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Report of the Canadian Computer / Communications Task Force

Vol. I

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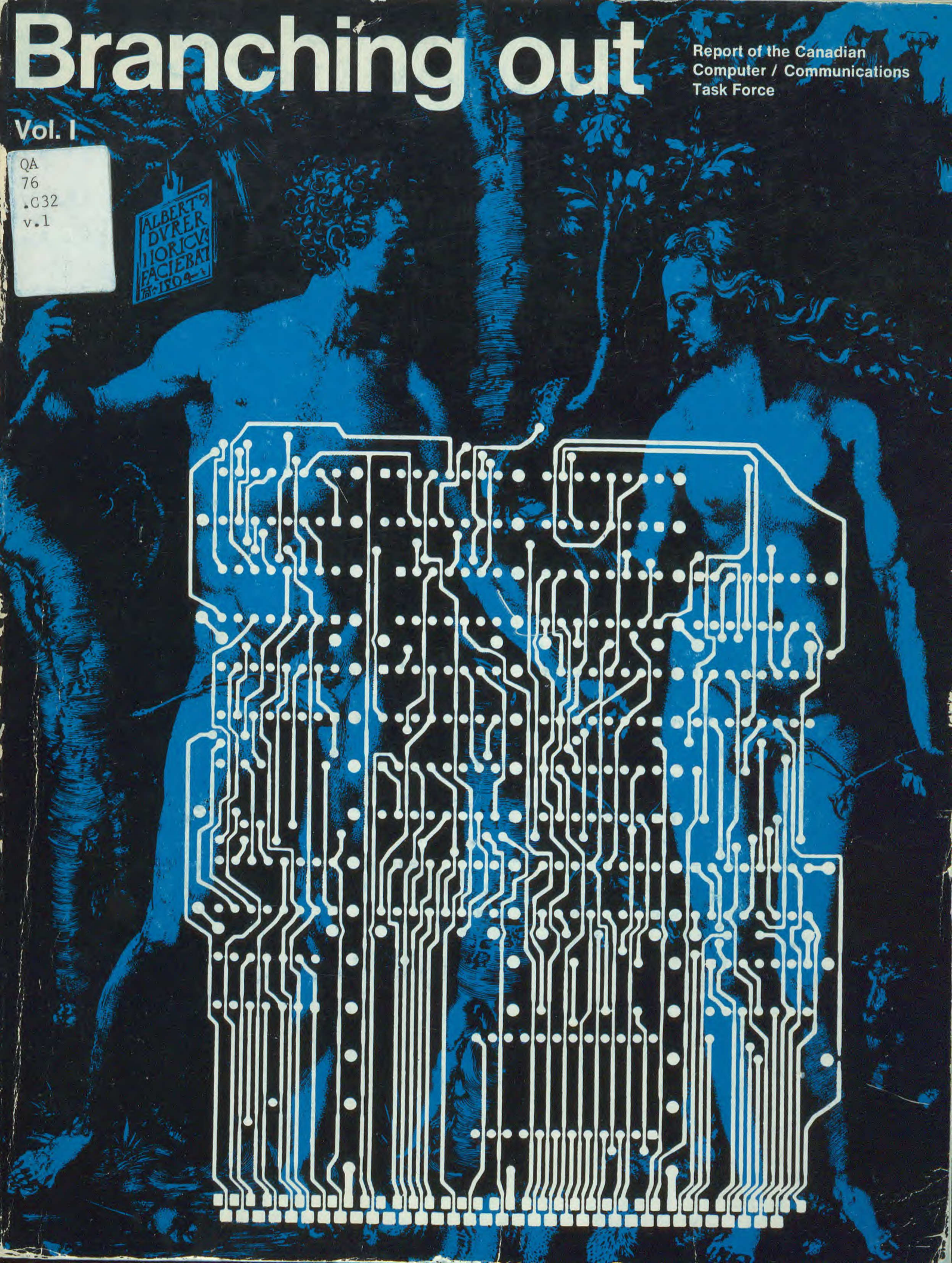

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Report of the Canadian Computer / Communications Task Force

Vol. I

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Canada: Computer/Communications Task Force

Department of Communications
Ottawa, May, 1972

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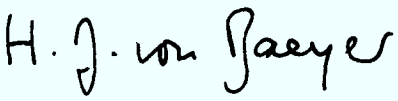
The Honourable Robert Stanbury
Minister of Communications.

Sir, I have the honour to submit the Report of the Canadian Computer/Communications Task Force. The Report presents the main findings, conclusions and recommendations derived from the mass of information collected by the Task Force during the past eighteen months. There are also background documents and contract studies which will be available for examination.

I should like to take this opportunity to express my appreciation of the constant support given by the officers and staff of the Department of Communications throughout the duration of this project. At the same time I should like to stress that the work of the Task Force could not have been completed successfully without the generous co-operation of individuals and groups in the federal public service, in the governments of the provinces, in the private sector and in professional and industry associations.



H.J. von Baeyer.

This Report in all its aspects represents the work of an independent Task Force. The views expressed are not necessarily those of the Department of Communications or of the Government of Canada.

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PREFACE

Under the leadership of the federal Department of Communications, a number of experts from industry, governments and universities studied, during 1970, the whole field of telecommunications in Canada. This project, known as the "Telecommission", resulted in a general report entitled *Instant World*, published in April 1971 by Information Canada. It was followed by the publication of a number of studies covering many varied aspects of telecommunications in greater detail.

Part of the Telecommission study was concerned with issues and problems that arise from the rapidly-growing use of remote-access computers through communication lines and the expected formation of computer networks spreading throughout Canada and the whole world.

Instant World referred to the enormous complexity of issues raised by this marriage of computers and communications and the pervasiveness of the technology which is affecting many segments of political, social and economic existence. Due to the urgent need for a definition of a government position, and the rapid evolution of events in the computer services and communications industries, Cabinet established a Task Force under the auspices of the Department of Communications.

Thus, the work of this Task Force has grown out of, and continued, the Telecommission studies. For this reason, the broader aspects of computer/communications as part of the over-all telecommunications picture must be viewed in the light of the preceding Telecommission investigations, particularly as summarized in *Instant World*. In order to avoid lengthy repetition, it is assumed that the reader of this report is familiar with *Instant World*, so that this report's degree of specialization will not detract from a full understanding of the broader issues.

This document culminates in a set of policy recommendations for consideration by the government. Its major objective has been to consider computers and communications in Canada in the nineteen-seventies. It is an attempt to sort fact from fiction; to differentiate between probabilities and promises; to take stock of the current situation; to determine the likely direction for future development; and to recommend fundamental policies to prepare for that future. Details of the Task Force organization, its aims and objectives, its approach and methodology and its major program stages are contained in Appendix 1. Throughout the Report, there are references to representations made to the Task Force on specific points. In order to preserve anonymity, the particular respondent is not identified. However, Appendix 1 contains a list of those who have made written submissions to the Task Force.

In order to achieve the greatest degree of clarity and organization, this Report is presented in two Volumes. Volume I has been divided into six parts. Their sequence is as follows:

Part A contains an overview of the computer/communications field in Canada, and discusses some of the eventual promises which computer/communications may fulfil. It describes the Task Force findings as to the present and expected state of the industry, the possible social and economic impact of computer/communications technology and the needs and problems of computer/communications users. It attempts to forecast the prospective market, on the basis of normal trend extrapolations, and to comment on the realism of such a forecast.

Following Part A, all subsequent sections of this report are recommendation-oriented, relating directly to the various aspects of recommended government policies.

Part B puts forward the fundamental policy approach and presents some general policy recommendations.

Part C is addressed to policy recommendations in the field of the computer services and data communications industries. It indicates the limits within which business and industry should operate and describes the particular areas in which there is a need for government concern.

Part D covers recommendations for direct government action for the stimulation of growth in the private sector and for promoting developments which would normally not be met by private enterprise – especially in regard to social systems. The recommendations are specifically directed to the federal government and its operating departments. However, the Task Force is well aware that the aims and objectives of the policies described in this Report cannot be achieved without a concerted approach, not only at the federal level, but at the provincial and municipal as well.

Parts B, C and D are function-oriented, *i.e.*, they describe issues, and recommend policies and actions without reference to the organizational measures needed for implementation.

Part E discusses the institutional arrangements necessary to perform the functions recommended in the preceding parts. It deals with organizational requirements within the federal government, those required to provide the necessary interaction between government and industry, and considers requirements for federal-provincial co-ordination.

The importance of this division between the "what" and the "how, by whom" should be particularly noted. Its purpose is to permit an understanding and assessment of functional needs, regardless of the individual institutional solutions, before proceeding to decisions on the preferred organizational structures. It is of marked importance in the examination of issues where constitutional factors pose complex problems of federal and provincial jurisdiction.

Part F, the final section, contains brief concluding remarks on the over-all approach taken by the Task Force.

Volume II has been divided into two parts. Part A examines in some detail the jurisdictional and legal aspects of computer/communications in Canada. Part B presents three Task Force investigations of the impact of computers and communications under the following headings: ''Automation of Payments and Credit''; ''Applications in Education''; ''Computers, Communications and Canada's Health Care Delivery System''.

It should be understood that the facts stated and the views expressed in this Report are derived from a large volume of information and statistics collected by the Task Force. Wherever possible, these will be presented in background documents and contract studies to be published later.

SUMMARY

Based on wide contacts with all levels of government, industry, business and public institutions, the Task Force studies have fully substantiated the Telecommission conclusions concerning the critical importance of computer/communications in Canada. In particular, the Task Force emphasizes the general pervasiveness, both actual and projected, of computer/communications throughout the Canadian social and economic fabric, and the consequent necessity for governments at all levels to recognize computer/communications as a key area of social and industrial activity. It therefore urges that governments take steps to strengthen the Canadian industry in this field and to co-ordinate its development to the benefit of Canadian society.

The formulation of national policies requires a unified approach throughout Canada, and must take into account both national objectives and regional interests and values. Close co-ordination between federal and provincial actions is therefore essential. In addition, there must be a high degree of co-operation between the public and private sectors in the development of computer/communications in Canada. Within the federal government many departments are concerned with particular aspects of policies for computer/communications. The Task Force consequently sees the need for a ''focal point'' in the federal government to work in the area of federal responsibilities and to work with the provinces and the private sector in the formulation and evaluation of national policies in computer/communications.

The policies advocated by the Task Force are centred on two main concepts: first, a strong emphasis on maintaining and developing a competitive and innovative industrial environment throughout the whole field of computer/communications, which combines the two functions of data processing and data communications; and second, a strong emphasis on the role of government in fostering the development and self-reliance of industry, and in maintaining a proper degree of Canadian independence in this field.

Specifically, in the provision of commercial data processing services, the Task Force recommends that no restrictions should be imposed on the entry of any organizations into this business, unless such entry would lead to anti-competitive practices not remediable under general competition laws in Canada, or where protection of the consumer interest requires explicit regulations. Under this concept, federally regulated telecommunication carriers wishing to provide commercial data processing services would have to do so through a separate, unregulated affiliate, subject to certain restrictions designed to prevent unfair competitive practices. Banking organizations wishing to provide commerical data processing services would be confined to the provision of services which are directly related to the business of banking as defined by the Bank Act.

In the provision of data communications services, the Task Force recommends that (1) government should assume a co-ordinating role in the gradual evolution of a coherent data communication network, essentially based on the networks of the existing telecommunication carriers and aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign computer networks; and (2) in the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement certain common carrier services.

In particular, non-carrier organizations should be permitted to interconnect data communications equipment and sub-lease rented carrier facilities for data communication purposes, subject to review by the appropriate regulatory commission responsible for telecommunication carrier regulation. The Task Force further recommends that organizations offering data processing and data bank services commercially to customers through remote-access facilities should be obliged to register with a registrar for data network services.

In order to stimulate the development of computer/communications services, particularly those of broad social significance, the Task Force recommends a number of measures in which the federal Focal Point would play a co-ordinating role. These include close co-operation between the public and private sectors in the standards development process, support of pilot-projects particularly involving regional or nation-wide networks in the public sector, support of the domestic industry through government incentives and procurement policies, support of industrial, government and university R & D programs, and support of professional and industry associations in the provision of training programs in collaboration with educational institutions.

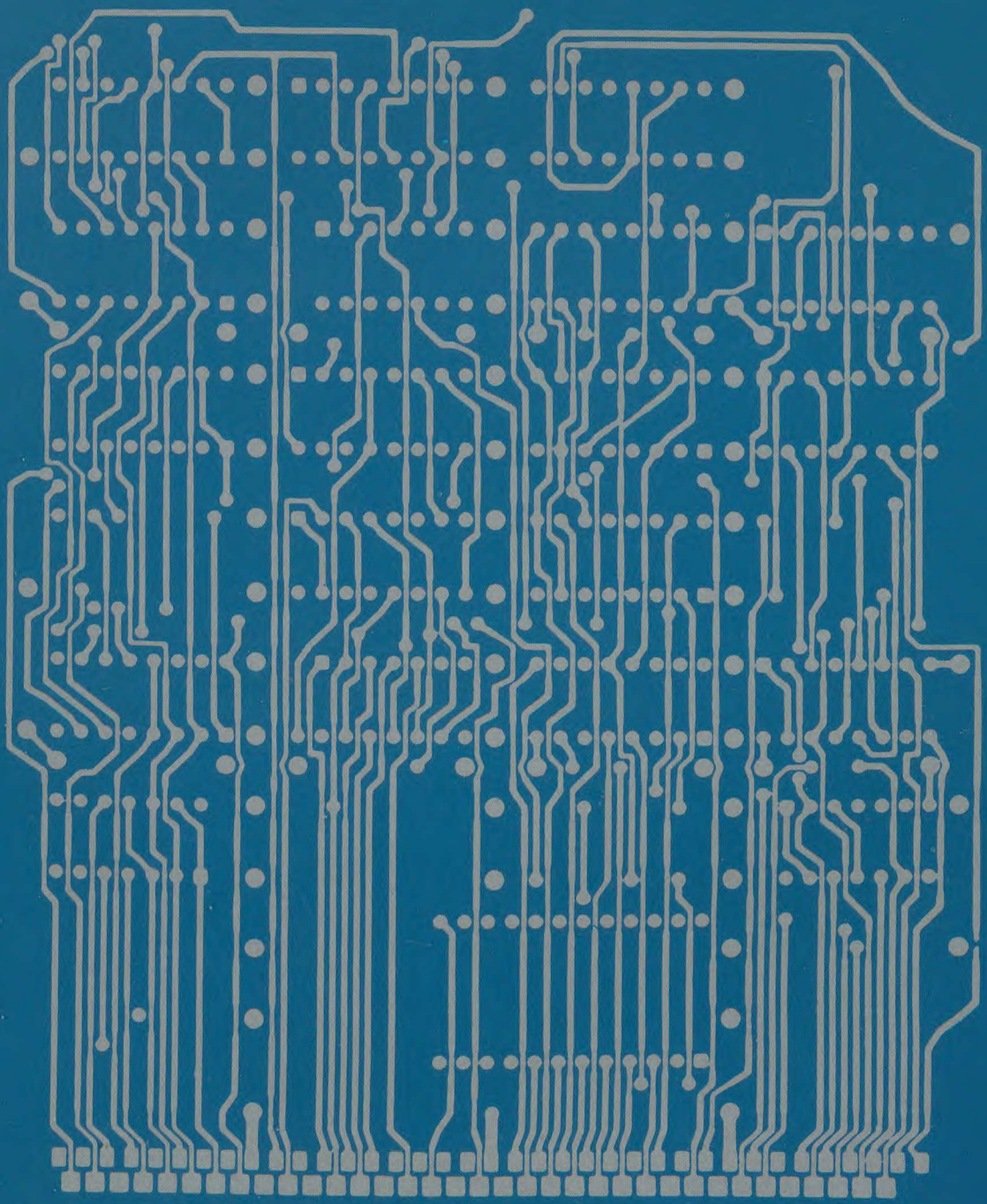
The Task Force was particularly sensitive to the problems of implementing policies of this kind within the complex system of Canadian political and organizational structures. First, there are the governments at federal and provincial level, with their respective constitutional areas of jurisdiction. Second, there is the unregulated industry in the manufacturing, computer service, engineering and consulting sectors. Third, there is the communication service industry, subject to regulation by federal or provincial regulatory bodies. It can be seen that actions towards meeting the stated objectives are bound to cross all these institutional boundaries. The Task Force recommendations therefore, emphasize a close understanding and co-operation between governments at all levels, and between the public and private sectors.

The Task Force has also proposed institutional and legislative measures which are required for implementation of the recommendations. All functions to be performed within the federal government can be allocated to existing organizations. As an interface between government and the private sector, an industrial planning board for computer/communications is suggested, and the role of the existing industrial agencies for development of standards is emphasized.

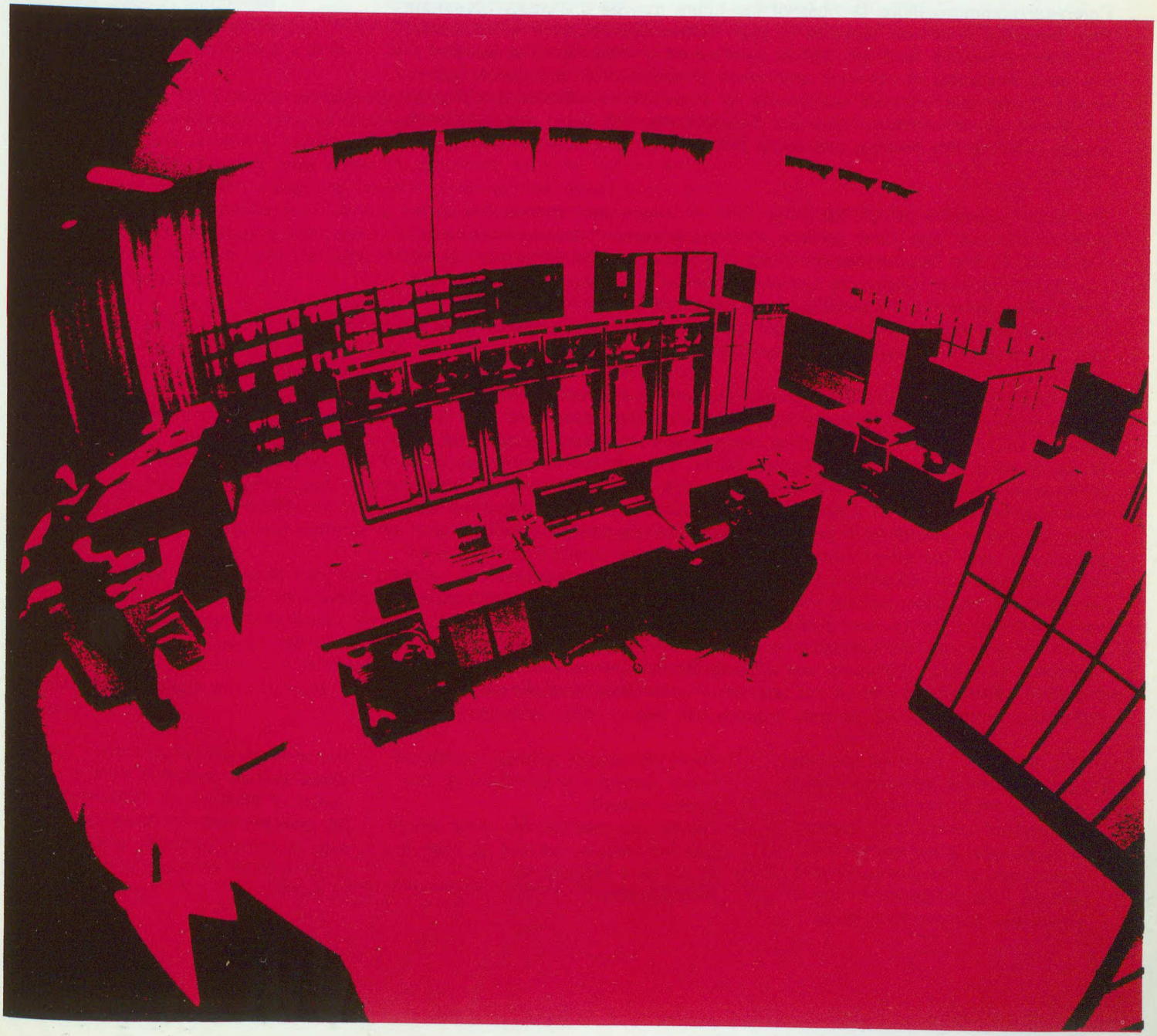
Part

A

Computer/Communications in Canada: an Overview



Chapter I
Concepts of Computer/Communications Services



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Perhaps the most outstanding trend in the evolution of computers is the consolidation of systems and facilities to take advantage of the economies made possible by the rapidly developing technology. Twenty years ago, the transfer of repetitive work of many clerks to small computers represented the first phase of such consolidation. Next, the work of a number of small computers was shifted to a larger installation with lower processing costs per application. The current phase of consolidation is concerned with taking advantage of the remote-access-capability through the merging of computer and communications technologies.

Computer/communications services of the future may be universally accessible from terminals in offices, factories or even homes. Consolidation of computer and communications facilities, and of data stored in public data banks, and the ready availability of common application programs in an integrated system would provide that universal accessibility at a fraction of today's costs through the shared use of common resources. Conceptually, this could make universal access economically feasible and could provide the multiplicity of services required.

The term ''computer utility'' has been used in recent years to describe such potential services, and some present commercial services are marketed under this name. In the Telecommission Study 5(a),(c),(d) and (e), ''Policy Considerations with Respect to Computer Utilities'', a categorization of public and private, general and special purpose computer utilities is given. Considerations relating to the expected development of such utilities were, in fact, major factors leading to the establishment of the Task Force.

With regard to the concept of a general purpose, public computer/communications network, a major supplier of computer equipment and services, in a brief to the Task Force, expressed ''reservations about referring to the ultimate network as a 'computer utility'. Competition in computer and information services can and will exist for a considerable period even though there may be attributes of a natural monopoly present.'' Yet other authorities have recognized difficulties in precise definition of the utility concept, particularly since the term ''utility'' in the provision of services (such as gas, water, electricity or telephone) has a number of legal and popular connotations. Important among these are: an essential service required by a wide segment of the general public; a ''natural'' monopoly within a franchised area with the obligation to provide service on demand; a ''plug-in'' capability, with users obtaining and utilizing the services available with little individual effort on the part of the user on a continuing basis. As yet the computer/communications services industry has few of these characteristics:

- The number of users of computer/communications services is still relatively small. For most applications, users need special skills to take advantage of the capabilities of the computer and, at present, only a fraction of the population possess such skills.
- There are already a large number of highly competitive members of this service industry.
- Capital requirements for initial entry into the industry are not so high as to act as a restraint to entrepreneurs.
- The services offered are many and varied and are available from a variety of sources, by comparison for example with the telephone system, which generally provides a single service although in a variety of forms.

Whether the many services will progressively evolve into an integrated, readily accessible network of computers having the characteristics of a general-purpose public utility cannot easily be foreseen at this time. F.G. Withington, of Arthur D. Little, Inc., in a presentation to the 1971 Annual Conference of the Association of Computing Machinery suggested that:

"The data processing industry, rather than becoming a utility, will become more like the retail food industry, realizing economies of scale for mass products through automated agricultural and supermarket networks, but also providing a rich variety of specialty foods and services, ranging from gourmet and diet stores to 24-hour delicatessens at premium prices and dock-side fish markets at minimum prices. Opportunities will be many and so will failures, but — one thing for sure — any competitor who tries to remain within one of the traditional subdivisions of the computer industry, however large, will be lucky if he is around in 25 years."[1]

Consideration of the possible development of general-purpose public computer/communications services involves three aspects: First the aspect of the technical and economic viability of a computing centre offering a multiplicity of services to a wide range of customers. Second, the aspect of customer access to such computing facilities, requiring the development of a nation-wide, public data communications network. And third, the aspect of resource-sharing by different computing centres in the network, requiring development of sophisticated software. These points are considered in the following discussion.

The concept of broad-range public computer services implies that there are economies of scale inherent in large-scale public computer/communications service networks and that these would result in consolidation of facilities through the replacement of privately-owned computers in a manner analogous to the replacement of individual electrical generators by common generating and distribution systems. In the light of the economies of scale that large computers are reputed to achieve, and in view of the fact that user organizations have been under pressure to reduce computing costs, it is surprising that the expenditures on commercially-offered computing services accounted for only about one-tenth of the total for data processing in Canada in 1970-71.
In order to look more closely into this paradox, the Task Force visited some 60 user organizations, and interviewed representatives of senior management and of data processing management in each, with a view to obtaining information on the potential market for public computer services and on the factors which would favour or inhibit the growth and development of systems which would supply such services. This is described in further detail in Chapter V.

[1] Withington, F. G. quoted by Smith, William D. "Future of the Computer is Assessed". *New York Times*. August 5, 1971. pp. 45 & 50

Branching Out

The most striking fact which emerged from these investigations was the wide variety of services provided at the present time through individual computer/communications systems. It was apparent that many private as well as commercial computer/communications service networks have already been established and that their services fall into two main groupings. The first group is the one whose main purpose is to offer remote computational capability. In general, the user designs and maintains his own programs which are then run through terminals, usually on his own premises. To supplement the computing service, a library of general-purpose application and utility programs is often made available. Second, computer/communications service networks have been formed to provide specialized functional or industry-oriented services. Examples of these include the hotel and airline reservation systems, order entry and invoicing systems, text editing, message transfer and information retrieval, services for real estate property management, doctors' and dentists' billing services, and services for freight forwarding and other industries. This list is by no means comprehensive. The main characteristic of such specialized services is that the customer has only a limited capability to modify the programs used and the services provided. These specialized networks are characterized by having more customers than the remote computational networks of the service bureaux.

Some user organizations operating their own in-house facilities also make use of commercial, general-purpose service bureaux on a limited basis, for work overflow or for specialized programs or packages. But the main requirement appears to be for specialized computer/communications services, usually to supplement the functions performed on their in-house computers. Such services are attractive to customers because they usually cannot be economically developed by a single organization for its own use, or because they require skills which may not be readily available to the customer organizations.

The current trend in the provision of private and public computer services is to establish a specialized, dedicated data communications network for each system. Large corporations and government agencies, for their own in-house use, and remote-access commercial service bureaux, are designing dedicated networks reflecting the specific requirements of their systems. Usually, the network control logic is programmed into the main or front-end computer and carriers provide the passive element of the network — dedicated data transmission links between the main computer and terminals or satellite computers. In some cases, connection to the telephone, TELEX or TWX networks provides limited accessibility for the more distant or the low traffic terminals.

An alternative to the formation of a multiplicity of basically incompatible dedicated computer networks, and a next step towards the provision of broad-range public computer services, is the development of a general purpose data communications network providing widespread access to a multitude of specialized computer services. Policies for the development of such a general-purpose data communications network are the subject of discussion in Chapter IX of this Report. Eventually such a network is expected to have many attractions for its users, but a number of economic, technical and institutional problems need to be solved before such an undertaking becomes a commercially viable proposition. Its main features are: universal accessibility where so desired; cost reductions to users through sharing of common network resources and through implementation of standard techniques and practices; lower cost of developing new services as the need to develop the network control logic repeatedly for each system or application disappears; and flexibility for change caused by new customer needs or technological progress.

A further stage of development, and one of much greater technological complexity, is the full resource-sharing computer network. Users would have access to combinations of any of the devices in the network, to any specific computer configuration, or combination of computers and data banks, in order to meet their needs in the most cost-effective way possible with the total combined computing and communications network resources. However, the technical problems in achieving compatibility of operations of geographically separated data banks and computer systems of different types and characteristics, are still of such dimensions that their commercial viability is not yet in sight.

In viewing computer/communications services in the present and immediate future environment a separation can still be made between those functions associated with data communications (the transfer of data in machine-processible form between two or more geographically separate locations) and those associated with data processing (the manipulation and storage of data). However, the Task Force also recognizes that evolutionary technical and economic developments will occur and that these developments will bring the computer and communications functions closer and closer together, thereby significantly altering the structure of the computer/communications service industry.

This report, concerned as it mostly is with the future development of computer/communications in Canada, can afford but a small backward glance to assess how far the nation has come. In so doing, it recognizes the dangers of superficial coverage; of overemphasizing some developments; perhaps leaving out others of more importance; and of misconstruing the significance of some of the available information.

Communications-oriented computers evolved from military applications and from academic experiments. In the early nineteen-sixties, projects in universities became the centre of attention, where non-dedicated, time-shared facilities were established to take advantage of the computer memory's extremely fast internal speeds. These projects demonstrated the feasibility of a central computer complex, serving users at remote terminal locations at the same "apparent" time. Each user, working separately, had at his disposal the equivalent of his own computer system. It became evident that many of the concepts employed in the military and academic environments had potential commercial applicability. As the hardware manufacturers were closely associated with these developments, they were quick to take advantage of the much larger market potential offered by the private sector. It was not until about 1962, however, that the first commercial experimental applications proved feasible, and perhaps not until 1967 that commercial computer/communications systems were becoming widespread and viable. In this period, and up to the present, hundreds of applications have been developed to serve the needs of private and public organizations and institutions.

Perhaps the foremost Canadian development in this field was the automatic reservation system for Trans-Canada Airlines (now Air Canada). From about 1958 to 1962, this project was planned and organized to take the fullest advantage of the country's indigenous resources in both equipment and manpower. Ferranti-Packard Electric Ltd. of Toronto was commissioned to provide the computation and other equipment. The system was based on dual Gemini computers for which all of the detailed logical design was carried out in Canada. It became one of the world's first commercial on-line, real-time systems. An outstanding feature was the transaction-oriented operator's terminal using simple mark-sense cards — an early forerunner of a type of technology which even now is still in its infancy.

The success of the TCA system led Ferranti-Packard into making Canada's most illustrious bid to enter the computer mainframe design and manufacturing field. This was the ill-fated FP6000 General Purpose Digital Computer project, which incorporated many features generally considered to be the then current state of the art. A number of orders were received from those organizations courageous enough to place their faith in a system which lacked the test of time and a handful of deliveries were made. However, it soon became evident that the costs associated with development, marketing, distribution and maintenance had been underestimated and were growing at a much faster rate than the sales could support. At this point, after vainly seeking aid, the company decided to abandon further development of the system in Canada. One can only speculate on what might have transpired if sufficient funding had been made available, or if more Canadian organizations had been willing to place firm orders.

In many ways, the Consolidated Computer Company's experience over the past two years reads like a re-enactment of the FP6000 story. Their Key-Edit system was designed to overcome the inadequacies of key-punch and key-tape units by utilizing a mini-computer for editing and verifying the preparation of data received from a number of input stations at electronic speed. Although it was a conceptually sound design, and met a definite need, the company's problems in meeting cash-flow requirements provided yet another instance where the merits of a product were not sufficient on their own to guarantee its success. Recently funding has become available, promising a more secure future for this system.

If one is to measure success in terms of favourable response, then the software developments which have emerged from the experiments at the University of Waterloo are of considerable merit. Starting from the recognition that lack of sufficient computer time encumbered students, a professor and three students designed and wrote a programming language compiler with the purpose of increasing machine utilization. The team's success has made the WATFOR compiler a familiar name in university computer centres around the world. Other software developments have emerged since the debut of WATFOR which have added to the University's list of achievements. WATFOR has since been extended and refined under the name of WATFIV. Their success has indeed become self-evident, because in addition to several other universities, a large number of institutions and commercial organizations have availed themselves of these software packages.

Another significant software development in recent years is APL (A Programming Language). Although it is not an original Canadian development, one Canadian company has done much to popularize this system of programming, particularly in interactive business applications. The concept involved is essentially that of making the computer ''transparent'' to the user by means of an on-line terminal, whose key-board has been modified to include powerful operators, the equivalent to many normal program instructions. As a consequence, it is claimed that non-programmers can produce useful output within two or three hours of exposure to APL, which is a little longer than the time required to learn to operate an electronic desk calculator. The significance of this development is that it may have a profound effect on the future usage of computers by small businesses.

This miscellany of Canadian developments provides only a taste of the work already accomplished, and what has been achieved to date. These examples and other similar developments lend credence to a number of frequently mentioned observations, which will be explored more fully in later parts of the Report.

Canadian expertise is second-to-none in high technology areas. Many developments are far advanced and, given the opportunity, can continue to be the equal of all but the very largest developments. The major Canadian failing lies in our inability to fully exploit opportunities and insufficient clarity in the

definition of objectives. There appears to be a delay in the acceptance of Canadian technological developments until they have been acknowledged by other countries. This has the combined effect of producing heavy marketing costs, as well as indicating a discouraging lack of confidence in our own products.

Sufficient funds have been lacking at critical stages of development and marketing for hardware and software innovations. There are hopeful signs that this particular problem has begun to be recognized and that it may be more easily resolved in the future.

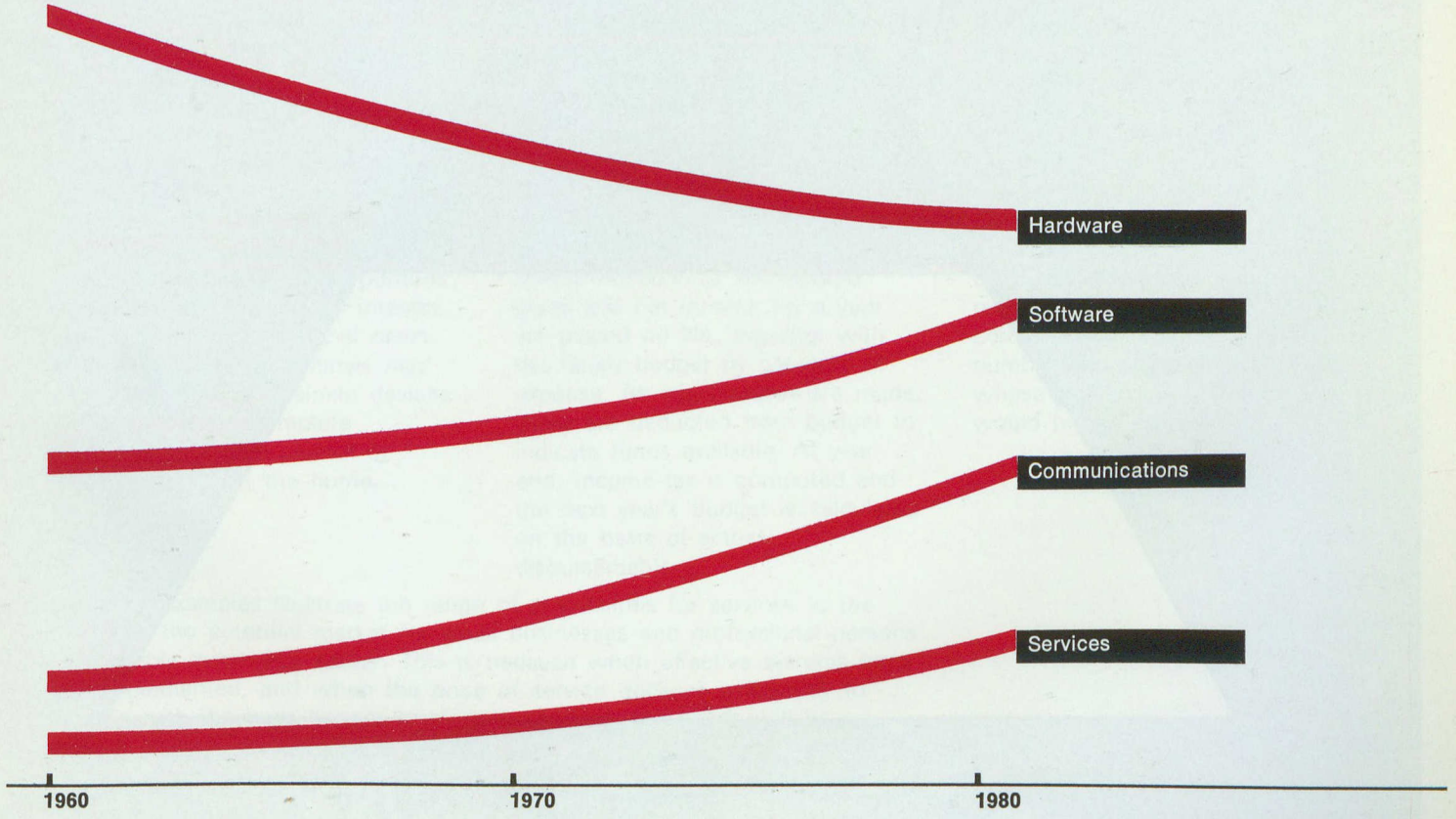
The common theme which seems to emerge is that advances have been achieved mainly by small, dedicated teams of individuals, brought together by the stimulus of high quality leadership.

As the situation now stands, the more successful applications appear to have been those using dedicated facilities. In particular, reservations systems for airlines, hotels, railways, theatres and for other discrete events have benefitted from the ability to access and update large files of information from remote locations in a matter of seconds. Similarly, process-control applications for monitoring oil refineries, pipelines and other flow processes now require little human intervention, having been equally successful. On the factory floor, good progress has been made with data collection systems feeding information by means of communication lines to central computers in order to monitor work in process against predetermined schedules. These are but a few examples, and the list of successes continues to grow.

There have been a number of failures, and it would be misleading not to mention them. In particular, the development of Management Information Systems cannot be said to have achieved the degree of success originally envisaged. The concept of an organization's total information being processed directly by a computer, with each level of management receiving that amount of information necessary to fulfil the responsibility involved, is most appealing. But results thus far have fallen short of expectations, and the real usefulness of computers for managerial decision-making has not yet reached an advanced level. Furthermore, a general disenchantment with computer systems has arisen, where management's expectations and funds expended on data processing functions have not been met with satisfactory returns. In the long run, this will be all to the good, for it will mean that in the future, projects will receive more critical appraisal in the early stages. This view lends credence to the reputed shift in emphasis taking place within the industry which suggests that the hardware orientation of the last few years is giving way to much more of a total service approach. As a consequence, the relative expenditures on computer/communications products and services will change to reflect this shift in emphasis, as depicted in Figure 1.

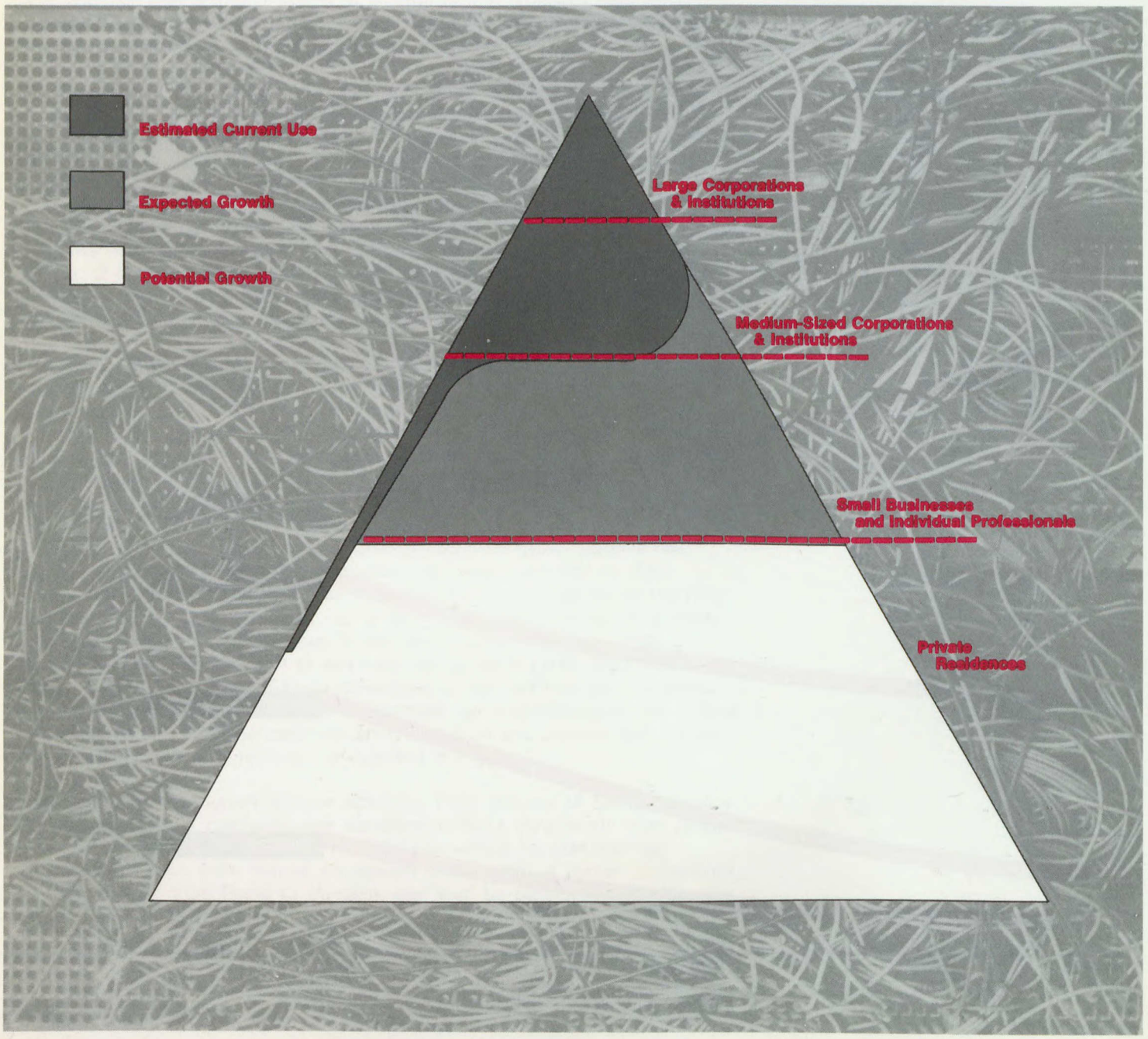
Two points emerge which deserve attention. First, the use of communications in conjunction with computers has transformed these instruments from on-site tools to interactive extensions of the individual whose location may be thousands of miles from that of the system being used. A person in Frankfurt booking a flight from Rome to Bangkok may well be oblivious to the fact that

Figure 1
Relative Trends
in Expenditures by Users



Source: CCC/TF

Figure 2
Usage of Computer/Communications
Facilities and Services



the processing of his reservation is taking place in New York City. Thus, as far as the end-user is concerned, the physical location of computational facilities is inconsequential, although this could well become of increasing concern to governments. Second, the direct use of computer/communications facilities and services remains limited to a relatively small part of society. Only large and medium-sized corporations and institutions make extensive use of computer/communications technology at the present time. While it is not feasible to assign values to potential usage, in terms of numbers these organizations probably account for less than 10% of the total; small businesses represent perhaps another 20% and households perhaps in excess of 70% of the total potential number of users. Figure 2 illustrates this point.

While potential expenditures for computer/communications goods and services will not be in the same proportions as the numbers of users in these categories, it is nevertheless clear that the bulk of the potential market remains unexploited. This essential fact gives rise to optimism with regard to the long-term outlook for the industry.

For example, when examining the future direction of computer terminal usage, observers point to the telephone — one in every home. Whether the demand for home terminals, or rather for the services they could provide, will materialize is open to question. Among the possible services postulated for the future are:

- *Electronic Mail.* Public messages and postal letters may be supplanted by private messages from home terminal to home terminal via a switched network. Prices will vary according to urgency and length of message, but would need to be cheaper than telephone over long distances.
- *Electronic Newspapers.* A terminal used to access only those portions of newspapers that are of interest, *e.g.*, sports pages, financial news. Alternatively, some terminals may be equipped with facsimile devices which reproduce complete newspapers, or the journal of choice, directly in the home.
- *Computer-Aided Instruction and Computer Tutor.* A range of courses on every conceivable subject with a view towards the completion of a specified course of study with appropriate examinations, or simply towards satisfying personal interests. The terminal display and keyboard are used to interact with the computer.
- *Family Accounting.* Anticipated gross and net income for a year are placed on file, together with the family budget by category of expense. As expenditures are made, these are deducted from budget to indicate funds available. At year end, income-tax is computed and the next year's budget is calculated on the basis of actual disbursements.
- *Video Library.* The home terminal display screen is used to ascertain the films or books available for viewing and their price. After final selection (perhaps by sampling) and viewing, the cost is debitted to the subscriber's account.
- *Grocery Pricing and Ordering.* Based on a particular family's needs, a series of menus is computed for the week. The total grocery requirement is then ordered via a central computer from one of a number of neighbourhood stores whose total price to the consumer would be the lowest.

The above examples illustrate the range of possibilities for services to the home, but the potential market for small businesses and professional persons will probably materialize earlier. This is because when effective systems have been implemented, and when the price of service declines sufficiently to compete with the book-keeper or clerical assistant, the needs will be

transformed rapidly into effective demand. Thus, in contrast to the fulfilment of home needs, the service will be regarded as a normal business expense. The type of service required initially will probably centre upon accounting packages, where the information could be transmitted by means of a telephone line from the place of business. This service, plus others of a more sophisticated nature, will be required by doctors, dentists, lawyers, architects, engineers, and consultants. The degree to which these services may be made convenient to the professional will play a large part in determining the growth of this market. Even before this occurs, it is probable that the rising costs of social programmes will force governments to seek relief through the application of various technologies, thus generating a substantial demand for computer/communications equipment and services in the public sector.

What then are the expectations for the implementation of such services?

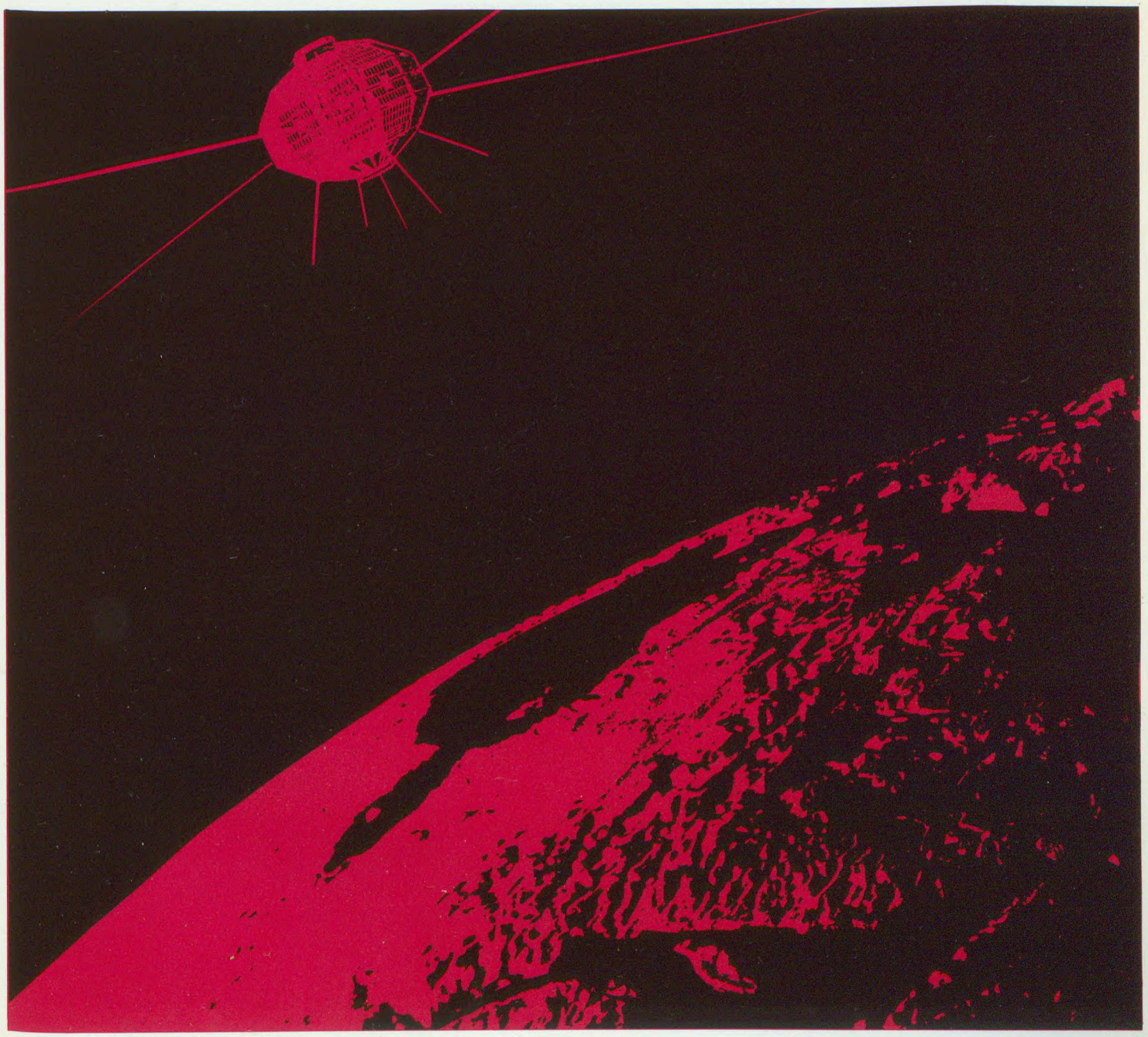
As indicated previously, the potential market for services to the home is numerically larger than all other markets combined. The fact is that the technology to accomplish these things, and much more, is a near prospect. As partial evidence of this, a number of entrepreneurs in the United States have already embarked on such schemes as:

- The provision of simplified computer terminals for each house in a new subdivision, connected to the subdivision office computer, primarily for protection against burglary, but also with the aim of providing cooking recipes and a variety of other services on demand.
- The installation of a coin-operated computer system which allows the user a choice of programs which may be of interest.
- The establishment of a computer-operated bingo game over a modified local CATV station network, which allows two-way communication for a limited number of participants.
- The installation of cash register terminals in the stores of an Ohio town connected directly to the local bank's computer which instantaneously debits the purchaser's account with the value of a sale and credits the store with a like amount, minus commission (often referred to as the first example of the cashless-chequeless society).

The evidence seems to suggest that as the price of equipment falls, more and more experiments like these will be undertaken to determine the viability of satisfying consumer-level and small-business demand. As tantalizing or as frivolous as some of these services may appear, it would be foolish not to take them seriously. The history of technological forecasting indicates that the majority of predicted techniques or inventions do in fact take place, although seldom in the time predicted — often much sooner or much later than expected. What is needed is to channel some of these experiments towards high priority, socially-desirable outcomes, rather than simply to add to our list of entertainments. By way of example, the potential in terms of assistance to health care or educational instruction by means of computer/communications technology is large.

Such new developments will pose many problems for governments in particular, and for society in general. There will be problems relating to priorities; to jurisdictions; to questions of who should be allowed to provide which services; to the displacement of persons in industries and institutions which may become obsolete; and problems of leadership in the face of possible societal fragmentation. Other questions will of course arise when consumer choices and opinions are made known. Will we prefer to read *Le Devoir* of Montrel, or *Le Monde* of Paris, the Toronto *Globe and Mail* or the *New York Times,* if all were electronically available? Will the sending of messages and the writing of letters become forgotten pastimes? Is "Bingo Night in Canada" inevitable (or even desirable)?

Answers to many such questions will be required in the decade ahead.



Introduction

The field of computer/communications has had its widest application in serving the administrative and operational needs of businesses, industries and institutions. However, there are an increasing number of applications affecting Canadian society and the individual. Social considerations have therefore played an important role in the deliberations of the Task Force. The area of concern is wide-ranging. It encompasses the whole technology of computer/communications because of the effects the application of the technology may have on individuals, on groups, and on society as a whole. There are those who view the development of these effects as a process of enslavement, fearing that man will become subject to the whims and fancies of some giant computer complex before the realization of its existence is fully upon us. Others take the opposite view, and are convinced that the technology will liberate mankind from the drudgery of routine and repetitive work. However, if the experience with computer/commmunications systems over the last decade is a reliable indication of what the future may hold it is unlikely that either of these extreme situations will materialize. Most observers agree that the impact of the technology thus far has been neither as good nor as bad as predicted. On the other hand, experience in this field may not be the best basis from which to judge the future course of events. The pace of change in computer/communications technology may well out-distance our ability to deal successfully with the problems that it will undoubtedly raise:

"The anonymity of the computer is about to disappear, for it now appears likely that the coming era will carry to fulfillment a gigantic revolution in the generation and distribution of computer power. Before that revolution has run its course, the computer will have become as much a part of our daily lives as is the telephone today, and our society will probably have been altered almost beyond recognition."[1]

If this premise is accepted, that our society is going to be altered drastically by computer/communications technology, then, before bowing to the inevitable, it is entirely appropriate to attempt to guide the future course of events as much as possible to our own advantage. In order to achieve this, at least three types of goals would appear desirable:

- To recognize and utilize those computer/communications systems which directly serve, or are of benefit to, society;
- to optimize the use of scarce resources by recognizing and assigning higher priorities to those socially-desirable applications which promise the greatest benefits; and
- to recognize and mitigate to the greatest extent possible the undesirable side-effects of the application of computer/communications technology.

[1] Parkhill, D. F., *The Challenge of the Computer Utility* (Addison-Wesley Pub. Co., 1966)

While the general direction as to what should be done may seem clear, it may be infinitely more difficult to put policy into practice. The problem is vastly complicated by the very adaptability and pervasiveness of computer/communications. It seems evident also that there is no sharp dividing line between those systems which are directed towards serving society and those systems which, ostensibly, appear to serve essentially economic goals. All types of systems are capable of having both beneficial and detrimental effects. The changing technology combined with the imagination of man make it extremely difficult to assess where and how the next applications will develop, and precisely what their effects on society and the individual will be.

1. CONSIDERATIONS OF BENEFITS AND EFFECTS

The use of computer/communications technology as a tool which could serve society has only recently evolved. With this evolution has come a wave of potential applications varying from medical diagnosis to housework, and some of these have been cited in Chapter II. This vision of the technology being able to provide the ultimate solution to all of today's ills was particularly prevalent during the mid-sixties, to the extent that new problems were being sought for which there might be a technological solution. The rush to apply the technology tended to overlook two important questions:

- Was there a clearly defined problem to solve?
- Was computer/communications technology the best means of solving the problem?

In the recent difficult economic climate, a more pragmatic view has developed, coupled with a degree of disillusionment on the part of many users, due to the lack of effectiveness of many computer installations. For this state of affairs, neither the users nor the hardware salesmen, who have tended to oversell their machines and to underestimate the difficulties involved, can be held blameless.

In its review of possible future developments, the Task Force was faced with the problem of determining the means of ensuring that these developments would meet the social needs of Canada. This led inexorably to the difficulties of measuring social, rather than economic, phenomena. Three frameworks were tried, but none seemed appropriate in an environment where the requisite information was lacking and where the constraints were changing constantly. The areas considered were the assignment of social merit; the most frequently identified social applications; and some of the benefits that might be anticipated.

(a) Problems of Measuring Social Phenomena

In identifying possible national goals, the Task Force examined in some detail those already defined by the Science Council in Report No. 4 (1968), *Towards a Science Policy for Canada*. The Science Council, faced with the same dilemma of providing a framework for measuring the national interest, developed a list of six national goals, including an extensive set of sub-goals, qualifying their work with the statement that the list was not comprehensive. These were:

- National prosperity.
- Physical and mental health and high life-expectancy.
- A high and rising standard of education, readily available to all.
- Personal freedom, justice and security for all in a united Canada.
- Increased availability of leisure and enhancement of the opportunities for personal development.
- World peace, based on a fair distribution of the opportunities for personal development.
- (These were subsequently amended by a seventh goal on control of environmental pollution.)

The formulation of a set of national goals is an extremely difficult process in a democratic society. Out of necessity, they are generally aimed at the long-term, while society and its institutions react primarily to short-term issues. What appears as a problem today may not be a problem next year. In Canada, the process is further complicated by potential conflicts between national goals and regional goals. Any list inevitably causes concern because of its omissions and inclusions. The Task Force found that virtually all computer/communications applications could be an aid to their fulfilment, but to what degree remained uncertain. The generality of the goals, and the lack of the assignment of priorities, meant that they could not provide meaningful measures for assessing either the relative importance of a social need, or the applicability of a particular computer/communications system.

The generality of these national goals spurred the Task Force to seek a framework more attuned to the computer/communications environment. To develop a work program for policy analysis, a set of tentative criteria was drawn up:

- Establishing effective Canadian problem-solving and decision-making capacity, by (i) optimizing data processing power and access to data, wherever stored, and (ii) fostering improvements in data collection, processing, dissemination, and utilization.
- Protection of national sovereignty, by (i) maintaining control over data essential to Canada, and by (ii) fostering the growth of Canadian-owned and/or controlled firms, and the growth of Canadian skills in the computer/communications field.
- Protection of Canadians from unwarranted intrusions into the life of the individual by the computer.
- Promotion of regional development by (i) ensuring the availability of data to all areas of Canada at costs which are not prohibitive, and (ii) providing opportunities for special computer/communications facilities in the less-developed areas of Canada.

[2] Science Council of Canada Report No. 4, *Towards a National Science Policy for Canada* (Ottawa, Queen's Printer (Information Canada), October, 1968).

- Rationalization of system structure and design, by (i) avoiding excessive systems cost and unnecessary duplication of facilities, and (ii) avoiding unnecessary obsolescence of useful equipment and unreasonable demands on organizations with obligations of a higher national priority.
- Utilization of private initiative and resource allocation processes, by (i) fostering a competitive environment and (ii) maintaining or introducing restrictions against unfair competition.
- Rationalization of the role of government by (i) ensuring that administrative or legislative policy-making is coherent and practical, (ii) ensuring that no major policy changes are implemented without due process, and (iii) ensuring that adequate jurisdiction and capability resides in the agencies or institutions charged with implementing government policy.
- Optimization of national resource allocation by government, so as to ensure that resources applied to computer/communications are not misallocated to sectors that are low in social priority.
- Ensuring acceptance of computer-communications technology by interest groups and Canadian society by (i) avoiding censorship of ideas, and (ii) providing for adequate participation in the decision-making process by the groups affected.
- Promotion of international co-operation in computer/communications by (i) facilitating international technical compatibility, (ii) participating in international councils, attending international forums, and exchanging information, and (iii) providing Canadian skills and resources to developing countries when requested.

In recent years, there has been an increasing use of analytical techniques whose purpose is to determine which of two or more courses of action should be undertaken when resources are limited. Although the purpose of such techniques has been to determine the most preferable choice among a number of alternatives, their success appears to have been greatest when the alternatives are few in number.

These techniques are known by various names, of which perhaps cost-benefit analysis is the most widely-used. Essentially, they have in common the idea of quantifying the anticipated costs and the expected benefits, in order to determine whether the ratio between the benefits and costs is greater for a given course of action than for another. Generally, however, it seems clear that whenever social costs or social benefits are involved, their quantification remains an inexact art. Only in the most straightforward instances, where inputs and outputs are easily measurable, does the analysis become reasonably practicable. Indeed, it has been suggested that one of the greatest advantages of cost-benefit analysis is the learning process contained in the exercise itself.

At the level of policy development, the techniques of cost-benefit analysis are difficult to apply unless a great deal of information is available regarding the alternatives proposed for consideration. It must be entirely clear as to what is being measured and analyzed. Until a number of definitive proposals have been made (*e.g.*, for a network to link certain hospitals for specific, well-defined functions) it is neither possible to estimate the costs involved, nor to postulate the potential benefits.

Within its sphere of applicability, each of the above approaches to the assignment of social merit has its advantages. However, within the constraints of the Task Force responsibilities and time-frame, the major drawback is the

problem of measurement. There is no easy way to measure social costs and benefits, and even the current use of the GNP as an indicator of economic growth is being criticized for its lack of reflection of the real quality of life:

"...GNP is still the best indicator of economic activity available. But even its most ardent defenders are troubled by the increasingly glaring paradoxes which emerge when it is used to estimate levels of, and changes in economic and social well-being. For example, air pollution doesn't enter the accounts as a cost or negative item but air pollution equipment is dutifully registered as a plus. Littered parks require more park attendants and equipment: up goes GNP. More crime involves more policemen and police cars: GNP solemnly records an increase."[3]

The whole problem of measuring social change is in fact so contentious that there are those who claim that the entire exercise is misleading:

"To make progress in the social sciences, we must give up the (often ridiculous) attempt to measure and quantify social phenomena."[4]

(b) Some Probable Developments

At the present time, it seems that the most appropriate method of determining likely future developments is through an investigation of experienced, educated opinion, particularly when it is held by a large number of people engaged in the same field of activity. On this basis the Task Force identified education, health care, and finance as areas of unquestioned social importance to society. All three areas suffer from a number of problems, and it is generally considered that computer/communications technology could assist towards providing effective solutions. In these application areas special studies were undertaken, and the detailed findings are published in Volume II of this Report. Health and education as services in the public sector are subject to continual discussion and criticism. They directly affect the entire population, both through their functions in society and through the funds derived for their support by taxation. They have demonstrated an accelerating rise in costs throughout the sixties due to rising labour costs, increasing enrolments in educational institutions, and an expanding use of health care facilities. At the same time, a disparity in services between different regions of the country has persisted and there is an increasing public demand for

[3] Ostry, Sylvia, Economic Council of Canada. "New Indicators". *The Montreal Star*. June 16, 1971, p.71.

[4] Howard, N. *Paradoxes of Rationality: Theory of metagames and political behavior* (The MIT Press, Cambridge, Mass., 1971), p.1.

improvements in service combined with a growing dissatisfaction with the rising costs. Less public attention has been focussed on financial services, but they are beginning to play an important role in society because money, in the form of bank-notes and coins, is being replaced by other means of exchange.

Numerous other applications of computer/communications technology are already being developed by all levels of government and by other public institutions, which are directed towards serving the individual and society-at-large. Systems such as those concerned with community information, police information, automated traffic control, legal information, and liens registration portray the extent to which the alleviation of some aspects of the social condition could be met by applications of the new technology. Some of these systems will, of necessity, make large-scale use of network facilities.

The understanding and protection of individual freedom and rights in a free society has been the subject of increased interest in democratic countries in the past few years. It is becoming more and more difficult for the average person either to obtain information concerning his rights, or to understand their implications. Across Canada a number of community information centres have come into being. These vary in form from public libraries to social welfare agencies to store-front operations. Some are directed towards serving ethnic groups, some to social welfare services, while others are geared to legal rights and services. Some maintain extensive files while others operate on a personal contact basis. In recognizing this problem, the Consumers Association of Canada has had a study undertaken regarding the possibilities for providing centralized information to these centres. The role computer/communications could play in this endeavour is being examined as a potential way of providing readily-accessible and complete information to these centres, as well as providing feedback on the nature of individual concerns.

A national police information system, already under development by the RCMP, promises to give all Canadian law enforcement agencies access to such information as stolen vehicles, wanted persons, fire-arm registration, stolen fire-arms, stolen property and criminal records. While this information is already available, access to it is slow, and network access to centralized information could provide quick responses giving an officer information within the time available for action.

The potential value of the computer to the legal profession in the long-term seems assured. In both case law and statute law, experiments have been undertaken by governments and universities with the primary aim of providing rapid information retrieval. The basic problem is that the expanding volume and complexity of our laws has made it more and more difficult for the lawyer to locate the specific information he requires. In consequence, it is becoming more and more costly to provide for the proper functioning of the legal system. The experiments at the University of Montreal — project DATUM/SEDOJ (Documentation Automatique des Textes juridiques de l'Université de Montréal — Service de DOcumentation Juridique) and at Queen's University (project QUIC/LAW) are concerned with case and statute law retrieval and there are reasonable expectations that they will prove

capable of adaptation for wide, practical application. The Manitoba Government and the federal Department of Justice have developed statute law data banks from which various indices can be extracted. The Department also utilizes a computerized photocomposition system for draft legislation, a process which enables changes in texts to be introduced rapidly and easily.

These few examples of the types of systems already serving or beginning to serve society, suggest that wherever problems are evident concerning the collection, storage, manipulation, and retrieval of large quantities of information, computer/communications techniques are regarded increasingly as the natural solution.

(c) Some Possible Effects

While the magnitude of the applications of computer/communications can be surmised reasonably well, much less is known or understood about the effects of this technology on society. Even educated opinions are expressed hesitantly because of our present lack of knowledge of meaningful methods by which to observe or measure social change. It is conceivable that the indirect effects of systems which appear, at first sight, to have little potential to affect the individual or society may have much greater impact than anyone can foresee. We should be concerned, therefore, not merely with systems directed towards serving society but with all computer/communications systems, however far removed they may appear from contact with the individual.

Few research programs have been undertaken to study the effects of computer/communications technology on society, and little of real significance has been produced by the research currently underway. As an example, IBM funded a $5 million project at Harvard to study Technology and Society, which began in 1964. A recent description of this project stated:

''The program is the only sizeable project of its kind anywhere. Because the subject matter — society and technology — is a new discipline, it was expected from the start that it would take some time to get off the ground. When the program was established in 1964, it was stated: 'The area of proposed research is relatively new and lacks well defined problem definition and methodology.' A successful approach is most likely to develop from an effort spread over a relatively long period, approximately 10 years, during which the intellectual resources of the University can be gradually deployed to mount a substantial and coordinated effort on this class of problems.''[5]

The article goes on to point out that in spite of the 40 or so research projects undertaken to date, it has been unable ''to produce much of note'', and the effort is being disbanded at the end of the 1971-72 academic year.

[5] Gardner, W. David. ''Harvard Will 'Redirect' IBM-Funded Study on Technology and Socity''. *Datamation*, August 15, 1971, p. 38.

Some other studies are underway, many with more specific terms of reference than the Harvard programme. For example, the Manchester Business School in England has undertaken a five-year study of the sociological aspects of introducing computer systems.

The problem of identifying and measuring social parameters seems to be a major stumbling block. Gabor Strasser, at the U.S. Office of Science and Technology, stated recently that there is little understanding of which indicators are relevant to measuring the quality of life, what their interrelationships are, or how to measure them.[6] Few analytic techniques are available which can use qualitative rather than quantitative information, and yet the qualitative information is more relevant in assessing social change. The following analogy with mathematics illustrates the point:

> "Nonmathematicians often think that mathematics is primarily concerned with numbers. That is not so today. In fact, while twentieth-century social scientists have tried desperately to become more quantitative in the belief that this would make them more mathematical, twentieth-century mathematicians have become increasingly non-quantitative. The subjects loosely called modern mathematics (say symbolic logic, topology, modern algebra, and, more than all, set theory) become less concerned each day with common-or-garden numbers. They discuss relations. The idea that mathematics is the science of quantity is a nineteenth-century notion, and social scientists who pursue it are immersing themselves in dead ideas".[7]

Whether or not, therefore, we shall ever be able to quantify and measure the effects of this, or any other technology on society appears to be in dispute. What is clear is that genuine concern exists about the effects, or envisaged effects, that computer/communications technology may bring forth. Whereas the beneficial effects of computer/communications systems have been stressed in the second part of this chapter, little mention was made of the frequently quoted negative aspects and potential hazards. Perhaps paramount among these are the issues of privacy, depersonalization, manpower replacement, and, at the official and political levels, aspects concerning regional differences.

The issues related to privacy are not new. Files of a private and confidential nature concerning individuals, groups and organizations have been maintained for centuries. However, the issues have recently come into prominence because the technology now enables access to confidential information by many more persons than was formerly possible. With the situation as it now stands, there is the danger that such access places not merely the unscrupulous, but also the misguided individual in a better position from which to misuse such information. This is but one aspect of the complex issues surrounding privacy, which is the subject of a special Task Force established by the federal Departments of Justice and Communications.

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[6] Strasser, G., "Impediments to Societal Problem Solving", *IEEE Spectrum*, July, 1971, pp.43-48.

[7] Howard, N., *op. cit.*, p.2.

A related problem concerns the depersonalizing effects of the use of numbers to identify individuals. No longer, it is argued, is a person an individual with a name, unique features and characteristics. Rather he has become simply a number in a vast bureaucratic system which conspires to obliterate all traces of the human spirit. There may be some truth in this allegation because, in one sense, it reduces the status of man to the equivalent of an automobile part. On the other hand, given our present state of knowledge with regard to data manipulation, not using numbers to identify individuals would make some computer systems much more difficult and certainly more costly to operate. Furthermore, it has been claimed that when numbers are assigned to people, companies and institutions can provide more individualized attention than would otherwise be the case. It may indeed be preferable to be a number if this ensures that we receive the right pay-cheques on time, or that we do not pay another person's taxes.

There is a widespread belief that computers cause job redundancy and manpower replacement. From a survey[8] partly commissioned by the Task Force into the attitudes of Canadians towards computers, some 71% of respondents believe that computers will cause unemployment. There have, in fact, been some instances of redundancy caused by the installation of computers, but the majority of these appear to have occurred in areas of process-control. This more appropriately comes under the wider subject of automation, but where information-processing is concerned, most organizations appear to have added to, rather than reduced, their staff. This is not to deny that dislocations have taken place, that changes have been created in the demands for different types of jobs, and that adjustments have had to be made even while computer/communications are in their infancy. The danger of dislocation in employment therefore cannot be lightly disregarded, and should be a continuing concern of governments.

2. REGIONAL ASPECTS

The size and topography of Canada have given rise to a diversity of conditions within its borders. Nevertheless, in spite of the well-known social, cultural, linguistic, economic, and geographic differences which do exist, there appears to be a basic homogeneity in the life-style of Canadians from coast to coast. Although the tempo of life may differ between the smaller and larger urban centres, and between urban and rural settings, the greatest variations occur as much between occupational groupings as between separate areas of the country. The degree of uniformity that exists among regions is due to the youthfulness of Canada; to the relative mobility of individuals; and to the increasing use of modern transportation and communications systems. However, the contrasts among regions, regarding the extent and pace of industrialization, pose problems for the policy-maker in government. What may

[8] *The Public Looks at Computer Services* (Canadian Facts Co. Ltd., 1972), p.35.

well be the best policy for a highly industrialized region may not be entirely appropriate for a resource-based region, and vice-versa. The perennial Canadian problem of ensuring adequate regional development, and, at the same time, promoting national unity and national standards, is very real.

Against this background of regional considerations, the role that computer/communications plays now, and that it is likely to play in the future, has not been the subject of much public discussion. This is probably because too little is known about the cause-and-effect relationships of computer/communications with regard to industrial development in a regional context. Some 75% of installed computers are found within Ontario and Quebec and the concentration is even more marked within the Windsor-Quebec City corridor. Furthermore, computer installations appeared to correlate well with industrialization and commercialization rather than with the distribution of population. This is supported by the fact that Ontario and Quebec possess about 64% of the population of Canada, while some 80% of Canada's manufacturing activity is located in these provinces. It is essentially this factor, perhaps more than any other, which has brought about the concentration of computer operations. The normal pattern which exists, for the most part, in a modern computer/communications system is for a computer complex to be located in a firm's head office or major manufacturing facility, with computer terminals located in branch plants, sales offices, and warehouses across the country. Thus, the extent to which head offices and major manufacturing facilities are found in the provinces of Ontario and Quebec, has a large bearing on the location of computer installations.

Given this apparently high degree of correlation between extensive computer usage and a diversified industrial and commercial base, two questions arise which are of concern, particularly to the less-developed regions of Canada:

- Will the increasing use of computer/communications technology in the future result in a greater centralization of computer facilities?
- Are computing facilities a prerequisite for new industrial development, or do they tend to follow in the wake of such development?

The factors which favour further concentration of computing facilities include: central processor economies of scale; availability of expertise; more economical and reliable data communications; and more advanced data bank management systems. Opposed to these are factors which mitigate the effects of centralization, such as: advantages of local service capabilities; less developmental time requirements; and the promise of spectacular gains in mini-computer technology. On balance, because of the pyramid structures of most organizations, it is unlikely that the pressures towards computing facility centralization will lessen. In spite of the already high concentration of computing facilities in Ontario and Quebec, the concentration might have been even greater but for some of the difficulties experienced with the operation of very large systems and the relatively high cost of data communications.

With regard to the second question, that is, whether computing facilities are a prerequisite for industrial development, no evidence has come to light which would suggest that industrial, commercial or even institutional development is being retarded due to lack of regional computer/communications facilities. Service bureau facilities, for example, are established or are accessible throughout Canada, and the service supply segment of the industry believes that there is no lack of computing capacity. The decision to locate an industrial or commercial enterprise does not at present seem to depend on the availability of and close proximity to computing facilities. There is no reason to suppose that the hardware and service supply segments do not respond to market demand as it materializes.

Any discussion of the regional aspects of computer/communications in Canada would be incomplete without reference to the more isolated installations. A surprising number of these have grown up to serve the resource industries in isolated communities. Their significance, in terms of regional development, lies in two directions: first, their existence is evidence of the computer's applicability in the resource-based industries; second, that it is possible, albeit difficult, to obtain and retain EDP personnel in such areas.

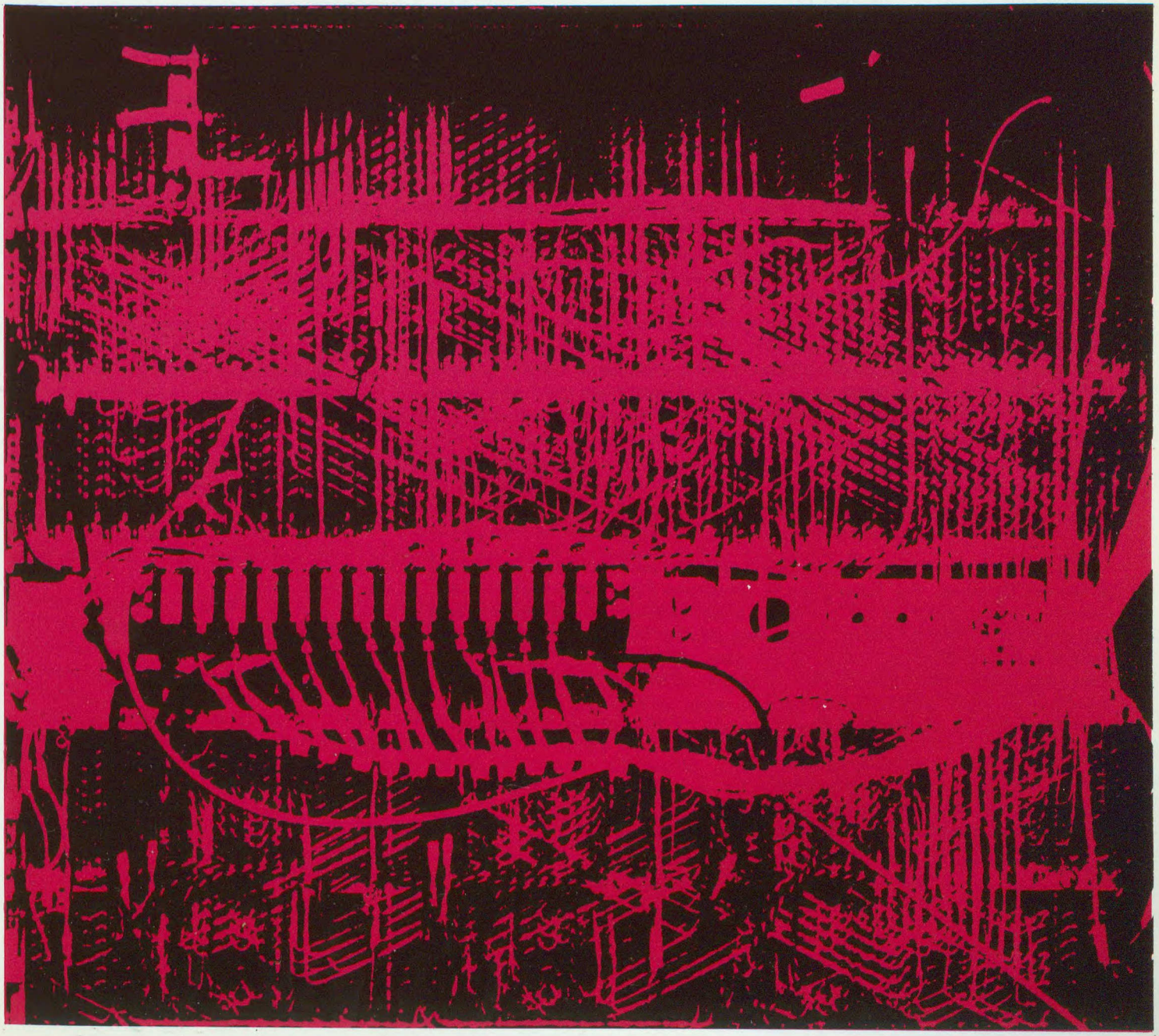
In communities like Kitimat, Flin Flon, and Sept-Iles, computers are being used not merely for such applications as payroll, inventory control, and other accounting procedures, but also for process-control, ore body measurements, seismic data processing and geological surveying, and the application of the computer has helped considerably in the functioning of the processes themselves. In addition, it has enabled the more remotely placed enterprises to maintain a semi-independent posture.

In staffing remote locations it has often been necessary to provide special inducements for managers, systems analysts, and programmers. These usually have taken the form of premium pay and fixed-term arrangements.

Remote installations of this type face an uncertain future, for it seems inevitable that, apart from specific process-control computers, much of the computing workload in the future may be transmitted through on-site terminals via communications links to central, more powerful processors. The factors that may inhibit this trend are the lack of reliable data communications facilities, the cost of these facilities, and the increased use of mini-computers.

There are no magic formulae to apply which would guarantee adequate regional development through computer/communications. The best solutions appear to lie in policies of increasing specialization, both nationally and regionally. This implies the necessity to be increasingly selective in the products and services which are developed. Unless concerted approaches towards common solutions are taken, there is the ever-present danger that particular regional needs will tend to be met from foreign sources. The fact that virtually all regions of the country are, in some measure, in closer proximity to parts of the United States than to each other does not bode well for national solutions. Foreign computer/communications services which are

readily accessible might alleviate certain regional conditions, but the ultimate result would undoubtedly be a further fragmentation of the Canadian computer/communications environment. These problems of data communications within Canada are more fully examined in Chapters IX and X.



The Task Force takes a broad view of the computer/communications industry. Computer/communications encompasses virtually all of the computer industry, in the sense that most computers are capable of being adapted to operate in a communications environment. On the other hand, many of the activities of the communications industry are not of direct concern at the present time, and the products and services relating to voice transmission, for example, are of interest only if they are commonly employed in computer/communications. Consequently, the industry is described as consisting of:

Those organizations which
manufacture or supply computer or
computer-related communications
goods and services.

This provides a sufficiently broad scope to examine the relationships within the industry, while excluding those products and services which are not in some way related to the computer or to communications-oriented computers.

However, the very act of definition itself creates a number of problems. It is not being suggested, for example, that a clearly-identifiable economic sector has emerged. Indeed, a number of the organizations involved may derive only a small part of their revenues from the products and services under consideration. Nevertheless, the attempt has been made to identify and include these entities and their pertinent revenues. Similarly, there are a number of specific products and services which might be included more appropriately under some other industry: products connected with avionics; with certain military uses of the computer; and with some aspects of process control. While special-purpose systems of this nature have not been entirely excluded, this Report is mainly concerned with information-processing products and services, where the industry's efforts are now being concentrated.

1. SIZE AND SCOPE

Few studies of the Canadian computer/communications industry have been published. Of these, the Trans-Canada Telephone System's analysis[1] of the Canadian market potential for computer related services is perhaps the most systematic and comprehensive. Investment dealers in particular have made reports available which appraise certain parts of the industry, but no public data base exists from which a picture of the whole can be drawn. It was therefore decided, first, to commission a study[2] of a profile of the supply side of the industry by means of in-depth interviews with a cross-section of

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[1] *Computer Based Services of the Seventies* (Trans-Canada Telephone System, July, 1971)

[2] Forsyth, George and Owen, Brian, Report to the Task Force on "The Canadian Computer Supply Industry Study". University of Western Ontario, London, Ontario, February, 1972

supplier-organizations; and second, to establish a data base of available information in an attempt to determine the size and scope of the industry.

In pursuing the second course of action, it was initially decided to make the arbitrary and artificial division between SUPPLIERS of computer/communications goods and services, and USERS of such goods and services, with the idea that it would then be possible to correlate the supply and demand functions of the industry. In practice, the lack of published information and the complexity of the inter-relationships among the organizations involved, precluded making measurements to the desired degree of precision. Nevertheless, the attempt was made to:

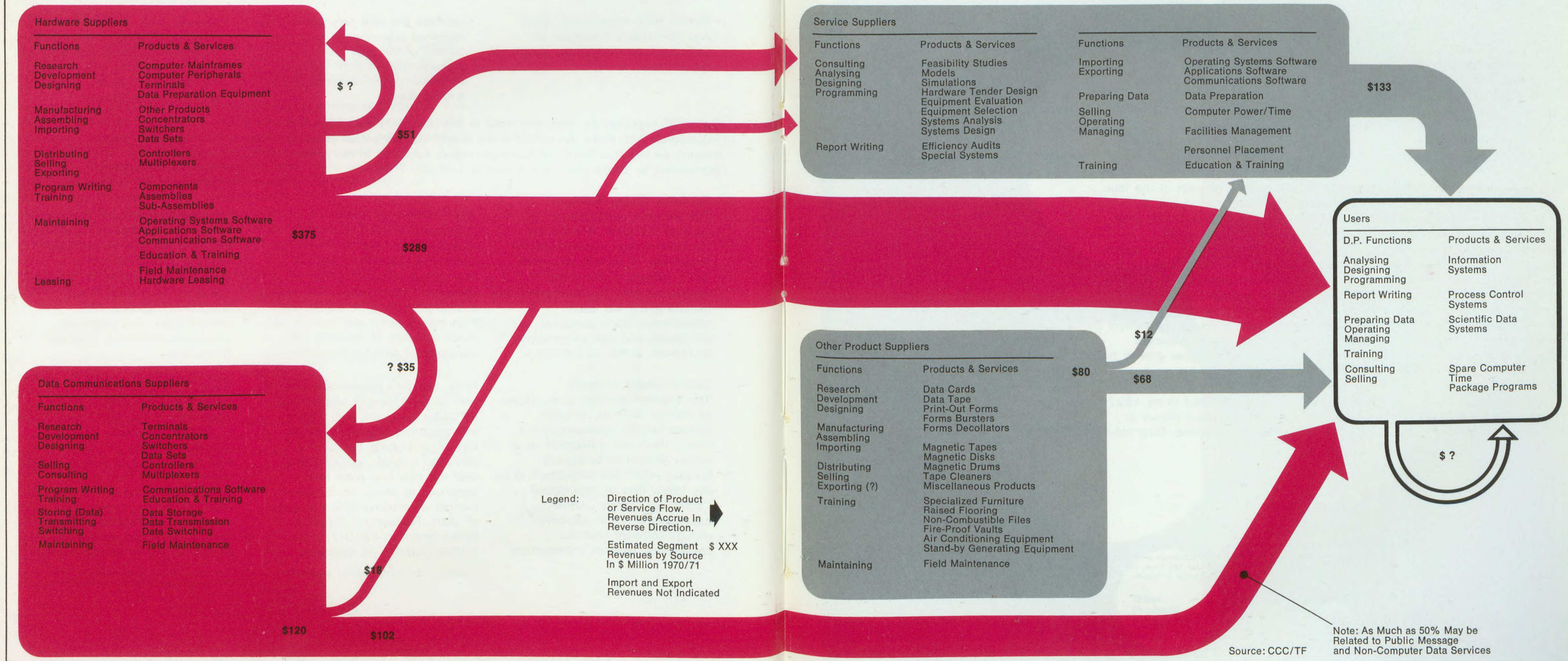
- Identify each organization which was conceivably a supplier of computer/communications goods and services;
- estimate the total revenues of the identified organizations, and that portion of the total revenues probably derived from the supply of computer/communications goods and services;
- compile other available statistics or estimates relating to the identified organizations which would be of use in the assessment process, including employment, rates of growth, and profitability.

Over 500 organizations were examined in this manner, with results not inconsistent with those derived from the supply industry profile study. It became evident that there are four main supply functions in the industry, demarcated by broad types of products or services. These are:

- Hardware Supply Segment
  This segment manufactures and/or supplies computer systems and computer-related communications equipment. In Canada, in recent years, virtually all computer mainframes have been imported and manufacturing has been concentrated upon computer peripherals and data preparation equipment. Some assembling of small mainframes is now proceeding. Recent initiatives by the Department of Industry, Trade and Commerce promise to result in medium-size processor and component manufacture. The accent in this segment is on supply rather than manufacture, and there is not much evidence of research and development directed towards computer hardware. In computer-related communications equipment, the Canadian presence is much stronger. It includes the manufacture of modems, terminals, and other equipment; the development of front-end concentrators, and switching equipment employing computer technology.

- Service Supply Segment
  This segment provides a multitude of services both to computer owners and to organizations not having their own equipment. It is largely dominated by service bureaux which are considered to be the forerunners of commercial "computer utilities". Other organizations in this segment include software houses, consultants, facilities management firms, and data preparation firms, as well as organizations engaged in computer education and training and personnel placement. While lack of profitability has been a particular problem, growth rates over the past few years have continued to attract an increasing number of entrants from the ranks of users. Following a period of retrenchment in 1970-71, the entities involved are optimistic about future prospects. An expanding trade appears to be developing in the export and import of program packages. Remote computer services are exported as well as imported by means of data communications links across international borders. Most of the organizations are owned and operated by Canadians, though some of the larger entities are partially or wholly foreign-owned.

Figure 3
Product and Service Flows of
the Canadian Computer/Communications Industry



- Data Communications Supply Segment
  This segment provides the facilities and services for the transmission of data between computers and between computers and terminals. The suppliers comprise the telegraph and telephone companies, which have a mixture of public and private ownership. There are many hundreds of telephone companies in Canada, of which 15 account for 98% of the revenues. No more than 4% of these revenues[3] are derived from the transmission of data and the rental of data equipment. Much of the data transmission in Canada is through private-line facilities leased from the carriers by individual users. This segment is now beginning to play a more active role in the industry as the merging of the technologies of computers and communications becomes more pronounced. At the same time, pressures on the carriers for more economical and reliable data (as opposed to voice) transmission facilities have been growing.

- Other Product Supply Segment
  The function of this segment is to supply those products which the computer has engendered during the course of its evolution. In general, they may be described as important adjuncts without which computer systems could not operate. A convenient classification suggests two types of product: first, operating supplies and consumables (magnetic tapes, punch cards, etc.); second, computer facility equipment which provides or enhances the environment in which computer systems operate (raised flooring, stand-by generating equipment, etc.). The value of these products has now reached significant proportions, and Canadian organizations are well represented.

Figure 3 illustrates the functions, products and services of each of the four segments as they pertain to the computer/communications industry. It illustrates the magnitude of their relationship with the user and with other segment suppliers. An important point to note is that some supply organizations are involved extensively in as many as three of the four supply segments, and are frequently prolific users of computers as well. Figure 4 illustrates the degree of involvement in the computer/communications industry by the organizations within the four segments. Some of their more traditional products and services are shown, to indicate the difficulties of segregating pertinent revenues from the total and to suggest that, although involvement by some segments is marginal, an increased involvement can be expected depending upon the extent to which the industry provides higher growth rates than those supplied by their other interests.

In summary, total industry revenues in 1970-71 are estimated to be $592 million. This is after taking into account trade among suppliers shown in Figure 3, and deducting estimated inter-segment trade revenues. Total industry

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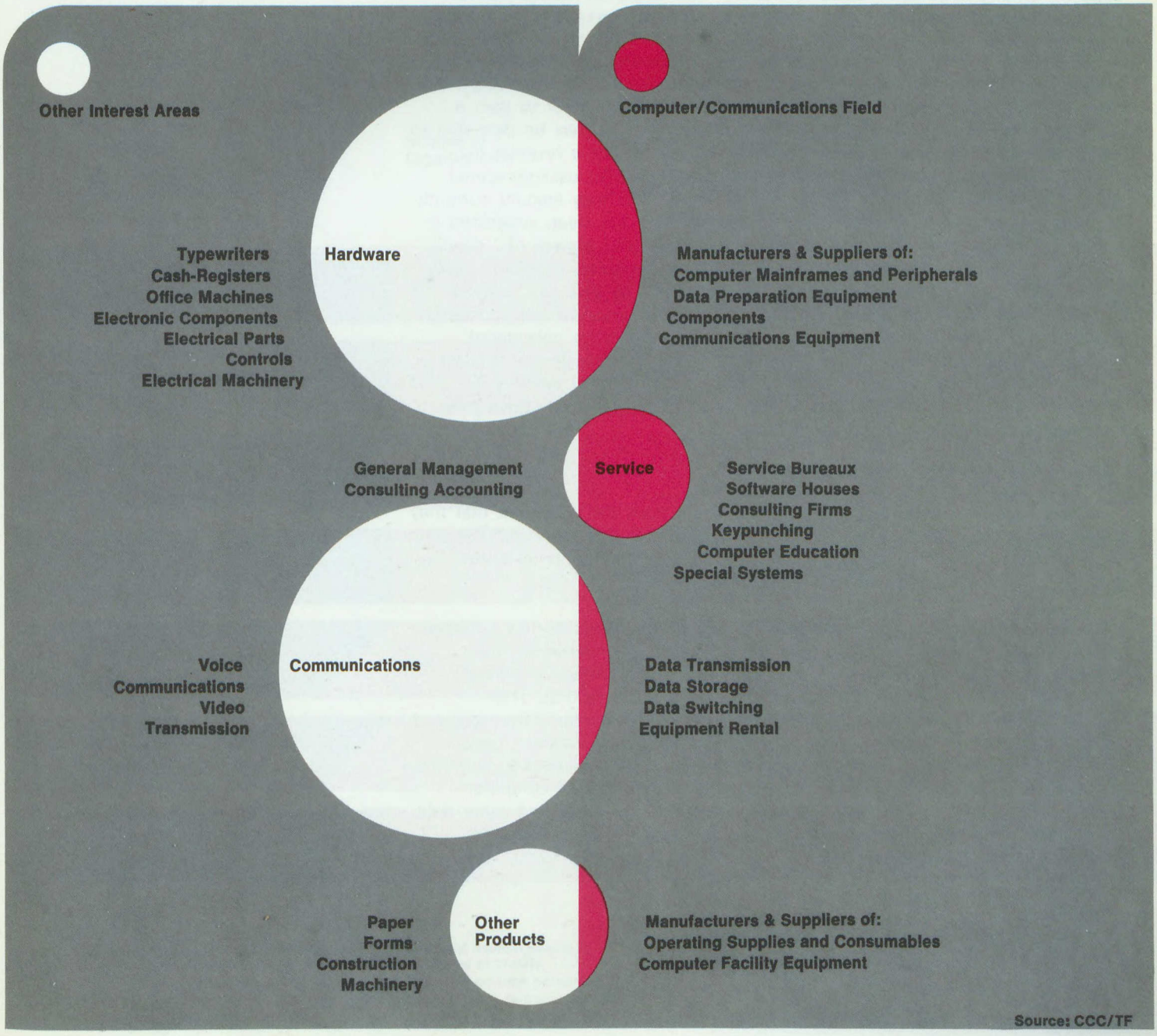
[3] "Greener fields ahead? – Bell merges computer communications into new division". *Financial Times of Canada*. Vol.59. No.42. March 8. 1971. p.16. R.C. Scrivener. President of Bell Canada was quoted in this publication as stating that data communications revenues accounted for 3% of Bell's business. In private communications to the Task Force, and in subsequent public presentations, TCTS has stated that the applicable figure for TCTS member companies is "between 3 and 4% of total revenues".

Figure 4
Supplier Participation in Computer/ Communications



employment attributable to computer/communications goods and services is estimated at 39,900. Segment revenues, employment, and industry totals are indicated in Table 1.

It is now necessary to consider the position of users within this industrial context. One of the unexpected factors that has emerged from the Task Force study is the recognition of the growing number of users who are also suppliers or potential suppliers of computer-based services. It has long been recognized that some users have sold spare computing capacity in an effort to offset in-house data processing costs, but more recently a trend has become apparent among large-scale users to transfer their expertise to the market-place by offering computer-based services as regular, marketable commodities. The reasons for this development are explored more fully in the profile study and in Part C of this Report, but, in the present context, it emphasizes the artificiality of the distinction between users and suppliers. As a consequence, there are some legitimate grounds for suggesting that, in order to gain a more complete appreciation of the size of the industry, it may be desirable to include in the total those user-expenditures which are not a revenue to suppliers. These are mainly the salaries and wages paid to user-personnel directly concerned with computer/communications, and they amount currently to an estimated net $345 million. A further rationale has been suggested in which the computer is regarded as essentially a complex system of ''dead'' machinery, which is not brought ''alive'' until the necessary programs have been written, and which is constantly ''rejuvenated'' by changes to those programs. The rationale implies that data processing personnel are somewhat apart from all other user-personnel, and that they should be considered, therefore, as part of the computer/communications industry. If one accepts either of these interpretations, then the total ''value'' of the industry in 1970-71 amounted to $937 million ($592 million supplier revenues plus user salaries and wages at $345 million).

2. USERS OF EQUIPMENT AND SERVICES

It is also useful to examine the position of users from the viewpoint that they represent, in part, the demand function for equipment and services. (The term ''user'' implies use of a computer from whatever source, be it in-house, through a service bureau, or from a casual supplier).

In reality, only users of equipment are included here, although they constitute probably the major portion of service users as well. Information on the universe of users in Canada is derived from the annual computer census, published by the Canadian Information Processing Society(CIPS). The information contained in these documents is provided voluntarily by users and figures relating to equipment rental or purchase prices are retained on a confidential basis by the CIPS Census Committee. It was necessary, therefore, to obtain the raw data, apply average values to each installed computer system in terms of annual rental equivalents and to use these and other data in a variety of ways in order to extract the inferences, conclusions and forecasts presented below.

Table 1
Suppliers of Equipment and Services
Annual Revenues and Employment: 1970-71

Segment	Number of Organizations	Estimated Total Revenues ($ Million)	Estimated Revenues Attributable to Computer/ Communications ($ Million)	Estimated Number Employed in Computer/ Communications
Hardware	156	1,850	375	21,000
Service	258	145	133	7,500
Communications	15	1,650	120	6,400
Other Products	57	700	80	5,000
Sub-Totals	486	4,345	708	39,900
Less: Inter-Segment Trade	—	—	116	—
Totals	486	4,345	592	39,900

Explanatory Notes:

1. For the most part, the estimates shown represent median values, the ranges of which have been omitted for purposes of brevity.
2. The employment estimates include both full and part-time personnel.
3. The communications revenues in this industry include public message and non-computer data revenues.

Source: CCC/TF

The 1971 census data indicated that there were approximately 3600 computers[4] installed in Canada as of the end of May 1971. A year earlier, 2700 computers were reported as installed, indicating a net increase of 900 systems between 1970 and 1971, or 33 1/3%. Because of the voluntary nature of the reporting, persons connected with the industry have suggested that the 1970 census was understated by as much as 15%, while the 1971 census understatement is considered to be less than 5%. Thus, the net increase in the number of computer systems installed in Canada between May 1970 and May 1971 was probably closer to 20%. While this represents the most recent estimate of growth, numbers of systems can be misleading because they encompass such a wide variety of computers. The counting of a mini-computer at a rental of less than $1000 per month is by no means equivalent to the counting of a super-large computer at over $50,000 per month, yet both appear in many tabulations as numbers in a common total. The value of a system, or annual rental equivalent, is perhaps the best yardstick that can be employed. Using this measure, the value of installed computer systems in Canada grew from about $300 million in 1970, to about $354 million in 1971, an increase of 18%.

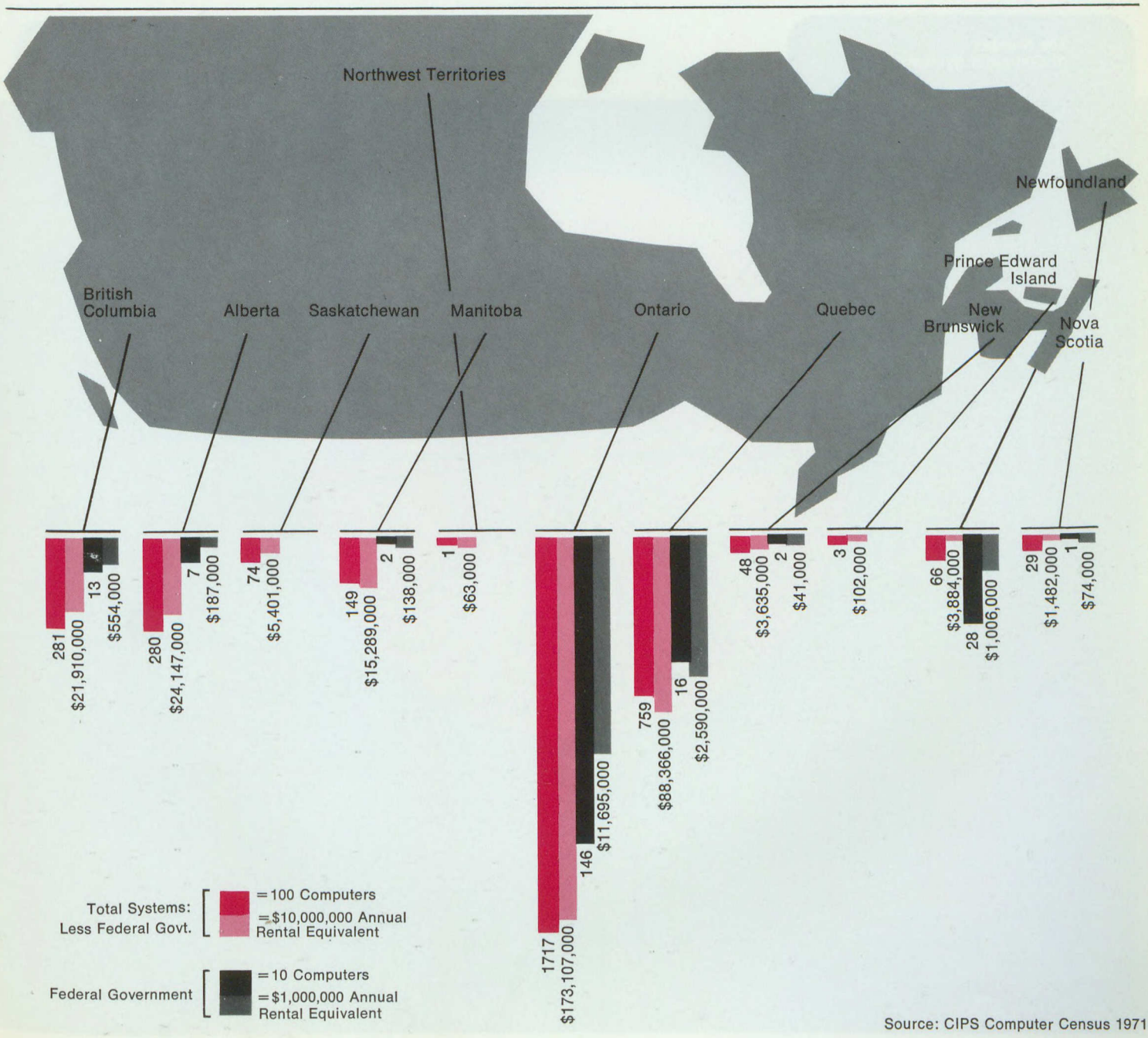
There are many possible ways to present the total picture of Canadian usage, but perhaps three methods, illustrated in Figures 5, 6, and 7, are sufficient to describe the essential points. Figure 5 shows the geographic distribution of computer systems by province, with federal government departments shown separately. Not unexpectedly, the provinces of Ontario and Quebec account for some 75% of the total installed value. But the concentration is even more marked when it is considered that the great majority of these systems are to be found in the Windsor-Ottawa-Quebec City corridor. The preponderance of usage in Ontario is further accentuated by the bulk of the federal government systems being located in the national capital. In general, the geographic distribution of computer systems appears to be a correlate of industrialization and commercialization, rather than bearing a direct relationship to population distribution.

Figure 6 illustrates the number and value of computer systems installed, by economic or institutional sector. To some degree, it emphasizes the diversity of users and the universality of the computer, at least at the organizational level. In both value and number, the public sector accounts for just over one-third of the total systems, and appears to be gaining a greater share, while the private sector accounts for the remainder. The diagrams in Figure 6 illustrate also those sectors which tend to operate larger-than-average systems, as well as the reverse. Thus, the service bureau sector accounts for 15.3% of the value of installed systems, but only 8.6% of the number, whereas the manufacturing sector has 17.6% of the value and 22.0% of the number. This situation would not be substantially affected by the transfer of

[4] The data cards supplied to the Task Force by CIPS recorded 3622 computer systems installed in Canada as at May 1971. This figure differs from that of 3548 systems published in the 1971 census, and may be the result of more recent information.

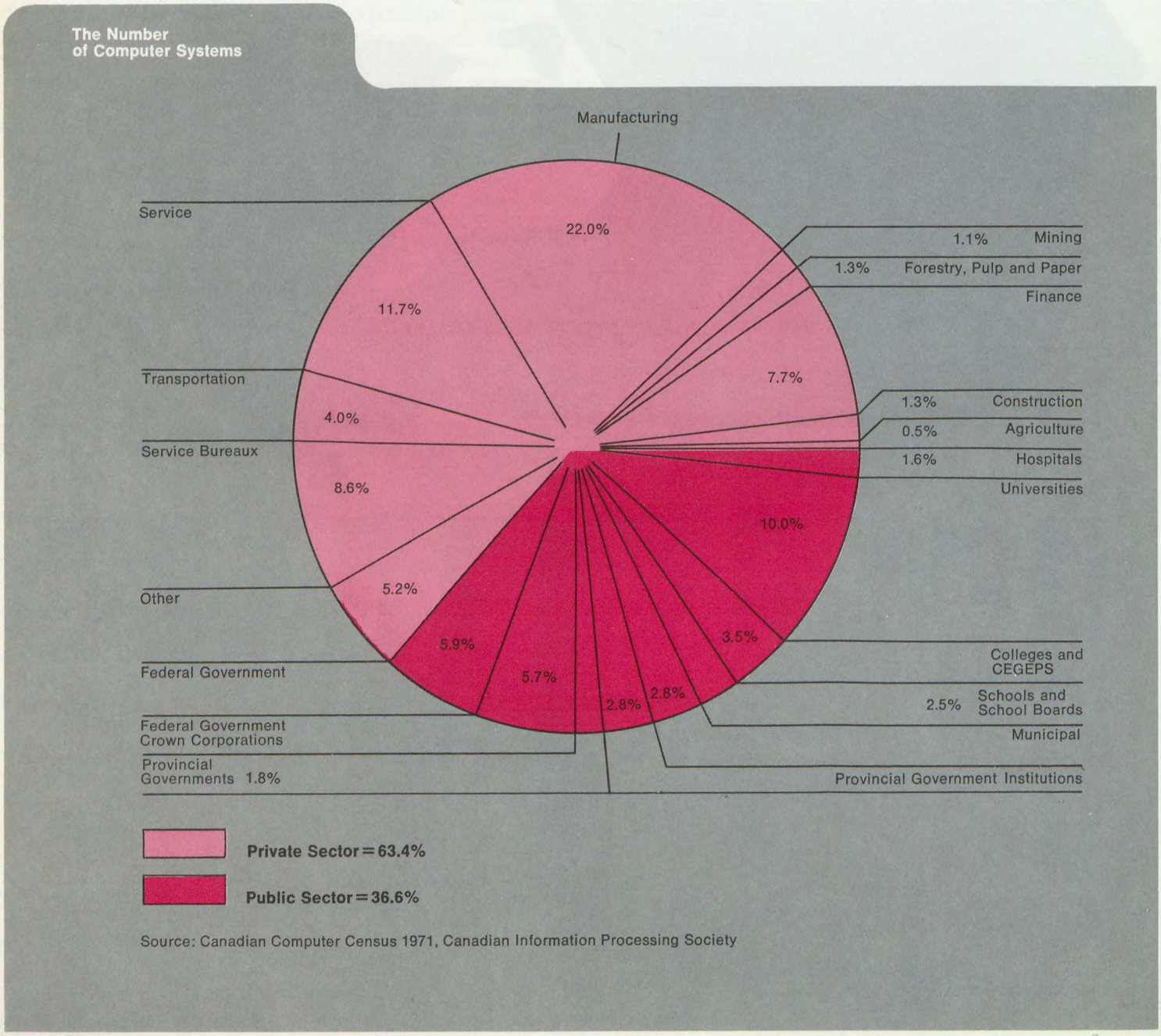
Figure 5

Geographic Distribution of Computers
by Number and Annual Rental Equivalent: May 1971



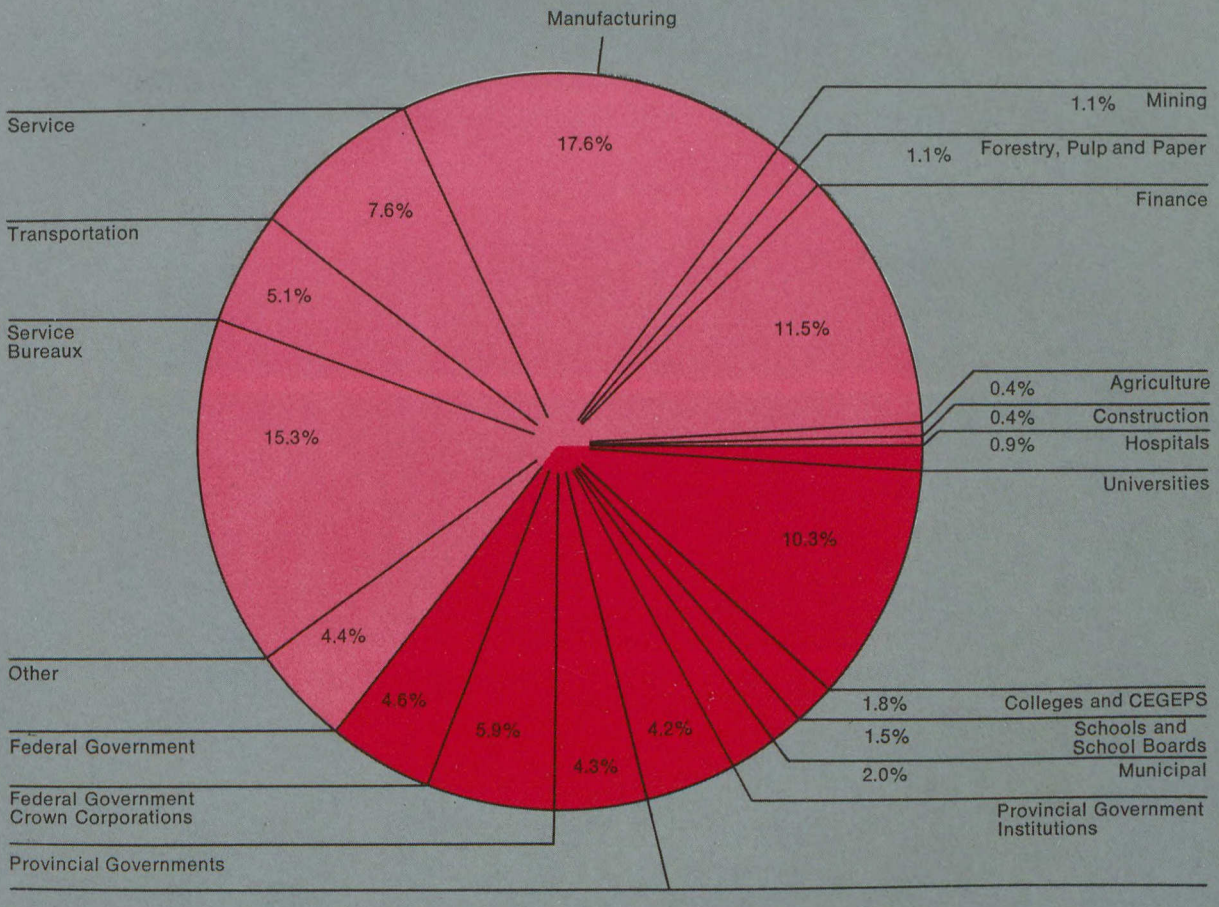
Source: CIPS Computer Census 1971

Figure 6
The Relative Distribution of the Number and Value of Computers by Economic and Institutional Sector in Service in Canada: May 1971



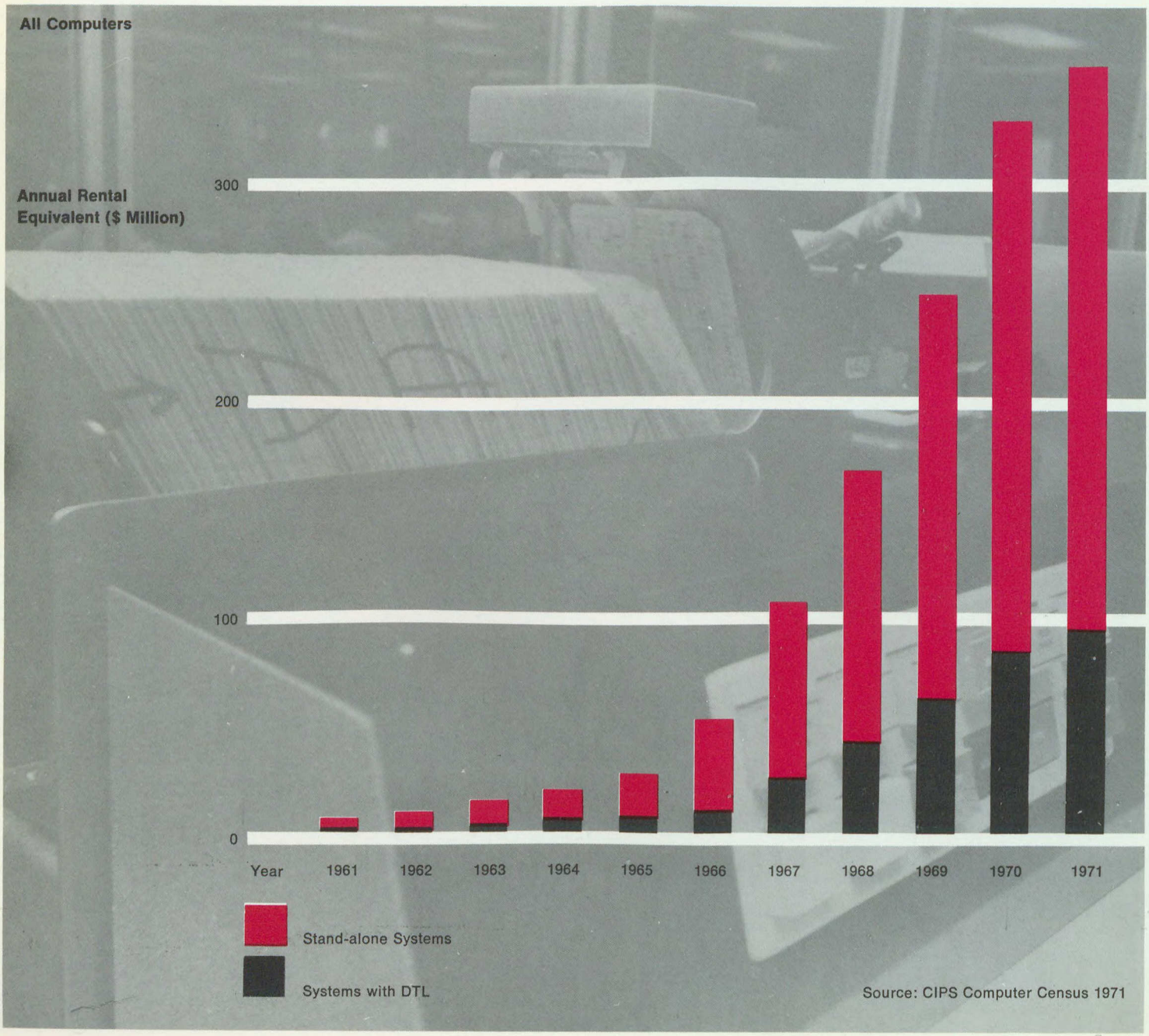
Source: Canadian Computer Census 1971, Canadian Information Processing Society

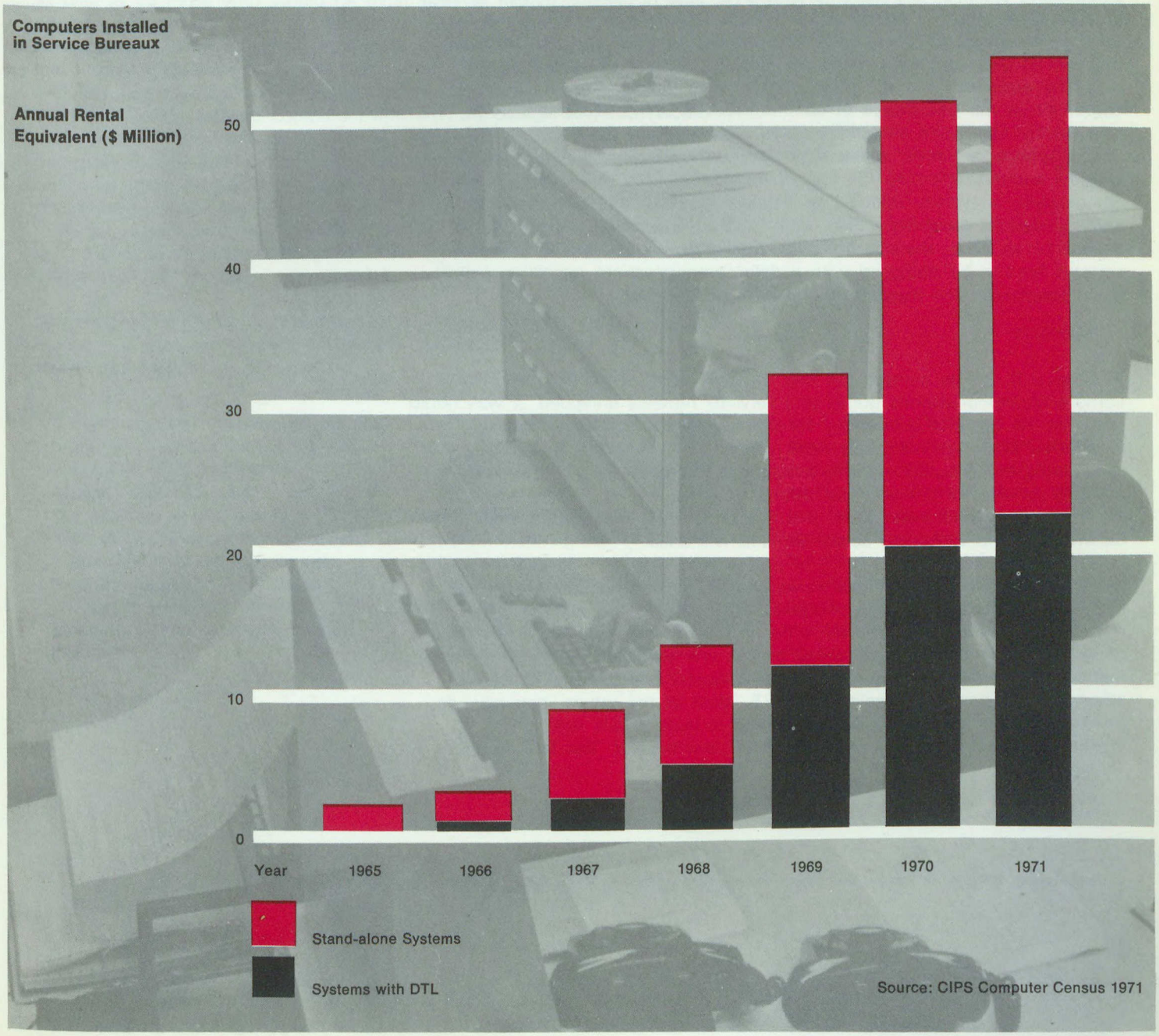
The Value of Computer Systems



Source: Canadian Computer Census 1971, Canadian Information Processing Society

Figure 7
The Value of Computers by Year of Installation in Service: May 1971




Computers Installed in Service Bureaux
Annual Rental Equivalent ($ Million)
50
40
30
20
10
0
Year
1965
1966
1967
1968
1969
1970
1971
Stand-alone Systems
Systems with DTL
Source: CIPS Computer Census 1971

entities from institutional to economic sectors, *e.g.*, from federal Crown Corporations to transportation, although the latter would, of course, gain a larger share.

It is informative also to look at those users which utilize data transmission facilities in conjunction with their computer systems. The CIPS computer census identifies these systems with the notation "DTL" (Data Transmission Link), which is described by CIPS as "computer to computer transmission". Figure 7 illustrates two dimensions of this use: first, the value of all systems in service in 1971, cumulatively by year of installation, showing separately stand-alone systems, and systems with DTL; second, service bureau systems in a similar manner. These diagrams depict the extent to which computer systems have become communications-oriented in total, and also in that segment of user-suppliers where the most prolific use of communications might be expected, that is, among the service bureaux. This is indeed confirmed by the percentage of communications usage: 13% and 27% respectively. One point should be noted, however, for the representations are not reflections of trends; rather they signify the age of installed computer systems without indicating the age of the attached communications capability. For example, a system reported as installed in 1965 may not have had a communications capability added until 1969. Thus, while the true trends may be difficult to trace, there is no doubt that more of the recently-installed systems tend to be equipped with a data communications capability, which again emphasizes the merging of the two technologies.

3. PROSPECTS

In Chapter II, it was pointed out that the bulk of the potential market for computer/communications goods and services remains untapped. It was noted also that the costs of technology for this market are still considered prohibitive. There are many questions which arise, therefore, when considering the prospects for the industry in this decade: questions relating primarily to whether the potential demand for services to the home and to small businesses will materialize, and if it does, what methods of delivery will be involved, and when the actual demand will arise.

Many attempts have been made in an effort to provide some answers, including the use of Delphi techniques.[5] Most of them predict that these developments will take place, but differ in their assessments as to the timing of their introduction and widespread use. A few studies, based on the limited number of experiments now in existence, suggest that some of these advances, will become a reality by 1975. Most of the others, however, do not see these developments occurring until at least 1980, with wide implementation extending to the year 2000 and beyond. The Task Force,

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[5] *Communications, Computers and Canada* (Trans-Canada Telephone System, November, 1971, revised December, 1971).

which is concerned primarily with developments in this decade, takes the view that widespread use of computers in, or connected to, the home is most unlikely before 1980. Small businesses, however, are much more likely to benefit from computer/ communications technology, particularly after 1975. In each instance, cost will be the key factor, although reliability and quality of service will be of great importance as well.

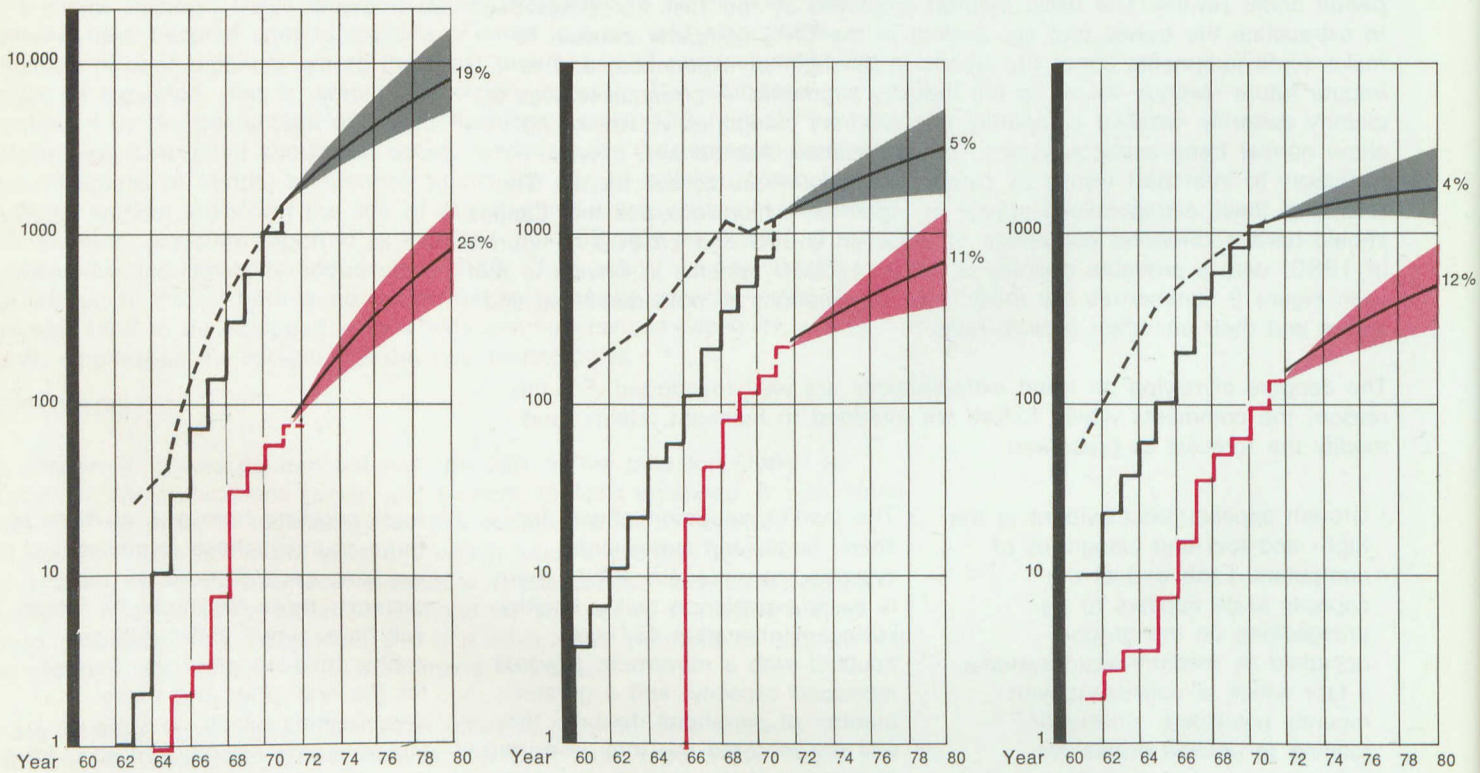
Where computing equipment is concerned, it is possible to take a more conventional approach to forecasting future requirements. Here, the problem is to measure the probable demand which will be generated by present users, as well as by those who would be most likely to join their ranks in the period under review. The basic method employed by the Task Force has been to extrapolate the trends that are evident in the CIPS computer census; to make some judgments about the trends in the light of experience; and to impute future revenue values to the industry segments. A prerequisite was to classify currently installed computers into arbitrary categories which would allow normal trend extrapolations to be undertaken. Additionally, it was necessary to infer past trends by category from previous census figures. The results of these extrapolations appear in Figure 8, which indicates that Canada should have a computer population of between 9,000 and 24,500 computers in 1980, with a probable quantity of about 15,000 systems in service in that year. Figure 9 summarizes the most likely expectations of both quantities and values and their attendant growth-rates.

The dangers of relying on trend extrapolations are well recognized. For this reason, the comments which follow are intended to highlight, clarify, and modify the forecast as presented:

- Growth appears most evident in the high- and low-end categories of computers. Each end of the capacity scale appears to be encroaching on the ground occupied by medium-sized systems, a fact which is consistent with recently published information[6] relating to unfilled orders for computers compared with those installed.
- The market saturation effects for small, large, and super-large systems are uncertain. While there is every expectation that a healthy replacement market will exist, coupled with a movement towards increased capacity, and a greater number of peripheral devices, this will not increase the total inventory of systems If the growth projections are to be realized, the demand must originate from one or more of three sources: those organizations requiring second, third, or more systems; those organizations which will have grown sufficiently to enable them to enter the market for the first time; and those organizations which, in spite of already being of sufficient size, have not thus far become users of in-house equipment.

[6] *EDP Industry Report* (International Data Corporation. Newtonville. Mass. August 31. 1971. and October 19. 1971)

Figure 8
Estimated Number of Computer Systems in Service by Size by
(i) All Systems, Including Year of Installation and Growth-Trends, and
(ii) Data Transmission Capability: 1960-1980



Mini-Computer Systems
Annual Rental
Equivalent $0 - 12000

Small Computer Systems
Annual Rental
Equivalent $12 - 60 Thousand

Medium Computer Systems
Annual Rental
Equivalent $60 - 240 Thousand

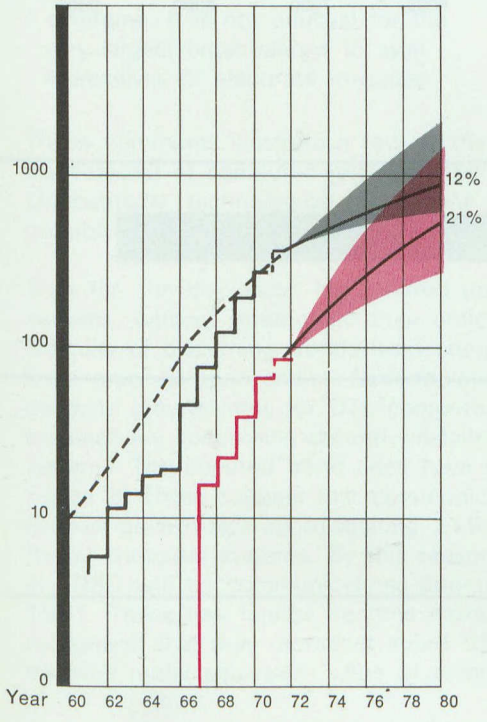
Legend

The Number of Computer Systems by Year of Installation in Service at May 1971

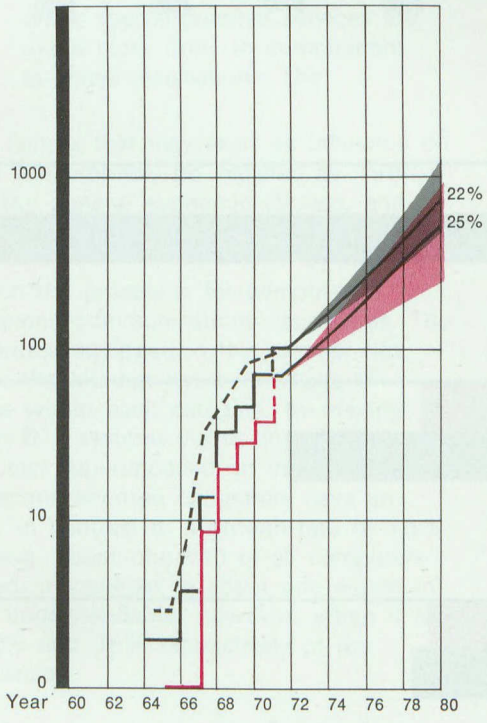
The Number of Computer Systems with DTL by Year of Installation in Service at May 1971

The Actual Number of Computers in Service in each Year 1960 to 1971

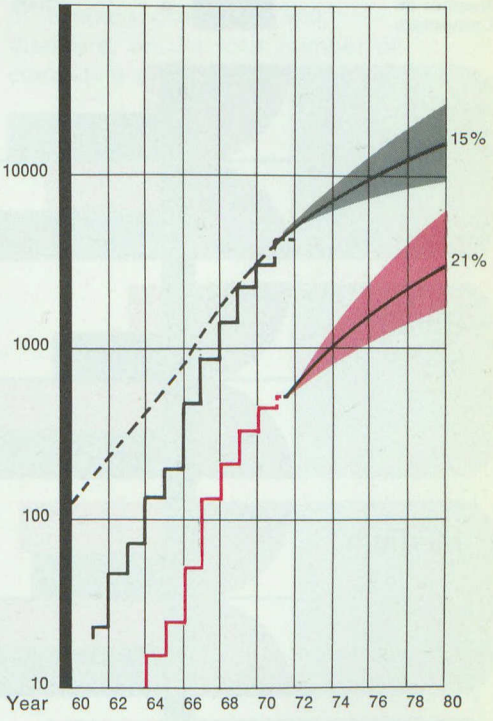
Upper and Lower Limits of the Projected Number of Computers in Service 1971 to 1980



Large Computer Systems
Annual Rental
Equivalent $240 - 600 Thousand



Super-Large Computer Systems
Annual Rental
Equivalent over $600 Thousand



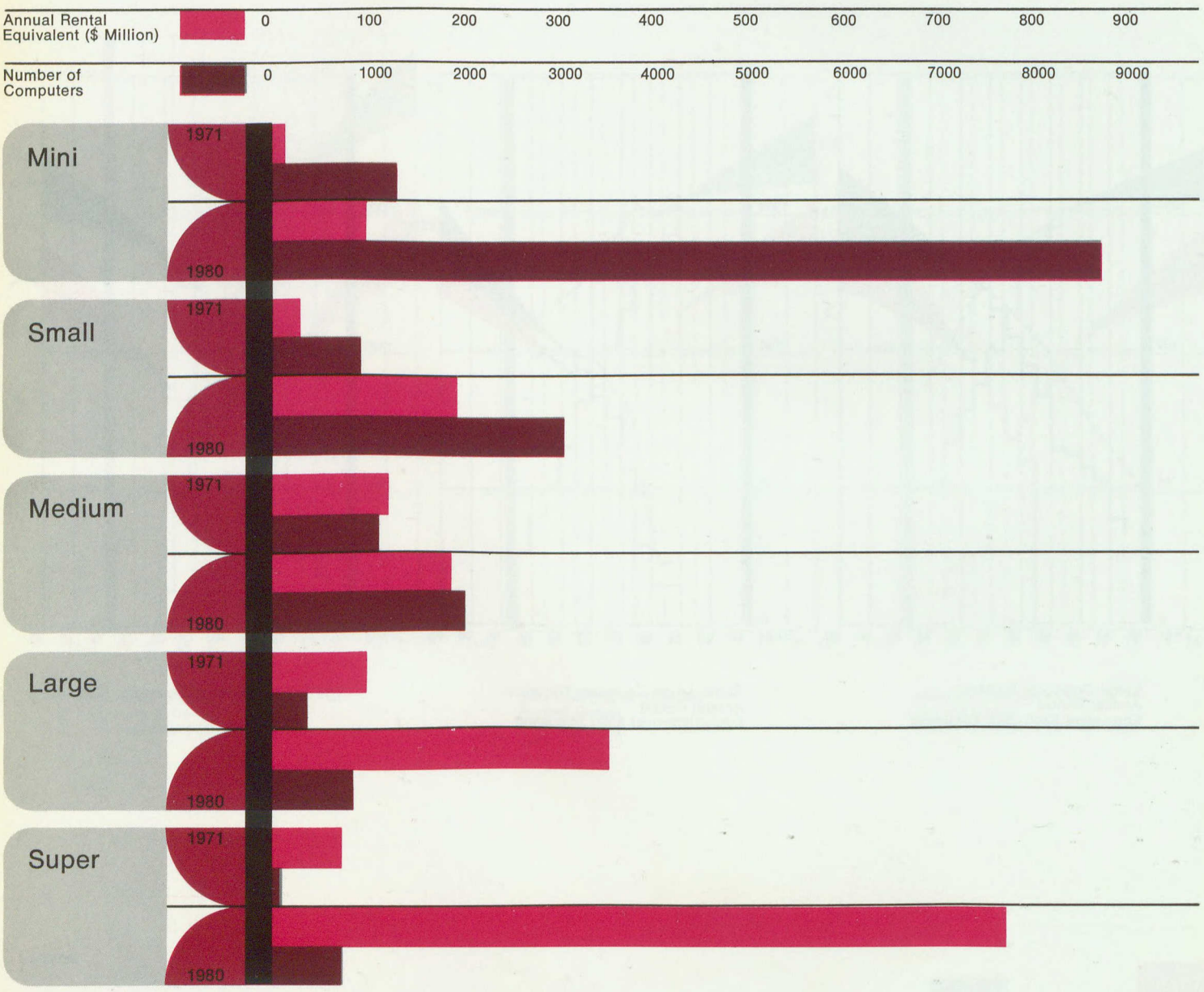
The Total Number of Computer Systems

Upper and Lower Limits of
the Projected Number of Computers
with DTL in Service 1971 to 1980

Nota Bene: Percentages Shown Indicate Compound Annual Median Growth-Rate

Source: CIPS Canadian Computer Census 1971 Projections CCC/TF

Figure 9
The Number of Computer Systems in Service in 1971 and Projected for 1980



Source: CIPS Computer Census 1971
Projections CCC/TF

- As a corollary to the market saturation effects, there are particular doubts about the growth of computer usage in the number of super-large systems to the extent predicted. It requires a very big organization to support annual expenditures approaching $2,000,000 for data processing activities, which is the basic amount required to operate such systems. There do not appear to be enough entities, either existing or being formed, which could support such expenditures in Canada. On the other hand, if economies of scale are seen to be emerging, new consortia, and mergers of government departmental systems, could be sufficiently numerous to attain the predicted growth.

- Services of the types provided by service bureaux both complement and compete with in-house systems. The nature of their impact on in-house installations is still emerging. It is not unusual for the very largest organizations to avail themselves of elaborate in-house systems, while also using service bureau facilities. It would seem probable that general-purpose computing services tend to reduce the number of in-house systems, while special-purpose services are much more likely to complement in-house installations. The increasing specialization which is becoming evident among service bureaux suggests therefore that these suppliers are unlikely to have a significant impact on the numbers of in-house computers and, therefore, on the total number of computers predicted.

These comments illustrate a few of the factors that may exert an influence on the forecast of computer systems which will probably be installed by 1980. Undoubtedly, technological innovations, the general economic climate, and possibly other influences could also affect the forecast substantially.

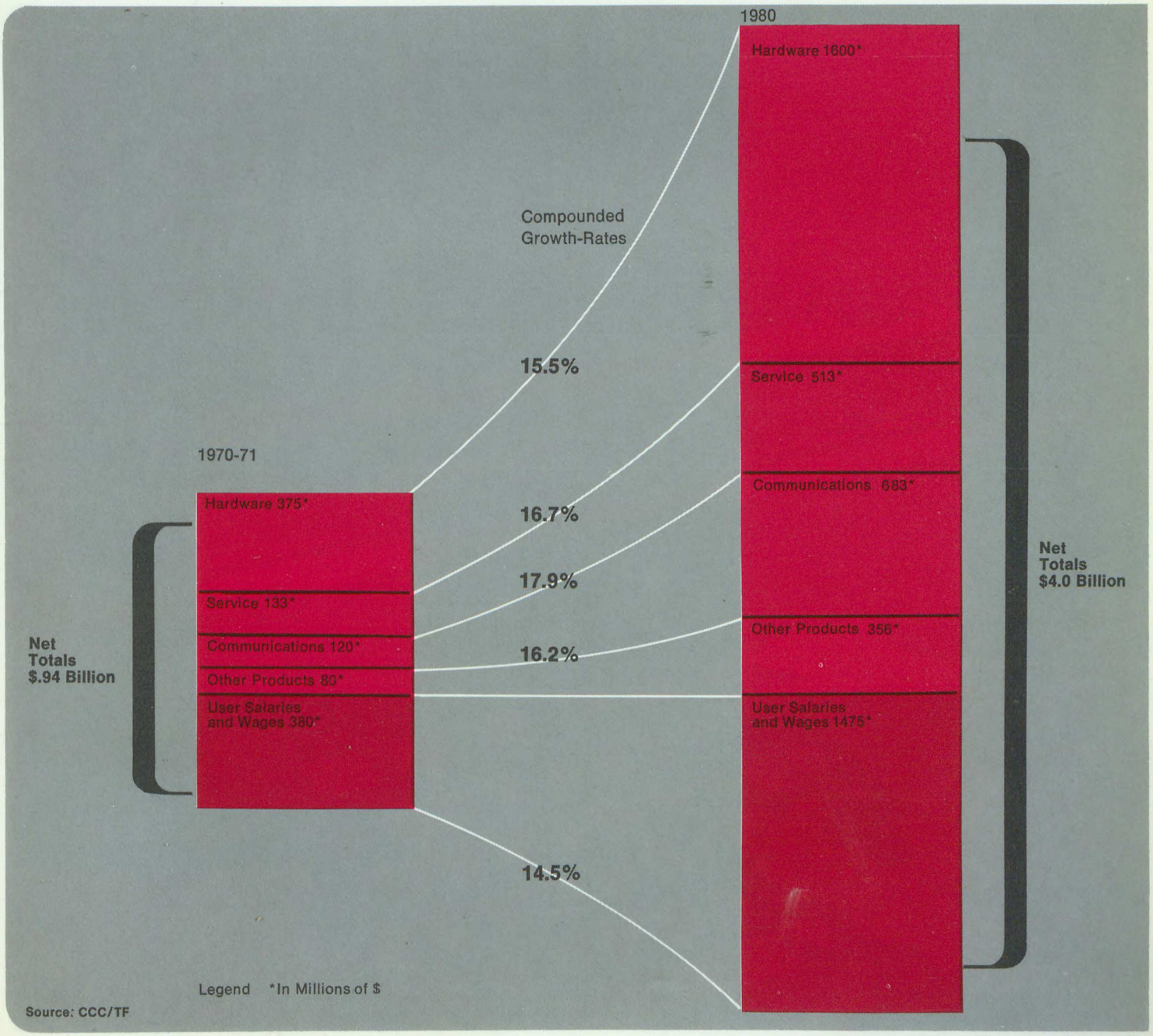
Thus far, the discussion has centred upon the prospects for computer systems, without referring to their anticipated communications capabilities. The difficulty of discerning trends from computers equipped in this manner has been touched upon earlier. Nevertheless, the attempt has been made to estimate growth-rates for DTL computers within each category, by making assumptions concerning recently-installed DTL systems versus total DTL systems. The imputed trend lines have been superimposed on the diagrams in Figure 8. These suggest that communications-oriented computers have an over-all growth-rate approximating 21%, in contrast to a growth-rate of 15% for all computer systems. By this reasoning, about one-fifth of all computers in 1980 will be communications-oriented, in contrast to about one-eighth in 1971. These low figures become more understandable, however, when it is recognized that they represent about 55% and 26% respectively of the installed rental equivalent value of computers.

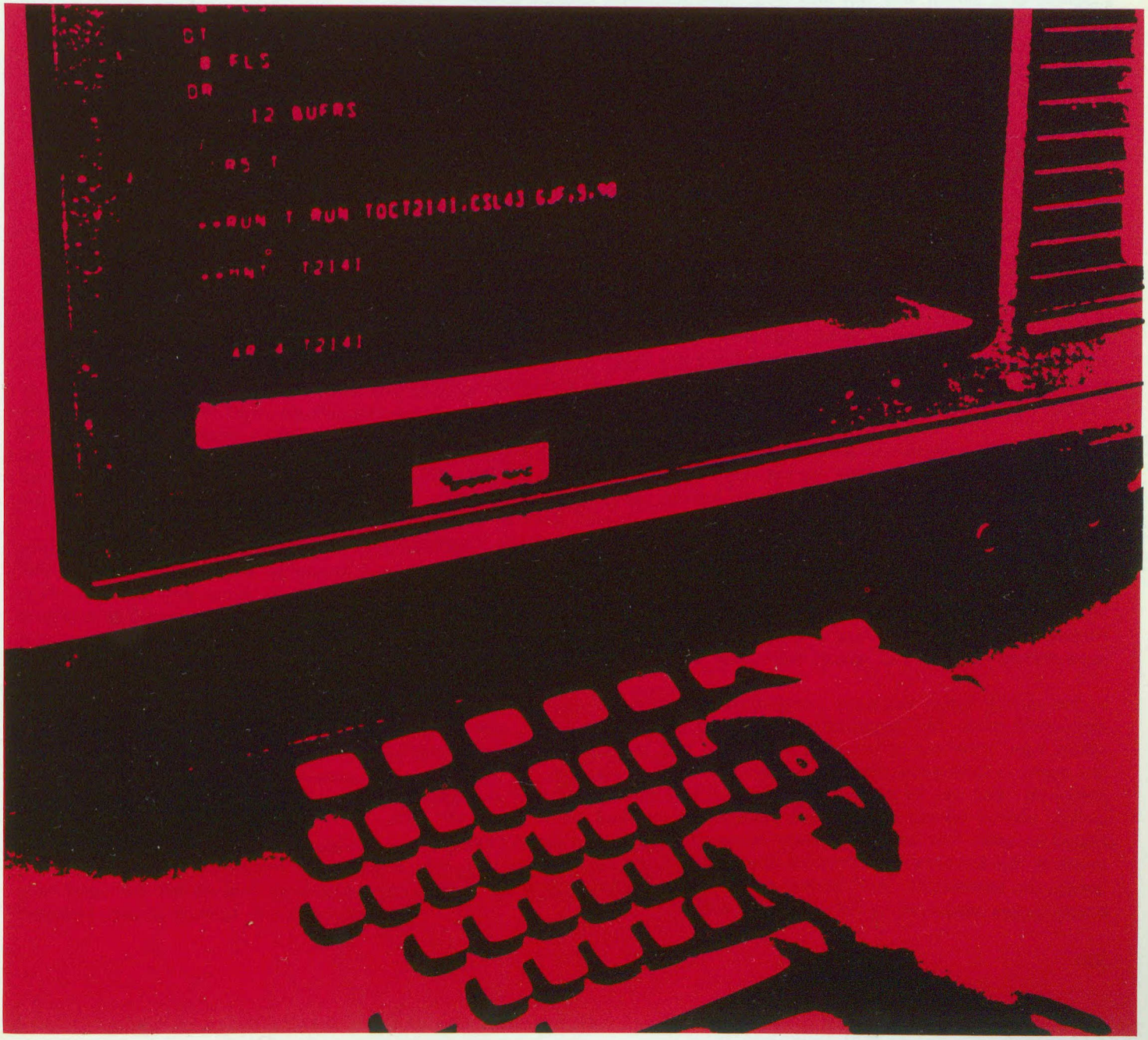
These statistics do not by any means reflect the whole story of computer/communications. Within this activity a growing number of devices which complement the computer have come upon the scene. The particular reference here is to computer terminals. A recent estimate suggests that there are over 500 models of terminals available, but this information does not assist in either defining or quantifying these devices. Their characteristics range all the way from a sophisticated input-output station, in which a small computer may be involved, to a Touch-Tone telephone set which may be used to interrogate a computer file and to receive a response in voice answer-back form. The fact that a very large computer, operated in conjunction with appropriate concentrating facilities, can manage hundreds of terminals suggests that these devices, perhaps together with the requisite data

sets, are better determinants of usage and growth of data transmission than are DTL computers. Unfortunately, the available statistics, where terminals and data sets are concerned, leave much to be desired. Apart from the special case of telephone-type terminals, the Task Force estimates that there were in the order of 50,000 data terminals installed in Canada in 1970-71, of which 21,000 were TELEX and 4,000 TWX; the remainder cover the spectrum of data terminals, both on- and off-line, but the bulk of these fall into the low-speed category. An over-all growth-rate of not less than 20% to 1980 may be anticipated, yielding an estimated 310,000 installed data terminals at that time. This growth-rate is based on a combination of factors, including the growth in the number of DTL-equipped computers, and increases in the number of TELEX and TWX terminals, and is somewhat less than current predictions for terminal installation growth-rates in the United States.

Bearing in mind the provisos mentioned at the beginning of this sub-section, the growth in industry values, based upon the predictions above, rises from the previously-mentioned $937 million in 1970-71, to an estimated $4 billion in 1980. This represents an over-all industry growth-rate of 15.6%, and a rise in terms of economic output from about 1% GNP in 1970-71 to 2% GNP in 1980. Figure 10 illustrates the growth of the industry by segment and by total, after deductions for inter-segment trade, from 1970-71 to 1980.

Figure 10
Industry Revenue Estimates




12 BUFFS

1. SUPPLIERS

The industry consists of some 500 supplier-organizations, which range in size from a small services firm to a very large subsidiary of a multi-national computer manufacturing corporation, where the latter type of organization may be actively engaged in as many as three of the four supply segments. With such diversities of size and interests to consider, it is apparent that the needs and problems of suppliers can be very different. Common needs and problems, therefore, probably do not extend beyond the bounds of supply segments, and, even within a particular segment, it is likely that only suppliers of a similar size will find they share the same types of problem. The situation is further complicated by the fact that, in the competitive environment which largely prevails, one supplier's problem is often another supplier's opportunity. Any particular supplier, however, probably conceives of his difficulties as arising from one or a combination of four sources:

- From his immediate competitors in the same supply segment;
- from suppliers in other segments on whom he must rely for the provision of services or equipment;
- from organizations outside the industry which may provide key inputs without which he could not operate his business;
- from governments which may or may not be providing an environment in which he can operate successfully.

(a) Problems Arising from the Competitive Environment

In three of the four supply segments (hardware, service, and "other product") a competitive environment exists, where competitive bidding for equipment and service contracts and volume discounting are much in evidence. In this situation, the primary concerns expressed by some of the participants relate to "unfair" competition or "unfair" practices.

With regard to competition among hardware suppliers, widespread concern has been expressed about the market dominance of IBM. It is alleged, and with some justification, that its inordinate market share results in *de facto* standards being set for the whole industry in such diverse areas as computer systems architecture, input/output format dimensions, programming languages, and code specifications. To some degree, this has given rise to either a "follow the leader" attitude, or to competing in those niches where IBM is less pervasive. In reality, this has meant that any new entrants to the hardware supply segment face enormous obstacles in the scale of expenditures necessary to obtain more than a very small share of the market.

In the service supply segment, competitive pressures are most acute. In addition to some 250 organizations identified by the Task Force, about 90 others have gone out of business in the last two to three years. The reasons are many: under-capitalization, over-capacity, lack of planning, lack of marketing, and lack of service specialization and differentiation. In this same period, service bureau organizations have also expressed growing concern with regard to what they see as "unfair" competition, which is developing as a result of the entrance or continued operations of the common carriers, the banks, the universities, and, to some extent, the hardware suppliers. These problems are discussed in Part C of this Report.

The "other product" supply segment is characterized by having perhaps the fewest problems. A competitive but profitable environment exists, where the focus of concern centres upon potential product obsolescence. Studies by some of the participants have been undertaken to determine, for example, the future prospects for continuous print-out forms in the face of competition from visual display units.

(b) Problems Caused by Inter-Segment Supply

The segment most affected by the actions of other industry participants is the service supply segment. Essentially, companies in this segment are placed in the position of users of equipment and services, and they suffer from almost the same needs and problems as many of the users they attempt to serve. Many of their difficulties, particularly those of the service bureaux, are brought about by their comparative sophistication. This is because a high degree of efficiency in the use of equipment, service and personnel, is mandatory in order to maintain or achieve profitability. If any of these three elements essential to their operations falls short of expected performance, the results may have a critical effect on the organization's ability to remain in business. In this respect, they probably differ from the average user. The focus of their needs, and the potential or actual cause of some of their problems, is related to hardware and communications supply.

"Hardware" in this context is perhaps the wrong designation, because the service supply segment's concern here focuses upon operating systems, executive, and communications software. Traditionally, the hardware manufacturers have been the supply source of these key items, but because of their extremely complex nature and the uses to which they are put, it has become necessary for many service bureaux to modify and maintain such software. The associated modification and maintenance costs to a particular service bureau often verge on the prohibitive, and are frequently viewed as non-productive functions. On the other hand, the absorption of these costs by the service bureaux represents a cost-saving for users or potential users.

With regard to data communications services, Task Force interviews indicate that most of the concerns expressed by the service segment center upon price, and that they range all the way from dissatisfaction with the pricing structure as being unsuited to the characteristics of data transmission, to frustration with the large differentials between U.S. and Canadian data transmission prices. In the long run, such differentials are seen by the service bureaux as one of the major factors which could induce Canadian users to be served from the United States. Furthermore, since a large part of service bureau costs are fixed, the volume of business is the primary factor affecting profitability. The price of data transmission enters into this equation because, in general, it effectively circumscribes the geographic area which may be served, which in turn limits the potential volume of business.

Other concerns focus upon the quality and reliability of service provided by the common carriers. In some instances, it has been stated that transmission error rates still remain at a level which jeopardizes the business relationship between service bureaux and their clients.

A normal competitive situation does not exist in the data communications supply segment. Here, the traditional common carriers, *i.e.*, the telephone and telegraph companies, have co-existed in serving prescribed sections of the telecommunications market. With the increasing requirement for data communications, both have responded to market demand, and a competitive situation is said to exist mostly in factors other than price. Consequently, the competitive pressures are probably limited to such items as the range of services offered; the quality of services; the availability of maintenance; and perhaps the image the companies portray. The rate of growth in the communications field as a whole has resulted in there being a major need for this segment to continue large-scale investment funding for upgrading facilities and plant extension. Entry by new organizations into this segment as common carriers is effectively prohibited by the necessity of obtaining rights of way, or an allocation of the frequency spectrum, and possibly by precedents relating to monopoly service.

(c) Problems Arising from Outside the Industry

Apart from the consideration of government actions, perhaps the foremost problem arising from outside the industry is the relatively small size of the Canadian market. It affects all segments of the industry to some degree, but particularly those supply functions which depend on economies of scale for maintaining internationally competitive prices for products and services. In hardware, this factor is evident in short production runs and disproportionate marketing costs; in services, the market potential is limited to a small number of major towns and cities; in data communications, the transmission volumes are still a relatively insignificant part of total communications volumes; and "other products" suffer from the same limitations as hardware.

Another problem relates to the availability of venture capital in Canada. Much concern has been expressed, particularly by the smaller and medium-sized suppliers in the service segment, that such organizations as Canadian banks, financial institutions, and the money markets generally, are unable or unwilling to provide initial and continuing capital requirements for high-technology areas at reasonable cost. This would include needs for the financing of leasing arrangements. It has long been recognized that Canadian investors have been conservative in their support of new areas of endeavour and in this regard the computer/communications industry is no different from any of the other emergent industries. Furthermore, this reluctance is not surprising in view of the poor financial record of many of the entities in the service segment, and of a much smaller number in the hardware supply segment. It may have been presumed that problems associated with the supply of capital from Canadian sources would be overcome when companies within the segments under consideration have demonstrated consistently profitable operations, but there is some evidence to suggest that even this may be insufficient to loosen the most conservative purse-strings.

(d) Problems Arising from Government-Industry Interactions

This situation is perhaps the most difficult to describe. The range of concern encompasses the very general to the very specific; from problems relating to rates of taxation, to government support of research and development costs for software packages. Given this wide variety of interests, and the range of products and services in the computer/communications field, it is difficult to summarize the industry's concern with regard to the over-all business climate as influenced by government. Undoubtedly, no supplier can afford to be uninterested, because the events of 1970-71 have dispelled any doubt that economic conditions are determinants of the level of user activity. As regards specific support, however, the concerns of the industry have been expressed to the Task Force as follows:

- Some government support programmes are available; the difficulty is in knowing which are available, which are appropriate to computer/communications, which to apply for, and where to apply.
- There is a general belief that there are no workable support programmes for software development, in contrast to hardware and equipment support programmes.
- There is concern that support, once applied for, takes an inordinate length of time to materialize, due in large measure to what appears to be a process of interminable negotiations.
- Due to the general nature of government support programmes, there does not appear to be recognition of specific needs in the light of technological developments. Software-hardware combinations are cited.
- Some suppliers regard the current lack of support beyond the development stage as effectively deterring viable long-term innovation. They cite marketing costs as the prime expense in the new product or service cycle.
- There is a widely-held belief in the service segment that insufficient government internal data processing is in the hands of commercial service bureaux.
- There is concern that when a new product or service has received support by government, the departments do not demonstrate their faith by placing significant orders for the product or service for their own use.
- There is concern that information relating to Canadian-developed products and services does not receive the widest possible circulation within governmental departments.
- There is a belief that, as long as the criteria for support remain unknown, some applications for financial assistance are rejected for reasons unconnected with the purpose of the aid.
- There is concern that the imposition of customs duties and excise taxes on imported hardware no longer serve the purposes intended. Since these additional elements of cost must be passed along to the customer, they are viewed as factors which make foreign services more competitive by comparison.

While the situations described above do not cover the complete range of the computer/communications industry's needs and problems, they do highlight the main concerns expressed by the industry. Further discussion of this subject is contained in parts C and D.

2. USERS

Large and medium-size businesses and institutions comprise the great majority of users of computer/communications equipment and services at the present time. The purposes of these organizations cover the spectrum of economic and institutional activities, their computer/communications systems being applied to a large number of administrative and operational functions.

Many of these organizations were users of unit-record equipment and other electro-mechanical devices before the nineteen-sixties, so that the ideas associated with data manipulation were not entirely new to them when computers became commercially available. This may have been a handicap, for in many instances the concepts associated with unit records were carried over into the computer era. The advantages which the computer offered were often foregone in favour of relatively simple, discrete tasks which had previously been manual or semi-manual operations. Successive generations of computers have introduced increasing technological complexity in methods of operation, coupled with an enormous increase in speed. Emphasis in recent years on efficient operation of the machines and conversion to new generations of computers has forced the necessity of focussing on the technical problems involved, rather than upon satisfying the needs of users. The requirement for skilled manpower and new applications, plus the associated demand for more and more highly powered computation and storage devices, have combined to increase total computing costs to the point where they have come under intensive scrutiny in both the private and public sectors. There has been a concurrent re-evaluation of the computer's role and a reappraisal of its contribution.

The problems encountered by users were expressed to the Task Force in many briefs and submissions. These were very broad in range because, in general, the Task Force avoided asking particular questions of potential respondents in order to prevent pre-conditioned replies. As a result, the briefs revealed many diverse and independent viewpoints.

To gather supplementary, structured information, the Task Force undertook a number of user interviews to determine the status of computer/communications in different sectors of the economy; to assess the impact of past experience in computing; and to uncover trends, problems and issues relating to the future use of computer/communications. Apart from studying special computer/communications applications in financial, educational and hospital systems (Volume II) as well as reviewing studies done by other organizations, the Task Force interviewed a sample cross-section of computer users. The organizations approached included business and industries, data communications users, universities, federal government departments and provincial governments. In every case, the investigations attempted to cover a sufficiently broad and representative sample of users to ensure that valid conclusions could be drawn.

The major problems faced by users are shown in Table 2 at the end of this chapter. They have been extracted from many source documents and have been summarized by class of user. While the list of problems is by no means exhaustive, the tabulation is intended to highlight the main areas of concern which may be summarized as follows:

- Computer and communications costs for users are generally considered to be excessive. It is not always clear whether the results achieved are commensurate with the expenditures involved. There is much concern among users regarding ways and means of reducing these costs.
- The management and control of information processing systems have left much to be desired. Senior management, either by default or by lack of knowledge, has not exerted sufficient direction, while technical computer personnel have not paid sufficient attention to the needs of the organizations they serve.
- Despite progress, computer/communications has not yet reached technological maturity. There is much room for new types of application systems, hardware, software, and associated developments in standards and other areas.
- Education and training have been outpaced by the technological developments in computer/communications.

(a) Computer and Communications Costs

One of the major reasons for the current reappraisal of computer systems and their associated costs is connected with the high expectations accorded these machines a few years ago. The situation has been compounded by the widely-advertised, dramatic drop in cost per unit of computation. But neither this factor, nor the deeper involvement and added experience of computer systems personnel, seems to have resulted in more effective systems. The costs of operating computer installations have not declined, even if the amount of work accomplished has increased. In such circumstances, it is often easier to look for ways and means of cost-reduction than to redirect efforts towards greater effectiveness.

The most widespread concern of users was the need to reduce the cost of data communications services. Many future applications of computers will depend heavily on communications since the services will be shared by many users and will need access to remote computers and data banks. Data communications costs are considered by many users to be excessive, particularly because rates are higher in Canada than in the U.S., over equivalent distances. In some cases, high data communications costs are limiting the development of new systems which would be of economic advantage to users. Mechanisms for achieving cost-reduction, through more effective utilization and the expansion of competition are explored in more depth in Chapter IX.

Reduction of data communications costs is important in controlling the rate of increase in the costs of government data processing. As the volume of information handled by governments continues to grow, and as steps are taken to improve efficiencies and reduce costs, more communications services will be utilized.

In the private sector, the Task Force investigations showed that computing costs are under intensive scrutiny. The steps that are being taken to reduce and minimize increases in costs include a general trend towards centralization of hardware and of management control. More particularly, this includes the investigation and implementation of consortium arrangements whereby two or more companies are combining their computing requirements on larger machines so as to take advantage of the economies of scale. Many business and industry users are seeking means of reducing the costs of computer systems, program development and maintenance through the use of more sophisticated, higher-level systems definition and programming techniques. Methods for data acquisition, storage and retrieval are being studied and new approaches to improve efficiencies are being explored. In business and industry, trends towards systems which make greater use of data communications and remote-access capability have generated a need for lower data communications rates.

Many of the organizations interviewed have investigated the possibility of using commercial computing services to meet their needs. In the great majority of instances the investigations were launched because of the expected reduction of high computing costs, identified as one of the most significant user problems. Of the senior management respondents, 85% stated that cost-savings would be a primary inducement to the use of outside services. These managers were asked to specify the extent of the cost-reduction that would be necessary to induce them to convert to commercial services. Their responses may be summarized as follows:

Extent of Cost-Reduction Required	*Frequency Selected*
At least 10%	15%
At least 25%	70%
No estimate	15%

Clearly, commercial service bureaux have been unable to meet these price objectives, since few organizations have adopted the alternative of using commercial general-purpose computing facilities as a substitute for in-house capability.

Respondents cited other important factors which also inhibit their conversion to commercially offered services, including: (a) the uncertainties regarding the financial stability and consequent continuity of service from the commercial service organizations; (b) insecurity regarding unauthorized access to private data; (c) absence of assurances on the legal liability of the supplier in the event of non-performance or loss of data; (d) costs of conversion to machines different from the existing in-house facilities, and diversion of systems and programming efforts to this purpose; and (e), loss of direct control over an important, integral function of the business. Other considerations, which act as constraints on some organizations, are: (a) the uncertainties regarding future costs; (b) corporate policies; (c), special conditions, such as dedicated

facilities and special software or hardware configurations not readily duplicated by the commercial service organization. Whether or not these reasons are valid, they represent the present views of users, and changes in attitude must occur before there can be extensive replacement of private computer installations by commercial offerings.

(b) Planning and Control

The need for consistent and progressive policies and objectives for the proper development of computer/communications systems in organizations is broadly recognized in all sectors of the economy. Many of the computer systems now in use have, at best, little cost-effectiveness. This condition originates from the high rate of development of new systems and from the tremendous technological changes which have been incorporated since the original introduction of computers. Senior managers have had to rely on technical staff to provide the focus for planning and control and have not been able, for various reasons, to exercise sufficient managerial influence over current or future computer and communications activities. This function is now in a transitional phase where control is shifting to senior management. Technical computer personnel are finding it necessary to develop a greater awareness of management problems to reduce the communications gap and to lessen the effects of the dichotomy of technical and business aims.

Co-ordination with regard to the establishment of policies and objectives is needed between governments and other public institutions in areas of common interest and problems, *e.g.*, educational, hospital, municipal, and other systems.

Rationalization of university computing capability and greater standardization of university administrative systems and programs will necessitate greater co-operation among the institutions involved. The possibility of a Canadian Universities Network (CANUNET) is now being investigated and, in Quebec, the "Système d'information de gestion universitaire" (SIGU) is a joint project for the development of a group of administrative programs.

A prior requisite for such improvements in administrative processes in various parts of the public sector includes the definition of the ownership of, and authorization for, access to the data. Only by such means can the responsibility for maintenance of the necessary data banks be assigned and suitable procedures set up to prevent unauthorized retrieval, thus protecting the privacy and confidentiality of the data.

Another general problem which requires resolution before computer operations in both the private and public sectors can be made truly effective is to discover meaningful ways of assessing the real contribution of computer systems and programs. In the case of an industrial enterprise, the ultimate measure of the results of an undertaking is the difference between revenue and costs. Such measures are only partially effective where computers are concerned; even where systems have been designed to produce cost-savings,

means for determining the effectiveness of the systems are lacking, and while some procedures are now becoming available for this purpose, they are not yet sufficiently well-developed.

(c) Innovation and New Technology

A number of changes are needed in technology, both to hardware and software, as well as the evolution of new systems-concepts from their present stages, before the potential of computers and communications can be realized. For example, in data communications, present call set-up times are excessive for systems such as credit checking, which uses small amounts of input data and short response messages; the quality and integrity of transmission (error rate) is frequently inadequate; the quality varies among regions; and tariffs are inappropriate for specific applications. In commercial systems, the flexibility of computer programs and their responsiveness to environmental, organizational and other changes require improvement. New and better processes allowing individuals to interact directly with computer/communications systems are required. Present systems-design and programming procedures are time-consuming and cumbersome.

Further improvements in the capability of computer systems to interact with other computers would improve flexibility and usefulness. If, for example, private computer systems could interact easily with bank systems, improvements in payroll applications would be possible. Similarly, direct communication between separate ordering and invoicing systems would further speed these processes. The efficiency of the exchange of data between business and government could be improved by automation.

As computer systems are developed which extend beyond individual organizations, assured ways of protecting the privacy and confidentiality of data, particularly in sensitive government areas, will be needed. Standards are a prerequisite for interconnection of systems and will have to be adopted for data formats and structures, for system interfaces, for codes to identify individuals and other information and for those parts of programs which are common to many users. Data communications links will become essential, so that systems can be integrated and data efficiently exchanged.

While many varieties of computer hardware and peripheral equipment are already available on the market, the cost of some types of equipment, particularly terminals, remains too high to meet the economic requirements of some systems, such as credit card checking.

(d) Training and Education

Computer training and education have not kept pace with the rapid advance of computer/communications technology and its increasing ubiquity. As more individuals entering business or government service are required to interact

with computers in their daily tasks, there is a growing need for them to have a basic understanding of computer functions. There will be an increasing necessity for students to experience a general exposure to computers at an early stage of the educational process.

Although the universities and colleges are producing graduates trained in computer sciences and programming, Task Force investigations showed that much of the training of computer systems analysts and programmers is undertaken within the organizations in which they work. This method is exceptional in comparison with the majority of disciplines and reflects the need for more appropriate training programs than now exist. Attempts are being made by some technical associations, in conjunction with educational institutions and with business and industry, to improve training courses.

In the future, systems analysts will need greater understanding of the administrative, managerial, and interactive processes within their employer-organizations. To produce such generalists will require multi-disciplinary educational programs, few of which are in existence today. Since the educational requirements, particularly for systems analysts, are not yet well defined, it is not surprising that accreditation of computer professionals, similar to that of engineers and accountants, is not at present widely regarded as practicable. As the computer profession matures, recognition of professionalism through accreditation and the availability of sufficient well-trained personnel, might help to reduce the turn-over of staff which is now a considerable problem in some organizations.

Table 2
User — Needs and Problems Summary

Business and Industry

1. Greater involvement of management in the planning of computer applications and improved management training.
2. Communication gap between management and computer technologists — need for a service rather than a technical orientation.
3. Improved means of evaluating the operating and development effectiveness of the computer's contribution.
4. Reduced costs of systems development and programming.
5. Reduced cost and improved quality of data transmission.
6. Increased flexibility and responsiveness of computer systems — need for new developments in this field.
7. Improved training of computer technical staff — multidisciplinary approach to training systems-analysts.
8. Reduced overall costs of computing through centralization or other means.
9. Data and systems security, protection of privacy and confidentiality of business data.
10. New hardware developments and systems concepts to meet present unfilled needs.
11. Introduction of computer training at an earlier stage of the general education process.
12. Means of exchanging data between different businesses and between government and businesses more effectively — system interconnection.
13. Development of more effective and lower cost data management and systems development technologies.

Federal Government

1. Consistent policies and objectives for development of computer systems, and for planning and co-ordinating government computing activities.
2. High security requirements for sensitive data (*e.g.*, DND and RCMP) and protection of confidentiality of data in other cases.
3. Reduced duplication in systems development between departments, exchange of information on available systems.
4. Standardization of data to support functional computing centres and for various other purposes.
5. Reduced growth-rates in computer and communications costs.
6. Reduced staff turnover and improved availability of high quality staff.
7. Access to computing capability for all regions of Canada.
8. Defined authority for "ownership" and access to data.
9. Improved management of computing centres with more emphasis on service as opposed to hardware and software considerations.
10. Improved assessment and reporting of the contribution of computers.
11. Resolution of the problems of dehumanization and depersonalization resulting from extended use of computers.
12. Resolution of foreign ownership and control issue.

Provincial Governments

1. Co-ordination between various provincial governments and with the federal Government in the development of common policies and objectives on common problems.
2. Definition of areas of jurisdiction and co-ordination with other communications problems.
3. Availability of computer and communications services to support industry, particularly in under-industrialized areas.
4. Protection of civil rights of provincial citizens, particularly as regards privacy and control of data and avoidance of depersonalization.
5. Attracting and holding trained computer personnel, especially in remote provincial areas.
6. Dissemination of information on computer systems developments to avoid duplication of effort.
7. Computer standards for data, hardware interfaces and common individual identification.
8. Lower communications costs and resolution of the problems of poor data communications in some remote areas.
9. Maintenance of the economic and technical integrity of provincial telecommunications carrier networks.

Universities

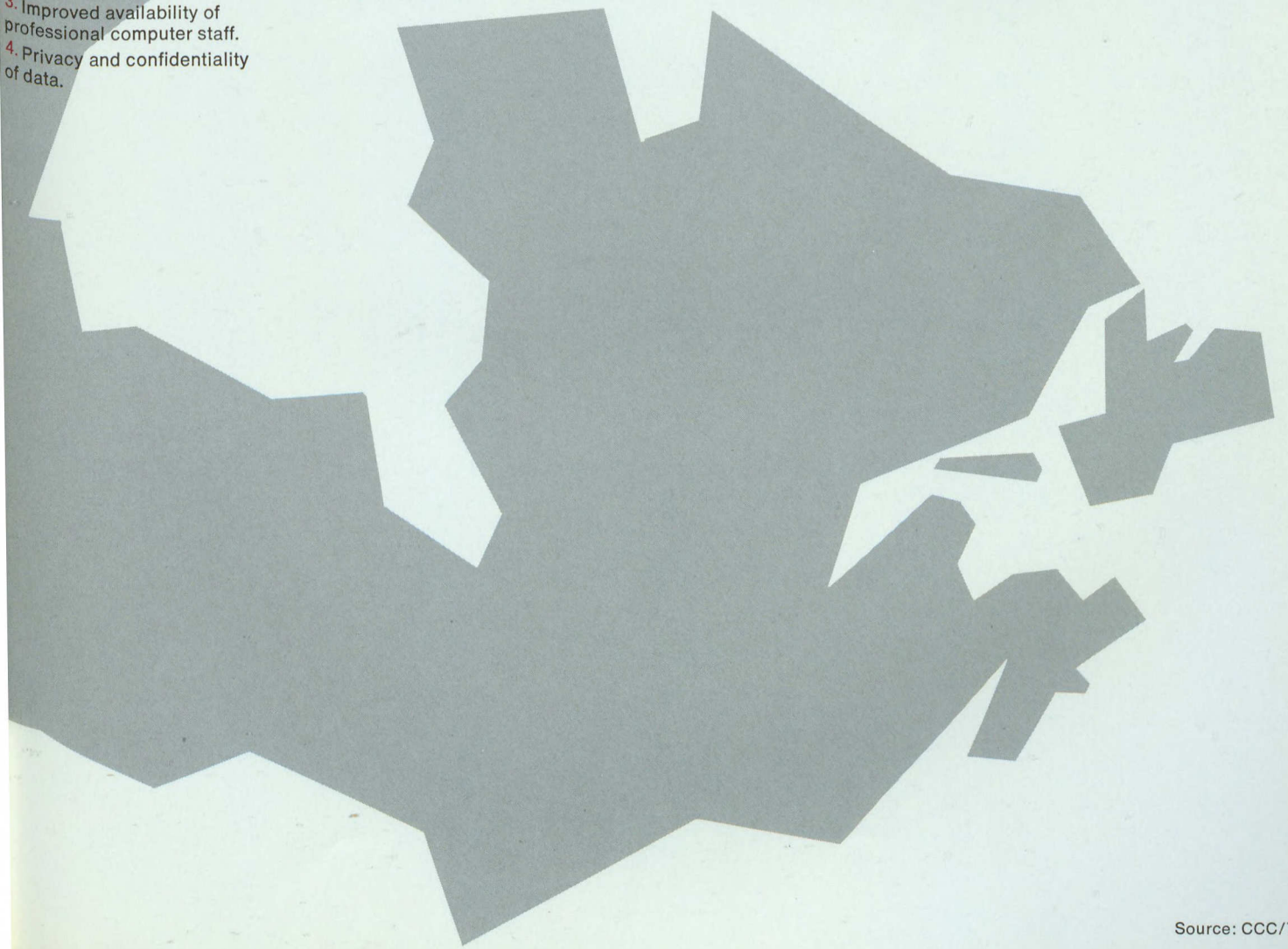
1. Continually increasing need for expanded computing capability to satisfy larger demand and increasingly complex research problems.
2. Stabilization of computing costs.
3. Ability for each to have knowledge of and access to developments at other universities, such as data banks for research, etc. — requires information exchange procedures, low-cost communications and standard data formats.
4. Rationalization of computing capability and standardization of administrative procedures and programs.
5. Improvements in ease of student access to computing capability and improved service to students.

Municipal Governments

1. Co-operation with federal and provincial governments to avoid duplication of work on such matters as census data, vehicle registration, etc.
2. Standards, particularly for personal identification.
3. Improved availability of professional computer staff.
4. Privacy and confidentiality of data.

General

1. Legal protection of copyright on systems and programming.
2. High quality and integrity of data transmission.
3. Removal of restrictive tariffs and technological improvements in data communications.

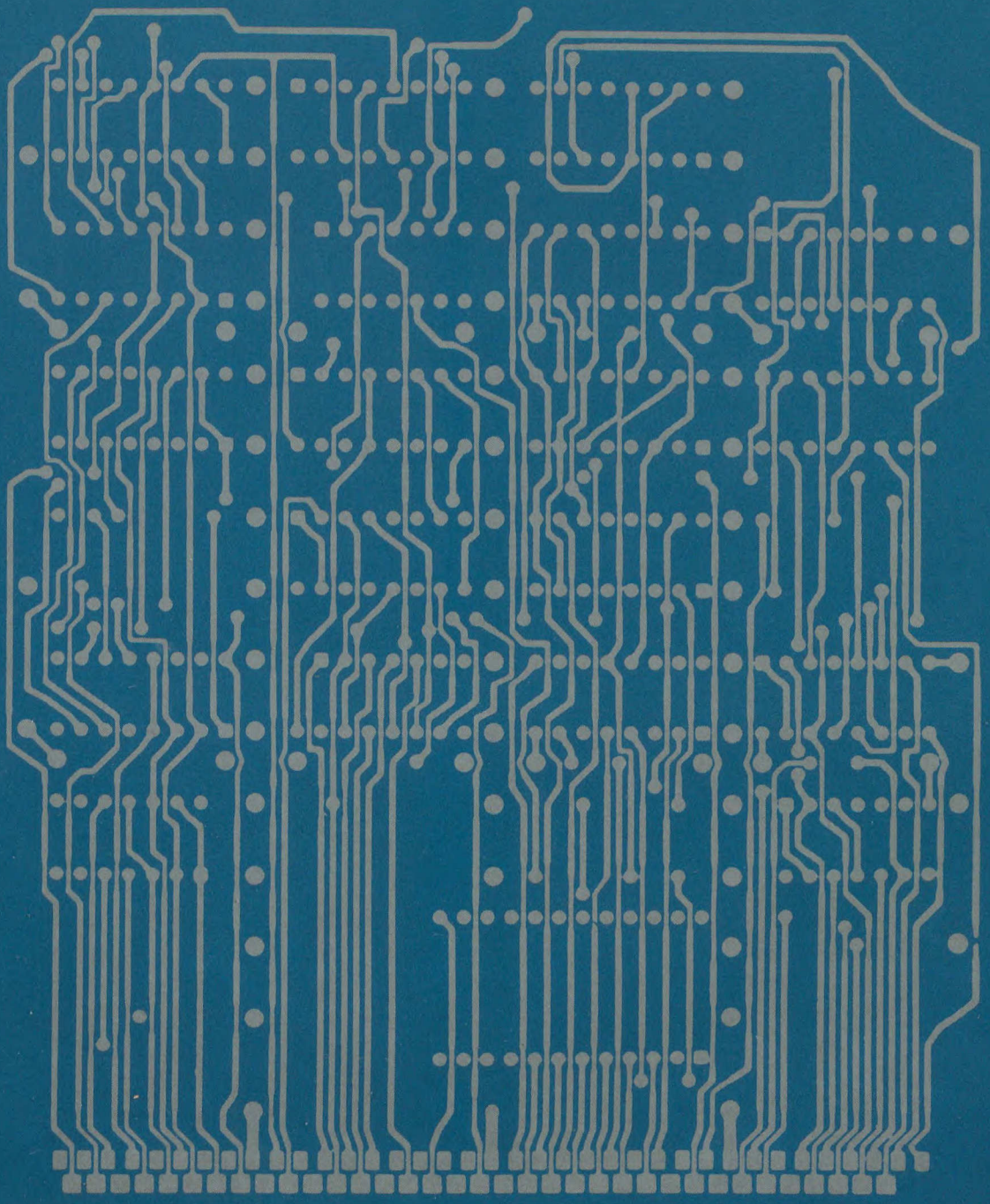


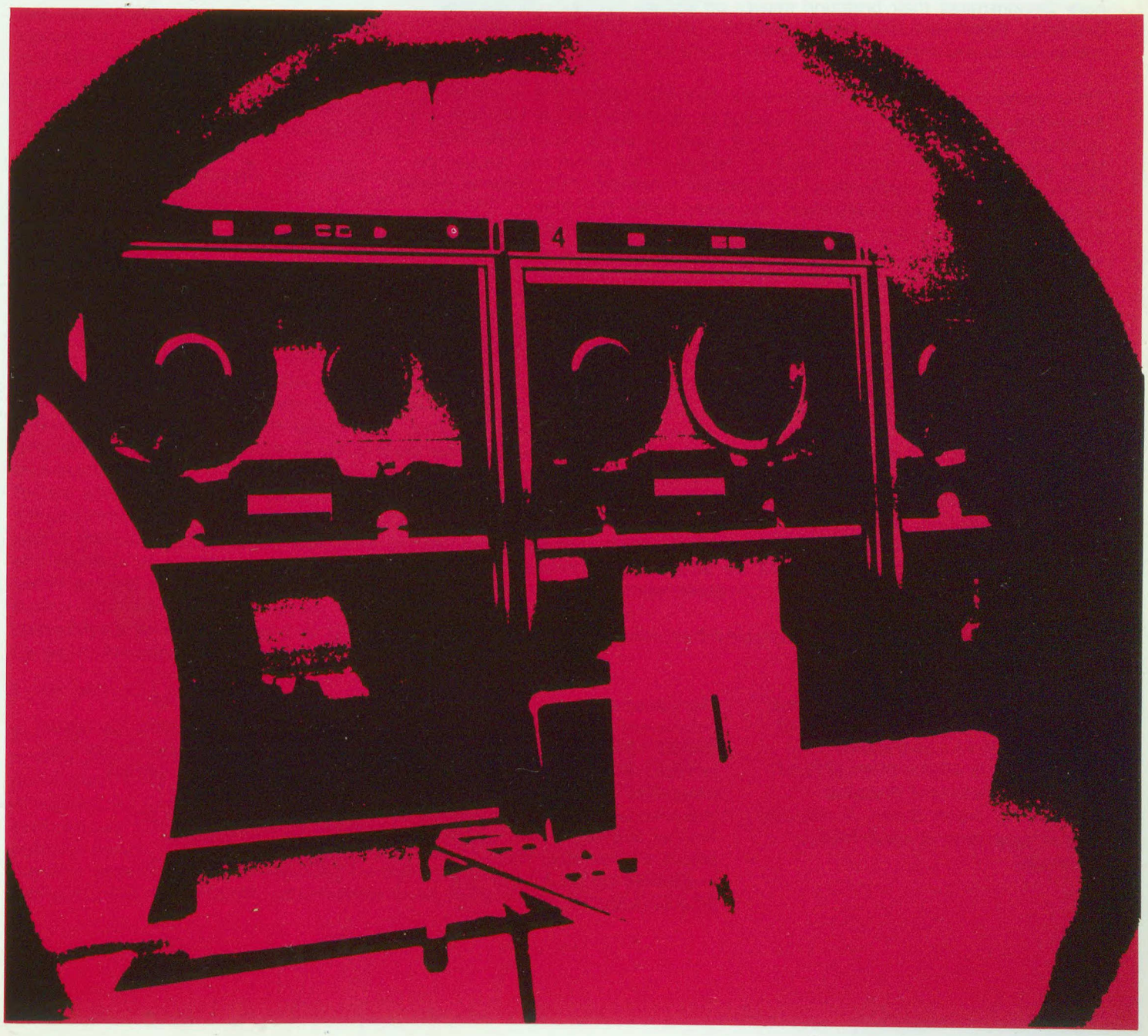
Source: CCC/TF

Part

8

Policies and General Recommendations





Remote access to computers is now an indispensable tool in the operation and administration of large and medium-sized industrial and business undertakings. It is becoming increasingly vital to the degree of efficiency required to maintain a competitive position in national and international markets.

At the same time, in the public sector all levels of government — federal, provincial and local — are finding growing benefits in the possibilities of rapid information storage, distribution and retrieval through computer/communications technology. Already, these applications in the public domain have demonstrated their profound impact on society by their role in crime detection, health care and welfare, national security, financial transactions, transportation and manpower deployment, to give some prime examples.

Thus, computers and communications are intricately involved in the economic functioning of the nation and have started to show their social significance in applications which reach into the lives of every individual. At present, this latter process is in its infancy, but it is expected that within this decade the public at large will experience a much greater involvement in computer-based systems which will eventually reach into every home. Education, entertainment, information services, community interaction, shopping services, will extend the sphere of computers from their present role, namely in business, industry and government, into all segments of society.

It is this pervasiveness of computers and communications and their penetration into every aspect of professional and private life which is the subject of concern and study all over the world.

1. THE CANADIAN PROBLEM OUTLINED

Theories, policies and experience in other countries may be of interest for the purpose of a comparative evaluation, but they cannot be directly applied to the Canadian situation. Geographical and physical conditions, demographic and industrial distribution, regional differences and disparities, bilingualism, the constitutional separation of powers, the political system, and the social and economic structure peculiar to Canada are of greatest significance in the assessment of solutions for Canadian computer/communications problems.

In summary, though by necessity over-simplified, the main contributing factors are:

- The basic technology of computers is almost entirely in the control of foreign-owned corporations. Equipment is mostly manufactured outside Canada and imported, subject to import duties. A relatively small proportion is assembled in Canada.
- The Canadian market for commercial computer services is limited. Therefore, the scale of commercial operations, with a few exceptions in the highly industrialized areas of the country, has not reached a level which allows a satisfactory return on investment for equipment and programming.
- The widespread use of communication networks for remote access to computer operations has not yet materialized, partially because of prevailing communications rates and limitations of available communication services.

- The sheer dynamics, capacity and associated economics of U.S.-based operations often favour the adoption of U.S.-developed service packages, or direct use of U.S. computer services, even when similar Canadian services are available.
- Business and industry have been slow to adapt to the new tool of computer technology in relation to the rate of technological advance.
- The volume of research and development in Canada is not yet at a level to provide a continuing, viable product base in either hardware or software.

Under the many pressures and other factors identified in this Report, present Canadian needs are being met by a great variety of unrelated actions and systems, mostly (90%) confined to in-house operations of business, industry and governments. This fragmentation leads to economically unsatisfactory operations; to financial instability of commercial computer service enterprises; and adds to the attractiveness of more sophisticated and perhaps less expensive offerings from the United States. In the light of the growing economic and social significance of computers, this should be seen as a disturbing situation, with increasingly serious implications.

Before drawing conclusions from these observations, one must make a clear distinction between the computer hardware, computer programming or software, application programming, and the provision of computer services. Whereas computing equipment, including its main machine-oriented software, is essentially "neutral" to the economic and social environment in which it is used, the programming for a specific application and the provision of services depends to a much greater extent on the special interests and circumstances of the community of customers. Some applications are standard the world over — for example, hotel or airline reservations. Others, however, depend on national characteristics, as in the operation of financial institutions and social services — and most particularly in areas where language, education and cultural values are involved, in which case computer services will perform functions very similar to those of the present news media, broadcasting and educational services. There is obviously a considerable difference between a foreign influence limited to the provision of hardware and software, and one which permeates the whole field of application programming and computer use. A domestic capability for application programming, systems development, and provision of services is essential for Canadian solutions, in the economic sector as well as in the rapidly growing fields of general social significance. If such a capability is not maintained, the inevitable pressure of foreign technological advance will lead to situations increasingly in conflict with Canadian concepts, aspirations and goals.

2. APPROACH TO A SOLUTION

The Task Force has come to the conclusion that the most promising approach to satisfying Canadian users' needs and countering the emergence of foreign domination in the computer application field lies in a concerted effort to strengthen the Canadian presence in this field, both technically and economically, through a policy of improving domestic and international competitiveness. A multiplicity of objectives must be established, based on a common understanding and requiring co-ordinated action by many agencies and authorities. In particular, governments at all levels should aim at a general

acceptance of certain guiding principles from which detailed policies and actions can be developed. Such principles should be:

- To recognize the vital importance of computer/communications to Canada;
- to ensure that the socio-economic effects of computer/communications conform both to accepted national objectives and to regional interests and values; to promote and support the development of socially desirable systems; and to counteract undesirable trends, such as foreign domination of the industry, and invasion of personal privacy;
- to ensure the evolution of data communication systems towards an effective, coherent data communication network.

The Task Force is convinced that in this rapidly changing technological field, the key to the solution of Canadian problems is a close working relationship between governments, industry and users. Those involved must monitor change in the industry and its environment, define problems and opportunities and continually adapt policies and programs to actual conditions. Therefore, the Task Force recommendations take the form of broad and flexible policy quidelines, leaving adjustments in their implementation to interactions between the public and the bodies responsible for administering the policy.

The keynote of the recommendations is that governments should promote an orderly and planned transition that will assist both the private and public sectors to achieve the greatest possible gains at the lowest possible cost. The role of government must be carefully defined, so as to maintain a proper degree of Canadian independence and further the development and self-reliance of the industry to the highest possible degree. In broad terms, the Task Force has identified the following objectives, which are described in much greater detail in the various parts of the Report:

- Innovation in the Canadian-based computer application and service industry should be encouraged and supported by government incentives.
- In the provision of commercial computer services, the opportunities for the free play of competitive market forces should be maximized and government intervention should be brought to bear only where competition is about to be eliminated through monopolistic tendencies, or where protection of the consumer interest requires explicit regulations.
- Steps should be taken towards a periodic identification of user-needs and evaluation of the impact of existing and projected computer/communications systems on society.
- Applications of broad social significance should be given priority in their support by public funding for pilot-projects.
- Steps should be taken to foster the evolution of a cohesive data communication network, providing access to every part of the country.
- Policies in the data communication network development should be oriented towards improving service availability and rate structures in Canada, in order to offset economic and technical incentives for meeting Canadian user-needs through facilities outside Canada.
- In the development of rate structures for data communication services, attention should be paid to rates for special services and specific communities of interest, in which geographical distance is of minor or no influence.

- The spending of public funds to meet the internal data processing requirements of governments and public institutions should be oriented towards strengthening the Canadian controlled service and applications industry.
- Standardization in the field of computer/communications equipment, methods and procedures should be encouraged.
- At all levels of education and training, Canadian expertise and familiarity computer/communications technology and its applications should be strengthened.
- Tariffs on the import of equipment and components not manufactured in Canada should be reviewed, with the objectives of removing unwarranted costs to Canadian users.

Moving from the setting of objectives of this kind to the necessary actions for implementation, one is faced with the complex system of Canadian political and organizational structures. First, there are the governments at federal and provincial level, with their respective constitutional areas of jurisdiction; this aspect is dealt with at length in Volume II. Second, there is the unregulated industry in the manufacturing, computer service, engineering and consulting sectors. Third, there is the communication service industry, subject to regulation by federal or provincial regulatory bodies. It can be seen that actions towards meeting the stated objectives are bound to cross all these institutional borderlines. The Task Force recommendations therefore emphasize a close understanding and co-operation between governments at all levels, and between the public and private sectors.

3. GENERAL RECOMMENDATIONS

Accordingly, as a first recommendation, the Task Force draws the attention of governments at all levels to the importance of computer/communications with respect to the social and economic well-being of the country, and recommends that:

Rec. 1 Computer/communications (*i.e.*, computer services by remote-access through communication facilities), should be recognized by governments as a key area of industrial and social activity, and steps should be taken towards strengthening of the Canadian industry in this field, and co-ordination of its development to the benefit of Canadian society.

In the furtherance of the closest possible co-operation between public and private sectors towards the continuing development of a national policy, the federal government must take steps to bring together all concerned and to permit a feedback mechanism for assessing impacts and trends in relation to national objectives. The Task Force therefore recommends that:

Rec. 2 The federal government should take specific measures, as outlined throughout this report, to promote a high degree of co-operation between public and private sectors in the development and execution of policies for computer/communications in Canada.

Some aspects of control in the computer/communications field fall clearly within the jurisdiction of the federal government, while others are clearly within provincial jurisdiction. In a number of significant areas, jurisdiction is intermeshed, and subject to varying interpretations. It is clear, however, that a closely co-ordinated approach across Canada is necessary, if fragmentation and incompatibility are to be avoided. The Task Force therefore recommends that:

Rec. 3 In the formulation of national computer/communications policy a unified approach throughout Canada should be stressed as a key factor requiring close co-ordination between federal and provincial actions.

At the federal level, many of the stated objectives call for government involvement in a variety of forms. Many different departments and agencies are concerned with particular aspects of the computer/communications field, for example: with regard to competition policy; industrial incentives; common carrier regulation; research and development; technical standardization; and general telecommunications policy.

Policies in all these areas cannot be melded together into a useful national program without internal co-ordination. Accordingly, the Task Force considers it fundamental to the implementation of the recommended policies that:

Rec. 4 In the area of federal responsibilities a Focal Point should be established within the government for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications.

At the Focal Point, the actions and concerns of many different government departments, agencies and institutions, on matters related to computer/communications, would be considered in their mutual relationship, and analyzed with regard to the effectiveness of government measures in the light of an over-all computer/communications policy. New measures could then be proposed, as required. Such a role at the Focal Point clearly involves two distinct functions:

- A strategic planning function, to advise on the formulation of long-range national objectives within the framework of general communications policy, and to lay the foundation for future policies; and
- a program co-ordination function for the assessment of current trends, evaluation of government actions, and identification of proposals for new government measures.

The fact that recommendation 4 is addressed to the federal government reflects the mandate of the Task Force, which is specifically related to federal government policies. However, it is clear from the wording of recommendations 2 and 3 that the development of national policies requires close co-operation between the federal and provincial governments, and between them and the private sector. Recommendation 4, in conjunction with 3, may therefore be extended to cover measures which express a joint federal-provincial involvement in focussing attention on the development of national policies in matters of computer/communications. Such measures are suggested in Part E of this Report, and amount to mechanisms for federal-provincial co-operation in pursuing policies of national scope. Of particular importance in this regard is the recognition of regional differences in factors such as population density, degree of industrialization, social and cultural values, and aspirations, which all require appropriate reflection in the interpretation of national policies, as they apply to the needs and situation in computer/communications in a particular region.

4. AREAS COVERED BY SPECIFIC RECOMMENDATIONS

Having focused attention in the general recommendations on the importance of computer/communications and its pervasiveness throughout all levels of government and all segments of society, the main thrust of specific recommendations, which are presented in the following chapters, is directed towards a concerted effort by governments to strengthen the Canadian presence in this field. Specifically, a number of possible measures have been identified in the following areas:

(a)Competition Policy in the Computer and Communications Services Industries

Recommendations in this area are concerned with certain constraints on the entry into this business, as well as regulatory measures to ensure an appropriate balance between the forces of free competition and those restraints made necessary to protect the interests of users and society. In the field of commercial data processing, no direct regulation of operations is recommended, although certain restrictions on entry were found desirable. Where data processing and data bank services are provided as a commercial service to customers through remote-access facilities, it was found desirable to institute a registration process, in order to make available information on suppliers and the types of services they offer. In data communications, where the established telecommunication carriers play a dominant role, the Task Force found it advisable to let the customer have greater choice and freedom in decisions on the technical and economic characteristics of services he receives. The government, through the established regulatory bodies responsible for telecommunication regulations, is brought in to play an active role in the definition of relationships between carrier organizations and customers. Further, the government, through its planning and co-ordination bodies, is called upon to work together with user organizations and the service industry on the evolution of a cohesive Canadian computer/communications network.

In the area of data communications services, the Task Force has developed general guidelines from which specific recommendations are derived. These quidelines are as follows:

- Government should assume a co-ordinating role in the planning and gradual implementation of a coherent data communications network, aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign data communications networks.
- In the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement common carrier services. However, the technical and economic integrity of the public switched-networks, in particular the present telephone voice network, should be protected.
- In order to ensure the orderly growth of a coherent data communication network, government should take steps to avoid the proliferation of incompatible terminals and data networks providing commercial services to customers.

(b)Policies For The Stimulation of Development

In this area, recommendations are presented on the government role in:

- Furthering of standardization of equipment, methods and procedures;
- supporting efforts towards the broadening of knowledge in the application of computers at all levels of education;
- providing incentives to all phases of industrial innovation, from research to marketing;
- co-ordinating the information exchange between organizations in the public and private sectors, so as to establish common approaches in the installation of data banks and information systems;
- supporting the development of computer/communications systems of broad social significance;
- providing opportunities for the Canadian controlled computer/communications service industry, through procurement policies in the public sector.

(c)Institutional Arangements Required to Implement the Recommended Policies

The proposed arrangements are primarily concerned with the area of federal responsibilities and cover the following points:

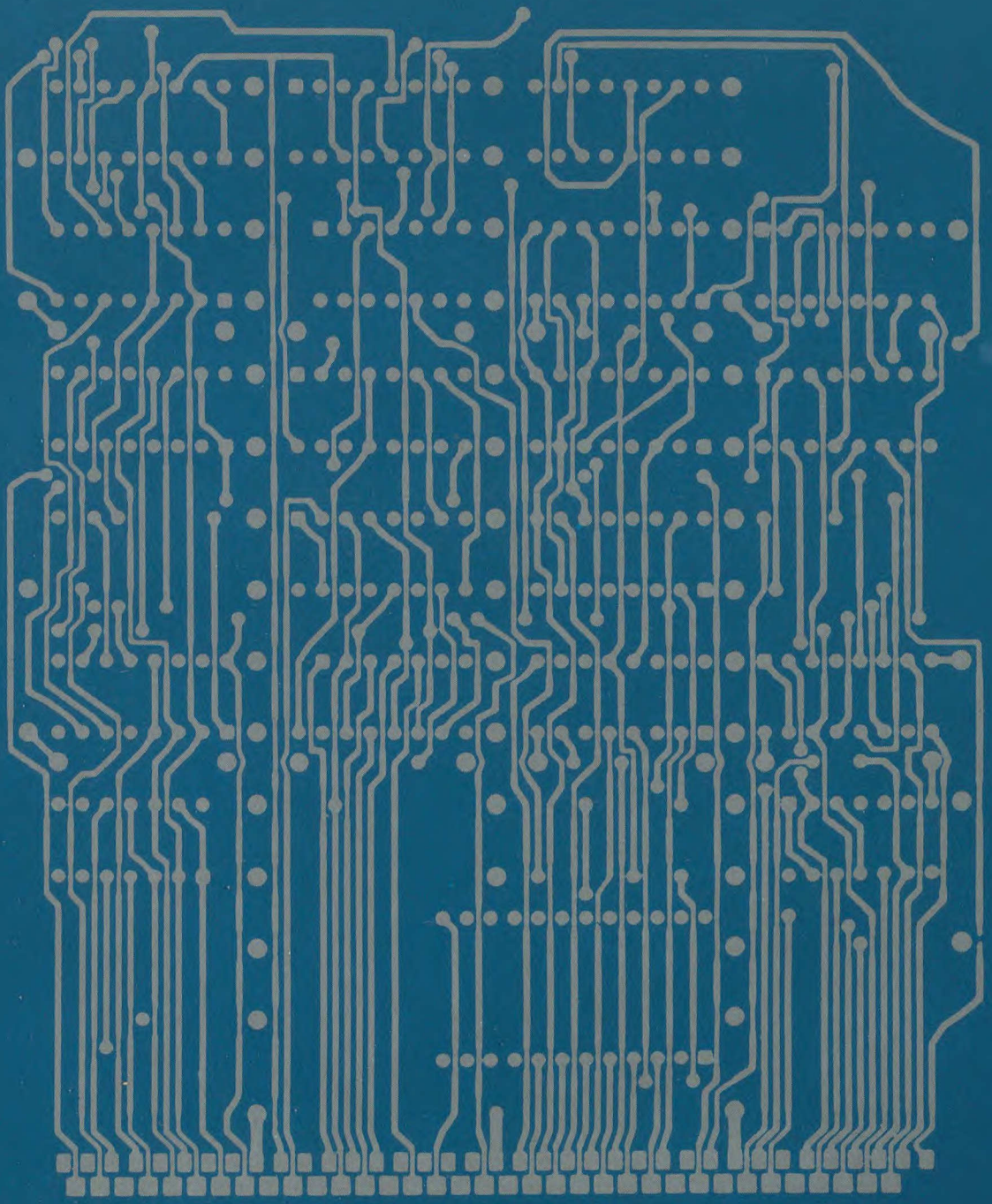
- Organization and terms of reference of the federal Focal Point for computer/communications;
- federal-provincial co-ordination;
- government-industry relationship, to ensure co-ordination between the public and private sector;
- regulatory requirements in the computer/communications field.

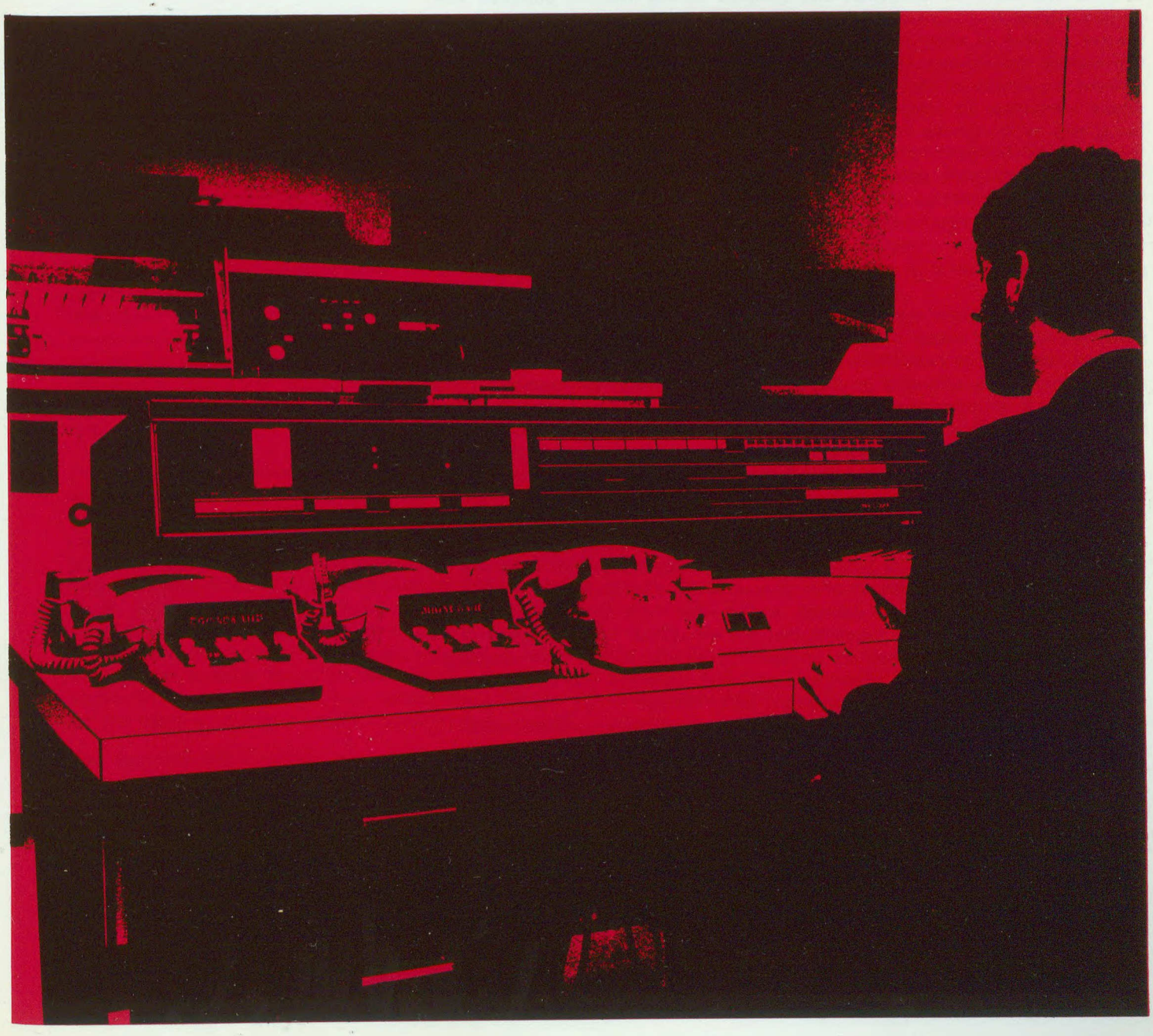
In the area of federal-provincial relationships, some suggestions for provincial action are presented, which may serve as a base for discussion with the provinces. The Task Force has had the opportunity to meet with representatives from the provincial governments and discuss the concepts presented in this Report.

Part

C

Computer/Communications Services





The computer/communications industry is marked by the existence of both competition and regulated monopoly in greater or lesser degree, depending upon the sector of activity. The Task Force has therefore found it appropriate to consider to what extent a competitive or regulatory framework might constitute the best possible environment for the development and rationalization of the computer/communications industry. A number of briefs submitted to the Task Force have addressed this question.

In Canada it is generally true that reliance is placed upon the "free enterprise" system, with the maximum possible latitude for individual initiative to enter into any given enterprise and compete for the available business. The general legislation in Canada relating to combines policy is designed to prevent restraint of trade and other unfair restrictions on competition. Government intervention, regulation, and in some cases direct provision of services are limited to those areas in which there is a natural monopoly, where a potential for unfair practices exists, or because a social need is not being met by the private sector. Computer/communications services, because they combine elements from both data processing and data communications, constitute a particularly difficult problem area for government policy-making. Will the industry continue to flourish best in a competitive environment; should government regulation be imposed with respect to entry, pricing, technical standards, or other criteria; under what conditions is direct government participation in the provision of services justified or desirable?

The basic question that must be faced in any determination of competition policy is the proper scope of the monopoly of the regulated communications common carriers. The restrictions imposed by telecommunication carriers on their customers are defended on the ground that the telephone monopoly should include all communications services and all related equipment, in order to maximize the efficiency of the carrier in planning and operation. The contrary argument is that the monopoly should be limited to those areas of natural monopoly in which duplication is prohibitive, so as to maximize the advantages and possibilities of competition. Many of the submissions to the Task Force have indicated that competition can provide substantial benefits in communications, as in other regulated fields. In fact, the current pressure for change by the computer data processing industry results from the readiness of actual prospective competitors to offer diverse services and equipment on more favourable rates than the carriers, and to offer them to an important and growing class of users. This suggests that the elimination or modification of restrictions imposed by the carriers on such competition would have desirable effects. Among the expected advantages are more advanced and cheaper equipment, a reduction in communications costs through circuit sharing and other means, and faster satisfaction of the specialized communication needs of data transmission.

Competition appears to be not only of great potential value in computer/communications, but is in many ways becoming more feasible. Although technological advance often leads to greater sophistication and more complex

systems, this has not historically demanded ever increasing size and more monopoly. In the communications field, the most striking development is the progressive increase in transmission capacities and circuit availabilities. This may reinforce some of the natural monopoly characteristics of the transmission aspects of the carrier systems, but it lays the foundation for the growth of many competitive services which can be channelled through these systems. The argument has been raised a number of times to this Task Force that freer attachments, freer interconnections, and freer use of circuits should enable users to combine the advantages of an efficient mass network and individualized applications and services.

Along with the growth in transmission capability, there has been an increase in the sources of available technological competence and innovative talent, which could provide the basis for effective competition and for the diverse applications and services mentioned above. The suggestion is commonly made that such benefits should be foregone only for very sound reasons. Obviously they might have to be foregone if the removal of the present restrictions were accompanied by a significant risk of injury to the basic telephone network. But one should view critically the justifications advanced for such restrictions.

The development of competition in the computer/communications industry might also tend to spread the benefits of communications advances and of lower communication costs in other ways. For example, independent manufacturers may be prepared to supply terminal equipment for small, specialized markets. Independent service companies are prepared to arrange circuit sharing and to enable small users to obtain some of the advantageous charges for bulk transmission capability and large volume that are now available to only a few. These actions would enhance rather than discourage equitable treatment among users of the communications services including computer users.

On the other hand, a variety of arguments have also been raised to the opposite effect — namely that the scope of the regulated monopoly service provided by the telecommunication carriers be extended to include a variety of data processing and other related services. It has been argued that, in the long run, government ought to foresee, and move toward, an integrated single network which can provide services most efficiently and at lowest costs. Some are even willing to try to extrapolate far enough to predict the scale of future economies in order to demonstrate that this kind of result is economically irresistible. Since a data network to duplicate the existing carrier transmission facilities would be uneconomic, the argument continues that it should be decided in advance to reserve the computer/communications field for the basic telecommunications carrier system, suitably regulated.

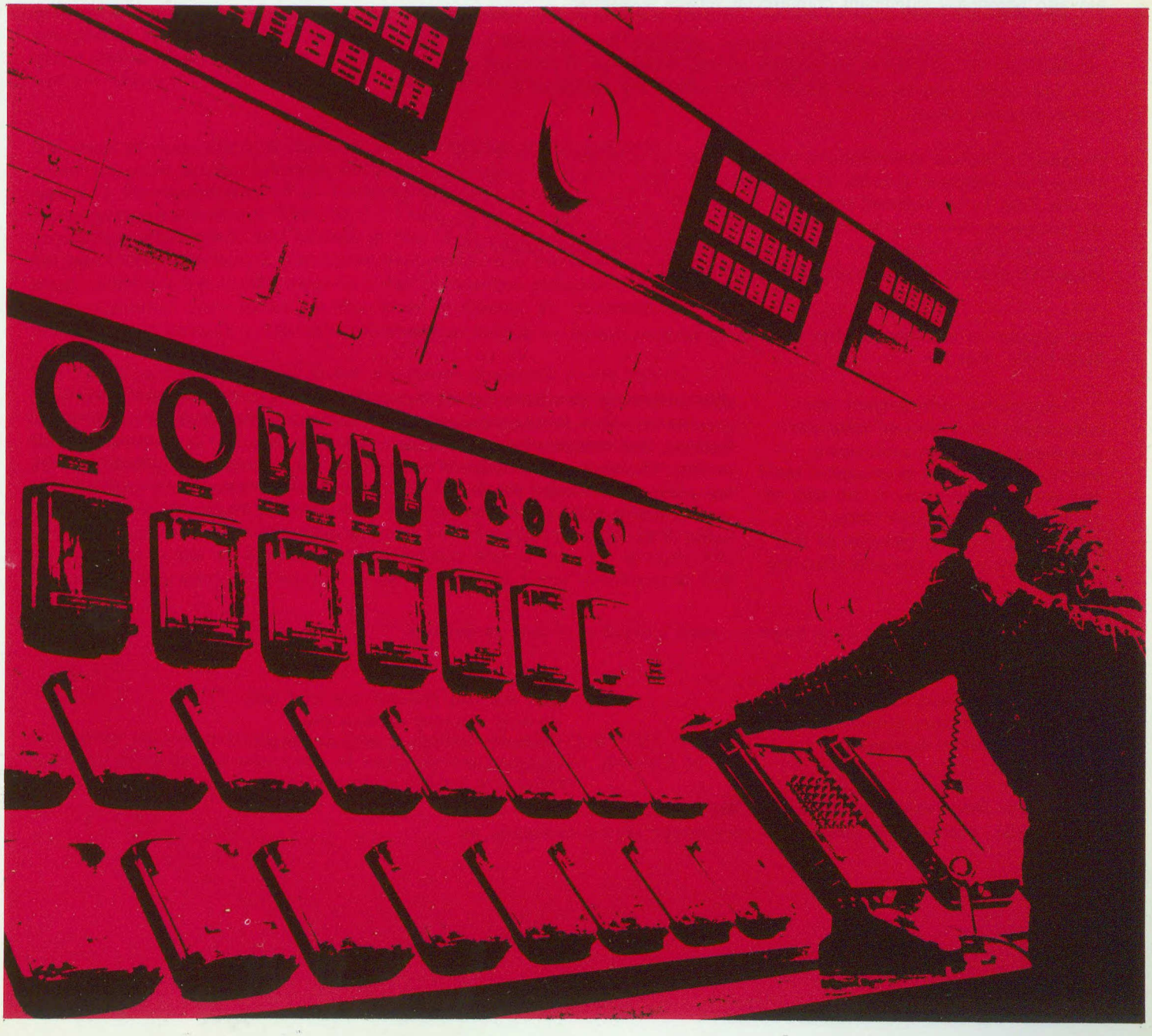
This argument has a certain attraction and it sounds like rational planning. For a variety of reasons, it was not supportable in the light of Task Force research: the evidence indicates that market discipline, rather than regulatory pressures, would be likely to move more rapidly in the direction of lowering costs, advancing innovations, and providing a diversity of applications and services for the computer industry.

A number of economic arguments against unregulated competition exist that touch upon the computer/communications industry. In the public utility industries, the quality of service has many dimensions, not just its physical specifications, but its reliability, safety, regularity, frequency, and the financial responsibility of its purveyors. A good deal of the case for regulation is the importance of assuring that services meet acceptable standards in these various respects. Where price competition is very intense and consumers have only limited ability to judge the quality of a service, which may be particularly true in information processing, the decline in price can lead to a skimping on safety, reliability, and other service characteristics that consumers may have difficulty in detecting promptly. Even if there is a danger of unregulated competition resulting in an unwanted deterioration in the quality of service, it does not necessarily follow that the proper remedy is to impose direct restraints on entry or on competition in price. Legally prescribed quality standards, for example, could conceivably give consumers of data processing services sufficient protection, without the necessity for suppressing competition in other respects as well.

The Task Force has concluded that the retention and expansion of competition in the data processing services industry is an effective means of ensuring innovative development. This must be paralleled by development of competition in data communications if the full potential of the technology is to be realized. Competition should serve the dual purpose of spurring innovative development and of limiting monopolistic tendencies which could, at this stage, hinder the growth of computer/communications. Detailed recommendations along these lines appear in succeeding chapters.

In this context, the Task Force welcomes the introduction of new competition legislation which would for the first time embrace services as well as commodities. Practices which would be subject to review under the proposed legislation include price discrimination, tied sales, directed selling, exclusive dealing, delivered pricing, and refusal to deal, some of which have been the subject of specific complaints to the Task Force. To the extent that these practices are not reviewable by the telecommunications regulatory agencies, the Task Force favours the passage of appropriate general-competition legislation which would maintain a suitable environment for free competition. In this regard, the recommendations of the Task Force in the ensuing sections with respect to free entry into the data processing service industry are all conditional on the existence of such a competitive environment, maintained by a Competitive Practices Tribunal with effective powers to review anti-competitive practices.

The Task Force is aware of certain problems presented by the terms of the draft legislation now undergoing revision. It may be, for example, that the legislation precludes the development of computer services consortia; such multi-firm organizations could contribute to the quality and availability of low-cost computer services. Other difficulties may also be presented by the interpretation of the language of certain other sections in the draft legislation. Nevertheless, the Task Force finds itself in support of the basic principles embodied in that draft; however, attention should be paid in the current revision to the specific developments in the computer communications industry.



1. PARTICIPATION IN GENERAL

The most important participants in the provision of commercial computer services are the independent service bureaux, of which there are about 20 larger and some 100 smaller, and the computer equipment suppliers. Some Crown Corporations and affiliates of common carriers also provide commercial services. In addition, there are certain private organizations which sell specialized services, using surplus capacity available on "in-house" computers. A new and important class of suppliers is developing. Its members include: the banks, other financial institutions, and consortia of businesses. Universities are also potentially significant commercial service suppliers.

Many of those companies and associations supplying data processing services commercially do so only as an adjunct to their main line of business which, in a few cases, may be quite distinct from either the computer or communications fields.

Progress in applied technology is closely linked to innovation and to the competitive selection process of the market. A large number of briefs received by the Task Force stressed the need to maintain a competitive environment in the computer services industry. There is a definite fear in the private sector that constraints or regulation of the industry would seriously impede the innovative process and technological development.

One supplier of commercial data processing services stated, in a brief to the Task Force, that the

"... competitive environment has encouraged technological advances and improved design techniques which, in turn, have produced a rapid and dramatic reduction in the cost of computing and therefore data processing. It is the freedom of this environment which has permitted the data processing services business to provide the innovation, specialization, flexibility and responsiveness required to meet the demands of users. This has meant lower costs to users, widespread availability of different types of service and new developments to meet user-needs. We believe the continuing success of the Canadian data processing services business depends on maintaining this free environment and that competition will continue to be socially and economically desirable."

Another respondent to the Task Force — again a supplier of data processing services — stated that

"... there is a need for an integrated network of computer utilities and telecommunication systems but we feel that this network can and will develop naturally without the necessity for extensive government direction...."

Many other respondents supported this position and one, from a user organization, analyzed the question of competition versus monopoly, as follows:

"Conditions in the service bureau business favour competition and show no tendency to supporting a natural monopoly. Relatively little capital is needed to establish a service bureau. The ability to lease facilities shifts much of the burden of capital requirements back to the computer manufacturer or leasing company. As the service bureau increases its size of operations there are technical limits to its optimum size which arise from the amount of computer memory and time needed for internal computer management of operations as the diversity of processing expands. In addition, the increasing cost of communications as services are extended further geographically from the computer location also favours the development of competitive alternatives.

"In contrast to the standardized services of public utilities, the service provided in data processing is diverse and a choice of many services to the users is essential for the meeting of all needs. Each user's requirements vary according to the size and type of business, organization, accounting methods and recording procedures. In this environment one of the most important requirements for success seems to have been the ability to innovate and develop specialized services to meet the requirements of each user."

The tenor of many briefs to the Task Force, reflected in the selected quotations given above, indicates the general concern of the private sector regarding the maintenance of an environment which will foster innovation in computer/communications. Many of the briefs, while stressing the need for a competitive environment and expressing fear of government intervention, at the same time emphasized that government action was necessary in some areas to prevent the development of unfair competitive practices. On the other hand, arguments were raised, as mentioned in Chapter VII, stressing the eventual emergence of a regulated monopoly.

The Task Force has examined all the arguments presented in the light of user-needs and problems, and is reluctant to recommend action which could result in the denial of new services, unless the providers of such services could, through their position or subsequent actions, stifle competition in the data processing services market. In principle, the Task Force takes the view that the data processing service industry is of such an individualistic and innovative character, and the variety of services which could be developed and marketed is so great, that the entry of new suppliers into the field will be beneficial to the development of the industry and to the user of computer/communications services. With this in mind, the Task Force recommends that:

Rec. 5 No restrictions should be imposed on the entry of any organizations into the commercial data processing business, unless such entry would lead to anti-competitive practices, not remediable under the general laws relating to competition in Canada.

The above recommendation refers only to restrictions relating to entry, and does not preclude the enactment of regulations governing the operation of data processing firms on such matters as privacy and liability.

2. TELECOMMUNICATIONS CARRIERS

The problems arising from the possible entry of the telecommunications carriers into the commercial data processing services field are complex. The underlying factors have been covered in detail in the Telecommission Study 5(a), (c), (d) and (e) and were also the subject of a number of submissions to the Task Force.

As described in the Telecommission reports there is a wide spectrum of possibilities for carrier participation in data processing. At one extreme is the total integration of the supply of computer services into the present range of services offered by the carriers to the public. This case is often referred to as ''horizontal integration'' or ''horizontal diversification''. At the other extreme, short of complete barring of computer services supply, is the requirement for ''vertical diversification'', or total ''arms length'' operation, in which a data processing affiliate of the carrier could be totally separated and even prohibited from providing services to its own parent. Between these extremes is an infinite number of variations, depending on the degree to which the data processing business is related to the communication business of the carrier. In one group of such options the carrier may act exclusively or non-exclusively as an agent for data processing firms, provide for distribution of data processing through its communication lines, and perform marketing, billing, consulting, and advertising functions.

Depending on the particular mode of operation, and depending on the particular situation of the data processing service market in an area or region, the effects of carrier participation on competition in the computer/communication field are quite different. Accordingly, the position on the question of carrier participation taken by users and competitors in different parts of the country and in different segments of industry is not uniform.

(a) Carrier Participation

There is, in Canada, a complex mixture of federal and provincial jurisdictions (as outlined in Volume II) with regard to carrier regulation, and a large number of commercial carriers, some of which are privately owned and some of which are Crown Corporations. In addition, some carriers are already providing commercial data processing services or are planning to do so. All the carriers providing data processing services, with the exception of CN/CP Telecommunications (which has a controlling interest in a data processing service company), fall outside federal jurisdiction. In Nova Scotia the telephone carrier has recently purchased a data services bureau. Québec-Téléphone provides data processing services as approved by the Quebec Public Service Board. The New Brunswick Telephone Company has entered into a service and marketing agreement with a time-share service organization. These are precedent-setting actions which reflect specific regional factors.

Some provinces do not consider that a separation of carrier and data processing functions would be appropriate to their situations at this time, nor that it is necessary to provide for legal protection against cross-subsidization or unfair competitive practices. Instead they maintain that there would be plenty of time to institute corrective action before such effects occurred. The provinces concerned are not now well served by private data processing companies because of the small local markets and they feel that it is first essential to make computer services available within their own territories, in order to support business and industry, and to ensure that the proper environment exists for the development of socially desirable systems. One of the provinces considers that the small demand for computer services in remote areas is not considered sufficient to justify the cost of separate management and staff for communications sales and data service sales in a vertical diversification arrangement.

(b) User Attitudes

The attitudes of users, and of potential users, of data processing services with regard to the entry of telecommunication carriers into this field, was explored by the Task Force and two other independent surveys, the results of which were made available to the Task Force. In the case of the Task Force investigations, user company executives responsible for data processing generally did not oppose the entry of carriers, mainly because of prospects for a wider choice of services and potential suppliers through increased competition.

In one of the independent surveys, carried out in October 1970, 284 responses were received to questionnaires mailed out to personnel in both supplier and user organizations. The answers to the question as to whether or not carriers should be permitted to participate were as follows:

Yes	50%
No	39%
Not qualified to answer	11%

Of those respondents favouring carrier participation, 70% favoured an arms-length affiliate, 23% offered no opinions and 7% did not respond.

In the other independent survey carried out a year later, in October 1971, essentially the same question was asked. In this case 250 responses to a total of 564 questionnaires sent to computer users in Ontario and Quebec were analyzed and the results were as follows:

Yes	56%
No	26%
No reply	18%

Of respondents who answered "yes" to this question, 69% felt that the data processing affiliate should have an arms-length relationship, 20% felt this unnecessary, and 11% did not reply.

(c) Policy Considerations

Discussion of competition policy in computer/communications must consider the two aspects — data processing and data communications — in combination. National policy should have as its aim the creation of the best possible conditions for the development of computer/communications capability in Canada for the benefit of Canadian society. In assessing policy options, the weighing of advantages and disadvantages for participation by one or the other particular industry group should always be related to the over-all national interest in the combined field of computer/communications

The principal participants in the supply of computer/communications services are the telecommunication organizations and the computer service organizations. As mentioned earlier, the main distinguishing feature between these two groups is that the former operates under regulation by federal or provincial regulatory bodies, whereas the latter operates without regulatory constraints. As a broad classification, one can therefore define the two classes: carriers and non-carriers.

Accordingly, policy options are concerned with the two following questions conjointly:

- To what extent should carriers be free to offer commercial data processing services;
- to what extent should non-carriers be free to offer services commercially, which could be considered as forming part of the data communication function.

The following table represents, in simplified form, and for the purposes of illustration, the four main policy options:

	CARRIER ORGANIZATIONS		NON-CARRIER ORGANIZATIONS	
	Data Communi-cation	Data Processing	Data Processing	Data Communi-cation
Case(1)	+	—	+	—
Case(2)	+	(+)	+	—
Case(3)	+	—	+	(+)
Case(4)	+	(+)	+	(+)

Legend:

\+ Free to perform the indicated function
— Barred from performing the indicated function.
(+) Allowed to perform indicated function under specified conditions

Case (1) describes the situation where carriers are confined to data communications and non-carriers are free to offer data processing services in which all communications functions must be supplied through the carriers.

Such complete separation of functions is not practical for several reasons.

First, federal jurisdiction with regard to barring of carriers from providing commercial data processing services would not apply to provincially-regulated carriers, and provincial regulations have already, as mentioned before, permitted entry of some carriers into the data processing business. With the intermeshing of relationships between the carriers, their corporate structures, their franchises and operating areas, the barring of certain carriers, but leaving others in the business of data processing, would create complex conditions which would be substantially different in different parts of the country; and these differences would not be related to specific regional requirements.

Second, a clear separation of data communication functions and data processing functions becomes increasingly unrealistic. Switching, concentrating, multiplexing, sorting and merging of data streams can be considered as part of either function and to form part of the particular service responsibility. It will be shown in Chapter IX that the barring of non-carriers from performing certain communication functions would be ineffective and would not provide the innovation required for a healthy development of Canadian computer/communications.

As a result, if case (1) were adopted as policy, available computer/ communications services would be severely constrained.

Case (2) describes a situation where the conditions of case (1) change to include data processing competition from the carriers, without removing the restrictions of communication services being made available by the carriers to non-carriers. The effect would be the gradual elimination of non-carrier data processors from the remote-access computer services market — a result which would reduce competition to that which exists within the carrier group itself (telephone and telegraph companies). Even if carrier entry into the data processing field were subject to constraints, for example, requiring some degree of vertical diversification, the non-carriers would still depend entirely on the communication services offered by the carriers, whereas the blurring of technical distinctions between computer functions and communication switching and routing functions would give the carriers a distinct advantage in their data processing operations.

Case (3) In this case, carriers are barred from data processing, but non-carriers are permitted to perform communication functions in addition to being

free in providing data processing services. As in case (1), jurisdictional problems make it unlikely that a unified approach throughout Canada could be achieved. If federally regulated carriers were barred from involvement in data processing services, while some provincially regulated telephone carriers were active in providing such services, the federally-regulated telegraph companies would be at a serious disadvantage by being excluded from the computer services field; whereas the telephone companies, because of the close working interrelationship between their member organizations, would, to some extent, be able to operate in this field.

This case presents an unrealistic alternative with severely impaired competition in computer/communications.

Case 4. In this situation, there is competition in the whole field of computer/communications (data processing and data communication combined) within the carrier groups (telephone and telegraph companies), as well as between carriers and non-carriers. In order to provide a fair basis for such general competition without placing some of the competitors in a situation where they gain unfair advantage from their other business involvements, a carefully selected set of conditions for constraints and limitations is required. This must take into account the possibilities for cross-subsidization, unfair practices, interference with the carriers' non-data-oriented operations, damage to carrier plant and other factors as covered in greater detail in Chapter IX.

Once such a set of suitable constraints is established, a situation is created in which forces and counter-forces can arise equally from telephone and telegraph carriers and non-carriers.

The constraints should provide the possibility for adequate and fair competition in commercial computer/communications in areas of high business activities, and should also provide for the availability of service from the telephone carriers to marginal commercial users and ultimately to the non-commercial home user.

(d) Recommendations

The Task Force, after consideration of the arguments put forward in the Telecommission Report 5(a), (c), (d), (e), and in light of the foregoing discussion, has concluded that it would neither be practical, nor to the advantage of the users and Canadian society as a whole, to attempt to prevent the carriers from participation in the data processing business.

Action should be taken, however, by the government to ensure maintenance of effective competition and to minimize the impact of the problems which may occur as a result of carrier participation. These problems arise from the possibility of cross-subsidization of the carriers' data processing business by their voice and message business intended to eliminate competition, and from the position of the carriers as providers of transmission facilities which may

facilitate unfair competitive practices. The independent service bureaux would be at a competitive disadvantage, not only through price, but also because of possible disadvantages in obtaining the required communications links and other services through preferential treatment by the carrier of its own data processing operation. The carrier might, for example, provide its own data processing operation with better maintenance service, advance information on new communications services, and other such plans, and might disclose information concerning carrier customers who were data processing competitors.

Constraints on carrier participation in data processing should, therefore, be directed at controlling such possible abuses. Since the regulatory authorities have encountered difficulties in obtaining adequate cost distribution information on individual carrier services, and because this problem would be compounded if data processing services were integrated with other carrier services, horizontal integration, involving sharing of management, technical and sales staff, and other facilities, does not seem to permit a satisfactory bar to possible cross-subsidization. It also does not allow for an easy identification of unfair competitive practices. This suggests that the carrier data processing affiliate should be vertically separated from the parent carrier through establishment or purchase of a separate organization with independent facilities, management and staff. Further, if the data processing affiliate were constrained from providing services to the parent carrier it would effectively remove the carriers' incentive to set up a data processing entity, by limiting its ability to obtain the benefits of a base market and of possible economies of scale, which are to the advantage of the end user. If, however, services were provided to the parent carrier, they would have to be made available to all other customers on an equal basis to prevent preferential treatment of the parent carrier and to avoid disguised cross-subsidies designed to eliminate competition.

The Task Force therefore recommends that:

Rec. 6 Federal legislation should be introduced which might serve as a model for parallel provincial action, empowering the federal regulatory body responsible for the regulation of telecommunications carrier organizations to impose conditions on the entry of telecommunication carriers into the business of offering data processing services commercially.

In particular, the Task Force has concluded that for carriers under federal jurisdiction the following set of constraints should be imposed:

Rec. 7 Telecommunication carriers wishing to offer data processing services commercially in Canada may do so only under the following conditions:

(i) That such services be offered by a separate affiliate, with officers, staff, equipment and computer facilities distinct from those of the carrier;

(ii) that all communications or other services provided to the affiliate by the related carrier must be tariffed and made available on a non-discriminatory basis to any other customer;

(iii) that the carrier may obtain data processing services from outside sources (including its data processing affiliate) save for those communications-oriented computer services which, in the opinion of the regulatory body, are integral to the operation of the public switched network; computer services, such as network switching, which are directly integral to the operation of the network should be provided by carrier in-house facilities designed exclusively for the public service obligations of the carrier;

(iv) that the carrier may purchase data processing services from its data processing affiliate, but that if it chooses to do so, it must carefully separate and identify such services, and file information as to their precise nature and cost for public inspection by the regulatory body; such costs and all transfer payments from the carrier to its affiliate or *vice versa* would be subject to regulatory scrutiny and review;

(v) that except for the restriction in paragraph (iv) above, all data processing services offered by the affiliate would be unregulated.

The Task Force considers that the carriers should not be allowed to obtain computer services "integral to the operation of the public switched-network" from outside sources. This is because such services are so vital to the public obligations of the carriers that they should be available only on a dedicated in-house basis for reasons of safety and reliability. In addition, they are so specialized, and their value is so difficult to measure, that the presence of cross-subsidization, were these services to be provided by an affiliate, would be difficult to detect. The determination of the computer services that fall within this class would be left to the telecommunications regulatory body for rulings on a case-by-case basis. The Task Force is not recommending that there be any direct regulation of the data processing service industry except, possibly, in certain special areas such as privacy. Nevertheless, it will obviously be necessary, in order to implement the above recommendations, that the regulatory body be authorized to review allegations of unfair practices by the carriers, and, if they are substantiated, to enforce corrective measures.

3. BANKS

Concern has been expressed in submissions to the Task Force with regard to the entry of banks and other financial institutions into the commercial data processing field. It was suggested in one brief from a commercial service bureau that "it would be in Canada's best interest if [the banks] were restrained from offering extended computer services to the public," although this brief recognized that, at the present time, "the chartered banks are only minimally involved in supplying computer services to the public." The Canadian Association of Data Processing Service Organizations (CADAPSO) recommended that "any regulated or licensed Canadian industry or organization whose principal activity is *not* in the field of computer services,

should be required to establish computer services subsidiaries that have an arms-length relationship." They were concerned about the opportunities which exist for cross-subsidization or "bundled marketing" which would allow regulated or licensed industries an unfair competitive advantage. Another brief, also from a supplier of data processing services, was more explicit in requesting that "The rapidly growing incursion by the Banking Fraternity into the Service Bureau Field must be stopped and reversed." The suggestion was also made that the banks might misuse their lending powers, their unique position with respect to their customers and their already available data bases, to gain an unduly dominant position in the data processing field. One submission indicated that "the chartered banks are willing to provide the services at less than cost, presumably to minimize the chances of competition becoming too well established," and in another case it was indicated that, while the service bureaux' basic price structure was lower for a payroll system, the ability of the banks to wield influence through relief from service-charges, additional allowances based on the increased float available to the bank, and the persuasion that can be applied by a branch manager, could result in rejection of a private service bureau proposal.

The banks have been unanimous in their responses to the Task Force in stating that it is their firm policy to ensure that every service offered will be independently profitable. If their intention is put into practice, the prices of their services, including data processing, would not be subsidized by other services. Lower prices than those charged by competitors would in this situation result from possible economies of scale and efficiencies of advanced systems. Such economies are, of course, advantageous to customers and cannot be classified as unfair competition.

The Task Force has examined the need for restraining entry of the chartered banks into commercial data processing. The chartered banks already operate under restrictions imposed by the Bank Act which at present permits them to "engage in and carry on such business generally as appertains to the business of banking" (section 75(1)(e)), but which also includes the proviso that a chartered bank shall not otherwise, directly or indirectly, "deal in goods, wares and merchandise or engage in any trade or business." (Section 75 (2)(b)). The Task Force has therefore concluded that, provided the banks limit their data processing offerings to "banking related services", supplementary to such activities as acquiring, dealing in, discounting and lending money and related services as stated in the Bank Act, they should not be subject to any restrictions on entry into the commercial data processing services business.

The Task Force is not satisfied, however, that the terms of the present Bank Act adequately define the areas where the banks may freely offer data processing services and accordingly recommends that:

Rec. 8 Chartered banks should be permitted to offer data processing services to the general public in Canada, subject to the following conditions:

(i) that such service should be directly related to the business of banking; and,

(ii) that the Bank Act be amended to provide the mechanism whereby interested persons may obtain rulings, from the Inspector-General of Banks for the administration of the Act as to whether any particular service is within or outside the meaning of (i) above, and that the banks would be bound by such rulings.

The Task Force does not underestimate the difficulty of defining precisely which services fall within the terms of the Act, since these services are evolving. A mechanism for obtaining case-by-case rulings is, therefore, essential without necessarily placing prior restraint on them by defining the boundaries in advance, and thus preventing the emergence of a service which may be of great value to customers.

4. UNIVERSITIES

The Task Force has been concerned with commercial computer services offered by universities. Computers used by universities are exempt from federal sales tax and import duty and are made available to them and other educational institutions by some suppliers at a discount price. In the latter case they are required to rebate the portion of the discount applicable to the time that the computer is used for commercial services. In addition, the university computing centres generally receive funds for their space, power, operating personnel, supervision and telephone charges out of the university budgets. The federal government, under a federal program started in 1966, subsidized about 50% of the $1.5 billion operating expenditures at post-secondary institutions during 1971, in the form of tax transfers and equalization payments. This means that, indirectly at least, a part of the university expenditures on computing is supported by federal taxation, and most of the rest from provincial taxes. In addition, NRC provides money through grants either directly to the computer departments or indirectly through research awards.

The total revenues received by the universities from commercial services were in excess of $1.2 million in 1970/71 or about 2% of the total annual cost of their computer operations. Most of the revenue is derived from over-the-counter service bureau operations, time-sharing services for computational work and remote job entry (RJE). One of the major groups of users consists of members of the Financial Research Institute (FRI) which uses the university computing centre at McGill University. FRI supports what is probably the most highly developed financial data bank in Canada and makes available services for financial and economic analysis and portfolio management to its members, through terminals linked to the McGill computer. The members of FRI are banks, brokerage houses, trust companies, insurance companies, mutual

funds, government institutions, industrial firms and universities. Other institutions which use university computers are hospitals, libraries and governments.

Although the commercial revenues of universities from computing activities represent only about 1.5% of the revenues of commercial service bureaux in Canada, service suppliers have expressed great concern regarding the apparent increasing trend towards service bureau operations by the universities. While CADAPSO, in their brief to the Task Force, recognized that total prohibition of the universities from engaging in commercial be unwarranted, and acknowledged "the beneficial contribution of university computing centres", they believe that "their continued existence as a commercial competitor can no longer be justified at the expense of undermining the growth of a broadly-based Canadian Computer Services Industry." They point to the recently announced offerings of remote job entry service by universities, other than McGill, in the Montreal area as illustrations of the increase.

From the universities' point of view, the commercial services offer a means of absorbing a portion of their costs at a time when they are under greater financial pressures than in earlier years. Time-sharing and remote job entry are frequently part of the capability of the university computer for internal university usage and the universities claim that extension of the services, by placing terminals in private businesses and other institutions, can be done without great additional effort.

An alternative approach for reducing the cost of university computer operations would be by centralizing or co-ordinating the computing facilities of a number of universities. Efforts towards this end are now in progress in a number of areas.

In many instances, the services the universities provide present a unique solution for satisfying needs which arise when either regional conditions of the computer industry or a highly specialized program of research and development make the provision of required facilities by commercial data processing bureaux uneconomic. The universities have developed data banks for special analyses and others for reference purposes, such as legal information services, surveys, mapping and land titles, soil data, archeological sites and museum holdings. In addition, the University of Waterloo's WATFOR and WATFIV compilers have received wide acceptance. The University of Western Ontario is planning to market a geological data storage and retrieval system with the acronym of SAFFRASS. Development of these systems and data banks provides a vehicle for the training of computer technicians, programmers and analysts, and, on occasion, results in program packages which are of wide general applicability and use. If the results of this work are not made available in the public domain, the product of tax-supported efforts would be lost.

The Task Force, however, considers that organizations which are subsidized by government funds or exempt from taxes should not take advantage of their position in a competitive situation.

Accordingly, while the Task Force does not presume to interfere in the universities' rights of administration, it is recommended, in the interests of maintaining a healthy development of the computer service industry that:

Rec. 9 Universities, in the consideration of providing commercial data processing services to outside customers, should be strongly discouraged from taking advantage of their privileged position (which arises from their publicly-supported operating budgets, tax exemptions and grants), in areas where services are available from other sources. However, this policy should be sufficiently flexible to allow universities to employ excess capacity (over and above their primary teaching and research commitments) in special cases where commercial operations from outside sources are not filling the need.

5. CROWN CORPORATIONS

Some Crown corporations, both federal and provincial, are actively involved in the provision of data processing services as commercial ventures. Of the federal Crown corporations, Canadian National, with a 25.5% interest in Computer Sciences of Canada Ltd., and Polymer Corporation, with a large interest in Comshare of Canada Ltd., are the present participants. Air Canada has expressed the intention of providing commercial services in connection with its reservations system. Provincially, Crown corporations are providing, or are about to provide, commercial services in Newfoundland and Manitoba.

Only a very small number of respondents have taken exception to the provision of commercial data processing services by Crown corporations. The opposition to Canadian National's activity in this field, for example, has centred upon its rôle as a communications carrier, rather than upon the fact that it is a Crown corporation.

In general terms, Crown corporations are normally initially formed to perform functions or to provide services which the private sector is unable or unwilling to furnish. To the extent that a Crown corporation's diversification from its prime function encroaches upon the market already served by the private sector, it would clearly intensify the level of competition. In such situations, Crown corporations should not receive any special consideration from government if they enter the data processing service industry. Should they choose to do so, their continuing presence should be assessed on the basis of the economic viability of the services offered as a self-supporting entity. However, there may well be special circumstances where the requisite services are not furnished by the private sector, and where a Crown corporation or some other government institution would be the only means of ensuring their provision. These special circumstances might include: the lack of service in a remote geographic region where the market is too sparse to be profitably served; or where a data base intrinsic to the corporation could not be maintained or offered for commercial access by the private sector.

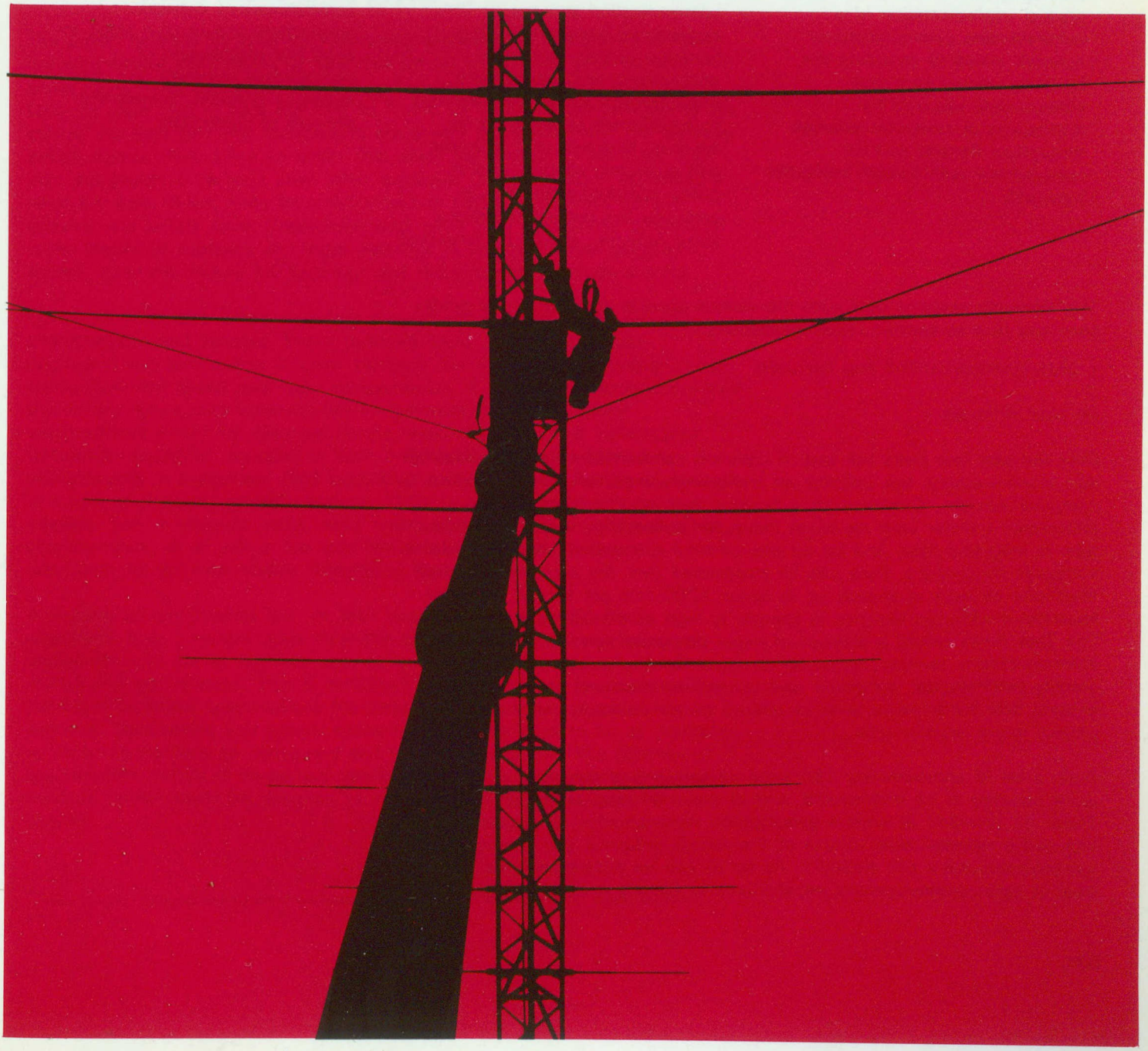
6. COMPUTER EQUIPMENT SUPPLIERS

Relatively little computer hardware is manufactured in Canada and the suppliers of computer equipment are, for the most part, Canadian subsidiaries of U.S. companies. These suppliers also operate commercial data service bureaux in Canada. Since their main business function is the supply of equipment, their service bureaux usually exist primarily as an adjunct to the marketing operation. In this manner, for example, the supplier can provide service to a client whose requirements are too small to warrant an in-house system, or who is in the process of conversion to a larger system, or who has a specialized requirement.

Six major suppliers operating service bureaux command about 30% to 50% of the data processing services market in Canada. IBM, the largest member of this group, operates a "network" of some 23 service bureaux across Canada which provide various over-the-counter and teleprocessing.

Independent service bureaux — those which are not controlled by suppliers — are themselves important customers of the suppliers. It is indeed likely that the independent bureaux have even helped to develop the hardware and software market by the introduction of new services.

It appears that the strategy of the hardware suppliers at this time is aimed primarily at developing the equipment market and that their activities in the data services field are part of this strategy. Moreover, practices which might occur, and which would restrict competition or impede development of the data processing industry, as a result of the suppliers' presence in the services field should be remediable under general competition legislation. The Task Force therefore believes that at this time restrictions on the activities of hardware suppliers in the data processing field are not justified but that the situation should be monitored by government so that if trends emerge which may impose restraint on competition, they can be identified.



The basic Task Force approach to policy developments in the field of data communication services was described in Chapter VI. It centers on the two main concepts of fostering a competitive and innovative industrial environment, and maintaining a strong presence by government in defining the conditions under which industry must operate to the benefit of society. These policies are expressed in the form of the following broad Task Force guide-lines from which specific recommendations are derived:

- Government should assume a co-ordinating role in the planning and gradual implementation of a coherent data communications network aimed at providing the flexibility, variety and cost-effectiveness required for distribution of computer services throughout Canada and for compatibility with foreign computer networks.
- In the interest of stimulating innovation in the provision of data communication services, competition between existing common carriers should be encouraged, and independent entrepreneurs should be permitted to supplement common carrier services. However, the technical and economic integrity of the public switched-networks, in particular the present telephone voice network, should be protected.
- In order to ensure the orderly growth of a coherent data communications network, government should take steps to avoid the proliferation of incompatible terminals and data networks providing commercial services to customers.

The following sections deal with the various aspects covered by the guide-lines and lead to specific recommendations.

1. DATA COMMUNICATIONS AND THE USER

(a) User Attitudes

Over the past few years the use of common carrier transmission facilities for data communication has become an increasingly important part of modern computer systems. Communication facilities are used both for off-line information transfer with no direct computer connection, (such as magnetic tape to magnetic tape) and for on-line terminal-to-computer and computer-to-computer connections. Data can be transmitted over the switched (general) telephone network at speeds up to about 1200 bits per second and over specially conditioned facilities at speeds as high as 50,000 bits per second. The Task Force visited a number of major corporate users of data communications services, including computer service bureaux, in order to identify technological, economic and operational problems encountered in existing data transmission services offered by the common carriers, and to project future requirements.

From a list of approximately 150 large corporate data transmission users, 60 were selected to be interviewed, and of these 51 responded fully or in part. These 51 provided as wide a geographical representation as possible, and included a representative sample of the various industrial and business sectors (governments were not included). As far as can be determined, the present level of data communications expenditures in Canada is approximately $120

million per annum. This sample accounts for nearly a fifth of that expenditure. The following paragraphs give a brief summary of the findings from this survey.

Expenditures for data transmission services for an individual user range up to more than $200,000 per month. Subscribers are utilizing the service offerings of the carriers including Data-Phone, Data-Line, Broadband Exchange Service, Multicom, private line data channels, multiplexers, and foreign exchange circuits conditioned for data use. Regular services such as telephone and Telex are also being adapted for this purpose.

The public network as used for low-speed services was recognized to have the well-known deficiencies of long call set-up times, high error rates in some cases[1], and disparities of services between regions. Dedicated circuit facilities were said to take too long to "tune up". The rentals charged by the carriers for data sets and multiplexing equipment or, alternatively, the services which replace them were so costly that users felt obliged to purchase their own equipment or at least seek other suppliers. Users moreover expressed a need for more liberal rules on interconnection between different carriers' systems and private ones. Interconnections were held to offer the promise of wider choice of suppliers and more flexibility in services; wider geographic access; alternate routing for back-up; and reduced costs through sharing.

Questions were also asked regarding present and possible future network characteristics and services. These included items such as automatic origination and termination of calls, two-way simultaneous transmission, code conversion, and speed and code independence. A majority of respondents said that in any future data communications networks, code and speed independence would be essential. Some respondents felt that code/speed conversion would be desirable in such a network. This latter feature is available only in specialized (and expensive) services offered by the carriers, or in customer-designed private-networks. Other questions dealt with network integrity, use of alternate voice, error rates, signalling conventions and other characteristics, all of which are now the subject of much study and discussion by technical bodies throughout the world.

A majority of respondents use, or plan to use, data communications equipment from suppliers other than the carriers. At present interfacing this equipment with carrier facilities can result in operational problems of system-design and maintenance. This is attributed in the first place to an absence of published technical specifications for carrier facilities. Users in general want technical descriptions and specifications for carrier facilities to be as available as those of suppliers of computers and terminal equipment. The absence of specifications results in ill-defined interfaces, and the responsibility for tracing troubles cannot easily be assigned to either the carrier or the computer supplier.

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[1] *Communications, Computers and Canada* (Trans-Canada Telephone System, November, 1971, revised December, 1971), p 24.

There was a general feeling among users that rates are too high, so that many feasibility studies for new systems were being deferred. The majority of respondents view data communications as a commodity with elasticity of demand.

There was substantial criticism of carrier marketing services, and of the manner in which data communications services are described. Information from different sources within TCTS, for example, was said to be inconsistent.

Under-utilization of circuits was considered to be a major problem. In many situations users are leasing facilities which are under-utilized, but which must nevertheless be paid for as if they were fully utilized. To offset this, users would like to share communications facilities by collaborating directly with other users, so as to increase utilization and thereby reduce unit costs. Seventy-five per cent of respondents favoured line-sharing arrangements to serve this purpose.

Finally, while a majority of users would like to see a wider variety of facilities and services offered by the carriers, they recognized the economic problem of adapting common facilities to a multiplicity of varying user demands.

In addition to carrying out the survey mentioned above, the Task Force also received many position papers from data communications users. These generally reinforced the observations summarized above. To avoid repetition, comment is offered only on items throwing new light on data communications problems. Interconnection, according to some users who submitted briefs, is not to be confused with intercommunication. Users of dedicated data lines do not, at the present time, wish to communicate with one another to any significant extent; rather they want to reduce their data communications costs and improve the quality of the services obtained.

Additional difficulties arise from such factors as, for example, incompatibilities between U.S. and Canadian terminals on a CN/CP Tel link with Western Union, which entails the use of two terminals instead of one and a relay operation on the Canadian side. Need for a responsible body to review interface problems was stated clearly. Also, there is a common requirement to combine voice and data for set-up and control of a data service. Users of CN/CP Tel services commonly complained of the lack of supporting voice circuits.

Airlines and other organizations offering reservation services are especially concerned with international as well as domestic communication services. They would like greater flexibility in network structure, and in tariffs, in order to utilize their facilities fully.

(b) Restrictive Tariffs

The great majority of users expressed the opinion that tariffs, as written and applied by the common carriers, are restrictive and continue to be a serious impediment to the development of data communications in Canada. To the

less sophisticated users, tariffs equate only to rates, and the statement that "rates are too high" generally means that no economic benefit derives from the addition of data communications to a computer system. Operators of larger and more sophisticated networks consider that the technical restrictions implicit in the tariffs, which limit application of user-owned equipment and of new technology, are more serious than rates.

Some appreciation of the situation may be obtained from the wording of actual tariffs, excerpts of which are presented in Appendix 2. The words of course reveal nothing about the administration of the tariffs by the carriers. Many users cited their frustration in attempts to obtain more information about tariffs. Since tariffs are originated by the carriers, and in due process filed with regulatory bodies, they are not at all static, and in fact are a running reflection of the interplay between the carriers and users. The tariffs quoted in Appendix 2 relate to the interconnection of customer equipment or to possible arrangements the user might wish to make in order to multiplex or concentrate, to reduce costs, or even to re-sell. These are perhaps the greatest areas of contention. The selection of the tariffs does not imply any opinion of the Task Force as to the relative positions of the two carriers with regard to use of tariffs. Editorial comments and underlining have been added.

Carriers introduce new services after the necessary internal organizational preparations, by writing or re-writing appropriate tariffs. From their special knowledge and use of the infrastructure of tariffs, the carriers can write tariffs to meet competitive situations. They are also readily able to relate tariffs for communications links, terminals, and data sets into a single "package" for bidding purposes. The resulting offer is frequently for lease rather than sale of the peripheral equipment (notwithstanding the fact that the necessary capital comes from general funding sources of the carriers). There is, moreover, no obligation on the carriers to publish a breakdown of the package cost structure. One of the briefs offered to the Task Force by a supplier of computing equipment and services noted that the carriers occupy a privileged position with respect to their competitors in bidding for such package systems. While all computer communications suppliers need to reveal, at least partially, their plans to the carrier to obtain specifications and prices for communications services, the carriers are under no obligation to make similar disclosures to their customers. The carriers are able, moreover, to create new tariffs — related to custom made services — to suppress the competition. Wider dissemination of carrier tariffs is needed, but the increasing variety of service requests will result in continuing deviation from existing tariffs, and publication of the latter, while necessary, will not be sufficient for the users' purposes in many cases.

(c) Rate Considerations

Distance, as a factor in the rate structure, has been diminishing in importance, since transmission costs have been dropping and exchange and local costs rising so as to reduce the proportion of transmission costs to total costs. The number of circuit break-out points and the population size served by each point have increased to produce this effect. The new satellite

technology is an extreme example of a case where transmission costs per mile are virtually meaningless and, with the exception of the satellite itself, all costs are actually related to break-out points (ground stations). Elimination of mileage as an element of rate structure does not imply a reduction of total plant costs or of rates to the average user.

Rate structures for voice could be based upon the assumption that the class of service was uniform in technical characteristics. With data communications there are many combinations of technical parameters at the command of the user. The parameter of speed alone can completely change the class of service, its cost and availability. In addition, interconnections which would be necessary for extended distance-independent rates assume special significance.

In the Task Force investigations of user requirements relating to rate structures and other problems associated with the provision of data communications services, very few of the 45 responding data communication user organizations said that they would prefer a "flat rate", whereas about half said that distance should remain a factor in the rating structure. About half the respondents also suggested that volume (rather than holding time) should be a factor.

There was no evidence of a strong demand for distance-independent rates, perhaps because such rates are by no means necessarily low. However, there may be specific cases of services which are confined to communities of interest (*e.g.*, travel agents, stock-brokers, or community information centres), which have a large number of geographically-dispersed users, for whom administrative cost-savings could result from establishing rates in which distance is a minor element.

Tariff structures are complex and the expertise in their formulation and understanding still rests with the carriers. Some attempts have been made to reduce the impact of distance on rates by the introduction of "zoned-rate" services, such as DATA LINE II and Telex Computer Inquiry Service.

In discussions with representatives from less industrialized regions, concern was expressed on the possible socio-economic effects which could result from general distance-independent rates. Computing services could become centralized in a few locations in Canada, thereby reducing the computing capability in more remote areas.

In the light of these uncertainties, the Task Force has come to the conclusion that distance-independent rates should be considered at this time only with regard to specialized services for communities of interest and possibly for regional zones.

The Task Force therefore recommends that:

Rec. 10 Policies in network development should be oriented, in consultation and co-operation with the provinces and the private sector towards achieving rates for specific services in which the controlling factors may include time, bit rates or other parameters of network utilization but in which geographical distance is of minor or no influence, particularly within regional zones.

The Task Force considers that regional interests, the state of the art, the yet unachieved transition from voice structured tariffs to those more suited to data communications, and the complexities of network cost distribution all combine to push the realization of generalized national distance-independent rates for data communications into the future.

A frequently-used point of comparison is the rate for data communications services in Canada and the U.S.A. This comparison is made with respect to services being offered by the telephone systems. It has been noted earlier that the characteristics of data services are complex compared to those of voice services. Therefore it is not possible to develop a common scale of values to users. In fact, the only chargeable feature of telephone service which may have value to both data and voice users alike is distance; even this is in dispute and it is in any case unlikely that both types of users ascribe the same dollar value to the same unit of distance. Assuming that the technical characteristics of generalized communications services of the Canadian and U.S. carriers are uniform, a rate comparison may be made by comparing unit prices which, in the case of long-distance telephony and private-line service, vary according to mileage.

- Long-distance Telephony — The rate per mile (for a call of given duration) in Canada varies from slightly less than the U.S. rate (about 80%) to more than double the U.S. (about 225%) depending upon the mileage. The lower the mileage the more favourable is the Canadian rate relative to the U.S. rate. Comparisons are based on interprovincial long-distance calls in Canada and interstate calls in the U.S. and such calls are presumed to be "station-to-station, customer-dialed, business day".
- Intercity private line — The rates for voice-grade dedicated (private) lines in Canada vary from 50% to over 200% of the comparable U.S. rates, again depending upon circuit mileage. The Canadian rate is approximately 175% of the U.S. rate, on average.
- TELEX — The Canadian per minute rate for TELEX service averages approximately 150% of the comparable U.S. rate, again varying with distance.
- WATS/INWATS — These are forms of bulk long-distance telephone service which have proven to be of considerable interest to data communications users. Because service is purchased by "zones" for a fixed monthly charge a price-distance comparison is meaningless. The maximum monthly charge for this service in Canada is $3500 versus $1900 in the U.S.A. The minimum monthly charge (for full-time service) in Canada is $1750 versus $500 in the U.S.
- Data terminal equipment — Carriers in Canada and the U.S.A. offer, for monthly rentals, items of communications-oriented terminal equipment which, in conjunction with a generalized communications service, may be configured into a data communications service. A common example is Data-Phone, a combination of terminal equipment with telephone service. The rental rates for such items of equipment leased from the carriers in Canada vary from near parity with the U.S. rates for certain high-volume items to three, four or even five times the U.S. rates for items such as medium- to high-speed data sets, tape terminals and printers.

The cost of data communications in Canada through generalized communications services is generally higher, by a significant margin, than it is in the U.S. under comparable circumstances. However, the differences result partly from the different relative distribution of rates (long/haul versus local) that exists between the two countries and which arises from different regulatory and administrative philosophies. Furthermore the causes of these differences are to be found in such factors as population density, over-all size (distances spanned), population distribution, and aggregate population, all of which are, of course, markedly different in the two countries. These factors all have a bearing on all communications costs and the details of their influence have been examined by the carriers in their submissions to the Telecommission.[2] Approximately three-quarters of respondents to queries from the Task Force viewed data communications as an elastic commodity, *i.e.*, that lower prices would result in more use. The others view their own demand for data communications as substantially independent of price. The carriers also agree that there is some elasticity but have yet to be convinced that it is significant. Probably the best approach may be an experimental tariff reduction. The carriers are asking for more freedom to experiment in this area.

An avenue of improvement is to use data sets operating at the highest speeds consistent with acceptable error performance. Another is to use multiplexers which make possible the use of single circuit transfer of several streams of low-speed data which might originate with different users. Recently, data concentrators have been introduced to more efficiently pre-form the data before multiplexing. Hence, it is technically possible for two or more users whose individual demands are low to band together to increase the utilization of a private-line network.

In summary, the disadvantages to Canadian users of data communications, relative to their U.S. counterparts, can to some extent be overcome by taking advantage of the present unused capacity of communications facilities which can be used for data.

2. COMPETITION AND INTERCONNECTION

Computer/communications and data communications are in early development stages, and it will be important for Canada to establish the correct balance between the factors leading to monopoly, and the alternative economics of a competitive environment. In addition to competition between themselves, the carriers now have to deal with competition from non-carrier organizations which are computer-industry-oriented. Competition issues frequently emerge also as interconnection issues. Several forms of interconnection will be reviewed as they relate to competition, and to compatibility between data communications systems.

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[2] Department of Communications. *Telecommission Study 2(a): The Canadian Telecommunications Industry: Structure and Regulation* (Ottawa. Information Canada).

(a) Competition Issues

Competition Between TCTS and CN/CP Tel

The competition between these carriers is one-sided according to briefs submitted to the Telecommission by CN/CP Tel.[3] Essentially, they claim that their capital base is too small and that this is due in part to a lack of a profitable class of monopoly service. The public telegraph service is not profitable. Additionally, they are seriously hampered by lack of local distribution systems; by restricted access to those of the telephone carriers; and by the impermanence of their agreements with the telephone carriers. Consequently, in these submissions, a request is made for a monopoly of switched record services below 600 baud. They also request the right to acquire local distribution facilities from the telephone carriers and to interconnection from their dedicated circuits to public switched distribution systems.

Currently data communications account for only 3 to 4% of the revenue of the TCTS organizations. CN/CP Tel obtain nearly 60% of their revenue from data communications if TELEX is included. The TCTS has made an interesting comparison of the volume of data traffic compared to voice traffic both at present and projected to 1980. The TCTS analysis, which is based on actual traffic figures in bits per month, states that:

"Although a person speaks at the rate of perhaps 50 bits per second...an individual's voice is encoded at somewhere between 2,400 and 60,000 bits per second, primarily due to redundancy in the human voice. If telephony were equated at 50 bits per second the ratio of telephone to data traffic would be about 25:1 instead of 1200:1 (The value which results when voice is equated to 2,400 bits per second). Hence, on the basis of holding times or revenue, about four per cent of the total business today comes from data traffic. By 1980, the ratio would be 6:1, or about 17 per cent of the total business."[4]

While the purpose of this analysis is to indicate that data forms a relatively small portion of the traffic load it is obvious that the portion of revenues is not equally small. Indeed it would appear that data is about 50 times (*i.e.*, the ratio of 1200 to 25) as productive of revenue as is voice traffic. This is a considerable premium for data communications users to pay for use of a common network. The forecast may not be realistic because it is based upon the assumption that the present voice-oriented rate structures will continue to apply for data communications services. While this is unlikely, the fact is that the business community has to date seemingly accommodated, within its overhead structure, a high cost multiplier for charges for data communications. It appears possible that significant changes can be made in data communications costs and network technology.

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[3] Department of Communications. *Telecommission Study 8(b)(ii): Interconnection Between TCTS and CN/CP Telecommunications* (Ottawa. Information Canada)

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[4] *Communications, Computers and Canada. op. cit.*, p 23

Data communication rate structures have evolved from voice structures. As a result, the majority of data communications charges are related to those for voice communications which incorporate the basic voice service philosophy of rate-averaging.

Rate-averaging is an arrangement wherein prices are adjusted so that total costs of providing telephone service are recovered from total revenues, even when there are large differences in the cost of providing individual service. Rate-averaging has ensured that most individual householders can afford to have access to the telephone networks.

The voice monopoly has arisen from an over-riding social demand for a telephone in every house. Voice (telephone) service is indeed a public service, *i.e.*, one wherein any subscriber can call any other subscriber; it is nominally available to all who request service, and is in widespread use by all members of the public. Thus, there is sufficient reason to support this monopoly system which extends services on the broadest possible base at acceptable rates for all. In the diagram of Fig. 2, (Part A, Chapter II) the monopoly base for the telephone carriers comprises the private residences in which are installed 6.5 million telephones.

At present, data communication services do not have the characteristics of a public service. As shown in Fig. 2, data services, in contrast to voice-system development, are developing from the apex of the triangle, representing sophisticated special services, downwards to the base at which telephone services are provided under monopoly regulation. However, corresponding conditions in the data field for which the need for monopoly regulation would become evident, do not yet exist and are not likely to exist for a number of years. The bulk of data services today consists of dedicated, private-networks leased from the carriers. Service organizations offering remote job entry or point of sale and other computer/communications services to the commercial public are still relatively novel. Thus small business organizations constitute markets which are as yet largely unpenetrated.

Data communications for industry and commerce have developed from the low speeds (less than 1200 bits/sec) to a penetration of medium speeds (less than 9600 bits/sec). At medium speeds, data circuits are functionally separate[5] from voice circuits, (*e.g.*, the TCTS Multicom system). The movement into medium speeds will become important in this decade. More technical separation of voice from data traffic can be expected. Moreover, TCTS have disclaimed any monopoly obligations for present commercial data services. It follows, perhaps, that at least the separable data services operating above 1200 bits/sec can be expected to develop in a competitive environment.

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[5] A "functionally separate" system is one in which some elements, particularly switching components, are separate for voice or data use, while other elements in the system, particularly transmission components, may be common.

At the same time, data transmission below 1200 bits/sec may well be suitable for the marginal user, the small business man and ultimately the home-owner. This will require the widest possible switched base and may be expected to utilize the telephone network.

The use of carrier facilities for public- and private-network services means that the issues of monopoly, competition, and interconnection cannot be treated separately.

CN/CP Tel, in spite of their difficulties related to use of the telephone network, have managed to secure approximately half the data communications business in Canada, if one includes switched message services like Telex. If the size of CN/CP Tel, in terms of capital investment, does not change in relation to the TCTS, then the former will be unable to support data services offering marginal returns (without a subsidy). On the other hand, with full interconnection of CN/CP Tel facilities to the telephone network, such services could be selectively extended to areas now served by telephone. The argument is therefore that, ignoring cost-imposed limitations, such interconnection, in conjunction with the requested monopoly for switched record and data services to 600 baud, would give CN/CP Tel the opportunity, of developing a selective monopoly of low-speed data and message without the obligation of rate averaging (unless government intervened). Such a monopoly would put pressure on the economic mainstays of the telephone system and would inhibit development of data services for the small user and for those users who will be dependent upon the existence of a universal public switched-network with natural monopoly characteristics.

This is the main issue underlying extensions to the interconnections between the telegraph and telephone carriers. These relationships are a major determinant in establishing a line of demarcation between competition and monopoly in data communication.

Government has the option to encourage the development of competitive medium and higher-speed services by supporting CN/CP Tel in securing specific agreements covering price and technical factors for interconnection of their systems with those of TCTS. This would necessarily be an on-going activity as the two systems expand to meet demand. For example, different regions in Canada will tend to develop local data services in their own time-frames. Different economic needs and therefore different service requirements can be expected. There will be special problems associated with the interconnection to regional systems of non-telephone carrier transcontinental networks, such as those of CN/CP Tel (and Telesat), since provincial governments in some cases own and operate the telephone systems. Toll revenues from long-distance data communications could become a controversial subject between the "national" and provincial carriers. Hitherto interconnection has been arranged on a sharing basis by the telephone carriers.

Mandatory interconnection, if required between provincial carriers, CN/CP Tel (and Telesat) would affect the TCTS toll revenue distribution practices. Further,

since the railways hold rights-of-way from coast to coast, they may eventually develop a strong position regarding division of tolls if cable and waveguide come into common usage. Therefore agreements between TCTS and CN/CP Tel may be difficult to achieve.

From the foregoing, the Task Force concludes that a government presence will be required to ensure the development of data communications services using the monopoly-oriented switched-voice network, and concurrently of competitive with improved performance.

The Task Force accordingly recommends that:

Rec. 11 Government should take steps through the Focal Point, in consultation and co-operation with the provinces, to ensure the evolution of data communications networks which in part are functionally separate from the telephone network, with the aim of having improved technical and economic service characteristics provided.

Competition — Carriers Versus Computer Industry

There is no direct competition in Canada analogous to that in the U.S. where University Computing Corporation, through their subsidiary DATRAN, has achieved status as a special carrier, to offer data services over an all-digital national system. However, the pressure from the computer-related industries upon the common carriers is very real. It stems mostly from the fact that the user owns data communications equipment which is part and parcel of a computer facility, integral with his business process. Also, the business user is in frequent contact with representatives of the computer industry because of his requirements for business machines and supplies. With the introduction of the front-end processor concept for data communications by the computer industry, the user now has an owners' interest in techniques for code conversion, store and forward, and most important in a certain switching capacity. TCTS has reacted under these pressures, and in one instance the reaction was to contract with a computer organization for the supply of equipment to use as a base to develop a new front-end controller system.[6]

The carriers, desirous of broadening their rate bases and of diversifying their service portfolios, are clearly making concerted efforts to exploit data communications equipment to the full. It appears unlikely at present, however, that they will fully control this aspect of the business, as they do in telephone equipment, where all phases of the operation, back to manufacturing, are largely under the control of the carriers.

Regardless of the agencies providing data communications, the government needs to be very active in encouraging Canadian procurement. This is evident

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[6] Krupski, H., quoted by Blagg, M. "Ottawa labs give Canada a world lead in Communications". *Ottawa Citizen*, September 14, 1971, p.10.

from the fact that, for example, large international firms are the most likely sources of supply for digital switching equipment. Western Union in the U.S.A. have already placed orders for the German EDS digital switch. Such switches will form a large part of the investment in any digital network. CN/CP Tel estimates that $50 to $100 million for an initial national switching complex will be required. (See Appendix 3)

Will the necessary capital be furnished by the carriers, by the computing industry, or by some new combination? This must be one of the areas of concern by government because the rate base of the telephone carriers would be affected by a shift of capital allocation within the telecommunications industry.

Non-Carrier Organizations and Competition

Comparison of user submissions to the Telecommission with current submissions to the Task Force indicates that progress in resolving data communications problems has been slow during the past few years.

It is evident that the leadership for innovation during the period has come as often from the users as from the carriers, and if computer/communications are to achieve fulfilment in Canada, the barriers which have been maintained by the carriers around their "monopoly" plant in some cases will have to be lowered to non-carrier organizations. Users and entrepreneurs will have to be given participatory rights in the development of Canadian data communications networks.

For several years the experience of business managers has been that their systems analysts were not successful in relating their computer technology to the business in hand. Little wonder that the common carriers have been under fire for not relating their network facilities to their customers' data communications systems requirements. The problem is complex, but user representations to the Task Force indicate that the carriers are not providing leadership for data communications systems specifications, even to the extent of providing an adequate base of technical information about their own systems to aid users.

It is important that the services provided by the carriers be fully specified and published, in order to minimize pricing and technical problems related to system interconnections or use of non-carrier-owned attachments. Similarly, those technical precautions which the carriers consider essential for protection of their networks from interference or damage should be clearly expressed to all users. On the other hand, non-carrier organizations must expect to be bound by the specifications and standards as set out by the carriers for the use of their facilities. They should also be encouraged to comply, as far as possible, with published network standards in order to avoid the proliferation of incompatible networks.

The Task Force recommends that:

Rec. 12 A non-carrier organization leasing facilities from a carrier should be permitted to attach to those facilities any data communication equipment not owned by carriers, provided only that it meets published standards for continued protection of the carriers' networks from damage and interference; such an organization should, however, be encouraged to adopt published data network standards wherever possible.

Line-Sharing and Re-Sale

These terms are not synonymous in the view of the carriers and therefore some definition is necessary. "Line-sharing" will be considered here in the sense of customers making common use of a line, each for his own private interest and with some provision for sharing the cost. "Re-sale" will be interpreted as the use of a private line or lines for collection, delivery and transmission of communications for others with the express purpose of profiting by so doing. It is anticipated that services which use computers for such collection and delivery will become complicated to the point where they will be performing message-switching or other special functions. But as long as these are incidental to the sale of the computing service, the whole will be regarded as a computer communications service or "hybrid" service and not as a "re-sale" service. Examples of this in practice are the computer-based enquiry services of brokerage firms.

Voice-systems usage is characteristically random. Not many calls can be scheduled, nor is it economical to store and concentrate voice messages in the concept of time division multiplexing, which is now being proposed for digital data communications. This technology opens up new possibilities for line-sharing. It makes even a few moments of otherwise idle time on a data circuit valuable. However, to be able to accomplish this, new equipment is required. Large corporations will be able to provide their own, but others will have to rely on the carriers or on entrepreneurs prepared to put up the capital to acquire the equipment and to organize computer/communications systems.

Generally, the carriers may be expected to modernize their plant to supply such new facilities and systems. The rate at which they do so, however, will be largely dictated by the availability of capital and by its apportionment to data or voice needs. Furthermore, in the more sophisticated forms of computer/communications, the problems to be solved may be fundamentally those of computer systems software and hardware rather than of traditional communications engineering. It is at least plausible that computer industry firms would excel in this situation. In the long run, one would expect that, to the extent that there are economies of scale in such operations, the carriers should be able to perform line-sharing of data communications at the lowest cost and to the satisfaction of most users.

The front runners of non-carrier groups offering new services are those which propose to lease circuits from the common carriers for re-sale to their own customers. Use of additional equipment is planned by these entrepreneurs to

provide new services to their customers, such as new forms of line-sharing and improved end-to-end quality due to new error-correction and detection techniques.

The wording in the selected tariffs in Appendix B suggests that carriers restrict line-sharing and re-sale because they consider them as forms of competition. The subject is an important point of current controversy between carriers and non-carriers. The Task Force has concluded that, at least in the short-term, a policy for liberalization of line-sharing and re-sale would result in advantages to users, both in reduced communications costs and improved service quality; and also that there would be synergistic increases in usage of carrier facilities which would result in over-all benefits to carriers and non-carriers. The Task Force therefore recommends that:

Rec. 13 A non-carrier organization (including data processing affiliates of carriers) may offer commercial data communication services to customers through carrier facilities, subject to filing with the regulatory body prior to initiation of service, information on its corporate structure and its data communication services; and the regulatory body should be empowered to conduct hearings which may result in the services being disallowed on the grounds of failure to comply technically with published network specifications and standards, or of economic infringement of the common carriers' regulated public switched-network services.

Responsibilities of the Carriers

The carriers enjoy a basic protection for use of rights of way for the public telephone and telegraph services. Certain data services, because they are functionally separable from these public services, can be made competitive without removing this protection. As long as non-carriers do not construct their own transmission facilities, this competition will be limited to various forms of derived services. The monopoly services of telephone and telegraph will continue to require regulation.

However, all that has been said to this point should make it clear that a new rate structure for data communications must be devised. Thus, both data processing affiliates of the carriers, if created, and non-carrier organizations could expect common rates for communications services using criteria different from those used for telephone. Moreover, while the telephone and telegraph monopolies will be retained, there will be scope for competition in data communications services.

In order to ensure that all users, including commercial computer/communications entrepreneurs and the data processing affiliates of carriers, have access to the data communications services of the carriers on an equitable basis, the Task Force therefore recommends that:

Rec. 14 Carriers should be required by legislation to file with the appropriate telecommunications regulatory body, specifications and charges for data communication services; and the regulatory body should be empowered to approve such specifications and charges; and to require publication of them.

Furthermore, the regulatory body should be empowered to prescribe the form, content, and frequency of carrier returns accounting for expenditures, the form of submissions relating to equity issues, and other particulars in support of their tariff submissions.

The Task Force recommends that:

Rec. 15 The telecommunications regulatory body should be empowered to enforce adherence by the telecommunication carriers to prescribed procedures in the establishment of their data communication rates.

(b) Interconnection Issues

Interconnection is frequently taken to refer to the connection of a non-carrier-owned terminal device to a carrier system. The devices are also described as ''foreign attachments''. There are many other forms of interconnection, however, most of which have an effect on competition. Some of these are:

- Carrier-to-carrier interconnection for competing services — for example, CN/CP Tel terminating dedicated circuits of customers through a local telephone distribution system;
- private system to public system — for example, Pacific Great Eastern railway network interconnecting to B.C. Telephone;
- dedicated private data networks operated by different organizations interconnected through a private computer facility — not permitted at this time by the carriers under the sharing restrictions.

Examples of interconnection which do not involve competition are the following common situations:

- Carrier-to-carrier for non-competitive services — for example, a telephone carrier interconnected to a neighbouring carrier in an interprovincial network;
- ''piecing-out'' — for example CN/CP Tel may make an agreement with a TCTS member company to extend a communication circuit into a certain area, using facilities of the other party (or *vice versa).*

Co-ordination of Canada's external telecommunications services with those of other nations is the responsibility of COTC[7] which operates computers and other facilities for connection with European and Pacific networks via trans-oceanic cable and satellite. Gateways are located at Montreal and Vancouver.

[7] Department of Communications. *Telecommission Study 3(e): An Analysis of International Telecommunications Operations, and the Growth and Handling of International Traffic* (Ottawa: Information Canada)

This service offers five-bit code only. There is a growing demand within Canada for overseas circuits offering additional code capability and higher speeds, end-to-end.

Connection with the U.S. is directly arranged between the carrier organizations in the two countries. Thus there are interconnections for TWX to TWX, and Telex to Telex or Datatelex services. Most data transfer, however, is via dedicated circuits. The absorption of the TWX facilities in the U.S. by Western Union may result in cross-over of Canadian TWX through the facilities of Western Union, but TCTS connects generally through AT&T and other telephone carriers in the U.S. CN/CP Tel have had long-standing agreements with Western Union, originating with telegraph traffic.

The present state of interconnection between the competing carriers in Canada is here summarized by reference to the trade names of the principal data-oriented services they offer to business firms. The tabulation below lists similar services in the first column; compares them for technical compatibility in the second column; and gives the present interconnection status in the last column. Telex, Broadband and Telenet are offered by CN/CP Tel and others by TCTS. The pairs are grouped according to similarity of service offered to the user.

SIMILAR SERVICE	TECHNICAL COMPATIBILITY	NATIONALLY INTERCONNECTED
Telex – TWX	No	No +
Broadband – Multicom	Yes + +	No
Telenet – MSDS	Yes	No

Legend

\+ But internationally interconnected.
\+ + This might require special interfaces and signal translation.

An area of recurring complaints from users is that system interconnection of competitive data services is not being offered by the common carriers, even where the technology is compatible.

In considering some of the probable network developments, attention is drawn to the fact that there are both differences and similarities between the technologies proposed by CN/CP Tel and TCTS. Thus, on toll routes, whereas microwave facilities will probably be similar, TCTS will be in an exclusive position for some time with their LD4 Cable, to service high-density short-haul traffic. Generally, the telegraph carriers' technology will tend to digital systems without voice, whereas the telephone carriers will develop voice-systems with supplementary digital services. In local loops, the present division between baseband and voice will increase as voice modems drop out of digital data networks. Digital repeater amplifiers and multiplexers will appear alongside their analogue counterparts.

Users and all non-carrier organizations involved with development of the new services should make determined efforts to minimize incompatibilities between basic requirements, systems and devices. Some idea of what might come is indicated by D.W. Davies,

"We might give some thought to the possibility of allowing digital communication systems to evolve for a number of years before attempting the synthesis of a unified network. The diversity of users' requirements would then ensure that a large number of incompatible private networks was set up. Even when the requirements of the businesses were plainly similar, as for example, in airline seat reservations, commercial and other considerations would ensure that there were separate networks."[8]

Previous recommendations have stressed the desirability of interconnection between such networks. The national carriers have not as yet offered jointly integrated switched data communication services. Also, functional incompatibilities between data communications networks, including such items as character codes, error checking and detection techniques and communication protocol, are already apparent, and there is little evidence of major efforts by the computer equipment manufacturers to resolve these differences. Therefore, it is reasonable to assume that interconnections between present and future systems will probably result only from pressures by users and government. To promote such developments, it is recommended that:

Rec. 16 Government, through the Focal Point, should request organizations offering data communication services to effect interconnections between their systems as needed for the development of a coherent data communication network.

If, in the process of establishing interconnections between networks of different carrier, or of non-carrier organizations, agreement cannot be reached, the telecomrnunications regulatory body should act as arbitrator.

It is therefore recommended that:

Rec. 17 The telecommunications regulatory body should be empowered to conduct hearings and decide on cases involving interconnections between networks of carrier or non-carrier organizations offering data communication services.

Attention is drawn at this point to Recommendation 14, calling for publication of specifications for services offered by the carriers. Specifications will very often be the testing medium for development of interconnection practices. Therefore, requests made in accordance with Recommendations 16 and 17 may affect certain specifications. Additionally, all findings made by the

[8] Davies, D.W. "Communications Networks to Service Rapid-Response Computers". *Information Processing 68* (North Holland Publishing Company, Amsterdam, 1969)

regulatory body will be in the public interest and should be published. Therefore it is recommended that:

Rec. 18 Decisions of the federal telecommunications regulatory body should be published and made readily available.

By these means it should be possible to advance the data communications systems and services in an orderly manner and with a maximum of open dialogue between government, carriers, non-carriers and users.

3. DIGITAL COMMUNICATIONS

(a) Introduction

The telecommunications networks existing today are systems for the communication of voice, facsimile and video signals which are analogue at their source. Computer data originate in digital form. Conversion from one form to the other is inefficient and costly. Up to the present, data have been transmitted after conversion to analogue form. Digital network systems make use of semi-conductors and reduce equipment requirements, making them economically the most attractive base for future network development. The interrelationships between the analogue and digital systems are principal concerns of carriers, governments and users around the world at this time.

Another characteristic of digital technology is that the signal-to-noise ratio in transmission can be made nearly independent of distance, since the signals can be effectively regenerated at intervals in a manner which has no equivalent in analogue systems. This feature, along with the economies already mentioned, has resulted in a carrier-industry decision to convert transmission systems for voice to digital. This in turn has opened the door for digital transmission of data within the current networks.

The digital world of business machines encompasses a very wide range of bit rates from hundreds to millions of bits per second. International agreement has been reached on standard rates of 600, 2400, 4800, and 9600 bits/sec for transmission of data over voice-networks.

The Pulse Code Modulation (PCM) method is the basic digital method for transmitting voice signals. Associated with this system is a particular bit rate hierarchy. Data streams of different bit rates can be introduced into the PCM transmission network, but only at corresponding levels of the PCM bit rate hierarchy which, in some cases, is a constraint on data transmission.

Another significant feature of digital network development, not as yet determined in degree, is the requirement for circuits that have unequal bit rate capacities in opposite directions. Thus, a slow speed may often suffice for an inquiry to a data bank, but the reply may be lengthy and require high speed for efficiency and to avoid blocking the network.

Switching is crucial to network development. Before the introduction of computers, switching was essentially confined to "circuit switching" between a calling and a called terminal. With this system, the only delays are associated with propagation, and connect and disconnect times.

Generally, there is no processing power or storage capability in a "circuit switched" system. Another technique known as "message-switching" has long been recognized as efficient when low-speed short bursts of information are transmitted over long distances and when relatively long delays can be tolerated. A processor associated with the switch accepts messages from a calling terminal and stores them. It is not necessary for the called terminal to be available at this time. Advantage can be taken of the processor to perform other functions such as multiple-addressing. Use of "message-switching" involves network control of the format of the message. Since the data correspondents at each end of the line are also concerned with format in their processing facilities, "message-switching" will introduce new network signalling and control concepts in which the subscriber has a role for the first time.

Analogue voice signals contain much redundant material which is expensive to store and therefore cannot be message-switched economically. Development of future digital networks will require both classes of switches. It is not known now in what proportion or in what applications they will serve. The immediate trend is for "circuit switching" still to predominate, for digital switching technology offers formidable technical and economic challenges. The financial resources required to meet these challenges are available to few companies in the world.

The subscriber drop or local loop which connects a terminal to the nearest exchange is a facility designed for voice, which consists of pairs of wires, connectors and terminals. Loops without repeaters are limited to a working length of ten miles. A number of circuit developments are needed to make the loops effective for digital data service.

Three characteristics are said to have limited the use of the basic voice technology for data communications. One is that the error rate is not as low as desired; another is that call set-up times are too slow; and the third is that the statistics of voice-transmission require different equipment-provisioning standards from those which would be optimum for data.

While data communications are in the early stages of development, networks require human operators at the terminals. The nature of the data is usually such that errors are detected and corrected by re-transmission. Users consulted by the Task Force did not cite error rates as more than an aspect of inefficiency. To achieve this status for their medium-speed circuits the carriers have found it necessary to functionally separate these circuits from the voice network. As user requirements tend more to end-to-end automation, error rates will have to be improved. This will be done by achieving economic trade-offs between improved error-correction software techniques, controlled by the terminals, and by improved transmission techniques.

Set-up times are important in transaction-oriented data communications. Set-up time in the telephone network is taken up by dialing, waiting for a connection and re-dialing if the call does not go through. Thus set-up time ranges upward to 30 secs, which is a very long data transaction period. If this procedure is carried out for every data burst, the useful transmission time is an inefficient fraction of the total access-time.

Shorter set-up times have been achieved in the Multicom and Broadband services by using special electromechanical switches. This can be considered as only an interim solution. Signalling and control of communications circuits introduce a further delay element which is associated with switching. At present, a terminal can only access a fixed transmission capacity. Special signalling circuits together with some form of time division switching could provide "demand assigned variable transmission capacity" as well as reduced set-up times for data circuits.

The question of equipment-provisioning standards revolves around traffic patterns. There is a well-established ratio for switching capacity, as related to the number of incoming and outgoing voice lines. Long holding times in data transmission may have invalidated this statistic. This may result in voice plant overload in high-density areas. Also services for very short transactions can overload switching processors and there is evidence to show that this has occurred.

In summary, the advances required in signalling and switching are a technical generation away from realization. Unfortunately the time-cycle for new developments in voice plant has been stabilized for a longer period than the data processing industry. This leads to another mis-match, because user terminal technology, and hence requirements in terms of classes of services as well as traffic patterns, appear to the telecommunications industry to be relatively fluid and undeveloped at this time. While great progress is being made through consultative processes, international consensus on basic digital network principles has not yet been reached.

The carriers today have networks which are efficient for analogue signals. New digital technology is being effectively introduced to improve performance. However the teleprocessing of data can be optimized only through development of digital networks designed for the purpose. The universal problem is how best to integrate the two network technologies to provide a general service.

(b) Existing Networks

In Appendix 3 there is a brief review of technical material which was made available to the Task Force by the carriers concerning present and proposed digital technology.

In addition to network activities controlled by the carriers, there are extensive network activities in the private domain. To give an example of such a private network, one corporation has established a message-switched data network

for the purpose of distributing reservations to sporting and theatrical events. The system is capable of being extended to include travel reservations and lottery sales as well, and the latter market is already being exploited in the U.S.A. This is a data bank operation and a single data bank computer is employed for all events for which reservations are filed.

For the system to be economically viable there must be many input-output terminals, widely distributed. This latter characteristic imposes upon the data bank in question the problem of "front-end blocking" — a combined hardware and software problem resulting from the need to terminate several communications lines each of which may contribute only a small amount of traffic. The solution used by the corporation is to use dispersed front ends — a series of small computers which can concentrate local or regional traffic before it is imposed on the data bank. This remote equipment also serves another useful function, that of filing format information. The system is a sophisticated message-switching and processing network, which meets the user-imposed requirements of high utilization of communications lines, efficient administration of file space, and reduction of front-end blocking. It is "in-house", *i.e.*, not accessible to other organizations.

Some computers used in the system are owned by the corporation, others are leased from the manufacturer. The manufacturer also provides all the hardware maintenance. The communications facilities — which are voice-grade private lines — are owned by the carriers and maintained by them. The terminals are owned by the corporation, and because of their number and unique design they represent a substantial portion of the investment. Some of the terminals are maintained, as a special arrangement, by the carrier, while others are maintained by the corporation. Software design, production, and maintenance are all undertaken by the corporation itself.

The Task Force has identified a significant number of such networks as, for example, the airlines' reservations systems. All strive for high utilization of communications facilities in order to reduce communications costs. All are designed to meet the user's own functional requirements and most are not compatible with each other. Comparable networks to serve users outside a single corporate umbrella are not particularly evident in Canada.

The authorization of new "special carriers" in the U.S. by the Federal Communications Commission has attracted much interest and comment among data communications users. Interest is centered on the DATRAN network which will be all digital, and is expected to produce cheaper and more flexible data services than those currently offered by the telephone carriers. This network will cost several hundred million dollars to build and is three to four years away from realization.

The Task Force sees no particular need in Canada at present for a "special carrier" concept for data communications. For example, the present and potential capacities of the long-haul facilities of the Canadian carriers, including those of Telesat and COTC, are more than sufficient to serve Canadian data communications needs. Alternative methods for stimulating the development of data communications in Canada have already been discussed.

(c) Recommendation for Network Development

The plans of the major Canadian carriers are pragmatically related each to their own capabilities and to the Canadian market for data communications. Thus, CN/CP Tel have limited technical resources, and may rely upon world suppliers for the most expensive and complicated network equipment. However, the telephone carriers will, to a large extent, develop their own transmission equipment and probably their own switchers. But, in the latter case and in the supply of terminals, the computer industry will have an important role. It is essential also to recognize that the evolution of user requirements is still in early stages and that these will, to a large extent, control the pace of developments. To the extent that the plans of the Canadian carriers develop autonomously in the quasi-competitive market for data communications, there will be a continuing problem of technical incompatibilities between their networks. The Task Force recommmends that the government should take measures to advance the development of a coherent data communications network in Canada, and therefore should be actively concerned with the plans of the carriers and seek means to minimize incompatibilities.

It is therefore recommended that:

Rec. 19 The plans of the telegraph (railway) companies for the immediate development of their teletype and data services, and the projected plans of the telephone companies for the evolution of a data transmission network should be recognized by government as the present viable direction for the development of data communication facilities, and the government should, through the Focal Point, periodically take cognizance of these common carrier plans, and take steps to ensure the avoidance of disadvantages to users through incompatibilities in the communication services offered and to ensure that the carriers' long-term technical and financial planning is commensurate with the potential and the future requirements for computer/communications in Canada.

Naturally, it must be recognized that technical developments are conditioned by financial considerations; the government should therefore also be concerned with the financial planning of the carriers. For example, in Telecommission Study 2(e), forecasts for 1980 were presented which indicated that total telecommunications revenues at that time will be approximately $4 billion. Capital investment of the telephone carriers will rise from the current $6 billion to $10 billion in 1976, and thereafter to $12-14 billion in 1980. The ratio of capital to annual revenue will therefore be approximately three-to-one.

Assuming a conservative forecast which sets data communications revenues by 1980 at 13-15% of total telecommunication revenues, say $500 million, a cumulative capital outlay related to data communications of $1.5 billion might reasonably be expected.

To date, investments assigned to data communications probably do not exceed $100 million. A public announcement[9] by TCTS in 1971 stated that expenditures of $100 million for a new digital network were planned up until 1976. There is a very large difference between this $200 million and the $1.5 billion suggested above. An explanation for this might be that the simple sums used here do not indicate the portion of voice plant capital which might be assigned to data communications as an indirect cost. Also the figures in the main refer to the largest carrier in TCTS. However, they do serve to illustrate a point. If indeed there is to be a cumulative investment of $1-1.5 billions, or any comparable sum in the period, then the government should require that it be regularly informed of related 5-, 10- and 15-year business plans of the carriers, so as to be assured that such large expenditures could be identified with long-term national policy objectives for data communications.

Recommendation 19 recognizes the free enterprise characteristics of the Canadian telecommunications system. But it does so in anticipation of the evolution of data systems to the point where many major system-users will be demanding network interconnections, maximum technical compatibility and more flexibility in manipulation of the circuits. When this happens, a certain amount of the insularity now enjoyed by the carriers will disappear, for then the issues will become those of competition practices, regulation, rights-of-way and monopoly prerogatives, all of which are in the domain of government.

4. INTERNATIONAL CONSIDERATIONS

World-wide data networks using land-lines, underwater cable and satellites are now commonplace. One large U.S. airline has networks linking six continents with the control facility in New York City, currently handling 100,000 inward messages and 130,000 outward messages per day. This traffic is expected to triple by the mid-seventies. A seat reservation request made anywhere in the world is answered in eight seconds on this system. The U.S. airlines use the international data routes for seat reservations, flight scheduling, maintenance and management. These airlines have their own carrier, ARINC. Canadian airlines have similar facilities.

Data communications services for connection to U.S. points from Canada are much less varied and less flexible than services over solely Canadian routes. Multicom, for example, terminates at the U.S. border. MSDS does cross, but is only economically attractive to users with a large number of stations in Canada coupled with a high traffic volume. At present, users wishing to operate at medium speeds have to resort to private lines. Unlike TCTS, the U.S. carriers permit such private lines to be connected to the switched-network from the U.S. termination point. It is also possible to obtain

[9] Blagg, M. *op. cit.*

interconnection to a multi-drop circuit on the U.S. side. The least-cost situation at present is for the Canadian originator to terminate the circuit at a computer centre in the U.S. This centre reaches the desired terminals on its own network. If this network is operating at U.S. bulk rates, the Canadian originator will benefit in cost-savings, as opposed to trying to reach the U.S. terminals directly from the termination of his private line in the U.S.

The Canadian subscriber is restricted to one hypothetical entry port to the U.S. This policy of the telephone carriers prevents subscribers from routing traffic between Canadian points via the U.S.A. Naturally, this single border-crossing philosophy of TCTS is a contentious issue. It may not be fully effective in protecting Canadian long-line revenues because the policy is being circumvented in various ways.

Canadian firms may lease a circuit terminating in a computer centre in the U.S. There, by use of store and forward and concentration techniques, the messages may be forwarded on global nets at rates lower than those available for traffic routed through the Canadian gateways of COTC. There may be more delays or other inconveniences compared to dedicated or public service connection through the Canadian system but there are cost-savings which apparently more than offset the disadvantages.

Since the computer centre has other customers, the system is employing circuits on a shared-use basis, in contrast to the principle of single use of circuits, which has prevailed for voice circuits. Multiple use is internationally considered to be a carrier prerogative. This opinion is shared by the Canadian carriers. Nevertheless, these practices are forcing world recognition that liberalization of leased circuit policies is inevitable. The problems of the non-carrier organizations therefore have also to be considered in relation to international data communications.

The recognized world forum for establishing agreement in principle on telecommunications articles is the International Telecommunication Union (ITU). Its members consist of government representatives. Canada has ratified the ITU convention and is a voting member. Industry participation is through advisory and working committees. Of the latter, the one principally concerned with data communications is the International Telegraph and Telephone Consultative Committee (CCITT). Most of the telecommunication authorities, operating agencies and industrial and scientific organizations in the world contribute to the work of the CCITT. This committee was formed in 1956 as a follow-on from telegraphic studies. In the past, Canadian industry and government have made contributions reflecting their separate interests which were principally technological and administrative respectively. Canada, with a number of other countries, has become aware of the increasing importance of the work of the CCITT. Continued support from the government must be assured as new tasks are undertaken in this field of international relations, for the necessary technical and administrative expertise will take time to develop.

In 1967, the CCITT held its first meeting to specifically discuss the possibility of a separate data network, and in 1968 a Joint Working Party (NRD) was formed to advance the concept. In Canada, an advisory committee for the study of these matters was formed, with members from government (DOC, COTC) and the telecommunications industry.

The following is a specific example of the type of problems to be studied. A major current working party of the CCITT has as its terms of reference (in part):

"To recommend which data services should be offered on a worldwide basis on public networks, and to simplify interconnection."

This is a complicated problem, as many national interests reflect different internal network requirements. Yet if no attempt is made to co-ordinate these requirements, and to make compromises in the best interests of the majority, then the alternative is isolationism through gateways which, in due course, would require intolerably expensive hardware and software.

Satellites are also expected to have an impact on data communications, with regard to both tariffs and technology. The recognized delay problem with satellite circuits does not restrict data transfer to one hop only, as it does voice, but special terminal design and the development of new error-correction techniques in hardware and software are required.

Coincident with the technical developments, new tariff and rate structures must be agreed upon. These will not always be questions of detail. Shared use of private facilities is a case in which tariffs might be used, either to inhibit or to encourage a new international service.

Much must be done then by governments to achieve agreements in principle on features of international switched data networks. In view of the importance to Canada of world data communications, it is recommended that:

Rec. 20 Government, through the Focal Point, should intensify the establishment of a Canadian position on international issues in data communications and ensure appropriate representation on international bodies.

The CCITT only influences governments and industry on matters of general policy for rates and classes of services. There are many serious technological and administrative matters which are decided by direct agreements between the operating carriers. Two technological examples will be cited. The first is the fact that intercontinental speech circuits have echo suppressors. This inhibits full duplex usage for data. It is necessary therefore to reach agreements on the need for new suppressor-design, which would permit control from the customer's terminal (a CCITT recommendation to this effect has already been made). Second, the introduction of digital multiplex equipment resulted in differences in standards between North American and European operators and equipment suppliers which could result in a serious incompatibility in interconnections.

The latter example is selected because it illustrates the manner in which international decisions may affect the Canadian telecommunications manufacturing industry. The Canadian decision on the digital multiplex question may decide whether Canadian manufacturers endeavoring to develop export business will be limited in access to either the U.S. or to the European Common Market.

The situation developing between the Canadian carriers and Western Union, which was mentioned earlier, needs additional emphasis. Western Union is developing a complex message-record data network linking Canada to Mexico and the Central and South American states. Extensive use will be made of computer technology in both hardware and software forms. It will be important to develop a clear forecast of Canadian requirements, and of technological plans from all the Canadian carriers, with regard to use of Western Union facilities. Incompatibilities in network hardware and software, if they are allowed to develop, will be very costly to correct. Unnecessary costs are certain to reflect upon Canadian rates.

The Government of Canada has a responsibility to use its resources to facilitate development of a unified Canadian approach to these and many other problems which are related to agreements made between Canadian and U.S. or other foreign carriers. It is therefore recommended that:

Rec. 21 Agreements between Canadian and foreign telecommunications carriers should be reviewed by the government on a regular basis to ensure that the Canadian position on international aspects of data communications is upheld.

5. NETWORK SPECIFICATIONS AND STANDARDS

In this Report, the word "specification" is used in the sense of a description of classes or kinds of services and facilities that are being offered. Specifications may be forerunners to standards. Commonly they will include reference to specific standards, and in fact a specification could be complete if it called up nothing but certain standards. Specifications may be used in the system sense to define network parameters such as codes, speeds, and signalling conventions. Standards are regularly used with reference to equipment for detailing quality and performance characteristics. Thus, in the case of certification of a terminal, the objective would be to determine that it met certain standards. There are also software and methodology standards.

Liberalization of interconnection policies would accelerate the development of criteria for interconnection of networks or for installing foreign attachments. If the changes are introduced by legislation, the regulatory body would be empowered to administer the legislation. As a result of these factors, however, there will be a requirement for the development of a large and evolving standards base. To date the carriers have controlled system specifications, while the computer industry has developed standards for terminals. The line of demarcation between data processing and data communications is vanishing. This convergence implies an increasing interest

by the data processing industry in the specifications and standards evolved for data communications. Development of these in a fully participatory environment, which includes the computer industry and which is not unduly influenced by any one of the major participants, will be required.

Evolution of specifications and standards comes as a result of a process which starts with policy-setting and eventually reaches a level of engineering design detail as would occur in establishing a hardware standard. The Task Force recognizes that responsibility for the work necessary for the preparation of specifications and standards rests with the suppliers of data communications equipment and services. The major issues of interconnection, however, will require a government presence in policy development in the domestic and international fields for reasons which are apparent in the preceding text. Government involvement is seen to be essential in the process of formulating policies, and ensuring that standards and specifications conform to these policies and meet their intent, and in regulatory decisions concerning the application of standards and specifications in particular cases. To perform all these functions, closest co-operation is required between government computer/communications planning and regulatory bodies, private industry, and institutions directly involved in the standard-setting process. Specific recommendations for such co-operative mechanisms are presented in Part E of this Report.

This chapter deals with a number of issues concerned with the provision and use of data services in Canada. The issues arise primarily because of Canada's proximity to the large industrial and technological markets in the United States. Problems associated with the location and information-content of data banks, with the use of data services provided from outside Canada, and with foreign ownership and control are all inter-related and are considered in the perspective of growing requirements in the private and public sectors of Canadian society.

In the discussion on Canadian ownership and control of companies supplying computer/communications goods and services, problems of take overs and other issues which are covered in the recently published report, *Foreign Direct Investment in Canada*,[1] are not considered here. Attention is directed at those issues peculiar to computer/communications, which involve primarily data flow and data banks. Running through all sections of the chapter is a consideration of the problems of control over data flow, of access to data banks, and of potential loss of business in Canada.

1. DATA BANK ISSUES

A data bank may be described as a collection of information which is subject to constant updating with frequent additions, deletions, and changes. It implies also the ability to rapidly access and display a discrete item or items of information on demand and the ability to manipulate and summarize the information in the data bank in a variety of ways. The term ''data bank'' has arisen only in recent years, concurrent with the use of computers which now perform these functions, in place of the traditional manual methods.

The two main issues regarding government policy for data banks relate to personal privacy and national sovereignty. Personal privacy is the concern of the Task Force on Privacy and Computers, which is conducting a major study on those data banks which contain personal information on Canadians.

The issue of national sovereignty arises in regard to the location of data banks. If they are outside Canada, they are, of course, no longer subject to Canadian laws. This will become increasingly important as measures are introduced to cover such aspects as privacy, security or liability. In addition, use of data banks having cultural or educational content will have an impact on the cultural values of Canadians and on the Canadian identity. These issues are also related to national sovereignty and will be covered in Section 4 of this chapter. Here, attention is focussed primarily on the location of data banks.

A consideration of possible government action in regard to the location of data banks must take into account factors influencing their establishment and use. The costs of establishing and maintaining data banks can be very high.

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[1] *Foreign Direct Investment in Canada* (Ottawa. Information Canada (Catalogue No. CP32-15/1971). 1972)

They normally require large computers, extensive on-line storage capacity, many terminals, and considerable communications facilities for their operation. Most systems of this nature require back-up central processors and auxiliary storage capacity to guard against the possibility of system failure. In addition, high costs are involved in systems analysis and design, and in the conversion of the base information from written records to storage in the data bank in many instances. Furthermore, to make the greatest possible use of the data bank often implies round-the-clock operations, which usually entail the necessity of maintaining a large staff.

With manual methods, systems and techniques can evolve with time, and numbers of staff can be more easily adjusted in accordance with demand. The absence of this flexibility in computerized systems, together with their high initial and operating costs, mean that the marketing of services must be directed at the broadest possible areas of demand.

It is not surprising therefore that there are a number of data banks in existence which cater to a North American, or even world market. In a number of cases a continental market is in fact a more logical entity, as for example in the in-house data bank operations of certain credit card organizations, such as Diners Club or American Express, which contain the files on a mobile population. These two organizations hold records in the U.S. on a very large number of individuals from many countries, including nearly a quarter of a million Canadians.

Similarly, the Medical Information Bureau, which is an unincorporated association of Canadian and U.S. insurance companies, serves a North American market, and maintains records on Canadian and U.S. nationals. Canadian insurance companies have pointed out the benefits which accrue from this data bank to their own operations, and have suggested that any limitations imposed on the storage of this type of data outside Canada could have serious repercussions on the international insurance business. The Canadian insurance companies operate internationally, and maintain records in Canada on foreign as well as Canadian residents.

These examples are given here to emphasize the fact that a data bank, even one containing information on Canadian customers, should not necessarily be regarded as logically requiring location in Canada.

Another kind of data bank which raises issues of national sovereignty is the type which relates to Canada's natural resources. Many data banks, such as those in the Department of the Environment on water resources, are operated and controlled by government departments. If such data banks come to be handled by data service organizations in the private sector, the government will need to be assured of sufficient security and protection measures.

There are, in addition, instances where data banks on natural resources are maintained in-house by exploration companies, some of which have headquarters in the United States. In general, any in-house data bank which is used solely by personnel in that organization for internal decisions and

operations should not normally be of concern to government. In this particular instance, however, where information relates to Canada's natural resources, government has a legitimate interest.

The Task Force was unable to find evidence that any important Canadian resource information is kept solely outside the country. For example, reports are received by the Canadian Government on exploration activities in areas under federal jurisdiction. Practices in areas under provincial jurisdiction differ, but, in the main, geological and other resource information is either provided to provincial authorities or is retained in Canada by the companies themselves.

These issues by no means arise in regard to all data banks. There is a growing legitimate requirement of many organizations for the establishment of, and access to, data banks, for example, for environmental and market data which can be used to evaluate proposed policies, strategies and management decisions, and to seek opportunities for new endeavours. In these cases, collating of information from many sources inside and outside the country is necessary.

Therefore, there are a number of considerations which lead logically to a need for data banks serving users in more than one country. However, the issue of loss of control over data banks outside Canada does pose important questions. As measures become necessary in certain areas — with regard to privacy, security, liability or ethical standards for data bank operations — it will be important to retain particular data banks in Canada. Possible steps to achieve this will be discussed at the end of the following section.

2. NORTH-SOUTH DATA FLOW

Considerable concern has been expressed to the Task Force about the attraction of U.S.-based data processing and data communication services, particularly in the light of recent U.S. policy announcements. While it appears that at present this effect has not yet led to a large flow of data across the border, the potential exists, and a trend is evident towards increasing use of facilities located south of the border. The inherent economies for U.S.-based corporations with operations in Canada, and the probability of reductions in data communication rates through offerings such as those of the Datran Corporation, are only two facets of this complex problem.

Before considering options for possible government action, a more detailed examination of some of the issues is necessary.

(a) Task Force Findings

Much of the data flowing to the south is generated by in-house operations of Canadian subsidiaries of U.S.-based companies and is directly concerned with the parent-subsidiary relationship. The economies and advantages of centralized data processing facilities are considered by these companies to be important to such operations, and constraints on the location of data processing capability, which attempt to keep the work in Canada, are claimed

to result in higher operating costs to all divisions of a company including those in Canada. A submission to the Task Force, typical of the concern of such organizations, stated that,

"Historically it is the right of all companies to exchange information within their own organizations whether the information is in one, two or several countries. We believe that if Canada is going to continue to participate effectively in international business, it will have to allow communications in all directions and not hamper the North-South flow of information in order to encourage communications between the Eastern and Western parts of Canada."

For economy and other reasons, subsidiary companies draw on the resources of the parent organization for managerial and technical skills and for financial support. For the same reasons, it may be expected that, in many situations, subsidiaries will tend to use the data processing services of the parent corporation to enhance their own cost-effectiveness.

It should be pointed out, however, that not all Canadian subsidiaries of U.S.-based corporations use the data processing facilities of the parent for all their requirements, and that, in fact, a great deal of data processing is performed in Canada on their own facilities. It should be further pointed out that there are also Canadian-based companies with subsidiaries in the United States where the reverse situation obtains. This presents a similar situation, but in the reverse direction, with some of the work of the subsidiaries in the United States being done in the Canadian headquarters.

Part of the north-south flow of data traffic arises from user-needs to access specialized data banks, programmes or other services, which are not readily available in Canada. An example is the analysis of seismic exploration data. It was suggested to the Task Force that a large volume of seismic data processing is being done in the U.S. by multi-national companies. To assess the dimensions of the problem, the Task Force commissioned a study by a consultant, who obtained data from 35 of the companies initiating seismic work. Of the 35 companies, 21 use terminals for access to external computers, either in Canada or the U.S. However, they also have 51 computers installed in Canada used for pre- and post-processing of analyzed seismic data, for administrative work and for local geophysical, geological and engineering analyses. Those companies using U.S. computers for seismic analysis in oil exploration do so not only because of the highly specialized requirements, but also because of the high degree of internal corporate security which must be maintained.

The study estimated that the total 1971 expenditures of companies in the Calgary area, including the 35 companies surveyed, for seismic data processing in the United States was approximately $5 million. This represents about 12% of all data processing expenditures by those companies, including the costs of services provided by Canadian data processing service bureaux. Other estimates place this figure somewhat higher.

This particular example, while here related to the need for special services, is also concerned with internal policies and operating practices of particular organizations in the private sector. Another example of the use of U.S.-based specialized data processing services by Canadian-based organizations (though not through telecommunication lines but through mailing of forms and reports), is in the field of medical audit services (University of Michigan PAS/MAP services). The extent of the use of these services by Canadian hospitals, and the implications involved, are discussed in Volume II, Part B3.

In a Task Force survey of Canadian-based user organizations, it was found that of 60 companies which are major users of data communications, only 22 have border-crossing links. By comparison with the total number of computer/communications users, it appears that only a small number connect with the United States. Of these, some use more south-to-north data transmission than north-to-south.

Also, a number of Canadian-based data processing organizations market their services in the United States. Of 20 Canadian-based service bureaux offering teleprocessing services, 9 have clients in the United States. Revenues derived from their U.S. business in 1970-71 represented around 10% of their total revenues from all services, or between $1 and $2 million.

The available information did not allow a quantitative analysis of the flow of data for processing purposes from north to south compared with that from south to north. However, statements made to the Task Force by Canadian service bureaux and computer centre operators indicate that their prime concern is on the issue of Canadian subsidiaries of U.S.-based corporations transferring their data processing activities to their headquarters, thereby causing a potential or actual loss of business to the Canadian industry. In comparison, the issue of Canadian user organizations utilizing U.S.-based commercial data processing services is considered a lesser problem, which is also compensated by an increasing flow of business in the opposite direction. However, mounting dissatisfaction on the part of Canadian users, possible changes in policies of U.S. parent companies, and further technological developments in the United States all help to emphasize the growing problem for the future of data processing in Canada.

The recent decision of one Canadian service bureau organization[2] to locate a second computer in the offices of its U.S. affiliate because "connecting Vancouver into Washington is considerably cheaper than connecting Vancouver into Toronto" is indicative of a trend which is likely to increase unless strong measures are taken to improve service availability and rates in Canada.

(b) Policy Approach

In assessing possible government policies and future courses of action, it is necessary to take account of the practical difficulties inherent in attempting to

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[2] Sharp, I.P. Associates Limited. "The Newsletter". *Canadian Datasystems*. April, 1972. Vol 4, No 4, p 17.

restrict or limit the flow of data across international boundaries. Traditional methods of international control of commodity transfers include customs tariffs or taxation measures, quota provisions, export licences, and anti-dumping controls. Unfortunately, although data are treated increasingly as an economic commodity in many areas of business activity, they are also a commodity that is almost impossible to value systematically.

The problem of valuation is compounded by the fact that the value to be determined in this context is not the commercial worth of the data themselves, but rather the commercial value of the computer processing which has transformed data from one form into another. Measuring this at the point of border transfer creates problems, since it is largely independent of either the volume of data or the technical form in which they are transferred (tapes, discs or through telecommunications lines).

The Task Force has concluded that, rather than attempting to impose restrictions on the cross-border data flow itself, the effectiveness of which would be doubtful, a better solution would consist of positive measures to strengthen the availability and the cost-effectiveness of Canadian computer/communications services. The Task Force considers that competition within Canada is the moving force which will in the long run provide the needed variety and quality of computer/communications services at lowest cost to the user. Likewise internationally, the Canadian competitive position must be encouraged if Canada is to survive in the North American information-flow market. The Task Force contends that inhibition of information flow between the U.S. and Canada would be, on balance, economically, technically and socially detrimental to Canada and that the Canadian computer/communications industry must therefore compete with cross-border flow of U.S. information services.

How then can Canada develop a self-sufficient computer/communications service industry and at the same time participate freely in the North American information-flow market?

The Task Force recommends the stimulation of the Canadian computer/communications service industry within a competitive environment as the method with most potential for achieving this objective. As outlined in greater detail throughout this Report, particularly in Chapter 11, the positive stimulative approach proposed by the Task Force includes:

- Establishing and maintaining a competitive computer/communications service industry within Canada;
- government financial and technical assistance in research and industrial development for the supply sector of these services;
- government co-ordination in the gradual evolution of a coherent data communications network;
- government participation in the development of national and international standards;
- government purchasing of computer/communications products and services from Canadian industry;
- government support for the development of computer/communications networks of broad social benefit;
- government financial assistance on a case-by-case basis in the form of subsidies to users or suppliers to meet specific service needs of social importance;

- moral suasion by governments directed towards encouraging Canadian subsidiaries of foreign firms to employ Canadian computer/communications services wherever possible;
- review of customs tariffs for the import of equipment and components not available from Canadian manufacture;
- government support of professional and industry associations in the provision of training programmes in collaboration with educational institutions.

Government, through the Focal Point, would have the critical task of continuous study and evaluation of the situation. If the implementation of the recommended positive actions has had insufficient time to be effective and a trend to increasing losses to Canadian data processing activities gains momentum, certain measures for protection and sheltering of the industry might be considered. Such protection or sheltering could be of a general fiscal nature or applied in a more specific mode. The general method is apparent in proposals such as disallowance for business expense purposes of certain expenditures by companies operating in Canada on computer/communications services supplied by firms outside Canada. The identification of such expenditures, without unduly restricting services which are not available from Canadian sources, would create extra administrative problems and costs to users and government. More specifically, customs tariffs can be applied to data processing information coming into Canada in the form of computer print-outs, magnetic tapes, discs, punched cards or punched tape as administered at present by the Department of National Revenue. The main problem lies in the fact that the information can alternatively be transmitted via telecommunication means across the borders without such tariff. The application of traditional tariff principles to such electronic transmission of information would have important administrative, technical and legal implications.

The Task Force considers that these methods would eventually lead to higher costs and a smaller variety of products and services available in Canada. Also, reciprocal action by foreign governments, such as the United States, would restrict Canadians from participating in foreign markets, including the side-effect of restricted freedom of information-flow, inherent in such action and counter-action.

The Task Force has concluded that positive competitive and stimulative measures should be the primary approach for advancing the development of Canadian computer/communications services.

The Task Force therefore recommends that:

Rec. 22 Policies in computer/communications development should be oriented, in consultation and co-operation with the provinces, towards improving service availability and reducing costs in Canada in order to offset economic and technical incentives for meeting user needs through facilities outside Canada.

Positive measures to improve the availability of data services in Canada, and to improve the Canadian development of computer/communications facilities, are those to which this whole Report is addressed. The Task Force therefore considers that the early implementation of its recommendations is the most effective safeguard against problems resulting from the availability of data services outside Canada.

3. REGISTRATION FOR DATA SERVICES

Data Services are here taken to include data processing services and data bank services offered through telecommunication links.

It has been emphasized, earlier in this report, that the Task Force recommendations are based on the fundamental concept that a suitable level of competition is the necessary stimulus for innovation and development. It has also been pointed out that there are dangers in a complete *"laissez-faire"* attitude by government, and that government intervention may be necessary in certain situations, such as those:

- Where particular participants may take undue advantage of their other business activities, leading to unfair competitive practices;
- which may lead to socially undesirable results;
- which could increase Canada's vulnerability to undesirable influences exerted by rapid technological and market development in foreign countries.

The Task Force also takes the view, however, that in order to obtain the necessary balance, it is essential that the government should obtain information which will permit it to observe the effects of competition and monitor trends and developments, so that judgments and decisions regarding government action can be based on factual information. This will be particularly important as the changes caused by new entrants into the data processing business (as recommended in Chapter VIII), and by the liberalization of present practices regarding foreign attachments, interconnection, re-sale and sharing (as recommended in Chapter IX), affect the market-place.

As the types of data processing services extend into social and cultural areas, and as the impact of computer/communications systems becomes more pronounced in their effect on the individual and on society in general, the government may need to take a more active role in order to protect the public interest. Again it is necessary to have a firm foundation of factual information on which to base any decisions for action.

The Task Force has had difficulty in assembling information on the data services industry. No one government source was able to provide information on companies offering data processing services. In order to arrive at an assessment of the size and scope of the industry and its components, it was necessary to examine and summarize data from a number of sources. The information obtained was in many cases difficult to collate, for different sources often used dissimilar definitions of measurements, and in some areas

information was incomplete, or did not relate to the specific requirement, and approximations had to be used.

The issues raised in the previous sections of this chapter on data banks and north-south data flow demonstrate the need for more readily-available and consistent information on the data services being offered commercially in Canada.

Accordingly, the Task Force recommends that:

Rec. 23 Organizations offering data services commercially to customers through telecommunications facilities, with terminals on remote premises, should be required to register with an appropriate body, and file information on their corporate structure, and on their data services.

Further details on the proposed registration process and the "appropriate body" are contained in Part E of this report.

This recommendation does NOT call for the establishment of a discretionary licensing system, which would only permit certain organizations to offer data services. On the contrary, it is a system open to all organizations, and merely requires the provision of information on the corporate structure of the organization itself, and on the data services offered.

This information will not only assist the government in formulating policies, but will also, by the publication of appropriate non-confidential items, be of direct assistance to commercial and other users by providing fuller information on the nature of available data services.

There will also be a number of indirect benefits to users. Consolidated information on available data services will help to identify areas where an uncontrolled proliferation of types, performance characteristics and techniques of data services might lead to incompatibilities which would be disadvantageous to users, but could be remedied by introducing suitable standards and standard practices.

In addition, the information could help to protect user interests by facilitating an assessment of the needs for introducing measures relating to such matters as ethical standards, security protection, privacy of sensitive information, and liability.

4. MAINTAINING A CANADIAN PRESENCE

(a) Issues

The preceding sections on data banks and north-south data flow have shown that there is no easy way to control the flow of data at border-crossing points, nor can a need for such control be clearly identified at this time. Therefore, it appears that any restriction on the transfer of data between

Canada and the United States, which may be found desirable for one reason or another, can be effectively carried out only when applied to the respective sources or recipients in such transfers. Three questions then arise:

- What are the motivating forces for the transfers?
- What are the criteria that make restrictions or limitations on the transfer desirable?
- What measures can be applied to control the transfers?

Motivating Forces

The first question is answered essentially by the discussions in the preceding two sections. The main forces were identified as:

- The economics of data processing and data communications on either side of the border;
- corporate policy of foreign corporations operating in Canada;
- availability of special computational expertise, or special sources of information (data banks) in either country.

Criteria for Restrictions

The second question regarding the desirability of restrictions requires a brief discussion of economic, legal and cultural issues.

When data processing for business purposes in Canada is done through remote connections to computers located in the United States, this represents a direct or a potential loss of business to Canadian data processing enterprises. The effect of such loss of business is to reduce employment opportunities, preventing a wider development of expertise in Canada and inhibiting the build-up of the business volume to a level where economies of scale would result in lower costs. The last point directly reinforces the economic motivation which may have led to the transfer of activities in the first place. In the economic interest of Canada, it would be desirable to retain as much of the Canadian data processing business as possible in the hands of Canadian-based organizations.

Another point of economic impact has to do with the adequacy of program packages developed in one country and applied in the other. As the nature of computer application programmes relates directly to the type and nature of the business in which these programmes are used, it is not unlikely that a readily-available foreign package, used in Canada is, in fact, not well suited to Canadian requirements and results in unsatisfactory operations. This argument leads to the conclusion that ''Canadian problems should find Canadian solutions'', and that it is therefore desirable to maintain in Canada all the expertise and skill required for developing these solutions for software as well as for application-oriented and communications hardware.

The legal implications of data transfer across national borders can be touched on only briefly. The aspects of personal privacy, copyright, liability, bonding, and software protection are examined in Volume II. The main point to be

made here is the placing of emphasis on the many areas of a legal nature which might be considered by a Canadian user in deciding whether to use commercial data bank and data processing services from:

- A foreign supplier located outside Canada directly through trans-border lines or through the lines of a representative organization in Canada; or,
- a Canadian subsidiary of a foreign supplier, subject to foreign control; or,
- a Canadian-controlled organization.

Protection with regard to privacy, liability, confidentiality, continuity of service, as well as against fraud or breach of contract, may well be substantially different for the different categories of suppliers.

Data processing and data bank services are instruments for information transfer. As they are used for information retrieval and dissemination, for educational processes and for entertainment, they convey cultural values and will increasingly form part of the cultural life of the country. As these services find wider distribution, eventually through communication lines into the schools and homes of the nation, they will assume the characterisitics of present-day broadcasting and CATV services, for which the need for Canadian control and adequate Canadian content is accepted. This aspect of the potential role of computer/communications in the distribution of information with cultural content to the general public must therefore be reflected in corresponding requirements to ensure that the user has sufficient choice of material including a sufficient volume from Canadian sources.

Measures for Control

There remains the third question on the nature of possible measures for restrictions or limitations, on international transfers.

Since the cost of Canadian computer/communications services is a frequently cited reason for increasing use of services supplied from the U.S., the most effective way of reducing the incentives for the "north-south flow" consists of measures to reduce Canadian costs of computer/communications and to increase the strength of the Canadian-based commercial service industry. This approach was discussed in the preceding section, "North-South Data Flow".

In the case of foreign-controlled corporations with subsidiaries in Canada, governments may find it advantageous to urge that these companies use, to the greatest possible extent, Canadian-based data processing facilities to serve the needs of their Canadian operations, particularly where suitable Canadian services already exist.

Governments may also find it advantageous to actively support the establishment of specialized service centres and data banks for handling special programmes of general importance to business and industry in an area. Also, selective subsidies might be considered on a case-by-case basis to help users or suppliers to overcome specific problems. This may apply to the price

of services as well as to other costs (such as those for programme conversion) which may occur in connection with the substitution of U.S.-provided services by Canadian services.

The attractiveness of Canadian commercial data processing and data bank services would, in many cases, be enhanced by the existence of a satisfactory legal framework for the protection of customers in questions of privacy, confidentiality, and liability, and in appropriate standard practices with regard to continuity of service, bonding, and emergency services.

For services supplied to public institutions and governments, Canadian control of the data processing organization in all financial, technical and operational aspects is likely to be a prerequisite, except in unique cases where services from foreign suppliers provide a better alternative with regard to specialization or other specific characteristics not involving legal risks.

When computer/communications services distribute information with cultural content to the public at large, legislation will likely be required to hold the distributing organizations to specified limitations on foreign participation and foreign content. In this connection, the federal and provincial governments may also find it necessary to stimulate the volume of specifically Canadian cultural and educational material that can be made available through computer/communications. Not all remote-access computer services, even if extended to the homes of private individuals, fall into this category. Therefore, difficulties arise in the definition of a dividing line between strictly private subscription services for information of a general nature, such as scientific or technical data, stock quotations, or travel information; and services which affect cultural values in such fields as education, entertainment or politics. A means for providing information to identify and segregate the various categories of computer services is the registration process recommended in the preceding Section 3.

(b) Present Situation with Regard to Canadian Ownership & Control

Earlier sections of this chapter have raised a number of problems associated with the use of data processing and data bank services provided by foreign organizations. Before presenting a policy approach for dealing with this situation, consideration is given to the present degree of Canadian ownership and control in the supply segment of the industry.

The situation is complicated by the fact that three official Canadian sources of information on foreign ownership use different methods and measurements. Statistics Canada uses consolidated figures for a group of companies under common ownership, and takes into account long-standing debt as well as voting shares. The Department of Industry, Trade and Commerce publishes information obtained in a survey of foreign-controlled companies with assets of more than $5 million. Completion of the survey questionnaire is voluntary.

Information is also collected under the Corporations and Labour Unions Returns Act (CALURA) which includes corporations having at least $250,000

in assets, or $500,000 in annual sales. CALURA differentiates between foreign ownership and foreign control.

The 1969 Annual CALURA report states that,

> "A company is considered to be foreign controlled if 50 per cent or more of its voting rights are known to be held outside Canada and/or by one or more Canadian companies which are, in turn, foreign controlled. Geographically, control of a Canadian company is ascribed to the foreign country where the majority of the company's voting rights are actually held or where the majority of the voting rights of its Canadian parent company are held. The whole of the corporation (whether measured in such terms as total assets, sales, profits or equity) is assigned to one or other country of control."[3]

With regard to ownership, the Report states that,

> "Under the concept of ownership used in this report each corporation is classified according to the percentage of its voting rights which are owned by non-residents either directly or through other Canadian corporations and the whole of the corporation is assigned to this particular degree of foreign ownership."[4]

Under these definitions of foreign ownership and foreign control it is possible that,

> "...foreign control of a corporation may exist despite the fact that foreigners own less than 50 per cent of its voting rights [and that a company may be] foreign controlled even though it is only 40 per cent foreign owned."[5]

Faced with these difficulties, and not having the powers of a Royal Commission to obtain private corporate information, the Task Force was not able to obtain adequate information on revenues and other financial items, categorized according to the degree of Canadian ownership.

The latest information collected under CALURA, and made available in summary form to the Task Force, relates to 1969. At that time, 176 of the 486 companies now identified (Table 1, Chapter IV) as part of the present computer/communications supply industry were of sufficient size to be recorded in the CALURA files. Table 3 summarizes that information for 163 of these corporations, broken down into three segments of the supply industry described in Chapter IV. The information from CALURA does not give

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[3] *Annual Report of the Minister of Industry, Trade and Commerce under the Corporations and Labour Unions Returns Act (Part I Corporations) 1969* (Ottawa, Department of Industry, Trade and Commerce, February, 1972), p.73.

[4] *ibid.*, p.74.

[5] *ibid.*

Table 3

The Ownership of the Canadian Computer Industries for the Year 1969[1]

	Service Suppliers			Hardware Suppliers			Other Product Suppliers		
	Canadian (2)	Foreign (3)	Total	Canadian	Foreign	Total	Canadian	Foreign	Total
Number of Corporations	26	14	40	34	69	103	11	9	20
% Total	65	35	100	33	67	100	55	45	100
Assets ($,000)	60,868	29,210	90,078	444,692	1,551,385	1,996,077	40,305	98,455	138,760
% Total	68	32	100	22	78	100	29	71	100
Sales ($,000)	17,346	34,799	52,145	539,871	1,828,024	2,367,895	67,387	124,023	191,410
% Total	33	67	100	23	77	100	35	65	100
Profits ($,000)	(2,474)	1,667	(807)	17,437	182,099	199,536	10,033	19,301	29,334
% Total	—	—	—	9	91	100	34	66	100
Profit Sales %	—	5	—	3	10	8	15	16	15
Equity ($,000)	32,144	17,226	49,370	233,412	769,915	1,003,327	28,545	52,710	81,255
% Total	65	35	100	23	77	100	35	65	100

Notes:

(1) Source: Corporations and Labour Unions Returns Act (CALURA), Statistics Canada

(2) Canadian Ownership indicates that over 50% of the voting rights of a corporation are owned by Canadians

(3) Foreign Ownership indicates that over 50% of the voting rights of a corporation are owned by non-residents

a breakdown for the 13 corporations in the communications segment. These segments of the supply industry may be summarized as follows:

- *Hardware*, encompassing manufacture or supply of computers, peripheral and terminal equipment and computer-related communications equipment.
- *Services*, which include those provided by the computer services bureaux, software houses, consultants, facilities management firms, data preparation firms, and private organizations engaged in computer education and training, and personnel placement.
- *Data communications*, encompassing the provision of facilities and services for the transmission of data between computers, and between computers and terminals.
- *Other products*, which includes the provision of operating supplies and consumables, as well as computer environment equipment, such as air-conditioning, false flooring, and fire-proof storage.

Revenues are quoted for *total* sales, and do not relate only to computer/communications products and services. In addition, the revenues of computer manufacturers from their service bureau operations are included under revenues in the hardware supply segment.

In the services supply segment, the number of Canadian companies and their assets represent approximately 2/3 of the totals for the segment, but their sales account for only 1/4 of the total revenues for the segment; in aggregate they showed a loss, whereas foreign-owned firms showed a profit. In the hardware supply segment, profits of Canadian-owned firms represented only 3% of sales, whereas profits of foreign-owned firms represented about 10% of sales. In the other two segments, the profitability of Canadian-owned firms compares favourably with that of foreign-owned firms.

In the service segment, the majority of the independent service bureaux remain Canadian-owned and controlled. The Task Force estimates that, of the $133 million total revenue for 1970-71 for this segment (see Table 1, Chapter IV), some $114 million is attributable to sales of service bureaux, and that about one-third to one-half ($35 to $55 million) are revenues from the service-bureau operations of foreign-owned computer suppliers.

(c) Policy Approach

The four segments of the industry require separate consideration.

The "other products" segment, for example, covers such items as paper forms, air-conditioning, false floors and other "support" products, which do not have the particular characteristics associated with computer/communications. This segment raises none of the problems peculiar to computer/communications, and therefore does not require special treatment in regard to foreign ownership.

The communications segment, on the other hand, differs markedly from most other industries in Canada by virtue of the fact that it is regulated. The

complexities of the regulatory procedures are reviewed in Volume II. An indication is given there of the powers of the different regulatory bodies in regard to mergers, issue of shares and debentures, and other items touching on the ability of foreign interests to increase their ownership of, or control over, telecommunications in Canada. The majority of the carriers are already under Canadian ownership and control, and possible future government policies must be developed in the context of the overall telecommunications field.

The hardware and services segments of the industry require particular attention, for they raise a number of special issues which must be carefully considered in the formulation of a policy on foreign ownership and control.

Hardware Supply

Some other countries have considered it of national importance to support the development of an indigenous computer main-frame manufacturing industry in order to reduce their dependence on United States technology. Large amounts of capital have been provided for this purpose from public funds. The limited size of the Canadian market, the protectionist measures taken by other countries, the large capital investment required, and the dominant position of U.S.-based companies are all factors which will deter the entry of purely Canadian enterprises into the field.

The suggestion is made, from time to time, that Canadian strategy should be to undertake joint ventures with European or other countries. This, it is alleged, would serve the dual purpose of lessening Canadian dependence on U.S. technology and of providing an entry to foreign markets. Notwithstanding the merits of such a plan, the realities of the situation must be recognized.

First, there does not appear to be any particular advantage for a European or other non-U.S. computer main-frame manufacturer to consider such a venture. The available markets could not be guaranteed, and a single production facility would probably be sufficient for total requirements. The Canadian company would probably be the junior partner, manufacturing components for assembly in the other country.

Second, differing standards in Europe and North America are obstacles not easily overcome. Canada is firmly committed to North American standards and practices and, until international agreements are reached, changes to equipment to suit different conditions in foreign countries will still be required.

Third, the history of international joint ventures on a government-to-government basis in areas of high technology has been plagued with difficulties. Escalating costs, production delays, and insufficient market research are but a few of the problems often encountered.

This is not to suggest however, that Canadian-owned companies should ignore the possibilities of joint ventures with non-U.S., foreign-owned

companies, but rather that this should be arranged at a company-to-company level; government involvement should be limited to initial support of the project only when it shows demonstrable chances of success.
It must also be emphasized that Canada has received, and continues to receive, large benefits from U.S. technology in the field of computer/communications — benefits which make it possible to serve the domestic market as well as providing opportunities for export to the United States.

In addition to special measures which may be used to support industry in Canada, leverage may be exercised through the procurement practices of public institutions, which are considered in Chapter XI.

Supply of Services

The services segment of the industry requires particular attention, especially in regard to software development, and the provision of data processing services.

Software development and supply, from the viewpoint of Canadian ownership and control, is conceptually very similar to hardware development and supply, and may therefore be treated in a similar fashion. Machine-oriented software may, in fact, be regarded as an integral part of the hardware system. The objectives of government policy should therefore be to encourage firms to establish the necessary R & D facilities in Canada, so that Canadian expertise can be developed and maintained.

Applications software, *i.e.*, problem-oriented programmes developed to meet specific user-needs, are of particular significance in the context of Canadian ownership and control, because a small creative group of technologists, without large initial capital investment, can be effective in software development and systems-design.

In addition, as systems-design and applications software are the means of solving specific problems, it is essential for Canada to have the necessary expertise to develop Canadian solutions for Canadian problems.

It is only recently that the Department of Industry, Trade and Commerce has considered direct financial support to the development of software through its industry support programmes. The problems posed by software support are briefly outlined in Chapter XI.

In addition, every advantage should be taken of the stimulation that can result from government procurement policies, which are discussed in greater length in Chapter XI.

Data processing services, which are here taken to include data bank services, are unlike many other services in that they can be provided on a day-to-day basis from a remote location. A further significant distinguishing feature is that they are concerned with *information content*, much of which is critical to the operations of government or private industry, or is "sensitive" in other ways, as for example, in containing confidential information on Canadian individuals.

These two distinguishing features make the data processing services industry one which merits close attention by government in regard to foreign ownership and control. Of particular concern here are the economic and legal issues outlined earlier in this chapter, with special emphasis on the fact that users in many instances will need to be assured that data submitted for processing and analysis remain subject to Canadian laws and that management and operational decisions are not directed from outside the country.

Present users of data processing services can decide for themselves when it is in their own interests to use Canadian-controlled organizations for their requirements. However, it is essential that the government should support the development of a strong Canadian controlled data processing services industry so that, as services are extended to smaller businesses, the professions, and the general public, there are Canadian organizations able to provide them.

Accordingly, the Task Force recommends that:

Rec. 24 Governments should recognize the importance to the public interest, of a strong Canadian-controlled data processing services industry.

Programmes similar to PAIT could be used to support software development for new types of services, but cannot easily be used in support of the regular data processing services themselves, for the emphasis in these programmes is on innovation. Other incentive programmes for Canadian-controlled organizations to offer data processing services also raise practical difficulties. The Task Force has therefore concluded that the government can best support the development of a Canadian-controlled data processing industry through its procurement policies.

In obtaining such services from the private sector, the main criterion in procurement must continue to be that they meet requirements of effectiveness, efficiency and cost. But, within these constraints, preference should be given to Canadian-controlled organizations. In particularly sensitive areas, associated, for example, with personal information or resource information on government files, the government should insist that data not be transmitted outside the country.

Canadian-controlled organizations are already well represented in the data processing services industry and, in fact, form the majority of corporations engaged in this activity. The government should capitalize on this and not allow the advantage to be lost. By orienting the spending of public funds towards these organizations, a more stable Canadian-controlled computer services business will develop. The increased use by government of services from the private sector will help to provide the much-needed base work-load.

Cultural Aspects

As data processing services extend into a cultural context, and as they move into the home, their content will become enmeshed with the social values

and way of life of Canada, and will thus have an impact on Canadian identity. In this context "home" is not used to denote the four walls and roof of a physical dwelling but rather the concept of an individual's environment; data services into the home could influence an individual just as his choice of radio programme to some extent reflects or has an effect on his personality.

If steps are not taken to strengthen the Canadian-controlled data processing services industry as outlined in the previous section, there will be a growing dependence on services developed elsewhere and offered through communications links to users in Canada. Not only may these not meet Canadian needs — for industry and for social systems — but, in addition, as cultural content increases, they will have an increasing effect on individuals.

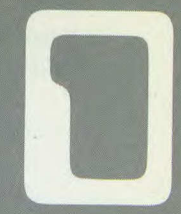
At present, services to homes are virtually non-existent and therefore pose no problem. But governments should be aware of the potential development. This, in addition to the arguments already advanced, places greater importance on government support of a strong Canadian-controlled data processing service industry.

As services become personally available to Canadian citizens, they become similar in many respects to the services provided by CATV operators or broadcasters, which are regarded as amenable to direct restrictions on foreign ownership, and to standards for Canadian programme content. It is conceivable, therefore, that requirements may be developed which in certain respects parallel those applied in broadcasting.

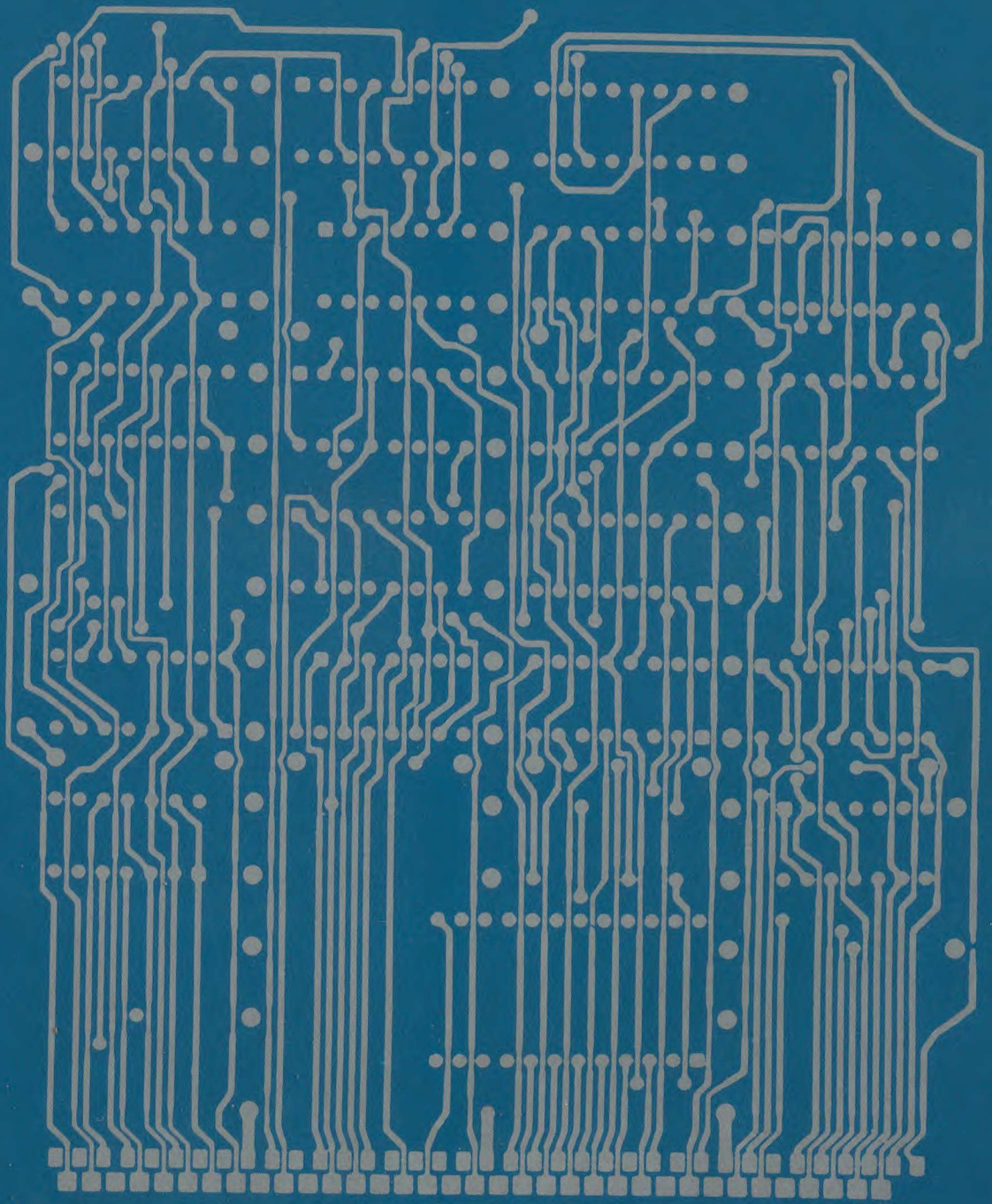
Accordingly, the Task Force recommends that:

Rec. 25 Before computer-based information services are offered on a regular basis to individual Canadians and the public in general, governments should consider the feasibility of imposing special requirements on Canadian ownership and control of organizations providing services which convey cultural values analogous to those conveyed by broadcasting systems, and on the volume of material from Canadian sources made available through such services.

Part



Stimulation of Development



1. IDENTIFICATION OF PRIORITIES

(a) Identification of User-Needs

User-needs may be broadly described as reflections of basic demands and of problems which arise when users undertake the development or use of computer/communications systems. Frequently, these needs arise out of specific problems which have been identified as being amenable to solution by the technology. Sometimes, they arise as a result of a step-by-step progression, where it can be readily seen that a small application of technology will result in improved operational capabilities. On rare occasions, the needs will arise as a result of the realization that a new technological break-through completely alters the base conditions which existed before. In the majority of these instances, user-needs will be met by the normal functioning of the market, through the supply of equipment, services, and personnel. There are a number of other areas, however, where market forces either do not operate, or where the user has a restricted choice in meeting his requirements. Examples of needs that arise in these areas are standards, education and training, availability of information, and monopoly services. All these factors point to the necessity of a government presence in the computer/communications field where there is a void to be filled.

First, governments must be continually aware of the needs of users because of the problems and opportunities which may arise from time to time in the fulfilment or frustration of these demands. For example, a special type of data communications service may be required in a particular location. Or a sudden shift in emphasis in this rapidly changing technological field may render a particular service obsolete, with consequent repercussions on the user, the industry, and the economy. Government intervention may be desirable, and in order to avoid *ad hoc* solutions at the point of crisis, a continuing awareness of user-needs is required. The type of solution required would depend on actual conditions and might range from customs duty amendments to subsidies or re-training schemes. Whatever the solution, the crux of the matter rests upon correct and timely recognition of the problem or opportunity as it begins to develop.

The second general responsibility of government is the identification of the effects of computer/communications systems on society. There may be both beneficial and detrimental effects from the application of computer/communications technology, and government must protect society and the individual from any excesses which may arise from any application. The initial requirement is to collect information and study the effects on society of the application of computer/communications technology. Second, there is the requirement for new qualitative and possibly quantitative techniques for the proper assessment of the effects. Third, government should be in a position to curtail or re-direct the development of particular systems if their implementation and wide usage would have adverse effects on society. To protect the public interest in this way, part of the information necessary for proper assessment will originate with user-needs. It is only by keeping a

perspective on, and closely following, the development and actions users choose to fulfill their requirements that the main trends in technology and its effects will become apparent.

The Task Force therefore recommends that:

Rec. 26 The Focal Point should, periodically, and in close co-operation with associations and industries, undertake identification of user needs and evaluation of the impact of existing and projected computer/communications systems on society.

(b) Pilot-Projects Serving Social Needs

The difficulties of measuring social phenomena have been discussed in Chapter III. Not only is there insufficient knowledge of the social impacts of the application of computer/communications technology, but also too little is known about the priorities to be accorded to particular systems. In one sense, these are part of the same problem, for if the social benefits and costs were known for a number of systems, they would implicitly suggest the order of priority, and would indicate the probable effects.

As an aid towards solving this problem, government has an important role to play in providing the appropriate mechanisms. One of these would be to commission a number of pilot-projects which would:

- Stimulate the advance of systems having broad social significance, so that Canadians may benefit by their wide application;
- determine the social benefits and costs of such systems so that meaningful priorities may be assigned to their possible wider implementation; and
- provide experience in the formulation and operation of computer/communications projects which encompass many disciplines, institutions, and jurisdictions.

Ideally, the initiative for such pilot-projects would originate with those communities of interest which express a desire for, and are able to participate in their development. Prerequisites for the success of a pilot-project include:

- Clearly defined objectives;
- the concurrence of the appropriate jurisdictional bodies;
- the inclusion of experts from appropriate disciplines on the project team, such as sociologists and economic analysts, in addition to technological experts;
- sufficient and appropriate measures of existing conditions;
- the utilization of regional and local resources;
- retrospective assessment after completion.

These pilot-projects should be regarded as controlled experiments, offering perhaps the best promise of guidance for computer/communications developments. While it would not be practical at this stage to delimit the possible areas of application, there are several which are obvious candidates, *e.g.*, health care, education, community information, leisure activities, manpower placement and community activities.

In order, therefore, that society may benefit more fully from computer/communications technology, the Task Force recommends that:

Rec. 27 Government should stimulate the advance of special computer/communications systems, particularly those having broad social benefits to Canadians, by making funds available through the Focal Point for pilot-projects undertaken by or in conjunction with associations, industry, universities and governments at all levels.

In making this recommendation, the Task Force recognizes that computer/communications, while being an integral and important part of the pilot-projects, are the technical means for achieving specific ends. Much of the impetus and initiative for their development must therefore rest with those other organizations which have primary responsibility in the areas of application. These organizations will be in a position to assess the degree of relevance and importance of the proposed services to be tested in the pilot-project, and the Focal Point will be in a position to assess which aspects of computer/communications are important for test and evaluation. This involvement of the Focal Point should be with the full knowledge and understanding of the federal government department, if any, having prime responsibility in the area of application. The main activity of the Focal Point in these joint ventures should be the application, in any given situation, of the knowledge and expertise gained in other areas; the organization responsible for the new development will, in many cases, already be well informed of developments in computer/communications in its own sphere of operation.

(c) Public Sector Co-ordination

As the functions of governments and other public institutions become increasingly interdependent, the dangers of isolated systems-development become more acute. Information transfer barriers may evolve which would become more difficult to surmount with the passage of time. The impetus for co-ordination, particularly among governments, may come from a realization of the community of interest that undoubtedly exists in the need for common data and information.

Canadian geography tends to impose limitations on the development of public computer/communications systems beyond the boundaries of large urban centres. The less populated areas may have difficulty in providing the necessary resources to develop their own systems. Because of high communications costs and certain differences in requirements, they may also be prevented from using public systems developed in the large urban centres. To alleviate these disparities, regional and national approaches to systems-development are required. A significant example of this kind is the move towards the sharing of resources and facilities by the provincial governments in the Maritimes.

Another example of collaboration, in this case in the United States, among a number of organizations with apparently divergent interests but common requirements regarding data is that of an economic data bank being

developed for the New England states. The supporting organizations are four banks, two electric utility companies, a state government agency, and the telephone company. The intent is to create a data bank which will facilitate and encourage research into regional economic problems. It is to be set up on the New Jersey computer of a private time-sharing company.

In the future development of systems in the public sector, greater recognition should be given to the information transfer process among governments and other public institutions; among government departments; between governments and the private sector; and between governments and the public at large. Attention should also be given to the need for co-ordinated systems approaches, and to the need for the sharing of resources wherever appropriate.

Accordingly, the Task Force recommends that:

Rec. 28 In government support of projects, priority should be given to those which involve the formation of regional and nation-wide computer systems in the public sector, designed to make available on a shared basis, computer and specialized data bank facilities to public institutions and to the general public.

(d) Research

Technological forecasts for the future predict an abundance of new techniques and equipment in computer/communications, although, in many instances, we have barely begun to make adequate use of what exists. It is, without doubt, an area of continuous innovation, with development following closely upon development at a rapid pace.

In these circumstances, the government must be able to take a position on issues; to determine where stimulation is required; to demonstrate that intervention is necessary; and to guide developments in the national interest. For all of these reasons, as well as for its own internal requirements in the computer/communications field, the government must have at its disposal an adequate level of competence, the ability to recognize the implications of developing trends, and a fund of expert knowledge on which to draw.

The Task Force considers it essential that the government should undertake two separate but related research programmes. The first relates to the long-range social effects of computers and communications, while the second concerns technological research.

Recommendations 26 and 27 were addressed to the need for the identification, assessment, and stimulation of systems which would be beneficial to Canadian society, and are indicative of Task Force concern that the effects of systems on society be understood. There is a further need, however, to take a more coherent view of the impact of the application of this technology. For while the identification of user-needs and the undertaking of pilot-projects should provide a great deal of knowledge at the micro-level,

there remains the need to place this information in perspective, and to supplement it by original research into specific areas of concern. For example, it was pointed out in Chapter III that there exists a widespread belief that computers will cause unemployment. The validity of this conjecture in specific cases should be determined in order that government may take remedial measures if necessary, and so that the general public may be reassured. Societal fragmentation in the face of technological change, and population concentration into urban areas, may be other important subjects of enquiry where the effects of computer/communications systems may have a causal relationship in the long term. These, then, would be the types of subject which should form part of the research programme into the long-range social effects of computers and communications.

An important corollary to research of this nature is the need for multi-disciplinary skills to be brought to bear on problem areas. The pervasiveness of the technology and the wide variety of applications require co-ordinated efforts from a wide range of disciplines if they are to be effective. Government must look particularly to the universities for close co-operation in this endeavour.

The Task Force therefore recommends that:

Rec. 29 In conjunction with universities and other research institutions, government should foster multi-disciplinary research on the long-range social effects of computers and communications.

As far as technological research is concerned, the Task Force believes the major part shcuild be performed by private industry, especially when related to product development, and recommendations towards this end are to be found later in this Chapter. However, there is also a need for direct government involvement in research work in computer/communications, and existing government research laboratories are well suited for its undertaking. The need arises from the capabilities which government must exhibit from its position of concern for the public interest. Underlying this point, however, is the recognition that closer liaison and co-ordination are required between the operating departments of government and their research resources. The knowledge derived from a research programme must be imparted to operational officials, and particularly to those engaged in long-range planning functions.

An important part of the role for government research laboratories is to concentrate on technological areas that relate to Canadian conditions, which would include:

- The technical feasibility of incorporating communications satellites in a data network structure;
- the technical feasibility of centralized, versus distributed, networks of computers and data banks;
- the technical feasibility of hardware techniques for overcoming problems of compatibility and code conversion;
- forecasts of technological innovations, their applicability to user needs, and their likely impact in terms of cost-reduction capability.

The results of such research should be made available, not only to interested departments of government, but also to private Canadian organizations which are involved in the field.

Accordingly, the Task Force recommends that:

Rec. 30 Existing government research laboratories should include in their programmes, selected areas of computer/communications technology and make the results available to public and private organizations, for the development of techniques and applications specifically adapted to Canadian needs.

2. INCENTIVES TO SUPPORT THE SUPPLY INDUSTRY

(a) Background

Any consideration of the support that government should give to the computer/communications supply industry must acknowledge its importance to the nation; the present realities of the Canadian supply industry vis-à-vis its position in the world context; and, in this light, what may be reasonably expected of industry, in order that government policy objectives can be realistically formulated.

Throughout this report the pervasiveness of the computer has been stressed. It is expected that computers will soon be used extensively by small businesses, and eventually in the home. This essential fact that there are many applications of the computer yet to materialize re-emphasizes the point that computer/communications supply is a growth industry. Notwithstanding the economic pause of 1970-71, the overall growth rate extrapolated for the remainder of the decade at over 15%, is high by any standard. The automobile industry, for example, bases its current long-term predictions on a 5.5% growth-rate. Even if the actual growth-rate for computer/communications is not as high as predicted, most observers agree that there will be few other industries which will match its pace of development. In terms of importance to the nation, therefore, the growth of the industry implies the creation of job opportunities. With one of the most rapidly expanding working populations in the western world, Canada will be hard-pressed to find sufficient job opportunities for all, even should a dramatic change in attitude towards the work ethic materialize.

In business and industry generally, Canada cannot afford to be less competitive than other nations, and even if the effectiveness of the computer has yet to be truly apparent in many instances, there is a widespread feeling that we are about to turn the corner in this regard. The existence of some highly successful applications cannot be denied. In the public sector, the increased use of computer/communications systems may well be one of the possible methods of helping to arrest the escalation of costs of certain public services. Furthermore, there is a growing number of systems directed towards serving areas of social significance where the potential benefits, although difficult to define and quantify at present, appear nonetheless real.

The reason for stressing the importance of the domestic supply industry in conjunction with the concept of a national computing capability is that it is conceivably possible to have the capability without necessarily having the industry. The rationale for this approach suggests that all the necessary technology, equipment, and services can be bought from foreign sources at less cost to the Canadian user. All the evidence before the Task Force, however, indicates that there are no simple trade-offs which can be made; that the computing capability of the nation is inextricably interwoven with the products and services of the domestic manufacturing and supply industry; and that the fortunes of the one are highly dependent on the fortunes of the other. The service supply segment of the industry, for example, serves not only the user of in-house equipment, but also companies which would otherwise lack a computing capability geared to Canadian circumstances. In a similar fashion hardware suppliers have undertaken the manufacture of teller terminals designed for certain Canadian banking methods. Without a domestic manufacturing and supply capability, it is doubtful, in most instances, whether specifically Canadian needs would be met at all. Its importance to the nation, therefore, lies in its ability to interact with the user in providing essentially Canadian solutions to Canadian problems while at the same time providing other benefits to the economy as a whole.

(b) The Role of Multi-National Corporations

The present realities of the domestic supply industry within the world context cannot be overlooked. In terms of hardware, Canada is firmly committed to North American product lines and standards for virtually all its computing and most of its communications equipment. Apart from the products of some of the Canadian-owned entities, manufacturing is based mainly on U.S. designs. Where computing equipment is concerned, the supply is dominated by the multi-national computer corporations. In recent years, their strategies have centred upon the international rationalization of product lines, to the extent that a complete computer system may consist of units of equipment manufactured in several different countries. To some degree, the fortunes of a particular subsidiary in a particular country may depend, therefore, on the success of its unit of equipment or product line in the world market. The extent to which local management plays a role in anticipating the decline of a particular product line, and preparing for the next product development, is unknown, but probably varies between companies and countries. One of the key factors in ensuring continuity and expansion is an amount of research and development proportional to the total operations of the subsidiary. There are indications that multi-national computer corporations are beginning to allocate development and manufacturing expenditures in line with sales revenues in other countries where they are doing a substantial volume of business.

Because of the dominant position of the multi-national corporations in the computer/communications system supply function, the contributions which they have made and continue to make to the industry, and to the economy generally, are of vital importance to Canada. In order to ensure, therefore,

that Canada obtains an adequate share of research and development work, which would generate job opportunities in the manufacturing process, the Task Force recommmends that:

Rec. 31 Government should continue its efforts to ensure that foreign or multi-national computer and communications corporations with substantial sales in Canada expend appropriate sums in Canada on research and development leading to manufacturing activities.

(c) Support for Canadian Enterprises

At this stage of development, it would be unrealistic to assume that Canadian companies could or should engage in every facet of the supply of computer/communications goods and services. Nevertheless, there are a number of opportunities which Canadian companies, supported by appropriate and consistent government policies, could exploit to a greater extent than heretofore. Included among these would be: computer/communications interface equipment; terminal devices; computer peripheral equipment; computer components; computer environmental equipment and consumables; applications software; data base management software; and standardized package software. For the most part, these areas of specialty are not dependent on organizational size for their exploitation, but rather on innovative abilities, a realistic programme of development, and managerial ability to recognize, penetrate, and sustain the available and potential markets. Many excellent products in this field have been developed by dedicated teams of individuals, brought together by a high quality of leadership. For a number of reasons, often related to the size of the company and its capital resources, they have failed to exploit fully the potential of the product or service.

Of particular concern in this context are the software developments of Canadian enterprises. These undoubtedly represent an area where the expertise is available; where the products are internationally competitive, at least in quality; and where the market is still sufficiently fluid that it is not too late to capitalize on both the available and anticipated opportunities. The first point to be made is that software can be, and frequently is, as much a tangible commercial product as any item of hardware. Second, while there is still a lack of user acceptance for much of the commercially-developed software, the re-evaluation of in-house computing which is now taking place could result in a change of user attitude towards these products. Third, there are a number of advantages in using commercially-developed software which have not been sufficiently impressed upon potential customers. These include: reduced in-house personnel costs; faster development and implementation; training, maintenance, and documentation provided by vendors; and increased flexibility due to the provision of more program functions than are required initially. Much of software development should be considered as an appropriate innovative product meriting support, in the same manner as hardware. At the same time, Canadian entrepreneurs must be fully aware of the necessity to produce ''saleable'' software products. This often intangible quality would include: the identification of market needs; a sound marketing capability; the uniqueness and quality of the software; a pricing structure

appropriate to the investment and pay-off period; and an ability to instill in the customer the need for adequate operating, training and software maintenance practices.

In Chapter V, reference was made to the problem of lease-capital financing for Canadian companies. The problem is particularly acute for Canadian manufacturers who are attempting to obtain a foothold in a market which traditionally favours leasing arrangements for hardware products. Even when sufficient venture capital has been obtained to develop, manufacture, and sell the product successfully, the working capital required for continued operations during the initial years is greater than the revenues derived from leased products. Because it is probable that the private sector particularly, will continue to favour lease rather than purchase, consideration by government should be given to support arrangements for the financing of hardware leases.

Because of their importance in this innovation-oriented industry, Canadian entrepreneurs should be afforded ready access to government incentives which will enable them to overcome the costly barriers of the development phase and the subsequent marketing phase. Accordingly, the Task Force recommends that:

Rec. 32 Incentives should be granted to Canadian enterprises for all phases of innovation in the computer/communications field, particularly in application software and ancillary equipment development.

(d) Customs Tariffs

Concurrent with the necessity to establish policies relating to support for the domestic supply industry, based on a realistic appraisal of its international position, is the need to establish complementary policies for customs tariffs for hardware and computer service products.

There are two main problem areas. First, there is the classification of computer/communications products for tariff purposes. Many items within a complete system fall under different categories, resulting in a range of applicable tariff rates from zero to 20% of the value of the items. As a consequence, arbitrary rulings sometimes occur whereby identical pieces of equipment are tariffed under different classifications. This, in turn, makes it difficult to assess statistically the nature of the imports of computer/communications equipment and components. Second, there is the broader problem of the purpose of the tariff and the protection it affords. In general, the application of the tariff raises the cost of computing in Canada both to in-house users and to service bureaux in the service supply segment. On the other hand, it is intended to provide protection for Canadian industries which are manufacturing end-products and components in the field. On the surface, there would appear to be a case for revising such tariffs on all equipment of a type not manufactured in Canada, and particularly on large-scale computer systems. This would ensure that the service supply segment could compete on a more equal footing with services offered from foreign countries. However, it must be acknowledged that this is an over-simplified solution of a very complex problem.

The Task Force has had neither the mandate to investigate this problem, nor access to the confidential corporate information that such an investigation requires. Accordingly, the Task Force welcomes the government's direction to the Tariff Board to examine this area; to report its findings; and to make recommendations, where necessary, to amend such tariffs. In the light of the rapid changes in technology, a periodic review may be necessary.

3. EDUCATION AND TRAINING IN COMPUTER/COMMUNICATIONS

According to user and supplier responses to Task Force investigations, education and training in computer/communications and related information-systems technology is widely recognized as one of the key factors which will determine the extent, efficiency and effectiveness of computer/communications application systems in use throughout the nation and, indirectly, the development of the national computer/communications industry. Similar studies in other countries, such as the United States, Japan and Germany, have also placed emphasis on this subject.

(a) Needs in Education and Training

The rapid growth of computers in Canada over the past 20 years has placed a heavy burden on users and designers of computer systems to gain and maintain knowledge in this field. Apart from the great difficulty for computer professionals to keep abreast of the current technology, the rapidly expanding industry has created an increasing number of jobs to be filled; and the lack of perspective on employment opportunities has resulted in an oversupply of specialists in some fields. All these problems have created a confused situation. Many users and professionals have gained their knowledge primarily through training provided by hardware manufacturers, professional associations or training seminars offered by consultants, and, to a lesser degree, through formal college or university education.

The early sixties saw the emergence of high-level computer languages such as FORTRAN, COBOL and others. New hardware with emphasis on greater input/output flexibility became available. Operating systems and software packages increased computing capabilities immensely. This fast pace of new development put a considerable strain on computer professionals to absorb new knowledge and placed emphasis on technological aspects in training programmes. This emphasis shifted the spotlight from the computer generalist, more concerned about user problems, to the hardware-oriented specialist, more concerned with computer throughput. This development, while beneficial to the explosive growth of the computer industry, has been at the root of the gap between users and computer professionals.

Consolidation of previously decentralized computer facilities and central control of EDP departments within the larger user organizations have brought new problems, but have also provided new opportunities both to users and computer professionals. Consolidation of facilities has also opened new prospects in information systems integration, using data banks and terminals. Unfortunately, the very pace of this evolution causes a gap of understanding

between users and computer professionals which cannot easily be bridged without an educational programme directed to both. The following needs were identified:

- An increased level of understanding by users of the role that advanced technologies will play in their organization;
- a broader perspective by computer specialists of the structure and operation of business, industry and society, to enable them to be more responsive to user needs;
- a greater in-depth knowledge on the part of computer specialists of new technologies and methodologies, such as data communications and data management;
- an introduction to computer/communications at an early stage in the education process, to prepare students for future contact with these technologies.

(b) Fragmentation in the Provision of Education

A wide variety of organizations has become involved in attempting to satisfy education and training requirements for computer/communications. These organizations include universities, institutes of technology, community colleges, private schools, manufacturers, professional associations, and, not least, the computer user-organizations by means of their in-house training schemes.

The universities were among the first to teach computer technology, particularly in the applied sciences. They remain pre-eminent in the teaching of the theory and underlying principles of computation, and most universities now include computer science courses in their curricula. Computer science has been described as "the systematic study of constructive methods – algorithms – and of systems for the automatic performance of such algorithms".[1] Because the Task Force has been concerned primarily with the fulfilment of needs through the application of computer/communications technology, no attempt has been made to assess the contribution of computer science education. However, a number of representations to the Task Force by business users suggest that computer science graduates who intend to follow careers in an industrial environment would benefit from, and would find more job opportunities in being exposed to a wider range of business subjects.

The evolution of computer systems training began with hardware manufacturers as early as the nineteen-fifties. Their purpose was to ensure that customer personnel would be able to make use of their equipment. As a result, hardware manufacturers have laid the foundation for the evolving education of programmer and systems-analysts. In recent years, new products, services and software packages required a broadening of the range of courses by manufacturers and other suppliers. Manufacturers continue to be an excellent source of education, both in general courses and in courses on the advanced use of new products and technologies.

[1] Samet, P A. "Insight, Not Numbers". *The Computer Journal*. Vol 15. No 1. p 88

Associations which have been formed for the purpose of fostering professional interest in the use of computers also contribute to the educational process. Among these are: The Canadian Information Processing Society (CIPS); the Data Processing Management Association (DPMA); the Association for Systems Management (ASM); the Canadian Management Centre of the American Management Association (CMC-AMA); and the Data Processing Institute (DPI). The most active of these in an educational role are DPMA and ASM. DPMA offers, through the auspices of certain educational institutions, courses leading to examinations for a certificate in data processing (CDP), and for a certificate in business programming (CBP). ASM also offers courses in systems and procedures and an EDP user-management introductory course. CMC-AMA conducts workshops and seminars in all management subjects, and many are focussed upon aspects related to computers. DPI (for federal public servants engaged in computing), CIPS, ASM and DPMA, hold regular meetings at the local level to discuss topics of interest and concern to their memberships. ASM and DPMA provide seminars in co-operation with their respective international headquarters. Lack of funds to support their educational objectives, absence of adequately researched job profiles for professionals, dependence on international headquarters, and lack of an adequate membership base outside the major centres of computing are problems to some of these associations in furthering education and training in computer/communications.

In-house training facilities of the larger user organizations became an important source of education and training for programmers, analysts and users during the early sixties. Nearly two-thirds of the companies interviewed by the Task Force offer some form of training to their employees. In many cases, instructional material is purchased from commercial U.S. sources or from computer manufacturers. However, the small size of many Canadian organizations prevents the establishment of sufficiently comprehensive in-house training programmes.

The shortage of computer professionals during the sixties led to the establishment of a number of private training schools. However, they have been subject to criticism as their graduates were absorbed into the market. While they are registered in each province, little or no control is exercised over course content or entry qualification. The exception is Quebec, where the Department of Education established strict qualification requirements for private-school licensing. As a result, only one private computer school has been granted a licence in that province. Elsewhere, control over the application of aptitude tests, course content, qualification of teaching staff, and course fees with value received, still remain problems.

Computer graduates from Community Colleges, CEGEPs and Institutes of Technology are generally highly regarded, and their training seems to meet needs of business and industry. Many managers of computer operations suggested that programming aptitude tests should be given by these colleges as part of the entrance requirements for programmer education to further improve the quality of graduates.

There is a modest beginning in the teaching of the fundamentals of computer technology to students in the secondary levels. High-school courses are beginning to aid in the training of operators of computers and peripheral devices. Leaders in business and industry expressed the view that the current level of computer/communications education at the secondary level requires considerable extension. As an increasing number of high-school graduates on entering the work force are exposed to computers in their daily work, any lack of exposure to the technology will make them initially less effective, and place the burden of their training on the employer.

(c) Employment Requirements

In general, long-term growth predictions for industries assist in keeping manpower supply in line with demand. However, the complexities and rapid development of the technology and the resulting rapid changes in job profiles have made this extremely difficult in regard to computer/communications.

There are a number of established broad job classifications, such as programmer, analyst, key-punch operator, but the scope of jobs seems to vary considerably by industry, by size of operation, and by interpretation of job-profile given by senior management. The task of the educator, in estimating future requirements both in regard to numbers and types of qualified personnel, has been enormously complicated by lack of information on required job-profiles.

Several attempts have been made by professional associations to determine job-profiles in Canada. However, with the limited resources available for this task, the results of these efforts have been disappointing.

A parallel situation exists in general education at the primary and secondary level. It is a safe assumption that most of today's school population will be required to interact with computer/communications during their life. Familiarity with the nature and use of computer/communications will be important in the economic and social life of the next generation.

(d) Conclusions

The interest of professional associations in training and education for effective use of computer/communications has already been mentioned. A need for greater co-operation between the educator responsible for providing the training in computer/communications, and the established professional responsible for developing job-profiles was recognized in 1969 by a study team of the Montreal Chapter of ASM, which recommended an Institute for Information Systems Training. An independent submission to the Task Force made a similar suggestion. The creation of the Canadian DPMA Institute also indicates the needs.

In recognition of the contribution that associations can make to education in the computer/communications field, the Task Force recommends that:

Rec. 33 Government should support professional and industry associations in their endeavour to organize and stimulate the provision of suitable training programmes in the field of computer/communications in collaboration with educational institutions.

Management of user organizations see the need for systems-analysts, who, besides having the technical background, would have a broader perspective of economic and business systems, problems and issues. They see the need for emphasis on problem-solving capability and on economics, management and behavioral science. The co-operative courses provided by some universities, which expose students to the practical aspects of systems problems in the working environment, will assist in providing a broader understanding of problems and requirements of users.

There is also a need to develop a broader range of courses to teach the multi-faceted aspects of computer/communications. The broadening base of technology requires increasing specialization of professionals into such areas as data communications or data management. There is also a need to provide opportunities during education in other disciplines for obtaining some familiarity with computer/communications systems. Doctors or lawyers, as well as managers in business and industry, might benefit from an appreciation of the capabilities of computer/communications systems for use in later professional life.

There is also a need for courses in continuing education for general management and for some professions, which would introduce some of the technological aspects of computer/communications, and would place emphasis on evaluation of information requirements and on the use of planning and development techniques for information systems. These courses would help bridge the communication gap between the user and the computer specialist.

Similar needs exist for computer specialists in the form of "state of the art" extension courses to maintain the competence of the practising professional. This suggests training in the practical and cost-effective application of emerging technologies, products, methods and standards to new and improved information systems.

In view of these requirements, the Task Force recommends that:

Rec. 34 Government should encourage post-secondary educational institutions to offer courses on the multi-disciplinary aspects of computers and communications systems.

As outlined in more detail in the study "Applications in Education" (Volume II), there is potential for the application of computer/communications systems in educational processes. Although it is not the usual argument in support of computer-aided learning (CAL), if CAL was introduced into the lower grades,

students would have early experience in interacting with computers which would be of benefit as computers become more integrated into every day activities.

In the administrative area, an interesting result from experimental systems, such as the Peel County pilot-project, has been the basic acceptance of this technology by students because it is possible to bring information to them which is more closely timed with activities as they occur. The presence of such systems serves also to raise their level of awareness of computer/communications.

However, there is still a great deal of research, development and testing to be done in order to decide where and how computers can be integrated effectively into the educational process. Accordingly, the Task Force recommends that:

Rec. 35 Government should encourage research and development into the use of computers at all levels of education, through co-ordinated funding on a multi-disciplinary basis and extension of existing programmes in technological development.

4. COMPUTER/COMMUNICATIONS STANDARDS

The importance of standards in computer/communications is widely recognized, and a high degree of concern was expressed by users and suppliers in regard to present problems in this area. One of the major problem areas will require a reconciliation of the often-conflicting interests among various groups, such as carriers, users and manufacturers, in the standards-setting process. Users view standardization as a means of rationalizing development and operations of computer applications systems and, as such, it has tangible economic value to them. The main benefits are the reduction of duplication, fragmentation and proliferation of development effort, fewer uncertainties in the expected results of such efforts and the assurance that the many systems components (hardware, software, communications facilities) and the methodology of development and operations are sufficiently compatible with each other to function as an integrated system. More than two-thirds of the interviewed users have developed and adopted some kinds of standards for internal use, and about the same number favoured some form of government support to the standards-setting process.

Some suppliers see standards-setting as a means for the smaller business to gain easier entry in the national and international markets and as an opportunity to supply particular components, either hardware, software or services to the overall computer/communications system. In either eventuality the user will benefit ultimately.

As the principle user of computer/communications systems, the federal government has an important role in the standards-setting process. When used in procurement, standards can be an aid to the development of a national industry and an effective tool to bring the industry closer to the real needs of

its users. The efforts of Commander Grace Hopper to standardize on COBOL in the United States Navy is an often-quoted example in the data processing community of how the power of government can be exercised for the benefit of the community. Support of national and international co-operation is also viewed as an essential role of government, especially in a world where there is a danger of evolving invisible trade barriers. The preparation of standards in Canada cannot be undertaken in isolation from standards developed in other countries. The nature of computer/communications technology makes the fact of geographic location unimportant to end-users. Overlaps exist in the activities of the International Organization of Standardization (ISO) and the International Consultative Committee for Telegraphy and Telephony (CCITT), and it is conceivable that conflicting standards may be recommended, complicated by the possibility that the U.S. organizations such as the American National Standards Institute (ANSI) may establish yet another set.

The present state of the evolution of computer/communications networks has added urgency to the need for a cohesive national standards-setting activity, not only in respect to computer/communications interfacing standards, but also to adequately cover the ramifications of network operations into product-, methods- and data-standards and practices. With regard to interfacing standards, for example, the data processing components derive principally from the computer industry, while the data communications systems and components derive from the telecommunications industry, and incompatibilities are common.

In discussions with the Canadian computer/communications community, the Task Force gained the impression that standards-setting and subsequent acceptance by the community in the Canadian environment will be a delicate task. The majority of users have already developed individual standards and practices for internal use, often at considerable expense, and the conversion costs to common standards, ultimately necessary for network operation, may be found to be a most formidable barrier. There is also concern that the early setting of standards for products and methods which have not yet reached technological maturity may reduce the rate of innovation and hinder rationalization. Further, manufacturers and suppliers who have already reached a dominant position in the market may view common standards as not being in their own commercial interest.

In order to achieve a cohesive standards-setting process in Canada, leading to generally accepted standards, wide involvement of users and suppliers is necessary, with more active participation by government.

As a major user of computer/communications, the government should increase its participation in this area beyond its present involvement with ISO, CCITT and the Canadian Standards Association (CSA). In addition to increasing its activities in these organizations, other considerations, such as the role of government as an official national representative in international data communications standards organizations, the impact of regulatory aspects of telecommunication on standards-setting activities, and legislative aspects

related to standards on privacy and information security, suggest a need for co-ordination within government, between governments and with other standards-setting organizations.

In Chapter IX, a distinction was made between standards in the broad sense, and specifications drawn up by the carriers. It was also pointed out that the common carriers should have responsibility for the development of a data communications network, with the Focal Point ensuring that such development does not lead to disadvantages to users which could be caused by incompatibilities in the communication services offered. This then places an additional responsibility on government, and in order to assist in attaining this objective and to overcome some of the problems described herein, additional emphasis is placed on the need for government to participate actively with industry management in the standardization process.

In view of the range of activities associated with standards-setting, the Task Force recommends that:

Rec. 36 The Focal Point should co-ordinate the participation of the federal government in national and international standardization activities relating to computer/communications and in conjunction with provincial governments, industry and user associations, promote the preparation, publication and adoption of standards for an orderly and coherent growth of computer/communications in Canada.

An important part of the extended role envisaged for CSA relates to data communications standards, particularly in regard to interconnection of networks. In order that CSA would be able to carry out its additional functions in the computer/communications industry, a well-balanced representation from users and suppliers in the committee structure is required. However, since committee members are volunteers and there is no reimbursement to their company for time lost and expenses incurred in the work of standards preparation, the resulting financial burden is more than the smaller organizations can carry. Similar observations apply to international committee activity and to delegations to international conferences. Recently, the Standards Council of the federal government has made international travel funds available to CSA. In view of the extended role of CSA recommended by the Task Force, it is therefore proposed that:

Rec. 37 Government should provide funds in order to increase the participation of user groups in the formulation of standards, and place increased emphasis on communications, particularly in regard to interconnection of networks.

5. GOVERNMENT AS A USER

So far, in this part of the Report, recommendations have indicated measures governments can take which are specifically directed at creating a climate favourable for the development and application of computer/communications

in Canada. No less important in this regard are the actions taken by government departments and public institutions at all levels of government, in their own data processing operations.

Unless national policies are carried through to the operational level of individual departments and agencies, much of the credibility and impetus of these policies will be lost. This becomes particularly clear when one considers the large percentage of public sector activities compared to the total of EDP activities in Canada, as shown in Figure 6, Part A.

While the Task Force has been looking at the national scene, two other investigations have been carried out on the internal computer and communications requirements of the federal government. The EDP Policy Project of the Treasury Board, which was initiated in February 1971 to look into certain aspects of electronic data processing in the federal government, published its report in the spring of 1972. At the same time, a survey was conducted by the Government Telecommunications Agency in the Department of Communications, to obtain information on government use of telecommunications facilities; data communications was only one aspect of this study.

The report of the EDP Policy Project[2] shows an expenditure of over $80 million for EDP requirements in 1971. It also emphasizes the rapid growth-rate (26% per annum) of these expenditures over the past 10 years, and the rapid increase in EDP personnel over the last four years — 15% annually, as compared with about 3% annually for the total public service. In spite of the rapid growth, present EDP costs represent not more than 1.6% of the total operating budget for federal departments.

The report forecasts an increase in annual expenditures to about $175 million in 1975, if the policies recommended in the report are implemented. At the same time, it is expected that personnel connected with EDP will increase from about 5,000 today to about 8,000 in 1975.

Expenditures incurred by the federal government on external computing facilities (commercial and universities) have increased from about one million dollars in 1967 (which was about 3.5% of total EDP expenditures) to about $7 million in 1971 (which represented about 8.5% of the total EDP expenditures in that year). It is expected that this proportion will continue to increase. It might be mentioned that expenditures by the U.S. Federal Government (less military and other classified systems) for services on external computing facilities amount to about 14% of the total EDP expenditures.[3]

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2 *Report on Electronic Data Processing in the Federal Government of Canada* (EDP Policy Project. Administrative Policy Branch. Treasury Board Secretariat. November 30. 1971).

3 See data contained in: "IMPACT 70's (Illinois Master Plan Applying Computer Technology in the 70's). Volume II: Detailed Development" (Illinois Department of Finance. Management Information Division (submitted to Governor Richard B Ogilvie))

Based on Government Telecommunications Agency figures, the Task Force estimates that federal government expenditures on data communications in 1970 represented about 7% of the total data communication revenue of the carriers in Canada. It is expected that these expenditures will about double by 1975, at which time they will represent about 10% of the total Canadian figure.

(a) Alignment with National Policies

Unquestionably the whole computer/communications industry is strongly affected by such public activities, and the federal government, as the largest single user of computers and communications in Canada, can exert considerable leverage on the direction and rate of development of the industry through its operational policies.

Operations in government cover a wide range of activities which touch on many of the technological aspects and applications of computer/communications. In particular, government activities in the following areas, which are considered below, will have significant impact:

- Standards for hardware and software;
- standards for information handling, data coding, and information format;
- training for line management as well as for data processing personnel;
- social systems;
- regional development;
- procurement policies.

Because of the magnitude of government usage of computer/communications and the potential impact on the industry, the Task Force recommends that:

Rec. 38 Steps should be taken to ensure that the policies for internal federal government data processing and data communication activities are continually related to national policies in the computer/communications field.

While this recommendation is specifically addressed to the federal government, it is suggested that concerted lines of action should be developed also with Crown corporations and other public institutions at all levels of government. Standardization and training are also extremely important to the internal operations of government departments.

The co-ordination implied in the recommendations of the EDP Policy Project report places greater emphasis on government-wide standards for hardware and software. Standards activities within the government, which might be co-ordinated under the auspices of the Canadian Government Specifications Board, must be aligned with standards policies and other activities of the Canadian Standards Council and the Canadian Standards Association. In particular, with regard to drawing up specifications for tender, the government could play a leading role in the adoption of new standards.

Another area which will probably receive greater attention under the new policies is that of co-ordinating methods and procedures for information-handling and for its transfer across departmental boundaries. The work done in this area, and in standardizing data codes and information format, would also be of value in the exchange of information between governments and between government and industry. It would therefore be advantageous to take cognizance, where possible, of industry and provincial needs and constraints and possible solutions, when considering some of the internal requirements of the federal government.

The Public Service Commission has also devoted much attention to the training requirements in EDP. Many of the problems and needs in the federal government, provincial governments and industry are similar, and some joint action may be possible in, for example, developing certain training profiles and course-programmes, which might then be implemented by professional associations in conjunction with universities and colleges.

In addition to these examples which cover, primarily, the technological aspects, there are three other areas which will be considered at greater length.

(b) Social Significance of Government EDP Systems

Of particular importance in the national scene is the social impact of systems developed for departmental programmes. It is beyond the scope of this report to consider the social implications of all the computer systems in the federal government. The following examples help to illustrate the pervasive nature of the applications and the leverage that the government can exert in the development of socially-desirable systems, as indicated in recommendations 26, 27 and 28.

The Department of Supply and Services is one of the major users of EDP facilities in the federal government, with an EDP budget in excess of $10 million for 1971-72. It is responsible for issuing about 9 million cheques per month, and is, at the present time, studying the feasibility of direct transfers of money to individual banking accounts. Such an action would be a step towards the "cheque-less" society, and would need to be co-ordinated with systems-development in the chartered banks.

The Department of National Health and Welfare is responsible for the Canada Pension Plan, the computerized operations of which are handled by the Department of Supply and Services for over 8 million contributors. The Department of National Health and Welfare is also interested in additional uses of computerized services in health care delivery systems in Canada.

Automation of the national bibliography and the cataloguing sub-systems of the National Library is to commence, in 1972, as the start of a planned joint long-term and large-scale computerization programme of the National Library and National Science Library computing facility which will be used by both national libraries, and eventually will cover all government library data

processing needs. A recent report[4] has suggested that the Urban Information Exchange Service "would form, together with its various components, a subnetwork of the Canadian Scientific and Technical Information Network".

This last example illustrates the possible ramifications of federal government developments, and their application to other requirements. In view of the wider applicability of systems already developed, or to be developed, in government, it would be advantageous, where possible, for departmental plans to be published.

Operational policies of federal government departments can have a strong influence on the development of regional computing capability, particularly through possible shared use of local facilities by the federal and provincial governments. The possibility of dispersing the federal government's computing operations in order to assist regional development raises many of the classical considerations surrounding centralization versus decentralization which include: the purpose or purposes of the system; economies of scale; systems-design considerations; communication costs; availability of expertise; the types and levels of service required; and the costs associated with systems-development.

If a computer system for a particular department is considered in isolation, and if trends continue towards the use of larger processors, accompanied by a decline in communication costs, and an increase in the ability to manipulate large files of information, then there may be a tendency to accentuate centralization.

If, on the other hand, a department's computing requirements are considered in relation to local requirements, and if emphasis is placed on providing service in the field, there may be a tendency to decentralize certain operations, using central facilities only for summarizing and collating information on a nation-wide basis. Such decentralization, combined with joint projects with provincial authorities could materially assist in some aspects of regional development, and would promote useful opportunities for shared experience.

Where it is possible to decentralize certain EDP operations, the federal government should consider the feasibility of utilizing local service bureau facilities, in order to stimulate regional development of the computer/communications industry. This should be done in consultation with local provincial authorities, so as to develop a concerted approach.

(c) Procurement

The EDP Policy Project report, in itemizing "key problem areas", points out that "Because of several recent industry and technological developments, there are many areas in EDP procurement that are not adequately covered by

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[4] *Information for Urban Affairs in Canada* (Ottawa. Canadian Council on Urban and Regional Research. 1971)

present policy. Among these are: use of computer service bureaux, obtaining of peripheral EDP devices from suppliers other than those supplying central processors, acquisition of computer software, and use of communications-based devices." Each of these areas will be considered below, for it is in these areas especially (where procurement policies need to be clarified) that there is particular potential for development in Canada.

Government procurement policies and practices can have wide-ranging effects on computer/communications in Canada. Direct effects include:

- Providing a market for computer/communications hardware and software developed and produced in Canada;
- strengthening Canadian-controlled firms, particularly in applications involving sensitive information;
- development of systems of national scope which may be co-ordinated with provincial and private sector activities;
- providing a market for the development of commercial computer/communications services in regions of low industrial activity.

Indirect effects include:

- Development of standards for hardware and software;
- development of standardized data codes and information format;
- raising the level of Canadian industrial expertise in application programs, application hardware, and systems-design.

Accordingly, the Task Force recommends that:

Rec. 39 Federal government policies for the procurement of computer and communications goods and services to satisfy the internal needs of departments, should be directed towards the greatest possible stimulation of the computer/communications industry in Canada.

In particular, it is recommended that departments, while maintaining a high degree of professional competence internally, should increase, to the greatest possible extent, their use of commercial service organizations. The particular importance of the services supply segment of the industry has been outlined in Chapter X.

The EDP Policy Project report recommends that "Government policy for EDP be to meet its needs for EDP equipment and services from the private sector except when it is in the public interest or it would be more economical to provide them internally", which is in general agreement with the above recommendation.

Use of Computer Service Bureaux

Individual departments must retain sufficient professional expertise, and must be provided with the equipment necessary for carrying out their mandates. Notwithstanding this overriding requirement the Task Force is concerned that

some — perhaps much — of what is now done internally by increasing staff and acquiring additional equipment could be accomplished by contracting with commercial services in Canada.

If a high level of security is required, or some other particular need exists, it may be very difficult for departments to relinquish, even partially, control over the full operations of a system. However, in other cases, where a department is servicing some of its own internal operations and where security requirements can be met by commercial organizations, consideration should be given either to contracting out this work, or, in some instances perhaps, to facilities management.

In developing policy guide-lines for deciding on whether to build up internal staff and facilities or whether to purchase the required services, it should be borne in mind that direct purchase of services is perhaps the most logical (and least expensive) means of supporting the data processing services industry in Canada. Industry support programmes of the Department of Industry, Trade and Commerce place prime emphasis on research and innovation and cannot easily be modified to support the provision of available services.

The basic concern in deciding whether to provide services internally or obtain them externally, and in the selection of external services, must be to obtain the best overall services at least cost to support government operations and programmes.

The EDP Policy Project report has already emphasized that "In considering the relative costs of providing service in the government and obtaining it from the private sector, full costs should be accounted in each case." A definition of "full costs" is necessary to ensure consistent implementation of the policy.

Departments should avoid the acquisition of services which would entail the transfer of information outside the country. It is not possible to be dogmatic on this point, for in some circumstances — particularly in some scientific applications — it may be in Canada's interest to use highly specialized data bank facilities or other special services outside the country. Such a decision, however, should be based on an analysis in which the national interest is paramount.

In addition, provided a Canadian-controlled firm offering data processing services can meet the requirements of the user department, preference should be given to such a firm, based on a case-by-case decision. Where the data to be processed are of a sensitive nature, Canadian control should be a mandatory requirement.

Particular attention should also be paid to the possibility of utilizing commercial service bureaux as regional data processing centres for federal government requirements, in order to provide a base workload for a regional computing capability.

Peripheral EDP Devices

The Department of Industry, Trade and Commerce, in its support programmes for industry, already takes into account the "corporate behaviour" of firms in Canada. Consideration should be given to purchase of equipment developed under PAIT or other similar industry support programmes. Use of such products by the Canadian Government could assist in introducing them into the market-place. This of course, does not preclude consideration of those Canadian-developed products not assisted by government grants.

So that peripheral and terminal devices may be purchased from suppliers other than the one supplying the central processor, much greater emphasis will need to be placed on standards development for government operations aligned with national standards activities.

Acquisition of Computer Software

A distinction is made here between machine-oriented software, such as the executive and other operating systems, and application-oriented software. The former, to a large extent, may be considered as being very similar to hardware in regard to procurement. There are, however, some differences in that there is more reason and more opportunity for in-house development of this type of software than there is for in-house development of hardware. It is, however, inconceivable that all government departments should see a need to become involved in this type of development.

On the other hand, virtually all departments are concerned with the need for application software to meet their particular operational requirements. There are, for example, a number of different software systems handling personnel requirements. Such fragmentation and, to a certain extent, duplication of developments, should be of concern to government. It is of particular importance to the development of a computer/communications industry in Canada that more of this work be contracted to the private sector. Policies need to be developed which will minimize duplication and enforce adherence to government standards for data codes and information format. In the United States, government contracts have been used to great advantage in developing software expertise in the private sector.

Data Communications

It has been recommended (Recommendation 13) that non-carrier organizations be permitted greater freedom to attach equipment to carrier facilities, thereby improving the quality and efficiency of data communication services. This will open up new opportunities for the private sector in Canada, and will provide a wider variety of choices, both in regard to equipment and services for the users in government.

It is a general practice in the computer/communications industry to supply equipment such as data communications terminals on a lease basis. This has led to the smaller supply firms getting into difficulties in financing. Commercial

users probably welcome the practice as an aid to their tax structure. Government could consider outright purchase, in order to assist in reducing the capital requirements of the vendor. At the present time the decision to lease or buy depends mainly upon a cost-analysis by the department which is funding the contract, although it is also influenced by other factors, particularly the capability of the vendor to provide adequate maintenance support, and problems of obsolescence in a rapidly-changing technology. If national policies are directed towards stimulation of Canadian industry, recognition of this problem in the ''lease or buy'' policy is indicated, possibly favouring, in appropriate cases, outright purchase, even if a certain premium would have to be paid.

Several references to pilot-projects for computer/communications are made in this Report. A new digital network, being tested by TCTS, is a special case regarding which the initiative is from outside government, and government is only one of several users. The published results of this testing will be analyzed by government, and considered in relation to its requirements. However, there is at present no specific mandate for experimental work for the development of government data communications networks. In formulating policies for the procurement of data communications facilities and services, the need for such experimental work should be borne in mind, with particular emphasis on the evolution of a co-ordinated data communications network in Canada. In conjunction with the carriers, for example, it may be possible to test different types of equipment, different techniques, and perhaps new tariff structures for data communications, on an experimental basis, which could not be tried on a public network because of regulatory or other requirements.

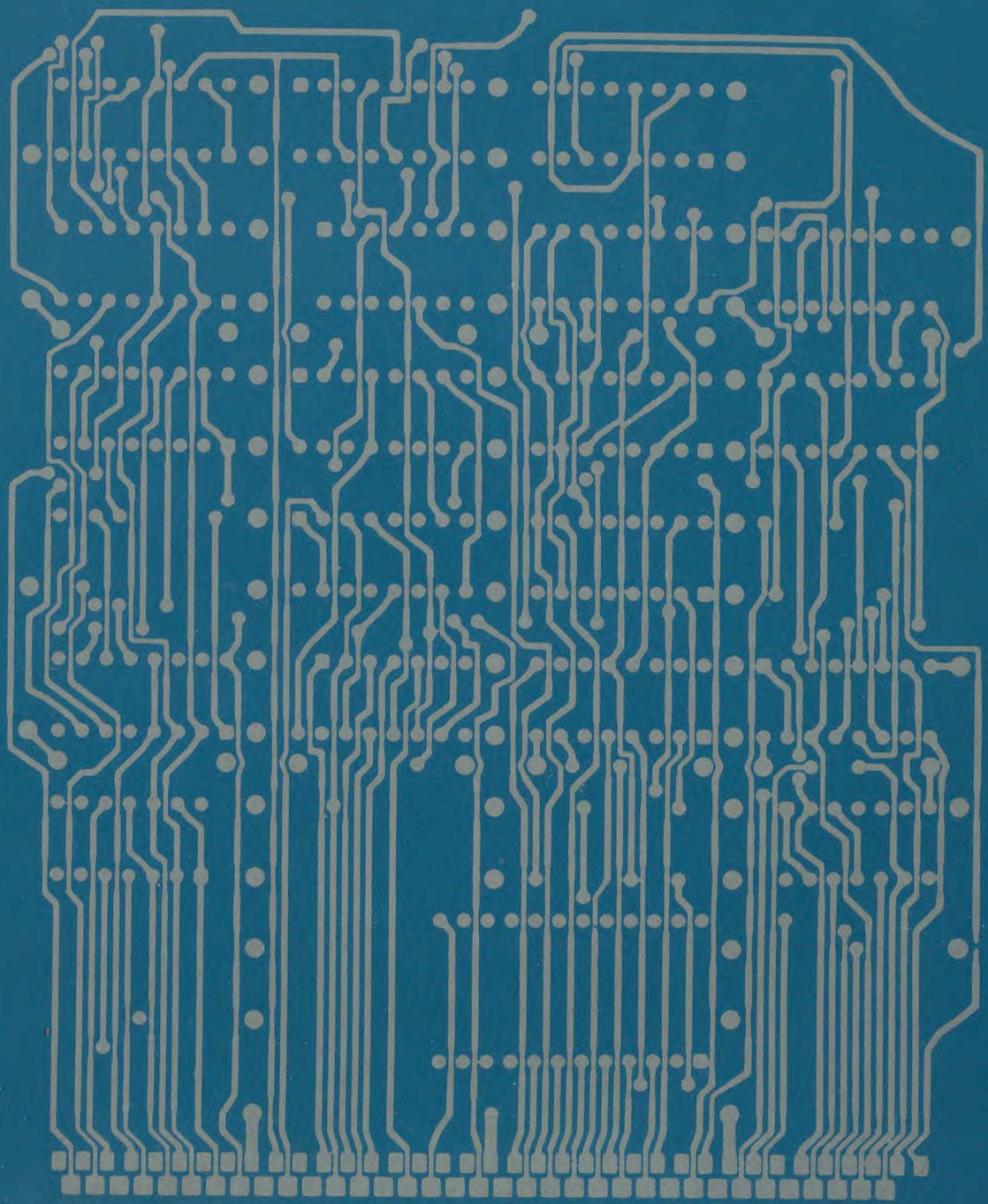
It may also be possible to develop a network within the government framework for a number of departments, which could act as a pilot-project for nation-wide network development.

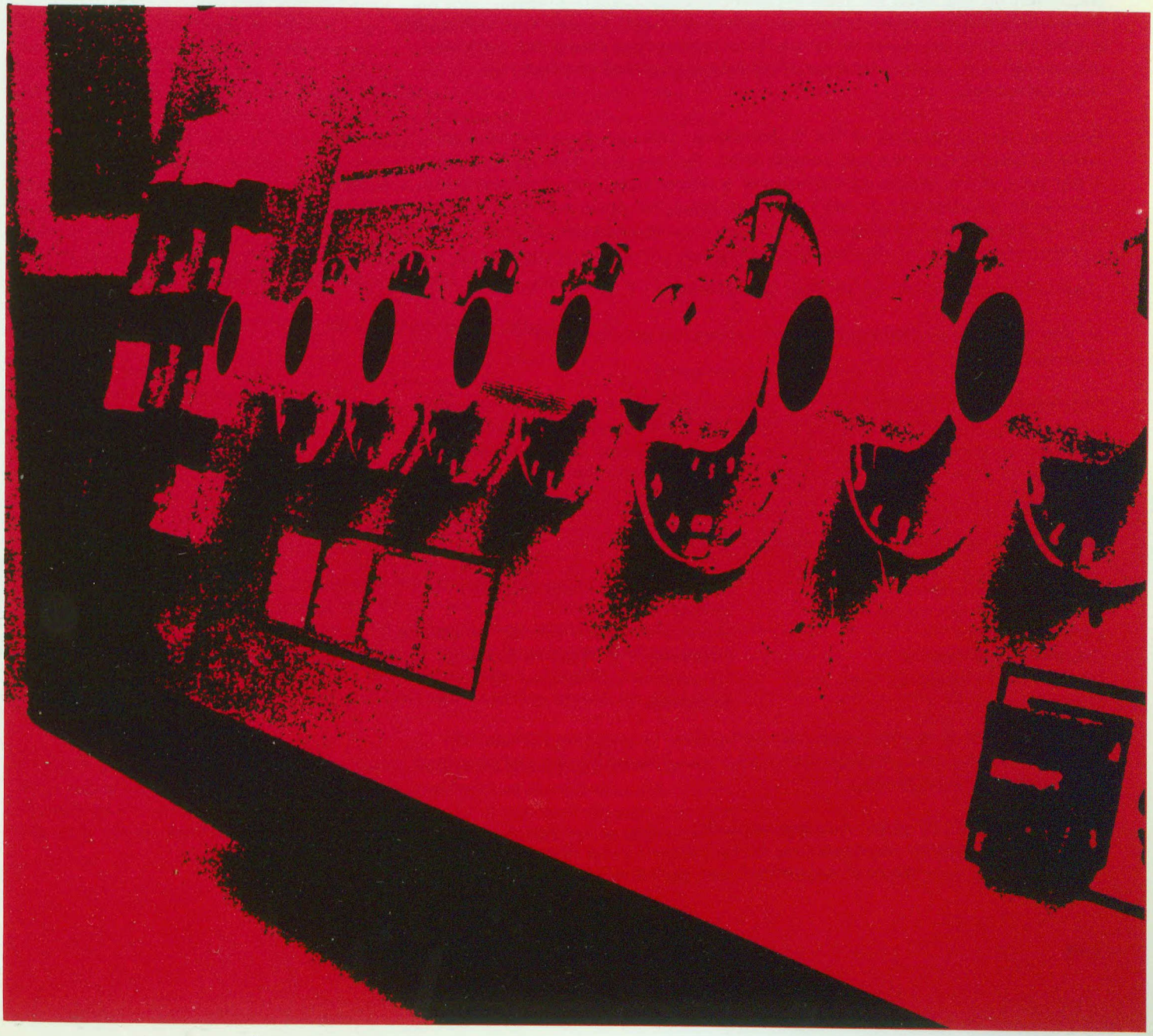
The above suggestions indicate that measures may be required to ensure a unified response by all departments to national data communications policy, particularly where such policies may be in conflict with short-term budgetary objectives of individual departments.

Part

E

Institutional Arrangements





This Report thus far has concentrated on functional requirements, with little indication of the appropriate institutions for carrying out the different activities. Attention is now given to those institutional measures which are considered necessary for the implementation of the recommended policies.

This chapter describes the need for certain institutions, and for new institutional arrangements in the light of the functional requirements of computer/communications. First, attention is given to the means by which the many viewpoints within the federal government could be brought together for the formulation of co-ordinated federal policies. This is followed by a discussion on the need for federal-provincial collaboration. Finally, government-industry relationships are addressed, and a number of bodies are described which are seen to be the most appropriate means for planning, stimulating, and, where necessary, regulating, activities in computer/communications.

Because the complexities of the technologies under review reflect equally complex situations at the institutional level, Section 4 is devoted to a further explanation of the proposed institutional arrangements. The recommended institutions are depicted in chart form, in order that their inter-relationships may be more easily understood. The notes accompanying these charts indicate in more detail some of the functions envisaged for these institutions.

1. RELATIONSHIPS WITHIN THE FEDERAL GOVERNMENT

(a) The Need for an Interdepartmental Committee on Computer/Communications

Recommendations presented in the preceding chapters dealt with functions which fall in the area of responsibility of different federal departments or agencies. In such cases computers and communications form individual elements in a broad range of subjects under the particular mandate of a department.

Departments, or agencies, thus involved include:

Department of Communications
Department of Consumer and Corporate Affairs
Department of Finance
Department of Industry, Trade and Commerce
Department of Manpower and Immigration
National Research Council of Canada
Department of National Revenue
Department of Regional Economic Expansion
Department of Supply and Services
Ministry of State for Science and Technology
Treasury Board Secretariat

This list, which is by no means comprehensive, is given to indicate that policies touching on computer/communications fall within the purview of many different departments.

As in other fields of policy-development which cross a number of departmental areas of responsibility, an interdepartmental committee should be established for co-ordinated discussions and decisions on all matters

pertaining to the development of national policies in computer/communications. Such a committee would, in all likelihood, cover other areas of telecommunications, but reference is made here only to those aspects which concern computer/communications. A mechanism of this type is necessary, in view of the number of different departments affected by the recommendations in this Report.

(b) The Need for Computer/Communications Expertise and a Focal Point

The issues of computer/communications represent a highly complex mixture of technical, economic, social, jurisdictional, and institutional problems, which are all inter-related and, in addition, are subject to rapid change. This suggests that there is a requirement for a permanent centre of expertise in which the many interacting issues can be continually monitored and analyzed for presentation and advice to those responsible for policy-decisions. This concept led the Task Force to the basic Recommendation 4 which proposes that, in the area of federal responsibilities, a Focal Point should be established within the federal government to co-ordinate the development, formulation, and continuing evaluation of national policy in all matters pertaining to computer/communications. This Focal Point would be in close contact with industry and appropriate groups in provincial governments; it would provide inputs to the inter-departmental committee, and perform studies and investigations as they become necessary for the committee's work.

The functions of the Focal Point fall into two broad categories:

- Strategic planning; for the formulation and review of national policies and objectives, for the identification of needs, and for the evaluation of impacts on society; and
- programme co-ordination; for assisting in the implementation of national programmes, for assessing problems and recommending government actions, and for on-going co-ordination with other interest groups.

The Task Force is particularly concerned that those involved in strategic planning for computer/communications should not find themselves having to deal with urgent day-to-day problems. In addition, long-range planning for computer/communications must be placed in proper perspective with regard to telecommunications and integrated with the strategic planning for total telecommunications. It is envisaged that strategic planning would be primarily an advisory function.

Program co-ordination, on the other hand, would be concerned with day-to-day problems, and would focus attention on computer/communications aspects of the wide range of actions and policies of different departments and agencies, in an attempt to rationalize existing fragmentation of responsibility.

Strategic Planning

The orderly development of computer/communications systems in Canada is dependent upon realistic long-range plans, based on needs and capabilities, taking into account existing conditions, trends, and potential problems as identified through a continual monitoring process. The need for future-oriented, multi-disciplinary planning is now receiving wide recognition and increased emphasis in many government and industrial activities.

The functions of this group may be summarized as follows:

- To identify user-needs and problems.
- To evaluate the impact on society of planned and projected computer/communications systems.
- To develop and recommend national policies and objectives, and recommend appropriate legislation.
- To foster and assist the development of a coherent data communications network in Canada.
- To recommend priorities for implementation of special systems.
- To recommend areas requiring special attention in research and education.
- To prepare technological forecasts.

A small, highly-qualified staff should be recruited from a number of appropriate sociological and technological disciplines. Provision should also be made for a number of visiting specialists for limited periods, and extensive use should be made of contracts with universities and other research institutions and associations. These arrangements would ensure that, while the strategic planning group is buffered from immediate problems, it would maintain contact with the problems of the day and be primed with fresh thinking and new ideas.

Program Co-ordination

In view of the unsettled and rapidly-changing situation in computer/communications, a unified approach could be taken by assigning responsibility for co-ordinating all current aspects of computer/communications to a single group. The function of the group would embrace all those activities specifically related to computer/communications which involve interaction with other federal government departments, with private industry and associations, and with provincial and international organizations.

The present fragmentation in the government's approach to issues and problems in computer/communications would be overcome most readily by maintaining a group to focus its attention on such issues. The Task Force has identified a number of problem areas, which indicate the magnitude of the task. Additional specific problems within these areas have been brought to its attention through representations to the Minister of Communications, or through direct representations to the Task Force. These have occurred with sufficient regularity during the life-time of the Task Force to emphasize the continuing requirement for dealing coherently with day-to-day questions.

The functions of the program co-ordination group may be described as follows:

- To work closely with provincial authorities and those of other federal government departments and agencies in helping to resolve common problems, and identifying common needs related to computer/communications.
- To assist in the implementation of pilot-projects carried out in conjunction with provincial authorities, private industry, and other federal departments.
- To work closely with carrier organizations and standard-setting bodies in the development of technical standards for the network and for interconnection.
- To co-ordinate standards-setting activities of Government departments and agencies, and to work closely with industry, in the standard-developing process.
- To ensure that developments of computer/communications systems comply with long-range plans for the evolution of a coherent data communication network.
- To ensure that the Canadian position is maintained in international activities, and in agreements made between Canadian and foreign carriers.
- To monitor activities of organizations providing data processing services and data communication services in order to detect the development of trends that may be contrary to the public interest.
- To assess the feasibility of achieving rates which are largely independent of distance for data communications related to special services.

By relating recommendations to the responsibilities of the strategic planning group and the program co-ordination group it becomes apparent that there is a clear distinction between their functions. Some recommendations affect both groups, but in all these cases the strategic planning function is related to establishing and recommending principles, plans and priorities; it falls to the program co-ordination group to foster implementation.

The functions of the Focal Point as envisaged by the Task Force in co-ordinating, promoting, and recommending national policies for computer/communications, and in assisting Canadian telecommunication systems to adjust to the changing requirements imposed by computers, are closely related to the definition of duties outlined in sections 4 and 5 of the Department of Communications Act (RSC 1970, c.C-24), *viz*:

> ''4. The duties, powers and functions of the Minister of Communications extend to and include all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, branch or agency of the Government of Canada, relating to
>
> a) telecommunications; and
>
> b) the development and utilization generally of communication undertakings, facilities, systems and services for Canada.

"5. (1) The Minister of Communications, in exercising his powers and carrying out his duties and functions under section 4, shall

(a) Coordinate, promote and recommend national policies and programmes with respect to communication services for Canada, including the Canada Post Office.

(b) promote the establishment, development and efficiency of communication systems and facilities for Canada;

(c) assist Canadian communication systems and facilities to adjust to changing domestic and international conditions;

(d) plan and coordinate telecommunication services for departments, branches and agencies of the Government of Canada;

(e) compile and keep up to date detailed information in respect of communication systems and facilities and of trends and developments in Canada and abroad relating to communication matters; and

(f) take such action as may be necessary to secure, by international regulation or otherwise, the rights of Canada in communication matters.

(2) The Minister of Communications may, with the approval of the Governor in Council, enter into agreements with the government of any province or any agency thereof respecting the carrying out of programmes for which the Minister is responsible."

In the light of the close relationship between these duties and those outlined previously for the federal Focal Point in the area of federal responsibilities in computer/communications, the Task Force considers that the Minister of Communications and his Department should be the designated focal point for co-ordination in the development and continuing assessment of national policy for computer/communications.

2. FEDERAL-PROVINCIAL COLLABORATION

The importance of close collaboration between the federal and provincial governments in the successful implementation of national policies in computer/communications has been emphasized throughout this report. Collaboration is necessary in a number of areas including planning and policy formulation, compatible legislation, regulatory policies and procedures, and appropriate arrangements at the working level.

Development of communications in Canada has led to a complex mixture of federal and provincial Crown corporations and private companies, some of which are regulated by a federal body, and others by provincial bodies. It is possible for the federal government and for individual provincial governments

to take unilateral action in formulating and implementing policies and in developing and introducing computer/communications systems. There is, however, such close interdependence among the carriers and among the different governments in this field that independent actions by one government could have serious repercussions on the activities of others. Further, investments in money and manpower required for major public computer/communications systems are so great that individual governments will be hard-pressed to find sufficient resources for separate developments.

It will therefore be to the advantage of all governments to collaborate in resolving the many difficult and contentious problems posed by computer/communications.

Experience has shown that the introduction of computer methods and techniques into any large organization has necessitated significant changes in approach and in interrelations between various segments of that organization. It is perhaps trite to emphasize that this will be no less true in regard to the interrelationships between federal and provincial governments with regard to computer/communications.

In developing a unified approach to computer/communications for the orderly evolution of a data communications network in Canada, emphasis will need to be placed increasingly on multilateral planning and development. The co-ordination of policies and joint federal-provincial involvement in establishing priorities and in fostering the development of systems, will require discussion and consultation at the highest level. This will necessitate frequent consultations between the Minister of Communications and his counterparts in the provinces.

The initiative shown by the Maritime provinces in their plans for consolidating requirements and pooling resources in computer/communications provide an example of the need for ministerial consultations and an indication of possible measures that might be taken on a wider basis.

Coupled with the need for consultations at the ministerial level to foster a cohesive policy framework for computer/communications in Canada, there will be a need for increased consultations and joint developments at the official level. There is a need for a continuous interchange of views and information on all aspects of computer/communications, including user needs and problems, trends in the industry, and proposed government actions, as well as specific systems developments.

At the regulatory level, some co-ordination between the independent bodies is necessary to avoid the development of incompatible practices. The Task Force therefore suggests that a mechanism such as a Council of Regulatory Commissioners and Boards responsible for telecommunications should be considered.

This would provide a forum for discussion and possible resolution of some of the difficulties, would permit the identification of gaps in the areas covered, and would serve to promote the development of a cohesive approach to regulatory procedures for computer/communications throughout Canada.

3. RELATIONSHIPS BETWEEN GOVERNMENT AND INDUSTRY

Recommendation 2 calls for the closest possible co-operation between the public and private sectors in the development of national policies for computer/communications. Government actions recommended in this Report will bring the two sectors closer together in an interactive framework, rather than one in which prime emphasis is on regulation. However, regulation of certain aspects will continue to be an important area of government action.

At present the only direct regulation that relates to the computer/communications industry is that of the telecommunications carriers by the several federal and provincial regulatory agencies. Suggestions are therefore included in the following sections as to the new roles envisaged for these agencies with regard to computer/communications, together with suggestions for revisions to the legislation governing these agencies.

(a) The Role of the Telecommunications Regulatory Body

A number of Task Force recommendations suggest regulatory policies relating to such matters as carrier entry into data processing, use of customer-supplied attachments, interconnection, use of carrier lines and facilities, and network standards. In order to allow the appropriate regulatory body to adopt and implement these policies, with adequate jurisdiction to review and revise them should inadequacies or loopholes appear, the Task Force recommendations would require that the present legislation governing the federally-regulated telecommunications carriers should be amended where necessary to give specific jurisdiction to the appropriate regulatory body (at present, the Canadian Transport Commission) in regard to the following matters:

- The power to prescribe the conditions for entry by the carriers, or by partially or wholly-owned subsidiaries of the carriers, into non-regulated activities, including data processing. This might be part of a broader jurisdiction to review all non-regulated activities or investments by the carriers, the basis for such review being the effect of these activities both on the provision of traditional carrier service, and on the competitive structure of the non-regulated activity.
- The power to require the carriers to permit the use of foreign or customer-supplied attachments to the carrier facilities, subject to such technical or economic conditions as it may prescribe or arbitrate.
- The power to order interconnection between systems of data communications carriers, and between those of carriers and non-carriers, upon such conditions as it may prescribe.
- The power to arbitrate and remove or alter any specific or general restrictions on the use of carrier facilities set out in the carrier tariffs, where such restrictions have, in the opinion of the regulatory body, extended the area of carrier monopoly beyond that reasonably required for the discharge of the carrier's public obligations.
- The power to review and approve agreements respecting international tolls, charges, and tariffs arrived at between Canadian and foreign telecommunications carriers, and to prescribe by regulation the conditions for interconnection between such carriers.

In regard to each of the above matters, the Task Force has recommended administrative policies in earlier chapters. These policies are not meant to be embodied in statutory form, but would be the subject of detailed regulations passed by the regulatory body after due consideration at public hearings at which both industry and government views could be made known. If or when problems arise with regard to the day-to-day administration of the regulations, they can be amended by the body to take account of these problems. Accordingly, it is proposed that (a) the regulatory body be given a general regulatory or rule-making authority in regard to the above matters, enforceable by penalties or injunction; and (b) that all such rulings be subject to disallowance by the Governor in Council in cases where such rulings conflict with developing national policies in other fields (*e.g.*, regional incentive programmes, foreign ownership policy).

As part of the statutory framework for the regulatory body, a general statement of regulatory philosophy should be added to the appropriate legislation, which takes into account the needs of the competitive environment suggested in this Report, as well as the protection of the traditional carrier monopoly services. This statement of regulatory philosophy should be based on the concepts developed in earlier chapters of this Report.

(b) The Role of a Registrar of National Computer/Communications Networks

Recommendation 23 calls for the registration of organizations offering data processing services commercially through communications facilities with terminals on remote premises. The Task Force suggests the establishment of a Registrar of National Computer/Communications Networks within the framework of the federal regulatory commission. The Registrar would have no discretionary powers to refuse registration of any organization which provided the necessary information. The information required would be set in regulations approved by the Minister of Communications.

At the federal level, registration would be required for all suppliers of data processing and data bank services using data networks designed for communication with computers, where such networks have regularly-used terminals in more than one province, where such networks extend on a regular basis into foreign countries, or where such networks use, as an integral part of their operations, carrier facilities declared to be for the general advantage of Canada. The information sought would be kept to the minimum necessary for planning purposes, and might include a basic description of the network configuration, the technical specifications, the applicable tariffs, the nature and purpose of the computers linked to the network, the type of data stored in the computer, the type of traffic flow pattern, the nature of the application services and customer uses of the system and ownership of the network. Such information would be used for continuing surveys, evaluations of interconnection feasibility, and review of the development of the industry with a view to monitoring user needs that are still unmet and, the extent of the use of foreign data banks and computers by Canadians and *vice versa*, in case legislative or administrative policy changes are called for.

To facilitate these studies, the information collected by the Registrar would be available to the Focal Point. Some of the information, which might be detrimental to competition if disclosed, would not be open for examination by the general public. On a regular basis, the Registrar would summarize the trends and developments indicated by the registration process in reports to the industry. He would also seek to co-ordinate such information with any similar data collected by provincial registrars of data banks and networks, if such were established. New legislation should be introduced (perhaps as an extension of existing statutes relating to telecommunications) requiring the operators of national computer/communications networks to register with the appropriate federal official. Failure to register would be subject to punitive sanctions. Registration would be optional for all operators of "local" computer networks and operators of service bureaux where no remote facilities are used. Failure to register would not in these cases be subject to punitive sanctions, although such registration might be deemed a prerequisite for the obtaining of federal government grants or contracts.

(c) The Role of a Competitive Practices Tribunal

The Task Force anticipates that the introduction of new competition legislation covering services will assist in the achievement of the goals sought in this Report. Consequently, a need is seen for a Competitive Practices Tribunal with effective powers to review anti-competitive practices. The practices which would be subject to review include price discrimination, tied sales, directed selling, exclusive dealing, delivered pricing, and refusal to deal. Moreover, the recommendations in this Report with respect to free entry into the data processing services industry are all conditional on a competitive environment being maintained by such a Competitive Practices Tribunal. It would also review the practices of the telecommunications carriers, to the extent that their tariffs and practices were not subject to specific review by the regulatory agencies.

In addition, as mentioned in Recommendation 8, the entry of the banks into the data processing services industry may pose a unique problem. Accordingly, the Task Force considers that the Bank Act should be amended to provide that no chartered banks may offer data processing services to the general public in Canada, except where such services are directly incidental to the business of banking. A mechanism should be set up under the Bank Act through which interested persons may obtain rulings from the Inspector General of Banks as to whether any particular service offering is within or outside the meaning of "the business of banking", and the Act should provide that the banks would be bound by such rulings.

(d) A Computer/Communications Industry Planning Board

Recommendation 2 calls for close government-industry co-operation in the development of computer/communications in Canada. Avenues already exist whereby business and industry can make views known to government through representations to appropriate Ministers, Members of Parliament, and through direct contact with officers of government departments. The fact remains, however, that industry is not satisfied with present arrangements.

Accordingly, the Task Force sees a need for establishing a more formal approach whereby the private sector is not left to react to government actions, but is invited to participate in early discussions and can itself make constructive suggestions and proposals.

The Canadian Radio Technical Planning Board (CRTPB) was established in 1944 for giving advice and making recommendations to the government on the development and regulation of radio services in Canada, and is primarily concerned with standards and specifications relating to such services. Recently, its activities have been expanded to include broader responsibilities in the area of policy development. This arrangement appears to have worked well, and it is suggested that a similar approach might be taken with regard to the problems associated with computer/communications. The Task Force therefore sees a need for the establishment of a Computer/Communications Industry Planning Board, consisting of representatives from user and supplier associations, to assist in the development of national policies. Its objectives could encompass:

- Identifying problems and issues arising in computer/communications;
- presenting the views of different segments of the industry with regard to possible government policies and actions in the computer/communications field;
- initiating studies and investigations on matters of concern to the industry;
- promoting closer government-industry co-operation in resolving problems in computer/communications;
- promoting improved collaboration between different segments of the computer/communications industry;
- advising the government on specific problems referred to it for opinion;
- establishing specialized technical and other committees as required;
- collaborating in preparing national and regional forecasts and projections.

These suggested terms of reference give the proposed Planning Board a broad mandate within which to operate, but they should be further discussed and clarified during early meetings of the Board when it is established.

It is envisaged that the Board would be organized entirely by the private sector and would be representative of existing business and industry associations which have an interest in computer/communications. In order to initiate its formation, it is suggested that the Minister of Communications promote its inception as soon as possible and contact such associations with a view to setting up an inaugural meeting. Further action would then be left to the associations.

The government may be expected to provide financial support, particularly for the involvement of smaller organizations, but it should be left to the Board to forward specific recommendations.

The Board would meet as frequently as it felt was necessary. In general, these meetings would not involve government representation, except by invitation.

However, an annual joint meeting between the Board and representatives of government should be held under the aegis of the Focal Point. This annual meeting would provide a forum for detailed discussion of a wide range of problems. It would not preclude other meetings with departmental officials as the need arose.

The establishment of a Computer/Communications Industry Planning Board will help towards creating an environment for closer government-industry collaboration in facing the challenges posed by computer/communications. There is an additional need to place particular emphasis on the development of a co-ordinated data communications network in Canada. The Task Force therefore envisages the establishment of a Data Communications Advisory Committee as one of the permanent standing committees of the Planning Board. Such a committee is necessary in order to consider in more detail the requirements for development of a data communications network. Recommendation 19 places much responsibility for this development on the existing common carriers in Canada. The formation in February 1972 of the Canadian Telecommunications Carriers Association (CTCA) provides a formal means for carriers in Canada to consider problems and priorities, and to formulate cohesive plans for network development, including a consideration of specifications and standards.

Another permanent committee might be a Data Processing Advisory Committee which would also provide expertise and inputs to standards-setting organizations, particularly the CSA.

(e) The Role of the Canadian Standards Association

The need for increased attention to standards has been expressed in earlier sections. The Task Force has reviewed the various institutions involved in standardization activities in Canada. Whereas none has at present either the technical or the institutional scope that will be required for developing computer/communications standards, the Canadian Standards Association (CSA) does have the requisite basic background in the standards-setting process at the national level and therefore has a great advantage over any new organization which might be called into being. The Task Force therefore considers that, despite the expansion in scope of activities in the CSA which will be required, that body could be the most suitable to provide the carefully balanced and controlled environment for the preparation, adoption, and publication of computer/communications standards.

The CSA is active in the field of computer industry standards through its Sectional Committee on Computers, Information Processing and Office Machines. This Committee deals with the range of standards from programming languages to keyboard layout. However, communication networks standards and specifications have been developed by the common carriers and their supply industry. With the proposed increased participation of these organizations in the activities of CSA, it is expected that communications networks standards and specifications will be made available to CSA on a continuing basis. The task for the CSA will be to co-ordinate and prepare

standards that will maximize the efficiency and flexibility of technical interfaces between computers and data communications and minimize problems due to technical incompatibilities.

An additional role for CSA in computer/communications would be the examination and certification of computer/communications equipment. This is made particularly important by Recommendations 12 and 13 which permit a more liberal approach to attachment of equipment to the carrier networks. The CSA is already engaged in similar activities for certifying electrical apparatus for safety standards. It is proposed that the CSA be encouraged to establish the necessary organization and plant.

In its implementation of equipment certification there are several options to consider, but first it is necessary to recognize that the expense involved is not an obligation of the carriers unless it is their own equipment which is being certified. The CSA might choose to build its own facility; sub-contract to consulting organizations, or even engage the services of the carriers in certain cases. The Task Force is of the opinion that it will be necessary to keep the operation independent from vested interests and that, whatever option is selected, it will be necessary for CSA to retain the responsibility for certification.

The CSA would continue to be an industry organization and would derive principal membership and financial support from that source, although in the initial phases of its expanding role, government funds may be necessary.

The following figures and explanatory notes summarize the suggestions made in this chapter.

4. A CHART GUIDE TO THE INSTITUTIONAL RELATIONSHIPS

NOTES TO FIGURE 11 -

• *The Role of an Interdepartmental Committee on National Computer/ Communications Policy*

As indicated in Figure 11, a number of federal departments at present have substantial impact on national computer/communications policy. This impact ranges from the preparation and implementation of statutes affecting the industry (*e.g.*, the Income Tax Act, the Patents Act, the Combines Investigation Act, the Bank Act) to administrative policies relating to development funding, research, regional incentives, procurement, and similar matters. In order to co-ordinate these policies for the benefit of Canadian industry and Canadian computer/communication users, it is suggested that an interdepartmental committee be created which would include among its tasks the co-ordination of national policies relating to computer/communications. It is possible that in order to avoid a proliferation of such committees the mandate of the interdepartmental committee could extend also to other related areas. The intent of the creation of this committee is to provide a forum to facilitate the interchange of information and for the co-ordination of departmental policies.

• *Role of a Focal Point*

The Task Force recommends (Rec. 4) that within the federal government a Focal Point be created for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications. The functions of the Focal Point fall into two broad categories; (a) strategic planning; for the identification of user needs, for the preparatory work on, and review of, national policies and objectives, and for the evaluation of impacts on society; and (b) programme co-ordination; for assisting in the implementation of national programmes; for assessing problems and recommending government actions; and for ongoing co-ordination with other interest groups.

The specific role of the Focal Point in relation to the computer/ communications industry is discussed in detail in Note 1 to Figure 13. The Focal Point would also provide input to the Interdepartmental Committee on National Computer/Communications Policy. This input would particularly relate to the various external proposals, decisions, or legislation affecting the computer/communications field. A further possibility which would facilitate co-ordination would be for the Focal Point to act as a secretariat to the Interdepartmental Committee, in order to assist in the assimilation of the various inputs from the departments concerned with computer/communications policy.

Figure 11
Suggested Institutional Arrangements
at the Federal Departmental Level

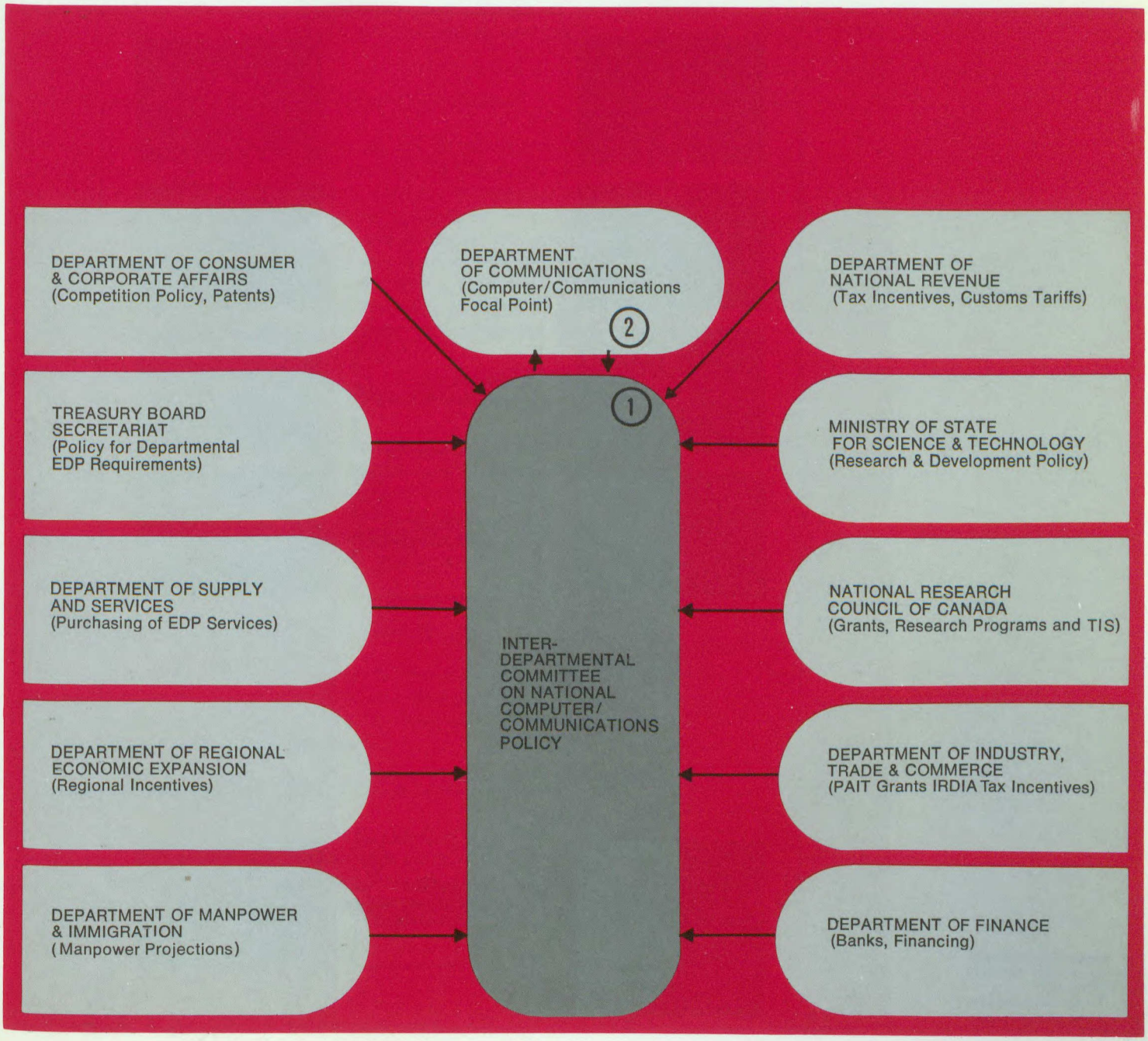
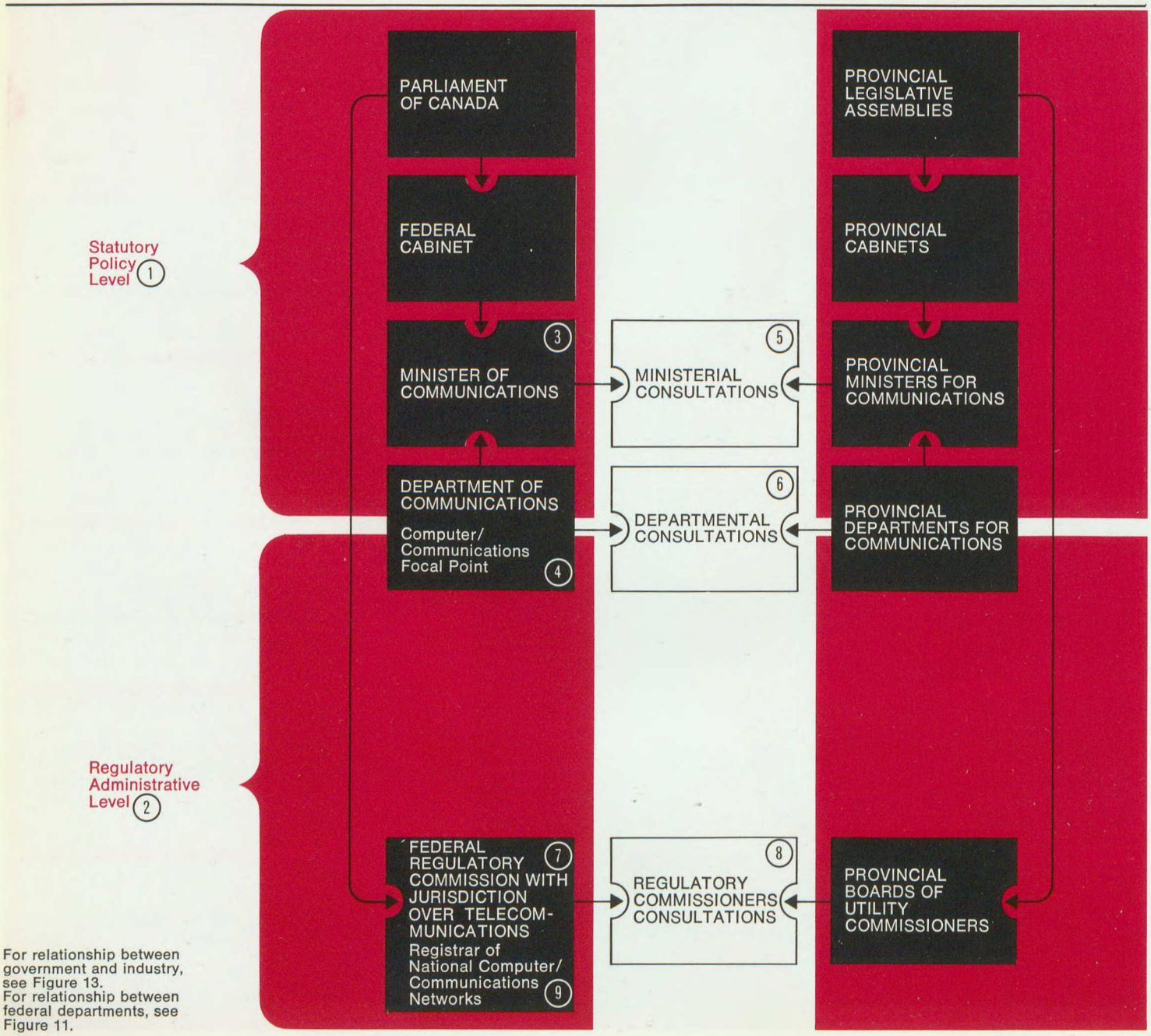


Figure 12
Suggested Federal-Provincial Liaison for Computer/Communications Policy



For relationship between government and industry, see Figure 13.
For relationship between federal departments, see Figure 11.

NOTES TO FIGURE 12

• *Ministerial Involvement at the Statutory Policy Level*

A distinction is drawn between the appropriate role for executive involvement in computer/communications policy and the involvement of the regulatory bodies, a distinction which is also found in such areas as broadcasting policy. The ministerial role is that of suggesting and implementing broad statutory policies relating to the fundamental long-range structure of the industry. In computer/communications, this would involve fundamental policy, development of appropriate legislation, and decisions on such matters as whether sectors should be regulated or unregulated, and the appropriate role for the regulatory body.

• *The Conceptual Role of the Regulatory Commissions*

It is not envisaged that there should be any direct regulation of the computer/communications industry as such. To the extent that regulation is required on such matters as network interface standards, the relationship between the monopoly and competitive services of the telecommunications carriers, and complaints about tariffs and practices, the appropriate regulatory commission would conduct hearings and render decisions. The jurisdiction of the boards or commissions to deal with these matters would be set out in their enabling statutes (perhaps supplemented by statutory provision for ministerial directions on specified matters) as enacted by the appropriate legislature.

• *The Role of the Federal Minister of Communications*

Although the federal Minister of Communications has a variety of other responsibilities in regard to communications under several federal statutes, only those functions relating to computer/communications are reflected here. The Minister and his Department, as the Computer/Communications Focal Point, would be responsible for evaluating and recommending broad statutory policies for computer/communications insofar as they fall within the legislative authority of Parliament.

• *The Federal Department of Communications*

In order to provide a resource centre for the development and evaluation of computer/communications policies, it is proposed that the Minister of Communications and his Department be designated as the Focal Point for matters falling under federal jurisdiction.

• *Liaison Between Ministers Responsible for Communications*

Liaison between federal and provincial ministers is desirable for the formulation and development of cohesive computer/communications policies in Canada. The Task Force recommendations are particularly directed towards a cohesive policy, suggesting consultations at the ministerial level.

• *Liaison Between Departments Responsible for Communications*

Continuous liaison and consultation between departmental officials for the exchange of information and the consideration of possible joint developments are desirable. In support of these, there should be an interchange of relevant studies, forecasts, and accumulated statistical data on computer/communications.

• *The Federal Regulatory Commission*

The role of the federal regulatory commission with jurisdiction over telecommunications is described in Figure 13, Note 2.

• *Liaison Between the Federal and Provincial Regulatory Commissions and Boards*

Just as liaison is desirable between federal and provincial governments involved with computer/communications policy, it is also suggested that continuing liaison be developed by the Federal Regulatory Commission with provincial boards and commissions dealing with the regulation of the telecommunication carriers. In computer/communications, this liaison would facilitate the ability of the boards to develop compatible administrative practices, particularly in areas where the carriers under their respective jurisdictions interact directly with each other. Because of the impact of practices relating to the federally regulated carriers on practices elsewhere in the carrier industry, it is suggested that broad new administrative practices to be implemented by the federal regulatory commission be referred to the provincial boards of utility commissioners for comments and discussion. This would not apply to particular day-to-day administrative decisions, but rather to more fundamental rule-making actions of broader scope.

In developing regulatory practices for communications in Canada as they may affect computer/communications, it will be desirable for the several regulatory commissions and boards to exchange views on many areas such as: broad regulatory and administrative practices proposed for implementation in the computer/communications areas; research studies on the forms of existing and contemplated administrative policies and practices; and probably specific rulings on matters of general interest such as foreign attachments. The consultations and exchanges of information could be formalized by creation of a Council of Regulatory Commissioners.

• *Registration of National Computer/Communications Networks*

The Registrar of National Computer/Communications Networks would be an officer responsible for the registration of suppliers of commercially offered data bank and data processing services through computer/communications networks where these have federal attributes. It is suggested that he be an official reporting to the federal regulatory commission with jurisdiction over telecommunications. The purpose of this registration process and its relationship with provincial concerns is discussed in more detail in Figure 13, notes 6,7 and 8.

NOTES TO FIGURE 13

• *Focal Point and Industry*

An exchange of views, information and policy proposals between industry and government is desirable. It is recommended that the Focal Point maintain close liaison with the computer/communications industry. Furthermore, it is proposed that representatives of the Focal Point should participate in joint committees set up under an industry planning board, (Note 9) and especially in CSA committee activity (Note 10). The Focal Point would also be responsible for funds to be granted in special circumstances, for example to support CSA expansion.

• *Role of the Federal Regulatory Commission*

The role of the federal regulatory commission with jurisdiction over telecommunications would be expanded to embrace a variety of computer/communications aspects of carrier operation not now reviewed by the Canadian Transport Commission. In particular it would be given expanded jurisdiction with respect to intercorporate activities and the conditions for entry of carriers into the provision of commercial data processing services; foreign attachments and the arbitration of the technical and economic criteria for their use; and the power to order interconnection between data communication networks, upon such conditions as it may order. In addition, it is suggested that the federal regulatory commission for telecommunications should put strong emphasis on cost allocation studies and the evaluation of route and service pricing for data communication services.

• *The Role of Provincial Boards*

At present there are nine active provincial boards of utility commissioners which regulate the public telephone service of a number of companies operating within their respective provinces. The policies and jurisdiction of such boards are outside the purview of this Report.

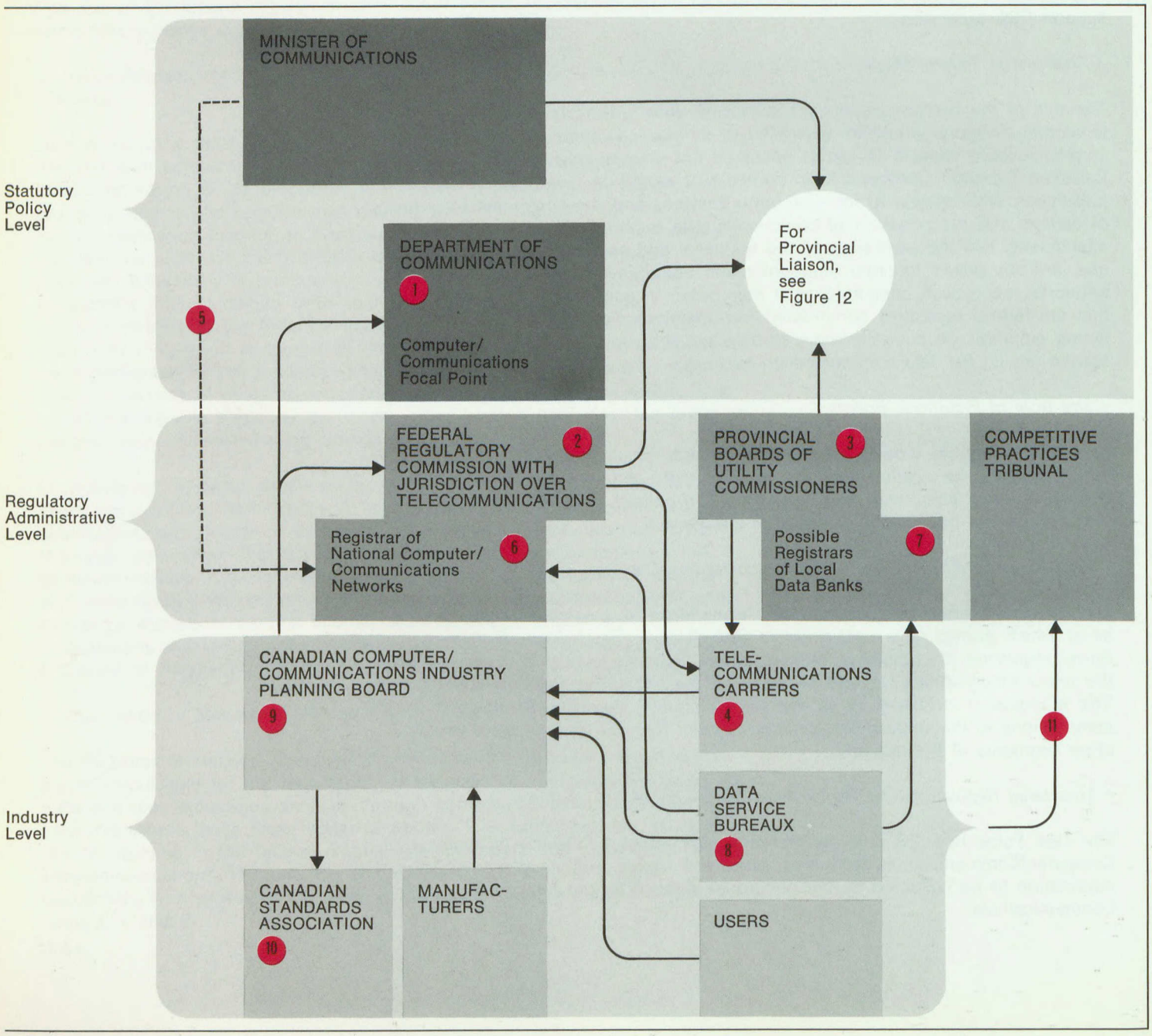
• *Regulation Confined to the Telecommunications Carriers*

The computer/communications industry is made up of a number of sectors, all of which overlap to a certain extent. This Report contemplates that there be no regulation of computer/communications as such, except with respect to the telecommunications services provided by the telecommunications carriers. This is indicated in Figure 13 by the arrows pointing from the boards and commissions to the telecommunications carriers. No such arrows point to any other segments of the industry.

• *Ministerial Regulations on Registration Requirements*

The Task Force Rec. 23 requires the establishment of a Registrar of National Computer/Communications Networks, discussed further in Note 6 below. The information to be collected by him would be defined by the Minister of Communications.

Figure 13
Suggested Government-Industry Relationship
for Computer/Communications



• *Nature and Function of the Federal Registration Process*

The Registrar of National Computer/Communications Networks would be an administrative officer of the federal regulatory commission. This officer would be responsible for the registration of organizations offering data bank and data processing services through computer/communications networks where these have federal attributes. The purpose of the registration process is solely one of information and the Registrar would have no discretion to refuse registration if the required information is provided.

• *Possible Role of Provincial Registrars*

Clearly, not all data networks will be covered by the federal registration process; moreover, many services are still used only on an over-the-counter basis. With regard to such matters as privacy, ethical standards, financial responsibility, and liability for damage, the provinces may wish to set up a similar registration process relating to local data banks and networks. Alternatively, a province may wish to delegate the registration of local data banks and networks to the federal Registrar in return for complete reports on all information collected for the province.

• *Provision of Information by Service Bureaux*

No direct regulation of service bureaux is envisaged, except that they may be required to register with the federal Registrar if they make their service available through remote links under circumstances giving rise to federal jurisdiction.

• *The Role of an Industry Planning Board*

The many voices of the computer/communications industry should be collectively expressed to government, both on policy and regulatory matters pertaining to computer/communications. Present relationships are on an *ad hoc* basis which could become more effective through the establishment of a Canadian Computer/Communications Industry Planning Board (CCCIPB). This Board, composed of associations of users, manufacturers, data service bureaux, and the telecommunication carriers, would have the primary role of facilitating liaison between industry and the government, particularly with regard to proposals for and comment on computer/communications policy. It is not intended that the CCCIPB should demand a consensus from its members, but that it should act like the Canadian Radio Technical Planning Board with its impact on government policy for frequency spectrum and radio services. Two major sub-committees of the CCCIPB would be a Data Communications Advisory Committee and a Data Processing Advisory Committee, both of which would, in addition to their social and economic policy interests, provide technical expertise and inputs to the Canadian Standards Association. Also, the Data Communication Advisory Committee, which might largely consist of members of the newly-formed Canadian Telecommunications Carriers Association, could meet regularly with the Focal Point to formulate guide-lines which the carriers could follow in developing the necessary data communications services and network architecture.

• *Enlarged Role for the Canadian Standards Association*

The Canadian Standards Association is an industry-sponsored standards-setting and testing organization having the background and organization which could be augmented to provide the capability for comprehensive development of computer/communications standards for Canada. The Task Force proposes that the CSA be concerned with data communications standards. The primary task would be to co-ordinate and implement standards that will maximize the effectiveness of technical interfaces between computers and data communications. It is further proposed that the CSA be encouraged (with federal assistance, if desired) to undertake the necessary expansion of personnel and facilities to enable the testing and certifying of data communications equipment. The participants in the standards-setting process would be the various interested representatives of industry together with the Focal Point in the Department of Communications. The intent is that the industry, through CSA, should establish voluntary standards which may receive government sanction as may be justified by national and international public interest.

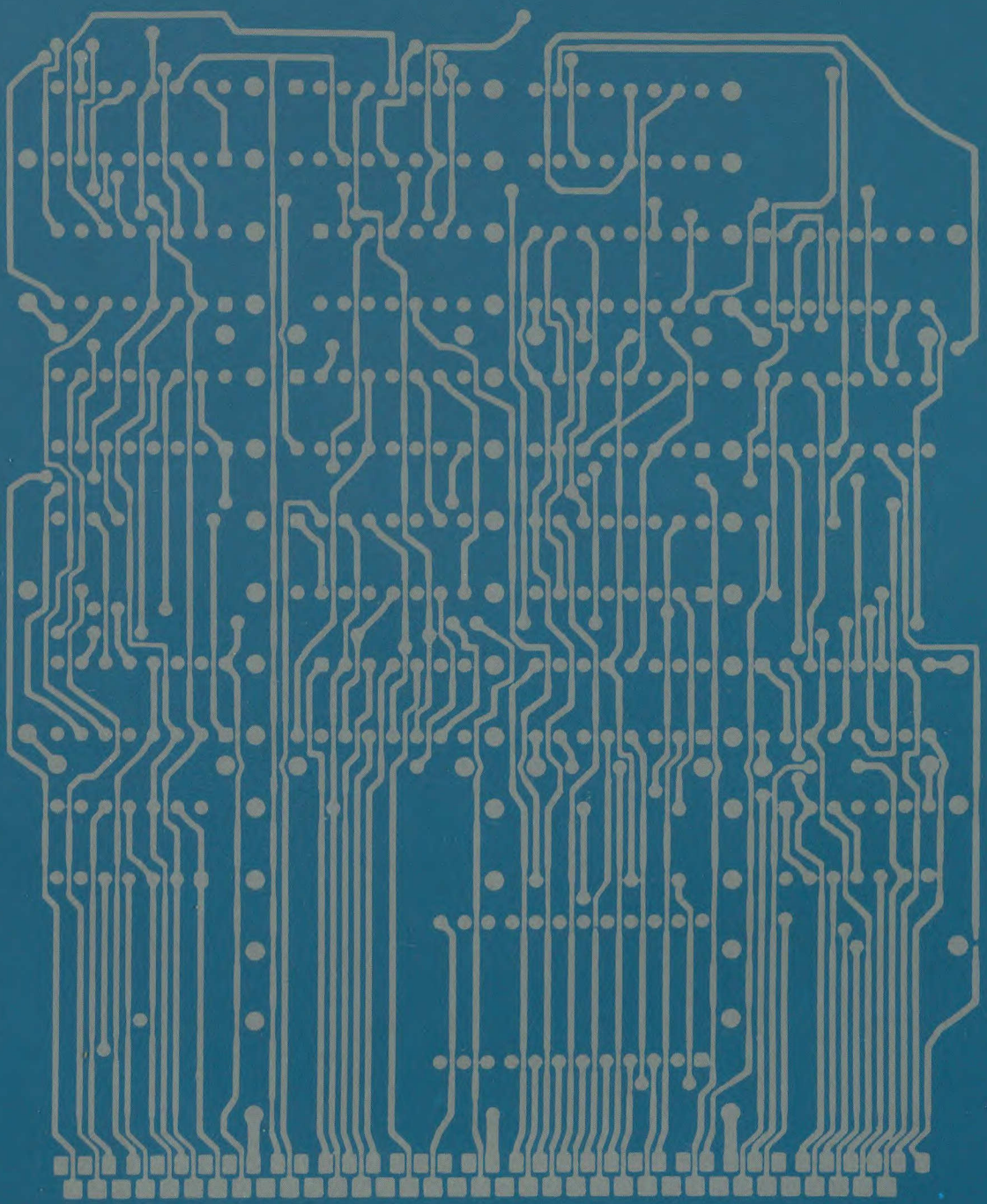
• *The Role of a Competitive Practices Tribunal*

Under both the present and proposed general legislation relating to competition policy in Canada, exemptions to the legislation are given for anti-competitive practices that are specifically subject to continuing review by a regulatory body in the public interest. Thus, to the extent that the computer/ communications industry is regulated by regulatory boards or commissions, it is not subject to the general terms of the competition legislation. This Report suggests that the carriers in respect of their monopoly or duopoly services and practices be subject to direct regulation, and that the industry in most other respects be unregulated. Hence, the competition legislation may have significant impact on pricing and marketing practices adopted by such organizations as service bureaux, computer mainframe and peripheral manufacturers, and applications service suppliers. To the extent that tariffs or practices of the telecommunications carriers are not subject to specific review by the regulatory agencies, such practices will also be governed by the terms of the general legislation relating to competition policy. Since open and fair competition within the computer/communications industry is a central element in this Report, the Task Force considers the enactment of competition legislation attuned to the needs of the computer/ communications industry to be of great importance.

Part

F

In Conclusion



In his study, *An Institute for Research on Public Policy* (Information Canada, 1971), Ronald S. Ritchie has the following comments on the activities of task forces in general:

"The research efforts of Royal commissions and task forces suffer the defects of the situation which creates them. Almost always, the appointment of a Royal commission or task force is an *ad hoc* response to a situation which is already urgent, if not critical. The whole research process is, therefore, under stringent, perhaps unreasonable, time pressures. The members of the commission or task force are likely to be under pressure from the government, from opposition politicians, or from the public at large to produce recommendations in the minimum possible time. They may be tempted to arrive at conclusions before all the research evidence is in or, in any event, before there has been time for adequate objective identification and evaluation of major policy alternatives. For proper policy research results to be achieved, it is almost always evident that the research should have been undertaken much earlier and in circumstances where the pressure for policy answers was less acute."

It would not be difficult to show that most of these problems have indeed been encountered by the Task Force on Computer/Communications. However, this describes only one aspect of the situation. The other is that of the rapidly-changing environment to which the Task Force addressed its efforts, as evidenced first by the rate of technological advance, and second by the progressing adaptation of industry, business and society to the new potentiality of computer/communications. Even within the short existence of the Task Force, many new types of enterprises have emerged, others have disappeared or changed purpose and structure; the carrier industry has unveiled plans for its response to the demands of the computer age, and has taken measures towards internal consolidation; the technology of mini-computers has shown the beginnings of an almost explosive growth; some provinces have declared their intentions in the area of telecommunications, and have made corresponding institutional arrangements; the federal government has developed policies for a rationalization and consolidation of its own data processing activities. The list could be much further extended — and it has not even touched on the changes taking place outside Canada, particularly in the United States. There is hardly an issue on the programme of the Task Force where the results of prior research were not at least partially affected or even superseded by events, or where the Task Force did not have to adapt its thinking to changing conditions. In such circumstances it is pointless to claim there has not been enough time, or that there were not enough opportunities for research. The answer must not be sought in the never-ending plea for more time and research — a plea which is based on the assumption that the final aim must be the proclamation of "firm" policies.

The real solution lies in recognizing that policies should not be conceived of as being static, even within a relatively short stretch of time, but should be capable of response to the pace of change. To ensure that new developments and decisions continue to conform with the public interest, a framework should be provided within which policies and their interpretation can be continuously adjusted in a dynamic feedback process, involving governments at all levels, institutions, private industry, business and the general public.

The problems of policy development in an environment as highly dynamic as that of computer/communications become particularly clear when policies for allocation of government spending are considered. The Task Force was directed to examine computer/communications networks of broad social significance, such as health care, education, and finance. It was thought that a cost-benefit analysis of a number of possible networks of national scope would lead to an indication of the amounts of money that might be required from public funds for the implementation of such systems, once their political priority and benefit to society had been established.

A number of such systems were investigated, as documented in Volume II of this report. However, it became clear during these investigations that the application of computer/communications in broad functional areas, such as health care, education, and finance does not yet lend itself to a definition which would meet the main prerequisites of an overall systems cost-benefit analysis, namely:

- A clear and quantifiable statement of need;
- a clear and realistic concept of the institutional framework within which the systems could be implemented and to which the benefits would accrue;
- a realistic model expressing the operational characteristics in quantifiable terms.

Although in general, the potential power and effectiveness of computer/communications are unquestioned, the applications within each broad field are still highly fragmented, and the degree to which benefits may be related to costs varies widely between individual situations. For example, in the health field, hospital administration, diagnostic aid, training aid, automatic patient testing, to name but a few, have totally different economic and operational aspects in the use of computer methods. Thus, each broad field is split up into many different, but often overlapping, sub-functions, most of which have not yet reached the point where quantitative statements can be made about their cost-effectiveness.

The role of computers in many of those sub-functions is still at the stage of experimentation and adaptation, where operational practices and procedures as well as technological solutions undergo continuing change as practical experience grows. This process of adaptation, between individual operational functions and technological tools in the component parts of the total system, necessitates many changes in the structure of the overall model before it can reach a level of stability that permits a valid assessment of total costs and overall benefits.

This example illustrates the inherent difficulty of prediction in a self-adaptive, changing environment. Although there is no doubt that eventually a well-defined overall "system", will have emerged, containing a multitude of sub-systems and ready to be analyzed in retrospect, it is impossible to anticipate the characteristics of the total system with sufficient accuracy for a valid predictive analysis. For the planning of such systems, the only possibility is a

gradual approach, following an evolutionary process in which individual planning decisions are made on component elements within an overall conceptual framework.

Thus, the field of computer/communications is characterized by two main factors: rapid technological change, and a vigorous process of adaptation of public and private institutions to the use of computers and communications as a tool in coping with economic and social pressures. The Task Force has found throughout Canadian governments, business and industry a great awareness of the potential of computers in controlling the increasing costs of industrial, social and cultural programmes. It also found a high degree of technical competence, innovativeness and familiarity with the state-of-the-art.

However, because of the role of computers and communications as tools in an infinite variety of different operations, computer-related activities at present are fragmented, leaving costs at levels where the effectiveness is questioned on economic grounds. This inevitably increases the attractiveness of services from outside the country, where the size of operations has led to the availability of a greater variety of services at lower marginal costs.

In this situation, in order to maintain and strengthen the Canadian presence in the computer/communications field, the government could inject massive sums to support and develop particular systems of national scope, but would have to face the difficulties of prediction and planning in broad functional areas encompassing many sub-functions.

Instead of attempting to formulate a policy of firm decisions on the allocation of funds to particular aspects of computer/communications, the Task Force has come to the conclusion that a faster response to present problems and a greater confidence-level for obtaining beneficial results could be achieved by a flexible approach. Particular emphasis should be placed on the creation of a favourable climate in which Canadian systems and applications in the public and private sectors are given opportunities for developing freely and at a pace allowing for self-adaptation.

This represents a policy of stimulation, and regulation in the broadest sense, where government action helps to overcome circumstances that inhibit Canadian development of computer communications. It also formulates general guide-lines for constraints and limitations necessary to safeguard the public interest and to maintain the climate for innovation required to withstand domestic and international pressures.

Development and implementation of such a policy is predicated on the establishment of mechanisms for intimate co-operation between the federal and provincial governments, and between the public and private sectors. The pervasiveness of computer/communications throughout all segments of Canadian social and economic activities must be reflected in a corresponding pervasiveness of the realization of the common responsibility for using this technology to the benefit of our society.

General

Rec. 1 Computer/communications (*i.e.*, computer services by remote-access through communication facilities), should be recognized by governments as a key area of industrial and social activity, and steps should be taken towards strengthening of the Canadian industry in this field, and co-ordination of its development to the benefit of Canadian society.

Rec. 2 The federal government should take specific measures, as outlined throughout this report, to promote a high degree of co-operation between public and private sectors in the development and execution of policies for computer/communications in Canada.

Rec. 3 In the formulation of national computer/communications policy a unified approach throughout Canada should be stressed as a key factor requiring close co-ordination between federal and provincial actions.

Rec. 4 In the area of federal responsibilities a Focal Point should be established within the government for co-ordination in the development, formulation and continuing evaluation of national policy in all matters pertaining to the field of computer/communications.

Data Processing Services

Rec. 5 No restrictions should be imposed on the entry of any organizations into the commercial data processing business, unless such entry would lead to anti-competitive practices, not remediable under the general laws relating to competition in Canada.

Rec. 6 Federal legislation should be introduced which might serve as a model for parallel provincial action, empowering the federal regulatory body responsible for the regulation of telecommunications carrier organizations to impose conditions on the entry of telecommunication carriers into the business of offering data processing services commercially.

In particular, the Task Force has concluded that for carriers under federal jurisdiction the following set of constraints should be imposed:

Rec. 7 Telecommunication carriers wishing to offer data processing services commercially in Canada may do so only under the following conditions:

(i) That such services be offered by a separate affiliate, with officers, staff, equipment and computer facilities distinct from those of the carrier;

(ii) that all communications or other services provided to the affiliate by the related carrier must be tariffed and made available on a non-discriminatory basis to any other customer;

(iii) that the carrier may obtain data processing services from outside sources (including its data processing affiliate) save for those communications-oriented computer services which, in the opinion of the regulatory body, are integral to the operation of the public switched network; computer services, such as network switching, which are directly integral to the operation of the network should be provided by carrier in-house facilities designed exclusively for the public service obligations of the carrier;

(iv) that the carrier may purchase data processing services from its data processing affiliate, but that if it chooses to do so, it must carefully separate and identify such services, and file information as to their precise nature and cost for public inspection by the regulatory body; such costs and all transfer payments from the carrier to its affiliate or *vice versa* would be subject to regulatory scrutiny and review;

(v) that except for the restriction in paragraph (iv) above, all data processing services offered by the affiliate would be unregulated.

Rec. 8 Chartered banks should be permitted to offer data processing services to the general public in Canada, subject to the following conditions:

(i) that such service should be directly related to the business of banking; and,

(ii) that the Bank Act be amended to provide the mechanism whereby interested persons may obtain rulings, from the Inspector-General of Banks for the administration of the Act as to whether any particular service is within or outside the meaning of (i) above, and that the banks would be bound by such rulings.

Rec. 9 Universities, in the consideration of providing commercial data processing services to outside customers, should be strongly discouraged from taking advantage of their privileged position (which arises from their publicly-supported operating budgets, tax exemptions and grants), in areas where services are available from other sources. However, this policy should be sufficiently flexible to allow universities to employ excess capacity (over and above their primary teaching and research commitments) in special cases where commercial operations from outside sources are not filling the need.

Data Communications Services

Rec. 10 Policies in network development should be oriented in consultation and co-operation with the provinces and the private sector towards achieving rates for specific services in which the controlling factors may include time, bit rates or other parameters of network utilization but in which geographical distance is of minor or no influence, particularly within regional zones.

Rec. 11 Government should take steps through the Focal Point, in consultation and co-operation with the provinces, to ensure the evolution of data communications networks which in part are functionally separate from the telephone network, with the aim of having improved technical and economic service characteristics provided.

Rec. 12 A non-carrier organization leasing facilities from a carrier should be permitted to attach to those facilities any data communication equipment not owned by carriers, provided only that it meets published standards for continued protection of the carriers' networks from damage and interference; such an organization should, however, be encouraged to adopt published data-network standards wherever possible.

Rec. 13 A non-carrier organization (including data processing affiliates of carriers) may offer commercial data communication services to customers through carrier facilities, subject to filing with the regulatory body prior to initiation of service, information on its corporate structure and its data communication services; and the regulatory body should be empowered to conduct hearings which may result in the services being disallowed on the grounds of failure to comply technically with published network specifications and standards, or of economic infringement of the common carriers' regulated public switched-network services.

Rec. 14 Carriers should be required by legislation to file with the appropriate telecommunications regulatory body, specifications and charges for data communication services; and the regulatory body should be empowered to approve such specifications and charges; and to require publication of them.

Rec. 15 The telecommunications regulatory body should be empowered to enforce adherence by the telecommunication carriers to prescribed procedures in the establishment of their data communication rates.

Rec. 16 Government, through the Focal Point, should request organizations offering data communication services to effect interconnections between their systems as needed for the development of a coherent data communication network.

Rec. 17 The telecommunications regulatory body should be empowered to conduct hearings and decide on cases involving interconnections between networks of carrier or non-carrier organizations offering data communication services.

Rec. 18 Decisions of the federal telecommunications regulatory body should be published and made readily available.

Rec. 19 The plans of the telegraph (railway) companies for the immediate development of their teletype and data services, and the projected plans of the telephone companies for the evolution of a data transmission network should be recognized by government as the present viable direction for the development of data communication facilities, and the government should, through the Focal Point, periodically take cognizance of these common carrier plans, and take steps to ensure the avoidance of disadvantages to users through incompatibilities in the communication services offered and to ensure that the carriers' long-term technical and financial planning is commensurate with the potential and the future requirements for computer/communications in Canada.

Rec. 20 Government, through the Focal Point, should intensify the establishment of a Canadian position on international issues in data communications and ensure appropriate representation on international bodies.

Rec. 21 Agreements between Canadian and foreign telecommunications carriers should be reviewed by the government on a regular basis to ensure that the Canadian position on international aspects of data communications is upheld.

Data Services Environment

Rec. 22 Policies in computer/communications development should be oriented, in consultation and co-operation with the provinces, towards improving service availability and reducing costs in Canada in order to offset economic and technical incentives for meeting user needs through facilities outside Canada.

Rec. 23 Organizations offering data services commercially to customers through telecommunications facilities, with terminals on remote premises, should be required to register with an appropriate body, and file information on their corporate structure, and on their data services.

Rec. 24 Governments should recognize the importance to the public interest, of a strong Canadian-controlled data processing services industry.

Rec. 25 Before computer-based information services are offered on a regular basis to individual Canadians and the public in general, governments should consider the feasibility of imposing special requirements on Canadian ownership and control of organizations providing services which convey cultural values analogous to those conveyed by broadcasting systems, and on the volume of material from Canadian sources made available through such services.

Government Actions Related to Stimulation of Development

Identification of Priorities

Rec. 26 The Focal Point should periodically, and in close co-operation with associations and industries, undertake identification of user needs and evaluation of the impact of existing and projected computer communication systems on society.

Rec. 27 Government should stimulate the advance of special computer/communications systems, particularly those having broad social benefits to Canadians, by making funds available through the Focal Point for pilot projects undertaken by or in conjunction with associations, industry, universities and governments at all levels.

Rec. 28 In government support of projects, priority should be given to those which involve the formation of regional and nation-wide computer systems in the public sector, designed to make available on a shared basis, computer and specialized data bank facilities to public institutions and to the general public.

Rec. 29 In conjunction with universities and other research institutions, government should foster multi-disciplinary research on the long-range social effects of computers and communications.

Rec. 30 Existing government research laboratories should include in their programmes selected areas of computer/communications technology and make the results available to public and private organizations for the development of techniques and applications specifically adapted to Canadian needs.

Government Support of Industry

Rec. 31 Government should continue its efforts to ensure that foreign or multi-national computer and communications corporations with substantial sales in Canada, expend appropriate sums in Canada on research and development leading to manufacturing activities.

Rec. 32 Incentives should be granted to Canadian enterprises for all phases of innovation in the computer/communications field, particularly in application software and ancillary equipment development.

Education and Training

Rec. 33 Government should support professional and industry associations in their endeavour to organize and stimulate the provision of suitable training programmes in the field of computer/communications in collaboration with educational institutions.

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Rec. 34 Government should encourage post-secondary educational institutions to offer courses on the multi-disciplinary aspects of computers and communications systems.

Rec. 35 Government should encourage research and development into the use of computers at all levels of education through co-ordinated funding on a multi-disciplinary basis and extension of existing programmes in technological development.

Standardization

Rec. 36 The Focal Point should co-ordinate the participation of the federal government in national and international standardization activities relating to computer/communications, and, in conjunction with provincial governments, industry and user associations, promote the preparation, publication and adoption of standards for an orderly and coherent growth of computer/communications in Canada.

Rec. 37 Government should provide funds in order to increase the participation of user groups in the formulation of standards, and place increased emphasis on communications particularly in regard to interconnection of networks.

Government As a User

Rec. 38 Steps should be taken to ensure that the policies for internal federal government data processing and data communications activities are continually related to national policies in the computer/communications field.

Rec. 39 Federal government policies, for the procurement of computer and communications goods and services to satisfy the internal needs of departments, should be directed towards the greatest possible stimulation of the computer/communications industry in Canada.

Institutional Arrangements

Suggestions are presented in Part E in three areas of interactive relationships:

1. Relationships within the Federal Government

- Interdepartmental Committee on National Computer/Communications Policy
- Department of Communications as Focal Point for computer/communications

2. Federal-Provincial Relationships

- Ministerial Consultations
- Communications Regulatory Commissioners Consultations
- Departmental Consultations

3. Government-Industry Relationships

- The role of the Federal Telecommunications Regulatory Commission in matters of computer communications
- Registrar of National Computer/Communications Networks
- Canadian Computer/Communications Industry

APPENDIX 1

BACKGROUND AND PURPOSE OF THE TASK FORCE

In November 1970, the Cabinet authorized the formation of the Canadian Computer Communications Task Force (CCCTF) as a semi-autonomous body within the Department of Communications. The Minister of Communications accordingly announced that the chief task assigned to the group was to develop and recommend specific policies and institutions that would ensure the orderly, rational and efficient growth of combined computer/communications systems in the public interest.

The possible objectives of a national system, as stated in the press release of November 27, 1970 could include: "achieving the most rapid expansion of services and systems that is possible without unduly disturbing our ability to meet other urgent social priorities; ensuring the widest possible range of services to all social and regional groups in every part of Canada; ensuring adequate Canadian control and ownership; ensuring that the overall system design is flexible enough in concept and implementation to minimize problems of obsolescence and permit the rapid incorporation of improvements resulting from technological change; ensuring adequate protection for privacy, right of access and freedom of speech in all elements of the national system."

In the same press release, the Minister "stressed that the task force's objectives will require co-operation with industry, users and other governments. He outlined some of the steps in the task: an analysis of national needs; technological forecasting; a study of social and economic impact, and, a definition of possible institutional arrangements. The group will bring cost-benefit analysis to bear on particular networks that might be able to provide such services as legal, financial, medical and consumer information as well as raw computer power".

1. ORGANIZATION AND STAFFING

The organizational structure of the Task Force has been kept flexible to allow for changes in orientation as each phase of the work program was completed, and in order to focus talents and resources on the diversity of activities in the computer/communications field. The organization adopted is depicted in Fig. 14, which illustrates the interaction between the various areas of concern.

Staffing was a serious problem in view of the requirement for experienced, professional personnel willing to accept a 12 to 18 months' commitment without assurance of employment after that period. Interviews were arranged with more than 130 candidates and, as a result, it was possible to obtain commitments for a total of 25 man-years during the period 1 December, 1970 to 31 May, 1972. A list of personnel, and a chart showing the build-up of professional staff are shown in Fig. 15. All services have been negotiated either by secondment from government departments, or by personal contracts with individuals after they have separated from, or obtained unpaid leave of absence from their previous employers. Although industry

showed considerable interest in providing such personnel, no contracts were made with industry for the provision of staff in order to ensure the full objectivity of the Task Force.

2. WORK PROGRAM

The Task Force was engaged in a wide-ranging investigation of issues and problems in the computer/communications field in Canada. A firm of consultants was engaged to formulate a program management network chart whereby the various objectives could be related diagrammatically to each other in time and with respect to relative priorities. This chart made it possible for the Task Force to identify critical paths and allocate resources for maximum effectiveness. Fig. 16 gives a schematic description of the information-gathering phase of the work of the Task Force.

(a) Contact With Outside Organizations

From the very beginning, strong emphasis was placed on establishing a continuing interaction with a wide cross-section of institutions, organizations and individuals across Canada. To this end, and at an early stage, some 700 invitations for the submission of position papers were sent to major business and industrial enterprises, and contact was also established with provincial governments, as well as with federal government departments and Crown agencies.

Organizations in the private sector were divided into users of computer/communications, and suppliers of computer/communications goods and services. In the category of user organizations, over 400 letters were sent to business and industrial enterprises, trade associations, and professional societies. Approximately 300 letters were also sent to supplier organizations. The response was good, and a large number of organizations requested interviews. Group meetings were arranged in the form of seminars, with extensive question-and-answer periods. At two meetings in Toronto and one in Montreal, some 200 senior representatives from a wide variety of companies and organizations met and expressed their views. In addition, a series of speeches and seminars were organized across the country, in which Task Force members addressed various professional societies and associations.

A list of organizations submitting position papers is given at the end of this Appendix.

Good co-operation was received from departments and agencies of the federal government. A federal government Advisory Committee was formed and six meetings were held with the liaison officers appointed by the various departments and agencies. Thirty-five position papers were received through this committee.

With respect to provincial governments, delegates were nominated by the Provincial Prime Ministers and Premiers. After initial contacts had been established, a round of meetings in the provincial capitals took place, followed by two meetings to which all provincial delegates were invited.

Figure 14
Task Force Functional Organization

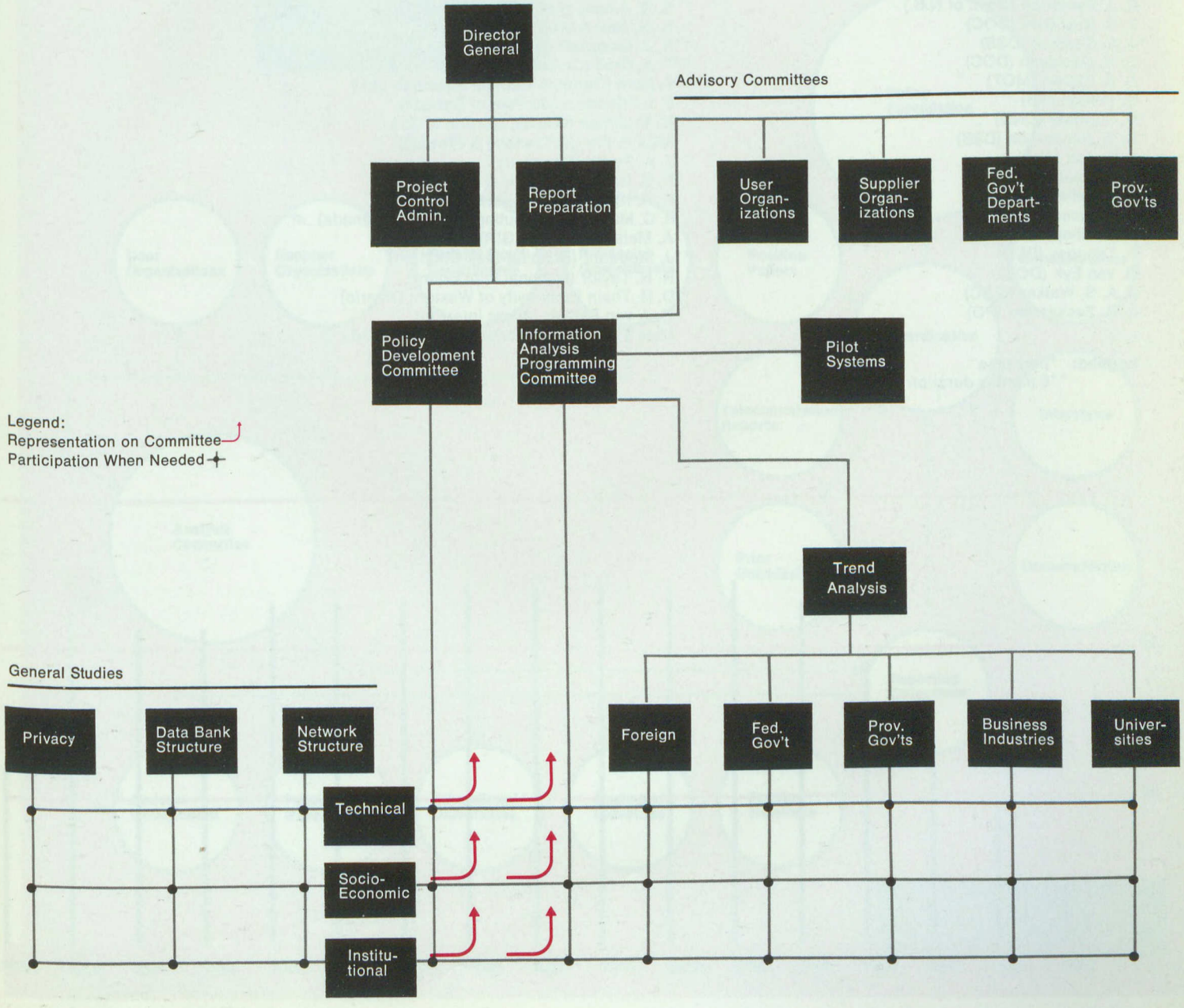


Figure 15
Professional Staff

Government

R. J. Bambrick (Govt. of N.B.)
E. R. Bushfield (DOC)
*J. A. Clement (DSS)
G. K. Davidson (DOC)
R. A. Eldred (MOT)
G. Fenton (TB)
*M. Gardner (DND)
*G. E. Henderson (DSS)
I. Jascolt (Agr.)
J. G. Nadon (PO)
R. O'Reilly (DOC)
P. Robinson (Agr.)
C. D. Shepard (DOC)
F. Tanguay (PCO)
R. van Eyk (DOC)
J. A. S. Walker (IT&C)
L. S. Zuckerman (PO)

Non-Government

A. S. Adams (AGT Data Systems)
H. H. Brune (Northern Electric)
**R. J. Campbell (RCA)
**T. A. Croil (Croil & Associates)
F. Doré (Carleton Opinion Research Ltd.)
F. I. Friedman (du Pont of Canada)
M. Fruitman (Woods, Gordon & Co.)
Miss P. Fry (McClelland & Stewart)
J. A. Fortin (Canadair)
*P. S. Grant (McCarthy & McCarthy)
E. A. Kangas (Bell Canada)
J. C. Madden (Computing Devices of Canada)
A. Maisonneuve (CEGIR)
**J. Stoddart (Hospital-Sick Children)
R. H. Taylor (National Film Board)
*D. H. Thain (University of Western Ontario)
H. J. von Baeyer (Acres InterTel)
Miss J. M. Wright (Computel Systems Ltd.)

Legend: *part-time
**6 months duration or less

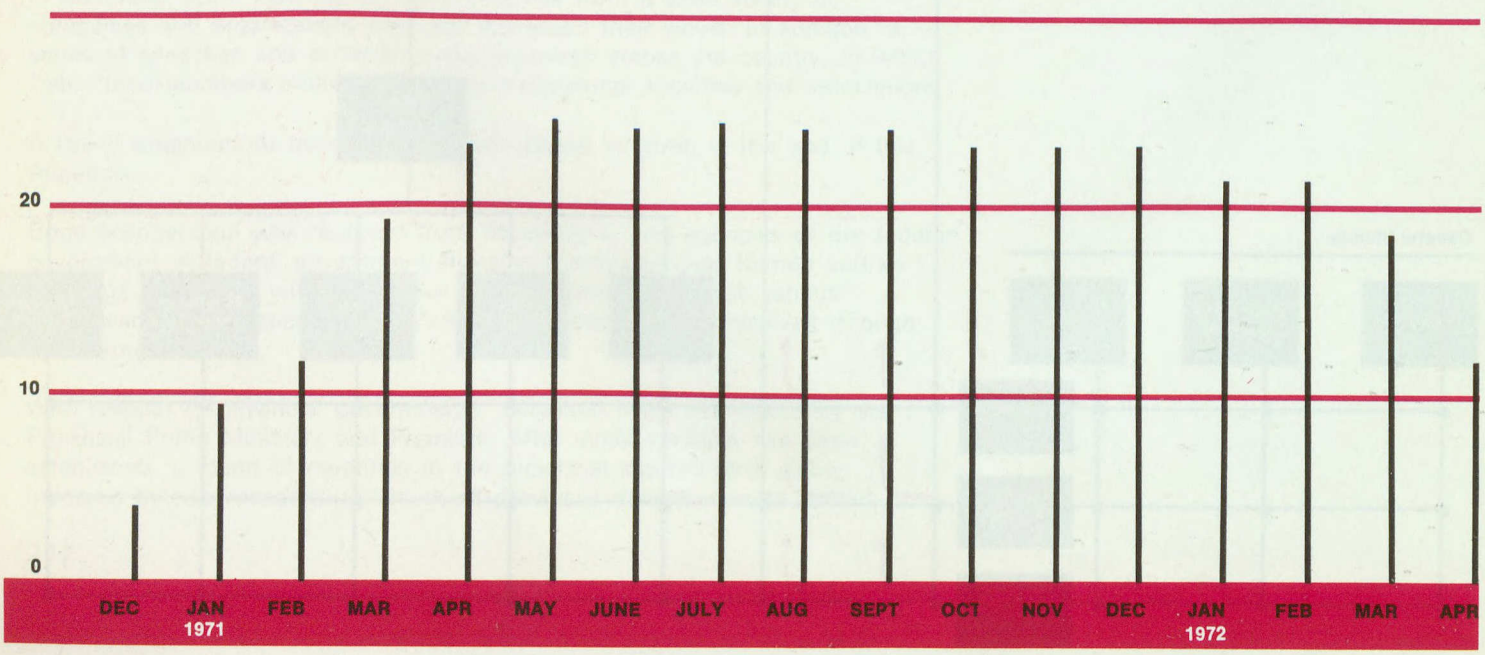
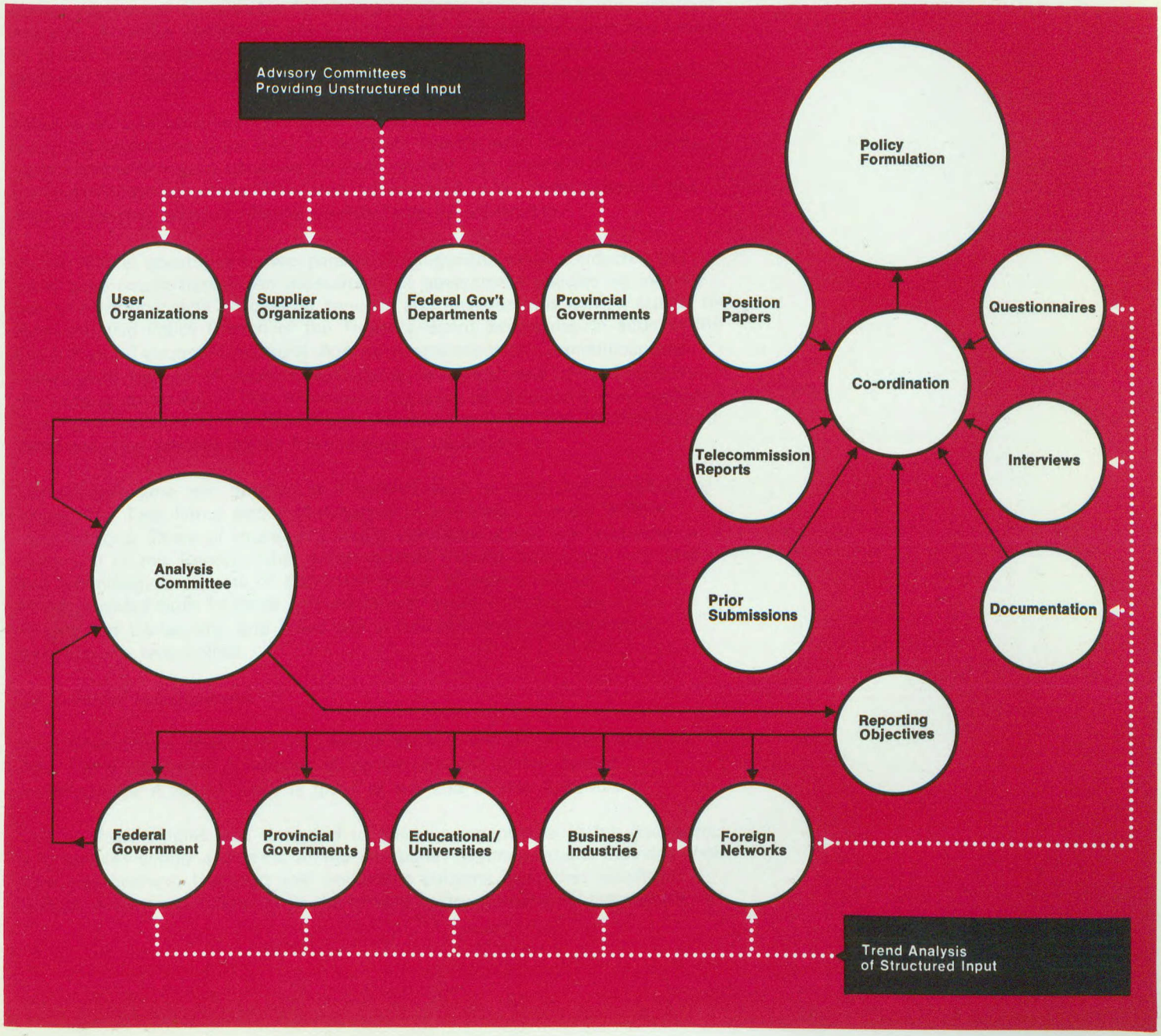


Figure 16
Fact-Finding Mission



(b) Task Force Investigations

In addition to obtaining the information on areas of concern, as expressed in the position papers and discussions outlined in (a) above, the Task Force investigated a number of aspects of computer/communications, using the telecommission reports as a starting point.

Some 60 major users of data communications in the private sector were visited to elicit information on their problems and technological, economic and operational service requirements in regard to data communications, and to obtain information on possible future requirements for a data communications network. A similar number of users in business and industry were also visited to obtain information on their use of computers, and to uncover trends, problems and issues relating to the future use of computer/communications.

Information was obtained from provincial authorities on their activities in the computer/communications field. In addition, twenty-eight universities were visited and information obtained on their present and potential use of computer/communications. They also co-operated in an investigation of the data processing services offered commercially by universities.

In the federal government, two parallel investigations were conducted by other government bodies. An assessment of government policies on internal use of electronic data processing services and facilities was carried out by the Administrative Policy Branch of the Treasury Board Secretariat. In addition the Government Telecommunications Agency (Department of Communications) investigated the use of telecommunications, including data communications, in the federal government. The information obtained in these two investigations was made available to the Task Force. Furthermore, the Task Force obtained information on specific points from individual departments.

Considerable time was devoted to a consideration of legal and constitutional issues. The Task Force also was engaged in a number of more specific investigations. Three of these, in socially significant areas, are published in Volume II of this Report. Other areas covered include technology forecasts, and technological aspects of data networks in foreign countries. The Task Force provided both financial and manpower support to the Task Force on Privacy and Computers, and there was a free exchange of information between the two bodies.

(c) Contract Investigations

In addition to the solicitation of position papers, and the investigations by Task Force personnel, a number of contracts were let for specific investigations. A list of these is given at the end of this Appendix.

One of these studies was designed to obtain a perspective of the hardware and services supply segments of the computer/communications industry, their inter-relationships, financing and ownership patterns and other significant factors. Another investigation in the private sector covered an assessment of

the use of foreign data processing services accessed from remote terminals for the analysis of seismic data. Other contracts covered an assessment of problems of smaller service bureaux in different parts of Canada.

In order to evaluate the importance of the trend towards the use of U.S. computer facilities by Canadian firms connected to them via telecommunications lines and remote terminals, an attempt was made to assess the trends of north-south data traffic and of its effect on the Canadian market. To assist in this evaluation, a consultant contract was awarded to conduct a Delphi forecast of the role of U.S. data processing and information industries in the Canadian market covering the time period between 1975-85.

As to social aspects, the Task Force provided part of the funds for a survey undertaken by Canadian Facts Co. Ltd., into social and cultural attitudes of Canadians towards computers and computer-services. In the area of community information-systems, a study was submitted by the Consumers' Association of Canada. Another contract investigation covered CATV technology for citizen feedback from citizens to government.

The Task Force also provided part of the funds for a pilot-system conducted by the Board of Education of Peel County, Ontario. The objective was to evaluate the effectiveness and desirability of computer-based administrative techniques in schools.

3. POLICY DEVELOPMENT

Following, and to some extent parallel with, the fact-finding phase of operations of the Task Force, many discussions centred on definitions of objectives and development of a cohesive policy framework. Early in the discussions, a set of decision criteria (Chapter III) was derived and, at a later stage, a metagame analysis of possible options was undertaken.

The findings presented in the telecommission studies, and discussions of options they contained, were reviewed and taken into consideration by the Task Force.

This phase of the work of the Task Force was a lengthy iterative process because of conflicting requirements and opposing points of view, and the many incompatible solutions to isolated problems.

A Progress Report was issued in June, 1971, and a summary of conclusions containing draft recommendations was submitted to Cabinet in December, 1971.

Companies and Organizations which have Contributed through Submissions and Task Force Surveys. (See also further lists of contacts mentioned in the Appendices of the Studies presented in Volume II, Part B.)

Abitibi Paper Company Ltd.
Acres InterTel Limited
Action Data Ltd.
AGT Data Systems, Limited
Air Canada
Alberta Government Telephones
Algoma Steel Corporation, Limited
Alpha Data Ltd.
Alphatext Systems Limited
Aluminum Company of Canada, Limited
Amoco Canadian Petroleum Company Ltd.
Andrew, D.J.
The AquiData Company Limited
Arcweld Products Limited
Argus Computer Applications
Association of Consulting Engineers
Association for Systems Management (Ottawa Valley Chapter)
Atomic Energy Control Board
Atomic Energy of Canada Limited
Automatic Electronic Systems Inc.
Banque Canadienne Nationale
Banque Provinciale du Canada
Bapco Paint Ltd.
B.C. Forest Products Ltd.
Bell Canada
Blair, A.B.
Bombardier Limited
The Borough of East York
British Columbia Packers Limited
British Columbia Telephone Company
Britton, D.
Burns Bros. and Denton Limited
Burns Food Limited
Burroughs Business Machines Ltd.
Calgary Power Ltd.
Canada Packers Limited
Canada Permanent Mortgage Corporation
Canada Safeway Limited
The Canada Systems Group
Canadair Limited
Canadian Association of Data Processing Service Organizations
The Canadian Bankers' Association
Canadian Bechtel Limited
Canadian Book Publishers' Council (and Canadian Copyright Institute)
Canadian Breweries/Rothmans of Pall Mall Canada Limited
Canadian Broadcasting Corporation
Canadian Business Equipment Manufacturers Association
Canadian Cablesystems Limited
Canadian Cable Television Association
Canadian Chamber of Commmerce
Canadian Construction Association
Canadian Data Centre
Canadian Export Association
Canadian Federation of Insurance Agents and Brokers Associations
Canadian Forest Products Ltd.
Canadian General Electric Company Limited
Canadian Imperial Bank of Commerce
Canadian Indemnity Company
Canadian Industries Limited
President, Canadian Information Processing Society
Canadian Institute of Steel Construction
Canadian International Development Agency
Canadian Kodak Sales Ltd.
Canadian Life Insurance Association
Canadian Manufacturers' Association
Canadian Marconi Company
Canadian Pacific Railway Company
Canadian Patents and Development Limited
Canadian Radio-Television Commission
Canadian Standards Association
Canadian Tire Corporation Limited
Can-Am Systems
Carleton University
CDP Computer Data Processors Ltd.
Centi (Canada) Ltée.
Central Data Systems Ltd.

Centre de gestion et traitement de données
Centre d'informatique Alpha Inc.
Centre informatique Calculus Ltée.
Cesco Electronics Ltd.
Chrysler Canada Ltd.
CN/CP Telecommunications
Coca-Cola Ltd.
Cogena Inc.
Columbia Cellulose Company, Limited
Columbia Computing Services Ltd.
Combined Market Quotations Ltd.
Comité conjoint de l'industrie de la construction de la région de Montréal
Commercial Data Services
Commonwealth Holiday Inns of Canada Limited
Company of Young Canadians
Compscan Ltd.
Computec Data & Control Applications Ltd.
Computech Consulting Canada Ltd.
Computel Systems Ltd.
Computer House
Computer Resources Ltd.
Computer Sciences Canada Ltd.
Computing Devices of Canada Limited
Comserve Ltd.
Com-Share (Canada) Ltd.
Confederation Life Insurance Company
Consolidated Computer Limited
Consultec Canada Ltd.
Consumers' Gas Company
Consumers Glass Co. Limited
Control Data Canada, Ltd.
Corporation of Thunder Bay
Cover-All Computer Services Ltd.
Crown Life Insurance Company
Cunningham Drug Stores Ltd.
Cytronics Corp.
Dalhousie University
Data Consultants
Data Management Systems
Dataline Systems Limited
Dataplus Ltd.
Datapro
Data Processing Management Association (Atlantic Chapter)
Data Tech Systems Ltd.
de Havilland Aircraft of Canada, Ltd.
Delstar Data Processing
Department of Agriculture
Department of Consumer and Corporate Affairs
Department of the Environment
Department of Finance
Department of Indian Affairs and Northern Development
Department of Industry, Trade and Commerce
Department of Justice — Attorney General
Department of Labour
Department of Manpower and Immigration
Department of National Defence
Department of National Health and Welfare
Department of National Revenue (Customs & Excise)
Department of National Revenue (Taxation)
Department of Public Works
Department of Regional Economic Expansion
Department of Solicitor General
Department of Supply and Services (Services)
Department of Supply and Services (Supply)
Department of Veterans Affairs
Digital Equipment of Canada Ltd.
Direct Winters Transport Ltd.
Dominion Foundries and Steel Limited
Domtar Limited
Dow Chemical of Canada, Limited
Drug Trading Company Limited
du Pont of Canada Limited
The E.B. Eddy Company
edmonton telephones
EDP Industries Limited
Electrodesign Limited
Electronic Industries Association of Canada
Emco Limited
Empire Data Centres Ltd.
Falconbridge Nickel Mines Limited
Federal Grain, Limited
Ferranti-Packard Limited

Financial Research Institute
Firestone Tire and Rubber Company of Canada, Limited
Ford Motor Company of Canada, Limited
Foremost Data Centre Ltd.
Gambles Canada Limited
Gandalf Data Communications Ltd.
Garrett Manufacturing Limited
Garritsen, J.B.J., C.A.
GAZ Métropolitain, Inc.
General Foods, Limited
General Motors Corporation
Goodyear Tire & Rubber Company of Canada, Limited
Government of the Northwest Territories
Great-West Life Assurance Co.
Guardian Ventures Limited
Gulf Oil Canada Limited
Harris & Partners Securities Limited
H.J. Heinz Company of Canada, Ltd.
Hewlett-Packard (Canada) Ltd.
M.P. Hofstetter Ltd.
Honeywell Information Systems
Horth Forestry Limited
Hunter Douglas Canada Limited
Hydro-Québec
I.A.C. Ltd.
IBM Canada Ltd.
Imperial Oil Limited
l'Industrielle Compagnie d'assurance sur la vie
Infopro Ltd.
Informatel (S.N.I. Inc.)
Instronics Limited
Interior Data Processing Ltd.
International Computers of Canada Limited
International Computer Optics
International Harvester Company of Canada, Limited
Interprovincial Pipe Line Company
J.D. Irving Ltd.
Irving Oil Company, Limited
Kates Peat Marwick & Co.
Kimberly-Clark of Canada Ltd.
Kurtz & Steel Ltd.
John Labatt Ltd.
Lakehead University
Lanpar Ltd.
Laurentian University of Sudbury/ Université Laurentienne de Sudbury
Laurentide Financial Corporation Ltd.
Leigh Instruments Ltd.
Lenkurt Electric Co. of Canada, Ltd.
M. Loeb Limited
London Life Insurance Co.
Macdonald Dettwiler & Associates Ltd.
MacMillan Bloedel Limited
Maislin Transport Ltd.
Manitoba Telephone System
Manpac Data Centres Ltd.
Manufacturers Life Insurance Company
Maritime Electric Company Limited
Massey-Ferguson Limited
McGill University
McMaster University
Memorial University of Newfoundland
Merck Frosst Laboratories
Metropolitan Life Insurance Company
Ministry of Transport
Mitches & Mitches
The Montreal Stock Exchange
Moore Corporation, Limited
Multiple Access General Computer Corporation Limited
Multitek
National Arts Centre Corporation
National Association of Canadian Credit Unions
National Capital Commission
National Cash Register Company of Canada, Limited
National Film Board
National Library
National Research Council of Canada
National Sea Products Limited
New Brunswick Telephone Company Limited
Newfoundland & Labrador Computer Services Ltd.
Newfoundland Telephone Company Limited
Noranda Mines Limited
Northern Electric Company Limited

Northern Telephone Limited and Téléphone du nord de Québec, Inc.
Olivetti Canada Ltd.
Ontario Northland
Orenda Limited
Outboard Marine Corporation of Canada Ltd.
Pacemaker Business Machines Ltd.
Pacific Brewers Distribution Ltd.
Pacific Data Systems Ltd.
PEACS Pan-American Engineering & Computing Services Ltd.
Pioneer Computing Services Ltd.
Pirelli Cables, Limited
Placer Development Limited
PolyCom Systems Limited
Polymer Corporation Limited
Post Office Department
Privy Council Office
Province of Alberta
Province of British Columbia
Province of Manitoba
Province of New Brunswick
Province of Newfoundland
Province of Nova Scotia
Province of Ontario
Province of Prince Edward Island
Province of Québec
Province of Saskatchewan
Quantum Information Resources Ltd.
Québecair
Queen's University at Kingston
RCA Limited
The Reader's Digest Association (Canada) Ltd.
Recognition Equipment (Canada) Ltd.
Research Council of Alberta
Retail Credit Company of Canada Ltd.
Retail Merchants Association of Canada
Reynolds Aluminum Company of Canada Ltd.
Richardson Securities of Canada Inc.
Riley's Datashare International Ltd.
Rotem Industrial Products Limited
The Royal Bank of Canada
Royal Canadian Mounted Police
The Royal Trust Company
Ryerson Polytechnical Institute
Saskatchewan Telecommunications
Savage Shoes (1970) Limited
SDI Associates Ltd.
Secretary of State Department
Setak Computer Services Corp. Ltd.
I.P. Sharp Associates Limited
Shell Canada Limited
Sherwin-Williams Co. of Canada Limited
Simon Fraser University
Simpsons, Limited
Simpsons-Sears Limited
Singer Company of Canada Ltd.
Sir George Williams University
Skil-Share of Ontario, Ltd.
S.M.A. (Société de Mathématiques Appliquées) Inc.
Smith Transport Ltd.
SNC Computation Ltd.
La Société des Artisans Co-opérative d'Assurance-Vie
Société Générale de l'Informatique
Le Soleil
Spectrum Data Systems Ltd.
Stanfield's Limited
Stark Electronic Instruments Ltd.
Steinberg's Limited
Stevenson & Kellogg Ltd.
Sun Life Assurance Company of Canada
Syner-Data Canada Ltd.
Systems & Management Services Ltd.
Systems Corporation Limited
Systems Dimensions Limited
Systems Equipment Limited
Tahsis Company Ltd.
Telegram Publishing Company Ltd.
Telesat Canada
Telex Ltd. Computer Products
Texaco Canada Limited
The Thorne Group Ltd.
Ticket Reservation Systems, Inc.
The Toronto Stock Exchange
Traders Group Ltd.
Trans-Canada Pipe Lines Limited
Trans-Canada Telephone System
Trimac Transportation System
T-Scan Limited
Unemployment Insurance Commission
Unicom Data Services Ltd.
United Funds Management Ltd.

UNIVAC Division, Sperry Rand Canada Limited
Université Laval
Université de Montréal
Université d'Ottawa/University of Ottawa
Université du Québec
Université de Sherbrooke
The University of Alberta
The University of British Columbia
University Computing Canada Ltd.
University of Guelph
The University of Manitoba
University of New Brunswick
University of Prince Edward Island
University of Saskatchewan
University of Toronto
University of Waterloo
The University of Western Ontario
University of Windsor
Urban Computers Ltd.
Hiram Walker & Sons, Limited
Warner-Lambert Canada Ltd.
Waterfront Employers of B.C.
Wisener and Partners Company Limited
Wood Gundy Limited
Woodward's
Xerox of Canada Ltd.
Xyno Plastics Ltd.
Yetnikoff, Trudeau, Levi, Cooper & McGraw Inc.
York Data Centre
York University
Zurich Life Insurance Co. of Canada Ltd.

SPECIAL STUDIES BY CONSULTANTS OUTSIDE OF THE TASK FORCE

Consultants	**Study**
AGT Data Systems, Limited	Canadian Computer Industry Survey and Analysis (Ontario/Quebec)
Barkhouse, S.B.	Survey of Some Smaller Companies in the Canadian Data Processing Industry in the Maritime Provinces
Bell Canada	Local Facility Study
Bell-Northern Research	Computer/Communcations Network Study
Canadian Facts Co. Limited	Attitudinal Survey
Canuck Survey Systems, Ltd.	Seismic Data Survey
Consumers' Association of Canada	Study of Community Information Networks, Project INFO/CIN
Display and Decision Systems, Limited	Survey of Some Smaller Ontario Companies in the Canadian Data Processing Industry
Forsyth, G.R.	Canadian Computer Supply Industry Study
Guité, M.	CATV Technology for Citizen Feedback to Government
Hayward Computer Corporation Limited	Canadian Computer Communications Task Force Strategy Options
Howard, N.	Metagame Analysis of Computer/ Communications Policy Options
Institute for the Future	Policy Option Effects Study
Samson, Belair, Riddell & Stead, Inc.	Survey of Some Smaller Quebec Companies in the Canadian Data Processing Industry
Syndex Data Services Ltd.	Survey of Some Smaller B.C. Coast Companies in the Canadian Data Processing Industry
T-Scan Limited	A Pilot Information System Covering Administrative Functions for the Peel County Board of Education

Appendix 2

EXCERPTS OF CARRIER TARRIFS

1. CN/CP TEL TARIFFS

The following section, while lengthy, deserves to be quoted in full.

Tariff CTC 138 — Page 22
Tariff CTC 39 — Effective: August 1, 1970
Issued: July 14, 1970

GENERAL TARIFF

''*4.7 Use of Service by Subscribers*

(a) Facilities furnished under this tariff may be employed for the private use of those companies whose offices are connected to the channels, their affiliated and subsidiary companies and their representatives, and each such office shall transmit and receive its particular communications and those of its affiliated and subsidiary companies and their representatives over the equipment installed therein. Further such facilities shall not be used either directly or indirectly for the handling of communications for the public or any person, firm or corporation other than those whose offices are connected to the channels or their affiliated and subsidiary companies and their representatives, *nor shall such facilities be used for any purpose for which a payment or other compensation for such use shall be received by the subscriber, or an authorized user, from any other person, firm or corporation.* The restrictions set forth in this paragraph do not apply to facilities furnished to another communications common carrier.

(b) In the event of a dispute between the Telecommunications Company and the subscriber as to the use of the facilities, *the Telecommunications Company's decision shall be final* and binding upon both parties.''

Tariff CTC (TG) 138 — Page 107
Tariff CTC (TG) 39 — Effective: August 1, 1970
Issued: July 14, 1970

''Item 22.0 CHANNEL — DERIVING ARRANGEMENTS (Continued)

22.4 ARRANGEMENTS PROVIDED BY THE SUBSCRIBER

(2) The connection of the subscriber-provided equipment is permitted subject to conditions as follows:

(a) The subscriber is responsible for the maintenance of his own equipment.

(b) Channels *may not be used to connect to any form of switching system,* including store and forward or line switching, other than the Telex network, which may be connected at the *discretion* of the Telecommunications Company."

Comment: (b) is consistent with the CN/CP Tel request to the telecommission (Telecommission Study 8b (ii)) for exclusive right to use of store and forward technology, and it clearly relates to maintenance of the concept that "switching" is a vested monopoly right of a common carrier.

Tariff CTC (TG) 137A
Tariff CTC (TG) 38

Page 8
Effective: August 1, 1970
Issued: June 30, 1970

"Item 8. JOINT USER SERVICE

8.1 Joint User Service is the use of a subscriber's service by another individual, firm or organization *whose requirements do not warrant subscribing for a separate service.*

8.2 *Joint User Service is not in accord with the general plan* of furnishing Telex and Datatelex Service, and shall be furnished only at the discretion of the Telecommunications Company. Furthermore, the Telecommunications Company reserves the right to limit the number of joint users in order to avoid impairment of the service.

8.5 The Joint User must be located in the *same room or suite of rooms* as that in which the station is located.

8.6 Separate signalling arrangements shall not be provided for the purpose of signalling the Joint User."

Comment: This Tariff clearly restricts any subscriber from realizing opportunities for reducing his operating cost by sharing or sub-leasing of not fully-utilized services, by requiring it to be done with the cognizance and also under the control of the carrier. The regulation of separate signalling and requirement of joint users to be under the same roof severely limit the prospects for shared usage.

Tariff CTC (TG) 139
Tariff CTC (TG) 40

Page 7
Effective: August 1, 1970
Issued : July 20, 1970

SPECIAL TARIFF

"4. *Computer Services*

The Telecommunications Company may levy charges against subscribers of its Computer Switched Service offerings, as well as against subscribers operating Computer Time Sharing Systems, based on *the particular circumstances* associated with each particular subcriber's requirements. When these requirements become more standardized and less custom-designed, the charges for major services will be filed as items in a General Tariff."

Comment: The phrase "may levy charges" perhaps raises the question as to what are the user prerogatives of appeal.

Tariff CTC (TG) 137A
Tariff CTC (TG) 38A

Page 53
Effective: August 4, 1970
Issued: July 15, 1970

SECTION V
TELEX COMPUTER INQUIRY SERVICE

"1. GENERAL

1.1 *This service provides for flat rate charges,* in lieu of tolls, for communication originated by Telex or Datatelex outstations to a centralized computer and is designed for operation at signalling speeds up to 180 bauds.

This service is subject to all terms, conditions and limitations of liability specified in Section 1, Item 1 to 9, both inclusive.

1.2 This service consists of two separate offerings:

a) *Flat rate calling* for outstations located in the same city service area as the centralized computer.

b) *Flat rate* calling for outstations located in cities other than the same city service area as the centralized computer.

1.3 Service is furnished subject to the availability of facilities and is only available within Canada.

1.4 Unequipped Telex or Datatelex lines connected between the Telex exchange and the centralized computer are provided at standard tariff rates.

1.5 Terminal equipment at the outstations may consist of standard Company offerings, or may be provided by the customer.

1.6 This tariff covers communication originated by the outstations only, however, *the centralized computer may originate calls using other standard tariff offerings of the Company.*

1.7 When technically feasible outstations may communicate with other outstations and other Telex or Datatelex subscribers at standard Telex tariff rates. Each individual case should be referred to the General Sales Manager.

1.8 The initial service period is one month."

Comment: This tariff is an interesting application of flat rates specifically for a computer network. The "computer" referenced in the text might for example be that of Computer Sciences of Canada Ltd. (an affiliate of CN/CP) as described in a press release made in 1971:

"Computer Sciences Canada recently introduced a service to small business users that will allow interactive timesharing access to Univac 1108s in Toronto and Calgary via a local Telex call.
"The system allows Telex users to access the CPUs at regular CSC rates plus a $15/mo. telecommunications computer inquiry service charge from Canadian National and Canadian Pacific (CNCP) which provide the Telex lines and equipment.
"Although a $50 initiation charge and a $25/mo minimum fee are also required of users, CSC said the service will allow 'unsophisticated' users the capability to use basic 5-level Telex terminals to do accounting, payroll and other necessary functions that would otherwise not justify the installations of an in-house CPU or more expensive interactive terminals."
"A Telex subscriber accesses a CPU calling the local CSC branch which then multiplexes the call into one of the 1108s."

This case illustrates a number of points:

- It is an application of flat rates where the mileage charge is constant over successive zones, but charges are still proportional to time used.
- The service offered by CSC requires use of the tariff noted, combined with tariffs 138-39 which permit an extension of the service between cities and termination through the Telex switched network but "at the discretion of the Telecommunications Company".
- It illustrates some of the confusing complexities which face subscribers dealing with tariffs.

2. BELL CANADA TARIFFS

Selection of Bell Canada tariffs rather than those of B.C. telephones is based upon dominant position of the former within TCTS. Other TCTS members are not under federal regulation.

Tariff CTC (TP) No. 6716

ARRANGEMENTS FOR DATA TRANSMISSION

Item 4660-10 Channel-Deriving Arrangements

"(a) A channel-deriving arrangement enables a customer to a data channel to obtain from it two or more data channels of a narrower band-width. The arrangement may be provided by the Company or by the customer.

"(c) Arrangements provided by the customer:

"(3)b. The equipment will not be used to connect *customer-provided concentration or switching systems.*"

(Page 504, Issued May 19, 1971, Effective June 2, 1971.)

Comment: A clear statement of prohibition of sharing or re-sale by users.

Item 4680 Systems and Services for Data Transmission (Page 518, Issued November 9, 1970, Effective December 1, 1970.)

"*3 Multicom Service*

(a) Multicom service is furnished for the transmission of data between stations of customers located in the local service area of certain exchanges. It is furnished between data equipment provided to operate at the *same speed* and where the customer's equipment arrangements are compatible.

"(c) *The Company determines the exchanges between which it will provide the service.*"

Comment: — Bell Canada decides which subscribers are to obtain the services. Also the restrictions on speed and compatibility of terminals would be unnecessary in a digital network designed solely for data transmission. To this extent the tariff reflects the state of the art within Bell's services.

Bell Act and Attachments — The following is a quotation from Chapter 48, 1967-68:

"5(4) For the protection of the subscribers of the Company and of the public, any equipment, apparatus, line, circuit or device not provided by the company shall only be attached to, connected or interconnected with, or used in connection with the facilities of the Company in conformity with such reasonable requirements as may be prescribed by the company.

"(5) The Canadian Transport Commission may determine, as questions of fact, whether or not any requirements prescribed by the Company under subsection (4) are reasonable and may disallow any such requirements as it considers unreasonable or contrary to the public interest and may require the company to substitute requirements satisfactory to the Canadian Transport Commission in lieu thereof or prescribe other requirements in lieu of any requirements so disallowed.

"(6) Any person who is affected by any requirements prescribed by the Company under subsection (4) of this section may apply to the Canadian Transport Commission to determine the reasonableness of such requirement having regard to the public interest and the effect such attachment, connection or interconnection is likely to have on the cost and value of the services to the subscribers.

The decision of the Commission is subject to review and appeal pursuant to the Railway Act."

Comment: The Act is capable of being invoked in respect of all forms of communication, including data.

Control of attached data communications switching equipment will be a contentious issue which will be very difficult to resolve, especially where the user is also performing switching for processing.

APPENDIX 3

NOTES ON CARRIER DIGITAL TECHNOLOGY

1. TCTS DIGITAL TECHNOLOGY

The basic short-haul digital facility is the T1 (PCM) repeatered line. It operates at 1.544 megabits per sec. which is structured from 24 voice channels at 56 kilobits per sec. each with necessary control bits added. Data are to be serviced by using one to four of the 24 voice channels of a system. A new time slot access unit is being developed for this purpose. The range of the T1 is 50 miles. Its successor the LD1 will increase this to 200 miles.

By 1980 long haul systems may consist of co-axial cable; analogue microwave, digital microwave; and of microwave waveguide.

- LD4. This new co-axial voice system will have a capacity of 20,000 two-way voice channels and is planned for service in 1975. Digital techniques are employed. The bit rate hierarchy is an extension of the T1 system. It will be possible to introduce data channels into the multiplexers with the same restrictions as for T1. The cable will have 12 co-axial tubes each operating at 283 megabits per sec.
- Microwave. In the immediate future, as in the proposed pilot digital private-line network for Ottawa, Toronto and Calgary, standard frequency division multiplex will be used. This will constrain data signals to a standard voice group bandwidth of 48 kHz. Development of digital radio using other multiplexing techniques is underway in Canada. Not all of the work is being done by TCTS members or affiliates. Exploratory programs have been started to define the form of the digital radio system, which will operate above 12 GHz, because of the extended frequency spectrum requirements of the digital technique. At these frequencies "hops" are shorter and re-investment in digital radio for a coast-to-coast route would involve considerable capital sums. Much of the existing lower frequency plant has already seen 15 years service, which is more than half a life-span for electronic equipment. A definite replacement program has not been set out at this time, because there is no basis for predicting the time at which the traffic density will require the 12GHz facility.

Supplementing the digital network developments, local loop equipment is being developed. This will include a digital subscriber terminal, a local loop digital repeater and a central office regenerator. Synchronous data from a standard computer terminal interface can be transmitted direct to the central office in bit form. From here it can be "slotted" into T1 or the microwave carrier. The significant feature is the elimination of digital to analogue conversion and the MODEM required to perform this function. The TCTS paper[1] of July 1971 forecasts requirements for modems on a one-for-one basis with terminals through this decade and to a value of several hundred million dollars. If digital subscriber loops were to be extensively installed in the same period, the substitution of the less costly interfacing equipment needed in them could result in the elimination of much of this very large expenditure for modems. No network with modems can truly be said to be a

[1] *Computer Based Services of the Seventies* (Trans-Canada Telephone Service. July. 1971)

digital data network. Thus far, digital subscriber loop equipment is proposed only on a pilot scale. Further expansion will depend upon demand according to TCTS.

The subject of digital switching can be succinctly introduced by a quotation from a TCTS paper, as follows: "It is also considered essential that the future data network include a fully-switched service. This will involve digital high-speed switching, using both circuit-switched and message-switched modes. Stored program control is envisaged in both cases. Progress has been somewhat slower in the switching field, for it is only very recently that electronic crosspoints became comparable in cost with their mechanical equivalents. The projected availability of such crosspoints has triggered an exploratory development aimed at producing a time-division switching machine for telephony, data and video signals to be available about 1980. This machine will be the digital equivalent of today's large circuit switchers."[2]

The following facts should be considered before an assessment of the foregoing quotation is made. Switching is used to permit load-sharing by certain carrier facilities, to perform logical functions for the subscribers, and to facilitate billing. Data loads on trunks are still very light. For example the Ontario-Manitoba data load is not expected to exceed one-half the capacity of a T1 line by 1975. Data switchers are still so expensive relatively that it is cheaper to provide more lines than to share with the aid of a switcher. As long as private networks do not require intercommunication, logic functions will be tailored to specific systems and switching logic will not accumulate at big switching centers. Therefore, it is not obvious at this time just when large digital switches will be required for interconnection of digital networks.

Electromechanical switching has been carried to practical limits in both Broadband and Multicom. The set-up times and signalling techniques have been reduced and improved to the point of marginal return from further development of this type of equipment. Therefore, if the new solid-state crosspoint switchers are not to be introduced before 1980, data communications users will be seeking alternatives. One of these has already appeared. This is a new addition to the switching hierarchy which is evolving from an adaptation of mini-computers. The following quotation is from a recent TCTS press release.

"Announced in September, 1971, after *considerable pilot development*, Software Controlled Communications Services (SCCS) is a family of data services using mini computers as "front ends" for large host computers, as remote concentrators, message switchers, or combinations of these. The initial service will be to provide the front end communications controller. The other features to be offered in the future will be for private user and common user networks.

---

[2] *Communications, Computers and Canada* (Trans-Canada Telephone Service, November, 1971, revised December, 1971)

"The advantages of SCCS systems include:

flexibility
the SCCS can handle a wide variety of speeds and transmission codes
expandability
the system can be easily extended
host computer economies
the host computer can be relieved of communications handling tasks which consume processing time and memory space
reliability
communications network reliability can be improved by continuous monitoring and diagnostic checking
economy
SCCS will be able to optimize the use of communications systems to the highest degree possible"

This raises the question whether the time-division switching machines of the early 1980's will have the capability of switching data with voice and video. At a recent European conference[3] on integrated voice, video and data, (the first of its kind on this theme) it was stressed that much work has still to be done with redundancy removal techniques, and that there is an unfortunate trade-off to be made in the use of such equipment which is more sensitive to noise as it becomes more efficient in removal of redundancy. As was revealed in one paper[4] bit rates associated with more advanced analogue services, such as holographic, long-three-dimensional video, which is the extreme case, requires manipulation of tens of billions of bits per second. This is beyond the state of the art, but even less sophisticated services will create great technical management problems. It was obvious at this conference that, in dealing with voice and data alone, the European community will avoid interconnections between analogue and digital networks via switches, although multiplex and transmission facilities will be used in common as in PCM systems.

Neither of the TCTS papers which have been quoted here has made reference to software developments which will be required to achieve digital switching. These developments will be substantial, and of no less significance in network development then switching hardware.

The economics of voice traffic fostered the development of first T1 and then LD4 for transmission links. As a consequence, the first digital networks will be essentially long-haul in nature, consisting mainly of dedicated circuits. Digital local loops and digital switches will likely be integrated into a Canadian digital data network subsequently, and in that order. Paradoxically the major Canadian industrial centres are located in the vicinities of large

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[3] International Zurich Seminar on Integrated Systems for Speech, Video and Data Communications, Zurich, Switzerland, March 15-17, 1972

[4] Huang, T.S., and Stucki, P., "Image Processing in Communications Systems", Conference Paper delivered at the International Zurich Seminar on Integrated Systems for Speech, Video and Data Communications, Zurich, Switzerland, March 15-17, 1972

cities which are much more interurban than they are interregional in their business activities. Therefore, from the point of view of the supply of data communications alone to such economic complexes, a different sequence for development of network components would seem more timely to users needs. This sequence would be: digital local loops, concentrators, short-route PCM followed by digital switchers, and the digital long-distance facility. In the pragmatic economics of the carriers there is no realism in such a supposition. Thus the TCTS position is that data communications are economically viable only if provided as a supplement to voice facilities. Any review of carrier data communications network proposals must take this postulate into consideration. Such time-sequence considerations, however, should not minimize the very promising technical developments which the telephone carriers intend to effect in data communications in Canada, in this decade.

2. CN/CP TEL DIGITAL TECHNOLOGY

The plans of the telegraph carriers for network development are conditioned by the fact that there is no vertically integrated manufacturing industry associated with them. The world is their market-place for acquisition of new technology. This results in lack of flexibility in system-design where there are major requirements peculiar to the Canadian environment. The Canadian market simply is too small to influence the features of equipment which is designed for world markets. On the other hand, the telegraph carriers can sometimes move quickly into a procurement cycle to establish new plant when the world suppliers by their research and development programs have effectively anticipated Canadian data communications requirements.

The telegraph carriers plan to supply T1 with low- medium- and high-speed multiplexers for data services. Commercial equipment will be used which means that it will conform to the voice hierarchy in bit rates.

CN/CP Tel proposals are to convert existing Telex junction exchanges to electronic switches and to use electronic concentrators to eventually replace all of the smaller district and sub-district exchanges.

The facilities may all be provided by a new switching technology which is being developed at various places in other countries. One example is the EDS family of equipments, developed and supplied by Siemens, Germany. This system is the first digital switch which has been designed for digital data services specifically, and in fact will not accommodate voice. The techniques employed in it are suitable for asynchronous low speed data, or Telex. It has limitations when used in synchronous systems.

The telegraph carriers lease local loop facilities from the telephone carriers. Therefore they do not have full freedom to plan in this area and have asked for government support to ensure long-term continuity in usage of local loops.

The new switching complex will require an investment of 50-100 million dollars to develop in Canada. The concept could be very strong in developing urban systems consisting of digital switchers, concentrators and local loops,

but would not be compatible in a network linking it with those TCTS facilities which are to be made available in this decade. This prospect emphasizes the fact that switching will be the key factor in the development of digital data facilities in Canada. An overall national network cannot be developed without a homogeneous switching hierarchy.

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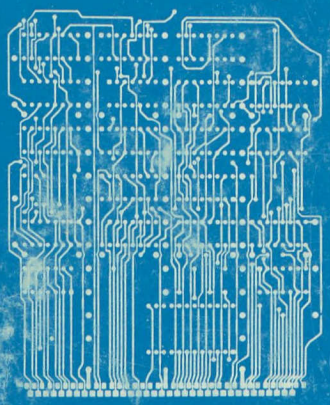

Machines and computers should become a functional part in a life-oriented social system and not a cancer which begins to play havoc and eventually kills the system.

Eric Fromm
The Revolution of Hope