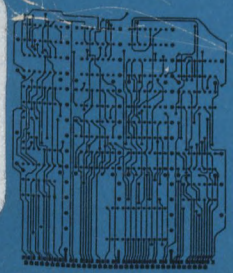
The
Canadian
Computer/Communications
Task Force

Background
Papers

15 Computers and Communications in the Canadian Business Community

16 Data Communications Survey



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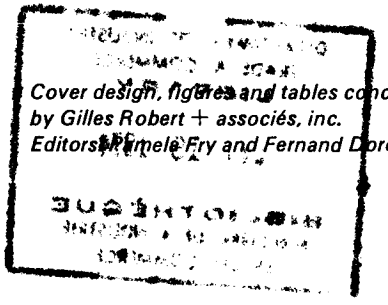

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Background Papers to *Branching Out*, the Report of the Canadian Computer/Communications Task Force

Already Published

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1 The Canadian Computer Supply Industry Study
by George R. Forsyth and Brian Owen

Volume 2

2 Peel County Pilot Education System
by Lyman Richardson
3 Computer/Communications Activities at Canadian Universities
by the CCC/TF

Volume 3

4 CATV Technology for Citizen Feedback to Government
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Background Papers

15

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15 Computers and Communications in the Canadian Business Community

CANADA/ COMPUTER COMMUNICATION TASK FORCE

Prepared by:
CCC/TF Ottawa
August, 1972

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Foreword

One of the fundamental premises behind the formation of the Canadian Computer/Communications Task Force was that computer and telecommunications technology have now reached the point at which processing, storing and communicating information effectively and efficiently over long distances are within practical reach of most organizations. Also, the services provided by means of this technology will become of increasing importance to the individual. Systems are rapidly coming into existence which will be able to serve many users through the employment of computers and interconnected terminals. This raises the question of whether any concerted, positive action is required, as a result of the advent of such systems.

In an attempt to obtain answers to this question, the Task Force undertook a number of investigations, and consulted many experts of various disciplines. One of these undertakings was the study and survey of in-house computer-systems users in the Canadian business community. Initial investigations, in 1971, indicated that business and industry were the largest group of computer-users in Canada. Therefore, business executives and senior Electronic Data Processing (EDP) managers from over sixty firms were consulted during this EDP user survey, to provide both quantitative information and opinions on matters pertaining to this question. This enabled the Task Force to gain a better appreciation of the present and future role of computers and communications in the business community; a greater understanding of the problems and opportunities contained in their use; as well as identifying what the business community felt were appropriate government policies in support of effective and efficient application of computers and communications.

The purpose of this report is to describe these findings in terms of identified needs, problems, opportunities, attitudes and opinions, as expressed by respondents. A significant portion of the findings were useful to the Task Force in the formulation of firm conclusions and recommendations, as described in the report, *Branching Out.*[1] However, this study and survey represents only one part of a wide range of Task Force investigations.

[1] Report of the Canadian Computer/Communications Task Force, *Branching Out* (Department of Communications, Ottawa, Information Canada, 2 Vols., May, 1972).

The present report is divided into four parts, each covering a major area of investigation, in the following sequence:

Part A contains an overview of in-house computer-systems expenditures, and expected growth, based on reported budget figures and estimates.
Part B presents executive assessments on contributions and problems in the application of computers. It describes how executives view: (i) the type and extent of contributions made by computers to the operation of their businesses; (ii) areas of future computer applications; and (iii) current gaps and deficiencies in the operation of their EDP departments.

Part C reports on the state of the evolution in computer-based information processing, within the business community. It attempts to identify from executive and EDP management responses: (i) the main reasons and purposes for computer application; (ii) measures to attain a more profitable use of computers; (iii) how computer systems and applications were planned for development; (iv) what approaches were taken to train computer personnel and user personnel, and what critical gaps were encountered; and (v) EDP management views on standards, and on measures taken to protect vital business data and security of EDP operations.

Part D reports on the trends which are developing in the use of computer/communications systems. It presents the findings of the user survey in relation to: (i) the attitudes of business executives and EDP management towards the use of public computer/communications systems; (ii) trends in the development of private computer/communications systems, data communications and data bank facilities; (iii) executive expectations regarding the inter-organizational transfer of information processed by computers; and (iv) executives' responses to questions related to the north/south flow of information.

1. Study Procedures

The study commenced with an analysis of various national and international policy reports on computers and communications, in order to identify major technological, social and economic issues. Included in this analysis were the publications of the "Telecommission" study, undertaken by the federal Department of Communications[2]; the (U.S.) President's Task Force Report on Communications Policy[3]; the 1971

[2] Department of Communications, *Instant World* and *Telecommission Studies* (Ottawa, Information Canada, 1971).

[3] Rostow, Eugene V., *A Survey of Telecommunications Technology, Part I* (President's Task Force on Communications Policy) (Washington, D.C., U.S. Superintendent of Documents, June, 1969).

Computer White Paper published by the Japan Computer Usage Development Institute[4]; reports by the Federal Communications Commission (U.S.) on decisions related to computer/communications services; and a number of reports prepared by consultants for various U.S. government departments on the subject of computer/communications. A number of private (in-house) and public (commercial) computer/communications systems in the United States were visited, to review the state of technological and commercial developments with leading experts. U.S. telecommunications carriers were also approached, and information on their plans, concerns and expectations in the field of data communications was obtained through direct discussions.

Once this background had been established, it was decided to approach a sample of in-house computer-systems users in the Canadian business community to obtain the required information.

The survey was conducted by means of in-depth interviews. A lengthy interview guide was drawn up. A sample of companies to be surveyed was selected from the Canadian Information Processing Society's (CIPS) March, 1970, census of computers. Within the time constraints imposed on the Task Force, efforts were made to ensure that the sample was as representative of the universe of users as possible. However, it cannot be postulated that the sample was statistically valid in all respects.

The organizations were chosen from the ten major industrial groupings defined by CIPS, from small, medium and large EDP users, and from the five major regions of Canada. About seventy companies were selected. From this sample, five pilot, one partial and sixty-two full-scale interviews were performed, covering ten large-, thirty-four medium- and eighteen small-size EDP users. However, a number of firms did not respond to all questions posed, or were unable or unwilling to provide the requested information. In these cases, appropriate notations are made in this report to indicate the actual number of respondents to specific questions. For instance, only fifty out of sixty-two firms provided the EDP budget information which is used in the projections of EDP expenditures listed in Part A. The data was provided

[4] Japan Computer Usage Development Institute, *Computer White Paper, 1971 Edition (A Summary of Highlights Compiled from the Japanese Original)*, trans. by Richard Foster (Tokyo, Japan, The Asahi Evening News Co., Ltd., July, 1971).

on the understanding that it would be treated as confidential and not released to any party, except in summarized form. Subsequently, user comments were edited to delete any possible identification of their source.

Figure 1 illustrates the profile of companies surveyed.

The duration of each interview ranged from several hours to a full day. Usually, a senior executive of the company was interviewed separately to obtain a "user" management view. The director or senior manager of Information Systems Services or Data Processing was then interviewed to obtain a systems-management viewpoint. The request for separately arranged interviews of executive personnel and systems-management was granted in almost every case, so that information was obtained on the differing perspectives of these two groups.

A team of six Task Force members conducted the interviews. The reception accorded to the members of the team was outstanding. While much of the useful information obtained in the survey arose from answers to the specific questions raised, many supplementary details were obtained from the comments recorded by the interviewers.

Following the completion of the interviews, the results obtained were compiled into summary tabulations and follow-up investigations were started to further explore the problems identified with members of the data processing industry, telecommunications carriers, and educators in the field of computer science. The following report contains the results which emerged from the analysis.

Figure 1
Business/Industry User Profile
(Excluding service bureaux)

Number of Companies Surveyed

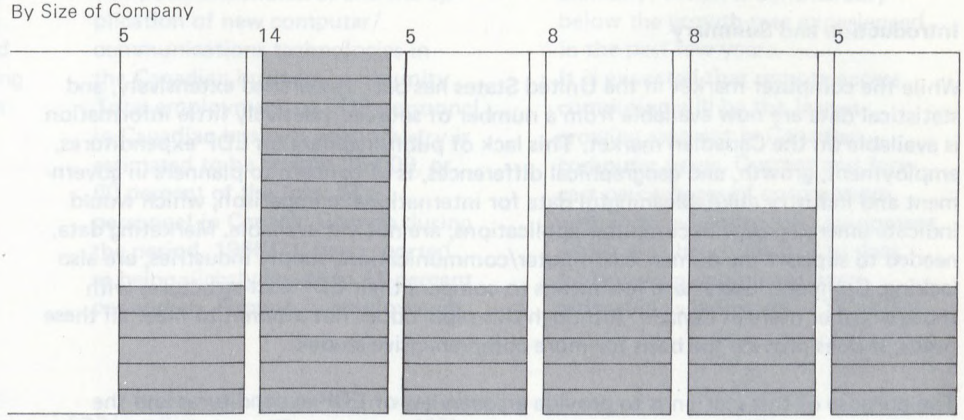
By Region

Maritime Provinces	2
Quebec	23
Ontario	27
Western Provinces, B.C.	11
Total	63

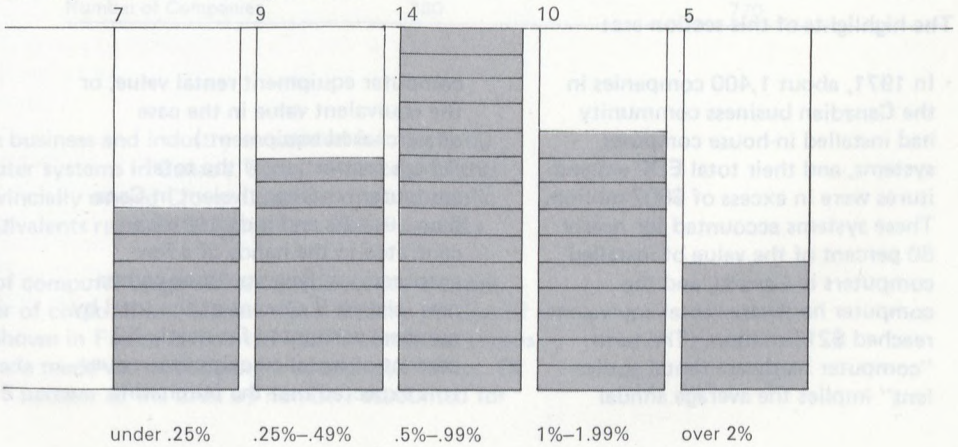
By Industry

Primary/Resource	4
Petroleum	4
Manufacturing	21
Communications	2
Construction	2
Distribution	7
Transport	6
Financial Services	7
Other Services	5
Utilities	5
Total	63

By Size of Company



EDP Expenditure as Percentage of Sales



Part A

In-House Computer-Systems Spending in the Canadian Business Community

Introduction and Summary

While the computer market in the United States has been researched extensively, and statistical data are now available from a number of sources, relatively little information is available on the Canadian market. This lack of published data on EDP expenditures, employment, growth, and geographical differences, is of concern to planners in government and industry alike. Meaningful data for international comparison, which would indicate emerging gaps in computer applications, are not yet available. Marketing data, needed to support the domestic computer/communications supply industries, are also lacking. Computer users have few means to compare their EDP cost-structures with those of other users in Canada. Although this report does not attempt to meet all these needs, it does provide the basis for more comprehensive studies.

The purpose of this section is to provide an overview of EDP expenditures and the growth of in-house computer systems in business and industry. The information contained herein was compiled from data collected from fifty-four companies during the EDP user survey, conducted by the Task Force in 1971, and from data collected by the Canadian Information Processing Society (CIPS) for the 1970 and 1971 computer censuses.

The highlights of this section are:

- In 1971, about 1,400 companies in the Canadian business community had installed in-house computer systems, and their total EDP expenditures were in excess of $607 million. These systems accounted for nearly 60 percent of the value of installed computers in Canada, and the computer hardware rental equivalent reached $213 million. (The term "computer hardware rental equivalent" implies the average annual computer equipment rental value, or the equivalent value in the case of purchased equipment.)
- A high proportion of the total computer rental equivalent in Canadian business and industry is concentrated in the hands of a few corporations. Seventy-three companies (almost 5 percent of the total by number) accounted for nearly 50 percent of installed computer value. It is expected that the purchasing power and technological competence of these companies will play a significant role in the development of computer/communications in Canada.
- Virtually all business enterprises with more than 750 employees have already installed in-house computer systems. For companies with less than 750 employees, the proportion possessing in-house systems decreased rapidly, with an equivalent

reduction in the number of employees. The main factors hindering a significant penetration of in-house computer systems into smaller enterprises are the costs of installing and operating computer systems, and the problems contained in maintaining a competent staff. It is expected that this market will be contested by the service bureaux and mini-computer manufacturers.

- EDP expenditures for business and industry in Canada are expected to double between 1971 and 1976, reaching $1.2 billion. There are indications that less than 100 companies will be the dominant force, affecting the growth of computer expenditures and the application of new computer/communications technologies in the Canadian business community.
- Total employment of EDP personnel in Canadian business and industry is estimated to be around 25,000, or 60 percent of the total EDP personnel in Canada. Growth during the period, 1966/71, was reported as being slightly less than 11 percent *per annum.* Growth in employment for the period 1971/76, has been projected by survey respondents to be 5 percent, compounded annually, which is considerably below the growth-rate experienced in the past few years.
- It is expected that remote-access computing will be the fastest-growing segment in Canadian computer usage. Current and forecast percentages of corporations with installed computing equipment, which are also connected to data transmission equipment, were estimated as indicated in Table 1.

Table 1

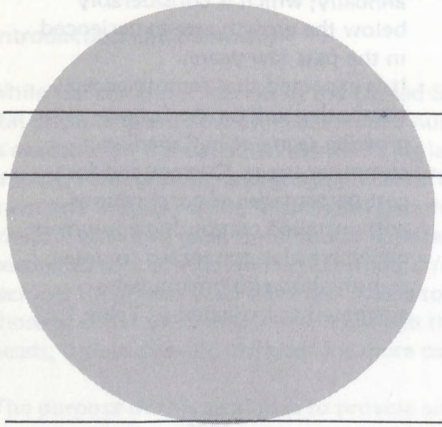
EDP User Size	1971	1976
Large	90%	Close to 100%
Medium	47%	87%
Small	4%	14%
Number of Companies	260	770

1. Overview

In 1971, in-house computer systems in business and industry accounted for nearly 60 percent of the value of installed computer systems in Canada. Some 11 percent of this total value resides in federally and provincially owned Crown Corporations and public utilities. Computer hardware rental equivalents reached $213 million. (See Figure 2.)

Perhaps the most outstanding feature of computer usage in the Canadian business community is that a relatively small number of corporations account for a sizeable portion of computer rental expenditures. This is shown in Figure 3. The 1971 CIPS computer census indicated that 1,406 companies in Canada made use of computers in their operations. Of these, seventy-three companies (about 5 percent of the total by number) accounted for

Figure 2
The Value of Installed Computer Systems in Canada—May, 1971 *



25% Government and Educational Institutions

15% Service Bureaux

60% Business and Industry

$213 Million (Including Crown Corporations)

*Source: 1971 CIPS Survey

nearly 50 percent of the total installed value of in-house computer systems. Information on EDP development plans suggests an even higher degree of concentration in the years to come.

Table 2
Value of Computer Hardware in Canadian Business and Industry

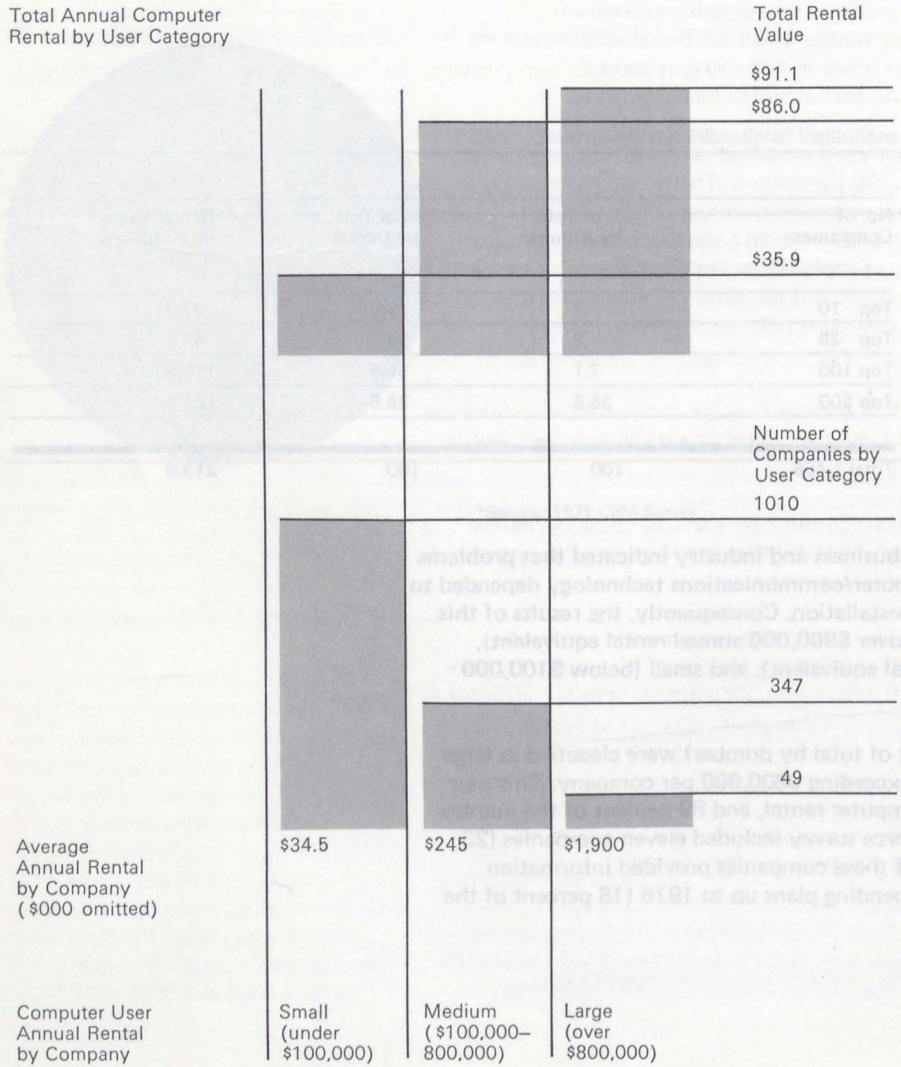
(Ranked in order of annual computer rental equivalent by company)

No. of Companies	% of Total by Number	% of Total by Rental	Rental Value in $ Millions
Top 10	.7	17.5	37.3
Top 25	1.8	30.9	65.7
Top 100	7.1	55.5	118.3
Top 500	35.6	86.8	184.9
Total 1,406	100	100	213.0

The Task Force survey of computer users in business and industry indicated that problems and opportunities in the application of computer/communications technology depended to some extent upon the size of the computer installation. Consequently, the results of this survey are discussed in the context of large (over $800,000 annual rental equivalent), medium ($100,000 to $800,000 annual rental equivalent), and small (below $100,000 annual rental equivalent) user installations.

Some forty-nine companies (about 3 percent of total by number) were classified as large EDP users, with an annual computer rental exceeding $800,000 per company. This user group accounted for about 43 percent of computer rental, and 89 percent of the number of installed computer terminals. The Task Force survey included eleven companies (23 percent of the total) in this category. Nine of these companies provided information on their EDP expenditures, as well as their spending plans up to 1976 (18 percent of the total in this category).

Figure 3
Computer Usage in Canadian Business and Industry—1971



Some 347 companies (about 25 percent of the total) were classified as medium-size EDP users, with an annual rental, per company, in the range of $100,000 to $800,000. This group accounted for about 40 percent of computer rental spending and close to 11 percent of the number of installed computer terminals. The Task Force survey covered thirty-four companies (about 10 percent of the total) in this category, and all thirty-four provided information on their EDP expenditures and spending plans to 1976.

Some 1,010 companies (71 percent of the total) were classified as small EDP users, with a rental value, per company, of less than $100,000 per annum. This group accounted for nearly 17 percent of computer rental, and made relatively little use of computer terminals. It included some 450 companies which only had either small computers, mini-computers, or programmable electronic accounting machine installations. The Task Force surveyed eighteen companies (about 2 percent of the total) in this category. However, only eleven companies (about 1 percent of the total) provided information on their EDP expenditures and spending plans to 1976.

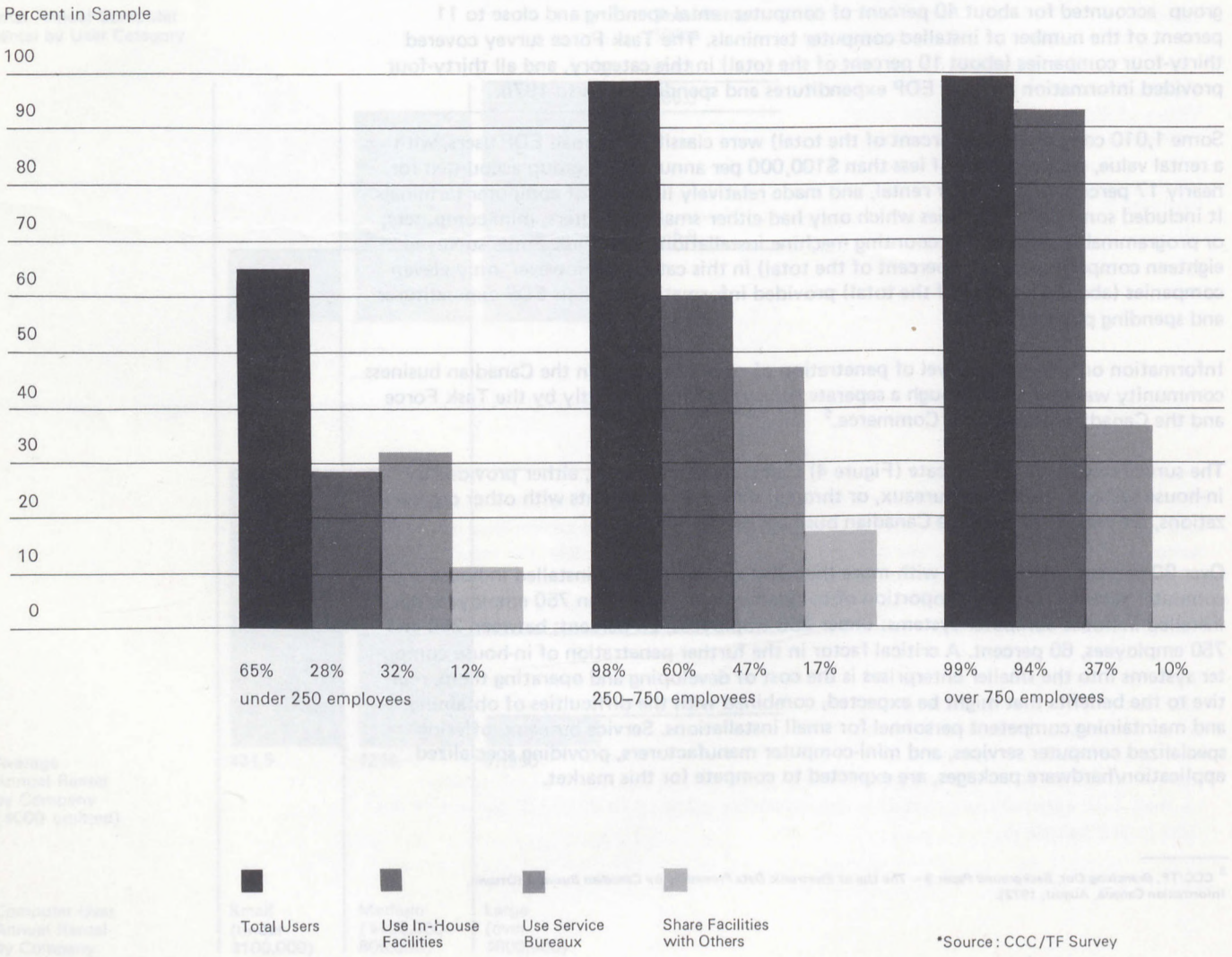
Information on the current level of penetration of computer usage in the Canadian business community was obtained through a separate survey, conducted jointly by the Task Force and the Canadian Chamber of Commerce.[5]

The survey results clearly indicate (Figure 4) that computer services, either provided by in-house systems, by service bureaux, or through shared arrangements with other organizations, are widely used by the Canadian business community.

Over 90 percent of companies with more than 750 employees have installed in-house computer systems. A lower proportion of companies with fewer than 750 employees have installed in-house computer systems: under 250 employees, 28 percent; between 250 and 750 employees, 60 percent. A critical factor in the further penetration of in-house computer systems into the smaller enterprises is the cost of developing and operating them, relative to the benefits that might be expected, combined with the difficulties of obtaining and maintaining competent personnel for small installations. Service bureaux, offering specialized computer services, and mini-computer manufacturers, providing specialized application/hardware packages, are expected to compete for this market.

[5] CCC/TF, *Branching Out, Background Paper 9 – The Use of Electronic Data Processing by Canadian Business* (Ottawa, Information Canada, August, 1972).

Figure 4
Use of Computer Services by Canadian Business and Industry Classified According to Number of Employees*



*Source: CCC/TF Survey

2. Computer/Communications Expenditures in 1971

The provision of 1971 EDP budget data by companies surveyed enabled the Task Force to estimate total EDP expenditures in business and industry, as shown in Figure 5. It should, however, be noted that these estimates cover EDP department budget spending only and do not include: (i) data communications costs for Telex and TWX services; (ii) data communications costs resulting from the shared use of telephone facilities, and (iii) service bureau charges for data processing billed directly to other departments, or to companies without EDP facilities.

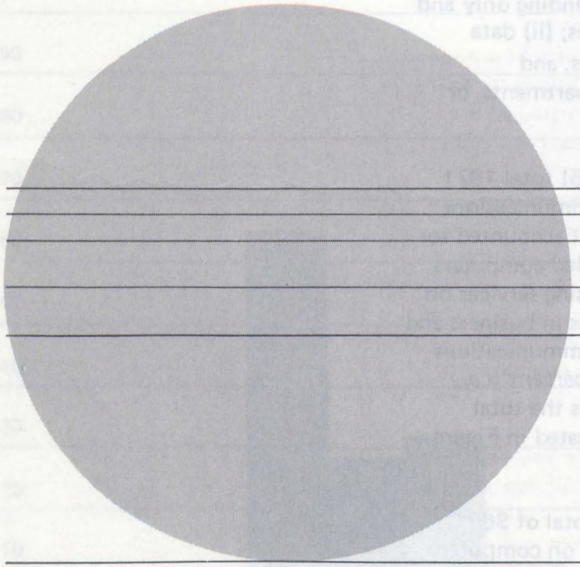
According to other Task Force studies (see *Branching Out*, Vol. I, page 45) total 1971 revenues for the communications segment of the Canadian computer/communications industry amounted to $120 million, and revenues for the services segment accounted for $113 million. Assuming a high correlation between rental values of installed computers on the one hand, and expenses for data communications and data processing services on the other, it may be concluded that, as the value of computer installations in business and industry is about 60 percent of the total in Canada, then costs of data communications and data processing services in business and industry would be about 60 percent (*i.e.*, about $150 million) of the total ($120 and $133 million) in Canada. Thus the total computer/communications spending by the business community, as indicated in Figure 5, may well be underestimated by about $100 million.

Figure 5 shows that EDP organizations in business and industry spent a total of $607 million in 1971. Of this, $329 million (54 percent of the total) was spent on computer products and services, with computer rental equivalent accounting for the biggest slice (35 percent). Personnel costs (wages, salaries and overhead) amounted to $278 million (or 46 percent of total spending).

Considerable variations exist in the spending pattern between the three EDP user categories and between individual companies within each category. Data communications charges, for instance, ranged from 10 percent of budget through 1 percent to 0.5 percent, respectively, for large, medium, and small EDP users. Again, it should be noted that these figures represent charges to the EDP department budget only; the cost will therefore be understated because a number of companies absorb data communications costs directly into their general telephone and telegraph accounts. Computer rental spending showed a similar ordering (38 percent; 33 percent; 32 percent) indicating a higher

Figure 5
Computer/Communications Expenditures
Business and Industry—1971

By Type of Expenditure (millions)
Total Expenditure $607 Million



35.1%	Computer Facility Rentals	$213
3.4%	Terminal Rentals	$ 20
4.6%	Data Communications Charges	$ 28
7.3%	Stationery and Consumables	$ 45
3.8%	Service Bureaux Software Rental Consulting	$ 22
54.2%	Purchased or Leased Products or Services	Not Included: Other Data Communications Charges (Telex, TWX, shared facilities) Service Purchased by: Non-EDP Departments Users without EDP Facilities
45.8%	Wages, Salaries, Overhead	$278

hardware-spending ratio by larger EDP users. Personnel spending in EDP operations (which excludes systems-development and maintenance) shows an inverse relationship (18 percent; 24 percent; 38 percent).

3. Expenditure Growth by User Category

Over fifty of the companies surveyed by the Task Force provided estimates of anticipated EDP growth between 1971 and 1976. Based on these data, EDP expenditures in business could nearly double in the same period; total expenditures by EDP departments are expected to rise from $607 million in 1971 to $1.19 billion in 1976. (See Figure 6.)

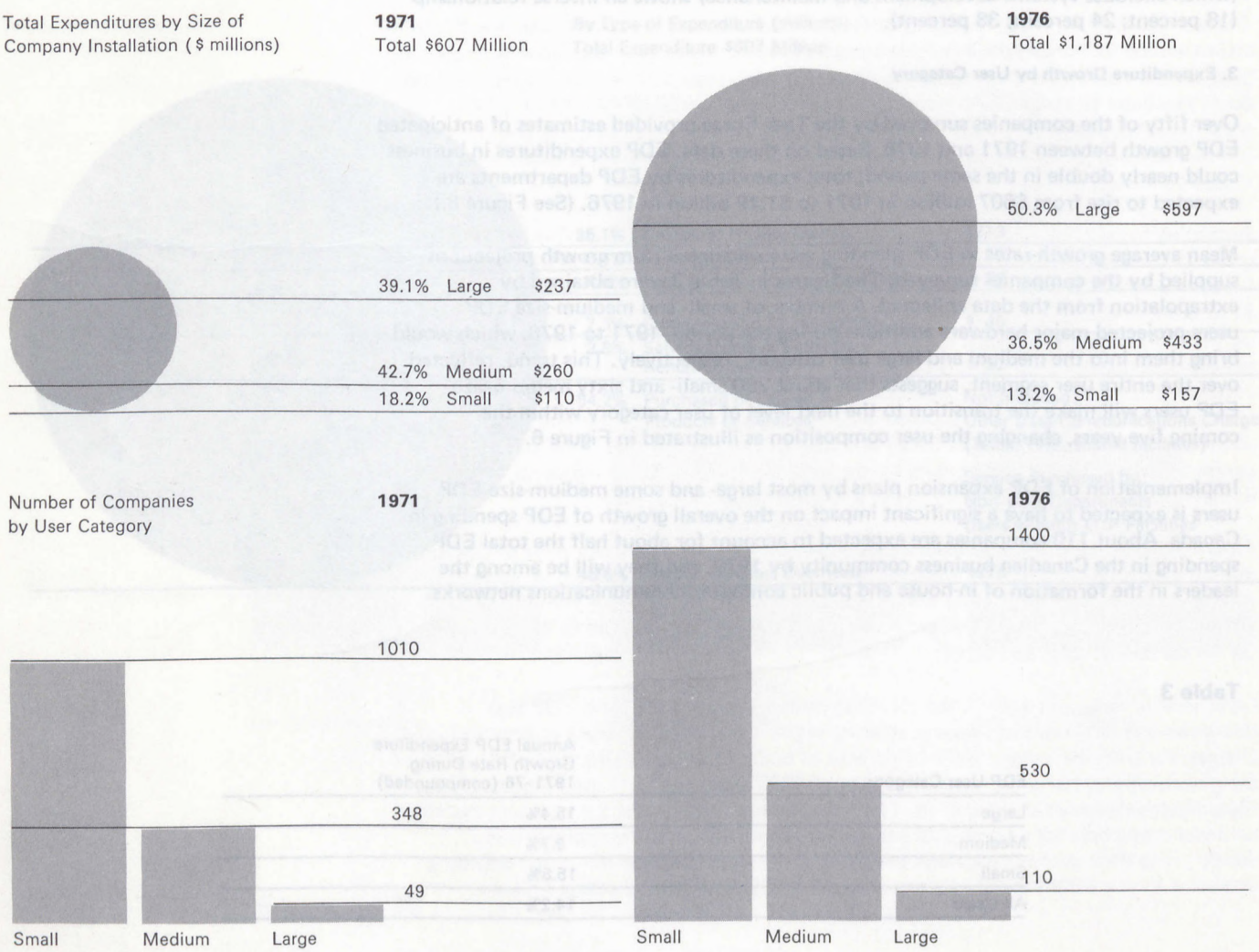
Mean average growth-rates in EDP spending were calculated from growth projections supplied by the companies surveyed. The figures in Table 3 were obtained by extrapolation from the data collected. A number of small- and medium-size EDP users projected major hardware additions during the period, 1971 to 1976, which would bring them into the medium and large user category, respectively. This trend, reflected over the entire user segment, suggests that about 250 small- and sixty medium-size EDP users will make the transition to the next level of user category within the coming five years, changing the user composition as illustrated in Figure 6.

Implementation of EDP expansion plans by most large- and some medium-size EDP users is expected to have a significant impact on the overall growth of EDP spending in Canada. About 110 companies are expected to account for about half the total EDP spending in the Canadian business community by 1976, and they will be among the leaders in the formation of in-house and public computer/communications networks.

Table 3

EDP User Category	Annual EDP Expenditure Growth Rate During 1971-76 (compounded)
Large	15.4%
Medium	9.7%
Small	15.8%
All Users	14.2%

Figure 6
Computer Usage in Canadian Business and Industry



As most enterprises with more than 750 employees already have in-house computer systems, the majority of first-time, new installations of in-house computer systems will take place in businesses with less than 750 employees. While new installations may add significantly to the number of user organizations in Canada, their relative impact in total EDP spending appears to be small.

Forecasting the number of new installations turned out, at best, to be a guessing game, because this market is also contested by both service bureaux and mini-computer manufacturers, and the outcome is still unclear. An analysis of growth-rates of small- and mini-computer installations (see *Branching Out,* Vol. I, page 54), and the current level of penetration of in-house computer systems into enterprises with less than 750 employees suggested that about 600 organizations will install their first computer system during 1971/76. After accounting for the transition of existing user organizations from the small- to the medium-size EDP user group, the number of small EDP users in 1976 is expected to be about 1,400.

4. Expenditure Growth by Function

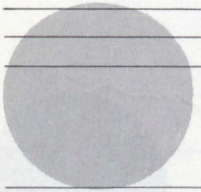
EDP operations may be considered as consisting of three distinct functions – computer operations, applications development and applications maintenance. These are indicated in Figure 7, but some definitions may also be helpful.

- Computer operations cover such activities as data preparation, data processing, communication of data to and from remote terminals, and maintenance of data in master files. Major expense items in computer operations are equipment rental, wages and salaries.
- Applications development covers such activities as planning, developing, programming and implementation of new information systems. The major expense items in applications development are salaries for systems analysts and programmers.
- Applications maintenance covers such activities as changes, updates and conversion of existing application programs. The major expense items are salaries for analysts and programmers.

Based on information provided by the fifty companies on their EDP development plans, computer operations accounted for 76 percent of the total 1971 EDP spending, and this cost is expected to be about double in 1976 – from $462 million to $961 million. Out of the fifty companies reporting, twenty-nine projected computer operations expenditure growth as being below 10 percent, compounded annually; fifteen companies projected growth as being between 10 percent and 30 percent; and six companies reported a rate in excess of 30 percent.

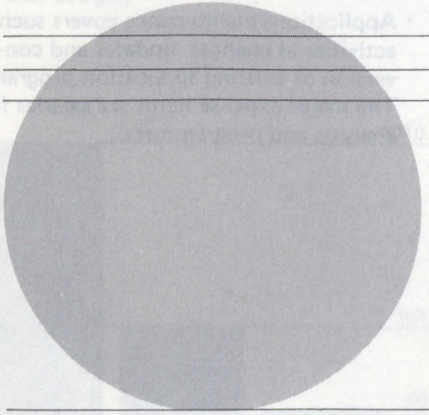
Figure 7
Computer/Communications Expenditures
Business and Industry ($ millions)

By Function



1971 Total $607 Million

15.8%	Development of New Applications	$ 96
7.6%	Maintenance of Existing Applications	$ 46
0.5%	Training	$ 3
76.1%	Computer Operations	$462



1976 Total $1,187 Million

12.4%	Development of New Applications	$147
6.2%	Maintenance of Existing Applications	$ 73
0.4%	Training	$ 5
81%	Computer Operations	$961

Predictions in the growth of data processing volume (in terms of numbers of records processed) were given by fifty-three companies. Seventeen companies reported their expected growth between 1971 and 1976 as being less than 10 percent, in line with the normal growth of their business. Twenty-eight companies projected their growth as being between 10 percent and 30 percent, based on an increased volume generated by the growth of the business, plus the effect of new computer applications. Eight companies, in the small- and medium-size EDP user category, reported annual growth predictions ranging from 30 percent to 60 percent. Computerization of major company information systems, ranging from hotel reservation systems to integrated systems for the transportation industry, was given by respondent companies as the reason for this rather startling growth-rate. Growth in data processing volume was reported as exceeding EDP expenditure growth in most companies. Apparently, these companies were expecting higher equipment utilization rates, or greater processing efficiencies, during 1971/76 than they had actually achieved in the past.

The cost of development of new applications in 1971 amounted to $96 million or about 16 percent of total spending. This cost is expected to increase to $147 million in 1976, but its share of overall spending will decline to about 13 percent. The larger growth-rate for development expenditures was reported by small users (14 percent weighted average, compounded annually). This is followed by medium-size users (9 percent). Large users reported an average growth-rate of about 6 percent.

The cost of maintenance, updating and conversion of existing application programs in 1971 was estimated to be $46 million or about 8 percent of total spending. This cost is expected to rise to $73 million by 1976, or about 6 percent of the total. Considerable difficulties were encountered in estimating the cost of training of computer personnel and users. Fifteen of the fifty-four companies reported identifiable training expenditures of $340,000 in total. When extrapolated over the total EDP user segment in the business community, the amount would be about $3 million. The Task Force estimates suggest that the 1976 figure will be around the $5 million mark.

5. EDP Employment Growth

Based on data provided by forty-nine companies, together with incomplete information from other sources, total 1971 employment of EDP personnel by in-house computer-systems users in business and industry is estimated to be around 25,000. Of these about

9 percent held positions in EDP management and administration; 38 percent in programming and system analysis, and 53 percent in computer operations. Past growth (between 1966 and 1971) has been reported by respondents to be about 11 percent, compounded annually, with the greatest rate of growth in the analyst/programmer category (13 percent). Future growth in EDP positions (between 1971 and 1976) has been reported as being less than 5 percent *per annum,* a relatively low figure when compared to past hirings (11 percent), and projected overall growth of expenditures (14 percent).

6. Remote-Access Computing

According to responses from forty-eight companies, remote-access computing should be one of the fastest-growing areas in the computer field. Almost all large EDP user organizations provide at least some in-house remote-access computing services from central computing facilities. A few of these companies operate sophisticated computer/communications networks. Nearly half the medium-size EDP users have installed computer/communications facilities. In isolated cases, small EDP user organizations employed data communications facilities to move data to and from distant branch locations for central in-house processing.

Forty-eight companies responded to questions on the use, or planned use, of telecommunications facilities for remote-access computing. EDP expenditures of small EDP user organizations in the sample were about twice those of the national average for organizations in this category, as reported by the CIPS census. It was therefore assumed that the sample was representative only of the top half of the organizations in this group, and that little, if any, action with regard to the use of telecommunications facilities would be taken by organizations in the lower half of this category. Making the necesasry adjustments (*i.e.*, dividing by two the percentages for the small EDP users) the results shown in Table 4 were obtained.

The data were used to extrapolate the number and percentage of companies expected to have in-house computer systems with remote-access capabilities installed in 1976. Appropriate provisions have been made in this forecast to account for hardware additions, which would bring a number of users into the category immediately above their present rating, and also to account for first-time installations. The number of present and projected user organizations is shown in Figure 8.

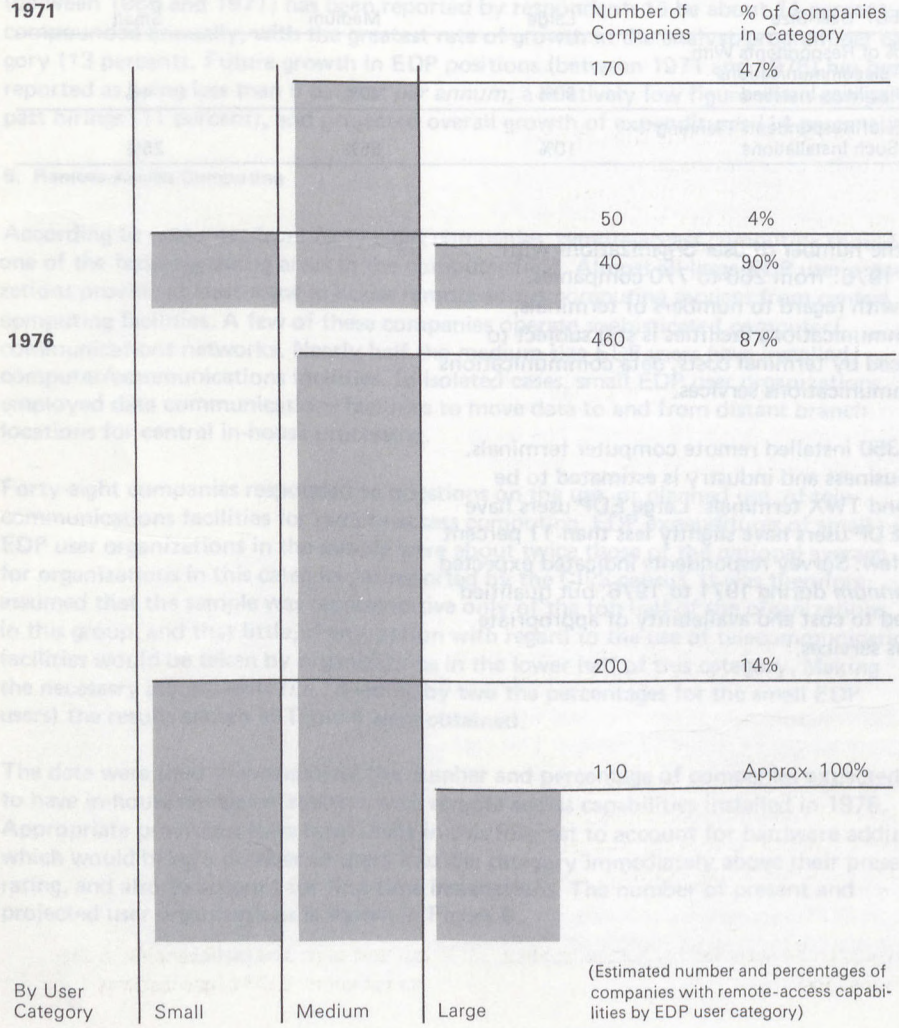
Table 4

EDP User Size	Large	Medium	Small
% of Respondents With Telecommunications Facilities Installed	90%	47%	4%
% of Respondents Planning Such Installations	10%	35%	25%

The forecast suggests a threefold increase in the number of user organizations with remote-access in-house computer systems by 1976: from 260 to 770 companies. However, the extent of actual usage in 1976 with regard to numbers of terminals, computer ports and associated computer/communications facilities is still subject to much speculation and will be heavily influenced by terminal costs, data communications rates and availability of appropriate data communications services.

Twenty-one companies reported a total of 2,350 installed remote computer terminals. The total number of computer terminals in business and industry is estimated to be around 15,000 in 1971, not counting Telex and TWX terminals. Large EDP users have approximately 89 percent, and medium-size EDP users have slightly less than 11 percent of installed terminals; small users had only a few. Survey respondents indicated expected growth-rates of up to almost 40 percent *per annum* during 1971 to 1976, but qualified these figures with a number of provisos related to cost and availability of appropriate terminal equipment and data communications services.

Figure 8
Remote-Access Computing Capabilities
in Canadian Business and Industry



(Estimated number and percentages of companies with remote-access capabilities by EDP user category)

Part B

The Business Executive and the Computer

Introduction

The following part addresses one of the most critical factors affecting the use of computers by the business community – the attitudes of top management toward computers. The formulation of policy recommendations to the Government, on ways and means of promoting computer development in Canada, could be greatly aided by a realistic assessment of the views of the Canadian business community.

For example, to what degree has top management accepted the use of computers? How much of a contribution do they feel that computers have made – or should make – to their business? What are their opinions regarding the major gaps and deficiencies in today's usage?

A number of other important questions might also be asked. Are there signs of large-scale demands for new computer applications, which could lend support to the prediction that computer usage may almost double over the next five years? How well have computers contributed to reductions in labour costs, and to better management information and control? To what level of sophistication have computers penetrated the management decision-making process and what are the expectations of top management in the future? What are the most significant obstacles in the way of a more widespread application of computers in the solution of business problems?

In an attempt to answer these questions, and to obtain information on prevailing attitudes of top management who approve EDP spending, and who therefore have a decisive voice in setting the level of sophistication of computer/communications uses in Canada, the Task Force directed a number of questions to sixty-two senior business executives during its survey of EDP users in business and industry. These questions covered three aspects:

- Extent of past contributions to business;
- needs to be satisfied by future applications, and
- current gaps and deficiencies in the operation of EDP organizations.

1. Summary

The highlights of these findings are:

- Most senior executives indicated their intention of taking a stronger role than in previous years, in planning and directing the development of computer applications, and in the operation of their EDP organizations.
- Most respondents expressed confidence that computers would play an increasingly important role in their business, once decisions were guided by a more realistic assessment of costs and benefits.
- In addition to the traditional role of computers in cutting costs of routine operations, they are also beginning to make a more significant contribution to the management process, through provision of up-to-date information regarding the operation of the business, and through aiding the formulation, execution and control of tactical and, to a lesser extent, strategic planning decisions.
- Respondents from large EDP user organizations most frequently mentioned clerical cost-reduction as the major contribution made by computers, followed by improved availability of information for planning and control of the business.
- Respondents from medium and small EDP user organizations mentioned improvements in the supply of more timely and accurate performance data as the most significant contribution, followed by cost-reduction.
- Respondents from large EDP user organizations projected improvements to the capital investment planning process as the most important EDP applications of the future, followed by additional clerical cost-reductions and better management information. The most important future applications in medium-size EDP user organizations will be those which help to raise sales volumes or revenues, followed by improvements in the supply of more timely and accurate performance data to management, and clerical cost-reductions. Respondents from small EDP user organizations consider that the most important future applications will be those which improve the availability of information to management for planning, operation and performance control of business activities.
- The responses of executives to questions on current gaps and deficiencies emphasized two basic problems: lack of user knowledge as to what computer systems can do for them, and excessive development costs and time over-runs. The level of cost effectiveness of computer operations was a significant problem to senior executives of large user organizations, but was of less importance to medium-size user organizations, and of minor consequence to small users. However, lack of cost effectiveness of the information systems-development process is considered as a significant problem by over two-thirds of all executives responding.

2. Past and Expected Contributions

Much has been written about the technological promises and achievements of computer-based business information systems. However, much less is known about their economic potential and achievements, and one searches in vain for

useful documentation on the level of acceptance of such systems by Canadian executives in business and industry. This is a rather surprising fact, when one considers that top management controls EDP spending (and therefore, collectively and indirectly the future development of the Canadian computer/communications market and the level of sophistication of computer/communications applications in Canada).

Computer systems have been applied to solve a variety of business problems, ranging from the automation of simple, repetitive clerical work to the support of comprehensive and integrated, corporation-wide planning tasks and performance control. Executives were asked to rate achieved or projected benefits of different types of applications to their business in terms of being either "very significant", "moderately significant", "insignificant" or "not known". The questions were designed to identify contributions in four areas:

(i) Clerical Work Automation: Computer-based information systems in this category are primarily designed to achieve cost-reductions by transferring routine clerical functions from manual to machine processing. Examples in this category are payroll, book-keeping, invoicing, and statistical (tabulating) applications.

(ii) Operations: Computer-based information systems in this category are primarily developed to provide operational information to management, or to perform more complex resource management functions in production, distribution, inventory control, seat reservations, etc. The prime benefits from such applications are:

- More timely and accurate historical (performance) data available to management;
- improved labour productivity;
- reduced investment in working capital.

(iii) Tactical Decisions: Computer-based information systems in this category are designed to provide management with improved information on which to base tactical decisions. Such systems usually require some integration of hitherto separate, function-oriented computer applications, and improved management of data resources within a company, or a major part thereof. The prime benefits of such systems are:

- Increased sales volume or services through, for instance, better forecasting or methods of distribution;
- more accurate and timely planning and control data available for management decision processes;
- better capital planning through, for instance, availability of financial models.

(iv) Strategic Decisions: Computer-based information systems in this category are designed to enable comprehensive and integrated, corporation-wide long-term planning, and also to monitor the performance of such plans. The prime benefit of such systems is a clearer, more realistic assessment as to the direction of the corporation's development, together with a better identification of performance trends.

(a) General Attitudes Towards Computers

All executives recognized computers as essential tools in business and, according to a number of respondents, many businesses would not be able to continue at their present level of operation without computers. Eighty-five percent of the sixty-two executives interviewed considered past contributions of computers (and information systems development) as "very significant", 13 percent as "moderately significant" and only 2 percent as "insignificant" to their businesses. Executives were perhaps somewhat less optimistic about future contributions. Seventy-seven percent expect "very significant", 18 percent "moderately significant", and only 5 percent "insignificant" additional contributions forthcoming from future computer applications.

(b) Achievements and Expectations

There were some differences in the views of executives as to the nature and level of benefits achieved through the use of computers in the business community. Clerical cost-reduction was most often mentioned by executives of large EDP user organizations as the most important contribution. Respondents from medium and small EDP user organizations listed improvements in the supply of more timely and accurate performance data as most significant, with reduction in clerical costs in second place.

Speculating on the future, executives of large EDP user organizations listed the need for more timely and accurate planning and control data for the management decision process, and for capital investment planning, as the most important contribution, with further clerical cost-reductions in second place. For medium-size user organizations, the most important computer applications of the future will be those which will help increase sales volumes and revenues; improve availability of more timely and accurate performance data to management; and reduce clerical costs. Small EDP user organizations indicated that their greatest need will be for those applications designed to improve the timeliness and accuracy of information available to management for planning, operation, and performance control of business activities.

(c) Clerical Cost Reduction — A Mixed Success

Computers have been traditionally viewed by management and computer specialists alike as powerful tools to mechanize routine clerical and accounting operations, thereby cutting clerical costs. Yet, the impact of clerical work automation on profits has had a mixed success with the business community. Executives of large EDP user organizations acknowledged that clerical cost-reduction has been a very significant benefit, but savings of this nature have been less in evidence in medium- and small-size EDP user organizations, as illustrated in Table 5.

The hopes for further significant clerical cost-reductions through future computer applications were not very high; less than half of all executives interviewed foresaw significant benefits in this area evolving from future computer applications. Most large EDP users have already successfully automated the bulk of their routine clerical functions, and have difficulty in finding new applications in this field which promise adequate economic returns on such EDP expenditures. Small- and medium-size users lack, in many cases, a sufficiently large base of routine clerical operations to justify in-house systems-development and computer operations expenditures on clerical cost-reductions alone. (See Table 6.)

(d) Application to Operational Problems

Financial benefits are possible if management is able to obtain a more accurate and current picture of business performance, or if routine decisions in the management of resources, such as inventories, labour scheduling, etc., can be automated and better optimized. About half the executives of medium and small EDP user organizations identified computer applications in this area as the major contribution of computers to improved business performance. The responses are shown in Table 7.

Better performance data and inventory control ranked high on the list of needs of respondents in medium and small EDP user organizations. However, large-size EDP user organizations expect only minor contributions from future computer applications in these areas, with more optimistic expectations from those applications designed to increase labour productivity. The extent of expected benefits of future computer applications to operational problems is listed in Table 8.

Table 5
Past Clerical Cost-Reductions

		% of Respondents by EDP User Category		
		Large	Medium	Small
The Degree to Which Computer Applications Have Reduced Clerical Costs:	Very Significant	70%	33%	50%
	Moderately Significant	10%	40%	17%
	Insignificant	10%	27%	33%
	No Known Contribution	10%	–	–

Table 6
Expected Clerical Cost-Reductions

		% of Respondents by EDP User Category		
		Large	Medium	Small
The Degree to Which Future Computer Applications Are Expected to Reduce Clerical Costs:	Significantly	40%	43%	39%
	Moderately Significant	20%	43%	28%
	Insignificant	–	6%	22%
	Not Known	40%	8%	11%

Table 7
Past Contributions to Business Operations

	% of Respondents by EDP User Category		
	Large	Medium	Small
A			
The Degree to Which Computers Have Improved the Timeliness and Accuracy of Historical (performance) Data:			
Very Significant	30%	49%	55%
Moderately Significant	20%	43%	33%
Insignificant	20%	6%	6%
Not Known	30%	2%	6%
B			
The Degree to Which Computers Have Reduced Investment in Inventories:			
Very Significant	30%	24%	28%
Moderately Significant	20%	15%	11%
Insignificant	20%	46%	44%
Not Known	30%	15%	16%
C			
The Degree to Which Computers Have Improved Labour Productivity:			
Very Significant	10%	24%	39%
Moderately Significant	10%	24%	28%
Insignificant	30%	37%	28%
Not Known	50%	15%	5%

Table 8
Expected Contributions to Business Operations

	% of Respondents by EDP User Category		
	Large	Medium	Small
A The Degree to Which New Applications Are Expected to Improve Timeliness and Accuracy of Historical (performance) Data:			
Significantly	10%	50%	56%
Slightly	20%	37%	28%
None	10%	6%	6%
Not Known	60%	7%	10%
B The Degree to Which New Applications Are Expected to Reduce Investment in Inventories:			
Significantly	20%	46%	56%
Slightly	40%	30%	17%
None	–	6%	11%
Not Known	40%	18%	16%
C The Degree to Which New Applications Are Expected to Increase Labour Productivity:			
Significantly	40%	33%	22%
Slightly	10%	37%	39%
None	–	18%	28%
Not Known	50%	12%	11%

(e) Application to Tactical Management Decisions

A frequently discussed area of computer applications is the provision of management information to aid tactical planning, and to control conformance to these plans. These applications should not be confused with the so-called total Management Information System which has achieved indifferent success. Applications of this nature are usually thought of as aids to the tactical management process, by providing information on trends in the external and internal business environment, and predictions of the impact of alternative actions on the business. Simulation models, and elementary data management approaches, which sort out and summarize data for management use, are typical applications in this area. Tangible benefits are harder to achieve in this field because of the difficulties of quantifying the value of such information, and because of the problems in communicating management needs and computer capabilities between manager and computer specialist. Nevertheless, an attempt was made to categorize benefits as (i) contributions resulting in increased sales or revenues; (ii) more timely and accurate planning and control data for the management process, and (iii) better capital investment planning.

In terms of past performance, executives of large EDP user organizations indicated that existing computer applications have helped to raise sales volume or revenues, and have significantly aided the management decision-making process. Executives in medium-size user organizations indicated improvements in sales volume and revenues through computer applications, while small user organizations found that their computer applications were most useful in management planning and control. The results of responses are listed in Table 9.

In terms of expected benefits, aid to tactical management problems ranked first on the list of needs of the majority of respondents, regardless of the size of EDP installation. Large EDP user organizations listed applications to aid the capital planning process as most important. The needs of medium-size EDP user organizations centered on applications to help raise sales volume or revenues. Small EDP user organizations saw their present needs as improvement in the availability of planning and control data for management decision – a goal not necessarily difficult to achieve, considering the less complex EDP environment of small users, and the increasing variety of management information services available from commercial sources. The degree of expected benefits from future computer applications to tactical management problems is listed in Table 10.

Table 9
Past Contributions to Tactical Management Decisions

	% of Respondents by EDP User Category		
	Large	Medium	Small
A The Degree to Which Computers Have Improved Sales Volume or Revenues:			
Very Significant	40%	40%	11%
Moderately Significant	–	27%	44%
Insignificant	40%	33%	33%
Not Known	20%	–	12%
B The Degree to Which Computers Have Improved Timeliness and Accuracy of Planning and Control Data for Decision-Making:			
Very Significant	40%	27%	44%
Moderately Significant	20%	27%	22%
Insignificant	20%	30%	22%
Not Known	20%	16%	12%
C The Degree to Which Computers Have Improved Capital Investment Planning:			
Very Significant	20%	12%	11%
Moderately Significant	10%	15%	17%
Insignificant	20%	55%	67%
Not Known	50%	18%	5%

Table 10
Expected Contributions to Tactical Management Decisions

	% of Respondents by EDP User Category		
	Large	Medium	Small
A The Degree to Which Future Applications Are Expected to Improve Sales Volume and Revenues:			
Significantly	20%	50%	33%
Slightly	20%	37%	39%
None	10%	6%	22%
Not Known	50%	7%	6%
B The Degree to Which Future Applications Are Expected to Improve Timeliness and Accuracy of Planning and Control Data for Decision-Making:			
Significantly	50%	46%	67%
Slightly	–	30%	11%
None	10%	12%	17%
Not Known	40%	12%	5%
C The Degree to Which Future Applications Are Expected to Improve Capital Investment Planning:			
Significantly	50%	30%	28%
Slightly	20%	24%	22%
None	–	37%	33%
Not Known	10%	9%	17%

(f) Application to Strategic Management Decisions

A more advanced concept of computer use in the business community is its application to strategic planning – the formulation, execution and control of business strategies. In this area, computers have been used to simulate systems incorporating variables associated with long-term business opportunities, and also have been helpful in determining optimum resource allocations to exploit such opportunities for the benefit of the enterprise.

In order to determine executive attitudes towards computer applications in the strategic planning field, questions were asked on the extent to which existing computer applications have aided the strategic planning process, and regarding what needs were foreseen in this field. The results are recorded in Tables 11 and 12.

Expectations that computers would provide increased aid to strategic planning were expressed by executives in all three user categories. Their responses are shown in Table 12.

3. Current Gaps and Deficiencies in Computer Applications

In order to obtain a better understanding of management's attitude towards EDP performance, two sets of questions were devised: the first set was concerned with problems of user acceptance, and the second with aspects of cost effectiveness. Executives were asked to identify up to three of the most important deficiencies from a list of possible inadequacies prepared by the Task Force, and to add any additional problems or requirements not included in the list.

The responses focussed squarely on only two major problems. Thirty-five out of fifty executives mentioned, as a major problem, the lack of user knowledge regarding what computer systems could accomplish. Twenty-three respondents mentioned excessive development costs and time over-runs as a major source of dissatisfaction. Generally, respondents felt that major gaps in the educational system, for both computer professionals and users, were the main cause for such deficiencies. A typical comment offered was: "We may have to wait for a new generation of users and systems-managers before we can make extensive use of computers". A more detailed presentation of the responses obtained is given in Table 13.

Table 11
Past Contributions to Strategic Management Decisions

The Degree to Which Computers Have Improved the Integrated Planning of Business Strategies:	% of Respondents by EDP User Category		
	Large	Medium	Small
Very Significant	–	3%	–
Moderately Significant	10%	15%	12%
Insignificant	30%	55%	73%
Not Known	60%	27%	15%

Table 12
Expected Contributions to Strategic Management Decisions

The Degree to Which Future Computer Applications Are Expected to Improve Integrated Planning of Business Strategies:	% of Respondents by EDP User Category		
	Large	Medium	Small
Significant	30%	37%	22%
Slightly	20%	24%	12%
None	10%	30%	50%
Not Known	40%	8%	16%

Apart from the two major problems, executives in large- and medium-size EDP user organizations were dissatisfied with the time and effort required to adjust existing systems to the changing needs of users. Small EDP user organizations were dissatisfied with the economic returns from computer applications, and their ability to perform as expected.

Fifty-three out of the sixty-two executives responded to questions aimed at exploring cost effectiveness of (i) computer operations, (ii) information systems-development, and (iii) their means to measure such. Slightly over half of the respondents from large EDP user organizations considered the current cost effectiveness in computer

Table 13
Gaps and Deficiencies in Computer Applications

Problem	All Respondents	Breakdown by EDP User Category: Large	Medium	Small
1				
Lack of user knowledge as to what the system can do for them	(1) *66%	(1) 75%	(1) 63%	(1) 67%
2				
Excessive development costs and time overruns	(2) 44%	(2) 38%	(2) 53%	(3) 27%
3				
Lack of systems responsiveness to organizational and environmental changes	(3) 28%	(2) 38%	(3) 37%	(9) 7%
4				
Economic returns on EDP expenditures	(4) 21%	(4) 12%	(6) 17%	(2) 33%
5				
Getting the right information on time	(4) 21%	(4) 12%	(4) 23%	(5) 20%
6				
Inability to get the right problem solved	(6) 19%	(–) 0%	(5) 20%	(3) 27%

*
Note:
Figures in brackets, *e.g.*, (3), indicate the ranking of the problem according to frequency of selection. The number of responses to each question is recorded as a percentage of executives responding in each user category.

operations as unsatisfactory, and as therefore posing a problem of some significance. Less concerned were respondents from medium-size user organizations, and the least concerned were small EDP user organizations. Apparently, user departments within larger corporations were frequently "stuck" with charges from their EDP department which exceeded the original estimates made during the initial systems-design phase. User departments believe that EDP charges are neither predictable nor controllable. (See Table 14.)

Respondents were far more vocal with regard to the question of cost effectiveness of information systems-design. More than three-quarters of those responding considered this to be a problem of some significance, and regarded systems-development costs and times as excessive. Frequently, budgeted costs were overrun and deadlines missed. According to comments by respondents, many difficulties seemed to originate in the definition of the concept of the system, when key points were often overlooked, and too much emphasis was placed by computer professionals on the technological challenges, to the detriment of obtaining practical solutions to business problems. (See Table 15.)

Measuring the economics of computer applications was considered by many as an almost impossible task because cost displacement, the normal yard stick, is only one part of the equation. Other aspects, such as an improved span of management control, greater attractiveness of customer services, and the impact on employee job satisfaction, still defy quantification. To gain an appreciation of management's concern about this topic, the question was posed as to whether the lack of standards to objectively measure the efficiency of computer operations and information systems-development represents a significant problem to management and to the operation of the business. The responses indicated that this does not rank as a significant management problem, as shown in Table 16.

Table 14
Cost Effectiveness of Computer Operations

The Degree to Which Cost Effectiveness of Computer Operations Still Remains a Problem:	% of Respondents by EDP User Category		
	Large	Medium	Small
Very Significant	43%	19%	7%
Moderately Significant	14%	36%	27%
Insignificant	43%	45%	66%

Table 15
Cost Effectiveness of Information Systems-Development

The Degree to Which Cost Effectiveness of Information Systems-Development Still Remains a Problem:	% of Respondents by EDP User Category		
	Large	Medium	Small
Very Significant	43%	36%	33%
Moderately Significant	43%	45%	33%
Insignificant	14%	16%	34%

Table 16
Measurements of EDP Efficiency

	% of Respondents by EDP User Category		
	Large	Medium	Small
A The Degree to Which Lack of Standards to Measure the Efficiency of Computer Operations and Information Systems Development Is Considered a Problem:			
Very Significant	–	23%	25%
Moderately Significant	43%	36%	19%
Insignificant	57%	36%	56%
B The Degree of Impact on Business Is:			
Very Significant	14%	13%	25%
Moderately Significant	14%	39%	19%
Insignificant	72%	42%	56%

Part C

Organizational Approaches to Information Processing

Introduction

The responses from executives to questions concerning the future role of computers in their businesses, outlined in the previous part, reflected an attitude of cautious optimism. Most executives expressed a somewhat skeptical view of the promises of technologists and considered the emergence of the "Cashless Society", the general-purpose "Management Information System" and "the Wired City" as opportunities for consideration in the more distant future. There was wide recognition by top management of the benefits to be derived from computer applications and of the growing dependence of businesses on computer systems.

On the other hand, the survey team was also made aware of the dissatisfaction of top management with computers: widespread problems of middle and lower management in making profitable use of computer applications within the existing structure of the organization; excessive development costs and time over-runs by the EDP organization; lack of responsiveness of computer systems to organizational, technological and environmental changes; visionary pipe-dreams of technologists which tend to raise hopes too high too soon. The practical implications of such problems have been the subject of many dissertations. McKinsey & Company reported in 1969 "that computer effort is in all but few exceptional companies in real, if often unacknowledged, trouble".[6] Dr. H. Grosch, a noted U.S. computer scientist, mentioned in his discussions with the Task Force "that the present generation of computer in the United States is utilized at a level of efficiency below 10 percent".

Closer to home, Douglas A. Louth of Price Waterhouse Associates, Vancouver, suggests that "a deep crisis of confidence in the computer exists in Canada".[7]

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[6] McKinsey & Company, Inc., "Unlocking the Computer's Profit Potential", *Computers and Automation* (April, 1969), pp.24-33.

[7] Douglas A. Louth, "The Computer – A Deep Crisis of Confidence", *Executive* (May, 1971), pp.15-8.

The two conflicting attitudes of high expectation and deep dissatisfaction prompted the survey team to probe further into these issues. It was felt that a clearer understanding was necessary as to the current "state of the art" in the evolution of computer use by the Canadian business community. To accomplish this, the survey team interviewed executives and senior EDP managers from sixty-two companies, and explored with them their approaches to computer use in their companies. These interviews concerned the following areas of investigation, considered to be important factors in the successful application of computers:

- The main purposes and objectives of computer applications;
- organizational measures taken to attain more profitable use of computers;
- approaches used in planning computer systems and applications;
- approaches used in the development of required manpower resources and critical gaps encountered in this area;
- approaches taken to protect vital business data, and security of EDP operations

The responses to these investigations primarily describe the past and current situation. The results of investigations on future uses of computers are described in the *Data Communications Survey,* to be found in this volume.

1. Summary

The highlights of the findings are:

- The vast majority of computer applications in the Canadian business community process relatively simple, but diverse, routine tasks, which were performed previously by manual means. Users expressed the belief that computers could process these faster, cheaper and with greater accuracy than by manual methods.
- Relatively few companies in Canada are in the forefront of advanced computer technology applications. Those who are, utilize their equipment to improve their competitive position within the business community. Most of these companies are very large organizations, and account for a significant share of total computer rental in Canada.
- With regard to the full exploitation of the usefulness of the computer, management at all levels is still at the learning stage. While many senior executives had assumed control over information processing in their companies, less than half of the companies surveyed had formal procedures for line-management participation in project selection. In most cases, control over computer application profitability is limited to budgetary control over the EDP department.
- While the mechanism and tools for integrating systems-development and computer operations into the mainstream of management processes had not yet evolved, attempts were being made to insure that computer development objectives converged with those of the business. Nearly two-thirds of the companies surveyed prepared periodic business plans, but the means for translating these into appropriate development plans were mostly in the early stages of production.

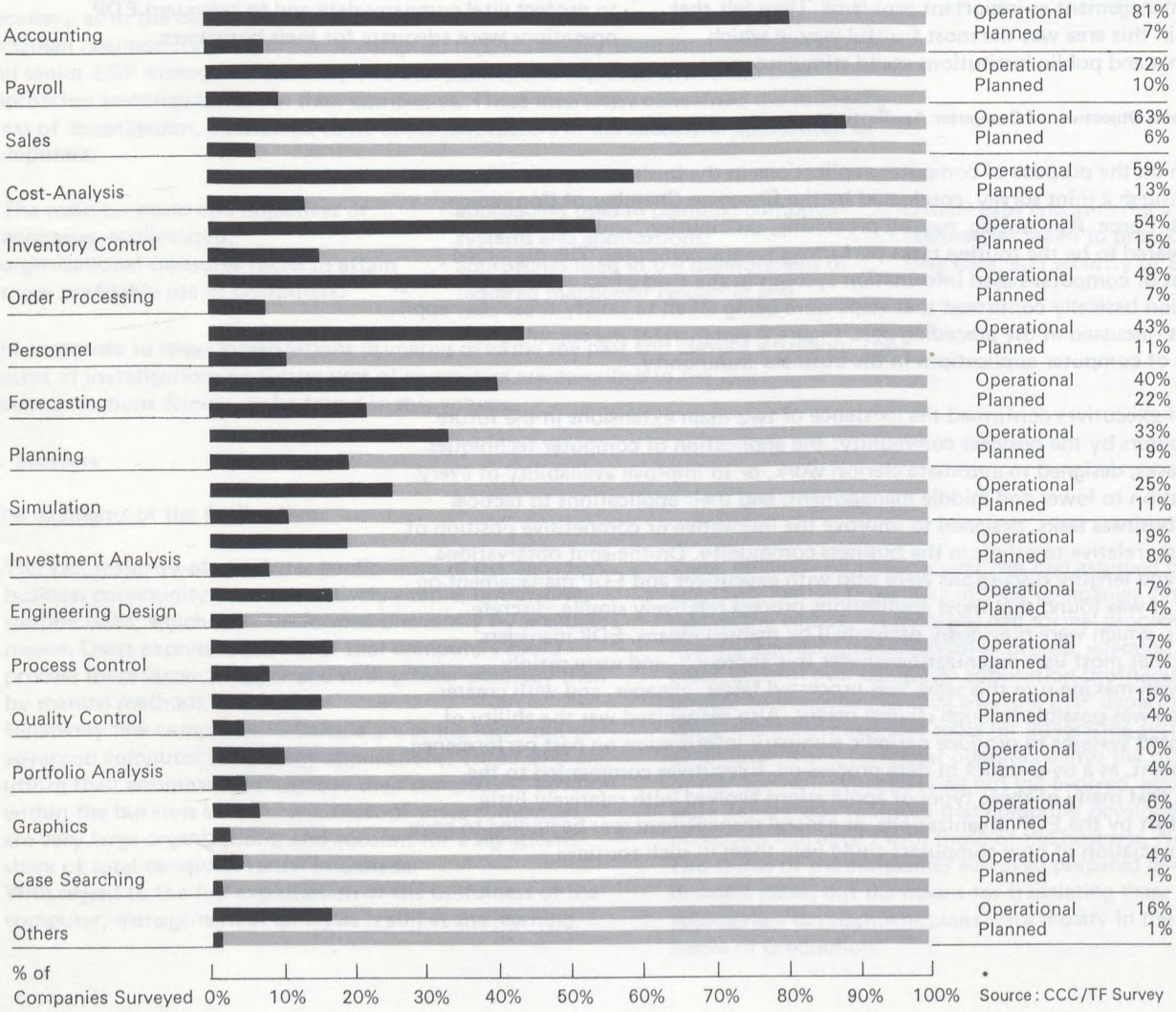
- Education and training in the field of computers and computer/communications were viewed by executives and EDP management as important problems. They felt that assistance in this area was the most fruitful way in which governments and public institutions could stimulate more effective and efficient use of computers in Canada.
- Most EDP managers considered that their security measures to protect vital company data and to safeguard EDP operations were adequate for their businesses.

2. Purposes and Objectives of Computer Applications

Information on the purpose of computer applications in the business community was obtained through a joint survey, conducted by the Canadian Chamber of Commerce and the Task Force. Accounting, payroll processing, distribution, and inventory control appeared to be the routine tasks performed by the computer. The projected development of computer-based information systems in the field of forecasting, planning, and simulation basically confirmed that steps were being taken to satisfy those new application needs discussed in the preceding part. Figure 9 summarizes the current and planned use of computer applications in the business community.

The views of executives confirmed the existence of two main extensions in the future use of computers by the business community: the application of computer techniques to routine tasks, designed to automate clerical work, or to improve availability of everyday information to lower and middle management; and their applications to tactical or strategic business tasks, designed to improve the innovative or competitive position of the enterprise, relative to others in the business community. On-the-spot observations were made, and lengthy discussions were held with executives and EDP management on this subject. If was found that most applications process relatively simple, discrete, routine tasks, which were previously performed by manual means. EDP managers commented that most user organizations prefer this approach, and were mainly concerned with making sure this work was processed faster, cheaper, and with greater accuracy than was possible through clerical means. Also recognized was the ability of computer-based systems to produce periodic summary information on past performance for management, as a by-product of data processing. Executives commented to the survey team that many of these types of applications evolved with relatively little "selling" effort by the EDP organizations, as general management was beginning to have a clearer appreciation of how computers could help them in such routines.

Figure 9
Application of Computer Services
in Business and Industry*



* Source: CCC/TF Survey

In evaluating the potential of advanced computer applications in support of specific business strategies, the survey team found that the sixty-two companies surveyed fell into one or the other of two groups: most companies were engaged in the computerization of relatively simple, but diverse everyday jobs, using traditional methods in the application design and operation; on the other hand, a small number of the companies surveyed had definite expectations on the use of computers and telecommunications to achieve specific business objectives. Examples of such uses were found in the financial community, transport, hotel and travel industries. Also a few companies in the primary industries were making use of advanced technology to improve their competitive strength on the international scale.

Those few companies who are in the forefront of advanced computer/communications applications displayed a well-defined economic purpose for the application of "leading-edge" technology, had an effective management focus on the purpose of the application, and indicated that financial and personnel resources were available for the task. Usually, executive and EDP management indicated an awareness of the economic risks in the application of "leading-edge" technology, as the price they would have to pay for leadership in their industry.

In viewing the usage of computer and computer/communications facilities by the business community in the context of the past, present, and future environment, it was therefore recognized that relatively simple, stand-alone routine applications are the "bread and butter" uses of computers in Canada now, and for some time to come. The need for large-scale systems integration, general-purpose Management Information Systems, together with associated data banks, ranked low in the scale of priorities of most of the people interviewed.

3. The Organization and the Computer

As progressively more areas of business have been affected by the computer, and as the expenditure on computer applications has increased, the need to control the effectiveness of computer applications has become more apparent. Each segment of the organization has a different perspective of the meaning of computer effectiveness. To some it may represent cost-savings, or an improved ability to plan for the business future; to others it may represent the tool for integrating control over the various functions of the business.

To assess what changes have occurred in the approaches which are used by businessmen in controlling the effectiveness of their computer operation, information was obtained from executives on:

- Top management participation in computer-systems effort, and level of reporting of the senior EDP manager;
- degree of EDP centralization;
- line-management participation in EDP project selection;
- control measures over EDP expenditures, and
- procedures used to plan computer systems and applications.

(a) Top Management Control

Many companies have made structural and organizational changes during the last few years to enable increased top management participation in EDP operations. Also, the downward course of the economic climate during 1970, as well as inflationary trends, has forced a re-examination of costs and contributions of computers. Senior executives (President, Vice-President) in over 70 percent of the companies surveyed had assumed responsibility for the EDP function. This provides, at least organizationally, the means for reconciliation of conflicting demands on the EDP organization, as is shown in Table 17.

The changes in reporting structures have also resulted in a greater degree of centralization of the EDP function. Seventy-eight percent of the companies surveyed reported that the EDP function was centralized at the corporate level; greater effectiveness of the systems-development function, and computer consolidation at the corporate level were some of the reasons offered by executives for such a change. However, many respondents emphasized the fact that the purpose of consolidating the direction of the EDP function at the corporate level was co-ordination and rationalization, and that the actual development process was still undertaken within the line department for which the system was being designed. (See Table 18.)

(b) Line-Management Participation

The responses from executives on the role of line-management in the selection of computer applications appeared to be less positive. Less than 50 percent of the companies surveyed had formal procedures for approval of computer systems-development, or for line-management participation in project selection and EDP expenditure control.

Table 17
Line of Reporting

The Senior EDP Manager Reports to:	All Respondents
President	15%
Vice-President	55%
Senior Accounting Executive	23%
Division or Branch Manager	5%
No Reply	2%

Table 18
Degree of Centralization

The EDP Function Is:	% of Respondents by EDP User Category		
	Large	Medium	Small
Centralized at Corporate Level	90%	68%	89%
Decentralized at Divisional or Lower Levels	10%	17%	–
Organized Around Functional Responsibilities	–	12%	11%
No Reply	–	3%	–

Line-management participation in project selection, approval, design and implementation plays a strong role in achieving effectiveness of computer applications. The proportions of companies having formal procedures for project approval are shown in Table 19, and the departments involved in the approval are shown in Table 20.

(c) Control over EDP Expenditures

Most companies monitored EDP expenditures through simple budgetary controls over their EDP department. A number of companies were beginning to view their EDP department as a profit centre and had implemented control measures to monitor the effectiveness of departmental expenditures and investments. The purpose of these measures was to monitor cost effectiveness of individual applications, as well as the overall efficiency of the EDP function. In some cases, user departments were charged for services rendered by the EDP organization, to help insure that such services were effective, while top management directed the overall strategy of computer applications to achieve company-wide efficiency of operations. While none of the existing control techniques can truly satisfy the needs of all users, a number of respondents claimed to have achieved greater efficiencies and effectiveness from computer expenditures through their use. Information on services charged to user departments is given in Table 21.

Table 19
Development Projects Approval Procedures

		% of Respondents by EDP User Category		
		Large	Medium	Small
Formal Procedures for Approval of Development Projects Exist:	Yes	70%	55%	28%
	No	–	24%	45%
	No Reply	30%	21%	27%

Table 20
Project Approval Participation

Project Selected for Development Requires Approval by:*	% of Respondents by EDP User Category		
	Large	Medium	Small
Executive	70%	65%	84%
Line-Management	30%	21%	22%
EDP Management	–	24%	6%
Committee	10%	18%	–
No Reply	20%	–	–

*Multiple replies possible

Table 21
EDP Expenditures Control

The EDP Department Charges for Services Rendered to Other Departments for:*	% of Respondents by EDP User Category		
	Large	Medium	Small
Systems-Development	50%	35%	17%
Systems-Maintenance	50%	35%	17%
Computer Operations	70%	41%	39%
No Reply	10%	3%	6%

*Multiple replies possible

(d) Computer-Systems Planning

Leading international consultants have stressed, time and time again, the need for adequate computer-systems planning. I. T. David and H. S. Moss of Touche, Ross, Bailey and Smart[8] defined systems planning as "the continuous process of defining systems projects, allocating resources to systems projects and controlling the performance of systems projects". The need for systems planning is evident when one considers: (i) the long lead-times required for systems-development and hardware acquisition; (ii) the problems involved in defining development priorities and user needs; (iii) the need to reconcile systems-development objectives with business objectives, and (iv) the difficulties in having the right development resources available in time for each project. Systems planning may be viewed as a two-phase process: operational planning and strategic planning. R. Greenblatt of Celanese Corporation[9] defines the processes as follows:

"OPERATIONAL SYSTEMS PLANNING is the process of developing short-term achievable objectives and producing action programs for accomplishing these objectives.

"STRATEGIC SYSTEMS PLANNING is the process of establishing enduring goals for the corporation, developing long-term achievable objectives, and selecting 'strategies' to meet these objectives that lie beyond operating group responsibilities."

To obtain a better understanding of the situation in Canadian business with regard to computer-systems planning, the survey team asked questions on the degree to which computer-systems planning was integrated with general business planning. In addition, the team obtained information from senior EDP managers on methods and information sources used in operational computer-systems planning and on their progress in the development of strategies for long-term computer utilization.

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[8] Touche, Ross, Bailey & Smart; Head, Robert V.; David, Irwin T. and Moss, Henry S., "Data Management Guidelines: Intermediate and Long Range Systems Planning", *Data Processing, Volume X* (Proceedings of the 1966 International Data Processing Conference, Data Processing Management Association, Chicago, Ill., June 21-24, 1966) (DPMA, 1966), pp.83-8, and handout at conference, "Data Management Guidelines for Long Range Systems Planning".

[9] Greenblatt, Robert, Celanese Corporation, "Strategic Systems Planning", paper presented at the 1970 Guide/Share Conference in Minneapolis, Minnesota, April 6, 1970.

It was found that, while the mechanisms and tools for integrating systems-development and computing into the mainstream of management processes had not yet evolved, attempts were being made to ensure that objectives for computer development converged with those of the business. Nearly two-thirds of the companies surveyed prepared periodic business plans, but the means for translating these into appropriate computer-systems development plans were costly in the early stages of development. Strategic computer-systems planning was observed in only two of the sixty-two companies surveyed, and only a minor interest in the use of such an approach by other respondents was noticed.

Table 22 summarizes the information obtained from executives on planning procedures in the different companies visited.

A somewhat different picture was obtained during the interviews with EDP managers. While 71 percent of executives claimed that a business plan existed on which the systems plans could be based, only 31 percent of EDP managers claimed to use the plan for computer-systems planning, as seen in Table 23.

The comments from EDP managers of large- and medium-size user organizations suggest that a wide variety of systems planning approaches are in use. An interesting approach was reported by one of the more advanced user companies. In this case, a document is prepared for discussion by the chief executive committee, outlining strategic and tactical opportunities for the use of computer/communications systems. Suitable proposals are then incorporated in the business plan and the related systems plan. Some companies reported that they were beginning to make effective use of planning committees, often involving the chief executive. In another case, systems planning was viewed as a responsibility primarily restricted to the EDP organization, with only skeleton plans made available to the executive.

4. Manpower Development

There was a broad interest among respondents in problems concerned with education and training in computer/communications. Business executives and EDP management felt that assistance in this area was perhaps the most fruitful way in which governments and public institutions could stimulate more effective and efficient use of computers in Canada.

Table 22
Computer Systems and Business Planning (Executive Viewpoint)

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Formal Business Plans Exist on Which Computer-System Plans Are Based:	Yes	70%	81%	61%
	No	30%	19%	39%
	No Reply	–	6%	–
B The Planning Horizon of the Business Plan Is:	1 Year	–	–	18%
	2–4 Years	–	11%	–
	5 Years	57%	70%	73%
	Over 5 Years	43%	19%	9%
C The Business Plan Is Revised:	Quarterly	14%	–	9%
	Semi-Annually	14%	8%	27%
	Annually	72%	92%	45%
	No Reply	–	–	29%
D Business and Computer-System Planning Procedures Are:	Integrated	40%	41%	–
	Co-ordinated	60%	38%	–
	Informal	–	21%	100%

Table 23
Systems Planning
(EDP Management View)

Systems Planning Is Triggered by:*	% of Respondents by EDP User Category		
	Large	Medium	Small
The Company Business Plan	50%	35%	11%
Requests by Users	40%	35%	22%
No Formal Plan Exists	10%	6%	17%
No Reply	20%	24%	60%

*Multiple replies possible

Executives voiced concern that EDP personnel did not have sufficient business training, experience and knowledge, and, as a consequence, sometimes had difficulty communicating with managers. And, on the other hand, managers had not always been quick to accept the new business technology embodied in computers.

In order to obtain a clear picture of problems in manpower development, the survey covered the following topics:

- Manpower needs;
- hiring practices;
- training of computer professionals;
- training of staff and management;
- accreditation of professionals.

(a) Manpower Needs

The general shortage of trained computer personnel which was evident in the sixties no longer exists because of the increased number of graduates from universities and community colleges with training in computer techniques. Also, the economic slowdown in Canada caused a number of companies to reduce their EDP staff, thus releasing trained employees into the job market. According to predictions by EDP management, new hirings during the period 1971/76 will proceed at the rate of less than 5 percent *per*

annum; this is in sharp contrast to the hiring rate of about 10 percent during the years 1966/71. University and college graduates, trained in computer science or programming, were, in fact, experiencing difficulties in finding appropriate employment at the time of the survey.

In spite of this situation of over-supply, there were still isolated shortages. Users of small computers, and some of those in less populated areas of Canada, experienced difficulties in obtaining competent analysts and programmers, probably because there is a general preference among analysts and programmers for the more sophisticated work and better remuneration to be found in large computer installations. Some users even reported difficulties in obtaining keypunch operators. The responses from EDP management on questions related to shortages of competent personnel are shown in Table 24.

(b) Hiring Practices

Nearly 70 percent of the companies interviewed hired technical staff primarily from external sources, while 19 percent obtained their personnel through internal transfers. The majority of companies appeared satisfied with the level of technical competence of those hired externally, as shown in Table 25.

Various procedures were used to assess aptitude, competence, and psychological suitability of job applicants, as indicated in Table 26.

Responses suggested the existence of a gap in understanding between universities and users. A number of EDP managers questioned the value to systems analysts of much of the computer science education, and were also not convinced that it was necessary for application programmers in the business community to have a university education. Computer science education, according to their views, placed the main emphasis on detailed knowledge of computer capabilities and operating systems, and this would be of value only to a few senior computer-systems programmers, employed in large installations.

Particular criticism was directed towards the absence of good systems analysis courses at the undergraduate level of education. It was felt that degree or diploma courses were needed, which combined computer and information systems technology with behavioural sciences, business administration, accounting, personnel administration and related subjects. It was also felt that improving the business orientation of systems

Table 24
EDP Manpower Shortages

A Shortage of Competent Computer Personnel Exists in the Following Fields:

		% of Respondents by EDP User Category		
		Large	Medium	Small
Systems-Management	Yes	20%	32%	6%
	No	80%	62%	56%
Systems-Planners	Yes	20%	38%	11%
	No	80%	53%	50%
Systems Analysts	Yes	20%	47%	28%
	No	80%	53%	39%
Applications-Programmers	Yes	10%	38%	28%
	No	90%	62%	39%
Data Communications Specialists	Yes	50%	18%	17%
	No	50%	62%	50%
EDP Operating Personnel	Yes	20%	30%	28%
	No	80%	67%	50%

Table 25
EDP Staff Hiring Practices

	% of Respondents by EDP User Category		
	Large	Medium	Small
A Technical Staff Is Hired Externally:			
Yes	70%	74%	67%
No	30%	24%	22%
B Their Level of Technical Competence Is Generally:			
Highly Satisfactory	25%	31%	42%
Satisfactory	62%	69%	42%
Unsatisfactory	13%	–	16%

Table 26
Job Applicant Evaluation Procedures

	% of Respondents by EDP User Category		
	Large	Medium	Small
The Competence of Job Applicants for Programming and Systems Analysis Positions Is Assessed Through:			
Interviews	80%	68%	61%
Standard Aptitude Tests	50%	71%	61%
Other Psychological Tests	30%	26%	–
Reference Checks	30%	15%	–
Hire Internally Only	–	6%	–

analysts would help to bridge the gap between the computer professional and those he serves. The co-operative courses in applied computer science, offered by some universities in Ontario and Quebec, were exceptions to this general criticism. In these programmes, students are exposed to problems in companies and government departments during the practical work periods which alternate with the study periods.

There appeared to be general satisfaction with application programmer training provided by the community colleges, the CEGEP's and institutes of technology in the various provinces. Application programming graduates from these schools were generally well regarded, and their training appeared to meet the expectations of the business community.

EDP managers had a generally low opinion of the quality of training offered by private commercial training institutions, excluding those of the manufacturers. They felt that, in a number of cases, selection procedures of the private schools were questionable, and that some candidates were attracted by unethical promises, and by exaggerated advertising and sales-promotional claims. In addition, cases were reported where inadequate, hands-on computer training was provided, or where the computer used for training was not of a make widely represented in that area. They stated that graduates of these institutions must frequently be re-trained after appointment. Almost two-thirds of the respondents recommended that provincial governments implement licensing measures for these institutions, or strengthen such measures where they now exist.

More than half of respondent companies criticized the commercially-available training courses provided by manufacturers, consultants, professional associations and others. Most of their criticisms were directed towards the high cost of these courses (including travel and living expenses) which limited the number of potential attendees; in addition, they felt that the content was too general, and not oriented to specific needs; and, in certain cases, there were too many subtle "sales pitches".

The combined effect of these problems, and the increased cost of training since "unbundling" occurred, had led many companies to establish or expand in-house training schemes for their EDP staff as shown in Table 27.

The procedures in use for internal training programmes varied considerably, but video tape recorded courses and programmed instruction manuals, available from commercial sources in the U.S., had become increasingly popular, as is shown in Table 28.

Table 27
Internal EDP Training

		% of Respondents by EDP User Category		
		Large	Medium	Small
Internal Technical EDP Training Facilities Are Available:	Yes	70%	76%	67%
	No	10%	24%	22%
	No Reply	20%	–	11%

Table 28
EDP Training Procedures

		% of Respondents by EDP User Category		
		Large	Medium	Small
Procedures in Use:	Manufacturers' Courses	70%	12%	6%
	Video Tape Recording	40%	12%	–
	In-House Courses	50%	18%	–
	On-the-Job Training	10%	24%	17%
	Programmed Instruction Manuals	20%	15%	6%
	Commercial Courses (other than those provided by manufacturers)	10%	15%	–
	Informal Arrangements	–	4%	39%

While executives expressed concerns with regard to training and education, most of them were satisfied with the technical competence of their personnel, as shown in Table 29.

(c) The Training of Management and User Personnel

A number of companies had taken measures in the field of user training. Management and user personnel training was being undertaken in about 40 percent of the companies interviewed, with a preponderance in the large user category, as shown in Table 30.

The methods for management and user training in computer applications varied from company to company. A very large computer user organization had an extensive, formal, management training programme, which included computer and terminal training. A number of organizations made good use of audio/visual training courses, originally developed for internal management training by a large U.S. corporation, and now sold commercially. Temporary assignments of management personnel to EDP operations were also used as a training approach by some organizations. House journals had also been found useful to familiarize employees with new computer application developments, and to help reduce the employees' nervousness regarding computers.

Some executives felt that secondary schools should devote more attention to giving their students an appreciation of the capabilities and limitations of computers. One company interviewed was making its surplus computer time available to local schools to alleviate this problem. They also felt that, as an increasing number of university-level recruits (besides computer professionals) were exposed to computers in their jobs, insufficient preparation was given by universities for these tasks. These gaps in secondary and post-secondary education had led the business community to provide in-house training facilities to attempt to overcome the suspicion and mistrust associated with the use of computers.

(d) Accreditation of Computer Professionals

Pressures have been mounting towards the attainment of a professional status and certification of competence for computer personnel in the same way that members of other professions, such as accountants or engineers, are accredited. So far, two certification programmes for computer programmers have attained a limited degree of acceptance. These are the Certified Data Processor (CDP) and the Certified Business Programmer (CBP) programmes of the Data Processing Management Association. Some

Table 29
Inadequacies in Technical Education of Computer Professionals (Executives' Views)

The Degree to Which Progress in the Application of Computers to Business Is Hindered Because of Inadequacies in the Education of Computer Professionals

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Executive Experience with This Problem:	Frequently	10%	18%	28%
	Occasionally	30%	35%	28%
	Never	30%	32%	28%
	No Reply	30%	15%	16%
B Impact of This Problem on Business:	Very Significant	10%	12%	22%
	Moderately Significant	30%	35%	17%
	Unimportant	30%	38%	44%
	No Reply	30%	15%	17%

Table 30
Management and User Training

		% of Respondents by EDP User Category		
		Large	Medium	Small
Management and User Training Programme Is Established:	Yes	80%	41%	17%
	No	10%	56%	67%

leading consultants have advocated the certification, or even licensing, of computer professionals, to ensure minimum standards of ability and adherence to a code of ethics.

Yet, the pressures for professional accreditation are not without opposition; for example, T. J. Vander Noot[10] gave, in his talk to the Ottawa Chapter of the Canadian Information Processing Society, a number of valid reasons against accreditation, the major one being the lack of an adequately defined professional profile.

Opinions of EDP managers' arrangements for certification are given in Table 31.

5. Practices and Standards for Information and Computer Systems

Formal systems practices and standards manuals for computer-systems design and operations have been developed by a number of companies because of their need to achieve increased productivity, greater operational reliability, and improved consistency of results. Some indicated that they had made large investments in such activities. Manuals for systems-development, programming and computer operations have been produced or adopted by many organizations, as shown in Table 32. In many cases, these manuals included detailed procedures for documentation of systems-design and programs, file and data structure, use of programming languages and operating systems features, data security, performance measurements, and project management.

Many EDP managers in large- and medium-size user organizations viewed standards and practices in systems-development and programming as a matter of internal concern only. A few suggested the development of national standards as a check list for internal standards, and as a means of overcoming training problems resulting from the high mobility of programmers and systems analysts. Some stated that the lack of uniform standards became most evident during the conversion from the second to the third generation of computers, which necessitated long periods of emulation until the systems were finally redesigned. Lack of standards for operating systems documentation, data communications, and optical character recognition were also mentioned as continuing problems.

[10] Vander Noot, T.J., "Some Negative Thoughts of EDP Accreditation", notes for a talk to the Ottawa Chapter of the Canadian Information Processing Society, March 15, 1972.

Table 31
Possible Arrangements for Certification

		% of Respondents by EDP User Category		
		Large	Medium	Small
Certification of Professional Competence Should Be Established Through:	Professional Associations	70%	44%	39%
	Government Licensing	20%	15%	22%
	University or College Degrees	–	15%	6%
	Technical Colleges	10%	9%	17%
	No Need	20%	–	6%

Table 32
Formal Standards and Practices in Use

		% of Respondents by EDP User Category		
		Large	Medium	Small
Formal Systems Standards and Practices Have Been Developed or Adopted:	Yes	80%	77%	33%
	No	10%	21%	56%
	No Reply	10%	2%	11%

There was no general consensus of opinion among EDP managers regarding the need for national standardization policies.

Some believed that standards, beyond those set by hardware manufacturers, impose limitations on the innovative capabilities of designers. Managers of smaller organizations suspected that standard-setting activities may favour larger users and, therefore, may not satisfy their needs. A few saw standard-setting activities in Canada as an almost hopeless task, because of powerful, vested commercial interests of hardware manufacturers and telecommunications carriers. Some felt that co-ordinated action would foster better co-operation among Canadian users, and assist in protecting Canadian interests in international standard-setting bodies.

Those organizations which had made investments in their internal standardization processes appeared least interested in the development of national policies. Many EDP managers in medium and small user organizations felt that government could support activity in this field through the provision of financial support to national standard-setting bodies; by funding research into prototype standards; and by fostering progress in standardization through its own internal use and procurement. Few would like to see enforced standards, as is clearly indicated in Table 33.

Strong concern was expressed with regard to the possible development of separate Canadian standards. There was a fear that any deviation from U.S. standard-setting practices may cause wastefulness and confusion.

6. Security of EDP Operations

The need for adequate protection of business and personal data against theft, unauthorized access, loss, and misuse is generally recognized, and measures have been adopted in a number of organizations to improve the security of EDP operations against sabotage, fire and other disasters. To obtain information on present conditions, EDP managers were asked to describe their data protection methods and security procedures.

Most EDP managers believed that their security measures were adequate for their businesses. About two-thirds of the respondents made use of off-site file storage facilities to ensure back-up of vital data in case of fire or accidental losses. (See Table 34.)

Table 33
Government Support of Standardization

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Direct Financial Support to Standard-Setting Bodies:	Yes	30%	64%	45%
	No	30%	21%	39%
	No Reply	40%	15%	16%
B Funding of Research to Develop Prototype Standards:	Yes	20%	55%	56%
	No	40%	30%	28%
	No Reply	40%	15%	16%
C Require Use of Standards in Federal Government Procurement:	Yes	40%	71%	67%
	No	20%	12%	17%
	No Reply	40%	17%	16%
D Enforcement of Standards Through Regulation:	Yes	20%	32%	22%
	No	40%	53%	62%
	No Reply	40%	15%	16%

Table 34
Security Against Loss of Files

		% of Respondents by EDP User Category		
		Large	Medium	Small
Vital Company Data Files Are Protected Through:*	Off-Site Storage Facilities	70%	67%	56%
	Separate On-Site Storage	80%	67%	44%
	No Reply	10%	–	11%

*Multiple replies possible

Security procedures with regard to entry into computer installations have been tightened since the Sir George Williams affair.[11] Computer centres are no longer considered as show-pieces for all to see. About two-thirds of respondents did not allow anyone except authorized EDP personnel to enter installations. In most cases, operators in computer areas were relied upon to recognize and challenge any unauthorized personnel attempting to enter. Others (a minority) had installed more sophisticated devices, such as remotely-operated or combination locks on access doors. The overall picture is shown in Table 35.

There was less anxiety regarding the actual theft of data. While about two-thirds of the respondents had developed basic procedures to avoid theft, or any unauthorized access to files or print-outs, the measures adopted were generally simple. Their main concern was generally focussed on unauthorized access to data, rather than the possible theft of proprietary computer programs. Companies permitting remote-access to files through terminals, relied heavily on simple passwords, and only in isolated cases were terminal codes or call-back procedures used.

Possible abuse of installations by operating staff was also a source of anxiety in most cases. About half of the respondents reported that their staff was bonded, frequently as part of a general policy for all company employees. Most employees were subject to personal checks before hiring; some checking was done by private investigator organizations, but mostly it was done by verifying references. In addition, those employees who were dismissed, no matter what the cause, were, in most cases, excluded from the computer room, to prevent possible mischief arising from retaliatory action.

Fire protection and alarm systems were used by most respondents from large- and medium-size installations, but most small installations did not have protection of this type.

One can therefore conclude that security procedures in use by the business community are, in general, simple and, while not entirely foolproof, appear to satisfy most needs.

[11] A student riot in 1969 caused the destruction of the computer centre and data files at Sir George Williams University in Montreal.

Table 35
Access to Computer Areas Restricted

	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	60%	68%	45%
No	30%	26%	45%
No Reply	10%	6%	10%

Part D

The Computer/Communications Evolution and the Canadian Business Community

Introduction

Advances in information systems-design, computer, and telecommunications technologies have given rise to new concepts of solving information systems-design problems. Of particular interest is the emergence of the "computer/communications" concept, which combines computer processing capabilities with data bank and telecommunications facilities, to provide a variety of information services to many users. The concept implies that information can be processed, stored and communicated entirely by computer and associated telecommunications facilities, with a minimum of human intervention, and that such services can be made accessible from remote terminals.

As more and more people become concerned with the evolution of computer/communications technology, an increasing number of questions are being asked. For example, how rapid and widespread is progress likely to be, and what are some of the future benefits which can be expected? In an attempt to gain answers to these questions, studies were undertaken to identify opportunities and trends in the use of such systems, and to sample the reactions of the Canadian business community to their implementation. This part of the report describes the findings of these studies.

A number of discussions took place with experts in large U.S. corporations, and with companies operating commercial computer/communications networks. They covered such topics as "the state of the art", benefits expected or achieved, and the problems encountered in the development of such systems. The information obtained was used to formulate questions for the survey of EDP users in business and industry, in order to gain a better appreciation of the Canadian situation.

1. Summary

More than half of the responding in-house computer-systems users have gained practical experience in the use of commercial computing services to augment in-house capability. However, only a few would consider replacement of in-house facilities by services provided through public computer/communications systems. Misgivings were expressed

regarding the possibility of becoming locked into a system over which users would have no managerial control.

User responses suggested that the growth of demand for raw computing power is not very large in Canada, when compared to the growth of specialized services. Greater competition in the supply of raw computing power may be expected from companies which market their surplus in-house computer capacity commercially.

There are two approaches being used by commercial operators in Canada, which are the most likely to achieve the greatest degree of user acceptance. These are: the provision of highly specialized information services marketed directly to the end user; and services to EDP organizations which augment in-house processing and systems-development capabilities.

Existing telecommunications facilities are adequate to meet the needs of most users but lack of low-speed, low-cost data transmission facilities, and the high costs of broadband facilities hinder the development of more advanced computer/communications systems in this country.

Data bank developments were underway in most large- and medium-size EDP user organizations, but most are designed for specialized purposes in support of a specific function or application. Only a small number of large user organizations were engaged in general-purpose data bank design.

Very few companies were making use of new application-design technology. Few have the resources to compete with major U.S. corporations in the application of leading-edge technologies.

Almost one-third of the surveyed companies used U.S.-based information or computing services, but the extent of such use was reported as small in comparison with the volume of information processed, stored and communicated in Canada. Much of the north/south information-flow was generated by in-house computer/communications systems of multinational corporations, but many Canadian firms used specialized services not yet available from Canadian sources.

Most users indicated preference for a government policy design which would attain a fair competitive environment in computer/communications services on the regional,

national and international scales. Restrictions on the international information-flow were viewed as having serious consequences for companies doing business abroad.

2. The In-House Computer-Systems User and the Public Computer/Communications System

To gain a better understanding of the potential participation of EDP users in public systems formation, the Task Force investigated the following aspects:

- The degree of current use of commercial EDP services by in-house computer-systems users;
- executive and systems-management attitudes on conversion from in-house processing to public- or jointly-shared computer/communications systems;
- types of computer/communications services required to satisfy user needs.

(a) Use of External EDP Services

More than half the responding companies used external facilities to augment in-house capability, and had gained practical experience in the use of service bureaux and other public facilities. Independent service bureaux appeared to be the most generally used suppliers of such services. Specialized application services, not available in-house, represented the main reason for external processing. (See Table 36.)

The sources of such services, as identified by those who replied in the affirmative, are given in Table 37, and the reasons for making use of these external services are given in Table 38.

Access to specialized software packages, such as those for operations research or for economic planning and engineering, was reported most frequently by large- and medium-size EDP user organizations as the principal reason for purchasing computer services commercially. Some medium and small users utilized service bureaux to process their payroll, billings or accounts receivable files, or to obtain aid in inventory planning, production scheduling or sales forecasting. A few used service bureaux as a back-up in emergency situations, or when application programs required computer storage capacity not available internally.

Less than a third of the small users, and almost none of the others, reported that they had used service bureaux before acquiring their first in-house computer.

Table 36
Use of External Computer Services

	% of Respondents by EDP User Category		
	Large	Medium	Small
External Facilities Are Used or Have Been Used:			
Yes	60%	62%	56%
No	20%	29%	44%
No Reply	20%	9%	–

Table 37
Sources of External Computer Services*

	% of Respondents by EDP User Category		
	Large	Medium	Small
Independent Service Bureaux	84%	57%	40%
Manufacturer's Service Bureaux	17%	29%	10%
University Facilities	17%	10%	–
Purchase Time on Private Facilities	17%	5%	–
Others	17%	5%	20%

*Multiple replies possible

Table 38
Purpose of External Computer Services

	% of Respondents by EDP User Category		
	Large	Medium	Small
Special Applications	50%	71%	60%
Work Overflow	26%	29%	20%
Software Availability	17%	19%	–
Consultation Services	–	–	20%

More than two-thirds of the respondents were satisfied with the services obtained from service bureaux. Those who were not listed costs, missed schedules, and lack of recognition of specific customer needs by service bureau personnel as their main reasons for dissatisfaction.

(b) Opportunities and Problems in the Use of Public Computer/Communications Facilities

Business executives and senior systems-managers were questioned on their attitudes towards the use of public or shared computer/communications systems, in preference to existing in-house installations. While both groups indicated that they were aware of the large-scale computer-systems' claims regarding economy, few expressed any willingness to consider the exclusive use of public facilities.

Users were concerned about the possibility of becoming "locked in" to a system over which they had neither full managerial control, nor the alternative of processing their information elsewhere when the need arose. A number of firms had explored, with other companies, the feasibility of shared facilities through the formation of a computer/communications consortium, as outlined later in this section.

More than half of all respondents reported that they had examined (some of them in great depth) the question of utilizing public or shared systems rather than in-house facilities. A further 20 percent had not done so for a number of different reasons: some because they had purchased their computer; others because they had specialized information-processing needs; and others, who already had very large systems in operation, were able to form their own private computer/communications systems. (See Table 39.)

To assess the degree and type of resistance on the part of user organizations to the utilization of public or shared computer/communications systems, a list of possible improvements, that would induce potential users to convert to such systems, was drawn up by the Task Force. Executives were asked to select from that list what they felt to be the three most important prerequisites to any serious consideration of such a conversion. It was also suggested that they add any other requirements which they felt to be of particular importance. Fifty out of sixty-two executives replied to these questions.

While computer costs played an important part in the decisions of business executives and assistant managers, many remarked that company decisions regarding their computer

system were not based on costs alone. Other factors, such as quality and consistency of processing results, job-processing time, security of vital company data and processing resources, and the level of service available to their user departments, often play a decisive role in such decisions. (See Tables 40 and 41.)

(c) Other Inducement Factors for Conversion

Executive responses varied widely with regard to the choice of other factors. Reductions in systems-development costs and time figured prominently with respondents in all user categories. Respondents from large and small user organizations recognized the advantages of being free from worry regarding the under- or over-capacity of a given computer. However, this factor ranked low with medium-size users. A lesser degree of dependence on a few in-house computer specialists in the development and operation of computer systems, and the elimination of fixed overhead costs and problems were recognized as being attractive to medium- and small-size users, but were of no interest to large users. Next in rank, were factors related to specialized data services, which would help to reduce the need for specialized in-house expertise and facilities. These responses are listed in Table 42.

Fifty out of sixty-two senior computer systems-managers responded to the same set of questions. About two-thirds would recommend conversion, if operating costs could be reduced by about a quarter.

A different approach was used to identify preferences of EDP managers regarding the conversion to public or shared computer/communications systems. A number of possible factors that might encourage such conversions were identified, and managers were asked to rate these in order of importance. Fifty out of sixty-two respondents replied to this question. Responses varied widely, and depended on size of installation and individual preferences. Managers of large user organizations favoured features which would help the organization to obtain greater cost effectiveness of operation and design, and improved security of data resources. Medium and small organizations appreciated most the flexibility and versatility of larger systems, plus greater security of data. The responses are listed in Table 43.

Most systems-managers stated that operators of public or shared facilities would have to be prepared to assist extensively in the conversion process to make such a transition technically and economically feasible. (See Table 44.)

Table 39
Use of Public or Shared Computer/Communications Studied

Did management study the question of subcontracting in-house computer operations to a public or jointly-shared computer/communications system?

	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	60%	74%	55%
No	30%	26%	38%
No Reply	10%	–	7%

Table 40
Minimum Expected Cost-Savings Required to Induce Conversion to a Public Facility (Executive View)

	% of Respondents by EDP User Category		
	Large	Medium	Small
10%	–	12%	22%
25%	60%	47%	33%
50%	–	18%	17%
Not a Main Factor	–	3%	22%
No Reply	40%	21%	6%

Table 41
Minimum Expected Cost-Savings Required to Induce Conversion to a Public Facility (EDP Management View)

	% of Respondents by EDP User Category		
	Large	Medium	Small
10%	10%	9%	22%
25%	70%	47%	45%

Table 42
Other Possible Factors Favouring the Conversion to Public or Shared Facilities

(Executive views) *

	% of Respondents by EDP User Category		
	Large	Medium	Small
Reduction of information systems-development costs and time	20%	32%	28%
Reduction of dependence on in-house computer skills and elimination of computer-systems overhead costs	–	26%	28%
Elimination of unused computer capacity	30%	3%	28%
Provision of user-oriented data services (application packages)	10%	26%	17%
Provision of interactive computing capability for technical and scientific applications	10%	26%	11%
Faster availability of needed computer capacity	–	12%	17%
Availability of consultation services	–	12%	11%
Improved responsiveness of information systems to organizational or environmental changes	–	9%	6%
Improvements in user education made available through public network operators	–	6%	–
Improved privacy and security of company data	10%	–	6%
No reply	40%	21%	6%

* Multiple replies possible

Table 43
Factors That Would Encourage the Conversion to Public or Shared Facilities (Systems-Management Views) *

	% of Respondents by EDP User Category		
	Large	Medium	Small
A Improved Data Security:			
Very Significant	50%	35%	39%
Moderately Significant	20%	26%	22%
Insignificant	–	12%	–
Not a Main Factor	20%	6%	17%
No Reply	10%	21%	22%
Ranks in Importance	2	3	1
B Improved Responsiveness to Technological Changes (software programming, etc.):			
Very Significant	50%	21%	33%
Moderately Significant	20%	41%	22%
Insignificant	10%	15%	11%
Not a Main Factor	10%	2%	12%
No Reply	10%	21%	22%
Ranks in Importance	1	9	3
C Ability to Make More Precise Trade-Off Decisions in the Selection of Software and Hardware Features:			
Very Significant	40%	32%	17%
Moderately Significant	10%	26%	39%
Insignificant	10%	15%	11%
Not a Main Factor	30%	6%	11%
No Reply	10%	6%	11%
Ranks in Importance	3	4	9
D Reduction on Systems-Development Costs:			
Very Significant	30%	41%	28%
Moderately Significant	20%	18%	22%
Insignificant	10%	18%	17%
Not a Main Factor	30%	2%	11%
No Reply	10%	21%	22%
Ranks in Importance	5	5	5

* Multiple replies possible

Table 43 cont.

		% of Respondents by EDP User Category		
		Large	Medium	Small
E Access to Consulting, Contract Programming, Educational and Systems Audit Services:	Very Significant	30%	26%	28%
	Moderately Significant	30%	28%	33%
	Insignificant	10%	21%	6%
	Not a Main Factor	20%	2%	22%
	No Reply	10%	21%	21%
	Ranks in Importance	4	8	4
F Availability of Application and Systems-Design Aids and Utility Programs:	Very Significant	20%	35%	22%
	Moderately Significant	40%	21%	33%
	Insignificant	–	21%	11%
	Not a Main Factor	3%	2%	12%
	No Reply	10%	21%	22%
	Ranks in Importance	8	6	6
G Reduction in the Number of Required In-House Skills:	Very Significant	10%	21%	6%
	Moderately Significant	40%	24%	33%
	Insignificant	10%	32%	28%
	Not a Main Factor	30%	2%	11%
	No Reply	10%	21%	22%
	Ranks in Importance	10	10	10
H Availability of Large Core Capacity:	Very Significant	20%	58%	33%
	Moderately Significant	30%	12%	33%
	Insignificant	10%	6%	–
	Not a Main Factor	30%	2%	13%
	No Reply	10%	22%	21%
	Ranks in Importance	9	1	2

Table 43 cont.

		% of Respondents by EDP User Category		
		Large	Medium	Small
I Availability of Interactive Processing:	Very Significant	30%	38%	22%
	Moderately Significant	10%	26%	22%
	Insignificant	20%	9%	22%
	Not a Main Factor	30%	6%	12%
	No Reply	10%	21%	22%
	Ranks in Importance	7	2	8
J Availability of Interactive Technical and Scientific Computing Capabilities:	Very Significant	30%	15%	6%
	Moderately Significant	20%	35%	17%
	Insignificant	20%	26%	39%
	Not a Main Factor	20%	2%	17%
	No Reply	10%	22%	21%
	Ranks in Importance	6	11	11
K Availability of Conversational Programming Capability:	Very Significant	–	29%	22%
	Moderately Significant	50%	26%	28%
	Insignificant	10%	18%	17%
	Not a Main Factor	30%	6%	11%
	No Reply	10%	21%	22%
	Ranks in Importance	11	7	7

Table 44
Conversion Assistance
(Systems-Management Views)

		% of Respondents by EDP User Category		
		Large	Medium	Small
Full Conversion Assistance Must be Available:	Very Significant	40%	59%	61%
	Moderately Significant	10%	9%	6%
	Insignificant	10%	9%	–
	Not a Main Factor	30%	2%	11%
	No Reply	10%	21%	22%

(d) Deterrent Factors to Conversion

Anxiety regarding the possibilities of the long-term survival of commercial systems-operators ranked as the most significant factor in the minds of both executives and systems-managers. This lack of confidence was based upon the importance of EDP operations to the survival of the enterprise. Of almost equal significance was the concern felt over the security of data; worry over the lack of defined legal liabilities of commercial operators in the event of business failure; non-performance; loss of data, and infringements of the legal rights of others. There was also some anxiety expressed regarding the degree of knowledge and understanding possessed by commercial operators in relation to the nature of the specific business to be served, and its requirements in data processing. Corporate policies and organization problems were also mentioned as factors, but these were considered of lesser importance.

Fifty-four out of sixty-two business executives responded to questions related to the deterrents to conversion, and the results are listed in Table 45.

Fifty-two EDP managers responded to a set of similar questions. Most of them were concerned with the risk of possible failure of a given service bureau, and the impact this

would have on the company's operations. Nearly half the respondents challenged the claim that public systems, now or in the future, could offer general-purpose data processing services at a lower cost than those available from in-house systems. Particular emphasis was laid on their fear of losing control over job-processing schedules, and the possibility that unexpected user demands could no longer be satisfied through *ad hoc* arrangements. Of lesser importance was the increased need to establish a more formal systems environment in terms of better documentation of programs, operating procedures and system descriptions, when using a commercial facility. In many cases they felt that the satisfactory processing of individual jobs was still dependent on the intimate knowledge of user department needs by computer personnel.

Data processing managers also expressed concern that operation in a commercial environment might inhibit the development of new applications. New jobs, added to in-house facilities, could usually be absorbed by available computer capacity with little incremental cost, whereas in a commercial environment full rates would be charged. Therefore, greater difficulties were expected in persuading user departments to accept and adopt new computer applications.

The major inhibiting factors in the conversion of in-house to commercial systems, as identified by EDP managers, are listed in Table 46.

3. Specialized Public Computer/Communications Systems

Data services from specialized commercial systems are still in the development phase. Offerings of this nature usually have a complementary rather than competitive relationship with in-house systems. Offerings range from large batch-processing systems (comparable in performance and operation with the in-house computer) to very specialized systems, such as, for example, point-of-sale data collection, credit services, financial and other data bank services.

Discussions with users clearly indicated that there is market interest and potential for such services. As shown in Table 36, page 68, more than half the respondents reported the use of commercial services to supplement in-house capability.

To explore individual utilization of such services, EDP managers were asked to describe the type of service which would best meet their requirements. Their responses are shown in Table 47.

Table 45
Deterring Factors in the Conversion to Public Facilities (Executive Views)

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Lack of Confidence in Long-Term Survival of Network Operators:	Very Significant	40%	56%	33%
	Moderately Significant	20%	24%	22%
	Insignificant	–	12%	22%
	Not a Main Factor	10%	2%	6%
	No Reply	30%	6%	17%
	Ranks in Importance	2	1	2
B Lack of Control Over Data Security:	Very Significant	50%	38%	33%
	Moderately Significant	–	30%	33%
	Insignificant	10%	18%	17%
	Not a Main Factor	10%	8%	–
	No Reply	30%	6%	17%
	Ranks in Importance	1	3	1
C Liabilities of Commercial Operators Not Yet Established Under the Law:	Very Significant	40%	41%	6%
	Moderately Significant	20%	24%	39%
	Insignificant	–	24%	33%
	Not a Main Factor	10%	5%	5%
	No Reply	30%	6%	17%
	Ranks in Importance	3	2	6
D Lack of Confidence in Commercial Operators to Serve Specific Business Needs Adequately:	Very Significant	40%	38%	28%
	Moderately Significant	–	15%	22%
	Insignificant	10%	26%	17%
	Not a Main Factor	20%	15%	16%
	No Reply	30%	6%	17%
	Ranks in Importance	4	4	3

Table 45 cont.

		% of Respondents by EDP User Category		
		Large	Medium	Small
E Corporate Policies May Prevent Conversion:	Very Significant	30%	30%	22%
	Moderately Significant	10%	12%	22%
	Insignificant	20%	44%	28%
	Not a Main Factor	10%	8%	11%
	No Reply	30%	6%	17%
	Ranks in Importance	5	5	5
F Organizational Problems May Prevent Conversion:	Very Significant	20%	15%	22%
	Moderately Significant	20%	41%	33%
	Insignificant	10%	30%	22%
	Not a Main Factor	20%	8%	6%
	No Reply	30%	6%	17%
	Ranks in Importance	6	6	4

4. In-House Systems User Participation in Public Computer/Communications Systems Formation

Business executives and EDP managers were aware of the potential economies of large-scale computer systems-operations, and were seeking ways of realizing the potential savings and advantages. Two general approaches were observed: first, the sale of surplus in-house capabilities on the open market; and second, efforts to interest other companies in the formation of a computer consortium.

Nearly a third of respondents sold surplus computer capacity to others. Since computer rental and operating costs are essentially of a fixed nature, revenues from such sales help directly in the reduction of computer costs. Often, the price for computer time was based on incremental rather than full operational costs, undercutting commercial operators by a considerable margin. Even at these rates, sales of computer time were still considered profitable. Greater sales of surplus capacity might be expected in the future, as over half the respondents indicated that they would consider such sales, if marketing services were available through computer-time "brokers".

Table 46
Deterring Factors in the Conversion to Public Facilities (EDP Management View)

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Uncertainties Regarding Continuity and Stability of Commercial Operators:	Very Significant	80%	53%	61%
	Moderately Significant	–	3%	–
	Insignificant	–	6%	33%
	Not a Main Factor	–	23%	–
	No Reply	20%	15%	6%
	Ranks in Importance	1	2	1
B Commercial Processing Costs Are Too High Now and Will Be So in the Future:	Very Significant	60%	50%	44%
	Moderately Significant	–	26%	17%
	Insignificant	10%	3%	6%
	Not a Main Factor	10%	6%	11%
	No Reply	20%	15%	22%
	Ranks in Importance	2	1	5
C Dependence on Job-Scheduling Capabilities of Commercial Operators to Meet User Needs:	Very Significant	60%	47%	61%
	Moderately Significant	–	21%	12%
	Insignificant	–	12%	–
	Not a Main Factor	20%	5%	5%
	No Reply	20%	15%	22%
	Ranks in Importance	3	4	2
D Loss of Control Over EDP Operations:	Very Significant	40%	44%	55%
	Moderately Significant	40%	21%	17%
	Insignificant	–	12%	6%
	Not a Main Factor	–	8%	–
	No Reply	20%	15%	22%
	Ranks in Importance	4	5	3

Table 46 cont.

E Costs and Effort Required for Conversion of Systems, Programs and Operating Procedures :	% of Respondents by EDP User Category		
	Large	Medium	Small
Very Significant	30%	47%	45%
Moderately Significant	30%	26%	17%
Insignificant	10%	6%	11%
Not a Main Factor	10%	6%	5%
No Reply	20%	15%	22%
Ranks in Importance	5	3	4

The responses of EDP managers on questions relating to the sale of in-house capabilities are shown in Table 48.

The figures in Table 49 indicate the degree of involvement of user organizations in selling excess computer capacity.

The percentage of respondents who would continue, or consider, the sale of surplus capacity if brokerage services were available to them, is listed in Table 50.

Nearly a quarter of the responding EDP managers claimed that their departments possessed unique qualifications in systems- or software-development which were, or could be, marketed inside or outside Canada. One well-known Canadian-owned company was already selling their systems services to developed and developing countries. Table 51 indicates the degree of interest among users in marketing such services. (No assessment as to the real market potential of such offerings was made by the Task Force.)

There was also evidence of a growing trend towards consortium arrangements. Executives in a number of companies reported that they had considered or implemented such arrangements, together with other companies. Many forms of organizational arrangements were evolving, to enable not only the sharing of computer/communications facilities between separate companies, but also the selling of excess computer capacity and associated services commercially.

Table 47
EDP Management Preferences by Type of Specialized Computer/ Communications Services

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Remote Batch-Processing Services:	Yes	50%	68%	67%
	No	10%	12%	11%
	Not a Main Factor	10%	8%	5%
	No Reply	30%	12%	17%
B Conversational Interactive Processing Services:	Yes	30%	50%	33%
	No	20%	18%	50%
	Not a Main Factor	20%	20%	–
	No Reply	30%	12%	17%
C Data Base-Oriented Services:	Yes	60%	47%	33%
	No	–	29%	45%
	Not a Main Factor	10%	12%	5%
	No Reply	30%	12%	17%
D Information Services (Sale of information from operator-owned data banks):	Yes	50%	47%	55%
	No	10%	26%	28%
	Not a Main Factor	10%	15%	–
	No Reply	30%	12%	17%
E Management Information-Oriented Services:	Yes	10%	44%	50%
	No	40%	50%	33%
	Not a Main Factor	20%	–	–
	No Reply	30%	6%	17%

Table 48
EDP Services Sold by In-House Systems Users*

Type of Service Sold:	% of Respondents by EDP User Category		
	Large	Medium	Small
Computer Time	40%	18%	39%
Software Services	30%	9%	22%
Programming Services	–	3%	–
Keypunching Services	–	–	11%
Do Not Sell Any Services	40%	59%	44%
No Reply	20%	18%	17%

*Multiple replies possible

Table 49
Sale of Computer Time

Percentage of Computer Capacity Sold:	% of Respondents by EDP User Category		
	Large	Medium	Small
Less Than 10%	40%	6%	10%
Less Than 50%	–	9%	6%
More Than 50%	–	–	6%
Unknown	–	3%	17%
Do Not Sell	40%	64%	44%
No Reply	20%	18%	17%

Table 50
Actual and Potential Sellers of Surplus Computer Capacity if Brokerage Services Were Available

	% of Respondents by EDP User Category		
	Large	Medium	Small
Will Continue or Consider Selling	50%	38%	39%
Will Not Sell	20%	38%	44%
No Reply	30%	24%	17%

Table 51
Potential Marketable Systems and Software Design Capabilities of Canadian In-House Systems Users

	% of Respondents by EDP User Category		
	Large	Medium	Small
Already Selling or Would Consider Selling Such Capabilities	60%	21%	28%
Not Interested	20%	56%	50%
No Reply	30%	23%	22%

Consortium arrangements tend to overcome some of the user reservations about commercial systems. Management control by participating companies over EDP operations can be maintained through direct participation in the management of the consortium. The long-term financial stability of the consortium is assured because of firm commitments by the participating companies. While the impact of consortium arrangements on Canadian computing capability is still subject to much speculation, there appear to be viable contenders in the services market.

5. Trends in Inter-Organizational Information Transfer — The Views of Business Executives

The complexity of contemporary society has brought with it an increasing need to transfer information across corporate boundaries, and between governments and industry. A typical example of such trends is outlined in *Branching Out,* Volume II, Part B-1 (page 54). Cheques cashed through the clearing system of the banking community increased from $300 million in 1950 to $1.3 billion in 1970. Information interchanges between governments and business have also increased considerably. It was thought that the need to rationalize such transfers would further contribute to the growth of computer/communications systems in Canada. Executives were therefore asked:

- To describe the current extent of inter-company information transfer in machine-processible form;
- to give an indication of their attitudes towards potential information services related to financial services, and
- to comment on opportunities and problems in government/business information transfer.

(a) Current Status

Nearly half of all respondents used information which originated in other organizations in machine-processible form. Included in this type of information transfer were: access to financial data banks; access to freight car location data banks, operated by a Canadian railroad; interchange of magnetic tapes with other firms, to reconcile accounts payable and receivable files, and payroll cheque status. The responses to this question are listed in Table 52 while the type of information received is indicated in Table 53.

Few respondents saw a strong need for standards to cover inter-company transfer of data, as shown in Table 54.

(b) Executive Attitudes Towards Financial Computer/Communications Services

Nearly half the executives interviewed would be favourably disposed towards the use of computer/communications services (potentially available from banking institutions) which would rationalize fund transfer or accounting processes, or which would improve their financial control over the business. They foresaw that direct links between their computer installations and their banks would develop within the next ten years, as shown in Table 55.

Table 52
Information Transfer in Machine-Processible Form

	% of Respondents by EDP User Category		
	Large	Medium	Small
The Company Uses Information Which Originated in an EDP Department of a Different Organization:			
Yes	60%	38%	39%
No	30%	59%	61%
No Reply	10%	3%	–

Table 53
Type of Information Received

	% of Respondents by EDP User Category		
	Large	Medium	Small
Information Type:			
Business Data	40%	21%	28%
Economic Data	–	6%	11%
Industry-Related Data	30%	15%	17%
Personnel Data	–	3%	–
Banking Data	–	3%	–

Table 54
Data Transfer Standards

	% of Respondents by EDP User Category		
	Large	Medium	Small
Standards Are Needed to Cover This Type of Transfer:			
Yes	40%	18%	17%
No	–	38%	28%
No Reply	60%	44%	55%

Payroll-Bank-Deposit Systems mechanization had already reached an advanced stage of development, as shown in Table 56. However, almost half the respondents expressed the opinion that direct deposits of wages into the bank accounts of employees would not create sufficient savings for their firms, and that many of their employees would oppose such a step.

Those replying in the negative were asked whether or not such methods had been investigated. The results are shown in Table 57.

Eight out of sixty-two respondents operated a credit card plan of their own, and an equal number of respondents accepted credit cards issued by other organizations. Five out of eight believed that within ten years a more universal credit card, or payment transfer system, would replace their in-house credit card plan. Some, however, seemed to be opposed to this, because they believed that the use of their credit cards helped to maintain customer loyalty, and provided customer service opportunities not available through universal card systems.

The present systems of transferring payments for products and services involve many transactions on the side of the creditor and debtor, as well as the banking institution, and generate sizeable expenditures for all involved. New methods, such as pre-authorized cheques and on-line payment services, are in the development stage. Forty-seven out of sixty-two executives responded to questions related to payment transfer and were unanimous in their support for an automated payment transfer system. Some, however, expressed certain reservations, such as loss of float, doubts regarding public acceptance, problems in handling NSF transfers, and potential lessening of internal control of fund management.

(c) Opportunities and Problems in Government/Business Information Transfer

The majority of respondents considered that the present state of information transfer between governments and the business community was unsatisfactory. Some respondents made cynical, or otherwise uncomplimentary comments about the way government departments collected or disseminated information. More than half of them would agree to participate in a joint industry/government effort to rectify this situation.

Table 55
Computer Links to Banks

Direct links between company and bank computers are envisaged within the next ten years to transfer funds and to improve book-keeping and financial control:	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	70%	56%	22%
No	10%	35%	72%
No Reply	20%	9%	6%

Table 56
Payroll-Bank Deposit System

Direct Payroll Credit Transfer System Is Used in the Firm:	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	50%	38%	39%
No	40%	59%	61%
No Reply	10%	3%	–

Table 57
Decision on Use of Payroll-Bank Deposit System

Reason For Not Using the System:	% of Respondents by EDP User Category		
	Large	Medium	Small
Investigated and Rejected	50%	55%	64%
Not Yet Investigated	25%	45%	36%
No Reply	25%	–	–

Many firms depend heavily on information supplied by governments in the conduct of their businesses, but a number of respondents identified problems of availability of information from government sources. The main complaints were that the information received was either too late to be effective, or not specific enough to be of direct value, as shown in Table 58.

Business executives foresaw many advantages in a joint and co-operative effort by business and governments to improve the efficiency and effectiveness of the information transfer process. (Statistics Canada is already working to this end, through discussions with business associations.) One manufacturer pointed out that government was the main source of information on possible dumped products, but publication was frequently three months' late, by which time the damage in the market had already been done, and could not be rectified. Others felt that government-provided information might help reduce marketing uncertainties, and assist in greater stability of operations.

Comments were also made about the manner in which governments collect information from businesses. Most executives felt that governments cause unnecessary additional costs to business, because of the time and money spent in the preparation of requested information. They also expressed the viewpoint that the cost of the information may be out of proportion to the benefits obtained from its use; and that little effort was made by government departments to improve information collection through the elimination of duplicate requests. The use of standard data formats and magnetic tapes in such a process was recommended.

Comments on government impact on EDP operations related mainly to changes in the tax structure, which affect many of the computerized payroll and salary systems. The question also arose as to whether it would be possible for the government to prepare standard sub-routines for incorporation into private payroll systems.

In summary, improvements in the information transfer process would not only be beneficial to national productivity, but would also expand the scope of useful application of computer/communications systems.

6. Trends in Private Computer/Communications Systems-Development

Investigations were also undertaken to determine the current and planned use of remote-access computer systems, in order to assess the status of private (in-house) computer/communications systems-development in Canada. Also stressed, was the urgent need to

Table 58
Problems in Transfer of Information from Governments to Business and Industry

A
Too Late to Be Effective
(% of responses by 62 firms):

Extent of Problem		Impact on Business	
Frequent Problem	31%	Very Significant	15%
Occasional Problem	21%	Moderately Significant	19%
No Problem	32%	Insignificant	50%
		No Reply	16%

B
Not Specific Enough For the Business:

Frequent Problem	21%	Very Significant	11%
Occasional Problem	19%	Moderately Significant	19%
No Problem	37%	Insignificant	47%
		No Reply	23%

C
Not Sufficiently Accurate For the Business:

Frequent Problem	16%	Very Significant	8%
Occasional Problem	16%	Moderately Significant	15%
No Problem	42%	Insignificant	26%
		No Reply	26%

D
Willingness to Participate in Joint Business / Industry Effort to Solve These Problems:

	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	40%	62%	61%
No	10%	27%	39%
No Reply	50%	11%	–

develop a public data communications network in Canada, which would support the formation of such systems.

To obtain a sharper awareness of any significant trends in this field, the survey team questioned executives regarding their opinions on the acceptance of terminal operations by their management and staff personnel. They also asked EDP managers to describe: their progress in the development of in-house, remote-access computing capabilities; their plans for its future use; their need for additional expertise in development and implementation, and their views on the importance of computer/communications systems to the operation of their businesses.

The Task Force also recognized that information on computer/communications systems trends could be made more meaningful if a distinction was made between the various types of systems. Therefore, the following four systems categories were defined and questions were structured to obtain separate information within these categories.

Remote Batch-Processing: covering systems which process data, entered from a remote terminal, in sequential form. Typical applications processed by such systems are payroll, sales statistics, or monthly accounting work.

Data Base-Oriented Processing: providing rapid-access to centralized data storage facilities, to obtain or deposit information in a transaction or conversation mode. Airline reservation systems, order- or inventory-status systems, and credit-checking systems are typical applications.

Conversational-Interactive Processing: enabling direct, repeated man/machine interactions, whereby the computer responds to specific instructions from terminals in a "conversation mode". Interactive scientific or engineering calculations, operation of graphic terminals, and military command systems are the more common applications of such methods.

Message-Communications Processing: collecting and costing messages (orders received in remote branch locations, job-completion notices, cash transactions) for later batch-processing, and the handling of messages between geographically separate terminal locations. Some of these systems operate as switching centres, to link remote terminals to one of a number of in-house computers, or even to interconnect computers.

(a) User Attitudes

The Task Force explored the attitude of business management toward the use of computer/communications systems. The summary of the responses given in Table 59 suggests that management was favourably disposed towards the future use of on-line information systems.

Table 59
Projected Terminal Use

		% of Respondents by EDP User Category		
		Large	Medium	Small
A Direct Use of Computers By Line-Management Through Terminals Is Foreseen to Be:	Extensive	30%	21%	22%
	Limited	50%	47%	22%
	Non-Existent	10%	24%	56%
	No Reply	10%	9%	–
B Direct Use of Computers by Staff Personnel Through Terminals Is Foreseen to Be:	Extensive	40%	32%	6%
	Limited	30%	29%	17%
	Non-Existent	20%	15%	44%
	No Reply	10%	24%	33%
C Line-Management Will Be Ready to Accept This Within:	Three Years	60%	27%	17%
	Five Years	10%	38%	39%
	Ten or More Years	–	9%	22%
	No Reply	30%	27%	22%

(b) Progress in Private Systems Formation

Transfer of computer data over telecommunications facilities has already made significant inroads into the Canadian business community. As outlined in Part A, about 90 percent of large, 47 percent of medium, and 4 percent of small EDP user firms have already installed data transmission facilities. These are expected to increase to almost 100 percent, about 85 percent and 14 percent, respectively, by 1976.

Thirty-eight out of sixty-two companies reported that they were using, or planning to use, data communications facilities for remote-access computing. These firms were asked

about the status of their computer/communications systems-development. Twenty-four firms replied; these included seven large, fifteen medium and two small user organizations. Eight firms reported that they had computer/communications systems in operation, and a further twelve claimed that such systems were under active development. One of the two small user firms reported that they had plans for computer/communications systems operation.

Two of the surveyed companies operated very large data-base-oriented computer/communications networks, while a further two had installed in-plant systems for inventory control and order-status control. A further four companies were actively engaged in such developments, and eleven respondents indicated readiness to become involved when costs of design and operations reached a more favourable level.

One respondent had installed the necessary software and hardware facilities to provide conversational-interactive processing capabilities to users in the firm. A second respondent was in the process of installing such a capability. An additional five firms had terminals installed, which were provided either by larger service bureaux or by their U.S. parent company, to make use of such services.

Three advanced message-communications-oriented computer/communications networks were observed, of which two were operated by companies in the transport industry. The third system operated an advanced order-entry application, accessible to customers through national and international public teletype networks. A further five companies reported the active development of such systems, some of which may include the handling of internal company teletype messages.

A summary of the status of computer/communications systems-development in the Canadian business community is provided in Table 60.

Almost half of the EDP managers responding to this part of the survey foresaw significant economic gains for their businesses arising out of the development of remote-batch and data-base-oriented computer/communications systems. Relatively few saw a need for the use of external expertise in the implementation of these networks, as shown in Tables 61 and 62.

Table 60
1971 Status of Computer/Communications Systems Development in the Business Community

% of Firms in EDP User Category Sample Responding

	Type of Remote Access Processing							
	Remote Batch		Data Base Oriented		Conversational Interactive		Message Communications	
EDP User Category	Large	Medium	Large	Medium	Large	Medium	Large	Medium
Status								
Operational	20%	9%	20%	6%	10%	–	30%	3%
Under Active Development	30%	15%	20%	12%	10%	–	–	12%
Considered in the Future	–	15%	20%	21%	–	–	–	3%

Table 61
Impact of Computer/ Communications Systems on Business

(Figures indicate percentages of 24 companies responding)

	Systems Capability			
	Remote Batch	Data Base Oriented	Conversational Interactive	Message Communications
Very Significant	41%	54%	17%	38%
Moderately Significant	38%	33%	29%	8%
Unimportant	4%	13%	21%	21%
No Reply	17%	–	43%	33%

7. Data Communications

Executive responses suggested that the cost of data communications was an inhibiting factor in computer systems-development, especially for small EDP user organizations. Table 63 reflects the attitudes of executives towards the cost of data communications.

This was considered to be the most significant problem faced by organizations which need computer/communications capabilities to operate their businesses. The belief was expressed that the considerable rate differential between Canada and the U.S., and other related problems, might ultimately make these organizations non-competitive with their U.S. counterparts. Line-costs posed severe restrictions on the size of the geographic area in which such services were available. Indirectly, they also affected the economic base of such firms, which are already small by U.S. standards.

The policy of Canadian telecommunications carriers to supply multi-channel facilities at a much reduced cost per channel to individual firms, while prohibiting the sharing or re-sale of such facilities among a number of users, also came under strong attack. Smaller organizations viewed this as a competitive disadvantage to themselves, which would be of no concern to very large corporations. However, the latter saw it as a problem when serving their more distant branch locations.

The technical services provided by telephone companies were described as inadequate. Users complained that many carrier representatives had little knowledge of data communications systems-design, and even had problems in interpreting the tariff structures. Users with data communications facilities across Canada reported difficulties in co-ordinating the effort of the various carriers involved in network construction and maintenance. Other problems of less importance were also reported, such as inadequate quality and reliability of data transmission, lack of available technical specifications for data transmission, and problems in obtaining the latest tariff information.

8. Data Banks

Most EDP managers in large- and medium-size user organizations were concerned about the costs and other problems created by storing business data in many, often uncoordinated, computer files. The resulting fragmentation was considered equally costly, from both the design and operations viewpoint, since each application requires its own set of computer files; and, the associated independent up-dating programs, data collection,

Table 62
Need for External Expertise for Implementation

(Figures indicate percentages of 24 companies responding)

	Systems Capability			
	Remote Batch	Data Base Oriented	Conversational Interactive	Message Communications
Essential	12%	8%	12%	21%
Desirable	17%	58%	17%	8%
Not Required	54%	34%	46%	38%
No Reply	17%	–	25%	33%

Table 63
Data Communications Costs (Executive View)

	% of Respondents by EDP User Category		
	Large	Medium	Small
A Executive Experience With This Problem:			
Frequently	40%	12%	50%
Occasionally	20%	29%	17%
Never	10%	38%	33%
No Reply	30%	21%	–
B Impact of This Problem On Business:			
Very Significant	30%	9%	39%
Moderately Significant	30%	29%	28%
Unimportant	10%	41%	33%

and verification procedures. Also, since in most of these installations, the number of computer files increases steadily, users are often confronted with conflicting information. This problem arises for a variety of reasons: for example, the timing of up-dating information in the different files may be out of phase, or slight differences in data definition or organization may result in significant differences in file information content.

As shown in Table 64, almost half the EDP managers reported plans for developing data banks to overcome such problems or to achieve a more orderly management of business data.

(a) Special-Purpose Data Bank Development

Most of the data banks under development or in operation were of a specialized nature which supported a specific function, or large application system, involving many users. (See Table 65.)

Data bank development for small EDP users had not yet reached the development stage and, when asked for specific information, EDP managers in small organizations displayed a considerable degree of uncertainty as to their future plans.

Eighteen users reported a total of sixty-two data banks, operational or under development. A breakdown by type of application of these sixty-two data banks is given in Table 66.

Forty percent of large- and 21 percent of medium-size EDP user organizations considered the impact of specialized data banks on the operation of their businesses as being very significant.

(b) General-Purpose Data Bank Development

Generalized data banks are designed for the purpose of consolidating many individual master-files into an integrated, computerized data management system, serving many applications and users. Four companies reported that they were in either the planning or development phase as shown in Table 67.

EDP managers from three small user organizations indicated involvement with generalized data bank design, but they felt that the absence of application design methodology and appropriate support software, suitable for such users, would inhibit development.

Table 64
Data Bank Development

Data Banks Are In the Planning or Development Stage:	% of Respondents by EDP User Category		
	Large	Medium	Small
Yes	80%	50%	22%
No	10%	9%	22%
No Reply	10%	41%	54%

Table 65
Status of Special-Purpose Data Bank Development

	% of Respondents by EDP User Category	
	Large	Medium
Operational Now	20%	6%
Under Active Development	20%	18%
Considered In the Future	–	6%
No Need	20%	9%
No Reply	40%	61%

Table 66
Present and Projected Specialized Data Bank Usage by Type of Data Stored

(Figures indicate percentage based on 62 data banks)

Financial or Accounting Data	34%
Product Data	26%
Marketing Data	16%
Employee Data	8%
Insurance Data	6%
Other Data	10%

Table 67
Status of General-Purpose Data Bank Development

	% of Respondents by EDP User Category	
	Large	Medium
Operational Now	10%	3%
Under Active Development	20%	–
Considered In the Future	10%	–
No Need	20%	18%
No Reply	40%	79%

Table 68 summarizes responses from thirteen companies on the problems which they feel could be alleviated by the use of generalized data banks.

In most cases, few EDP managers were willing to make an assessment of the importance of generalized data banks to the operation of their businesses, or to indicate their needs for external expertise during the development phase. Ten respondents had a total of twenty-nine generalized data banks, either under development or already in operation, and they expressed common reservations regarding the adequacy of available data management technology and software packages. (See Table 69.)

9. The North/South Information-Flow

In the period before the actual Task Force survey took place, certain important questions regarding the north/south flow of information had already been raised. They concerned the social, economic and political consequences which might result if Canadian needs for data processing, computerized information services, and east/west data communications were to be largely met by facilities and services within the U.S. It had been suggested that the failure to establish a strong Canadian presence in computer/communications might lead to the following problems:

- Loss of employment opportunities for Canadians: the use of foreign-based services may reduce the number of jobs available (quantity), especially in the higher skills (quality), suitable for personnel with college or university education.
- Loss of computer capabilities: the absence of a broad base of native capability, to develop and operate computer services and products, may lead to situations where specific Canadian needs could not be met. Important social, economic and cultural side-effects may then be expected. Specifically, national productivity, competitive ability of commerce and industry, rate of industrial growth, and the national taxation base could be adversely affected, if Canadian-based services fail to develop as expected.
- Loss of national sovereignty over information: there was concern that a significant trend towards the storing of Canadian information in foreign data banks may develop, and that this may affect the ability of Canadians to control their own affairs. Problems could be expected to arise regarding the protection of the privacy rights of both Canadian citizens and Canadian enterprises, when information is stored beyond the reach of our laws. Under these circumstances, our government and courts might well find it more difficult to exercise their right to legal access of business records. Foreign organizations might acquire knowledge about our resources and markets which we ourselves could be denied.

Table 68
Problems to Be Solved Through Use of Generalized Data Banks

(Figures indicate percentage of 13 companies responding)

	Essential	Desirable	Not Required	No Reply
Proliferation of Data in Many Files	92%	8%	–	–
Data Accuracy and Timeliness	100%	–	–	–
Program Interdependence	61%	39%	–	–
Systems Integration	61%	8%	8%	23%
Reduction of Operational and Development Costs	38%	–	8%	54%

Table 69
Present and Projected Generalized Data Bank Usage by Type of Data Stored (Figures indicate percentage based on 29 data banks)

Financial or Accounting Data	24%
Marketing Data	24%
Product Data	17%
Insurance Data	17%
Employee Data	10%
Other Data	8%

These "north/south information-flow" problems were therefore briefly explored with both executives and systems-managers in the companies which were surveyed. An attempt was made to gain some appreciation of the nature and extent of these problems in the Canadian business community. This was followed by questions related to the probable effects on business if government imposes restrictions upon the north/south flow. Finally, questions were posed which would help to identify those specific problems which are faced by the Canadian business community when they are processing data in Canadian, rather than U.S., locations.

(a) The Extent of the North/South Flow

Almost one-third of the companies in the sample used U.S.-based information or computing services, as shown in Table 70. Typical uses are: simulation models, financial planning packages and industrial information provided from a central location in the United States. A sample of such information services used by the companies surveyed includes the following:

- Interline billing services for North-American railways, located in Washington.
- Hotel reservation system, located in Memphis, Tenn. This service maintains a hotel accommodation data bank for a North-American hotel chain, and is provided and paid for under a franchise agreement with hotel owners on both sides of the border.
- Medical Information Bureau. A data bank of health information is maintained in Boston, Mass. Its purpose is to prevent fraudulent issuing of insurance policies to individuals with known health problems. Safeguards are included to prevent access by unauthorized personnel.

However, the extent to which foreign services are used was reported as small in comparison with the volume of information processed, stored and transmitted in Canada. The prime reasons for using foreign services were related to interactions between parent and subsidiary companies, or concerned with specialized commercial services not yet available in Canada. There was also a flow of information in the reverse direction, from foreign sources to Canadian computer locations.

Quantitative information on use of U.S.-based services by the companies surveyed could not be obtained. Companies treat payments for such operations as simply another service bill, and do not keep separate records. Statistics on the billing value of trans-border trade in computer-based services were not available from any government source. Thus, trans-border trade in such services can probably be classified among those invisible exports and imports which are not recorded in trade statistics.

Identifying the actual extent of the use of foreign services was further complicated by the difficulties of both defining them, and pin-pointing those links which move information across the border. Computer-based information can be moved by print-outs, punch cards, magnetic tapes, strips and cassettes, and telecommunications facilities. It is therefore virtually impossible to detect and assess, with a reasonable degree of accuracy, the value and volume of the north/south information-flow.

Eleven of sixty-two companies surveyed (18 percent) were reported as storing business data in computer facilities located outside Canada. Six of these used the facilities of their parent companies for this purpose. Three companies were storing employee data in the data banks of their parent companies. Two Canadian-owned companies were contributing and receiving information stored in U.S.-based data banks operated by industry associations. The overall picture is shown in Table 71.

(b) Possible Effects of North/South Information-Flow Restrictions

The question of the impact of possible restrictions imposed by the Canadian Government on the north/south information-flow was discussed during the survey. Thirty-five comments were received, analyzed and classified, according to the severity of the effect on the business concerned. The results which were obtained are listed in Table 72.

Protective or restrictive measures by government, which would affect the use of foreign-based services, were viewed by many executives in the companies surveyed as undesirable. They felt that such restrictions might weaken the competitive strength of their firms; add to the cost of doing business in Canada; prevent companies from marketing their products and services in the U.S.; affect the economic viability of U.S. subsidiaries of Canadian corporations; and create additional problems for the transportation-, insurance-, and financial-services industries.

Other concerns focussed on potential retaliatory action by foreign governments. This could create added problems for those members of the business community who wished to take advantage of international developments in computer/communications technology.

Executives in the transportation industry indicated that restrictions on international data flow would result in severe difficulties with their international operations, specifically with regard to interline billing procedures. Life-insurance companies operate data banks of both Canadian and foreign policy-holders in their respective headquarters locations,

Table 70
Use of Foreign Computer Services

	% of Respondents by EDP User Category		
	Large	Medium	Small
Make Use	70%	26%	33%
Do Not Make Use	30%	71%	67%
No Reply	–	3%	–

Table 71
Company Data Stored in Foreign Computer Systems

Location:	% of Respondents by EDP User Category		
	Large	Medium	Small
None	80%	68%	83%
Parent Company	10%	15%	6%
Other Organizations	–	11%	–
No Reply	10%	6%	11%

Table 72
Impact of Restriction on International Information Flow (Executive Views)

Impact:	% of Respondents	
	Canadian-Owned	Foreign-Owned
Severe	10%	21%
Moderate	8%	14%
Minor	13%	–
None	25%	21%
No Reply	44%	44%

and restriction on international data flow might force them into the uneconomic and inefficient undertaking of having to set up separate data banks in each country. A few Canadian companies depend on access to international statistical and marketing data, stored in the U.S., to operate internationally. Their executives viewed any potential access restriction as having "disastrous effects on their operations".

(c) The North/South Flow and the Multi-National Corporation

A special case for consideration is the multi-national corporation. Respondents from such corporations indicated their concern regarding the potential impact of government policies upon their internal computer/communications operations. Software is sold and bought, and computer-based data are transported both ways across international borders, to support the full range of international operations. Respondents from Canadian-owned organizations were worried about the possible effect on the operations of their U.S. subsidiaries and branch locations, which could be caused either by Canadian measures, or by retaliatory reactions of the U.S. government. Respondents from foreign-owned organizations were concerned about the counteractions of their parent companies if such restrictions interfered with the operation and management of the corporation.

Information obtained during the EDP user survey suggested that most of the multi-national corporations in the sample provide some form of in-house computer/communications services, which cross national boundaries.

The trends in the development of private computer/communications systems by multi-national corporations vary from company to company, depending on the size of operation, corporate policy, type of industry, or the unique needs of a specific firm. This survey provided some evidence of the existence of two basic trends in the use of computer/communications systems by foreign-based multi-national companies. (The long-term impact may well be far more serious than the mere loss of data processing activities in Canada.) The two trends, mentioned above, can be summarized as follows:

- In the first instance, two of the U.S.-based companies in the survey appeared to view their Canadian activities as branch operations. They were in the process of replacing their stand-alone computer facilities with terminal or satellite installations, connected to U.S.-based facilities. The ultimate intent, in such cases, is to achieve integration of the corporate systems, and to serve and control branch plants, warehouses and branch offices from the headquarters location in the U.S. Reductions in the number of management or administrative staff positions, greater corporate management control over world-wide operations, and greater efficiencies in computer operations were expected to result from a change of this nature.

- In the second instance, a number of U.S.-based multi-nationals appeared to use computer/communications as a tool, to achieve functional centralization in such fields as product design, marketing, financial control, production and distribution control, while maintaining a decentralized approach for routine data processing. A multi-national company, working in the field of electronics, suggested that this form of systems consolidation did not necessarily imply concentration of computer facilities in U.S. locations. In this specific case, computer facilities and data banks were installed in Canadian as well as U.S. locations, and were linked together by data communications facilities, to form a "distributed" computer/communications network. While overall operational and systems-design responsibility was centralized at the corporate headquarters in the U.S., to ensure corporate integration, specific development and operational responsibilities were decentralized.

A similar situation exists in the Canadian petroleum industry. A special study[12] on the processing of Canadian seismic oil exploration data in the U.S. was performed by a consultant on behalf of the Task Force, and the problem of the possible storage of geophysical data was also briefly explored during the user survey. The information obtained indicated that data security considerations, availability of proprietary software programs, and special computing facilities often govern the choice of the data processing location. The study showed that EDP charges from U.S. sources to oil companies in Canada represented about one-eighth of their total EDP budgets. Two-thirds of the cost of seismic data processing was spent in Canada.

Examples of services provided to U.S.-based subsidiaries by Canadian-owned corporations were also considered. One company, with manufacturing plants in a number of U.S. locations, performed the production scheduling for all plants from its Canadian head office. Information related to U.S. operations was also stored in Canada. Another multi-national corporation obtained financial and other information on its domestic and foreign operations through a world-wide data communications network, connected to a large headquarters computer, located in Montreal.

According to the responses obtained, computer/communications technology could provide the means of developing new forms of management and control-structures for large organizations which are independent of regional or national boundaries. Restrictive measures by government, impairing the flow of information between plants and offices

[12] Brown, A.W., Canuck Survey Systems Ltd., *Branching Out, Background Paper 10 – Oil Industry Use of Computer/Communications in Calgary (A Survey)* (Ottawa, Information Canada, June, 1971).

located in different countries, will affect, to some degree, the flexibility of organizing the management and operation of the companies concerned.

(d) The Concerns of Canadian In-House Computer-Systems Users

EDP users in the business community which operated computer/communications systems were most concerned about the cost of data communications in Canada, as shown in Table 63, page 96. They thought that higher costs, and the difficulty of obtaining the necessary services, would have a negative effect on their ability to compete with their U.S. counterparts in their respective businesses. They also felt government policies were inconsistent because, on the one hand, telecommunications carriers were protected from foreign competition but, on the other, the same protection was not extended to their businesses. Consequently, most users favoured the establishment of a truly competitive data communications environment in Canada, comparable to that of the United States, with the option of using U.S.-based services when needed.

The Canada/U.S. cost differential for the purchase or rental of computer equipment was of lesser importance to EDP users in the business community. Import tariffs and sales taxes tend to raise equipment costs by 25 to 35 percent above those paid by U.S. competitors, but the actual impact on total EDP costs is closer to 10 percent. Consequently, only large EDP users viewed this differential as a significant disadvantage in the operation of their businesses. Concern was expressed by some systems-managers in multinational companies that the combined effect of higher costs of equipment and data communications in Canada may have an impact on the decision to locate facilities in either Canada or the U.S. User responses to questions related to this differential are listed in Table 73.

Table 73
Canada/U.S. Computer Equipment Cost Differential (Executive View)

	% of Respondents by EDP User Category		
	Large	Medium	Small
A Extent of Problem:			
Very Significant	30%	3%	11%
Moderately Significant	–	18%	11%
Unimportant	40%	68%	61%
No Reply	30%	11%	17%
B Impact on Business:			
Very Significant	20%	6%	11%
Moderately Significant	–	6%	6%
Unimportant	50%	77%	66%
No Reply	30%	11%	17%

Background Papers

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The
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Background
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16 Data Communications Survey

Prepared by:
CCC/TF Ottawa
August, 1972

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Introduction

Early in 1971, while the Canadian Computer/Communications Task Force was still in its formative phase, the necessity was recognized for a better understanding of the problems and expectations created by the use of data communications services and facilities for computer/communications systems. It was felt that an understanding of such user needs was essential for the development of policy recommendations in the field of data communications. Steps were therefore taken to investigate the following areas of concern:

- The technical, economic and operational problems faced by users in adapting existing services and facilities of the telephone and telegraph companies to operate computer/communications systems;
- the identification of those user needs which will require to be met by a future Canadian data communications network.

The decision was made to obtain this information through a survey of medium- and large-size users of data communications facilities. It was felt that the experience and expertise of users with a total annual data communications billing value in excess of $12,000 each would provide more useful information. A two-part survey questionnaire was developed to guide the interviewer in collecting the required information.

Part A of the Questionnaire was used to identify the profile of the organizations surveyed, and to record responses to questions related to gaps in existing services. The purpose of this was to identify opportunities for short-term service improvements, which would be of benefit to both users and carriers.

Part B of the Questionnaire was designed for the purpose of defining the basic functional requirements for future data communications networks, and information was obtained on desired technical and economic service characteristics. This information was considered essential for preparing meaningful recommendations on data communications network development.

Initial information obtained by the Task Force suggested that at least 150 Canadian organizations in government, commerce and industry made use of public facilities to transmit data between computers and terminals. (Later, more complete information proved that this number erred by at least a factor of two.) From a list of approximately 150 organizations, sixty medium- and large-size data communications users were selected, and fifty of these organizations agreed to be interviewed. Efforts were made to ensure that the sample covered a wide representation of users in business and industry, as well as the geographic regions of Canada. Problems were encountered in obtaining adequate representation of industry viewpoints in the Maritime provinces, and two public institutions were selected instead.

Data Communications Survey

The survey was conducted during May and June of 1971 by two members of the Task Force. The senior EDP manager and, in some cases, the data communications specialist of each organization were interviewed and their responses recorded. However, a number of organizations did not reply to all questions posed, or were unable or unwilling to provide the requested information. In these cases, appropriate notations have been made in this report to indicate the actual number of respondents to specific questions.

Later in June a meeting was arranged with the management of Canadian carrier organizations to outline the initial findings of the survey. The intention of the present report is to document these findings.

For the purpose of this report, the computer/communications system is described as a large computer installation, connected through data communications facilities to a number of remote terminals, in order to provide remote-access computing or communications-oriented computer application services. "Data communications" refers to machine-to-machine communications in digital or binary form. The process of data communications requires the use of hardware and software products offered by the computer industry, encompassing communications control software, front-end computers, terminal equipment, modems, multiplexers and concentrators, as well as data transmission services offered by telephone and telegraph companies. These services include the provision of point-to-point private lines, or switched trunks of the public telephone or teletype networks.

1. Summary of Survey Results

The highlights of the findings obtained from the survey were:

- Almost half the surveyed companies operated computer/communications systems crossing national boundaries. The majority of these firms operated interconnected computer facilities in Canada and the United States, so that data could be processed and stored in both countries.
- Dedicated circuits, leased from the telephone and telegraph companies, carried the major portion of computer-based data traffic in Canada.
- The cost of data communications was viewed by respondents as a significant factor, affecting the growth of computer/communications systems in Canada. They felt that the solution was not solely a question of lowering rates, but that the provision of a wider range of data communications services, more responsive to the economic realities of computer/communications systems operation, was of equal importance.
- The majority of respondents found it difficult to obtain sufficient information on data communications services from carrier organizations. They had experienced problems in gaining access to adequate descriptions of services, rates and tariffs.

- The time required by carriers to install data communications services was considered excessive. Long delays in the provision of services caused problems to service bureaux and their customers.
- In spite of technical limitations in the use of voice facilities for data transmission, most respondents were reasonably satisfied with the operational performance of carrier facilities. It was suggested that closer co-operation between carriers, users and equipment manufacturers would help resolve a number of technical and operational problems, which would further improve network performance.
- Almost two-thirds of respondents saw a need for alternate voice communications in the operation of their computer/communications system to co-ordinate data processing activities between terminal and computer operators.
- The usefulness of various technical and operational features of a future data communications network was explored with respondents, and their replies are listed in Section 4.

2. Survey Profile

The survey covered fifty companies which are classified in Table 1. Computer service organizations represented the greatest number of firms interviewed within one category. Eighteen independent computer service bureaux, two computer manufacturers and one computer consulting firm are included in this category.

The geographic distribution of the organizations surveyed is given in Table 2.

Table 3 shows that forty-seven of the companies operated computer/communications systems which consisted of a central computer installation connected through facilities of the telephone or telegraph companies to remote terminals or satellite computer installations. Eighteen of the twenty-one computer service firms in the sample operated remote-access systems; sixteen were service bureaux; and two were computer manufacturers. Two of the remaining firms in the sample discontinued remote-access computer services prior to the survey.

Twenty-nine of the surveyed firms outside the computer service sector operated private (in-house) computer/communications systems. The level of systems sophistication ranged from a complex, on-line reservation system, with terminals throughout Canada, the U.S. and Europe, to remote job-entry systems serving a few terminals.

To gain a better appreciation of the geographic size of Canadian computer/communications systems, and the degree of their interconnection with foreign-based facilities, information was obtained from each respondent on the location of their main computer installation and termination points of leased-lines and dial-up facilities. Table 3 summarizes this information.

Table 1
Number of Organizations Surveyed by Industry Classification

Classification	Number of Companies	% of Total
Computer Services	21	42%
Primary/Resources	7	14%
Petroleum	2	4%
Manufacturing	6	12%
Distribution	4	8%
Financial Services	7	14%
Utilities	1	2%
Public Sector	2	4%

Table 2
Geographic Distribution of Companies Surveyed

Locations	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Maritime Provinces	–	–	2	7%	2	4%
Quebec	4	19%	5	18%	9	18%
Ontario	14	66%	16	55%	30	60%
Prairie Provinces	1	5%	3	10%	4	8%
B.C.	2	10%	3	10%	5	10%
Total	21	100%	29	100%	50	100%

Table 3
Geographic Extent of the Computer/Communications Systems in Organizations Surveyed

Extent of Network	Computer Services Industry		Other		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Regional	8	43%	9	31%	17	36%
National	1	6%	6	21%	7	15%
International-Canadian Data Processing	3	17%	5	17%	8	17%
International-Foreign Data Processing	3	17%	1	3%	4	9%
International-Distributed Data Processing	3	17%	8	28%	11	23%
	18	100%	29	100%	47	100%
No Facilities	3	–	–	–	3	–

About one-third of the systems were classified as "regional". In these cases, the computer had leased-line or dial-up facilities attached to serve branch offices or subscribers within a specific region of Canada. These regions are: Quebec and Ontario, B.C., the Maritimes, and the Prairie Provinces.

A small number of firms had leased-lines to terminals located in almost all regions of Canada. These systems are classified as "national" in scope.

Almost half of the companies operated systems with data links to foreign locations and their systems were classified as "international" in scope. In eight cases, Canadian-based computer facilities were linked to foreign terminal facilities, forming a Canadian computer/communications system with foreign terminations. The classification "International-Canadian Data Processing" is applied in these cases.

Four of the companies operated terminals and satellite or communications control computers in Canada which were connected to foreign-based, main computer facilities for data processing and storage. These systems are classified as "International-Foreign Data Processing".

Eleven firms operated computer/communications systems in Canada which were interconnected through medium- or high-speed data links to U.S.-based computer facilities so that data could be processed and stored in both countries. These systems are classified as "International-Distributed Data Processing".

Information on monthly data communications service charges and facility rental was obtained from forty-two companies, and listed in Table 4. In some cases, these figures included billings by foreign carriers and rental value of customer-provided facilities.

A variety of services, available from telephone and telegraph companies, were in use to link computers and terminals, as shown in Table 5. Forty-five companies responded to the request for a description of the type of services in use. Leased circuits (and, in some organizations — intercity — telephone tie-lines) carried the major portion of data traffic in Canada. Dial-up facilities to local telephone exchanges or Data Line services to distant telephone exchanges were most frequently used by members of the computer service industry. Special data-communications-oriented services, such as Multicom and Broadband, ranked next in importance. About a quarter of the surveyed systems had access to the Telex and/or TWX teletype networks.

Most large Canadian organizations operated private branch telephone systems with intercity tie trunks to access branch locations or telephone exchanges in distant cities without incurring long-distance telephone charges. The potential existed to use these telephone trunks alternately for the transmission of data, especially outside normal business hours, when intercity telephone traffic is at a minimum. Respondents were asked if such facilities were used for data traffic and their responses are shown in Table 6. Those who also use telephone tie-lines for data transmission carried from 30 percent to 80 percent of their total intercity data traffic volume over these lines.

Table 4
Monthly Data Communications Charges

Range of Monthly Charges	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
$ 1,000 – $ 4,900	4	22%	10	42%	14	34%
$ 5,000 – $ 9,900	4	22%	4	17%	8	19%
$ 10,000 – $24,900	7	39%	6	25%	13	31%
$ 25,000 – $99,900	3	17%	3	12%	6	14%
$100,000 and Over	0	0%	1	4%	1	2%
	18	100%	24	100%	42	100%
No Facilities or No Reply	3	–	5	–	8	–
Total Value	$253,000		$511,000		$764,000	
Average Monthly Charges	$ 13,400		$ 21,400		$ 18,200	

Table 5
Type of Data Communications Services Used*

Type of Service	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
a) TCTS Services						
Leased Circuits	14	78%	23	79%	37	79%
Switched Telephone	14	78%	6	21%	20	44%
TWX System	4	22%	3	10%	7	15%
Data Services	5	28%	4	14%	9	19%
b) CN/CPT Services						
Leased Circuits	2	11%	3	10%	5	11%
Telex System	2	11%	3	10%	5	11%
Data Services	4	22%	5	17%	9	19%
All Services Total	18	100%	29	100%	47	100%

*This implies that each company queried might use a number of different services from *both* suppliers in the operation of their system.

Table 6
Use of Intercity Telephone Tie Trunks for Data Communications

Tie Trunks Were Used	Computer Services Industry		Other		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Yes	3	17%	15	52%	18	38%
Not Used, or Service Not Available	15	83%	14	48%	29	62%
No Facilities	3	–	–	–	3	–
Total	21	100%	29	100%	50	100%

3. Gaps in Data Communications Services

The growing dependence of computer-systems users on services provided by telecommunications carriers has created a number of problems for both carriers and users. To identify areas of major concern to users, comments were invited on service gaps affecting economic, technical and operational performance. Respondents were asked to confine their comments to problems with existing facilities, rather than to needs related to future data communications.

(a) Economic Service Gaps

The cost of data communications was a prominent topic in the discussions with respondents. Some 70 percent of respondents reported that these costs were a major factor in decisions related to the geographic areas served by their systems. Respondents from multinational organizations frequently expressed the view that the cost of data communications in Canada could be an important factor in the decision to locate main computer facilities in Canada or in the United States.

Rate Elasticity: Respondents from the computer service industry claimed to be strongly affected by changes in the cost of data communications. Lower rates would provide the economic incentive to expand the geographic base of their markets and to offer services to the smaller users. Major increases could make remote-access computing economically unattractive to many existing customers, and alternative means for data transmission would have to be explored.

A lower proportion of the organizations outside the computer services category was sensitive to changes in rates. Almost one-third of those respondents were committed to their system in the operation of their businesses, and rate changes would appear to have only a marginal effect on their operation. A number of respondents would consider connecting branch locations in Western Canada (or Eastern Canada, with West Coast respondents) if transcontinental rates were reduced by a considerable margin. Responses on this subject are tabulated in Table 7.

Range of Services: Further discussions, related to the economic aspects of computer/communications systems operations, suggested that the solution of user problems was not solely a question of lower rates, but, more important, finding a means of closing the gaps in the range of existing data communications services. Many respondents were critical of the carriers for not responding to their specific needs, and to the economic realities of computer/communications systems operation. They expressed the view that a closer co-operation between users and carriers could be beneficial to both parties and eliminate many sources of irritation.

Lack of low-speed, low-cost, leased-line or switched data services was of concern to a number of respondents. They felt that offerings would provide an important economic incentive to form systems with an initially limited range of applications, or to expand existing systems to new locations, where the initial use was marginal, and time was required to build up sufficient transmission volume to justify more expensive facilities.

Other comments were related to major gaps in data transmission speeds which, if filled, would enable a progressive upgrade of transmission facilities as the traffic volume developed. Few offerings, for example, covered the speed range between 4,800 and 50,000 b/s. Others suggested that the transmission capability of the switched telephone network should be raised to 4,800 b/s. Further suggestions included the provision of low-speed leased lines with single-end access to the local telephone network, multi-drop services, and night-time Telpak – equivalent data services to move large volumes of data economically over long

Table 7
Price Elasticity of Demand

A Significant Change in Data Communications Rates Would Have the Following Effect on Demand for Services	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Demand Elastic to Change in Rate	18	85%	17	59%	35	70%
Demand Inelastic to Change in Rate	1	5%	9	31%	10	20%
No Reply	2	10%	3	10%	5	10%

distances. A general indication of users' attitudes related to the range of services offered is given in Table 8.

Availability of Service Information: Most respondents found it difficult to obtain adequate information on data communications services from carrier organizations. They had major problems in obtaining adequate descriptions of the available services, rates and tariffs appropriate to their needs. Some respondents felt that service representatives from carriers were inadequately trained, and received inadequate support for them to be able to assist users in finding solutions to their data communications problems. They felt that a marked contrast exists between support services provided by hardware manufacturers and those available from carriers. (See Table 9.)

Other Economic Factors: The cost of carrier-provided modems was a major irritant with most respondents. Rental rates for modems were considered a significant cost factor in the provision of remote-access services, and some respondents from the computer services industry found it most annoying to pay, in Canada, almost twice the rate charged by U.S. carriers.

Table 8
Range of Data Communications Services Offered

The Range of Services Offered by Carriers Is Considered as Being:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Too Narrow	15	72%	14	48%	29	58%
Adequate	3	14%	11	38%	14	28%
No Reply	3	14%	4	14%	7	14%
	21		29		50	

Table 9
Availability of Service, Rate and Tariff Information

Information Availability from Carriers Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Good	4	19%	6	21%	10	20%
Fair	6	29%	8	28%	14	24%
Poor	11	52%	14	48%	25	50%
No Response	–		1	3%	1	2%
	21		29		50	

Some respondents were critical of the policy of some Canadian carriers in not permitting the use of customer-provided modems and multiplexers, which, they said, affected the ability of the industry to serve some regions in Canada. Almost 90 percent of respondents in the services industry, and about half the other respondents, indicated a preference for providing their own modems in order to reduce costs and to obtain features which were not available on carrier-provided equipment.

The liberalization of tariff policies, related to the shared use of leased lines (such as Telpak) and multiplexing equipment, was favoured by about two-thirds of the respondents. It was felt that such arrangements would be effective interim measures to gain greater efficiencies from existing network facilities, and to foster the growth of computer/communications systems in Canada.

The time required by carriers to install the necessary data communications facilities was considered by respondents from the computer services industry as excessive. Delays in the provision caused problems to service bureaux and their customers.

(b) Technological and Operational Service Gaps

The use of error detection, correction techniques, and solid-state circuitry in contemporary computer hardware design has given users the confidence that computers operate virtually error-free and with great reliability. However, data communications facilities have not yet reached the same level of performance, because these facilities were designed originally for the different performance requirements of voice or telegraph communications. This variation in the level of errors leads to a number of difficulties, and the respondents were asked to describe their particular operational and technical problems in data communications.

Operational Reliability: In spite of problems caused by noise, and occasional failure of leased circuits, user responses indicated a reasonable degree of satisfaction with the level of performance, as shown in Table 10. Leased lines, conditioned for data transmission, carried most of the data traffic in Canada, primarily because of better transmission quality relative to the switched telephone system.

Most of the problems encountered by respondents using leased-line facilities occurred during the first few months after installation. Locating the source of trouble was a problem with many respondents. Difficulties were encountered in tracing the problem to

Table 10
Data Transmission Reliability

Data Transmission Reliability Is Considered as:	Switched Circuits		Leased Circuits	
	Number of Organizations	%	Number of Organizations	%
Good	14	40%	23	54%
Fair	15	43%	12	29%
Poor	6	17%	7	17%
Not Used	15	–	8	–

either hardware, software, customer-provided equipment, or to carrier facilities, which often resulted in unnecessary calls for service personnel. A number of respondents were critical of the technical competence of carrier personnel who service complex computer/communications equipment, and it was suggested that improved training was essential.

Service interruptions of leased-line circuits were a problem with respondents who required zero down-time in the operation of their system. Some were very critical of having to pay full rates for back-up facilities, needed only when carrier-provided facilities failed. Problems were reported in obtaining adequate services for the installation and maintenance of circuits which crossed regional or national boundaries. Some respondents found it necessary to deal individually with each carrier involved, rather than to rely on internal co-ordination among carriers. Transmission quality variations on overseas data circuits were a problem to some users.

A number of respondents who relied on the switched telephone network for data transmission reported difficulties in obtaining sufficiently noise-free lines, suitable for data transmission. In some cases several dial-up attempts were necessary to secure adequate transmission quality. Because of this problem, transmission speed was usually restricted to 1,200 b/s, when 2,400 or 4,800 b/s would have been more desirable.

Table 10 summarizes the attitudes of users to the reliability of data transmission facilities of the carriers.

Performance Specifications: A computer/communications system contains many hardware and software components, provided by a number of different suppliers, and its overall performance can be seriously degraded if one of these components fails to perform as expected. A set of questions was developed to identify user problems related to data communications standards.

A number of respondents felt that clear specifications, written so that they could be understood by computer personnel, on the technical performance of each service would help to eliminate many sources of irritation between user and carrier maintenance personnel. Many problems centered on testing practices for line facilities and modems. Standards must be developed so that the carrier, equipment supplier and user personnel can co-operate better with each other. Many respondents expressed the opinion that their own network integrity would be improved if equipment suppliers and carriers would develop mutually acceptable equipment performance standards and apply these to their products.

Foreign Attachments: Steps have been taken by some Canadian carriers to ease restrictive policies on the attachments of customer-provided equipment to their facilities. A number of respondents indicated there were problems in the use of customer-provided modems for switched services, and, they also encountered difficulties in the correct interpretation of carrier tariffs.

Network Interconnection: Network interconnection was both an economic and a technical issue with most respondents. They appeared to be satisfied with the policies of Canadian carriers (and U.S. carriers, in the case of international computer/communications systems) in providing leased-line facilities with a minimum of restrictions which allowed access to the switched telephone, TWX and Telex networks. This permitted firms operating computer/communications systems to select the most attractive offering from a number of competing carriers of national, continental and overseas data traffic. A number of respondents suggested interconnection between the CN/CPT network and the public telephone network, so that CN/CPT could become a stronger competitor in the provision of switched services for remote-access computing.

Lack of technical standards to facilitate network and equipment interconnection was mentioned by many as an important problem which must be solved. A number of respondents had technical difficulties in connecting their equipment to carrier facilities, or in interfacing the facilities of Canadian carriers with those of the U.S. carriers. They saw the necessity for better interconnection standards, developed jointly by carriers, equipment manufacturers and users.

4. The Future Data Communications Network

Discussions between Task Force personnel and representatives of U.S. and European telecommunications carrier organizations revealed that many countries had expended considerable effort in an attempt to define the economic and technical feasibility of data communications network development. In some countries, these activities had already reached a concrete planning phase in terms of functional requirements to be met by the network, and the type of switching and transmission equipment proposed. Most of these carrier organizations have opted for an electronically-switched data communications network, which would be functionally independent of existing public telephone networks, while sharing local distribution and long-distance transmission facilities. Some of these carrier organizations had announced their intention of offering switched data transmission services for both computer data and message traffic in the second half of this decade. Canadian carrier organizations indicated, at the time of the survey, that they intend to make similar services available, perhaps even in advance of those to be offered by foreign carriers.

To gain an appreciation of Canadian user requirements in any future national data communications network, a number of questions were posed during this survey which covered essential technical and economic aspects.

(a) Digital Transmission

The use of digital transmission technology in data communications promises major benefits to users. Long-distance transmission costs are expected to drop significantly, modem costs will be eliminated, and error rate and circuit availability performance are expected to improve by several magnitudes. However, the conversion from analogue to digital transmission will not be without problems for some users. Digital data transmission facilities cannot be used alternately for both data and voice communications. This feature is of no importance in the operation of the more advanced computer/

communications systems, but many of the less sophisticated systems still rely on voice communications to co-ordinate data processing between the terminal user and the computer operator prior to the actual transmission of the data. This approach poses no problems as long as analogue facilities are used which are designed to carry both voice and data alternately. To assess the extent of use of voice communications in computer/communications system operation, respondents were asked about their needs, and also to describe their main goals.

Almost two-thirds of respondents saw a need for alternate voice communications in the operation of their computer/communications systems. Fifty-two percent use voice communications to co-ordinate data processing activities, while 10 percent require voice communications to facilitate network maintenance. (See Table 11.)

It may appear that these responses cast some doubt as to the usefulness at this time of a purely digital network to many organizations operating computer/communications systems. It must, however, be noted that many respondents based their reactions to this question on their experience with analogue facilities and on the current state of technology. The attitudes of respondents regarding the need for alternative voice facilities could well change if digital facilities prove to be less costly and superior in performance, and if new equipment and communications protocol approaches become available to support communications between terminal and computer operators in all systems.

(b) Interconnection

There is a growing trend in many countries to merge existing and similar services into a general-purpose data communications network, and to interconnect such networks with those of other countries. Respondents were asked to indicate their needs for access to the Telex and TWX networks and international services. Their responses are shown in Tables 12 and 13.

(c) Rate Structure

Early submissions to the Task Force indicated that the application of distance-dependent telephone rates to data communications was a source of concern to respondents. This subject was therefore addressed in the survey by inviting comments on how rates should be structured in order to be fair to both carriers and the user community.

Table 11
Need for Alternate Voice Services

Alternate Voice Services Are Required	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Yes	10	47%	21	72%	31	62%
No	9	43%	4	14%	13	26%
No Reply	2	10%	4	14%	6	12%

Table 12
National Network Interconnection

Access to TWX and Telex Services Is :	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	8	38%	8	28%	16	32%
Desirable	9	43%	18	62%	27	54%
Not Required	3	14%	–	–	3	6%
No Reply	1	5%	3	10%	4	8%

The responses obtained suggest that users preferred a structure which would be more closely related to the cost of services. Forty-four firms responded and over 90 percent indicated a preference for a fixed base, plus a measured service rate. It was suggested that the base rate should be related to the cost of subscriber equipment dedicated for subscriber use, while the measured rate should take into account factors such as holding time, transmission speed of the selected circuit, and distance.

(d) Network Performance Characteristics

The two basic modes of remote-access computing are remote batch- and time-sharing. The latter mode includes conversational, transaction and message communications-oriented processing. These two modes pose different requirements on a future data communications network and the relative importance of network features were therefore discussed with respondents.

The requirements for remote batch-processing are oriented towards supporting a high-volume data transfer rate between the terminal and computer and a low-volume return rate, to indicate that the receiver has got the message correctly. Initial set-up time for the circuit is not critical and electro-mechanical switching speed of connection appears to be adequate for the purpose. Time-sharing, on the other hand, involves interactions between man and computer, and long set-up times or transmission delays are to be avoided. High-speed switching, in the order of a fraction of a second, is required. Table 14 indicates the number of respondents who would be satisfied with low-speed call set-up time *versus* those who would require high-speed switching.

In an attempt to overcome this drawback, new transmission techniques, such as store-and-forward, have been developed to achieve greater efficiencies at the expense of network response time. To obtain opinions on the desirability of such services, respondents were asked if the future network should provide services by class of message priority at appropriately scaled rates. Thus, time-sharing services, where response times are critical but transmission volumes are low, would be serviced and charged differently than for remote batch or data acquisition services, where transmission delays are not as critical. The responses are shown in Table 15.

Long-haul transmission circuits provide for full duplex operations, *i.e.*, data can be transmitted in both directions simultaneously. Computer systems and terminals, on the other hand, usually communicate with each other in a half-duplex mode. Data is

Table 13
International Network Interconnection

Access to International Network Is:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Required	17	81%	25	86%	42	84%
Not Required	3	14%	2	7%	5	10%
No Reply	1	5%	2	7%	3	6%

Table 14
Network Response Time

The Required Maximum Connect and Transmission Delay Time Is:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
200 Milliseconds	14	66%	10	35%	24	48%
2 Seconds	2	10%	5	17%	7	14%
20 Seconds	3	14%	9	31%	12	24%
No Reply	2	10%	5	17%	7	14%

flowing in only one direction at a time while the opposite direction remains idle. The cost of this unused transmission capacity becomes a significant factor when large volumes of data have to be transmitted over greater distances. As a consequence, the economic feasibility of remote batch-processing or data acquisition over great distances becomes marginal.

The importance of full duplex operations to respondents was also determined, and the results are shown in Table 16.

A wide variety of data formats and codes are in use to suit the specific operational requirements of computer and terminal equipment (Baudot, ANSCII, BCDIC, EBCDIC) or data compression needs for storage or transmission (word, byte, packet). Experts have therefore suggested that a data communications network must achieve code transparency, *i.e.*, it must have the capability of transmitting in any code. User views on the need for code transparency are listed in Table 17.

Most of today's terminal equipment for time-sharing operation and message traffic are key-driven mechanical devices, and the input/output speed is matched to the ability of human operators to manipulate the keyboard. Therefore, data traffic operates mainly in the low-speed range, but there are signs that later generations of terminal equipment will be equipped with buffers, so that the speed of transmission is no longer dependent on the printing and typing speed of the terminal. This situation raised the question as to whether or not the network should be capable of serving both synchronous and asynchronous terminals. The responses to this question are recorded in Table 18.

(e) Terminal Interconnection and Signalling

A fundamental consideration in data communications is to pose as few restrictions as possible on the operational characteristics of terminal equipment, so that the future network can support the widest possible range of data processing and data communications applications. This implies that the network must not only support terminal equipment transmitting at different speeds and codes, but also provide the means to prevent interconnections between speed- or code-incompatible terminals. For example, a five-level code teletypewriter, within a Telex network, cannot directly transmit a message to an eight-level code machine used in the TWX system, and any accidental, direct interconnection may cause interference in the operation of subscriber equipment. The opinions of respondents as to the importance of such a feature are listed in Table 19.

Table 15
Services by Class of Transmission Priority

A Network Service Which Provides Several Classes of Transmission Priority Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	4	19%	8	27%	12	24%
Desirable	8	38%	15	52%	23	46%
Not Required	8	38%	4	14%	12	24%
No Reply	1	5%	2	7%	3	6%

Table 16
Full Duplex Transmission Capability

Full Duplex Transmission Capabilities Are Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	17	80%	16	55%	33	66%
Desirable	2	10%	10	35%	12	24%
Not Required	2	10%	1	3%	3	6%
No Reply	–	–	2	7%	2	4%

Table 17
Data Transmission Code Transparency

Code Transparency Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	12	57%	21	73%	33	66%
Desirable	7	33%	5	17%	12	24%
Not Required	1	5%	1	3%	2	4%
No Reply	1	5%	2	7%	3	6%

Table 18
Asynchronous Operations

Asynchronous Transmission Capability Is Considered to Be:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	14	67%	17	59%	31	62%
Desirable	7	33%	9	31%	16	32%
Not Required	–		1	3%	1	2%
No Reply	–		2	7%	2	4%

The need for public data communications networks, capable of serving a wide variety of devices, ranging from large-scale computers to simple teletype machines, considerably increases the complexity of the necessary signalling procedures between the terminal devices of subscribers and the network. Subscriber/network signalling, such as dial pulses, busy signal and ringing, will no longer suffice. Features are needed to make call origination (including dialing, and the selection of circuits suitable for the required transmission code and speed) and answering, compatible with both automatic and manual operations. The International Telegraph and Telephone Consultative Committee (CCITT) has made a number of recommendations on this subject, and the opinions of respondents regarding their needs for such features were obtained.

More than half the respondents viewed as essential the provision of both automatic (device-originated) and manual-call origination, as shown in Table 20.

An even stronger response was obtained on the need to establish automatic connection between the called terminal device (computer, remote terminal) and the network without operator intervention, as shown in Table 21.

Identification of the calling subscriber by the switching system of the network was considered an important security feature, to prevent accidental or deliberate penetration into computer systems by unauthorized users. Table 22 indicates the respondents' rating of the necessity for such a feature.

(f) Data Transmission Error Rates

The transmission of data over digital facilities promises a considerable drop in network-induced transmission errors. Typical error rates for present switched data communications services, using the facilities of the public telephone network, are one error in 100,000 bits (10^5) while digital facilities are being designed for a rate of less than one error in 10,000,000 bits (10^7).

To assess the importance of transmission error performance to users, they were asked whether the present systems performance (10^5) was satisfactory, whether digital network performance requirements (10^7) were more desirable, or whether the expected network performance should be made virtually error-free (10^{10}) through the use of network-controlled error correction techniques. The responses are shown in Table 23.

Table 19
Blocking of Interconnections Between Incompatible Terminals

Blocking Features to Interconnection Between Incompatible Terminals Are:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	1	5%	7	24%	8	16%
Desirable	6	29%	13	45%	19	38%
Not Required	12	56%	5	17%	17	34%
No Reply	2	9%	4	14%	6	12%

Table 20
Automatic and Manual-Call Origination

Automatic and Manual-Call Origination Are Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	9	43%	18	62%	27	54%
Desirable	7	33%	6	21%	13	26%
Not Required	5	24%	3	10%	8	16%
No Reply	–	–	2	7%	2	4%

Table 21
Automatic Call Answering

Automatic Answering by the Called Device Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	18	85%	20	69%	38	76%
Desirable	2	10%	6	21%	8	16%
Not Required	1	5%	1	3%	2	4%
No Reply	–	–	2	7%	2	4%

Table 22
Identification of the Calling Subscriber

Network-Originated Identification of Calling Subscriber Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	6	28%	19	66%	25	50%
Desirable	9	43%	7	24%	16	32%
Not Required	5	24%	–	–	5	10%
No Reply	1	5%	3	10%	4	8%

Table 23
Transmission Error Rate Performance Requirements

Network Error Probability Should Be Less than One Error in:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
10^5 Bits	5	24%	12	41%	17	34%
10^7 Bits	12	56%	9	31%	21	42%
10^{10} Bits	2	10%	4	14%	6	12%
No Reply	2	10%	4	14%	6	12%

(g) Computer/Communications System Requirements on the Public Data Communications Network

The most common arrangement of contemporary computer/communications systems is a large data processing facility connected to a self-contained, dedicated communications network. The central processing unit, sometimes augmented by front-end computers, performs the dual function of data processing and data communications control. Leased lines, sometimes used in conjunction with multiplexing or concentrating equipment, are the most common form of data links between the computer and remote terminals.

This arrangement is costly in terms of both development and operating expenditures. A considerable portion of operating time and memory of the central processing unit, or front-end computer, is devoted to data communications control, and therefore is not available to data processing tasks. Leased lines are permanently connected, and their cost bears no relationship to actual use. Stand-by equipment and duplicate line facilities are often installed as back-up facilities, to permit continuous systems operation during line – or equipment – failures.

Many respondents viewed the communications capability of their system as a kind of overhead for extending data processing capability to remotely-located users. They expressed the view that they were forced into the development of their communications network because public network facilities, suitable for their purposes, were not available.

Some network designers took the view that a public data communications network, designed to meet the requirements of computer/communications systems operation, is an economically superior alternative to many dedicated networks. This implies availability of suitable line-switching arrangements, and availability of the more common network control features in the public network, eliminating the need to duplicate such features in each computer/communications system.

Electronically switched data transmission may prove to be an attractive alternative to most leased-line arrangements in computer/communications systems. Greater line utilization and improved circuit availability could be expected, bringing lower costs and greater flexibility to the user of such services. At the same time, computer services, offered by service bureaux, will become more accessible, and the data transmission capability between computers in different organizations will be improved.

However, most computer/communications systems are designed as closed networks. Terminal access is restricted to the central computing facility only or, in some cases, also to other terminals within the network. Deliberate or accidental interconnection to outside terminals could endanger the security of information handled within the system. To support this mode of operation, features could be incorporated in the switching systems of the public network which would facilitate the formation of closed networks nested within the public network. Respondents were therefore asked to rate the usefulness of closed network features to their operations, assuming that these could be provided more economically from carrier organizations.

Abbreviated Dialing and Hot-Line Services: The most elementary form of closed network services is the use of abbreviated dialing and hot-line service features. While not restricting access from outside terminals, the computer and terminals would operate in a closed network mode. A service demand (off-hook condition) by a terminal would cause the switching system to retrieve from its memory the full number of the main computer facility and establish a direct connection. This feature is known as the "hot-line" service. Conversely, the computer could establish a direct connection to a specific terminal within

the network, by transmitting one or two digits to the switching system, which would then retrieve the full number of the terminal and establish the connection. This is known as the "abbreviated dialing" service. The usefulness of these features was rated as listed in Table 24.

Closed Network Services: This would essentially provide similar services to those outlined above, with the important difference that accidental or deliberate access to, or from, outside terminals would be prevented. Network privacy would be maintained in spite of using public switching and trunk facilities. Its usefulness was rated as listed in Table 25.

Self-contained, dedicated computer/communications systems require complex hardware facilities and software to operate the communications control functions within the system. Conversions from computer to terminal code and speed, polling, message-framing, switching and multiplexing are some of the many functions performed. Some designers had taken the view that these functions could be performed more economically and more reliably when centralized into the public switching system. The practicality of this approach was explored with the respondents, and the results are described in the Section which follows.

Code Conversion Services: The purpose of this service would be to translate messages between terminals using different codes. It would, for example, translate a computer message transmitted in EBCDIC code to the code used by the terminal. Its usefulness was rated as listed in Table 26.

Broadcast Services: The purpose of this service would be to provide the ability to transmit a computer message to several terminals at the same time. Examples of this service are operational messages for network control, stock-market quotations, and company notices. Its usefulness was rated as listed in Table 27.

Polling Services: In some cases, it is more cost effective to connect a number of low-speed terminals to one line, and control these through a polling arrangement, than to provide individual line facilities to each terminal. A simple, limited example of this arrangement is point-of-sales terminals within a store, which must periodically transmit data to a central location. Its usefulness was rated as listed in Table 28.

Table 24
Abbreviated Dialing and Hot-Line Services

Availability of Such Services Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	4	19%	6	20%	10	20%
Desirable	12	57%	17	59%	29	58%
Not Required	5	24%	4	14%	9	18%
No Reply	–	–	2	7%	2	4%

Table 25
Closed Network Services

Availability of Such Services Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	2	10%	9	31%	11	22%
Desirable	7	33%	6	21%	13	26%
Not Required	10	47%	10	34%	20	40%
No Reply	2	10%	4	14%	6	12%

Table 26
Code Conversion Services

Availability of Such Services Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	3	14%	7	24%	10	20%
Desirable	5	24%	16	56%	21	42%
Not Required	13	62%	3	10%	16	32%
No Reply	–	–	3	10%	3	6%

Table 27
Broadcast Services

Availability of Such Services Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	4	19%	6	21%	10	20%
Desirable	10	48%	16	55%	26	52%
Not Required	7	33%	5	17%	12	24%
No Reply	–	–	2	7%	2	4%

Table 28
Decentralized Polling Services

Availability of Such Services Is Considered as:	Computer Services Industry		Others		Total	
	Number of Organizations	%	Number of Organizations	%	Number of Organizations	%
Essential	4	19%	8	28%	12	24%
Desirable	13	62%	15	51%	28	56%
Not Required	4	19%	4	14%	8	16%
No Reply	–	–	2	7%	2	4%

5. Conclusions

Comments obtained during the survey indicated a general desire to expand the use of computer/communications systems to many new applications. However, few respondents were willing to provide firm forecasts on the projected usage of data communications facilities during the period 1971/76 – probably because of major uncertainties regarding the types and costs of those data communications services and terminal equipment which may become available during this period. In view of the many economic uncertainties in the development of new communications-oriented applications, an evolutionary approach to data communications network development is clearly indicated.

In spite of some gaps, the survey has helped to bring the problems, and the often conflicting demands of data communications users, into clearer focus. It has also identified some, of the essential needs and priorities, whose resolution will determine the future direction of data communications network development in Canada.

Appendix

List of Participating Organizations

AGT Data Systems, Limited
Air Canada
Alphatext Systems Limited
Aluminum Company of Canada Limited
Amoco Canadian Petroleum Company Ltd.
Argus Computer Applications
Banque Canadienne Nationale
B.C. Forest Products Ltd.
Canadian Forest Products Ltd.
Canadian General Electric Company Limited
Canadian Imperial Bank of Commerce
Coca-Cola Ltd.
Columbia Cellulose Company, Limited
Computech Consulting Canada Ltd.
Computel Systems Ltd.
Computer Sciences Canada Ltd.
Com-Share (Canada) Ltd.
Consolidated Computer Limited
Dataline Systems Limited
Datapro
EDP Industries Limited
Falconbridge Nickel Mines Limited
Firestone Tire and Rubber Company of Canada, Limited
Ford Motor Company of Canada, Limited
General Foods, Limited
Honeywell Information Systems
Hydro-Quebec
IBM Canada Ltd.
Imperial Oil Limited
Interprovincial Pipe Line Company
Kimberly-Clark of Canada Ltd.
Massey-Ferguson Limited
Metropolitan Life Insurance Company
Multiple Access General Computer Corporation Limited
Noranda Mines Limited
PolyCom Systems Limited
Polymer Corporation Limited
Province of New Brunswick
Richardson Securities of Canada Inc.
Riley's Datashare International Ltd.
The Royal Bank of Canada
Setak Computer Services Corp. Ltd.
I. P. Sharp Associates Limited
Robert Simpsons, Limited
Simpsons-Sears Limited
S.M.A. (Société de mathématiques appliquées) inc.
Systems Dimensions Limited
Ticket Reservation Systems, Inc.
University of New Brunswick