

HD
9696
C63
C3272
1978

April 28, 1978

Draft for Discussion

2. [INFORMATION PROCESSING

IN

CANADA 1980 - 1985

Industry Canada
LIBRARY
MAY 20 1999
BIBLIOTHEQUE
Industrie Canada

Survey Analysis Report No. 1

Information Processing Growth Expectations 1975-1980

~~COMMUNICATIONS CANADA
FEB 7 1979
LIBRARY - BIBLIOTHEQUE~~

Prepared by:
H.H. Brune
Department of
Communications

Synopsis

This report presents a forecast of national expenditures for computer application development and maintenance, computer/communications equipment and related data transmission and personnel by industry classification for the period 1975-1980. The forecasts were developed from estimates provided by the respondents to the 1977 survey of the Informatics Institute of Canada and correlated to the growth model developed by the Computer/Communications Secretariat.

I. Contents

Information Processing Growth Expectations 1975-1980

	<u>Page</u>
I. Contents	2
II. Summary and Conclusions	3
III. Background	6
1. Purpose of Report	6
2. Approach	6
IV. Results of Analysis	8
1. Computing Equipment Revenue Growth	8
2. Data Transmission Expenditure Growth	12
3. Computer Applications Development and Maintenance Growth	15
4. Operating Personnel Growth	19
5. Computer/Communications Systems Plant Personnel Growth	20
6. Growth of Total Personnel Expenditures	21
V. Methodology	23
1. Definitions and Description of Boundaries	23
2. The Limitation of the Survey Approach	25
3. Basic Approach	26
4. Methodology - Computing Equipment Revenues	27
5. Methodology - Data Transmission Expenditures	27
6. Methodology - Personnel Expenditures	27

HD
9696
C63
U3272
1979



II. Summary and Conclusions

Table 1

Estimated Growth 1975-80 by Type of Expenditures

(Excluding in-house users and computer services suppliers entering after 1975).

<u>Type of Expenditures</u>	<u>1975 Estimate (\$000,000)</u>	<u>1975/80 Growth Rate %</u>	<u>1980 Estimate (\$000,000)</u>
Personnel	1,305	13	2,348
Computing Equipment	710	16	1,266
Data Transmission	125	18	294
Other Costs	<u>490</u>	<u>13</u>	<u>902</u>
Total Costs	2,630	13	4,810
Provision for new users and suppliers entering after 1975	-	-	470
Total User Costs	<u>2,630</u>	<u>16</u>	<u>5,280</u>

Highest Growing Industry Sectors

- Computing Equipment - Distribution (17%)
- Personnel - Provincial/Municipal Governments (15.5%)
- Data Transmission - Transport/Utility (25%)

Lowest Growing Industry Sectors - Manufacturing

- Computing Equipment - 6.5%
- Operating Personnel - 5%
- Data Transmission - 8%

- . Nearly half of the respondents perceived growth rates in personnel and computing equipment expenditures which amount to little more than projected GNP growth in current dollars.
- . On the other extreme of the growth scale, some ten to twenty percent of all respondents reported rates well in excess of average. In all but a few cases, the reporting organizations were small in size but either started major projects in conventional applications or began the development of new applications (word processing, graphics, electronic mail). These organizations are expected to increase their share of the market at the expense of existing larger computer user and commercial computer services organizations.
- . During 1970 to 1975, the government sector accounted for the largest

growth. Respondents from government forecast a much lower growth for the period 1975 to 1980 and beyond. Overall growth will be lowest in the federal government. However, a number of provincial/municipal governments and two federal departments or agencies are in the process of major expansion.

Responses from the service sector, especially the Computer Services Industry, Transport/Utilities, Finance and Services and Distribution predict gains well above average growth. Respondents from the Resource sector (primary resources, petroleum) suggest a "small growth" environment. The manufacturing sector reported the lowest growth in expenditures with the possible exception of computer application development.

In 1970, the Manufacturing sector ranked first in terms of value of installed computer base. In 1980, this sector may rank fifth if the projected growth rates materialize.

Table 2

Distribution of Installed Computer Base by Industry

<u>Industry Category</u>	<u>1970</u>	<u>1975</u>	<u>1980</u> (Estimate)
	%	%	%
<u>Users - Public Sector</u>	<u>21.1</u>	<u>24.7</u>	<u>24.4</u>
Federal Gov't	5.3	7.9	7.1
Prov./Mun. Gov'ts	6.7	9.0	9.1
Other Public Institutions	9.1	8.3	8.2
<u>Users - Private Sector</u>	<u>64.4</u>	<u>60.5</u>	<u>60.6</u>
Financial Services	12.1	12.9	13.9
Distribution	5.6	6.1	7.5
Manufacturing	20.4	15.1	11.6
Resources	7.6	6.7	6.0
Transp./Utilities	11.9	11.9	12.7
Other Industries	6.8	7.8	8.9
<u>Computer Services Ind.</u>	<u>14.5</u>	<u>14.8</u>	<u>15.0</u>
<u>Total Installed Base</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
Value of Installed Base (1)	\$410 Million	\$870 Million	\$1,525 Million

(1) Estimates prepared by the Computer/Communications Secretariat of the annual rental value of installed computers.

Table 3

Comparison of Distribution of Installed Computer Base by Country

<u>Industry Category</u>	<u>1975-76 Reports</u>		
	<u>Canada</u>	<u>United States (1)</u>	<u>Japan (1)</u>
	<u>%</u>	<u>%</u>	<u>%</u>
Manufacturing (including Resources)	21.8	26.4	32.8
Financial Services	12.9	18.5	26.4
Governments and other Public Institutions	24.7	13.2	14.5
Services	40.9	41.9	26.3
	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

(1) Source: International Data Corporation, EDP Industry Report, April 7/78.

Note: All figures appearing in this report are rounded off to the nearest \$ million or half percentage point.

III. Background

In 1977, the Informatics Institute of Canada, a Canadian non-profit association of senior managers in the field of information processing, undertook a survey of the Canadian information processing community entitled "Information Processing in Canada 1980-1985". The survey was undertaken to examine the future of information processing in Canada in terms of demands to be faced during the next decade and the potential barriers which must be overcome in order to meet those demands. Some two hundred organizations in the public and private sectors were approached to complete a lengthy questionnaire, of which 111 organizations returned completed responses.

The raw data from the survey were compiled during January 1977 and released in a 330 page report. No attempt was made to order or analyse the data or to draw any conclusions. These tasks were left to a later stage.

1. Purpose of Report

This report is intended to be the first in a series addressing the issues raised in the survey. Its purpose is the examination of the projected growth of expenditures for information processing in Canada. An attempt was made to relate the data obtained from the survey to statistical data from other sources and to correlate the responses related to expenditure growth with those addressing projected user demands for services. However, modifications of the projected growth rates may be necessary if the detailed analysis of the responses addressing user demands reveals any further inconsistencies. A detailed description of the methodology used in the analysis is included in Section V of this report for the benefit of interested readers.

2. Approach

The respondents were asked to provide an estimate of expected annual compound growth rates of expenditures within their respective organizations related to computer application development and maintenance, computing equipment, data transmission and personnel costs. These questions were asked for

the following purposes:

- To assist in the validation of forecasts produced by the Computer/Communications Secretariat.¹
- To gain an indication of any significant changes in the pace of automation of information-related activities undertaken by responding organizations.
- To allow a comparison between the perceived development plans of the responding organizations and the projected growth rates of expenditures.
- To permit a finer breakdown of growth expenditures and revenues by industry group.

An attempt was made to obtain a regional breakdown of national expenditures but differences in industry patterns, and the small number of responses from all regions but Ontario, made regional analysis impossible.

The perceived growth rates were used in conjunction with statistical data obtained from Statistics Canada,² the CIPS computer census,³ the DATACOM 76⁴ survey and other information, to develop growth estimates for computing equipment revenues, data transmission expenditures and personnel costs for the period 1975 to 1980. These trends may well continue, though with some modification, in the years following 1980 but likely changes in the application of new technology and in the economic climate of Canada appear to make detailed predictions beyond 1980 less reliable.

-
1. Computer/Communications Secretariat, The Growth of Computer/Communications in Canada, Discussion Paper March 78.
 2. Statistics Canada, Computer Service Industry, annual reports 1972 through 1976, Cat. No. 63-222.
 3. Canadian Information Processing Society, Canadian Computer Census, annual reports of 1965 through 1976.
 4. Dept. of Communications DATACOM 76, Results of a Survey, April 77, CRC Report No. 1306.

IV. Results of Analysis

The analysis of the survey responses differs in some aspects from that reported in the discussion paper "The Growth of Computer/Communications in Canada" issued in March 1978 by the Computer/Communications Secretariat. The most important difference is that the estimates in this report often exclude user organizations without in-house computing facilities and any new entrants who use computing facilities after 1975 for the first time.

1. Computing Equipment Revenue Growth

Table 4

Distribution of Computer/Communications Equipment Revenues by Industry

<u>Industry Category</u>	<u>Estimated Equipment Expenditures</u>			<u>Annual Compound Growth</u>	
	<u>1970</u>	<u>1975</u> (\$000,000)	<u>1980</u>	<u>1970-75</u> %	<u>1975-80</u> %
<u>Users-Public Sector</u>	<u>71</u>	<u>175</u>	<u>309</u>	<u>20.0</u>	<u>12.0</u>
Federal Gov't	18	52	90	24.0	11.5
Prov./Mun. Gov'ts	22	64	115	24.0	12.5
Other Public Institutions	31	59	104	14.0	12.0
<u>Users-Private Sector</u>	<u>216</u>	<u>430</u>	<u>768</u>	<u>15.0</u>	<u>12.0</u>
Financial Services	41	92	176	18.0	14.0
Distribution	19	43	95	18.0	17.0
Manufacturing	68	107	147	9.0	6.5
Resources	25	48	77	13.0	10.0
Transp./Utilities	40	84	161	16.0	14.0
Other Industries	23	56	112	20.0	(1)
<u>Comp. Services Ind.</u>	<u>49</u>	<u>105</u>	<u>189</u>	<u>17.0</u>	<u>12.5</u>
<u>Total Revenues</u>	<u>335</u>	<u>710</u>	<u>1,266</u>	<u>16.0</u>	<u>12.0</u>
Comp./Com. Secretariat Model Estimates (2)	<u>335</u>	<u>710</u>	<u>1,260</u>	<u>16.0</u>	<u>12.0</u>

Notes

- (1) Information not adequate to establish meaningful growth rates.
- (2) Estimates developed by the Secretariat. Computing equipment revenues less revenues from other equipment suppliers.

The above estimates represent operating revenues to equipment suppliers from sales, leases and servicing of computer hardware, allied data communications equipment, terminal and peripheral equipment, and related systems software in Canada. Intersegment revenues from sales to other hardware suppliers are excluded. Growth rates derived from the survey are linked to data from the Secretariat's model, the CIPS Census and the Treasury Board report on EDP in the federal government at 1975. The 1970 and 1975 total revenues were taken from the Secretariat's model. Because the sample analysis yielded very similar growth rates to those used in the model, the 1980 estimates are in close correspondence.

Year to year computing equipment revenues by customer industry category appear to vary considerably. This became apparent during the analysis of the CIPS Computer Census figures for 1970 to 1976 and the Computer Services Industry Reports for 1972 to 1976. Year to year growth in installed computer capacity by industry category listed in the CIPS Computer Census, and expressed in estimated annual rental value, ranged from a low of minus 15 percent to a high of plus 40 percent. It should be noted that the listed estimates represent trend value rather than actual annual revenues.

Public Sector

During 1970 to 1975, the equipment expenditures of Canadian governments showed the highest annual compound growth rates, averaging almost 24%. Respondents from governments forecast a much lower growth rate for 1975 to 1980 and beyond. (Federal government 11.5%; provincial/municipal government 12.5%). Two-thirds of all respondents from the federal government predicted that hardware expenditure growth will be kept below 10% p.a. while the same percentage of respondents from provincial/municipal governments suggested a 15% limit. Two respondents from the federal government predicted the initiation of major automation projects within their respective user organizations and two respondents from provincial governments foresaw major expansion of existing facilities, accounting for growth rates well above average.

Responses from universities and colleges suggested that these organizations have since 1970 been subject to spending constraints similar to those now placed on governments. We estimate that computing equipment revenues from other public institutions (education, health care and others) will grow from \$59 million in 1975 to \$104 million in 1980.

Private User Sector

In 1970, the Canadian Manufacturing sector ranked first in size as a revenue source for equipment suppliers. Low growth rates (9%) during 1970-75 and even lower expectations (6.5%) during 1975-80 may drop this sector into fifth place (\$147 million) behind Governments (\$205 million), the Computer Services Industry (\$189 million), Financial Services (\$176 million), and Transport/Utilities (\$161 million). Growth in equipment revenues from the resource industry (primary resources and petroleum) appear to be slightly higher (10%) than those predicted for the Manufacturing sector. It should however be noted that the Canadian Computer Services Industry has made considerable progress in attracting work from the Petroleum industry, especially seismic data processing. This could be a possible explanation for the low equipment revenue growth in this instance but uncertain economic prospects may also have contributed.

The Distribution sector (wholesale, retail, newspapers) may account for the highest computing equipment growth rate during the period 1975 to 1980. Respondents from this sector reported consistently high growth rates in application development (21%) and hardware expenditures (17%) which suggest that new applications should become operational during the late seventies and early eighties.

The Financial Services sector accounted for the largest absolute increase in computing equipment revenues within the private computer user community. Equipment expenditures of \$41 million in 1970 rose to \$92 million in 1975 and may reach \$176 million by 1980. Application development growth (15%) and reduction in hardware expenditure growth rates from 18% to 14% suggest that the automation development effort has passed its peak.

A similar situation may exist in the Transportation/Utility sector. Application development growth (12%) appears to be below average (16.5%), yet hardware expenditure growth (14%) and growth in operating personnel (13%) appear to be above average for 1975-80. Computing equipment expenditures of

\$40 million in 1970 doubled to \$84 million by 1975 and are expected to reach \$161 million by 1980. Projected expenditures arising out of new pipeline construction may account for some of the expected above average performance. The likely trend in the Transportation/Utility sector is towards improvement and expansion of existing applications.

Other industry categories such as Communications, Construction, Services, etc. have shown a considerable growth (20%) during 1970-75 but their contribution to total equipment supplier revenues was just under ten percent. Too few responses were received from these sectors to calculate meaningful growth rates. None of these industries seem to have reached their peak in development effort and the assumed growth rate may turn out to be very conservative.

Computer Services Industry

Computing equipment growth rates for the computer services industry (including provincially-owned and hardware supplier-owned service bureaus) peaked around 1970. Estimated revenues from this sector rose from \$49 million in 1970 to \$105 million in 1975 and are expected to climb to \$189 million by 1980. The estimated 1970-75 annual growth rate of 17% is expected by respondents to decline to 12.5% for the period 1975-80. It should be noted that the "hardware revenue" estimates for this industry are considerably higher than the "hardware cost" estimates in the Secretariat's model, especially for 1970 and 1975, because a considerable proportion of equipment is purchased outright by the industry rather than rented from computer manufacturers.

2. Data Transmission Expenditure Growth

Table 5

Distribution of Data Transmission Expenditures by Industry

<u>Industry Category</u>	<u>1975 Estimates (\$000,000)</u>	<u>1975-80 Growth Rates %</u>	<u>1980 Estimates (\$000,000)</u>
<u>Users - Public Sector</u>	<u>19</u>	<u>16</u>	<u>40</u>
Federal Gov't	6.5 (1)	20	16
Prov./Munic. Gov't	7.5	12	13
Other Public Institutions	5	17	11
<u>Users - Private Sector</u>	<u>91</u>	<u>19</u>	<u>221</u>
Financial Services	20	19	48
Distribution	8	15	16
Manufacturing	11	8	16
Resources	8	15	16
Transp./Utility	32	25	98
Other Industries	12	(2)	27
<u>Computer Services Ind.</u>	<u>15 (1)</u>	<u>17</u>	<u>33</u>
<u>Total Expenditures</u>	<u>125</u>	<u>18</u>	<u>294</u>
Comp/Comm. Secretariat Model Estimates	125	21.5	330

Notes

- (1) Reported Expenditures
- (2) Information not adequate to establish meaningful growth rates.

The above estimates represent projected user expenditures for data transmission services related to computer-based information processing for the years 1975 and 1980. Excluded from the above estimates are expenditures by organizations which will use data transmission services after 1975 for the first time.

The above estimates represent primarily revenues of telecommunications carriers for data transmission services related to information processing. However, an undetermined amount of expenditures by respondents from the Transport/Utility industry category is on account for services generated by "in-house" carrier facilities operated by some airlines, pipelines and public utilities.

The total growth rate of data transmission expenditures calculated as a weighted mean average rate (18%) appears to be slightly lower than the rate (21%) used in the Secretariat's model. A subsequent analysis of the projected trends in distributed data collection, distributed computing and the projected trends in the development of communications-oriented data banks suggests that some survey respondents may have taken a conservative approach in the preparation of their predictions.

A further contributing factor to the low growth estimate is the absence of information on growth generated by new users or by user organizations which purchase remote computing services from service bureaus and pay the resulting data transmission charges directly to carriers.

The potential increases in data transmission expenditures resulting from the introduction of electronic mail, remote word processing, facsimile transmission and electronic payments were assessed but it appears that the impact on data transmission expenditures may not be significant until the early to mid eighties.

The higher growth rate in data transmission should be reflected in staff additions in computer/communications systems plant personnel (software, hardware and communications specialists engaged in the design and maintenance of computer/communications systems). In general, a good correlation between the two rates was obtained.

Public Sector

With an expected growth rate of 20%, the federal government appears to be the fastest growing segment in the public sector. Decentralization of facilities, the growth of distributed computing and new on-line computer applications appear to be the major reasons. The apparent discrepancy between data transmission (20%) and computer/communications systems plant personnel growth (14%) could be explained by greater reliance on central agencies and carriers in computer network development.

A second area of high growth (17%) are Other Public Institutions if the responses from universities and colleges are a valid indication of trends. The likely reasons for their growth are the emerging institutional computer networks for educational institutions, hospitals, libraries and similar public institutions.

Provincial and municipal governments reported a relatively low growth rate of 12%. This may be because of the relatively restricted territory served by these installations.

Private User Sector

The Transport/Utility sector represents both the largest user (\$32 million and \$98 million respectively in 1975 and 1980) and the fastest growing segment (25%) for data transmission services. The relationship between application development (12%), computer communications systems plant personnel (15%) and data transmission growth (25%) suggests that much of the new traffic will be generated by network extension rather than through new applications.

A somewhat similar situation appears in the Financial Service sector. However the growth rates of 15%, 15% and 19% suggest that more traffic will be generated by new applications especially from on-line banking services servicing an increasingly larger number of geographically dispersed branches.

The Manufacturing sector appears to offer little prospect of growth. The ratio between data transmission (8%) and computer/communications systems plant personnel growth (5%) appears to be reasonable.

Growth for the Distribution sector of 15% appears to be below the average of the Private User sector (18%). Rates for application development (21%), C/C Plant personnel (15%) and data transmission growth (15%) suggest that the peak period for data transmission growth may occur during the early to mid eighties. Responses from the Resources industry suggest emphasis on computer network expansion.

The Computer Services Industry

Growth in data transmission expenditures suggested by respondents in this industry (17%) is well below the estimate of the Computer/Communications Secretariat (25%) but relates well to C/C Plant Personnel growth of 12%. The responses from the industry suggest a significant growth of remote computing services at the expense of over-the-counter services. It appears therefore that, in the absence of any indication for a substantial reduction of revenue growth, the reported data transmission expenditure projections may be low.

3. Computer Applications Development and Maintenance Growth

Table 6

Distribution of Application Development and Maintenance Personnel Expenditures by Industry

<u>Industry Category</u>	<u>Development</u>			<u>Maintenance</u>		
	<u>1975</u> <u>Estimates</u> <u>(\$000,000)</u>	<u>1975- 80</u> <u>Growth Rate</u> <u>%</u>	<u>1980</u> <u>Estimates</u> <u>(\$000,000)</u>	<u>1975</u> <u>Estimates</u> <u>(\$000,000)</u>	<u>1975- 80</u> <u>Growth Rate</u> <u>%</u>	<u>1980</u> <u>Estimates</u> <u>(\$000,000)</u>
<u>Users-Public Sec.</u>	<u>91</u>	<u>15</u>	<u>187</u>	<u>45</u>	<u>14</u>	<u>87</u>
Federal Gov't	27	14	51	13	9	20
Prov./Mun. Gov't	32	20	80	16	20	40
Other Public Institutions	32	(1)	56	16	(1)	27
<u>Users-Private Sec.</u>	<u>213</u>	<u>17</u>	<u>469</u>	<u>107</u>	<u>11</u>	<u>190</u>
Financial Services	46	15	92	23	13	42
Distribution	22	21	57	11	12	18
Manufacturing	54	22	146	27	9	41
Resources	18	12	32	9	10	14
Transp./Utility	42	12	74	21	18	48
Other Industries	31	(1)	68	16	(1)	27
<u>All User Org.</u>	<u>304</u>	<u>16.5</u>	<u>656</u>	<u>152</u>	<u>13</u>	<u>277</u>
<u>Comp. Serv. Ind.</u>	<u>43</u>	<u>16</u>	<u>90</u>	<u>21</u>	<u>16</u>	<u>44</u>
<u>Total</u>	<u>347</u>	<u>16.5</u>	<u>746</u>	<u>173</u>	<u>13</u>	<u>321</u>

(1) Information not adequate to establish meaningful growth rates.

The above estimates represent personnel costs only and include wages, salaries and employee benefits. According to the 1975 Computer Services Industry Report, Canadian computer user organizations also contracted systems development and maintenance services and purchased or leased application software from the Canadian computer services industry in amounts listed below.

Estimated Expenditures - 1975

<u>Type of Expenditure</u>	<u>Application Systems</u>		
	<u>Development</u> (\$000,000)	<u>Maintenance</u> (\$000,000)	<u>Total</u> (\$000,000)
In-House Personnel (All User Org.)	304	152	356
Appl. Software Purchases and Leases	13	-	13
Purchased Services	55	8	63
	<u>372</u>	<u>160</u>	<u>432</u>

Not included in the above estimates are services purchased by Canadian user organizations directly from foreign sources, i.e., software purchases from U.S. based software houses or services rendered by U.S. parent firms to Canadian subsidiaries. Also, no information is available to determine the ratios between domestically produced and imported application software packages or between domestically produced and imported systems development and maintenance services sold by the Canadian computer services industry.

Applications Development versus Maintenance

It is generally assumed that with the increase in the number of operational application systems, systems maintenance costs will rise faster than development costs, eventually overtaking development costs in absolute terms. The 1977 survey results have not borne out this assumption. A 1971 survey by the Canadian Computer/Communications Task Force⁵ showed that systems development costs in the private user sector accounted for two-thirds of total systems and programming services while maintenance costs accounted for the remaining one-third. Growth rates estimated at that time for both functions based on constant dollars were 9%.

5. CCCTF, Background Paper 15, Computers and Communications in the Canadian Business Community, Page 19, Information Canada 1974 C022-5/7-15/16.

The 1977 survey results have been a surprise. Systems development growth (16.5%) is now forecast to be higher than systems maintenance growth (13%) in all industry categories but Transport/Utility (12% versus 18%), Provincial/Municipal Governments (20% versus 20%), and the Computer Services Industry (16%, 16%).

Two explanations for this trend are plausible: Either the costs for changes, updates and conversions of existing systems are covered under "development expenditures", or the practices of the past of abandoning systems which require more than slight modifications (primarily because of lack of suitable documentation) in favour of complete re-development is still prevalent among many information systems service organizations.

Public Sector

Provincial and municipal governments appear to offer the greatest growth opportunities for systems development. Expenditures are reported to be increasing by 20% p.a. Consolidation and reorganization of some provincial information processing functions may account for this above-average growth. Respondents from the federal government report a much reduced growth (14%) but above average growth opportunities exist in a number of departments and agencies currently evaluating the feasibility of major automation projects. Respondents from colleges and universities project a moderate growth, suggesting that "Other Public Service" institutions are under considerable spending restraints on application development.

Private Sector

The exceptionally high growth rate in systems development reported by the Manufacturing sector is in sharp contrast to growth figures provided for other functions. One-third of all respondents from this sector reported growth rates in excess of 30%, one respondent reported a rate of 80%. While opportunities for rapid growth do exist in this sector, especially in the field of process and machine control, the uncertain prospects of the Canadian industry, lack of visible signs of increased capital goods spending and the low forecast of growth of computing equipment expenditures suggests an inconsistency in

survey responses. For these reasons, the reported growth rate for this sector should be regarded as questionable, subject to further investigation.

The growth rate of 21% reported by the Distribution sector correlates well with the reported growth of other related expenditures. This suggests that the sector is in the process of major development of new projects which may become operational during the late seventies or early eighties. The responses from the Financial Services segment suggest a somewhat reduced development effort as major systems become operational in the near future on a wide scale. The responses from the Transport/Utility segment suggests that expansion and improvements of existing systems rather than the development of new systems may be the general trend. The Resource segment reported below average growth in all accounts.

The Computer Service Industry

Responses from the industry (which includes Software Houses) report a growth expectation of 16%, based on a sales-weighted average. However, some 30% of all respondents from the industry, primarily smaller firms, expect growth rates ranging from 30% to 300% p.a. A major upturn of software revenues should be expected if the predictions of these respondents begin to materialize.

4. Operating Personnel Growth

Table 7

Distribution of Operating Personnel Expenditures by Industry

<u>Industry Category</u>	<u>1975 Estimates (\$000,000)</u>	<u>1975-80 Growth Rates %</u>	<u>1980 Estimates (\$000,000)</u>
<u>Users - Public Sector</u>	<u>203</u>	<u>11</u>	<u>341</u>
Federal Gov't	59	11	99
Prov./Mun. Gov't	72	12	126
Other Public Institutions	72	(1)	116
<u>Users - Private Sector</u>	<u>476</u>	<u>12</u>	<u>753</u>
<u>Financial Services</u>	<u>103</u>	<u>12</u>	<u>181</u>
Distribution	49	9	75
Manufacturing	120	5	154
Resources	40	8	58
Transp./Utility	94	13	173
Other Industries	70	(1)	112
<u>All User Organizations</u>	<u>679</u>	<u>10</u>	<u>1,094</u>
<u>Computer Serv. Ind.</u>	<u>106</u>	<u>12</u>	<u>187</u>
<u>Total</u>	<u>785</u>	<u>10</u>	<u>1,281</u>

(1) Information not adequate to establish meaningful growth rates.

The above estimates represent expenditures for personnel engaged in computer/communications operations including data conversion, operation of facilities, data control and associated administrative, managerial (and, in the Computer Services Industry, marketing) functions. Personnel expenditures are primarily wages, salaries and employee benefits.

Operating personnel growth rates (10%) are slightly below projected hardware growth (12%) in all reporting industry categories. Employment of operating personnel in the Manufacturing segment may decline slightly, remain at the same level in the Resources segment and increase between 2% and 6% p.a. for all other segments after taking the rate of prevailing wage and salary increases into account. Labour productivity improvements expressed in number of operating personnel per million dollars rental value of installed computing capacity should increase between 3% and 6% p.a. No evidence has been obtained to suggest a relative decline of data conversion (entry) costs in the near future; this is also contrary to a commonly held view.

5. Computer/Communications Systems Plant Growth

Table 8

Distribution of C/C Systems Plant Personnel Expenditure Growth by Industry

<u>Industry Category</u>	<u>Growth Rates, 1975 - 80</u> %
<u>Users - Public Sector (2)</u>	<u>11</u>
Federal Government	14
Prov./Munic. Governments	11
Other Public Institutions	(1)
<u>Users - Private Sector (2)</u>	<u>12</u>
Financial Services	14
Distribution	17
Manufacturing	5
Resources	15
Transp./Utility	15
Other Industries	(1)
<u>Computer Services Industry</u>	<u>13</u>
<u>All Respondents (2)</u>	<u>13</u>

(1) Information inadequate to establish meaningful growth rates.

(2) Figures weighted by installed computer capacity.

The respondents were asked to project the growth of expenditures for computer/communications systems plant personnel. This includes software programmers, hardware, mini-computer and telecommunications specialists engaged in the specification, installation and maintenance of the required computer configurations and computer network development including the acquisition, development and maintenance of systems software.

The collected data was applied in two ways. First, the reported growth rates were compared to those related to computing equipment, telecommunications and systems development growth. In general, a good correlation between these different growth rates was observed, as outlined above. Second, an attempt was made to reconcile the reported growth rates with expected changes in the mode of computer operations as reported by the respondents; changes from stand-alone batch to remote job entry, from batch to on-line, from centralized to distributed computing and data collections, from master files to data base management. In general no direct correlation could be established in the latter case. This raises the question whether the projected conversion schedule estimates to new modes of operation (addressed in Report No. 2) are not overly optimistic.

6. Growth of Total Personnel Expenditures

Table 9

Distribution of Total Personnel Expenditures by Industry

<u>Industry Category</u>	<u>1975 Estimates (\$000,000)</u>	<u>1975-80 Growth Rates %</u>	<u>1980 Estimates (\$000,000)</u>
<u>Users - Public Sector</u>	<u>339</u>	<u>13.0</u>	<u>615</u>
Federal Gov't	99	12.0	170
Prov./Munic. Gov't	120	15.5	246
Other Public Institutions	120	(1)	199
<u>Users - Private Sector</u>	<u>796</u>	<u>12.0</u>	<u>1,412</u>
Financial Services	172	13.0	315
Distribution	82	13.0	150
Manufacturing	201	11.0 (3)	341
Resources	67	9.0	104
Transp./Utility	157	13.0	295
Other Industries	117	(1)	207
<u>Total-User Organizations</u>	<u>1,135</u>	<u>12.0</u>	<u>2,027</u>
C/CS Model (2)	1,135	14.5	2,245
<u>Computer Services Industry</u>	<u>170</u>	<u>13.5</u>	<u>321</u>
C/CS Model (2)	170	18.0	380
<u>Total Personnel Costs</u>	<u>1,305</u>	<u>12.5</u>	<u>2,348</u>
C/CS Model (2)	1,305	15.0	2,625

- (1) Information not adequate to establish meaningful growth rates.
- (2) Computer/Communications Secretariat Estimates including cost estimates for new user and industry entrants and users without in-house facilities.
- (3) May be overstated because of abnormally high application development estimates supplied by the Manufacturing sector.

An attempt was made to develop a 1980 estimate of total personnel expenditures from reported growth predictions and to compare the results with the 1980 estimates derived from the Secretariat's model. It should be noted that the survey responses reflect essentially budget information of existing EDP organizations which have computers and do not take into account personnel expenditures for systems analysts, programmers and operators employed in other organizations. These latter include EDP organizations which will be formed after 1975. Also, no provision was made for any tendency to greater than average growth of expenditures by users of purchased computer services or those which obtain services from foreign-based parent companies. It was therefore expected that the growth rates derived from the Secretariat's model would be somewhat higher than the rates obtained from survey responses. This assumption is borne out in the estimates listed below.

C/CS Model/Survey Comparison
1980 Total Personnel Expenditures

	<u>Survey</u> (\$000,000)	<u>C/CS Model</u> (\$000,000)	<u>Differences</u> %
Computer Users - All Sectors	2,027	2,245	10.8
Computer Services Industry	321	380	18.4
Total	<u>2,348</u>	<u>2,625</u>	<u>11.8</u>

The relatively large difference between the estimates obtained for the Computer Services industry (18.4%) indicated a need for further investigation. One of the first tasks was the exploration of the difference between the sales-weighted growth rate of 13% and the unweighted mean growth rate of 19% for the Computer Services Industry. A subsequent analysis of individual survey sections indicated that growth rates reported by larger computer services organizations were in general considerably lower than those reported by medium and small size firms. The conclusion could be drawn that the market share of existing larger firms is expected to decline as new firms enter the market and smaller firms attempt to capture new markets. While the growth rate for large firms is still impressive (16%), small and medium size firms simply grow faster (over 20%).

An attempt was made to verify this conclusion but the only reliable source available was the data prepared by the Treasury Board. According to Table X of the 1976-77 Treasury Board report, the share of total EDP expenditures held by the ten largest computer user departments in the federal government declined from 70% to 68% over a three-year period while the share of the ten smallest user departments nearly doubled from 1% to 1.8% over the same period. In other words, the ten largest user departments reported an annual compound growth rate of 10% while the ten smallest reported a rate of 30%.

We are now of the opinion that when a sample consists chiefly of large firms, the average EDP growth rate for the sample will likely be below the true growth rate for all users. Under surprise-free conditions the estimates for the Computer Services Industry could be low by as much as ten percent with a somewhat lower deviation for computer user estimates in all sectors.

V. Methodology

1. Definitions and Description of Boundaries

The terms "computer/Communications" and "information processing" have been used frequently throughout this report to denote similar but not necessarily identical economic activities.

The term "computer/communications" was invented by the Canadian Computer/Communications Task Force to denote activities related to the use of the merging computer and data communications technologies. The term has since been used in Canada to cover all computing activities including application development plus all electronic data transmission activities. It has not been restricted to those computing activities which actually use data transmission, as any computing can be done remotely via terminal/telecommunications facilities or by stand-alone computer facilities. The scope of the activities is described in the discussion paper on "The Growth of Computer/Communications in Canada" and covers activities performed by in-house data processing organizations, telecommunications carriers, the Computer Services and Computer/Communications Equipment Industries.

The term "information processing" has generally been used to describe activities of organizations engaged in the planning, development and maintenance of manual and automated information systems and in the planning, acquisition and operation of computer/communications facilities. Information processing focusses on the processing needs of the organizations served and the uses of computer/communications as a tool while computer/communications deals with both the use and supply of these facilities.

Prior to the late sixties, in-house information processors were the sole operators of computer/communications facilities apart from the facilities operated by computer manufacturers to complement in-house activities. Statistical information obtained from these two principal sources could be considered as reliable indicators of Canadian activities in this field.

The emergence of the Canadian Computer Services Industry during the late sixties and early seventies created a new source of information processing activities in Canada. Users now have the choice of producing information processing services in-house or purchasing the same services from a commercial suppliers. It is no longer necessary to have in-house computer facilities in order to process information by computer. Consequently, a reliable estimate of Canadian computer/communications activities can be developed only on the basis of data collected from a number of sources, among these: users with in-house facilities, the Computer Services Industry and other suppliers of services (including foreign parents), and the Computer/Communications Equipment Industry.

In the past, in-house information processing organizations were primarily engaged in computer applications development and operation. In all but a few cases manual information systems development represented only a minor part of overall activities. The responses to the survey suggest a gradual change of the scope of the information processing function. These changes may include the following:

- more emphasis on economic and human aspects of information processing during the development phase, leading to more integrated man/machine/communications systems;
- more emphasis on information transfer activities in written, verbal and visual form; and
- wider use of new information handling facilities including graphics, micro-film, new printing techniques, word and text processing, process control, electronic mail, terminal devices and data banks.

A change in the orientation of information processing activities is also foreseen. Many of the present operating functions (data entry, terminal operations) will be absorbed by user organizations as an internal activity. The information systems design requirements of the future may place more emphasis on entrepreneurial goals and economic and social needs rather than rely exclusively on preferences of the individual user organizations served.

Changes of the nature outlined above could create a need for redefinition of "computer/communications" and "information processing" activities and their boundaries for measurement. Because most of these changes are expected to take place after 1980, the decision was made to restrict the development of expenditure and revenue estimates to a period 1975-80, using the definitions and measurement boundaries developed by the Computer/Communications Secretariat.

2. The Limitation of the Survey Approach

In 1976, the Computer/Communications Secretariat developed a statistical model for estimating computer/communications spending and employment in Canada. Further refinements were undertaken during 1977. The model, associated methodology and derived estimates for the period 1965 to 1985 were described in a discussion paper entitled "The Growth of Computer/Communications in Canada", issued March 1978. The model uses publicly available statistics and other information.

In general, the reliance of the model on factual statistical data and derived trends suggests greater accuracy of reported estimates over other methods. The limitation of this survey became evident during the detailed analysis of the obtained results. First, the responses from the Manufacturing sector were too few to provide a valid statistical sample of the industry. Second, certain peculiarities in individual responses to particular questions suggest that some respondents have taken an intuitive rather than analytical approach to growth rate development. Third, as managers of EDP organizations or computer service firms, the respondents represent in toto the largest share of present and future computer/communications markets. However, the survey could not include organizations which entered the market only after 1975, nor organizations which sell information processing services as a secondary activity, and these cannot be fully taken into account in this analysis.

3. Basic Approach

The 1975 estimates of total expenditures or revenues were taken from the Secretariat's model and distributed by industry category as described in the preceding sections. The analysis of the growth rate responses proceeded as follows:

1. Arithmetic mean growth rates (unweighted) were established for each industry category but some three to five percent of responses reporting rates in excess of 100% were excluded. These responses were checked individually, found plausible but speculative.
2. Arithmetic mean growth rates weighted by budget size or sales were also calculated for respondents in the federal government and for some respondents in the Computer Services Industry with known revenue figures. (Source: Sept. 77 issue of EDP In-Depth Reports). (The problems encountered in the use of weighted growth rates are described on page 21.)
3. Growth figures in excess of 30% p.a. were individually scrutinized for reasonableness of related responses and rejected if inconsistencies were evident. Only two to four responses were rejected this way.

The adjusted growth rates developed as described above were used to calculate the 1980 figures by industry category. The results were added together and used to establish composite growth rates for the public and private sectors and total expenditures. The 1980 estimates of the Secretariat's model were recorded where available to facilitate comparison.

In all cases a comparison of the estimates obtained for the federal government was made with the data published by the Treasury Board. No major deviations were discovered.

4. Methodology - Computing Equipment Revenues (Table 4)

The total annual revenues to equipment suppliers for 1970 and 1975 were taken from the Secretariat's model. The 1970 and 1975 computer censuses were used as the base for calculating revenue distribution by industry category and the results were validated, using the data published in the Statistics Canada reports "Computer Service Industry" 1972 to 1976. An assumption was made that the growth of hardware expenditures reported by the respondents would correspond to the growth in revenues of equipment suppliers. The 1980 revenues were estimated using the arithmetic means calculated for each industry category. The obtained results were also used in the preparation of the 1980 estimates of installed computing capacity, shown in Table 2.

5. Methodology - Data Transmission Expenditures (Table 5)

The 1975 estimates of data transmission expenditures by industry category were developed from expenditure ratios for hardware/data transmission expenditures taken from the DATACOM '76 survey. This survey was conducted by Price Waterhouse Associates for the federal Department of Communications. Because of the small number of DATACOM respondents, these distribution estimates may not be typical of industries as a whole. A comparison of the results obtained for the computer services industry using DATACOM information and using data provided in the Statistics Canada report revealed a difference of almost 40%. In this case an adjustment was possible, but caution is advised in the use of the provided estimates for data transmission expenditures.

6. Methodology - Personnel Expenditures (Tables 6 to 9)

The total personnel expenditures for 1975 were obtained from the Secretariat's model. Total personnel expenditures by industry category were calculated using the distribution of annual computer rental value by industry category derived from the 1975 CIPS Computer Census.

Personnel expenditures were further separated into systems development, systems maintenance and operating personnel expenditures. The CIPS Salary Survey and Treasury Board data were used to establish the ratios for in-house user organizations. Tables 3 and 4 of the 1975 Computer Service

