= Transaction
A part in an act	= Sub-process
The actor-producer-viewer	= Office employee
The TV studio and technical crew	= System utilities

To pursue the analogy, every office employee, regardless of level of responsibility, can tune in to (interact with) any of three non-competitive TV networks via a multifunctional terminal. Each of the three broadcasts over four different stations (functions), and on each of the stations a minimum of four different programs (activities) can be viewed. The number of stations, programs and shows (functions, activities and tasks) is not limited and could prove to be larger in practice, but four is adequate for conceptual purposes. Each program consists of a series of shows (tasks). A show can have any number of acts (transactions) composed of parts (sub-processes) supported by logic components which can be combined in many different ways.

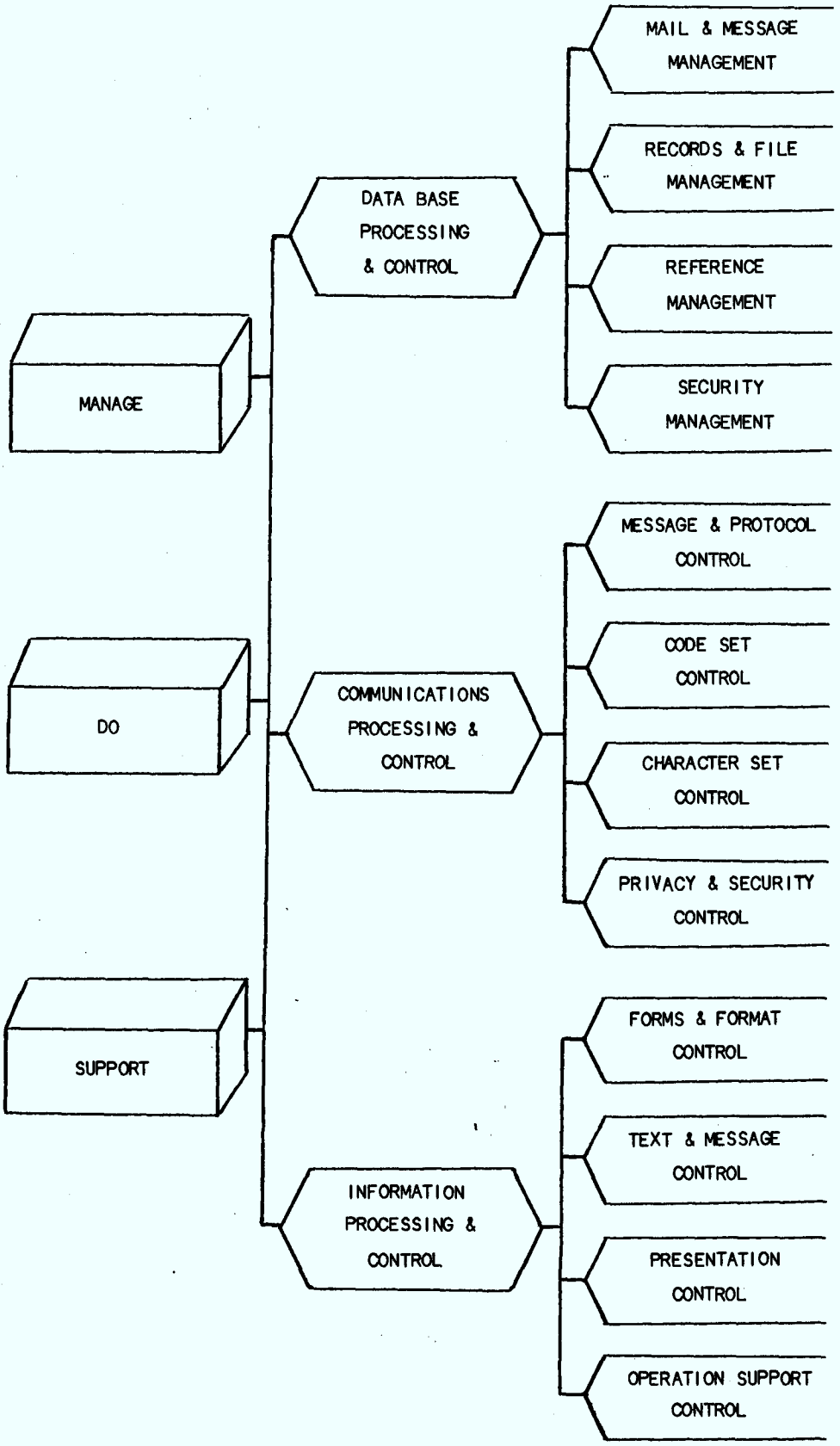
The networks and their operations are supported by the Utility Studios, where all parts (sub-processes) are produced and made available to each station (function) of all three networks for local selection by the producer (employee) and assembly into shows (tasks). The Utility Studios retain custody of the scripts (definitions of procedures) for all these parts to provide a standard reference for local producers. This might be compared to the unwritten dramatic rule that villains wear black or that the cowboy kisses the horse instead of the girl before riding into the sunset. The employee is at various times actor, producer and viewer, depending on the extent of his or her involvement in the task at hand.

Shows can be leased and viewed on several networks and stations at the same time or stored locally when required, with a variation in character to suit different viewers in the same way that the CBC and Radio Canada can broadcast the same show simultaneously in both official languages. Although of different orientation, these shows will be built from the same standard acts produced and maintained by the Studios.

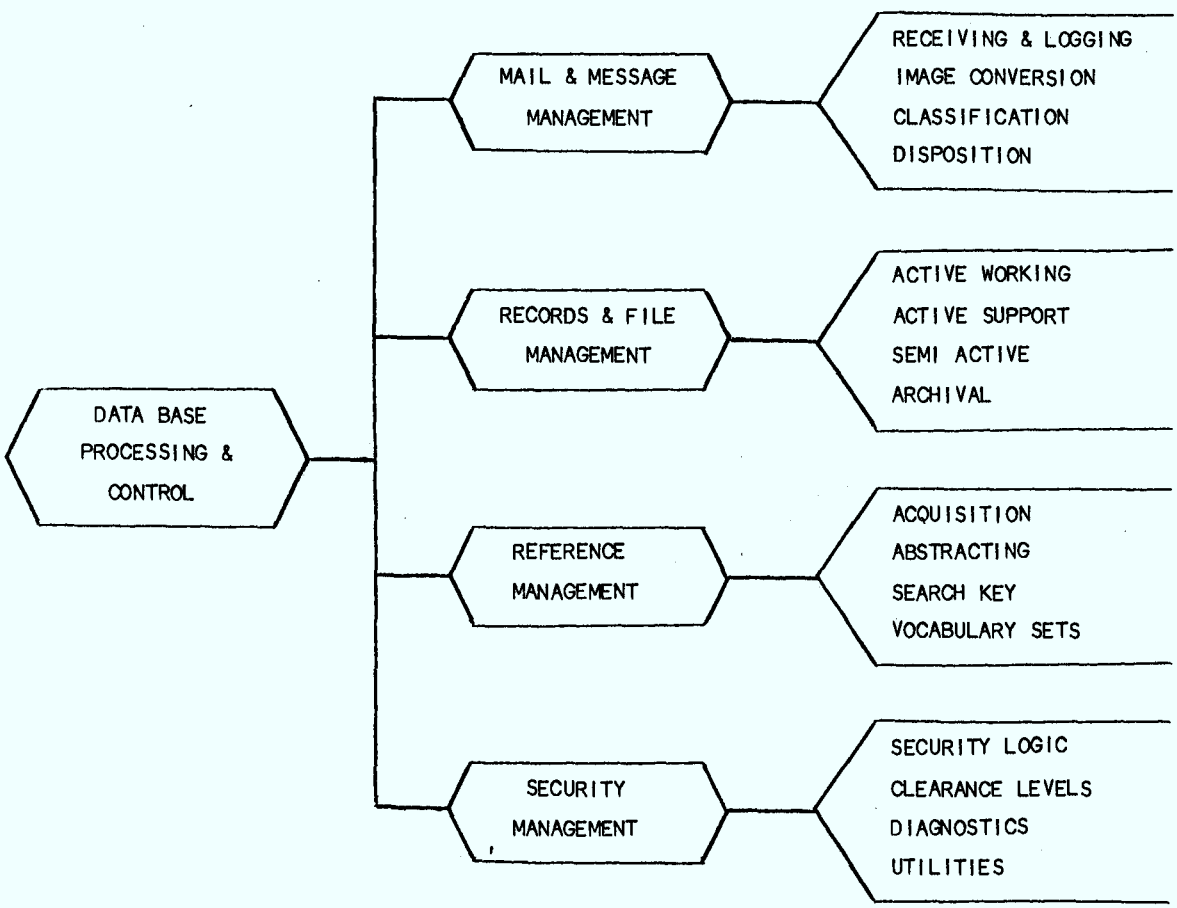
It is readily apparent that one could start with ten basic supporting logic patterns and compile them into, say, 20 different acts which in turn could be scheduled to appear in twice as many shows, and so forth. Certain of these logic patterns, like love in a soap opera, would appear with great frequency.

The following chart depicts the overall organization of the automated task management system. Subsequent charts illustrate the organization of each of the three "networks" with their "stations" and "programs".

AUTOMATED TASK MANAGEMENT



DATA BASE PROCESSING AND CONTROL NETWORK



The Data Base Processing and Control (DPC) network operates at least these four stations:

- Mail and Message Management
- Records and File Management
- Reference Management
- Security Management.

It is this network which has custody of and manages the asset, namely information. Thus its stations broadcast programs of more general interest than those of the other two networks, which are merely control oriented.

Being broader in scope, these programs are often interrelated. The shows which make up these programs are therefore likely to be rented by the other stations on this and the remaining networks as and when required. This would be particularly true of the Information Processing and Control (IPC) network, since the Data Base network manages the information it uses.

To take an example, the Receiving and Logging program is a series of shows, some of which are also available to the actor-producer-viewer via the other three stations on this network since each of them also receives and time-stamps file components, documents and messages. Similarly, the Classification program would have shows for content, currency and level of security according to which information would be classified. These shows would have links with those of other programs such as Disposition, which gives a "Nielsen rating" to messages and file components on the basis of how often they are viewed over a given period of time. In turn both Disposition and Classification shows relate to those of the Records and File Management station.

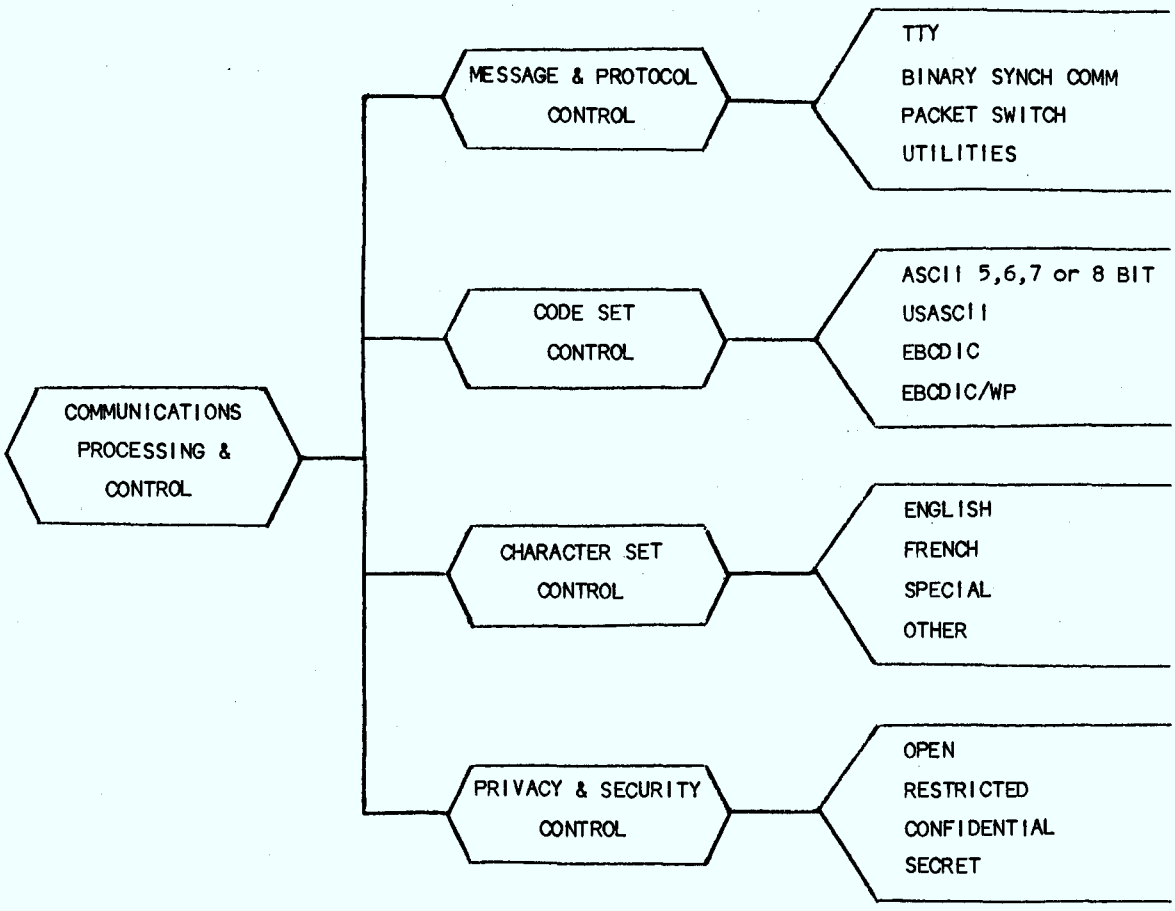
The Image Conversion program is produced and automatically updated by the Utility Studios to handle the latest technology for capture, storage and retrieval of images.

Search Key shows are produced when new categories of words are filed, to permit access to this information. This program also connects to the Security Procedures Logic program, which decides, for example, whether encryption is required.

The Level of Security show from the Classification program is also rented by Security Management to run as part of its Clearance program, which classifies employees according to their level of security clearance.

The Diagnostics program checks whether all systems are working and the Utilities program links this network to the Utility Studios.

COMMUNICATIONS PROCESSING AND CONTROL NETWORK



The Communications Processing and Control Network (CPC) also operates four stations at the outset:

- Message and Protocol Control
- Code Set Control
- Character Set Control
- Privacy and Security Control.

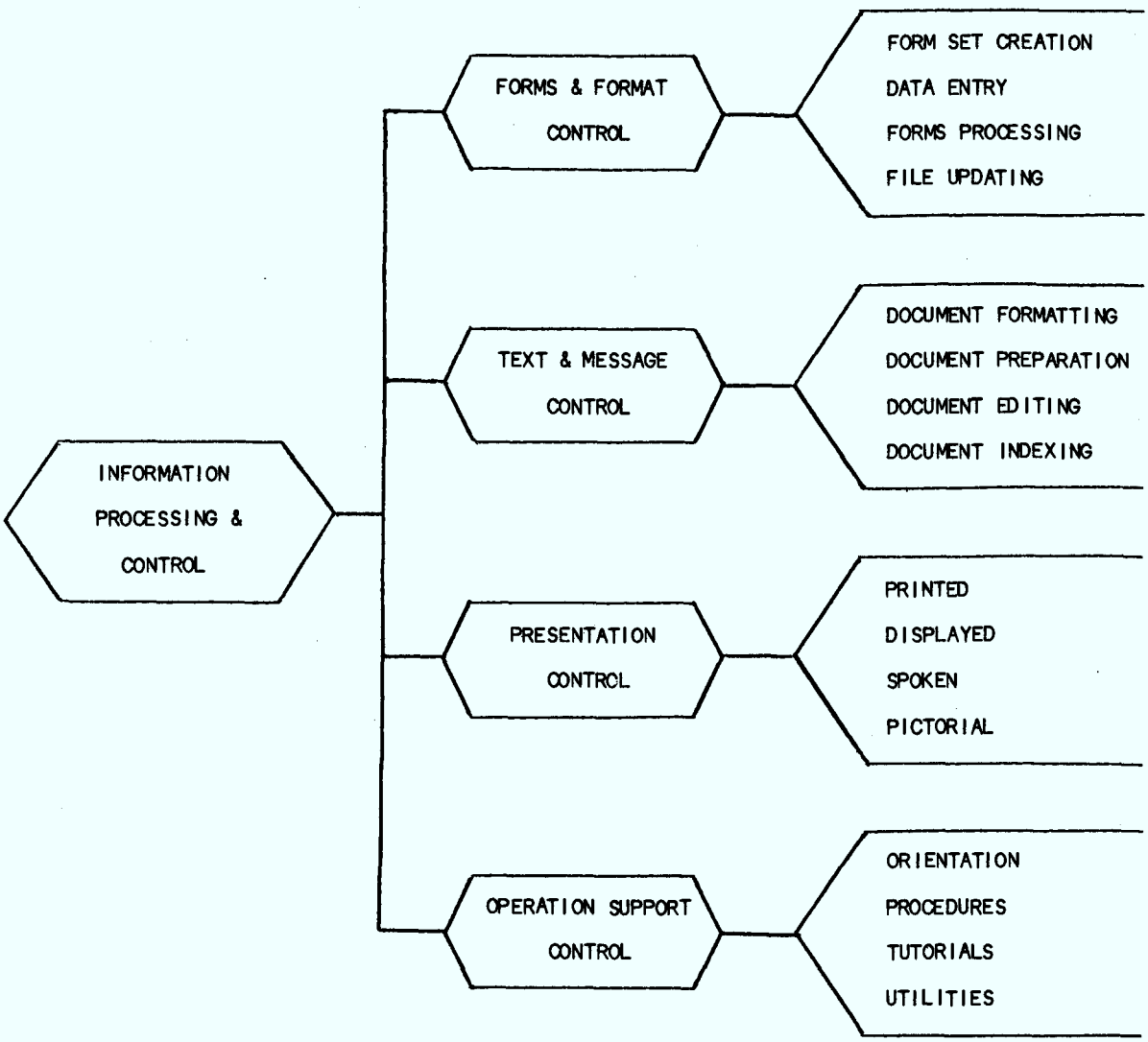
This network broadcasts specialist programs over control stations. The Message and Protocol Control station would offer a TTY (teletype) program, binary synchronous communications and packet switching to start, along with a Utilities program which links this network to the Utility Studios to access communications-oriented feature programs such as those of the line speed and transmission type control stations.

The code set control station offers ASCII shows in 5,6,7 and 8 bit mode, a USASCII feature, an EBCDIC series and an EBCDIC/WP program. The character set control station features character set programs in English and French, a special program covering languages from Spanish to Swedish, and another for scientific character shows and other alphabet shows such as Cyrillic, Katakana and Farsi.

Privacy and Security Control station programs are used to rate information as open, restricted, confidential and secret, using the Classification shows produced by the DPC network.

There are contracts with the Utility Studios to produce new programs such as Telidon and Radio Signal specials at a later date as needs are identified.

INFORMATION PROCESSING AND CONTROL NETWORK



The Information Processing and Control network operates these four stations at the outset:

- Forms and Format Control
- Text and Message Control
- Presentation Control
- Operation Support Control.

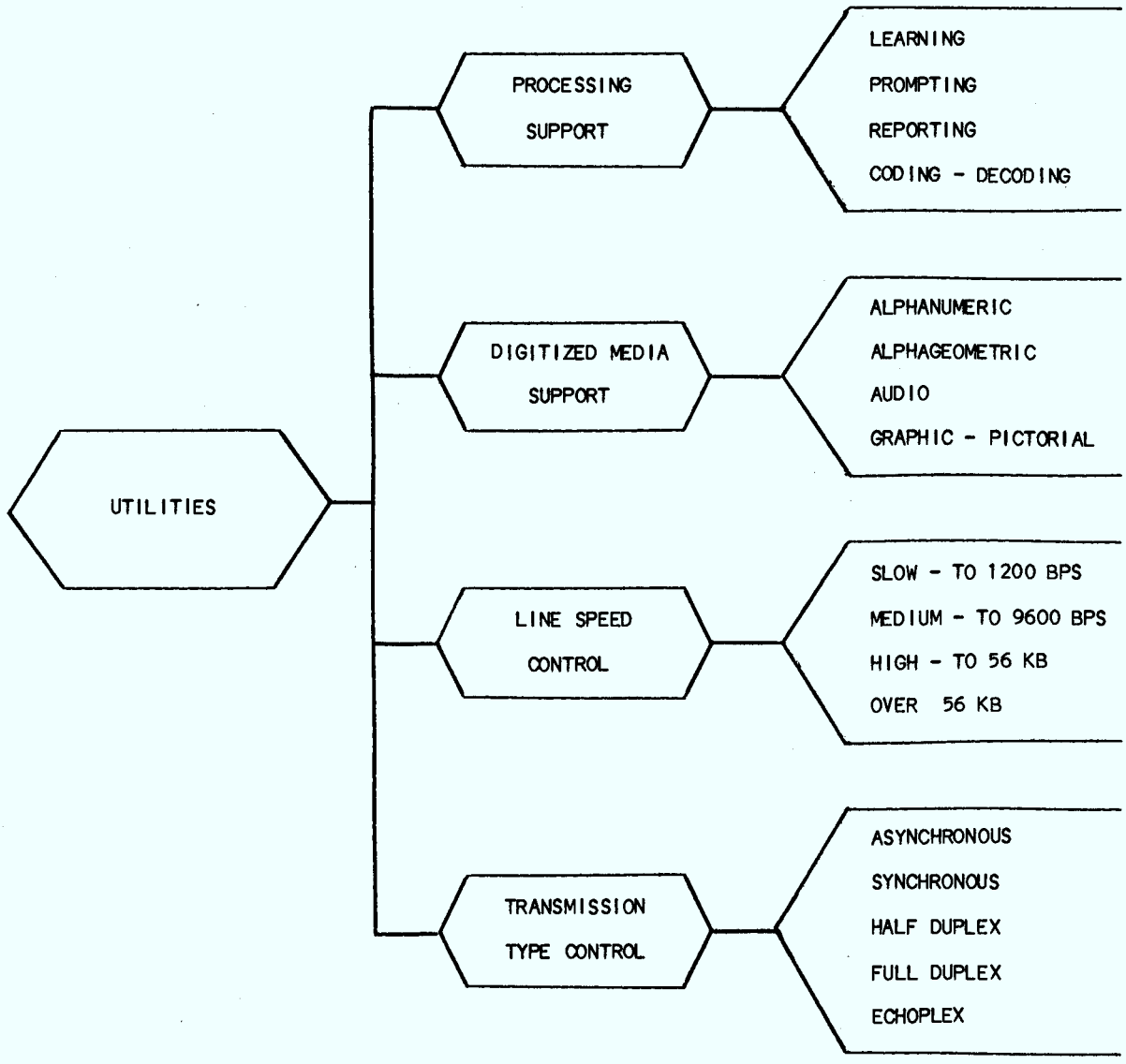
This network also broadcasts control oriented programs. The Forms and Formats Control station offers the programs required to create forms, enter data onto forms, process them (e.g. perform calculation, extend prices, file) and update file copies.

Text and Message Control provides similar disciplines for text-based documents.

Presentation Control programs are self explanatory.

Operation Support Control programs provide the actor-producer-viewer with supporting material for all other programs and shows, regardless of network. The viewer could watch orientation shows to become familiar with the overall responsibilities of a new job, for example, then tune in on a specific automated procedure as well as the tutorials to assist him or her in following that procedure. The Utilities program once more provides a means of accessing the Utility Studios.

UTILITY STUDIOS



The Utility Studios produce the standard parts and shows which are modified and assembled elsewhere into serials or individual shows for the various stations in the network. These four studios are in operation at the outset:

- Processing Support
- Digitized Media Support
- Line Speed Control
- Transmission Type Control.

The Processing Support studio produces a broad repertoire of shows, acts and bit parts ranging all the way from a learning series scheduled for broadcast whenever new employees are hired, to numerous report preparation shows, to walk-on parts for prompting and bit parts for coding and decoding.

The Digitized Media Support studio produces a variety of shows which enable the Processing Control station of the IPC network to operate. Alphanumeric events are made available for broadcast regularly and alphageometric shows are produced with guest stars for prime time viewing. Audio shows feature a conglomeration of talking celebrities. Graphic and pictorial Olympics are produced with the contributions of stars such as Telidon Picture Description Instructions (PDIs) and special guests such as digitized voice, the vA7p(M walking, running, driving and flying events. Each observes specific speed limits. The maximum walking speed is 1200 bps. Runners strive for 9600 bps while driving speed, in view of economies, is restricted in the competition to less than 56 Kbps. Travel at 56 Kbps is considered flying. Competitions are held on an on going basis to determine who is compatible for communication in each category.

The Transmission Type Control studio features shows of asynchronous, synchronous, half duplex, full duplex, echoplex and special-plex events on the basis of public demand and the availability of arenas in which to hold the events.

5. Available and Anticipated Technologies

5.1 Characteristics of the Technology Required

The capabilities of current and emerging technologies are such that virtually any routine office task can be automated. Given this kind of scope, what should be the criteria for designing automation systems for the office of the 80's?

In general terms, these systems must satisfy the need to invest the work place with more meaning, thereby combatting alienation and contributing to the self development goals of the individual. How can this requirement be translated into a set of system characteristics?

To do this we must carefully examine the major elements of the office environment, then fit them together into a coherent definition of what happens in the office. The first step is to focus on the flow of transactions, since they constitute the essence of office business. We must take a fresh look at how information is managed and manipulated as it flows through the point of action.

Bearing in mind that much of the specialized aspects of routine tasks can be automated, work at the point of action will be more homogeneous. This means that the socio-technical dimension of the environment merits relatively more attention than heretofore. Amongst the social aspects of work one must consider:

- employee aspirations, such as the desire for self actualization through learning and participation in organizational goal setting;

- the impact of the energy crisis and other developments on the location and facilities of the work place. For example, the home is likely to be the work place for many employees. How will it be equipped?

- how comprehensive and effective must communications be to permit appropriate interrelations between task components to be maintained in such an environment?

- how will new work methods affect the opportunities of both employees and the employer in their mutual relations? How will the employee ensure that his or her qualifications for promotion come to the attention of superiors when they are no longer working in the same location and do not meet for friendly chats around the coffee machine?

As for the technical dimension, one should consider the effects of automation on work:

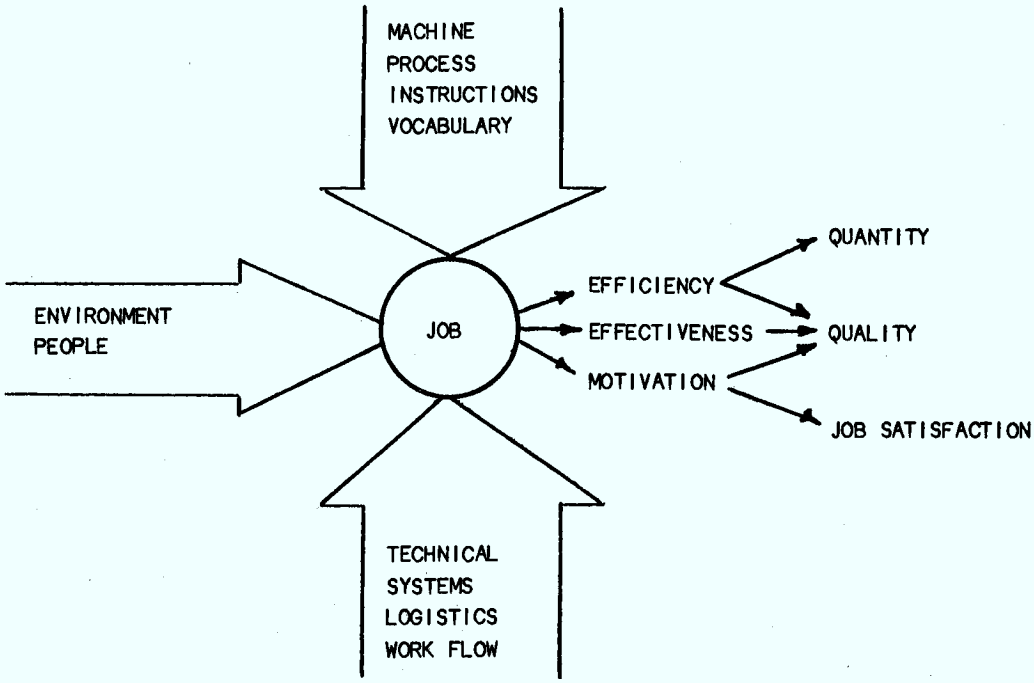
- plans: These will have to become dynamically updatable as automation permits an inventory of current transactions to be built up.

- process: The procedures and processes of the office will have to be completely rethought.

- allocation: This will be on the basis of vocational dexterity and level of interest.

- measurement: An automatic capability to measure time and quantity will be needed - something similar to clocking of long distance telephone calls.

Putting all of this together, the environment strived for is as follows:



As can readily be seen, the outputs of this system are efficiency or productivity, which assure adequate levels of both quantity and quality, and motivation, which provides for quality of result and job satisfaction.

The result of the above study will be the definition of a system capability which has the following characteristics:

- multifunctionality: everyone will have the same basic capability, just as with the telephone.

- multiconcurrency: information will be processed and distributed as it arrives, thus eliminating the costly processing associated with interim storage, priority assignment and queueing.

- operable at the desk of the user.

- transparent to the user.

- tutorial capability: will instruct and prompt the novice operator.

- telesoftware capability: not only texts and data but also instructions can be communicated.

- vocabulary sets to support selected discipline.

- modular and transferable.

- powerful editing routines for abstracting decision making material.

- operational in free standing mode, distributed or linked, either locally or over a distance.

- low cost usage and maintenance.

The essence of the foregoing is that office routine must be automated, and that this can be accomplished in a way that minimizes both the impact of an inevitable rise in unemployment and the problems related to underemployment, while conserving energy. The importance of this last feature cannot be overemphasized.

5.2 Available Technologies

It could easily take until 2005 to implement the technology now available for office automation. On the other hand, management practices have changed little since 1955. Thus realistically the gap between the way we function in the office and what is possible is five decades wide. The cost of this gap is estimated here, and it is striking.

Let us consider the cost of preparing, delivering and storing 1,000 messages of 1,000 characters each (total one million characters) for each of the communications media most common in the office today, namely paper, telex, voice, meetings, computer conferencing and communicating word processor. Both 1980 and 1983 costs are examined, with a normal rate of inflation being considered the only contributor to higher costs in 1983. All calculations are based on constant 1980 dollars.

Each of the messages would contain the equivalent of one and a half typewritten pages or a six minute telephone conversation. In the case of paper, half of the cost is assumed to be for paper itself and half for other factors such as the time of those involved in sending and receiving. One quarter of the messages are assumed to be delivered locally, one half within 500 miles and the remaining quarter to be national. On this basis the following costs apply for 1,000 messages in each medium:

ESTIMATED COST OF HANDLING 1,000 MESSAGES

EACH 1,000 CHARACTERS LONG

Medium		Cost 1980	% Increase	Cost 1983
Paper		$11,000	60	$19,000
Telex		12,000	40	16,800
Voice - 2 people		5,800	40	8,120
		$28,800		$43,920
Communicating Word Processor		$2,200	40	$3,100
Meetings	- 2 people	$4,000	40	$5,600
Meetings	- 4 people	9,000	40	12,600
Meetings	- 8 people	20,000	40	28,000
		$33,000		$46,200
Computer	- 2 people	$2,700	40	$3,780
Conference	- 4 people	5,000	40	7,000
	- 8 people	8,000	40	11,200
		$15,700		$21,980
	TOTAL COST-ALL MEDIA	$79,700		$115,200

Note that the highest 1980 costs are associated with the technology employing paper. The cost of messages sent and received at large face-to-face meetings is particularly high in relation to the cost of other media: computer conferencing costs only half as much. This will be equally true in 1983, by which time inflation will have added 40% to the cost of most media and 60% to the cost of paper (30% each for paper and other factors), which already had the highest base cost.

Now consider switching a portion of the 1,000 messages in each of the paper, telex, voice and meetings categories to the media employing more advanced technology. The savings would be very significant. To illustrate, assume that 25% of the paper-based messages, 50% of telex and 25% of voice messages were handled instead on a communicating word processor. This would result in a total saving of $10,200 for these messages, or $15,180 in 1983 prices. Switching 20% of two person meetings, 30% of four person, and 50% of those involving eight participants to computer conferencing facilities would save a total of $13,500 in 1980 or $18,900 in 1983 prices. The combined savings total $23,700 in 1980 and $34,080 in 1983. These results are depicted on the next page:

REDUCTION IN COST OF USING LESS ADVANCED MEDIA AVAILABLE NOW

Medium	Cost 1980	Change	Reduction 1980	Cost 1983	Change	Reduction 1983
Paper	$11,000	-25%	$2,750	$19,000	-25%	$4,750
Telex	12,000	-50%	6,000	16,800	-50%	8,400
Voice	5,800	-25%	1,450	8,120	-25%	2,030
REDUCTION			$10,200			$15,180
Meetings - 2 people	$ 4,000	-20%	$ 800	$ 5,600	-20%	$ 1,120
- 4 people	9,000	-30%	2,700	12,600	-30%	3,780
- 8 people	20,000	-50%	10,000	28,000	-50%	14,000
REDUCTION			$13,500			$18,900
TOTAL REDUCTION			$23,700			$34,080

The added cost of word processing to handle the extra traffic would be $2,200 in the current year and $3,100 in 1983, while that of the computer conferencing facilities would $6,040 in 1980 and $8,456 in 1983, as shown below. This totals $8,240 in 1980 and $11,556 in 1983, which is only one third of the combined savings itemized above.

ADDED COST OF USING MORE ADVANCED MEDIA AVAILABLE NOW

Medium	Cost 1980	Change	Added 1980	Cost 1983	Change	Added 1983
Paper	$2,200	+25%	$550	$3,100	+25%	$775
Telex	2,200	+50%	1,100	3,100	+50%	1,550
Voice	2,200	+25%	550	3,100	+25%	775
ADD TO WORD PROCESSOR COST			$2,200			$15,180
Meetings - 2 people	$2,700	+20%	$540	$3,780	+20%	$756
- 4 people	5,000	+30%	1,500	7,000	+30%	2,100
- 8 people	8,000	+50%	4,000	11,200	+50%	5,600
ADD TO COMPUTER CONFERENCE COST			$6,040			$8,456
TOTAL ADDED COST			$8,240			$11,556

Thus net savings from handling the traffic on more advanced media are twice the added cost:

NET SAVINGS - SWITCH BETWEEN AVAILABLE MEDIA

	1980	1983
TOTAL REDUCTION	$23,700	$34,080
TOTAL ADDED	8,240	11,556
NET SAVINGS	$15,460	$22,524

The net cost in 1980 after the switch would be $64,240 ($79,700 less $15,460), or a reduction of 20%.

To look at it another way, if no changes are made in the type of media used, the cost of handling 1,000 messages will rise by an average 44.5% between 1980 and 1983. By switching to more advanced media available now, costs would rise only 16%.

SUMMARY OF 1983 COSTS USING MEDIA AVAILABLE NOW

Medium	1983 Cost Without Media Switch	1983 Cost With Media Switch
Paper	$19,000	$14,250
Telex	16,800	8,400
Voice	8,120	6,030
Communicating Word Processor	3,100	6,200
Meetings - 2 people	5,600	4,480
- 4 people	12,600	8,820
- 8 people	28,000	14,000
Computer - 2 people	3,780	4,536
Conference - 4 people	7,000	9,100
- 8 people	11,200	16,800
TOTAL	$115,200	$92,616
Less 1980 Cost	$79,700	$79,700
INCREASE	$35,500 or 44.5%	$13,000 or 16%

It would be possible for 1983 costs to drop by 20% over 1980 through increases in productivity if new technologies becoming available as products over the next three years were applied to the extent that costs in each category were maintained at 1980 levels.

These results do not take into consideration the cost of switching media itself, which may be negligible or substantial. But they also do not consider the savings inherent in cutting down media conversion (e.g. spoken to written to typed word) which accrue from using fewer media. This kind of saving will become very significant once true multifunctional terminals, able to handle all types of communication, are available. The potential of this development is illustrated at the end of the next section. Only testing will define the precise magnitude of the savings potential with equipment of this kind.

5.3 Anticipated Technologies

"Communications systems are amoral. They transmit lies, error and paranoia with the same serene efficiency with which they transmit truth, accuracy and reality."

Ben H. Bagdikian, The Information Machine

This quotation zeros in on the pointlessness of pursuing technology without reference to how it can be applied by people. Therefore this section examines how the capacity of new technology evolving from what is familiar now could be absorbed in the latter part of this decade, rather than on the technical features of this technology.

We start by pursuing the line of reasoning followed in the previous section and consider what would happen if costs to handle a million characters of information (1,000 messages) in each of the media continued to increase at the same rate and one continued to switch to more advanced but available media during the period 1983-1986.

Assuming a constant rate of inflation and constant dollars, costs to handle a million characters would increase by 1986 to $30,000 for paper, $23,500 for telex and $11,500 for voice. If one were to switch a further 25% of the paper-based messages (a cumulative 50%), the remaining 50% of telex (thereby phasing it out) and a further 25% of the voice messages (a cumulative 50%) to communicating word processors, the volume of messages handled by word processors would require the addition of a third machine.

If one were also to switch a further 30% of two person face-to-face meetings (a cumulative 50%) and 20% of four person meetings (a cumulative 50%) to computer conferencing, and phase out the remainder of eight person face-to-face meetings, processing power for computer conferencing would have to increase by 30% (a cumulative 50%) for two person meetings, 20% (a cumulative 50%) for four person meetings and 50% (a cumulative 100%) for eight person meetings. People could then work half of the time from home.

The detailed cost implications are illustrated in the accompanying chart. We focus here on the more compelling findings. With no switching of media at all between 1980 and 1986, the overall cost of handling the messages would increase by 204% over 1980 and 75% over 1983. With only the switches proposed in the previous section for 1983, the overall cost would increase 65% over 1980 and 44% over 1983. However, with the further switches proposed above, the cost would increase by only 22% over 1980 and 5% over 1983.

SUMMARY OF 1986 COSTS USING MEDIA AVAILABLE NOW

Medium	1986 Cost Without Media Switch	1986 Cost With 1983 Switch Only	Further Change % (Cum %)	1986 Cost With Further Switch
Paper	$30,000	$22,500	- 25 (- 50)	$15,000
Telex	23,500	11,750	- 50 (-100)	-
Voice	11,500	8,750	- 25 (- 50)	5,750
CWP	4,340	8,680	+100 (+200)	13,020
Meetings - 2	7,800	6,440	- 30 (- 50)	3,900
- 4	17,600	14,120	- 20 (- 50)	8,800
- 8	39,000	19,500	- 50 (-100)	-
Computer Conference - 2	5,000	6,000	+ 30 (+ 50)	7,500
- 4	9,000	11,700	+ 20 (+ 50)	13,500
- 8	15,000	22,500	+ 50 (+100)	30,000
TOTAL	$162,740	$131,940		$97,470

This, then, is what could be accomplished simply by switching to technology already on the market or becoming available by 1983:

COMPARISON OF COST INCREASES 1980-1986

BY EXTENT OF MEDIA SWITCH

1986 Cost (No Switch)	$162,740	1986 Cost (With 1983 Switch Only)	$131,940	1986 Cost (With Further Switch)	$97,470
LESS 1980 Cost	79,700		79,700		79,700
$ INCREASE OVER 1980	$83,000		$52,240		$17,770
% INCREASE OVER 1980	204%		65%		22%

1986 Cost (No Switch)	$162,740	1986 Cost (With 1983 Switch Only)	$131,940	1986 Cost (With Further Switch)	$97,470
LESS 1983 Cost (With Switch)	92,616		92,616		92,616
$ INCREASE OVER 1983	$70,124		$39,324		$4,854
% INCREASE OVER 1983	75%		44%		5%

On the other hand, if improved technology were used, such as the multifunctional terminals which will be abundantly available by 1986, costs could be kept to 1980 levels. This is feasible because the terminals are expected to sell at 1980 word processor prices and because media conversion costs would be eliminated. In this case paper and voice costs would be half those of 1980 and both telex and eight person face-to-face meetings could disappear. The overall cost of handling the messages under these circumstances in 1986 would be only $49,050, or 61% of the 1980 cost. This technology would probably accommodate all the expected increases in processing volumes for that cost, meaning in effect that double the volume of 1980 traffic could be handled at little more than half the 1980 cost.

EFFECT OF USING MULTIFUNCTIONAL TERMINALS IN 1986

Medium	Cost In 1986	Meetings	CWP	CC
Paper -	$5,500	2 - $2,000	$6,600	2 - $4,050
Telex -	-	4 - 4,500		4 - 7,500
Voice -	2,900	8 - -		8 - 16,000
SUBTOTAL	$8,400	$6,500	$6,600	$27,550
ADD Meetings	6,500			
ADD CWP	6,600			
ADD CC	27,500			
TOTAL	$49,050	or 61% OF 1980 COST.		

The reasoning pursued here indicates that there is no need to introduce radically new technologies in the first half of the decade to achieve dramatic savings and improvements in productivity. It also suggests that there need be no critical surpluses of labour before 1986, since the increased productivity will be needed to absorb the expected double volume of information to be processed, as well as to operate parallel systems during the phase of switching to new media.

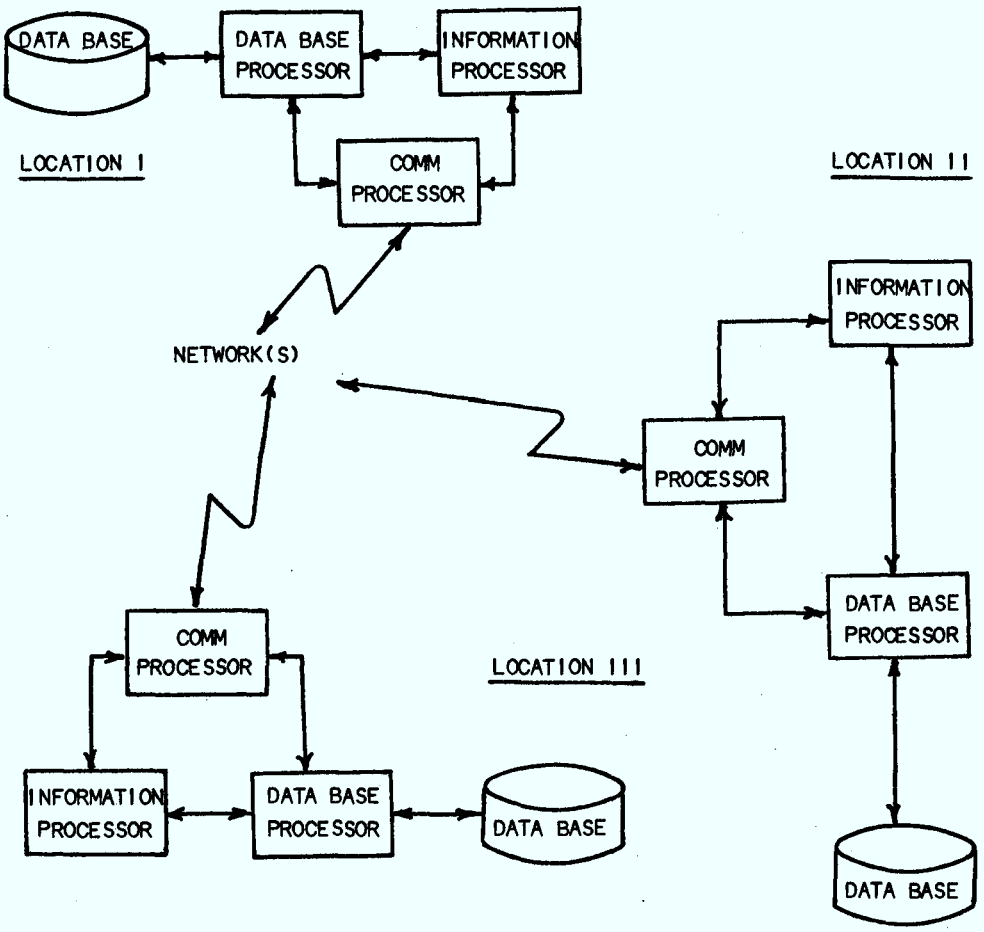
Thus a changeover to more efficient communications technology can be effected with minimum disruption while financing immediate investment in experiments with truly innovative technologies for implementation in the latter part of the decade.

6. The Automated Office Network

6.1 Design Considerations

The introduction and use of automated office network tools outpaces the existing frame of reference for systems design. Developments in this field are pioneering ventures in a no-man's land. We are entering a phase of such drastic change that old rules no longer fit and new rules for information management have to be established.

One design criterion is constant and provides an appropriate place to start. The basic building blocks for all networks are identical: information processing, data base processing and communications processing (intra- and internetwork), as expressed schematically below.



Given this structure, the objectives at the highest possible level of the network analysis and design sequence are:

1. Define the appropriate functional distribution. This calls for an analysis to determine at which locations within the network each of the three functions (information processing, network processing and data base processing) should reside. The result can differ depending on the size of the installation. The possibilities range from totally centralized for the small, through partially distributed for the medium to totally distributed for the large organization.

2. Determine the appropriate density and mix of the components. Knowing the functional distribution, determine how much of each function should be configured at each of the selected locations.

3. Determine physical and logical capability requirements. Given the functional distribution and density, quantify what combination of hardware and software will best provide it.

These objectives are stated at a near philosophical level. Translated into pragmatic terms, they call for a complex, multi-layered sequence of events that must provide acceptable solutions to the user's problems expressed in terms of:

- Topology - Can the configuration provide adequate service at the various user locations? This is vitally important to branch offices today and could become the yardstick for working at home.

- Volume - Can the various message traffic volumes be economically accommodated?

- Information Processing - Are the information processing resources adequate to handle the existing loads and provide for relatively easy growth to accommodate inevitable change?

- Data Base Processing - Are the data base processing resources capable of providing the levels of storage and access required by the information processing and network processing functions?

- Response - Can the network meet the changing response time requirements and operating dimensions of the various users?

- Availability - Has a sufficient level of hardware and software capacity been allocated to cope with the stated availability needs of all users?

- Security - Has a set of physical and logical security measures been incorporated in the design to meet stated security needs?

- Reliability - Have "fail hard", "fail soft", and "fail slow" measures been incorporated in the design?

The final overriding question to be asked concerns cost. Can a network that satisfies all of the above considerations be economically justified?

Many other questions must be asked, explored and answered. Only a few of the more obvious ones have been presented here. The answers to these should equip us to address the more complex issues such as:

- Separation of function between information processing, data base processing and communications processing to determine the major characteristics of a broad range of network components required to satisfy a mixture of office needs.

- The evolution of true distributed operating system philosophies which accommodate natural language.

- A similar evolution of systems to support ease of use and of simple remote diagnostic systems.

- Production of iterative, interactive network analysis and design sequences that will permit the synthesis and evaluation of alternative solutions so as to satisfy interim needs in a relatively short time.

Because of the magnitude and complexity of the undertaking, it is proposed that the task of developing the automated office network proceed gradually to a plateau from which transition to distributed information processing and network access at the office desk are economically feasible. The next section describes such an incremental approach.

6.2 Development Strategy Considerations

Given a task of this magnitude, how can a suitable office automation network be developed? The answer is to work to meet the following five objectives, using tests to validate small components of the project at every major decision point:

1. Orderly development - This can be achieved by adopting an overall planning strategy which can be broken down into components, then addressing each task in logical, manageable, bite-sized increments. The needed multifunctional capability would evolve as a byproduct of addressing office work one module at a time, as long as such a strategy were adopted.

2. Low Cost Start-Up - This can be achieved by establishing a sufficiently universal foundation that one planning increment can be added at a time as in-house capability grows (i.e. learn as you go, build on what you know and pay for what you use). An upgradable, expandable microprocessor capability would provide such a foundation.

3. Efficiency Potential - This can be achieved as text, forms and data processing are combined on the same system with telecommunications, thereby eliminating media conversion (e.g. raw data to forms, forms to card, card to tape, etc.) and providing the benefit of automatic concurrent communications.

4. Effectiveness Potential - This can be achieved through the use of uniform procedures and common media, the extension of basic human skills and instant systems turnaround, all made possible by locating the system device on the desk of the end user.

5. Economy Potential - This can be achieved with lower cost technology, higher throughput (productivity) and the elimination of media conversion costs.

6.3 Testing Strategy Considerations

The most elegant concept eloquently stated is valueless until a strategy for testing and validating it is devised. Tests also yield important byproducts such as understanding and acceptance, thereby providing a vehicle for transition to the new environment.

The Treasury Board Task Force on Information Technology identified these three major areas of need in the application of information technology in the federal government:

- orderly development
- a unified approach
- maximizing of benefits.

Orderly development calls for an overall strategy. It implies that a concept exists and has been defined as the target, but that general specifications cannot be prepared yet because user requirements are not clearly defined.

Hence a unified approach is required to identify the specific needs of government departments, prevent unnecessary duplication and promote the diffusion of results. Coupled with interest, these needs will yield the desire to test a selected portion of an undertaking or an entire undertaking. This assures that when implemented the office automation system will yield maximum benefits. Practical tests are now widely recognized as the only way to develop integrated office automation systems.

The testing of new media, products or technologies must satisfy a number of criteria:

- Does the facility or system to be tested offer recurring savings?

- Is there sufficient volume now to make an impact?

- Are these three basic telecommunications related aspects satisfied?

    - Can tests be conducted to evaluate distance, language and volume dimensions?
    - Is low start-up cost possible to protect the savings potential?
    - Is it easy and simple?

Test participants also should be selected to match certain criteria. The following approach is proposed on the basis of experience:

1. Find a department which handles a large volume of simple message traffic such as telex over media which can be upgraded. Then determine if that department can also satisfy language and distance requirements.

   Employment and Immigration would be an ideal candidate for text messages. Supply and Services would qualify in the area of data transmission.

2. Next identify a department which handles both data and text communications over outdated media but has a low volume of traffic. This would facilitate learning. DOC is a good candidate because it does text processing on its Sigma computer coast to coast and must handle both official languages in addition to data.

3. Then seek out a department handling concentrated traffic volumes between few regional locations and test satellite communications. Industry, Trade and Commerce, Transport and DSS could be good candidates for this.

4. Then add computer conferencing. DSS again is a good candidate.

5. Then, using newer equipment - the forerunner of the multifunctional terminal - test the merger of text and forms processing. Many candidates would be appropriate. Health and Welfare, Agriculture or Customs would be a good choice.

6. Also seek out users of X-25 (packet switching) such as Agriculture and learn from their experience.

7. Then tackle a complex terrestrial system, such as the National Library bibliographic network, with interconnection and complex character set requirements.

8. Then try translation. Again, newer equipment is needed to provide a split screen and operate both English and French character sets simultaneously.

This work must be done on a cooperative basis if real results are to be achieved, so a structure will be needed to foster collaboration. A great deal of work has already been started in the areas listed above by the DOC Research and Office Communications Systems programs as well as the Computer Services Branch. Thus it would be reasonable for DOC to develop the cooperative structure.

The above represents a very general approach to a testing strategy since detailed discussion is beyond the scope of this paper. However, the importance of the need for practical tests and the need for an overall testing strategy cannot be overemphasized.

6.4 Implementation Considerations

Given that practical tests are conducted and yield quantifiable information about alternatives to conventional office communications as well as understanding and acceptance, what factors should be considered by departments thinking of what to implement, when and how to proceed?

"What to implement?" should be decided on the basis of what promises the biggest savings. Savings cannot be predicted reliably at this point because there are too many unknowns, but the kind of analysis pursued in section 5 and subsequently in section 7.3, along with practical tests, will reveal promising areas. The following tables also provide insights.

First consider that oral communication, analysis and computing, telephone and report and correspondence preparation - mainly the areas covered in the media analysis in section 5 - account for a full 82% of office costs in 1980. Thus automation introduced into any of these areas, as previously proposed, would offer the potential of significant early return.

1980 OFFICE COST RATIOS

Oral Communication	27%	
Analysis & Computing	22%	82%
Telephone	18%	
Reports & Correspondence	15%	
Information Handling	10%	
Typing & Data Entry	5%	
Copying	3%	

Next, consider this breakdown of the relative cost of seven basic functions in an automated business communications system, as reported in 1980 by Exxon's Advanced Office Technology Project:

EXXON AUTOMATED BUSINESS COMMUNICATIONS SYSTEM

BREAKDOWN OF COSTS - 1980

Creation	28%*
Distribution	19%
Storage & Retrieval	15%
Capture	14%*
Keying	13%*
Expansion	10%

* Most of these costs are people-related.

Combining "creation", "capture" and "keying", a full 55% of the total cost of this system is for functions whose costs in turn are mainly people-related. Yet Exxon has achieved 100% improvements in productivity with this system.

This raises an interesting issue of relevance to the question "when to implement?" If productivity improvements of this order are possible with an automated system which is still heavily dependent on people, then there is another reason, aside from the predicted doubling of information volumes over the next six to eight years, to expect that mass unemployment will not result from office automation in the first half of the decade.

Some may still be tempted to ignore the savings potential and put off change on the grounds that there is ample time for adjustment later. It is certainly highly unlikely that the approach outlined in section 5 will be followed by everyone. However, the necessity for productivity improvements and the influence of those who are committed to reaping immediate benefit from the technology should not be underestimated. In the private sector, where cost is a significant factor, office automation is proceeding at a much more rapid pace than that considered in section 5. At the current rate it will not be long before government offices are completely out of step with those of major firms. The topic of "when" therefore demands a great deal more consideration than it has been given to date.

It is argued by many that office automation will not really take hold until the manager is provided with easy-to-use automation tools, since no manager would approve the purchase of an office system from which he/she was excluded. This brings us to the question of "how to implement?" Briefly, these are the technologies that should be looked for:

Unlike typists and data entry personnel, managers do not as a rule possess keyboard dexterity, so interaction with the terminal must take place by other means, preferably the same means that applies to communication with subordinates. This implies that a nominal voice interaction capability is required to interpret a limited repertoire of vocabulary. This would help the manager to access files and issue simple commands for message handling and presentation of information.

The other major area for investigation relates not only to the needs of managers and administrators, but also of technical and professional personnel, and concerns the fact that text is an inadequate and frustrating medium for conveying concepts, ideas and instructions. Research reveals that under ideal circumstances an individual can read, digest and retain information at the rate of approximately 300 words per minute, but that the same information conveyed pictorially, symbolically or schematically can be comprehended and retained at the rate of 1200 words per minute, if accompanied by brief explanations. This points to the need for accelerated incorporation of Telidon, video and extended voice recognition technology in the office communications system to provide for the use of "managerial shorthand".

As the changeover from analogue to digital systems accelerates, all these media can operate in a common mode. The introduction of high speed digital voice would facilitate the production of voice prints and resolve many current problems of security, privacy and confidentiality as well as providing the electronic equivalent of a signature for legal purposes. For example, upon being hired an individual's voice print would be taken in the same way that a specimen signature is required for a bank account, and used to provide clearance to classified information and authorization to perform certain transactions.

If all of the media switching and testing discussed earlier were to start as soon as possible, a natural progression into new technologies would occur late in this decade.

7. Information Processing and Management 1980-86

7.1 Overview

Clearly not all of the office automation capability can be provided at once, so a network development path must be plotted. The following chart shows what is possible in information processing and management in the first half of the decade, given that technology evolves at the rate now predicted and that it is applied to developing automation systems as discussed earlier in this document. This table was prepared according to the classic planning approach. The "who", "what", "where", "how" and "what type" dimensions are analyzed and then placed in three different positions of the "when" dimension. The milestones are selected on the basis that by 1983 a 32-bit microprocessor will be available at low cost, and that by 1986 a 64-bit processor will be mass produced and available at an OEM price of two or three dollars. A brief discussion follows.

INFORMATION PROCESSING AND MANAGEMENT

		1980	1983	1986
WHO	Manage Do Support	Nominal Message Handling Nominal File Handling Nominal Report Processing Nominal Forms Processing Basic Text Processing	Message Processing Selected File Processing Selected Report Processing Selected Forms Processing Text Management	Message Management File Management Report Management Forms Management Information Management
WHAT	Text Data Forms Files Telecomm.	Alphanumeric Nominal Manipulation Printed and Video Floppy Disk TTY, 3780, Custom	Alpha-geometric Distributed Processing Aligned and Custom Nominal Data Base Packet - OSI - Networks	Alpha-pictorial Predictive Processing Format Library Information Base Rooftop - Fibre - Coax
WHERE	Business Government Industry	Text Processing	Nominal Expediting of Text, Forms, Reports & Mail Bi-lingual, Multi-Font Multiple character generator Chemical Formulae, etc.	Transaction Management Nominal Function Management File Aging & Statistics Internal & External Mail Library Access
HOW	Audio Visual	None Paper and Video Output Keyboard & Optical Input	Digitized Voice Index Voice Recognition Retrieval Charts and Graphs Paper or Video Non-impact Printing	Digitized Voice & Graphics Nominal Voiceprint Pictorial Reports with Nominal Audio Output Nominal Audio Input
TYPE	Open Restricted Confidential Secret	Open Text Coded Commands Nominal Privacy Protected	Open Access to Index Secured Portions of File Permission needed Special Clearance	Open Access to Abstracts Selected Contents Sold Access to Secured Content Levelized Clearance

1980 - "WHO" - Nominal office automation exists at the level of typists and secretaries in the form of word processors operating in a free standing mode. Only basic text processing is practised. Message and file handling is very primitive and report and forms processing are virtually non-existent.

1983 - "WHO" - Selected managers, administrators and clerical staff use a primitive multifunctional terminal on which forms, text and selected reports are produced. About 25% of office operations are well on the way to being automated.

1986 - "WHO" - The majority of managers, administrators and clerks are using multifunctional terminals with voice retrieval available for recalling up to 256 different files. Large volume transactions are fully automated, and almost 50% of all transactions are automated, albeit in a relatively simple form.

1980 - "WHAT" - Basic alphanumeric character sets are generated by the system to produce unilingual texts. Nearly all output is printed on paper and file capacity at best does not exceed half a million characters or 80 pages of text. Nominal data manipulation may be performed but data processing is either done by EDP or manually. Communications offerings consist of teletype simulation, some IBM compatibility and many custom transmission protocols, most of which are not compatible.

1983 - "WHAT" - Nominal alpha-geometric capability is available for displaying simple charts, graphs and drawings. A variety of general business forms can be processed from a display on the screen and simple data processing is executed at the office desk. Text and data file handling is being offered by some manufacturers with voice recognition systems which sometimes refuse to deliver information. Packet switched electronic mail is used quite extensively and interconnection protocols operate freely on at least two of the five continents.

1986 - "WHAT" - Combined processing of texts, graphs, pictures and voice is offered. Information processing is possible at the desk with trend monitoring and predictive reporting software options becoming available. Format libraries provide full custom forms design capability and everyone can have a three coloured logo on their documents. An animated encyclopaedia is available for interactive use but comic strips still prevail. The first roof-top communications dish sale is held by Radio Shack and the pushbutton telephone is considered outmoded.

1980 - "WHERE" - Business, government and industry are evaluating the growth of information volumes and launching cost reduction programs in the office along with efficiency and effectiveness studies. Many office workers begin to resort to reading on their own time to keep up with accelerated outputs of memos and messages from text processing systems. "Power typing" has peaked and word processing pools in large offices are being disbanded.

1983 - "WHERE" - Motivated by the requirements for bilingualism at home and for business to access information overseas, manufacturers begin to provide multiple character sets along with special symbols used by science and academe. This opens free access to many library systems which could not be automated before because of limited capacity to handle bibliographic characters (e.g. square brackets and characters requiring graphics support.) Information merchandising plans are activated by many publishers and university extension programs.

1986 - "WHERE" - Full library access is possible on an international scale and the topics of information-knowledge-wisdom are being discussed widely. A Wisdomart Corporation offers a low cost interactive bachelor's degree and is being sued by the academic community. The Bureau of Competition Policy refuses to get involved. The first intelligent terminal graduates from high school.

1980 - "HOW" - Nearly all interaction with automated systems takes place via keyboard and screen. A very primitive document scanner available from the WORDEX Corporation offers audio output and printed output in a limited variety of fonts. The only other commercial offering in this area is from IBM and provides very limited voice output from a magnetic storage system.

1983 - "HOW" - Video display is making inroads due to rising paper costs. An attempt to arrest this trend ad interim is made with intelligent copiers and low cost non-impact printing devices. Audio systems are evolving and beginning to take hold, and voice-activated retrieval programs are offered by a number of manufacturers. Digitized voice systems are also available for document and file indexing. A number of stereo manufacturers are entering the digitized voice market, and Radio Shack offers the first intelligent rooftop antenna system.

1986 - "HOW" - Digitized voice and graphics programs are becoming available. Voice print signature chips are offered. Pictorial reports accompanied by nominal audio are available to enhance computer conferencing. Digitized dictating systems are offered by Dictadigit Corporation, but occasionally prove faulty on replay and refuse to surrender information.

1980 - "TYPE" - Nearly all text produced by word processors is unprotected. Nominal security coding is available, but it is for the most part inefficient and costly.

1983 - "TYPE" - Open access to file indexes is available, but portions of files and documents are secured. Pre-clearance or special clearance routines are required for access to restricted files. Information classification systems are becoming effective. New types of automated accounting and security procedures are introduced to control access to information made available commercially.

1986 - "TYPE" - Scientific abstracts can be accessed openly. Selected information contents are sold and other offerings are promoted via animated Telidon commercials. Effective selection systems are in place, providing levelized clearance to classified information.

7.2 Where to Start?

The first major step in the implementation strategy will be to merge text and data processing capabilities on a communicating device which accommodates Open System Interconnection (OSI) protocols. Since office automation started with text processing, text processing systems must be rendered capable of mounting forms and accepting data from filled forms. This will render them the equivalent of very sophisticated data entry devices. The merging process will be complete when either type of information can be transmitted over terrestrial or satellite communications networks automatically, and summary reports can be extracted regardless of the location and source of the system components.

None of the above is possible without data/information base support. Users have begun to look for sophisticated data base management capability to handle small files and will expect to see this kind of capability available in office automation systems. This applies no less to those who come to office automation from the text processing end than those who come from a data processing experience.

Manufacturers of office automation tools are critically underqualified to design a system of the kind required, and users are unable to provide much assistance, because new skills are required which cut across the traditional boundaries between data processing, text processing and telecommunications.

Following the maxim of "learn as you go and build on what you know", the following three major areas are thus proposed as the point of departure:

1. Forms Processing - as the logical means for launching the merger between text and data processing.

2. Information Base - without which development of an automated office network is not possible. File management is the basic building block.

3. Electronic Mail - because the most significant and the most easily proven savings potential lies in faster turnaround and reduced media conversion costs.

7.3 Economic Benefits

With total telecommunications expenses projected to exceed half a billion dollars in 1982/83, a project offering some savings potential is desirable.

A recurring net cost reduction of 25% is possible if a goal is set to transfer about one half of the annual intercity telephone traffic to an upgraded Government Data Network (GDN). To be specific, let us consider transferring 14 million calls, or 54% of the total.

On the basis that:

Average transmission cost per call is	$2.50
Talking time cost for 2 people is	5.00
Written confirmation cost (for 60% of calls) is	6.00 each

Fourteen million intercity calls at 1980 rates would cost:

Transmission	$35.0 million
Talking time	70.0 million
Confirmation of 60%	50.4 million
TOTAL COST/GROSS SAVING	$155.4 million

If the 14 million intercity messages were sent over GDN using communicating word processors and X-25 packet switching, the average cost per message would be $2.06 at 1980 rates, and the net saving would be:

Total gross saving	$155.4 million
Less word processing and packet switching cost	28.8 million
NET SAVING	$126.6 million

Subtracting the total government telephone bill in 1979/80 of $111.6 million, there would be a $15 million surplus, which more than adequately covers the planning, testing and implementation costs of the new system. Thus a strong motivation for media switch exists.

8. Planning Capability Requirements

Because this kind of project is unprecedented, no fully qualified planning capability is readily available. This is as true in business as it is in government. Therefore we must seek to identify people who possess the basic skills in the ranks of present government staff.

A logical place to look is amongst EDP personnel, who are experienced in handling automated data processing and communications. This would be a good start but by no means entirely adequate, since EDP people, as pointed out earlier, do not possess the necessary in-depth knowledge of general office operations.

We must look elsewhere in the government for people who are thoroughly familiar with today's office practices, records management, filing and retrieval techniques, and of course telecommunications. Some of this capability could doubtless be located amongst records management staffs, but for functions such as information classification and retrieval the resources of professional library staffs would have to be tapped. Many of these people hold masters degrees in Library Sciences and are specially trained to take custody of, classify and administer information.

What we are looking for is thus the generalist, ideally with in-depth training and experience in data communications, library operations and office methods and procedures, plus a good understanding of records management. With requirements as exacting as these, we can ill afford to ignore relevant experience wherever exists. The longest experience in and most fundamental knowledge of office routines and procedures is possessed by older employees. Normally the detailed knowledge of such people is irretrievably lost when they retire. Codifying and making this knowledge available to systems designers would keep many clerical-level people gainfully occupied during the closing years of their employment, provide them with the sense that they are contributing to a smooth transition to a new order, and avoid repetition of the mistakes made during the early years of Electronic Data Processing.

9. Close

It is hoped that a wide variety of interpretations of this document will emerge and be tabled to stimulate the development of many individual plans within the general planning framework. Because this document was intended to serve as input to the planning framework, the traditional summary and conclusions sections are not provided. Nonetheless, it would be worthwhile to focus on a number of the points made in these pages:

1. A new social structure is emerging.

2. Technology is abundant.

3. People (staff and management) are the key.

4. A people system has to be developed.

5. Office automation will not progress far unless management is included in the system.

6. Progress will be very painful unless early acceptance is secured.

7. Acceptance and understanding is best achieved via participation and tests.

8. Economic pressures combined with growth in information volume will soon render current office practices untenable.

9. Resources will be difficult to secure unless savings potentials are significant.

10. Profitable media switching will finance the testing and development if properly planned.

11. Many people on the verge of retirement can help to develop the new systems by documenting the basic procedures they understand well.

12. New system design will require considerable time and synchronization if a standard of any kind is to be achieved.

13. Innovative systems may be more acceptable to the willing specialist and young graduate joining the work force.

14. Actual user requirements must be fed to the industry and to the carrier.

15. Only tests will help determine what these requirements are.

16. Unemployment may not be a concern in the first half of the decade.

17. Underemployment may present a bigger problem.

18. To minimize start-up costs, gain maximum acceptance, and provide early pay-back, a two-pronged approach should be considered:

    1. A switch as soon as possible from the use of costly media such as paper, voice and face-to-face meetings to the use of communicating word processors and computer conferencing should be considered by all departments.

    2. Departments with the special requirements and capabilities outlined in the Testing Strategy Considerations should prepare now to test innovative communications technology and pass the results of these tests on to other departments.

Thus the next logical step is to proceed with the selection and definition of tests in both areas - media switch and innovation.

Barcode on previous page

KLEINS, JOHN E.
--Conceptual definition of an automated office network for the federal government.