Communications Research Centre

DATACOM '76
RESULTS OF A SURVEY OF COMPUTER/COMMUNICATIONS FACTS AND OPINIONS

by

PRICE WATERHOUSE ASSOCIATES IN COLLABORATION WITH ROGER W. HOUGH
EDITED BY T.A. KUBACKI

Department of Communications

Ministère des Communications

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OTTAWA, APRIL 1977

COMMUNICATIONS RESEARCH CENTRE

DEPARTMENT OF COMMUNICATIONS
CANADA

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(Technology and Systems Branch)

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1. SUMMARY

In order to support the Department's mandate to maintain current information on communications systems and services in Canada, the Research Branch of the Department of Communications contracted an outside consulting firm to undertake a sample survey of number of the largest users of computer/communications in Canada. The results of this survey are contained in this report.

The report is based on information supplied by a sample of 74 companies, most of them major computer/communications users and as such is a representation not of the universe but of the leading edge. Thus, it does not necessarily reflect the opinions or describe the operations of other companies, particularly those which make less use of data communications.

The interviews took place over the summer of 1976 and explored the system characteristics, attitudes and expectations of large users of computer communications. Some of the major findings were:

- *Computer/communications traffic in Canada is large and growing. The respondents transmit and receive some 4.9 billion characters per day. This traffic is highly concentrated geographically. Virtually all of it flows to or from computer centres in six cities – Toronto, Montreal, Ottawa, Calgary, Edmonton and Vancouver. Toronto computer centres alone account for 67% of the traffic flow.*

- *Computer service bureaus are large contributors to data communications traffic, accounting for 42% of the volume reported in this survey.*

- *92% of the data communications circuits used by the respondents are low to medium speed (2400 bits per second or less), but a very large amount of traffic flows through the small percentage of lines which are high speed.*

- *On-line banking, video display, teletype and point-of-sale terminals, all of which are low speed, interactive devices, comprise 92% of the terminals in use. Only 5% of the terminals are remote batch, but these transmit 73% of the data communications traffic.*

- *Although most of the companies surveyed are substantial computer users, their data processing expenditures continue to rise rapidly. These expenditures increased by 15% between 1975 and 1976, and are expected to rise a further 13% in 1977.*

- *Personnel costs account for over 40% of the respondents' data processing expenditures. Hardware and communications costs are a close second at 38%, including the cost of terminals and other communications equipment.*

- *At $222,000 per month, transportation and utility companies included in the survey pay the highest average rental for central site computer equipment.*

- *Financial institutions account for a third of the $439.3 million spent on data processing by the respondents.* *

- *Many respondents experienced problems in implementing computer/communications applications. Once the applications are operational, however, users are generally satisfied with both computer and communication services.*

- *Users appear to be unaware of the details of packet switching offerings, including software requirements, price, geographical availability and performance. Because of this, and of uncertainty about the cost implications, they have not made specific plans to use this service. Two-thirds of those surveyed indicated that they would use packet switching if it would reduce their data communications costs or improve performance.*

- *All users favour standards in data communications, but opinions vary about how these standards should be established and enforced.*

- *A large number of users (46 of 74) expect to complement their existing data processing operations by introducing minicomputers, but they do not expect data communications volumes to decrease as a result.*

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* *It should be noted that Financial Institutions were also the most heavily represented sector in the sample (see Figure 1).*

- *Users surveyed expect to install 20,000 more terminals in the period 1976–1980. This will equal the 20,000 terminals which these companies are presently using.*

The data described in this report are only part of a larger information base assembled on a mechanized data file by the Department. In addition to the survey results which give a detailed description of the network/equipment characteristics and opinions of the largest users, data are also available, viz.

- *An extensive description of the E.D.P. facilities of firms in Canada, both current and historical. This is contained in information derived from the Canadian Information Processing Society's (C.I.P.S.) Computer Census.*

- *An extensive description of some of the terminals and applications to which EDP facilities are devoted, for all firms in Canada as described in the International Data Corporation's data file on Canadian E.D.P. facilities.*

- *A description of some of the operational and financial characteristics of these firms as found in the Dun & Bradstreet data files.*

It is possible, through the use of these various data, to extrapolate and model a variety of scenarios concerning the use of computer/communications in Canada. The information from this study has already been utilised in this manner in several programs. Dependent on the value of this data to the Department and also on any indicated need for either an extension or an update, further work in data collection may be pursued at some future date.

2. INTRODUCTION

The mandate of the Department of Communications (DOC) of the Government of Canada includes the promotion of "the orderly evolution and growth of efficient and effective communications systems and services for Canada". The Department has, in recent years, carried out studies which contribute to this objective by identifying the expressed and potential needs of Canadian computer/communications users, as well as their opinions and attitudes.

In this connection, the DOC Computer/Communications Task Force under the leadership of Dr. H.J. von Baeyer recommended in its report "Branching Out" that the government periodically undertake surveys to identify user needs and to evaluate the impact of existing and projected computer/communications systems on society. In addition, the Task Force identified a need for research and development to be carried out in government laboratories, and for the results to be made available to industry as appropriate. "Branching Out" addressed other relevant points, such as the role of government in setting standards and the use of government procurement practices to support Canadian industry.

Responding to these objectives, recommendations and policy proposals, the Communications Research Centre (CRC) of the DOC initiated a broad computer/communications research and development program. It undertook projects covering many aspects of the subject, including the "Needs Research in Computer/Communications Program", which explored user requirements for computer/communications facilities in Canada as background for government policy with respect to such systems and services.

The information collected by this program is being structured into a database which enables the DOC to analyse trends in this area. The database consists of:

(a) Information on the data processing and data communication facilities in Canada, including an identification of users. Sources include the Canadian Information Processing Society's Census of Computers.

(b) Information on the characteristics of firms in Canada who are using data processing and data communications facilities, as contained in the Dun & Bradstreet data files.

(c) Details on the computer and communications systems and the attitudes of selected users of computer/communications, such as those who are described in this report.

The responses to this study, together with the information being put into the database, will be used for analysis and model building. Strict security measures included in the database design will, however, protect the confidentiality of individual replies. The survey results are contributing significantly to current policy studies about the needs of Canadian users, and the ability of new systems proposed by industry and data communications carriers to satisfy these needs. Future research studies are expected to make considerable use of the survey data. The results of these studies may be made available in further reports.

In February 1976, the DOC prepared a Statement of Objectives and a Work Plan for this study, after consultations involving the Social, National and Economic Research Branches of the DOC. Selected firms were asked to submit proposals, and in April 1976 a contract (No. 15ST.36001–5–2477) was awarded to Price Waterhouse Associates, management consultants to carry out the study.

The study was conducted, in collaboration with Mr. Roger W. Hough, between May and November 1976.

The Department of Communications thanks the companies and individual executives whose cooperation made this study possible. Many went to considerable trouble to develop the data requested. The names of the respondents must however be withheld to ensure that no inference about the data communications activity of any specific company can be drawn from this report.

This report summarizes the results of the survey, and has been prepared for the benefit of the companies who took part in it and for interested members of the public. Publication of the report by DOC does not imply that it is in entire agreement with the views and conclusions contained herein.

Readers are reminded that the report is based on information supplied by a sample of 74 companies, most of them major computer/communications users and as such is a representation not of the universe but of the leading edge. Thus, it does not necessarily reflect the opinions or describe the operations of other companies, particularly those which make less use of data communications. The opinions quoted are those of specific individuals within the companies responding. Since the degree to which respondents completed the questionnaire varied, the sample size is different for each subject area.

3. THE SURVEY

3.1 METHOD

Because of the length and complexity of the questionnaire, key data processing executives in each company were interviewed personally by experienced computer/communications specialists. Before each interview, the senior executive responsible for data processing received an introductory letter from the Department of Communications, a copy of the questionnaire, and detailed instructions.

3.2 SAMPLE SELECTION AND COVERAGE

88 major data communications users were asked to take part in the survey. Government departments and telecommunications carriers were not surveyed because the Department of Communications already had access to adequate data about them, or could obtain it through other channels. Individual companies were selected on the basis of sales volume, size of computer facilities, and the study team's knowledge of major computer/communications users.

A total of 74 companies replied to the survey. Of these, 66 completed most of the questionnaire, while the other eight expressed opinions, but did not provide data on their own operations. The sample size for individual questions is often somewhat smaller, because some companies were unable to answer certain questions. No attempt was made to estimate data when it was not supplied.

Figure 1 shows that the 74 respondents include 21 financial institutions, 11 service bureaus, 6 resource companies,* 17 manufacturing companies and 10 transportation and utility companies. There was one respondent from another industry, who was grouped with the 8 wholesalers and retailers to maintain confidentiality.

The companies responding to the survey play a very large role in Canadian business generally. The financial institutions have total assets of $80 billion, which is equal to almost 60% of the assets of the Financial Post's Top 50 Financial Institutions. The industrial companies have total sales of $30 billion or 40% of the sales of the Financial Post's Top 100 Industrials. Of these sales, $9 billion are attributable to the resource companies, $17 billion to the manufacturers, and $4 billion to the transportation and utility companies. Respondents in the wholesale/retail group have sales of $8 billion, or 35% of the sales of the Financial Post's Top Merchandisers. Comparisons for service bureaus are more difficult, but independent sources indicate that the revenues of the service bureaus taking part in the survey comprise about 35% of total service bureaus revenues, and that most major service bureaus engaged in remote computing are included.

Figure 2 shows that the head offices of the respondents are fairly well spread across the country, with Ontario accounting for just over half. The one serious gap in the sample is that none of the companies are headquartered in the Atlantic Provinces, despite efforts to obtain responses from that region. Nevertheless, Figure 3 demonstrates that the companies included do have substantial operations in the Atlantic Provinces.

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* *Including pipeline companies.*

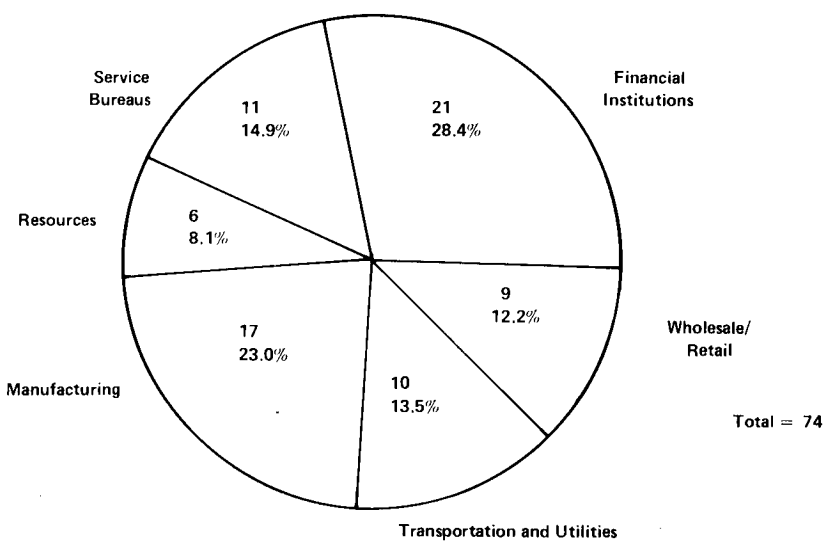

Figure 1. Breakdown of Respondents by Industry

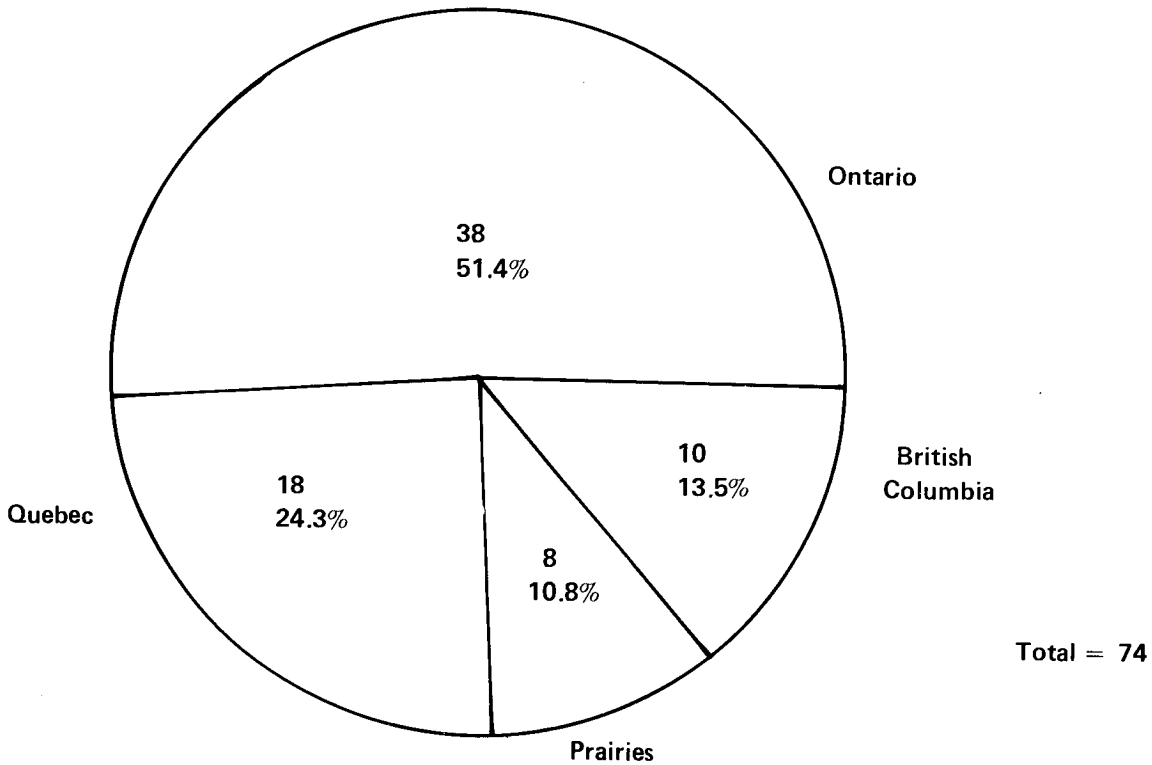

Figure 2. Breakdown of Respondents by Location of Head Office

	British Columbia	Prairies	Ontario	Quebec	Atlantic	All Regions
Financial Institutions	621	974	2,029	2,355	467	6,446
Service Bureaus*						53
Resource	585	1,132	967	605	595	3,884
Manufacturing	216	165	332	178	84	975
Transportation and Utilities	125	42	71	68	17	323
Wholesale/Retail	282	577	507	388	115	1,869
All Industries						13,550

*Figure 3. Respondents' Physical Locations** in Canada*

* *The regional distribution of service bureau locations has been omitted for reasons of confidentiality.*

** *Physical locations are plants, sales offices, bank branches, and so on.*

3.3 INDUSTRY CLASSIFICATION

The assignment of companies to industries generally follows the Standard Industrial Classification (SIC) established by Statistics Canada.* Following normal statistical practice, each company is assigned to the industry in which it is principally engaged. The company may also be involved in another industry, but its operations in that industry are included in the figures for the industry to which the company as a whole is assigned. For example, some computer manufacturers also carry on business as service bureaus. Since these companies are engaged primarily in manufacturing, their service bureau operations would be included under manufacturing, not under service bureaus. This approach makes it easier for companies to provide data, and simplifies tabulation.

4. QUANTITATIVE DATA

4.1 DATA PROCESSING COSTS

This section reports on the level, composition and trend of data processing costs for the companies surveyed. Note that in some situations data processing expenditures made or controlled by departments outside the data processing function are not included.

The 1976 data processing budgets of 60 reporting companies amounted to $439.3 million. The elements of cost are shown in Figure 4. Personnel is the largest item at 40.4%, followed by hardware and communications at 37.9%, administration and supplies at 15.9%, and use of service bureaus at 5.8%.

Figure 5 shows the breakdown of these expenditures by industry. Financial institutions spend the largest share (34.8%). Wholesale/retail has the smallest share at only 6.5%.

The $56.1 million spent *by* service bureaus (as shown in Figure 5) far exceeds the $25.6 million paid *to* service bureaus by these 60 companies (as shown in Figure 4). Our sample consists largely of companies with substantial computer capacity of their own. A broader sample including smaller companies with little or no computer capacity would show use of service bureaus as a larger portion of expense.

The highest data processing budgets per company (as shown in Figure 6) are in the transportation and utilities sector, at $10.1 million a year, compared to an average of $7.3 million for all companies in our sample. Lowest budgets are in wholesale/retail at $4.1 million, and manufacturing at $5.2 million.

Figure 7 relates data processing costs for each industry to sales, or assets in the case of financial institutions. Transportation and utility companies stand out with data processing costs at 1.9% of sales, compared to 0.6% for resource companies, and 0.4% for both manufacturing and wholesale/retail.

Figures 8 and 9 show trends in data processing budgets for the sample as a whole, and by industry. These results should be viewed with caution, however, since only 39 companies reported data for the three years requested.

Figure 8 shows average growth in data processing budgets of 15.0% from 1975 to 1976, and a projected growth of 13.0% between 1976 and 1977. These increases are substantial, considering that the companies surveyed are established computer users. This rate of increase may be compared to the growth rate of 20% per year for the data processing industry in Canada, as reported by the Financial Post on August 21, 1976.

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* *The exception being the inclusion of pipeline companies in the Resource Sector. Statistics Canada lists them as part of the Transportation and Utilities Sector.*

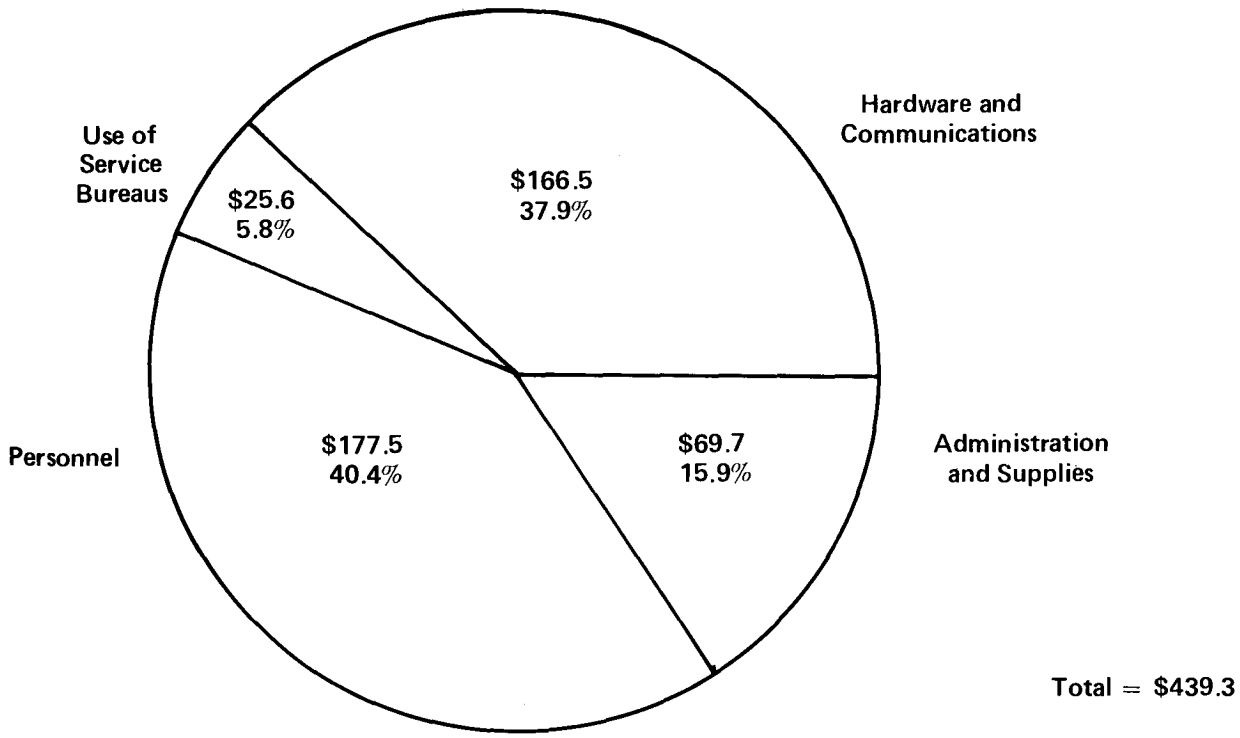

Figure 4. 1976 Data Processing Budget by Category of Expense (in Millions of Dollars)

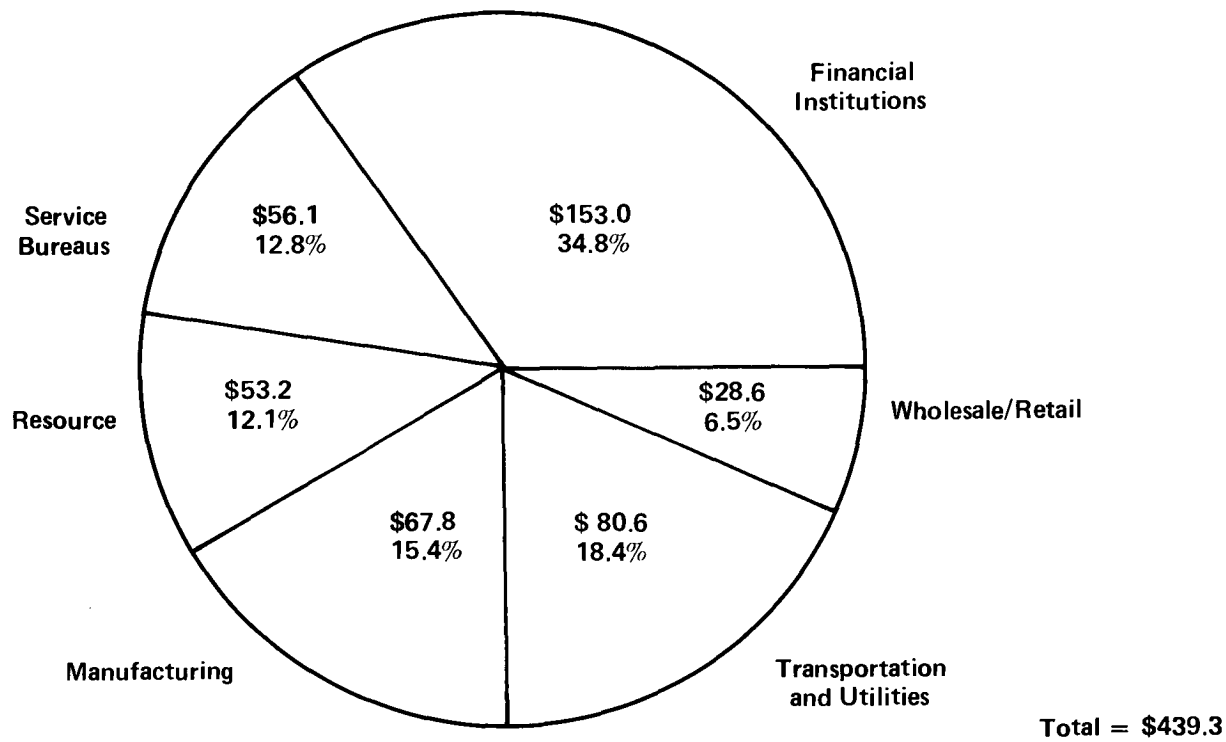

Figure 5. 1976 Data Processing Budget by Industry for this Sample (in Millions of Dollars)

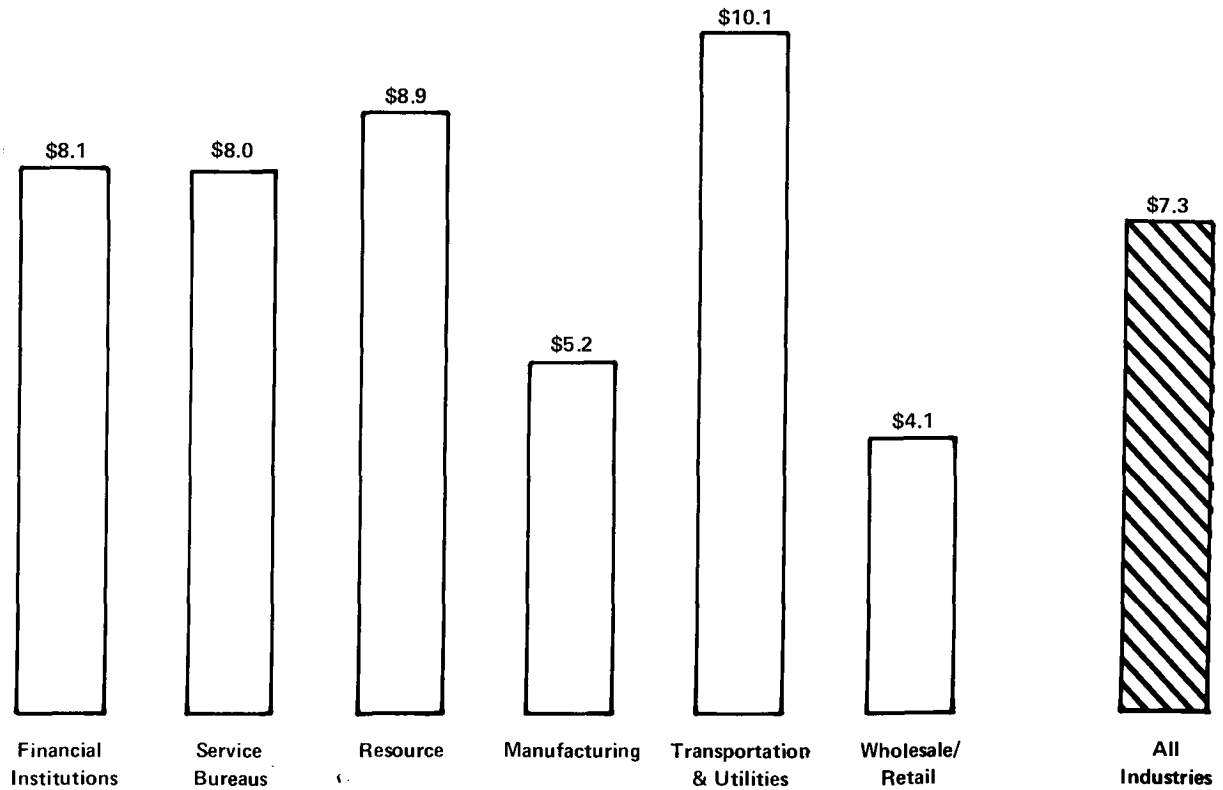

Figure 6. 1976 Data Processing Budget Per Organization (in Millions of Dollars)

	Companies Reporting	Assets ($ millions)	Annual Data Processing Costs ($ millions)	Data Processing Costs As a Percentage of Assets
Financial Institutions	14	39,735.5	97.5	0.2
		Annual Sales ($ millions)		**Percentage of Sales**
Resource	6	8,884.2	53.2	0.6
Manufacturing	13	15,978.4	66.4	0.4
Transportation and Utilities	8	4,201.6	80.6	1.9
Wholesale/Retail	7	7,182.7	28.6	0.4
Total (excluding Financial Institutions and Service Bureaus)	34	37,237.9	228.8	0.6

Figure 7. Data Processing Costs as a Percentage of Sales or Assets

	Amount ($ millions) 1975	1976	1977	Percentage Increase 1975–76	Percentage Increase 1976–77
Personnel	101.9	114.8	126.2	12.7	9.9
Administration	39.5	43.8	48.8	10.9	11.4
Hardware and Communications	89.7	106.0	123.9	18.1	16.8
Service Bureaus	14.7	18.0	20.5	22.4	13.9
Totals	245.8	282.6	319.4	15.0	13.0

Figure 8. Growth in Data Processing Costs (39 Companies Reporting for All Years)

The respondents' service bureau expenditures also grew particularly fast from 1975 to 1976 at 22.4%, but this is expected to moderate to 13.9% in 1977.

Data processing expenditures in the wholesale/retail group have increased by 21% in each of 1976 and 1977. Total expenditures for this group, however, are still low compared to other industries.

Figure 9 also shows that the composition of data processing costs differs among industries. Personnel costs are the largest category for our sample as a whole, but hardware and communications costs match them among service bureaus, and exceed them in two groups which use numerous on-line terminals – financial institutions, and transportation and utility companies.

4.2 DATA COMMUNICATIONS NETWORKS

This section identifies the various network configurations used by the companies surveyed; presents statistics on their computer centres and equipment costs; and shows the relative importance of local and remote printing.

4.2.1 Single Node, Interactive Networks

Many respondents have basic, single-node, star-type networks. In these, a single medium to large-scale computer centre is connected to a number of terminals, often distributed throughout the country. For the most part, the terminals are real time, and interactive, such as those used for airline reservations or on-line banking. Other applications include on-line entry, inventory control, and credit checking (e.g. CHARGEX). Time sharing applications are also represented.

The applications for which this type of network is used generally require only low to medium speed transmission, between 150 and 2,400 bits per second, with teletype terminals generally using lower speeds than video display terminals. Even when there are clusters of terminals, such systems seldom require high speed lines. Duty cycles, the periods when these on-line terminals are actually in use, are often sufficiently irregular that multiplexers and concentrators are added to increase line usage and network efficiency.

4.2.2 Multi-Centre Networks with Central Processing

The second network configuration type used by respondents consists of a number of small subsidiary computer centres connected to a large, central computer complex. The central computer is often located in Toronto or Montreal, but a few Western based companies have systems whose central node is in Calgary, Edmonton or Vancouver.

	Amount ($ millions)			Percentage Increase	Percentage Increase
	1975	1976	1977	1975–76	1976–77
FINANCIAL INSTITUTIONS					
Personnel	20.3	24.4	26.5	20.2	8.6
Administration	8.9	10.1	11.8	13.5	16.8
Hardware and Communications	25.0	29.2	35.0	16.8	19.9
Service Bureau	2.7	3.3	5.2	22.2	57.6
Totals	56.9	67.0	78.5	17.8	17.3
SERVICE BUREAUS					
Personnel	13.7	14.5	16.3	5.8	12.4
Administration	8.8	8.9	9.8	1.1	10.1
Hardware and Communications	11.4	15.1	16.5	32.5	9.3
Service Bureau	2.8	3.1	3.3	10.7	6.5
Totals	36.7	41.6	45.9	13.4	10.3
RESOURCE					
Personnel	16.7	18.8	20.6	12.6	9.6
Administration	5.5	6.1	6.7	10.9	9.8
Hardware and Communications	10.7	10.9	12.7	1.9	16.5
Service Bureau	3.6	5.3	5.5	47.2	3.8
Totals	36.5	41.1	45.5	12.6	10.7
MANUFACTURING					
Personnel	26.1	28.8	31.6	10.3	9.7
Administration	7.9	9.5	10.3	20.3	8.4
Hardware and Communications	14.1	15.6	18.6	10.6	10.2
Service Bureau	3.7	4.3	4.3	16.2	—
Totals	51.8	58.2	64.8	12.4	11.3
TRANSPORTATION AND UTILITIES					
Personnel	15.1	16.4	17.5	8.6	6.7
Administration	5.5	5.9	6.4	7.3	8.5
Hardware and Communications	20.8	25.3	28.2	21.6	11.5
Service Bureau	0.5	0.5	0.5	—	—
Totals	41.9	48.1	52.6	14.8	9.4
WHOLESALE/RETAIL					
Personnel	10.0	11.9	13.7	19.0	15.1
Administration	2.9	3.3	3.8	13.8	15.2
Hardware and Communications	7.7	9.9	12.9	28.6	30.3
Service Bureau	1.4	1.5	1.7	7.1	13.3
Totals	22.0	26.6	32.1	20.9	20.7

Figure 9. Growth in Data Processing by Industry (39 Companies Reporting)

Multi-centre systems are often used by the major banks, which have very heavy daily processing loads. Data is normally captured at regional centres, where some preliminary processing may be done before it is transmitted to the central computer. Files are updated centrally then results are transmitted back to the regional centres for printing and distribution.

4.2.3 Single-Node Remote Batch Systems

A third major type of network is the highly centralized Remote Batch or Remote Job Entry (RJE) system used by several service bureaus. Usually, a number of remote batch terminals or small computers are linked via leased or dial-up lines to a computer centre. As a general rule, such terminals are equipped with high speed printers operating at 600 to 1,200 lines per minutes. Because of throughput requirements, high speed transmission lines with capacities of 2,400 to 19,200 bits per second are used.

Service bureaus with remote batch networks operate very large computers such as IBM 370/165's and 168's or Univac 1108's. They are located principally in Toronto, Ottawa and Calgary, but their networks span several provinces, and many have branched into the United States.

4.2.4 Mixed Systems

Multi-centre and remote batch systems may be combined in configurations with two or more major nodes (centres), all more or less equal in size. Many respondents in the banking, resource, and transportation/utility sectors have such systems, because they have major operational facilities in more than one region.

The nodes in such systems are connected by high speed lines, at least 9,600 bits per second and more commonly 19,200 or 50,000 bits per second. These lines are used for computer to computer transmission and high speed file transfer, or to support load sharing, back up or redundancy. Such facilities allow companies to mount specialized programs on particular machines, but still make them available to all parts of the network, and to distribute data processing workloads more evenly.

4.2.5 Equipment and Computer Centres

The number of computer centres, machines and related rental costs of the respondents are given in Figure 10. Information in this section was requested only on those computers which are involved in data communications, not on all computers used by the respondents.

In most cases the service bureaus, which have single-node interactive or remote batch systems, operate one centre each. However, the average for the other sectors is greater than one, indicating that many respondents have multi-centre or mixed networks with two centres or more. The highest number is found in the manufacturing sector, at over two centres per reporting company. These are small centres, however, since the average monthly rental per machine, as shown in the last column of Figure 10, is very low.

Figures 10 and 11 show that the organizations surveyed spend an average of $133,000 per month for computer centre equipment*. The average for two of the sectors (manufacturing and wholesale/retail) are less than half this figure, while that for transportation/utilities is almost twice as much, indicating that machine sizes vary greatly.

4.2.6 Printing Activity – Local and Remote

Figure 12 shows that printing activity per company is far higher for service bureaus, at 1,506 million lines per year, than in other industries. Financial institutions at 798 million lines per year and resource companies at 762 also have large printing volumes.

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* *Note that this is not equivalent to the total hardware and communications expenditures given in Figure 4, since it includes only central site machine hardware rental, not the terminals, transmission lines, modems, concentrators, and so on that make up the communications network.*

	Centres*		Machines		Monthly Rental**		Average Number of Machines per Company	Average Monthly Rental per Company ($000)	Average Monthly Rental per Machine ($000)
	Number	Companies Reporting	Number	Companies Reporting	Amount ($000)	Companies Reporting			
Financial	40	20	97	19	2,934.6	20	5.1	146.7	28.6
Service Bureaus	10	10	20	10	1,787.0	10	2.0	178.7	89.4
Resource	9	6	14	6	703.0	6	2.3	117.2	50.3
Manufacturing	35	15	83	15	848.0	13	5.5	65.2	11.9
Transportation and Utilities	12	8	25	8	1,783.0	8	3.1	222.8	71.6
Wholesale/Retail	10	7	17	7	459.0	7	2.4	65.6	27.8
Total	116	66	256	65	8,513.6	64	3.9	133.0	34.1

* *Computer centre means a site where there are one or more computers, generally of medium to large scale, which account for a significant share of the company's computer/communications. Note that the survey did not request information on the large number of computers which are not involved in data communications.*

** *The equivalent monthly rental for purchased equipment is calculated at approximately 1/40 of the total purchase price.*

Figure 10. 1976 Number of Computer Centres, Number of Machines, and Value of Central Site Hardware

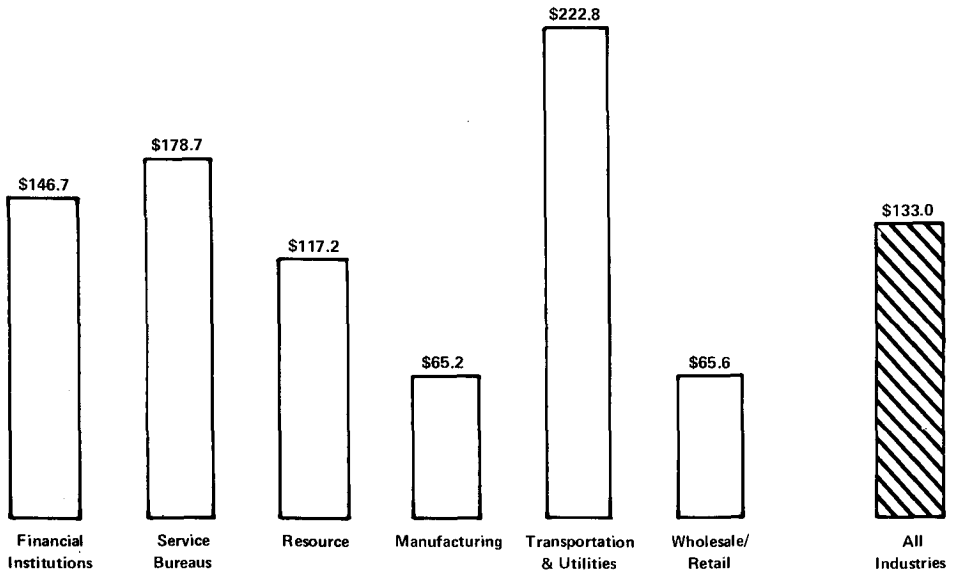


Figure 11. Average Monthly Machine Rental Per Organization in 1976 (Thousands of Dollars)

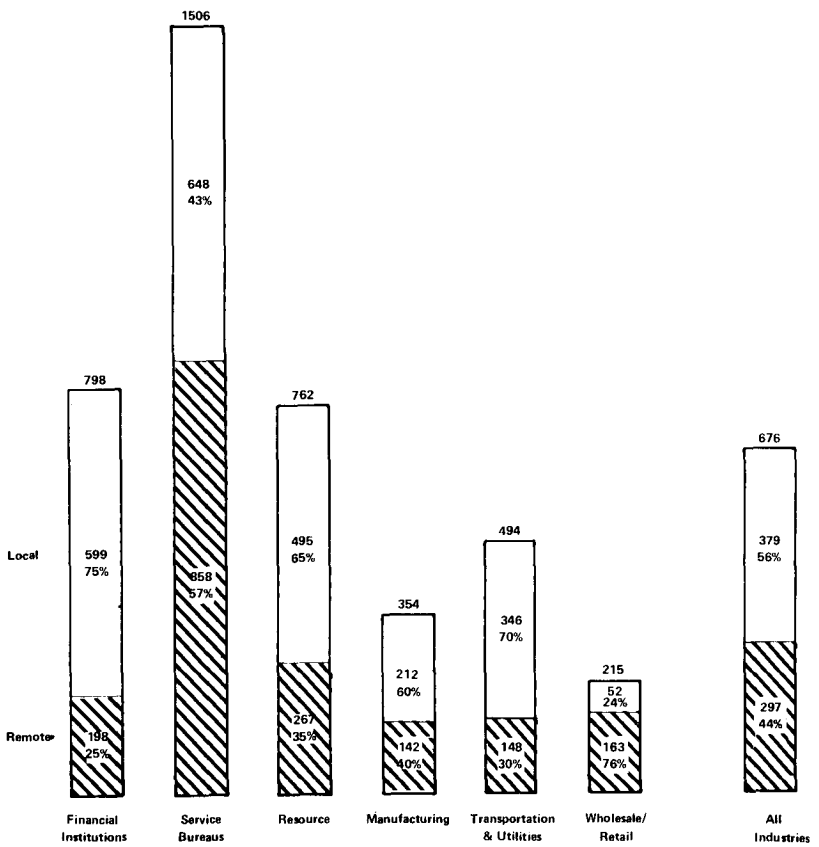


Figure 12. 1976 Printing Activity
Average Output Per Organization (Millions of Lines Per Year) Divided Between Local and Remote

Figure 13 provides a comparison of printing activity by industry and shows that the service bureaus account for almost 30% of the total volume indicated by the sample. By way of contact the wholesale/retail companies produce the smallest share at only 3.6% of total printing.

Wholesale/retail companies do a larger share of their printing remotely, that is using terminals at sites other than the computer centre which processes the data, than any other group. Service bureaus do the next highest percentage of their printing remotely, and account for many more lines of remote printing than any other group.

4.3 TRAFFIC, TERMINALS AND CIRCUITS

This section deals with traffic volume, types of terminals and circuit speeds of transmission lines. It is based on data for 54 of the respondents.

4.3.1 Terminals

The respondents use almost 20,000 terminals, as shown in Figure 14. About half of these are on-line banking terminals, and one quarter are video display terminals, most of which are used by transportation companies for on-line reservation systems. Service bureaus account for about half of the total teletype and remote batch terminals in the sample. There are also 404 tape-to-tape terminals, many of them used for order entry in the wholesale sector, and 137 point-of-sale terminals.

4.3.2 Traffic by Type of Terminal

Figure 15 provides an analysis of data communications traffic by type of terminal. While Figure 14 shows that only 4.9% of the respondents' terminals are remote batch, Figure 15 shows that these terminals transmit 72.7% of the data communications traffic. Figure 16 which provides industry detail, demonstrates that remote batch terminals produce almost all the service bureau traffic, and are the largest single source of traffic in all industries except transportation and utilities. CRT and other terminals produce 12.0% and 8.5% of the data communications traffic respectively, the majority of it from transportation and utility companies in both cases. Computer to computer communications, 5.2% of the total, are carried out largely by the financial institutions. Teletypes, though numerous, produce very little data communications traffic, only 1.7% of the total.

4.3.3 Traffic by Industry

Figures 17 and 18 deal with data communications traffic by industry and by company. Service bureaus, which are heavy remote batch users, generate 42.0% of the data communications traffic, even though they operate only 21.0% of the central site hardware (as measured by monthly equipment rentals in Figure 10). Resource companies also generate a relatively large share of the traffic at 13.9%, compared to 8.3% of central site hardware. At the other end of the scale, financial institutions account for no more traffic than resource companies, despite having 34.5% of the total central site hardware.

On a per company basis, the service bureau respondents generate far more data communications traffic (292.5 million characters per day) than any other type of company. Transportation and utility companies at 121.3 million characters per day and resource companies at 111.7 million are also above average, while traffic in all other groups is much lower.

4.3.4 Circuit Speeds

The respondents use 5,524 circuits for data communications. The majority of these are of low to medium speed capacity, as illustrated in Figure 19. Financial institutions, with their numerous on-line terminals, are the largest users of lower speed lines. Service bureaus account for only 963 circuits in total, but are relatively heavy users of medium and high speed circuits. The faster circuits connect remote batch facilities and multiplexor/concentrator equipment to service bureau central sites.

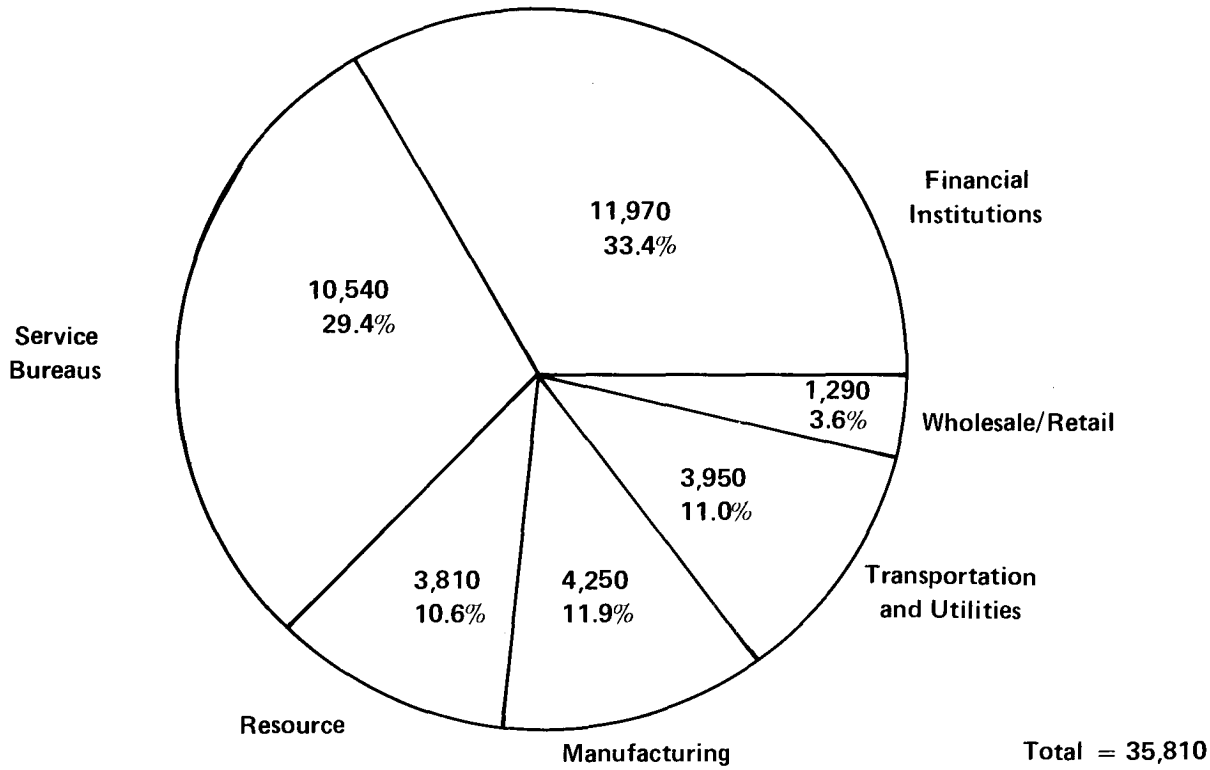


Figure 13. 1976 Total Printing Activity by Sector for this Sample (in Millions of Lines Per Year)

	Remote Batch	Video (CRT)	TTY	Other	Total
Financial Institutions	50	549	635	8,997	10,231
Service Bureaus	580	24	1,524	—	2,128
Resource	109	50	73	104	336
Manufacturing	119	550	197	960	1,826
Transportation and Utilities	41	3,705	828	139	4,713
Wholesale/Retail	66	44	20	404	534
	965	4,922	3,277	10,604	19,768

Figure 14. 1976 Terminals by Type and Industry

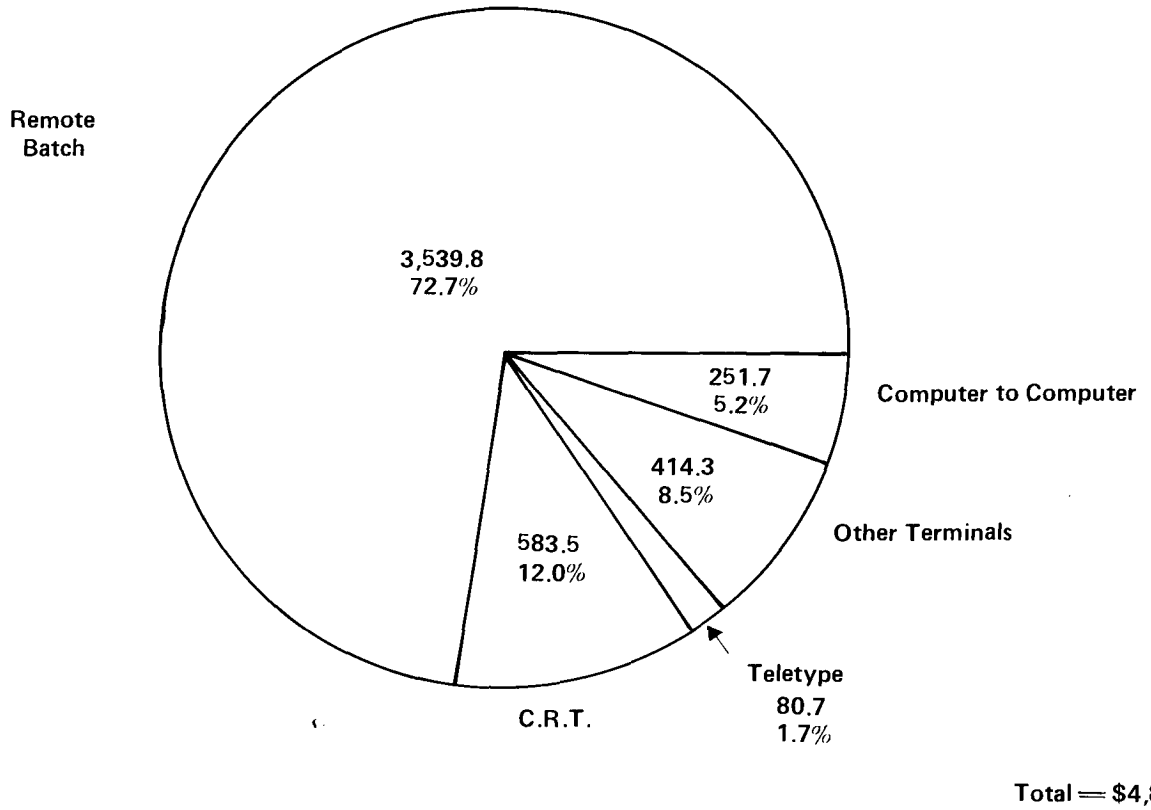


Figure 15. 1976 Data Communications Traffic by Type of Terminal (in Millions of Characters Per Day)

	Remote Batch	CRT	TTY	Other Terminals	Computer to Computer	Industry Total
Financial	270.4	81.1	24.1	121.2	182.0	678.8
Service Bureaus	2,018.7	0.4	28.3	—	—	2,047.4
Resource	512.1	142.7	9.0	6.6	—	670.4
Manufacturing	304.6	28.5	4.9	28.1	45.9	412.0
Transportation and Utilities	236.7	323.5	13.3	251.6	23.8	848.9
Wholesale/Retail	197.3	7.3	1.1	6.8	—	212.5
Total for Type of Terminal	3,539.8	583.5	80.7	414.3	251.7	4,870.0
Percent of Grand Total	72.7%	12.0%	1.7%	8.5%	5.2%	

Figure 16. 1976 Data Communications Traffic by Industry and Type of Terminal (Millions of Characters Per Day) (54 Companies Reporting)

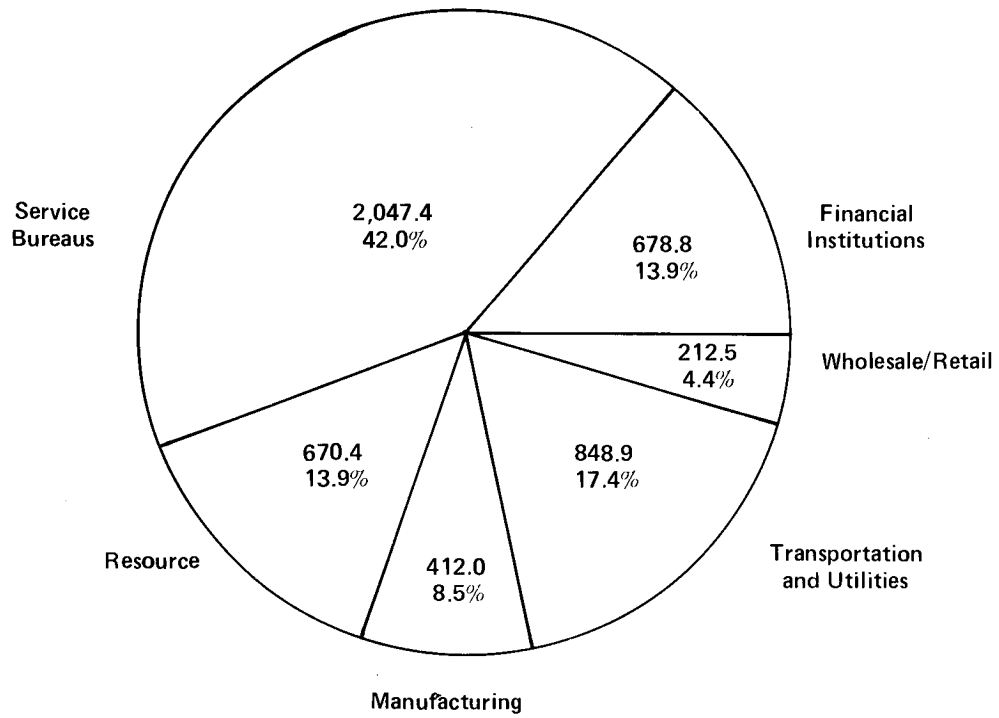


Figure 17. 1976 Data Communications Traffic by Industry for this Sample (in Millions of Characters Per Day)

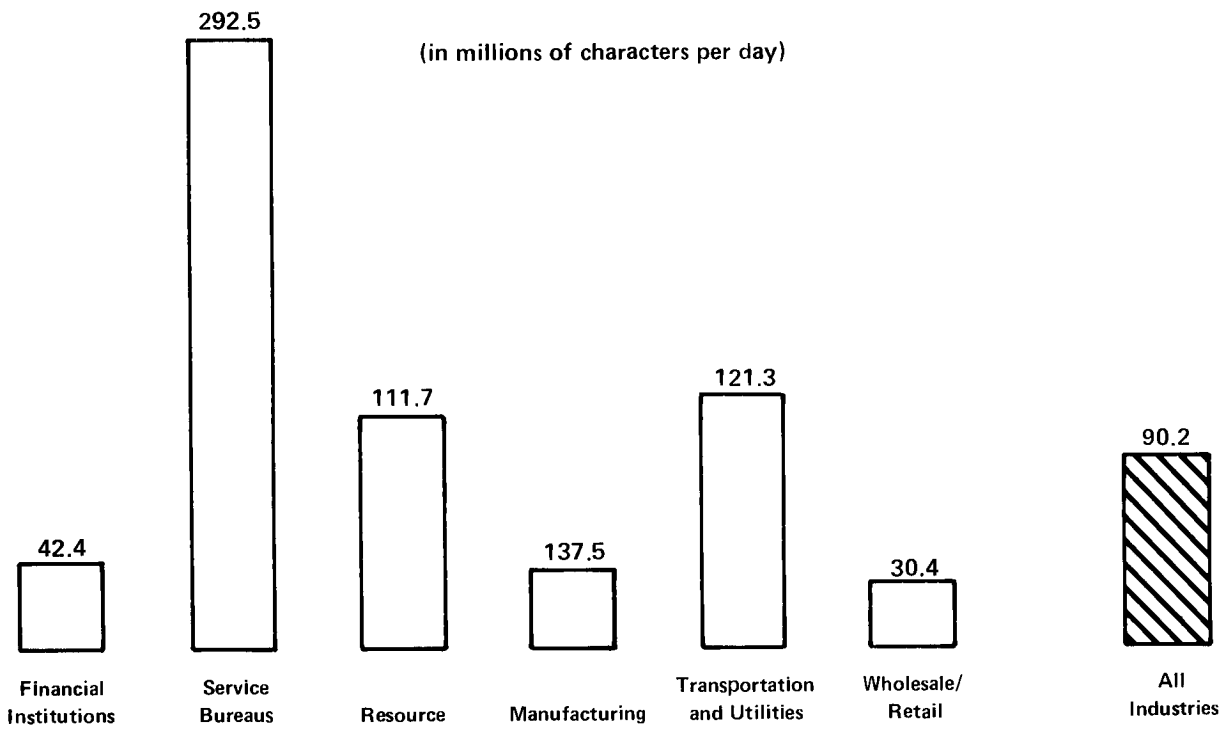


Figure 18. 1976 Data Communications Traffic Per Company for this Sample (in Millions of Characters Per Day)

	Circuit Speed (Bits Per Second)					
	Less than 1200	2000 or 2400	4800	7200 or 9600	19,200 or 50,000	Total
Financial Institutions	897	1657	68	21	3	2646
Service Bureaus	471	341	109	30	12	963
Resources	54	142	15	3	4	218
Manufacturing	594	146	52	45	1	838
Transportation and Utilities	457	243	50	12	3	765
Wholesale/Retail and Other	31	43	17	3	—	94
Total	2504	2572	311	114	23	5524

Figure 19. 1976 Communication Circuit Speeds by Industry

4.4 GEOGRAPHIC CONCENTRATION

4.4.1 Terminals

Canadian computer networks included in the sample reach out across most of the country. Figure 20 shows that there are nearly 7,700 terminals in Ontario, 38.9% of the total. Nearly one-half of the remote batch terminals are located in Ontario. Quebec has 28.0% of all terminals, and a large share of on-line banking terminals. The Prairies have 11.6% of the total terminals, including the largest share of tape-to-tape units. Also represented are British Columbia with 8.5%, the Atlantic Provinces with 4.7%, and locations outside Canada with 7.2% of all terminals.

4.4.2 Computers and Computer Centres

The computer population is more concentrated, but it is about as dispersed as the head offices of the companies in our sample (shown in Figure 2). Figure 21 indicates that 40.3% of the computer centres and 55.8% of the computers covered in this survey are in Ontario. Quebec also has a significant share of computer centres (21.1%) and computers (20.5%).

Figure 21 also shows that, as far as the location of the computers is concerned, our results are similar to those of a survey reported by the Computer/Communications Task Force in 1972. That survey used a much larger sample, and included computers used in a stand-alone or over-the-counter manner, as well as communications-oriented machines.

The computer centres in Ontario appear to be substantially larger than in other regions, with an average of three machines per centre in Ontario, compared to over two in Quebec, and between one and two in British Columbia, the Atlantic Provinces and the Prairies.

4.4.3 Data Communications Traffic

A significant proportion of data communications traffic flows into the large Ontario computer centres for processing. This conclusion is based on Figures 22, 23a and 23b.

	Remote Batch	Video CRT	TTY	Tape to Tape	On-line Banking	Point of Sale	Other	Total
British Columbia	70	775	256	97	667	—	12	1,877
Prairies	149	578	326	145	1,057	—	39	2,294
Ontario	425	1,673	1,325	141	3,845	130	156	7,695
Quebec	208	1,001	512	32	3,760	7	19	5,539
Atlantic	38	330	128	—	439	—	8	943
Outside Canada	75	565	730	6	—	—	44	1,420
Total	965	4,922	3,277	421	9,768	137	278	19,768

Figure 20. 1976 Terminals by Region

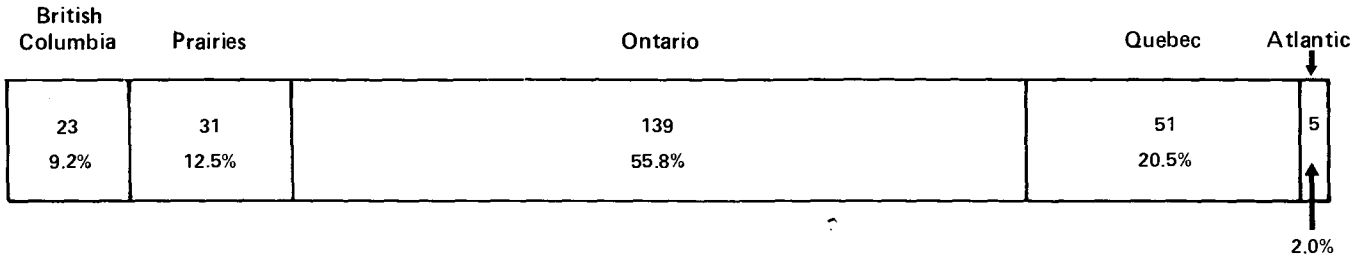
	As Shown by This Survey, 1976				Computer/Communications** Task Force Study, 1972	
	Computer Centres	Percentage of Total	Computers	Percentage of Total	Number	Percentage of Total
British Columbia	14	12.3	23	9.2	358	8.1
Prairies	26	22.8	31	12.5	601	13.7
Ontario	46	40.3	139	55.8	2,279	51.7
Quebec	24	21.1	51	20.5	939	21.3
Atlantic	4	3.5	5	2.0	228	5.2
Total	114*	100.0	249	100.0	4,405	100.0

* *This figure differs from figure 10 because of 2 computer centres located outside Canada.*

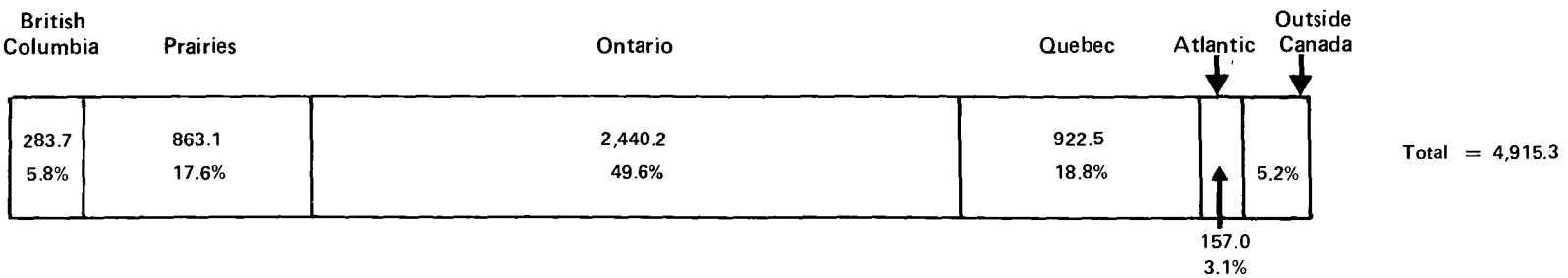
** *"Branching Out", report of the Canadian Computer/Communications Task Force, Ottawa, 1972.*

Figure 21. 1976 Regional Distribution of Computers and Computer Centres

OF COMPUTERS



OF TRAFFIC BY ORIGINATING LOCATION (millions of characters per day)



OF TRAFFIC BY DESTINATION (millions of characters per day)

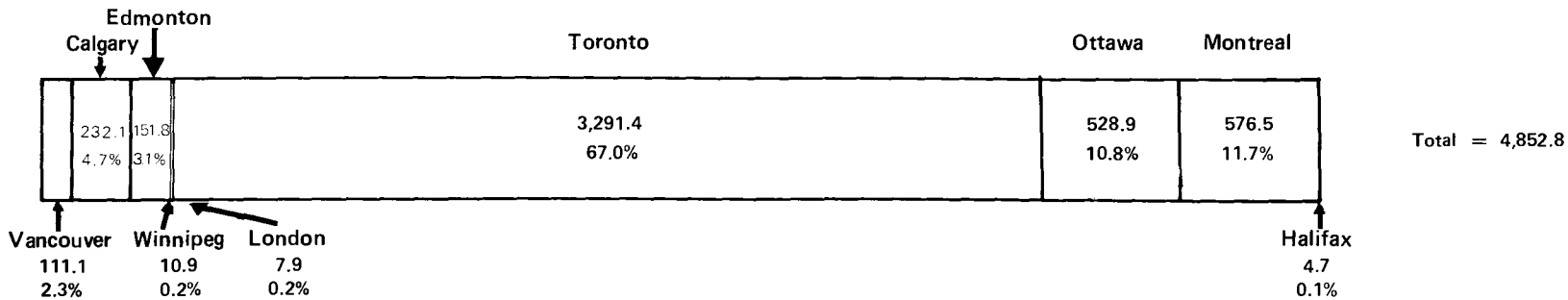


Figure 22. 1976 Geographical Distribution

TERMINAL LOCATION	LOCATION OF COMPUTER CENTRE									
	Vancouver	Calgary	Edmonton	Winnipeg	London	Toronto	Ottawa	Montreal	Halifax	TOTAL
N.W.T./Yukon	0.8		1.3			0.1				2.2
Vancouver/Victoria	58.6	72.4	2.5		0.7	111.7	0.1	1.5		247.5
B.C. Other	22.4	0.1	0.1			7.9		3.6		34.1
Calgary/Alberta South	0.7	103.7	142.8		0.2	163.0	5.2	0.8		416.4
Edmonton/Alberta North	1.5	33.1	2.0		0.3	43.3	0.2	6.5		86.9
Regina/Saskatchewan		2.4	1.0	1.2	0.1	122.2	0.2	3.6		130.7
Winnipeg/Manitoba	2.6	20.4	0.4	3.6	0.3	103.3	0.3	98.1		229.0
Thunder Bay/Northern Ontario				1.5	0.4	58.8	8.1	4.9		73.7
Windsor/London/Sarnia	0.2		0.1	0.1	0.7	63.5	10.1	4.3		79.0
Hamilton/Niagara Penn.	0.2				0.5	104.9	0.1	0.8		106.5
Toronto/Kitchener/Barrie	10.6		0.1	2.5	2.9	1,586.7	16.8	38.8		1,658.3
Cornwall/Eastern Ontario					0.2	10.7		26.3		37.2
Ottawa/Hull	1.0				0.3	160.1	317.2	6.8		485.4
Montreal Area	8.5		0.1	0.8	0.8	465.0	51.3	285.3		811.8
Quebec City	0.1					24.0	2.7	10.0		36.7
Quebec Other						32.2	10.9	30.8		73.9
New Brunswick					0.2	23.5	0.3	4.0	2.1	30.1
Prince Edward Island						1.0		0.2		1.2
Newfoundland						8.6		4.1	0.6	13.3
Nova Scotia					0.3	88.0	1.8	13.9	2.0	106.0
U.S.A.	3.9		1.4	1.2		84.3	103.6	26.3		220.8
Europe						21.5		5.9		27.4
Asia						0.5				0.5
Mexico & South America						6.5				6.5
Africa										
TOTAL	111.1	232.1	151.8	10.9	7.9	3,291.4	528.9	576.5	4.7	4,915.3

Figure 23a. 1976 Origin and Destination of Traffic Volumes (Millions of Characters Per Day)

LOCATION OF COMPUTER CENTRE

Terminal Location	Vancouver	Calgary	Edmonton	Winnipeg	London	Toronto	Ottawa	Montreal	Halifax	TOTAL
N.W.T./Yukon	.016		.026			.002				.040
Vancouver/Victoria	.455	.002	.022			.160		.073		.692
B.C. Other	1.190	1.472	.051		.015	2.273	.002	.031		5.034
Calgary/Alberta South	.014	2.110	2.905		.004	3.317	.105	.016		8.471
Edmonton/Alberta North	.031	.673	.041		.006	.881	.004	.132		1.768
Regina/Saskatchewan		.049	.020	.024	.002	2.487	.004	.073		2.659
Winnipeg/Manitoba	.054	.415	.008	.073	.006	2.102	.006	1.996		4.660
Thunder Bay/Northern Ontario				.031	.008	1.196	.165	.099		1.499
Windsor/London/Sarnia	.004		.002	.002	.014	1.291	.205	.086		1.608
Hamilton/Niagara Penn.	.004				.010	2.135	.002	.016		2.167
Toronto/Kitchener/Barrie	.215		.002	.051	.059	32.280	.341	.789		33.737
Cornwall/Eastern Ontario					.004	.218		.535		.757
Ottawa/Hull	.021				.006	3.257	6.452	.138		9.876
Montreal Area	.173		.002	.016	.016	9.460	1.044	5.803		16.516
Quebec City	.002					.487	.055	.202		.748
Quebec Other						.656	.222	.628		1.504
New Brunswick					.004	.479	.006	.081	.043	.613
Prince Edward Island						.021		.004		.025
Newfoundland						.176		.083	.012	.271
Nova Scotia					.006	1.790	.036	.282	.041	2.155
U.S.A.	.080		.028	.024		1.715	2.108	.536		4.491
Furope						.437		.120		.557
Asia						.010				.010
Mexico & South America						.132				.132
Africa										
TOTAL	2.259	4.721	3.087	.221	.160	66.962	10.759	11.723	.096	100.00

Figure 23b. 1976 Origin and Destination of Traffic Volumes (Percent Distribution)

Data communications traffic can be classified by the location of the terminal (origin) or by the location of the computer centre with which it communicates (destination). The location of the terminal is referred to as the origin since, as a rule, the terminal user initiates and the computer responds. But most terminals receive output as well as transmit input, so a substantial part of the traffic for which the terminal is said to be the origin in fact consists of output transmitted to the terminal from the central computer.

While only 49.6% of the data communications traffic in the sample originates with terminals in Ontario, 78.0% goes to Ontario computer centres. Toronto is the destination for 67.0%, with Ottawa at 10.8%.

Montreal is the destination for 11.7% of the traffic in the sample and none goes to other locations in Quebec, despite the fact that the Province is the location for 20.5% of the computer equipment and originates 18.8% of the traffic. The West also exports data to Ontario. Although they have 21.7% of the computers and originate 23.4% of the data communications traffic, the four Western provinces receive only 10.3%. Calgary is the leading Western destination with 4.7%, followed by Edmonton (3.1%), Vancouver (2.3%), and Winnipeg (0.2%). London, Ontario and Halifax also receive small amounts of data communications traffic.

4.4.4 Origin/Destination Matrix

For a more detailed picture of traffic flows, Figure 23a provides a complete origin/destination matrix for sample data flowing to Canadian computer centres. Originating locations are grouped into 25 areas specified in the questionnaire. These areas are listed down the left hand side of the Figure. Only 9 cities are shown on the destination axis along the top of the page, since all traffic, with minor exceptions, flowed to these centres. Figure 23b shows these traffic flows as a percentage of the total.

Toronto is the destination for over 75% of the total traffic originating in Saskatchewan, Northern Ontario, Windsor-London-Sarnia, Hamilton-Niagara Penninsula, Toronto-Kitchener-Barrie, New Brunswick, Prince Edward Island, Nova Scotia, Europe, Asia and Mexico-South America. It is the largest single destination for traffic from 10 other areas as well. The only five originating areas for which destinations other than Toronto predominate are the North-West and Yukon Territories, which transmit largely to Edmonton and Vancouver; British Columbia (other than Vancouver-Victoria), which sends 22.4 or 34.1 million characters per day to Vancouver; Ottawa-Hull, which sends most of its traffic to other locations in Ottawa; Cornwall-Eastern Ontario, which sends 26.3 of 37.2 million characters per day to Montreal; and the United States, which sends somewhat more traffic to Ottawa than to Toronto. While this inflow of data from across the country is important to Toronto, it is worth noting from the sample data that the Toronto-Kitchener-Barrie area itself originates a third of all Canadian traffic, almost all of it destined for Toronto, and provides half of the inflow.

Although only a third of the traffic generated in the Montreal area remains there, the 285.3 million characters transmitted per day still account for the majority of the traffic destined to Montreal. Winnipeg is the second largest source of Montreal-bound traffic at 98.1 million characters per day.

5. OPINIONS EXPRESSED BY USERS

The second part of the survey collected user opinions on important computer/communications issues. This section of the survey was intended to increase the awareness of the Department of Communications of user concerns and problems, and to provide an inventory of user comments. The opinion survey did not identify clearly any new areas of concern where the Department need be involved, but it did provide a wealth of new information on topics currently discussed in the user community and among other interested parties.

5.1 USER EXPERIENCE WITH COMPUTER/COMMUNICATIONS IMPLEMENTATION

Users were asked whether their implementation of computer/communications applications had been hampered by technical problems in seven areas. Figure 24 shows that, on average, more than a quarter of the

users encountered problems in at least one area. The most common problems related to the unavailability of or the delay in obtaining services from carriers (25 of 69 respondents) and unavailability of terminal maintenance (24 of 70). Only 10 of 63 respondents were hampered by start up problems involving data processing hardware.

	Yes	No	No Reply
Have your computer/communications been hampered by:			
– unavailability or delay in obtaining:			
. terminals	16	54	4
. services from carriers	25	44	5
– unavailability or poor quality of terminal maintenance	24	46	4
– delays in clearing up initial problems with:			
. terminals	17	53	4
. data communications facilities	21	49	4
. data processing/storage hardware	10	53	11
. computer/communications control software	18	49	7
Average*	19	50	6
Percent of Total	(26%)	(68%)	(6%)
Are you satisfied with the performance of your operational computer/ communications applications with respect to:			
– terminals	60	10	4
– data communication services from carriers	49	19	6
– mainframe	61	8	5
– computer/communications control software	55	13	6
Average	56	13	5
Percent of Total	(76%)	(17%)	(7%)
Have you experienced severe technical problems with data communications facilities for operational systems	41	29	4

* *Averages are presented to indicate general patterns.*

Figure 24. Recent Experience With Computer/Communications Implementation – All Industries

The second set of questions in Figure 24 indicates that most respondents are satisfied with the performance of computer/communications applications once they are operational. Questioned about four areas, an average of 56 of the 69 respondents expressed this opinion.

The survey confirms that data communications is an area where technical difficulties are frequent. A relatively large number of respondents (41 of 70) indicated that they have experienced severe technical problems with data communications facilities relative to operational applications. Data communications facilities are also cited as a common factor hampering computer/communications implementation, and as the area of least satisfaction with respect to the performance of operational systems.

Service bureaus are less satisfied with the performance of operational data communications applications than other users, and report more technical problems with their data transmission networks. This is understandable because service bureaus are high volume users dependent on good communications facilities for their livelihood.

The survey shows that excessive delays in obtaining communications facilities are most common in the Edmonton, Calgary and Vancouver regions. In addition, Alberta, remote locations in British Columbia, and Ontario are areas where respondents experienced problems in obtaining maintenance from the carriers. One manufacturer has given up trying to obtain adequate data transmission facilities to a remote area of British Columbia. Delays in obtaining a number of other services are singled out, with high speed lines (9600 baud), geographical coverage of digital transmission services, and multiplexing equipment being prominent. Several service bureaus express dissatisfaction with carrier billing practices of which two are specifically mentioned: insufficient information on invoices and late billings.

Figure 25 reveals that the majority of respondents would not hold back applications development because of technological risk. This implies that users expect that the market will provide adequate terminals and communications facilities if there is a demand. Moreover, Figure 26 shows that few users experience problems of incompatibility between their computer equipment and carrier communications facilities.

	Yes	No	No Reply
Are you holding up development because:			
a) technological risk is excessive due to unavailability of appropriate:			
– non-standard terminals	4	66	4
– data communications services from carriers	15	55	4
– computer/communications control software	7	63	4
b) implementation too complex	6	63	5
c) regional problems	10	59	5
Average	8	61	5
Percent of Total	(11%)	(83%)	(6%)

Figure 25. Reasons for Delaying Development of Applications

	Yes	No	No Reply
Severe compatibility problems over the last year with:			
– interfacing to carrier network at:			
. terminal end	6	64	4
. computer centre end	7	63	4
– interfacing mainframe to communications control equipment	1	65	8
– interfacing terminals to communications control equipment	5	62	7
Average	5	63	6
Percent of Total	(6%)	(86%)	(8%)

Figure 26. Computer Terminal Compatibility With Carrier Facilities

5.2 PRESENT SERVICE OFFERINGS OF CANADIAN COMMON CARRIERS

The majority of users surveyed obtain their data communications services from the Trans-Canada Telephone System (TCTS). More specifically:

- 55% use only TCTS
- 15% use only CNCP Telecommunications
- 30% use both major carriers

Many users indicated a preference for TCTS because it provides a dial-up service.

The majority of those receiving services from a single carrier are satisfied with the error rate in data transmission and the amount of carrier system downtime, as can be seen from Figure 27.

5.3 PACKET SWITCHING

Packet switching is a technical innovation meant to increase utilization of data communications lines. At present, a data communications user can choose between a dedicated line, which provides a permanent, exclusive link between two points, or dial-up service, which gives him exclusive but temporary use of the line. In packet switching, the transmission is broken down into brief messages, each labelled as destination, and these messages are forwarded through a network of lines shared among all users.

The majority of respondents expressed no enthusiasm for packet switching as a technical innovation. About a third did not reply to questions about the expected impact of packet switching on the cost and performance of their systems which, together with the diversity of opinion among those who did reply, suggests a low level of awareness. A large number of respondents anticipate using packet switching nevertheless, as indicated in Figure 28. Their prime motive is to reduce data transmission costs, rather than to take advantage of its technical features. Indifference towards packet switching as an innovation is further shown by the answers of those who do not intend to use packet switching – these respondents state that they have identified no technical requirement for its use.

	System Downtime	Error Rates in Transmission
Excellent	10	8
Very Good	20	19
Good	13	9
Fair	3	6
Poor	—	1
No Reply provided	3	6
Total	49	49

Figure 27. User Satisfaction With Carrier Services (Services Received From a Single Carrier) (49 Respondents Reporting)*

* *The local loop aspect (the connection of individual terminals to long-distance lines) of CNCP was ignored.*

	Yes	No	No Reply
Anticipate a need for packet switching	42 (57%)	22 (30%)	10 (13%)
Do present offerings (as announced) meet your needs	10 (14%)	34 (46%)	30 (40%)
Will there be security problems	19 (26%)	44 (60%)	11 (14%)

Figure 28. User Attitudes About Packet Switching

Although many expect to use packet switching, the majority say that present offerings (as announced) do not meet their needs. Some respondents may have adopted this position simply because complete performance standards and service specifications were not available at the time of the interviews (Summer 1976). Other respondents state that packet switching lacks features such as message acknowledgement, or would not meet their response time requirements.

Figure 29 shows that about 40% of the respondents expect packet switching to reduce their data transmission costs. Many also anticipate a reduction in equipment prices because of standardization. This is despite the fact that a more complex data exchange protocol for terminals and computers will be needed for packet switching, since information such as the destination will have to be added to outgoing messages, and incoming messages will have to be reassembled into a coherent form. One third of the respondents expect that

	Greater	Same	Lower	No Reply
. cost of packet switching compared to present computer/ communications costs	14*	4	30	26
. cost of buying/renting interface equipment relative to existing costs	19	5	29	21
. technical complexity of existing and planned computer/ communications applications	18	23	17	16
. technical performance of existing computer/communi- cations applications	24	21	9	20

	Significant	Marginal	No Reply
. cost of implementing packet switching software	27	22	25

	Yes	No	No Reply
. able and/or willing to develop necessary software if off the shelf systems for interfacing computers and packet switched networks are not available	21	35	18

* *9 of these users indicated that costs would rise because of increased use.*

Figure 29. User Expectations With Respect to Packet Switching

the cost of programming terminals and computers to interface directly with packet switching networks will be considerable. There is no consensus among respondents whether packet switching will increase or reduce the technical complexity of computer/communications applications, but they expect that technical performance will be improved or remain the same.

Many respondents are concerned about the compatibility of existing equipment with a packet switching network, particularly that terminals are not or cannot be programmed to support the pack switching data exchange protocol. One common carrier intends to provide an interface mechanism, but has also indicated that direct compatiblity with the packet switching network will be favoured, perhaps through lower rates.

The common carriers presumably hope that users will want to make their equipment compatible through programming or hardware changes. Many respondents indicate, however, that they are reluctant to get involved in the development of such software. A number (21) did express willingness to undertake this programming, particularly service bureaus who may identify this as a business opportunity.

5.4 STANDARDS

The respondents were almost unanimous in supporting increased standardization in computer/communications. A few identified disadvantages with standards, but would still support them. Figure 30 shows that there is disagreement, however, as to which body should set standards.

Twenty-four respondents out of seventy-two expressed interest in international standards applying to Canada, United States and other countries.

	Yes	No	No Reply
Aware of international deliberations on the standardization of packet switching standards	58	14	2
Generally support the development of computer/communications standards	73	—	1
Would you benefit from international standards	24	48	2

Standards should be set in the following manner:	% Breakdown
. mandatory fashion by government or quasi-government agency	38
. in a de facto fashion (e.g. by equipment vendors)	27
. voluntarily (e.g. by users or voluntary standards group)	37
. by the carriers	5
. by all parties concerned	6

Figure 30. Attitudes Towards Standards

5.5 FUTURE PLANS

The majority of users expect their computer/communications operations to expand considerably between 1976 and 1980. This growth will be mainly in present applications rather than new ones. These statements, however, were generally made by data processing or communications specialists, or managers who may have built-in biases. Figure 31 shows that 20,000 more remote terminals will be installed in addition to the current base of 20,000.

A number of respondents state that their plans are conditioned largely by the economic situation, the competitive situation in their sector, or "the way the whole industry" evolves.

The majority of respondents plan to install minicomputers, largely for use in entering and editing data and for handling enquiries. However, they do not expect their data communications traffic to decline as a result.

5.6 OTHER ISSUES

The final portion of the questionnaire covered user attitudes about government action and the sharing of communications facilities.

Figure 32 shows that users have mixed feelings about government involvement in the field of computer/communications. Over two-thirds feel they have not been kept adequately informed about government action. Moreover, a majority feel that their needs are not understood and their suggestions are not taken into account by government policy makers. This suggests a requirement for better user-government interaction.

	Installed	To Be Installed 1976	1977	1978–80	Total Installations
Financial Institutions	10,231	1,600	2,200	5,000	19,031
Service Bureaus	2,128	225	350	450	3,153
Resource	336	50	75	—	461
Manufacturing	1,826	1,100	600	1,150	4,676
Transportation and Utilities	4,713	1,050	1,700	3,300	10,763
Wholesale/Retail and Other	534	225	425	500	1,684
	19,768	4,250	5,350	10,400	39,768
Number of respondents	54	52	55	47	

MINICOMPUTERS

	Yes	No	No Reply
Plan to install minicomputers for:			
. data base/file updating	29	39	6
. data entry/editing	46	22	6
. enquiry	42	25	7
Average	39	29	6

Figure 31. Additional Remote Terminal Installations

	Yes	No	No Reply
Adequately informed of government actions in the field of computer/ communications	20 (27%)	50 (68%)	4 (5%)
Consider government action in this area meaningful	22 (30%)	33 (45%)	19 (25%)
Needs understood by government policy makers	15 (20%)	42 (57%)	17 (23%)
Needs and suggestions taken into account	20 (27%)	37 (50%)	17 (23%)
Field of computer/communications receives too much attention	17 (23%)	52 (70%)	5 (7%)
Believe his company has been surveyed too often	18 (24%)	51 (69%)	5 (7%)

Figure 32. User Attitudes Toward Government Involvement and Facilities Sharing

6. CONCLUSION

Readers are reminded that this report is based on information supplied by a sample of 74 companies, most of them major computer/communications users. It may not reflect the opinions or describe the operations of other companies. The opinions quoted are those of specific individuals within these companies, not of the Department of Communications or its staff.

The Department thanks the companies and individual executives whose cooperation made this study possible. Many went to considerable trouble to develop the data requested. The names of the respondents must however be withheld to ensure that no inference about the data communications activity of any specific company can be drawn from this report.

APPENDIX A

Description of Data Processing Applications by Industry

A1. FINANCIAL INSTITUTIONS

The larger Canadian banks and credit unions began to experiment with on-line systems in the late 1960's, but active use and rapid growth only began in the early 1970's. Many of the early on-line systems started as service bureau applications which were designed, built and operated for particular banks by major computer manufacturers. These on-line applications often involve substantial batch processing as well.

Savings accounts represent the major on-line application in financial institutions. Other major applications include processing of personal chequing and current accounts, term deposits, loans and mortgages, general ledgers and financial reporting. Relatively minor applications include foreign exchange, money orders, and drafts.

The major banks are at different stages in the development of on-line systems and as a consequence the emphasis in future development is not uniform. In general, the banks appear to be concentrating on developing internal systems, and resources are not being devoted to customer processing services, although the long range objective is generally to automate and integrate all branch banking functions.

There are approximately 10,000 on-line banking terminals installed in Canada. The banks who responded to the survey expect this to grow to 20,000 by 1980.

The financial institution category also includes insurance and investment companies, but these are much less prominent as data processing users.

A2. SERVICE BUREAUS

Remote access computer service revenue was about $100 million in Canada during 1975. Most of this was generated by approximately 27 large firms. Remote access computing services may be roughly divided into two categories: remote job entry or remote batch computing services, and interactive time sharing services. Industry sources indicate that remote batch revenues grew by almost 30% during calendar year 1975, while time sharing revenues grew by more than 40%. Most firms focus on one or the other of these two market segments, but some compete in both.

Time sharing services are used when interaction between an operator and a computer is desirable during the execution of programs. These applications typically involve relatively small input/output volumes. While a fast response is generally important, the terminals and data communication circuits used can be comparatively low speed, because so little data is generally transmitted. Remote batch applications, on the other hand, usually involve large input/output volumes and thus require higher speed terminals.

Firms offering interactive time sharing services may also provide high speed services to handle large input/output volumes effectively. For example, punched cards may be read into a storage space using a remote batch terminal connected to the computer centre by high speed lines. The job is then executed from a low speed interactive terminal, and the output may be directed to a high speed line printer for subsequent pick up by or delivery to the customer.

A3. RESOURCE INDUSTRIES

Applications in the resource sector are highly diversified, ranging from analysis of exploration results, scientific computing and program development to accounting, payroll, and other administrative functions.

The processing of exploration results involves enormous quantities of data and very heavy processing loads. Oil companies were, therefore, among the first users to incorporate the highest speed communication circuits into their systems. These lines, operating at 50,000 bits per second, were first installed in the early seventies to link Toronto and Calgary.

A4. MANUFACTURING

Manufacturing applications generally revolve around administrative procedures, accounts receivable, payroll, accounts payable, and so on. Some major respondents have introduced interactive computer applications, particularly in order entry and inventory control, two areas where rapid file updating and enquiry capabilities are important.

Recent developments in minicomputers have added new horizons to computing in the manufacturing sector, and some firms have introduced them to perform specific functions such as order entry, process control and/or billing, even though they already have larger general purpose computers.

A5. TRANSPORTATION

In transportation, the two major users of computer communications are the airlines and railroads. These companies have complex nation-wide operations which require a high degree of coordination, so they have an immediate built-in need to transmit data.

The railroads were pioneers of data communications, since they developed terminal-to-terminal message services long before the turn of the century. These private communications systems were developed to handle the railroads' needs regarding train movement, notification of delays, track status, freight waybills, and so on. Until recently, these systems consisted entirely of telegraph wires and poles along railroad rights-of-way, together with electromechanical terminals and associated switching equipment. In the late 1950's and early 60's, these systems began to give way to higher capacity microwave systems. Eventually this new equipment spanned the country, and provided the means to link computers and terminals together.

The major application area for the railroads is traffic reporting and control. These activities have spawned large on-line systems, with terminals being controlled and managed by one or two large computer centres. Their basic purpose is to provide immediate information on the make up of trains as they move across the country. These systems are complex since thousands of railroad cars are monitored as they are packed, moved and unloaded 24 hours a day. Moreover, cars are transferred constantly between United States and Canadian rail systems, necessitating inter-connection of data systems.

While railroads concentrated on freight shipments, the airlines programmed their major systems for passenger traffic. This led to the highly sophisticated, instantaneous response passenger reservation systems which virtually all airlines now have. The passenger reservation application began in the late 1950's, with the focus on providing current information on seat availability for each upcoming flight instantaneously. As seat inventory applications were perfected, development moved on to systems which kept track of passenger names as well. In recent years, the airline industry has concentrated on applications such as cargo information, flight status reporting, crew scheduling, parts inventory, and maintenance information.

A6. ELECTRIC UTILITIES

Electric utilities use data processing and data communications for administration, accounting, research and engineering, and power network control.

Administrative applications such as utility billing and accounting are highly centralized in this industry, but the trend is likely to be towards more enquiry/response applications, as indicated by forecasts of large additional terminal requirements to 1980.

Power network control is a small element in the total EDP budget of an electric utility, but it requires a large share of its data communications budget. In this application, communications are used primarily for collecting and analysing data. The actual control of the facilities is either manual or computer-assisted. Automated methods of network control are being developed, but it may be several years before they become widespread.

A7. WHOLESALE

The principal wholesale applications are order entry and billing. However, for marketing reasons, wholesalers are increasingly offering computer services to their customers. These include collecting orders using a variety of terminals located in individual stores, generating summaries of past orders, and producing shelf and product labels.

A8. RETAIL

A few years ago, it was predicted that retailers would rapidly replace or supplement conventional cash registers with point-of-sale terminals. These terminals would allow the immediate collection of detailed sales information, and might also provide electronic credit checking as a basis for the ultimate replacement of cheques with electronic funds transfer, the direct debiting of the customer's bank account. Particularly in food chains, point-of-sale systems would replace manual entry of prices by cashiers by a system of electronic scanning of codes printed on merchandise, followed by retrieval of the current price from a databank.

While point-of-sale terminals promise to improve inventory control and store profit performance, development to date has been slow and only a few respondents have definite plans for point-of-sale systems in the future. One major food chain is involved in an experimental system, but large food retailers are generally wary about possible public reaction to point-of-sale systems.

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