An Evaluation of Available Computer/Communications Information
and
Information Gaps

Report to the Interdepartmental Task Force
on
Transborder Data Flows
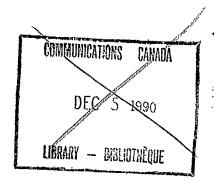
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Department of Communications
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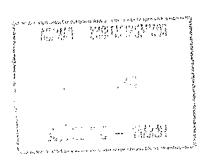and
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1. INTRODUCTION

1.1   Background and Purpose

Information/computer/communications activities are a major component of the Canadian economic infrastructure and represents a vital link for all activities. The magnitude of the historical and expected growth of information/computer/communications activities and their penetration and influence in all fields of social and economic life has brought to the foreground the urgency of formulating a national framework for measuring these activities.

The primary objective of analysts and decision-makers is to gain an understanding of these activities, their relationships with the rest of the economy, their performance in the international market scene and the issues and questions that arise concerning information/computer/communications activities. For this purpose an information base that describes these activities is required in order to enable analysts to monitor their performance in terms of broad policy objectives, conduct appropriate studies aimed at identifying causal factors and assess their significance.

Policy makers are faced with a wide range of issues, from the growth potential of the various activities to their role in the economic infrastructure of the country. This paper will address the major issues relating to computer/communications activities, the policy questions that may arise and the availability of an adequate information base to assist decision-makers in identifying the issues and possible solutions.

It is becoming evident that the impact, on both social and economic life, of information/computer/communications activities will spread quickly. The technological changes are so rapid that its products and services have made, and will continue to make, an important contribution to the changes in costs, productivity and efficiency, growth and technological change in industries and sectors which use them. Underlying these rapid technology changes are the innovations taking place within computer/communications activities. The major influence of computer/communications on all fields of economic and social life and the lack of a comprehensive information base makes it necessary to examine the activities themselves, their role in international trade, as well as the nature, extent, and implications of their penetration and the new technology associated with it, into the various sectors of the economy.

An attempt needs to be made to define the activities and outline the information requirements, as well as the analytical requirements needed for understanding computer/communications. This paper evaluates available sources of information, draws attention to information and data gaps, and outlines possible action plans with respect to filling these gaps.

In addition, the paper examines the state of international statistical development for information/computer/communications activities in selected countries and reviews proposals with respect to information requirements which are presently under discussion in the OECD.

1.2 Conceptual Problems and Definitions

Information/computer/communications activities are made up of a wide range of economic activities which includes, on the supply side, the preparation of information in a suitable format for transmission, the carriage or transmission of information, the processing of information, and the producing, selling, leasing and maintaining of equipment and software required in performing these activities. In principle the area includes such things as radio and television broadcasters, telephone companies, computer service firms, software houses, and manufacturers of communications, computer, micro-computer, electronic data processing and office automation equipment, as well as home entertainment equipment, including radios and televisions. The demand for these services and products extends across many sectors of the economy.

The overall area of information/computer/communications can be looked at as comprising three activities: telecommunication activities, electronic information activities and computer/communications activities. Telecommunications has been investigated in the past and has a reasonable statistical system established for gathering information, although estimates of carrier revenue derived from data communications are not readily available.
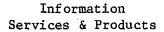
Electronic information services includes systems used for on-line transaction processing, such as airline reservations, point-of-sale services, on-line banking and inventory management. Also these systems are beginning to be used by the public for services such as teleshopping, automatic tellers and electronic funds transfer systems. Electronic information services and products is an activity that has been growing rapidly over the past decade, due to the advance and convergence of computer and communications technologies. The advent of videotex services, such as TELIDON, should further stimulate the demand for information services and products over the next decade. A subset of the extensive network of information services are the public on-line information retrieval services. The public on-line service industry is addressed in Public On-Line Information Retrieval Services (Neogi and Knoppers, January 1982, Ref. 5), where an attempt at estimating total revenues for the industry is presented.
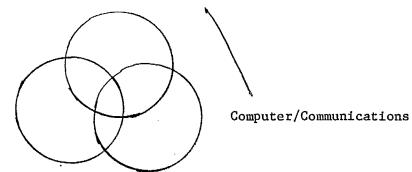
This paper will focus on the available information and information gaps for the narrower field of computer/communications and the activities associated with it, as defined in more detail below, as well as that portion of information activities addressed in Public On-Line Information Retrieval Services. It will consider the firms supplying the goods and services both as a primary and secondary activity and the users of these goods and services. Information should be gathered separately for both open market and in-house activity.

The nature of the computer/communications activities and their rapid penetration into the various sectors of the economy brings out several conceptual problems. The increasing inter-involvement of computer technology with telecommunications and other sectors, and the resulting diversity of applications makes it necessary to define the boundaries

separating computer/communications activities from other activities which are closely related, such as office automation equipment, enhanced communications services and communication carrier systems. These boundaries will change and erode over time, due to technological change, but definitions are necessary for statistical measurement purposes.

The following illustration presents a pictorial representation of the situation.

Information
Services & Products

Telecommunications   Computer/Communications

Initially, the three activities were more easily identified and separated. However, with the advance of computer technology, single purpose equipment is becoming obsolete and users are faced with economical multi-function equipment capable of performing several of their communications functions. Consequently, the shaded area is becoming increasingly larger.

Also, in the past few years, there has been an increasing trend for firms to move towards combining their computer/communication, telecommunication functions and other office communication functions under one responsibility centre, further complicating the task of separating costs and expenditures. There has been a rising concern for the problem of inconsistencies in the data, in addition to the gaps in the information relating to computer/communications activities.

Solutions to the conceptual problems facing analysts are critical to the overall success of developing an information base for these activities. They must be addressed and solved at the earliest stage of developing a system.

At present, there are no clear classifications defining computer/communications activities in place in Canada. For this paper, computer/communications activities are defined to include goods intended mainly for entering, processing, retrieving and distributing information under the control of programs which can be adapted to various uses, and the associated computer services. This definition of computer/communications activities brings out two separate types of industry on the production side: computer hardware,

which is considered a tangible good and computer services, which are made up of intangible goods (software) and services (information processing, training, etc.). This classification of the computer services activities will make them compatible with classifications now operating in the U.S., such as the one used by ADAPSO. A consistency is important because of the close linkages of the Canadian market with the U.S. market and is essential in getting an overall feel of the total North American market.

Prior to gathering information, industry should be consulted when finalizing the classification of computer goods and services to ensure consistency across firms and their acceptance of the system.

To distinguish between the two industries the following breakdown of products of computer/communications activities by industry is defined. These definitions are needed to obtain information in the long run for the supply side of computer/communications activities.

   a) Computer Hardware Industry (Tangible goods)

   This covers the sale, leasing and rental of hardware designed primarily for the entry, processing and retrieval of information under the control of stored programs, which include:

   - mainframes, mini-computers and micro-computers such as small
     business and desk top computers
   - peripherals such as auxiliary storage units (disks, tapes, etc.)
   - input-output units such as terminals and printers
   - systems software included with hardware and not sold separately

   b) Computer Services Industry (Intangible services and products)

   The computer services industry can be broken down into three main categories:

   i)   Processing services which include:

         - information processing services such as data-processing
           services, rental of machine time, and information retrieval
           services
         - input preparation and data entry

   ii)   Professional services which include:

         - intellectual services such as systems management, computer
           consultancy, systems engineering, and hardware and software
           maintenance
         - custom computer programming
         - purchased training and research services

iii) <u>Software products</u> which includes the sale, leasing and rental of:

- operating systems software (including high level languages/compilers)
- <u>utility software</u> such as data base management systems and productivity enhancement tools
- <u>applications software</u>, which can be broken down by function, such as, management, office automation programs, computer-aided design, production programs, technical and scientific applications, and teaching and games, and many others   CAL

1.3   Scope and Limitations

Computer/communications covers a wide range of activities and products, as described in the previous section. The focus of this report will be on the issues and information requirements needed for electronic information services and computer software products, and the usage of computer hardware both on the open market and in-house. Activities related to the selling of computer services and software products as a primary and secondary activity and other activities related to service bureaux, software houses and systems houses are included. It is important that information related to the purchase (imports) of software packages and services from outside of Canada be collected. In the short run focus should be put on the collection of information by activity rather than by industry. Although this paper focuses on a sub-set of the information/computer/communications activity, medium and long-term action plans should aim at developing a statistical framework encompassing all information/computer/communications activities.

Until recently, there has been little identification of industries involved in computer/communications activities, making it difficult to gather historical information on the field. Also, there has been a lack of distinction between the different types of computer software and services being produced. As the scope and influence of computer/communications grows, these distinctions will become increasingly difficult to define. In addition to these product definition problems, a method of assessing the value of these products and activities should be constructed.

2. INFORMATION REQUIREMENTS FOR COMPUTER/COMMUNICATIONS RELATED ACTIVITIES

There are many policy issues concerning computer/communications facing government decision-makers. First, there is a need to develop an analytical and definitional framework within which statistics for computer/communications activities can be collected. It is useful that decision-makers, both government and industry, are provided with the information necessary for understanding the area so as to aid in the development and planning of computer/ communications activities and to help solve the problems that arise.

Computer services is a unique activity which is shared between open-market and in-house operations. The economic and other factors governing the firm's decision to purchase computer services from the industry or supply the services for themselves vary greatly over time, resulting in a continuous shift of demand between open-market and in-house sources. Therefore, the overall demand for computer services would not easily be obtained until information on user expenditures can be obtained on a regular basis.

2.1 Major Issues and Analytical Requirements

The design of an information base for computer/communications activities must be directed by the main issues concerning it and the analytical requirements needed to address the issues, both in terms of quantitative and qualitative indicators.

First is the extent to which Canada is taking advantage of the development opportunities stemming from computer/communications activities, in the domestic as well as in the international market place. This broad issue raises several concerns dealing with the future development and competitiveness of the Canadian computer service industry and software industry. Equally important are the export capabilities and potential for these industries. Also, the effects and implications of government procurement policies and the degree of government aid directed towards computer/communications activities must be evaluated as they arise in order to determine the benefits of these activities.

An analysis of the key economic development policy issues, in terms of performance and growth potential, which policy-makers and industry are likely to identify, requires an assessment and understanding of the goods and services produced and their uses, including capital formation and consumption patterns. Concerns arise with respect to the costs faced by the Canadian service industry, in the areas of equipment costs, including related costs for importing foreign equipment and telecommunication costs.

Second, the questions and concerns relating to the penetration and impact of computer/communications activities on the different components of economic and social life should be addressed. This would include an investigation into the extent to which computer technology has diffused throughout industry, manufacturing and business as a whole. Policy questions

concerning the workforce relating to automation issues, employment opportunities, unemployment, possible skill shortages and training issues are raised here. Social issues include an analysis of areas such as data protection, privacy and copyright laws.

To fully understand and address these complex questions policy-makers require information that would provide the basis for analysis of computer/communications activities. This would include quantitative indicators on employment and the number of computers and terminals in service, and qualitative information such as the analyses of the workforce, computer stock and applications.

The third broad issue deals with questions relating to user expenditures on the goods and services produced through computer/communications activities. The share of the domestic market satisfied by indigenous industry, the extent of processing of Canadian data being performed outside of Canada and their economic impact should be considered by analysts. Another aspect which should be quantified is the ability, for the Canadian computer services industry, to access the domestic market, especially in light of in-house activities particularly by multi-national enterprises. Also, an on-going evaluation of government involvement in activities geared to stimulate the usage of computer goods and services would be useful.

A measurement of the financial importance of these activities, in terms of market penetration, should be determined. At present, in-house sources account for the bulk of the supply and usage of computer services. Therefore, total revenues, which for most activities is an excellent proxy for market size, does not give similar information for computer/communications activities, and one must obtain information on user expenditures for in-house activities as well as open-market revenues for this purpose.

An analytical framework designed while keeping the analytical requirements stemming from these issues and questions in mind would permit analysts to study the supply, production and use of computer goods and services in the economy. It would also permit the examination of economy-wide expenditure on computer goods and services, in relation to changes in private expenditure, government expenditure and fixed capital formation, particularly if both "traded" and in-house activity are included.

2.2   Information Requirements

In the previous section, the requirements necessary to analyze computer/communications activities were laid out. These included the production and supply of computer/communications goods and services, as well as information on their disposition and use. Other analyses were outlined to include financial information and trade and employment activities.

2.2.1 Production and Supply of Computer Goods and Services

Domestic sources of computer goods and services may, for convenience, be divided into two categories. They can be produced by firms which sell,

lease, rent or license them on a commercial basis, or they can be produced by firms for their own use, with in-house equipment and personnel. Some firms undertake both activities. In this case the primary purpose may be to develop a product or service for the firm's own use but they may also sell, lease or rent the product or service after it has been produced and successfully adopted in-house.

The information required from suppliers is on the production and sale of "traded" EDP goods and services falling within the categories of computer hardware, software and services, covered earlier in the report.

In the long run, it would be necessary to know the value, quantity and type of goods and services produced and sold domestically, as well as the associated costs of production in terms of the cost of resources purchased and used, R&D expenditures, and wages and salaries.

To analyze the performance and growth potential of computer/communications activities, particularly the computer hardware industry, information relating to goods in-service is required, identifying the different types of products in use.

Production data on information services and products, or more specifically information retrieval services, would be helpful. A breakdown by type of use would be useful as well as a breakout of on-line data bases into reference and source data bases. In the case of service bureaux which provided both computer services and information services, revenues generated from data processing activities and information retrieval services should be separated.

Information on the production of in-house services is probably more conveniently collected through computer (EDP) budgets of institutions and is described in the next section on disposition and use.

2.2.2 Disposition and Use of Computer Goods and Services

Analysis of this component requires information relating to the purchase and use of "traded" and in-house goods and services by user category. The user group is made up of industries, government, health and educational institutions and private consumers.

The information required is the capital stock of EDP equipment and annual capital expenditure on new purchases of equipment, in terms of the value, by type of equipment in place, purchased, leased or rented. Other information is required from the EDP budgets of institutions using computer goods and services on the value of current expenditures on the purchase or cost of "traded" and in-house goods and services, by nature and type of service.

The information on expenditures should be broken down into the cost of "traded" goods and services purchased, and for in-house services produced, a breakdown of costs in terms of materials and supplies purchased, overhead costs, and wages and salaries associated with computer and computer related activity, by user category.

It is important to ensure that complete coverage of the costs related to computer goods and services be included in the institutions' reported EDP budget. This would include such things as expenditures on micro-computers, which may not be centrally controlled by a corporate MIS/EDP authority.

For the purpose of analysis it would be useful in the long-term to regroup the user categories by main activity and size, as well as the breakdown by industry, government, health and educational institutions and private consumers.

2.2.3 Trade in Computer Goods and Services

Production of computer goods and services for sale or lease may be undertaken by firms operating in Canada or abroad. Similarly, in-house services used by institutions in Canada may be produced in Canada or as is often the case in multinational enterprises, in the country where the head office is located or in some third country.

Imports may occur as a result of the direct purchase of goods and services from abroad by Canadian institutions. They may be the result of in-house transfers of services originating within a part of the enterprise located abroad or they may be the indirect result of purchases of foreign computer services by the foreign head office or subsidiary which transmits services in-house to branch offices in Canada.

Similarly, exports of "traded" goods and services may occur because of direct sales by a Canadian firm making sales abroad. Exports of in-house goods and services may also occur through in-house links, transmitting services abroad to subsidiaries or head offices.

The level of trade activity is a good indication of the international competitiveness of Canadian industry and the degree of foreign penetration into the domestic market.

2.2.4 Employment

Information on the aspects of the supply of and demand for computer related manpower would be helpful when addressing the policy questions outlined in a previous section of this report.

Information, relating to the workforce, on the lines described below is required.

° Data on employment of computer-related personnel by occupational group and technical skill, by user category.

° Average salary by user category and size of firm for computer-related professional, managerial and training personnel.

° Number of persons enrolled in computer science programs in Canadian educational institutions.

° Number of persons trained per year, duration of courses and types of training in programming and systems analysis, by commercial institutions and in-house training given by user category.

2.2.5 Financial Information on Computer/Communications Activities

Financial information by the different components by size of firm is required to assess the need for government programs and to evaluate on-going programs. In addition, information on the cost and availability of venture capital is needed to assess the development opportunities for the expansion of computer/communications activities.

2.2.6 International Information Requirements

It is useful for analysts to acquire the knowledge and understanding of computer/communications activities in the world market, its growth trends and performance characteristics. Due to Canada's proximity to the U.S., the high degree of interconnection of the two country's telecommunications networks and the interdependence of the two national economies, a collection of the basic information requirements for computer/communications activities for the U.S. market would be needed.

The information required would be data on the total capital stock and user expenditure by type of equipment and service. Also information on the types of goods and services being used by user category and the level of employment would be useful.

2.3 Underlying Principles

An information base should cover all aspects of computer/communications activities to some degree. Such a system has to be able to adapt to decision-makers' needs in order to be able to warn them of situations that require attention and should therefore be dynamic in nature.

The information appearing in such a system should be clear and well defined, with the definitions well-known. As the information is intended to help decision-makers in their task, it is important that the information be timely and precise.

The task of defining computer/communications activities and their boundaries leaves certain ambiguities with respect to a line of separation between other related activities. However, it is not so important exactly where the lines are drawn, as it is to carry information at a sufficient level of detail, so that, depending upon the subject under study and the analysis being undertaken, flexibility can be maintained in aggregating across activities to the various needs that may arise.

The information base should consist of a set of raw indicators summarizing the situation and structure of computer/communications activities or their penetration into the rest of the economy. The indicators should address the level of computer stock installed, by type of hardware item and computing expenditures in terms of operating and investment costs. Also, indicators

covering computer applications, such as, administrative, industrial, scientific and technical, and teaching and games and computer/communications trades by type (programming, maintenance, data preparation, etc.) should be provided. The indicators should permit an overall evaluation of the financial commitment in the area and would be required to evaluate the level of computerization facing users.

An information base, as described, would be set up to provide information for the analyst to possibly identify the causal factors affecting the area. An input-output framework would bring together three necessary dimensions; output, utilization and costs or inputs. Representation of inputs can be extended to show capital stocks and employment by category. Such a system would allow for the collection of data on domestic production, imports and exports and a financial dimension can be added.

Analytical studies and performance of computer/communications activities would then be possible. For example, from a financial block, profitability analysis could be carried out, studying revenue data and costs. Information being collected at a very disaggregate level would allow analysts the flexibility to perform market analyses such as, revenue breakdowns by user group and the various cost inputs facing computer/ communications activities.

Such a system would permit analysts to monitor supply, production and use of computer/communications goods and services in the economy. The examination of expenditure on the goods and services in relation to total consumer expenditure, government expenditure and fixed capital formation could be possible.

The information should be accompanied by a series of observations on trends in the activity and on the strengths and weaknesses of the computer industries of the country. In all, this would allow analysts to monitor and identify problem areas and the causal factors leading to them, and it would give them a feel on future trends so that decisions taken would be based on sound and representative information.

3. ASSESSMENT OF EXISTING COMPUTER/COMMUNICATIONS RELATED
    INFORMATION

This chapter provides an assessment of the available Canadian and U.S. data
sources; the Canadian ones are described in detail in Appendix 2. The
emphasis has been placed on the Canadian data; the U.S. data is included to
indicate the size of U.S. EDP activities as well as the types of information
that are collectible. Information gaps are dicussed in Chapter 5.

In assessing the Canadian data, it is useful to classify them by source into
the following four categories:

a) Data collected by Statistics Canada under the authority of the Statistics
   Act;

b) Data collected by other government agencies like Customs and Excise,
   Treasury Board Secretariat, DOC, etc;

c) Data collected by industry associations like the Canadian Information
   Processing Society (CIPS), Canadian Association of Data Processing
   Service Associations (CADAPSO), etc;

d) Data collected by market research organizations specializing in studying
   the computer industry, like Evans Research Corporation, and the
   information reported in the industry press (Computer Data, Canadian
   Datasystems, etc.).

In assessing U.S. data the first two categories have been combined. Thus no
distinction is made between data produced by government agencies like the
Bureau of Labour Statistics (BLS), National Technical Information Service
(NTIS) and the General Services Administration (GSA).

The five main areas in which information is required were outlined in
Chapter 2. Table 3.1 shows a mapping of the available Canadian and U.S.
data into these areas, and a preliminary assessment of the information
available. A "0" indicates an area where no information is available, an
"I" denotes partial or incomplete coverage, and a "?" denotes an area or
source which has not been assessed, due to time constraints. Information
collected periodically (i.e., monthly, quarterly, annually) is denoted by a
"P". It should be noted that item 5, Financial Information, consists of
income statement and balance sheet information for the suppliers of
computer/communications goods and services.

An examination of Table 3.1 leads to the following broad assessment of both
the Canadian and U.S. data:

a) There is much better information regarding the production and supply of
   computer/communications hardware, services, software products and
   information products (i.e. the supply side) than there is on their
   disposition and use (i.e., the demand side);

b) Data regarding the export and import of computer/communications hardware is much better than similar data regarding services, software products and information products. For these latter categories very little import data are available.

3.1   Assessment of Canadian Information and Sources

Statistics Canada (Ref. 7,8,9), the federal Treasury Board (Ref. 12), the Canadian Information Processing Society (Ref. 10) and Evans Research Corporation (Ref. 16) are four Canadian organizations which produce annual information about computer/communications goods and services in Canada. The Statistics Canada and Evans information relates primarily to the production and supply side, as well as to exports; the Treasury Board and CIPS data relate to the disposition and use, i.e. the demand side. CADAPSO produces an annual report covering its activities which provides useful qualitative information, but very little primary data.

Occasional studies are currently produced by Evans Research Corporation (as a part of their Continuing Information Service and EDP In-Depth Reports), Northern Business Information, and other market research firms specializing in the study of the computer industry; these are often summarized in the industry press. The user surveys conducted in the past by DOC (Ref. 2, 13) and the Informatics Institute of Canada (Ref. 14) are described in detail in Appendix II.

It should be noted that there is no commonly accepted and used classification for computer/communications goods and services. For this reason, information from different sources on some particular aspect or area of computer/communications is often not comparable. This is illustrated, in the next section, by the problems encountered in attempting to reconcile information on the production and supply of computer/communications equipment from the various Statistics Canada reports and the Evans survey.

A.   Production and Supply, Exports and Imports

The three major Statistics Canada annual publications relevant to this area are:

a) Computer Services Industry Report (Cat. 63-222, Annual);
b) Office and Store Machinery Industry (Cat. 42-216, Annual), which uses data from the census of manufacturers;
c) Commodity Exports and Imports (Cat. 65-202, 65-203 and 65-207, Annual).

Data relating to the sales of EDP equipment are also collected by the Wholesale and Retail Trade Censuses.

These Statistics Canada publications are supplemented by various Evans Research Corporation reports (Ref. 16). These are based on that company's annual survey of some 120 of the largest firms engaged in the manufacturing and supply of computer/communications equipment, as well as the provision of both machine-based and people-based computer services. Northern Business Information (Ref. 17) has just published a major, in-depth study of the

Canadian computer market. MacLean Hunter Ltd. has published the first edition of its Canadian Directory of Software, and the Alberta Information Retrieval Association publishes COIN: A Directory of Computerized Information in Canada, which provides extensive coverage of database products and services currently being accessed by Canadians.

Because of the importance of the Statistics Canada Computer Service Industry report as a source of primary data, one must be aware of both its scope and coverage. The report classifies computer service companies into two main groups: those primarily engaged in the provision of computer services and those primarily engaged in the sale and rental or lease of EDP hardware. The survey is of a census type, covering all businesses identified by Statistics Canada's Business Register as belonging to the 1980 Standard Industrial Classification (SIC) 772 – Computer and Related Services, equivalent to the 1970 SIC 853. The mailing list for the survey is drawn from the Business Register, and is augmented by various trade magazines and directories.

Changes have occurred in the scope and coverage of the Computer Service Industry Census since 1977, which have made it a less comprehensive source of information for this industry than it was in 1974. The loss of the secondary suppliers of services, and the transfer of establishments primarily engaged in sales to the Wholesale and Retail Trade Censuses after 1977 has brought about a considerable reduction in the Census scope and coverage for the computer sales and services activities. In 1977 the secondary suppliers accounted for some $46.8 million (5%) of hardware revenues and $102 million (18%) of computer services revenues. The coverage of firms primarily engaged in the sales/lease/rental of computer equipment has declined slowly from 35 establishments with operating revenues of $612 million in 1974 to 28 establishments with revenues of $1,411 million in 1981. The coverage of firms primarily engaged in the provision of computer services has, however, increased rapidly from 345 establishments with operating revenues of $211 million in 1974 to 1,392 establishments with operating revenues of $1,102 million in 1981.

The differences in definition and coverage are mainly responsible for the very large difference in the estimates of the revenues of hardware suppliers by Evans Research Corporation and the Computer Service Industry Census. For 1981, Evans includes 56 hardware suppliers with revenues of $3,632 million, while the Computer Service Industry Census has 28 suppliers with revenues of $1,411 million, or 38.8% of the former. The Evans sample includes several firms (e.g. Northern Telecom, Mitel, Gandalf) which would be classified to other manufacturing industries by Statistics Canada; it also includes export revenues. Though the hardware sales of the remaining 28 firms are picked up in other Statistics Canada surveys such as the censuses of Manufacturers, Wholesale and Retail Trade, collating a figure of total sales of computer hardware from all these sources is not a straight-forward matter. The Input-Output Tables which bring these sources of data together do not, as yet, distinguish EDP equipment as a separate commodity category.

There are also problems in comparing the revenues of the hardware suppliers with the size of the apparent domestic market for electronic computer

equipment. For 1981, using a value of $604 million for shipments (Cat. 42-216), $2,363 million for imports (Cat. 65-203, including unit record equipment and magnetic tapes), $734 million for exports and $216 million for re-exports (Cat. 65-202), the apparent domestic market is $2,017 million. This is considerably greater than the Computer Service Industry survey estimate of the revenues for hardware suppliers, but considerably smaller than the Evans estimate. If the Evans estimate is reduced by $940 million for exports and re-exports, this still leaves a considerably higher figure of $2,692 million.

The above comparisons illustrate the dilemma which the figures from these various sources pose for an analyst attempting to arrive at a "correct" estimate of the computer sales and services activities. The problem is compounded by the fact that an outside analyst cannot even arrive at an appropriate total figure from the various published Statistics Canada sources, because he cannot match and aggregate the information on a comparable basis.

B. Disposition and Use

The Treasury Board, in its annual report <u>Review of EDP and Telecommunications in the Government of Canada</u>, provides a good profile of user service demand in the federal departments and agencies named in Schedules A and B of the Financial Administration Act. However, it must be noted that the federal government costs, as defined by Treasury Board, amounted to only some $400 million in 1980-81, or about 7% of the estimated total Canadian user costs of $6.09 billion. It should also be recognized that the pattern of service demand for federal government users could differ appreciably from that of other types of institutional users, or from the demand presented to the commercial service suppliers. For example, over-the-counter batch processing and terminal batch processing formed 18% and 11% of government service demand in 1980-81 (Table II.3) ; in the demand directed to commercial service suppliers, they respectively formed 6% and 24% of the total. Federal government departments and agencies are also unlikely to make significant purchases of computer services from foreign vendors who do not have well established Canadian subsidiaries.

The CIPS computer census provides extensive coverage of the use of computers in most sectors, including business, government, educational and other institutions. For practical purposes, it is limited to computers having a rental value of $1,000 per month or more; efforts to include smaller computers have not met with success. This means that virtually all personal computers and most small business computers are excluded; yet this is precisely the current area of most rapid growth in computer use. The coverage for small computers, in the rental range $1,000-5,000 per month, is also deteriorating seriously. One estimate indicates that the 1980 CIPS census covered only about 2/3 of the installed value of computers in Canada. It is therefore difficult, if not impossible, to develop a systematic breakdown of computing by class of user, on this basis.

The DOC DATACOM '76 survey (Ref. 13) and the Informatics Institute of Canada survey (Ref. 14) in 1977 remain as two of the very few available surveys of

Canadian user EDP budgets outside the federal government. Computer Data magazine has conducted three annual surveys of private sector firms, but these are of limited scope and coverage. No further attempt has been made, after the C/CS Telephone survey in 1977, to obtain information from users regarding service imports.

3.2 Assessment of U.S. Information and Sources

In the U.S., market research firms and industry organizations play a very important role in collecting source data and generating information, as well as in making it available through publications or computerized information services. Thus the Association of Data Processing Service Organizations (ADAPSO), through its annual survey of the computer services industry (Ref. 20), provides an authoritative statement of this industry's performance, with regard to revenues and profit margins. Similarly, International Data Corporation (IDC) produces an annual report titled "Computer Industry Review and Forecast" (Ref. 21), which provides a wealth of information regarding shipments of general-purpose mainframe computers, minicomputers, small business computers and desktops, market shares held by major equipment vendors, as well as some basic information regarding software products, services and user spending. Datamation, a leading industry magazine, conducts annual surveys of user budgets, DP salaries and user experience with , software packages, both systems and application (Ref. 24).

In addition to this annual information, a number of market research firms specializing in the analysis of the computer/communications and information markets produce in-depth reports covering specific market segments or topics of interest. These firms include International Research and Development Inc. (IRD), Frost and Sullivan, Datapro Research Corporation, Creative Strategies Inc. (CSI) and Dataquest Inc., to name just a few. The studies usually contain a current analysis of the market segment and 5-year growth forecasts; they are often based on surveys of current and potential user populations as well as suppliers. Such studies can be very useful for the in-depth analysis of a particular market segment.

A number of firms publish periodically updated directories of available software products, online databases and service providers. Periodic updating is a vital requirement because of the large number of products and services which enter the market every year. These directories give a good picture of the supply side, but generally do not include information regarding usage of the product or service, i.e., the demand side. The International Directory of Software (Ref. 25), Directory of Online Databases (Ref. 26) and Encyclopedia of Information Systems and Services (Ref. 27) serve as examples of this category of information.

Because of time constraints, no attempt has been made to assess the data collected and published by U.S. government agencies. Since the U.S. government does not have a central statistical agency similar to Statistics Canada, a large number of agencies are involved in such data collection and dissemination. Thus the Bureau of Labour Statistics provides some data on current employment in computer-related professions (programmers, systems

analysts, data entry personnel, operators), as well as forecasts of future requirements. The Department of Commerce publishes trade statistics, as well as a wealth of technical and other relevant information through the National Technical Information Service; the online NTIS database is made available through several vendors, including the Canada Institute for Scientific and Technical Information (CISTI). As in Canada, however, data regarding the imports and exports of services and software products is very difficult to come by. The General Services Administration records the EDP expenditure of U.S. Federal Government agencies, but does not publish them in a form as convenient as the Treasury Board's Annual Review of EDP and Telecommunications in the Government of Canada.

3.3 Market Size Estimates

Preliminary estimates of the size and growth trends of the Canadian markets for telecommunications and computer/communications services are given in Appendix I, Table I.1; estimates for the corresponding U.S. markets are also provided as a basis for comparison. The best proxy for the demand for computer/communications services is the sum total of user expenditures for this purpose; the revenues of the computer services industry do not provide a good proxy because in-house sources still account for the bulk of the supply of such services. Until comprehensive and reliable information on such user expenditures can be obtained from a creditable source on a regular basis, all such estimates must be considered as order-of-magnitude only, and viewed with great caution.

Total user costs for the acquisition of computer/communications services can be broken down into the following categories: personnel, computer/communications equipment, purchase of computer services (both machinebased and people-based), data transmission and overheads. Statistics Canada provides data (Ref. 7) on the purchase of computer services and the lease/rental/ purchase of computer equipment from most Canadian suppliers; the latter can be supplemented with data from the CIPS computer census (Ref. 10).

The Treasury Board Annual Review (Ref. 12) provides information on all of the above cost categories for designated government departments and agencies; the reported costs, however, account for only some 7-8% of the estimated total user costs. There is no other generally available data on personnel costs and overheads. Finally, though Statistics Canada began to collect data on the imports of computer services recently (in the 1981 quadrennial survey of Business and Miscellaneous Services and Charges, conducted by the Balance of Payments Division), the figures were not available at the time of writing of this report. The figures are expected to cover direct purchases of computer services from foreign suppliers and intracorporate transfers of computer services between affiliated companies, but the extent to which they will cover the import of computer software is not known, nor is it known whether figures reported under the category of management fees may not also contain some payment for computer services.

The task of constructing estimates of total user costs is thus a difficult one, especially as there are no benchmarks against which such estimates can be checked. The Computer/Communications Secretariat Growth Model (Ref. 2) was constructed for this purpose; the Canadian estimates in Tables I.1, I.2 and I.3 are based upon model results obtained by L.A. Shackleton of DOC in February 1982. In this context, it should be pointed out that the U.S. estimates are from IDC (Ref. 21), and are based on that firm's survey of user EDP spending patterns.

Even with the above caveats regarding estimates of user expenditures for computer/communications services, a study of Tables I.1 and I.2 yields some interesting conclusions. In 1980, estimated Canadian user expenditures for computer/communications services ($6.09 billion) were of the same order-of-magnitude as the total revenues of the telecommunications carriers ($6.5 billion). The latter, however, can be divided into a business segment (some 60-65%) and a residential segment, while the former is almost entirely business and institutional use. Thus business and institutional expenditures for the acquisition of computer/communications services were greater than those for telecommunications services. It should be noted that data transmission expenditures, estimated at some $250-275 million in 1980, appear in both categories. Correcting for this double counting, it can be seen that in 1980, business expenditures for the procurement of computer/-communications and telecommunications services were close to $10 billion. Assuming that a similar analysis is valid, the corresponding figure for 1980 U.S. business expenditures is some U.S. $95 billion.

It has been pointed out elsewhere that the convergence of telecommunications, computing and word processing technologies will lead to increasing overlaps between these service areas and markets. It will therefore become necessary to analyze, estimate and project these markets as an integrated whole, as well as study the three segments separately. The above estimates of business use are a preliminary step in the required direction.

Table 3.1

Preliminary Assessment of Available Canadian and U.S. EDP related
Information and Information Sources

Area and Sub-Area	Canadian				U.S.			Comments
	Govt. Agencies		Ind. Assoc.	Other Ind. Sources	Govt. Agencies	Ind. Assoc.	Other Ind. Sources	
	STC	Other						
1. Production and Supply								
a. Hardware	P,I	O	O	P,I	?	?	P	
b. Services	P,I	O	O	P,I	?	P	P	
c. Software Products	P,I	O	O	P,I	?	?	P	
d. Information Products	O	O	O	P,I	?	P	P	
2. Disposition and Use								
a. User Budgets	O	P,I	O	I	?	?	P	
b. Hardware	O	P,I	P,I	O	?	?	P	
c. Services	P,I	P,I	O	O	?	P	P	
d. Software Products	O	P,I	O	O	?	P	P	
3. Imports and Exports								
a. Hardware								
– imports	P	P	O	O	P	?	I	
– exports	P	P	O	O	P	?	I	
b. Software and Services								
– imports	O	O	O	O	?	?	?	
– exports	P,I	O	O	O	?	I	?	
4. Employment								
a. Suppliers	P	O	O	O	P	?	P	
b. In-house	O	P,I	P,I	O	P	?	P	
5. Financial Information								In the U.S., much of this information comes from 10-K forms filed by firms with the SEC.
– income statement	I	O	O	P,I	?	I	I	
– balance sheet	O	O	O	I	?	I	I	

Key: P = Information Available at Periodic Intervals

  I = Partial or Incomplete Coverage

  O = No Information Available

  ? = Area/Source not assessed, due to time constraints

4. REVIEW OF INTERNATIONAL STATISTICAL DEVELOPMENT

4.1 OECD Activity

The OECD is currently involved in assessing proposals for a statistical framework for the information, computer and communications field. A need for statistical information became evident when the organization started to study the impact of electronic-based technologies on economic growth, productivity and employment, in 1977. It was quickly discovered that the statistical schemes in place did not adequately reflect the information, computer and communications field. Therefore, the need for developing a coherent and reliable statistical base for the field was identified.

The scope of a framework for the area would be broad so as to include both information goods and services, where information is taken to include data, text, image and sound. In the broadest sense the area would consist of electronic components, electronic capital equipment and consumer products, communication systems, computer systems, network and computer system management services, and information services.

The main purpose of a statistical framework for the information, computer and communications field, as is being considered by the OECD, is to provide decision-makers in government and industry with general information in the form of a small number of parameters enabling them to:

° Measure the direct and indirect impact of the field from the standpoint of production activities and products.

° Assess the extent to which these new technologies are penetrating other sectors of the economy.

° Estimate the growth capacity and the social impact of these new technologies.

4.1.1 A French Proposal

A French proposal, prepared in the summer of 1982, outlines a statistical information system for computer/communications activities. They put forth three objectives for the system: first, to fill the gaps in computer/communications statistics, then to ensure compatibility between the statistics prepared by different countries and their homogeneity with national and international statistical systems, and finally to provide economic policymakers with the information they require to take action in the field.

Although they address the computer/communications activities in their proposal, they intend to work out a similar system for telecommunications and eventually to cover all branches of the electronics industry and information services.

The statistical information system, as they have laid it out, covers all aspects of computer/communications activities: production, organizational structure, computerization and infrastructures.

It looks at production and products, foreign trade and domestic uses of computer/communications goods and services, thus allowing an appreciation of the direct impact of computers with regards to both resources and costs. Indicators of the level of computerization of users are examined enabling an estimate to be made of the degree of diffusion of computerization firms and government and of the level of maturity of computer applications. In addition, activities aggregates are analyzed permitting an overall asessment of the situation of computer/communications activities within the economy as a whole.

It would be beneficial if all OECD member countries become involved in collecting information on the information, computer and communications area in phases from existing data based on short term needs. This would give the OECD and member countries an idea of the methodological and statistical problems of setting up a system in its final form, as well as allowing them to define a standardized information, computer and communications statistical information system.

4.2 Present Statistical Collection

4.2.1 Japan

The key institute in the Japanese industrial and technology forum is MITI – the Ministry of International Trade and Industry. Most of the information available on computer/communications activities is provided by MITI. The data is published annually in the Japan Electronics Almanac (formerly the Japan Fact Book). Statistics on the state of employment, production, export and imports of computers and related equipment is provided. Installation figures, market trends and utilization information are also collected for general purpose, mini and office computers.

Information on computer services, on an on-going basis, is not collected for publication.

4.2.2 West European Countries

Similar information on computer and related equipment, as collected in Japan, is collected by several European countries and are published in the MacKintosh Yearbook of West European Electronics Data.

As for computer services information, there is no single official source providing relevant data on the industry.

Evidently, there is a general lack of information on computer/communications activities in all countries around the world and the OECD would like to remedy the situation. The need for comparable and disaggregated information is useful for a system to be reliable. These two characteristics should be kept in mind when designing a system in Canada so that the information collected may be used effectively.

5. IDENTIFICATION OF INFORMATION GAPS

Information gaps result from the mismatch or short falls between information requirements and information availability. The requirements for a computer/communications related information base adequate for policy development purposes are outlined in Chapter 2. The principal existing Canadian sources of information related to computer/communications are described in Appendix II, and assessed in Chapter 3. The following sections describe some of the important information gaps that have been identified. They are grouped in the same order as the information requirements presented in Chapter 2.

5.1 Production and Supply of Computer/Communications Goods and Services

A. Hardware

At present, information on the production of computer hardware is collected by Statistics Canada in the Census of Manufacturers, as part of a larger industrial category called Office, Store and Business Machinery Industries (SIC 318). As a result, though there are figures for total production and sales of EDP equipment and parts, it is difficult to isolate the principal statistics relating to manufacturers of computer equipment. This situation will be ameliorated in 1984 with the adoption of the 1980 SIC, which distinguishes a separate computer hardware industry. Under the revised 1980 SIC, the Census of Manufacturers will collect information on the cost of materials purchased and total employment, for the industry. Some thought should be given to the question of data by quantity and type of equipment, as well as to establishing concordances between the various classification systems in use, so that Statistics Canada and other users can bring together data on domestic production, imports and exports.

As stated in Chapter 3, the main source of information for the sale, rental and lease of computer hardware, the Statistics Canada Computer Services Industry Survey, must be supplmented with other sales data from the Censuses of Manufacturers, Wholesale and Retail Trade, to avoid significant under-estimation of the total activity in this area. The problem here lies in the fact that the data have to be compiled from several sources, which can only be matched by Statistics Canada itself, and that the information is not in a form that can be readily assembled and aggregated. Published Sales figures are not broken down by type of computer equipment, such as mainframes, minicomputers, small business computers, desktop or personal computers and terminals. Because of this reason no published information is available from Statistics Canada regarding the sales of small business computers, desktop computers and intelligent terminals, the fastest growing segment of the computer hardware market. For such information one must look at industry reports, such as the recently published Northern Business Information report "Canadian Computer Market" (Ref. 17), though Statistics Canada could also be asked to examine to what extent some breakdown of the aggregate figure could be made available; in particular, to throw some light on the production and shipments of micro-computers.

B. Software and Services

Considerable information is collected on the computer service industry by
Statistics Canada. Revenue information in the Computer Service Industry
survey is broken out by machine-based services and people based services;
the former includes processing services and input preparation while the
latter includes professional services related to software and system
services, education, computer consulting, equipment maintenance, etc. The
data are not broken out, however, by type of service firm, e.g. service
bureau, software house, systems suppliers, consultants, etc, because these
are not recognized categories. To complicate matters, it must be realized
that a particular firm may undertake a number of activities, and therefore
qualify in a number of categories. The classic case is IBM, which qualifies
as an equipment supplier (primary revenue source), service bureau and
provider of software products and services. This means that the Statistics
Canada data cannot be used directly to study segments of the computer
service industry such as the service bureaus or software houses.

The only Canadian information regarding information retrieval services which
is collected and published regularly is that by the Canada Institute for
Scientific and Technical Information (CISTI); this only covers a small
portion of the market for reference data bases and does not touch the market
for source data bases. Since many data base vendors are also service
bureaus, it is admittedly difficult to separate their revenues from data
processing from those generated by information retrieval. Nevertheless, it
must be noted that with the exception of the COIN Directory, very little
Canadian information is currently available regarding the supply of, and
demand for information retrieval services. Although the supply side is well
covered by U.S. sources (Ref. 26, 27), the demand side is not.

Individuals, partnerships and small businesses (both unincorporated and
incorporated), are a growing source of supply of computer services,
especially people-based services and software products. To ensure complete
coverage of the supply side, it is important that information be assembled
on the provision of computer services wherever the activity originates.

5.2   Disposition and Use of Computer/Communications Goods and Services

The existing Canadian sources of information on annual capital expenditures
on computer hardware by industry, government, health and educational
institutions and consumers are inadequate. There is also totally inadequate
information on capital stocks of computer hardware by using institutions.
The coverage of the presently available CIPS Canadian Computer Census is not
complete, on account of its voluntary nature and cut off point; and, in any
case, the construction of capital stocks from this data presents a major
challenge. There is need for information on the acquisition, by using
sector, of desktop and small business computers, the fastest growing sector
of the computer hardware industry. Similar information is required about
intelligent terminals, word processing equipment and executive or
multi-functional workstations.

Though the Statistics Canada Computer Service Industry census provides some
information on customers, by class of customer and by region, there is as
yet no comprehensive source of information on user EDP budgets. This

information is required for various categories of users, such as industry, government, health and educational institutions and consumers. The Treasury Board Secretariat compiles its annual report on federal government EDP expenditures, but similar information needs to be compiled for provincial and municipal governments. Computer Data magazine has published the results of three annual surveys of user data processing budgets which it attempted to carry out among the FP 500 firms. These results, though useful, are not comprehensive and cannot serve as benchmarks due to methodological and coverage problems.

As stated in Appendix I, one must obtain systematic, comprehensive and reliable information regarding user expenditures, on a regular basis, in order to provide estimates of the size and growth trends of the computer/ communications services market. Such expenditures must be broken down by user category and size, and include data regarding:

i)   in-house expenditures for both direct costs (e.g. equipment,
        personnel and data communications) and indirect or support costs;

ii)   commercial purchases of services and software (including packages)
        from Canadian and foreign suppliers;

iii)   intra-company service·transfers between corporate affiliates,
        especially MNE parents and subsidiaries, covering data processing
        services, network services and information flows.

Information is particularly deficient on the use of packaged software, which is becoming an increasingly important component of the software market, especially for small business and desktop computers; and on the use of the new mass market software, especially video games and consumer packages.

5.3   Trade in Computer/Communications Goods and Services

The Statistics Canada census of the computer service industry does obtain some information on revenues generated from exports of "traded" services. The 1981 Business and Miscellaneous Services and Charges survey of the Balance of Payments Division should provide, for the first time, an overall estimate of imports of computer services, though there is a lack of information on the exact nature of the services covered. Data needs to be collected on imports of services by categories and their users, as well as on the nature and value of in-house transfers of services across national boundaries, particularly by MNE's and commercial service bureaus.

There is also need for information on the imports and exports of computer software, including packaged software. Though data on the exports and imports of computer hardware exist, they need to be made comparable and compatible with production data. It is also important to recognize that system software is often bundled with hardware, and sold at a single price. There is no simple way of determining what percentage of the value of hardware imports and exports should be allocated to system software.

5.4 Employment

The only computer related employment statistics collected currently are the Treasury Board ones for the federal government, and the Statistics Canada ones for the computer services industry. The Treasury Board gives a breakdown of EDP person-years in terms of classifications such as managerial, systems and programming, data conversion and data production; no such breakdowns are available in the Statistics Canada survey.

The termination of the CIPS Salary and Manpower Survey has expanded the major information gap in this area. Data is required on the employment and salaries of management, professional and support personnel in computer-related jobs, broken down by occupational classifications and technical skills. Such data should be available by user category and size of firm, and permit comparisons between the manpower situation in Canada and the U.S.

On the supply side, some information is available on the number of students enrolled in computer science courses in Canadian post-secondary institutions, and the number graduating from such courses. This, however, does not constitute the only or even principal source of supply for computer personnel; professional, marketing and managerial personnel can be drawn from other disciplines such as mathematics, the physical sciences, engineering, and so on.

To round out the supply picture, information is required (but lacking) on the amount of training provided by commercial institutions in the computer services industry, and in-house training given by users. Ideally, one should have information regarding the types of training provided, such as programming, systems analysis, etc., the duration and cost of the courses, and the number of persons trained each year.

Information on the rate of growth of computer related skills and adequacy of training facilities, on the lines indicated above, is necessary to monitor potential bottlenecks to the growth of computer/communications activities, and indirectly the potential rate of growth in the productivity of the total economy, to the extent that this depends upon the impact of computer/communications activities on domestically produced goods and services. To collect such information, it may be necessary to elaborate upon the current classification of computer-related employment.

5.5 Financial Information

It would be useful if Statistics Canada were able to identify a computer/communications sub-sector in publications providing financial and balance sheet data for sectors of the economy. Such information is particularly required for the commercial supply side of the computer/communications activity, both for the sub-sector as a whole and by its different components, preferably broken down by size of firm. This information is necessary to determine the competitive position of the Canadian computer services and products industry, assess the need for government programs and to evaluate on-going programs. The availability and use of venture capital in this industry is another area where very little information is collected and none is reported.

5.5 Summary of Findings

This report has pointed to a number of important gaps in the factual information about computer/communications in Canada. Three of these gaps are of fundamental importance:

(1)   The lack of any benchmark, at periodic intervals, for estimates of the composition and profile of users of computer/communications services;

(2)   The lack of any benchmark, at periodic intervals, of the cost to users of required computer/communications services;

(3)   The lack of any benchmark, at periodic intervals, of the value of computer/ communications services imported from abroad by Canadian users. This is of special importance because there is no obvious indicator of transactions by such users, especially if the transactions are intra-corporate transfers between an MNE parent and subsidiary.

These three types of information could all be derived from a well-designed survey of user EDP budgets, conducted at periodic intervals. By choosing an appropriate sampling scheme, it would be possible to hold down costs and speed up data collection, while still permitting estimates of the universe to be derived from the sample data.

If benchmark values of user budget information were available from time to time, it is believed that adequate annual estimates could be derived using techniques similar to those described in the Computer/Communications Secretariat's paper. Until such benchmarks are made available by a recognized and authoritative source, in the words of the author of that paper "... the best estimates that can be made will have a greater kinship to the efforts of pioneer cartographers than to the products of modern aerial surveys".

6. PROPOSED ACTION PLAN

The major conclusion reached in the last chapter was that an adequate information base does not currently exist for the information/computer/ communications area. The development of such a base must be seen not as an ad hoc, short term exercise but as a medium to long term activity, which will require significant resources.

A tentative action plan is proposed in this chapter, which will aid in the development of such an information base. It is sub-divided into a short term plan, which could be implemented in the next 6-24 months, a medium term plan which would have a 3-5 year horizon, and a long term plan which is only presented in outline. The measures proposed are grouped by the agencies which would have the prime responsibility of implementing them. These measures are necessarily indicative, rather than detailed; they are subject to resource availability, need to be refined by a process of discussion among the participants identified, and could be modified by experience gained over time.

6.1 Short Term Plan

A. Statistics Canada

Statistics Canada should be requested to:

1. Review and coordinate the various separate surveys presently in place which collect information on the production and final sale of computer equipment and computer services and, wherever possible, bring together the major output statistics at the aggregate level, bearing in mind that these are activities which cut across industry boundaries specified in the Standard Industry Classification.

2. Develop concordances between the various classification systems presently in use within Statistics Canada, to ensure that information which is collected on production, exports and imports of goods and services describes, in a more complete manner, the production and use of computer/communications equipment and services,

3. Increase the coverage of statistics relating to the output and associated costs of computer services; collect additional information on software products and information retrieval services; and provide more breakdowns by types of supplier firms, wherever possible. Restoration of the scope of the Computer Services Industry survey, at least to the level that existed up to 1977, should be given urgent consideration.

4. Investigate the feasibility and cost of collecting information, at periodic intervals, on user computer/communications budgets relating to 'purchased' and 'in-house' computer/communications goods and services, to meet the data gaps described in this paper.

B. DOC/Statistics Canada/CIPS

DOC and Statistics Canada could jointly investigate with CIPS the possibility of supplementing and utilizing the data presently collected by CIPS, on capital stock and annual capital expenditure on the acquisition of computer/communications equipment by industries and other institutions and of integrating it with other data for purposes of analysis.

C. Statistics Canada/DOC

Statistics Canada and DOC should jointly:

1. Start work on the development of comprehensive analytical frameworks for Information/Computer/Communications activities, to enable medium term data collection and study of the "activity" in the context of the economy. The possible use of an expanded input-output framework for this purpose should be investigated.

2. Examine the problems involved in developing "capital stock" or "plant" type measures for computer/communications hardware and software.

D. DOC/Industry Sources

1. DOC should investigate the feasibility and cost of using existing industry sources, such as Evans Research Corporation and Northern Business Intelligence, for obtaining urgently required information on a one time basis. Such items could include

    i) information related to the use of small business and personal computers, software products, etc.

    ii) an ad-hoc survey of user EDP budgets, which could both provide immediately needed information and serve as a precursor or field test for future periodic surveys by Statistics Canada.

2. The current DOC survey of computer/communications equipment manufacturers and some major users should be reviewed, once the data obtained from the exercise has been analyzed, to see if it can be used to obtain information on user EDP budgets.

6.2 **Medium Term Plan**

All the measures proposed in this section would be implemented by Statistics Canada, although it is intended that DOC should remain involved with this area and continue to provide inputs, preferably under the aegis of a Common Service Policy agreement which could lead to an Information/Computer/Communications Statistics Program. Implementation of these measures is based upon the favourable outcome of feasibility and cost studies undertaken as a part of the short term plan. Statistics Canada should be requested to:

1.   Ensure the collection of data on imports and exports of computer/communications goods, services and software products, both commercially traded and transferred through in-house activity.

2.   Collect information at periodic intervals on user computer/communications budgets, and also obtain information on computer-related employment. Information on capital and current expenditures, as well as computer related employment, should be obtained both at the company level, and at the level of the smallest reporting accounting unit, if possible. The information collection procedures must recognize the fact that a considerable proportion of the computer/communications related expenditures may not be controlled by a central MIS/EDP corporate authority.

6.3   Long Term Plan

In the long term, Statistics Canada should be requested to design and implement a comprehensive and coordinated data collection scheme, to support the analytical frameworks developed for the Information/Computer/Communications "activity". Such a data collection scheme might eventually become a part of the ongoing data collection mechanisms which are used to support the system of National Accounts.

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   Gale Research Co., Michigan, USA; 4th Edition, 1981.

APPENDIX I

Comparison of Canadian and U.S. Telecommunications

and Computer/Communications Markets

There are important linkages between the Canadian and U.S. markets for telecommunications and computer/communications services. These are largely due to Canada's proximity to the U.S., the high degree of interconnection between the telecommunications networks of the two countries, and the interdependence of the two national economies. It is quite feasible for suppliers of computer/communications based services (i.e. data processing and information retrieval services) located in the U.S. to serve customers in Canada, and vice versa. These markets have exhibited similar patterns of technological development over the last 25 years, but also some interesting contrasts. For these reasons, it is necessary to study the Canadian and U.S. markets jointly, as well as separately. In this section, the two markets are compared, and their similiarities and differences outlined.

The important similarities between the U.S. and Canadian telecommunications and computer/communications services activities are as follows. First, the technology used on both sides of the border is essentially the same. Second, almost all telecommunications services used by both business and residential customers are supplied by common carriers; these, in the past, have traditionally been regulated, although this is changing in the U.S. Third, computer/communications services are unregulated activities in both countries and, notwithstanding the existence of a vigorous computer services industry, in-house sources still account for the bulk of the supply in this market. Last, the convergence of telecommunications, computing and word processing technologies means that there is an increasing overlap between "enhanced" telecommunications services which are (or can be) provided by the telecommunications carriers, and computer/communications services which are (or can be) supplied by commercial service bureaus and in-house computer installations.

At this point, it is worth stressing two important differences between the telecommunications and computer/communications markets, which relate to market structure and the problems of estimating market size and growth trends. First, the telecommunications services market has a large and mature residential segment, which accounts for some 35-40% of the total. Mass consumer use of computer/communications services, on the other hand, is still in an embryonic stage, with video games and personal computers being the only well established and rapidly growing area of consumer demand. Secondly, as stated earlier, almost all telecommunications services are provided by the national telecommunications common carriers or international carriers, while in-house sources still account for the bulk of the supply of computer/communications services. This means that the total revenues of the telecommunications carriers provides an excellent proxy for the size of each national telecommunications services market, and gives considerable information regarding its growth trends. The revenues of the computer services industry do not give similar information regarding the computer/communications services market, and one must obtain information on total user expenditures for this purpose. Until comprehensive and reliable information on user expenditures can be obtained on a regular basis, estimates of the size and growth trends of the computer/communications services market, such as those presented in Tables I.1 and I.2, must be viewed with caution.

The differences between the U.S. and Canadian telecommunications and computer/communications services activities relate to market size and characteristics, and organizational and institutional structures.

Table I.1 shows that both the telecommunications and computer/communications services markets in Canada (depending on exchange rate fluctuations) are approximately one-tenth to one-twelfth of the size of their U.S. counterparts. Our projections indicate that this ratio will be maintained at least until 1985. These data, however, should not be interpreted to mean that the Canadian markets are a mirror-image of the U.S. - the only difference being that of size. What they do indicate, however, is that equal imports of computer/communications services by Canadian and U.S. users from suppliers in the other country would account for a much larger proportion of total Canadian user expenditures than of total U.S. user expenditures.

There are several other important differences between the telecommunications and computer/communications services markets in both countries. For example, as noted earlier, while both the telecommunications and computer/communications systems have always been technologically similar and compatible, the characteristics of the markets served by the U.S. suppliers of telecommunications and computer/communications services are considerably different to those faced by Canadian suppliers. The Canadian market is not only much smaller than its U.S. counterpart, but also has the unique characteristic of being spread out in a thin 200 kilometre-wide ribbon along the U.S. border, with the bulk of its population concentrated in the Quebec City - Windsor axis. The concentration of the Canadian market along this axis has meant, for example, that North-South traffic within Canada is far less significant than in the U.S. The small size of the Canadian market has also meant that Canada does not possess the number or variety of telecommunications and computer/communications service suppliers which currently operate in U.S. markets.

The institutional, regulatory and jurisdictional differences governing the provision of telecommunications services in Canada and the U.S. have been described at length elsewhere, and will not be discussed here. Suffice it to say that the Canadian scene is characterized by fragmented regulatory jurisdiction, and a much more cautious approach to competition. Specialized Common Carriers (SCCs) and Value Added Carriers (VACs) are not presently allowed in Canada.

Turning now to computer/communications services we find that, unlike telecommunications, the Canadian and U.S. marketplaces share many institutional and organizational resemblances, although the markets have different characteristics. One similarity, as mentioned earlier, is that in both Canada and the U.S. computer/communications markets are largely unregulated and subject to competitive market forces. Three other similarities are that IBM is the leading equipment supplier, that there is a thriving, domestically-controlled service bureau industry in both markets, and that the telecommunications common carriers have been prevented in the past from competing directly with the service bureaus on the grounds that such competition would not only breach the principle of carriage/content separation, but be inherently unfair. Unlike telecommunications, where

international services are provided through connecting and revenue sharing agreements between national and international common carriers, a number of major U.S. service bureaus such as Computer Sciences Corporation (CSC), General Electric Information Services Company (GEISCO) and Control Data Corporation Cybernet Services, operate directly in the Canadian market through subsidiaries. Similarly, Canadian service bureaus such as I.P. Sharp Ltd. and Canada Systems Group (CSG) operate in the U.S. market, also through subsidiaries.

There are, however, some important differences which need to be kept in mind. First, Canada has no indigenous manufacturers of mainframe computer hardware (like IBM, Honeywell, etc) or of minicomputers (like DEC, Data General, Hewlett-Packard, etc), although the Canadian subsidiaries of these firms may have world product mandates for certain products. Since hardware manufacturers of mainframes and minicomputers almost invariably develop their own systems software (operating systems, teleprocessing monitors, high level language compilers), this type of software development is very rare in Canada.

Secondly, although Canada has a well developed software services industry and is self sufficient in custom programming applications, it is very weak in the development of software products, especially applications packages. Most of the software packages used by Canadian users are developed in the U.S. or elsewhere. Although Canadian firms like Quasar and Systemhouse have begun to move into the software products market, Canada lacks well established, world-class software development firms comparable to the U.S. based Management Science America (MSA), Cullinet or Visicorp. Quasar is the most successful Canadian firm in this area; some 52% of its 1982 revenues of $18.6 million were derived from the sale of computer software products.

Table I.3 shows the estimated and projected total revenues of the computer services industry in the U.S. and Canada, as well as the revenues attributable to machine-based processing services provided by the service bureaus and secondary suppliers. The balance of the industry revenues result from software products and professional services. It should be noted that the projections were made in 1981, with some revisions to the Canadian figures later. The current recession has caused a considerable slowdown in the growth of the computer services industry, particularly in Canada.

In 1980, the Canadian computer services industry had revenues exceeding $1 billion (Canadian); processing services revenues are estimated to have been in the $600-700 million range. The estimates of the projected 5-year compound annual growth rate to 1985 now range from 13% to 16.5% for processing services, and from 17% to 21.5% for total revenues. Due to the current recession, growth in processing services revenues slowed to 14-16% in 1982 and could be as low as 10% in 1983. The top 34 computer service bureaus had revenues of some $508 million in 1980 and $610 million in 1981 (Table I.4); Canadian-owned bureaus dominated the market, accounting for over 80% of these revenues. IBM Canada Ltd.'s service bureau revenues are estimated at $34 million in 1980 and $38 million in 1981, ranking sixth in size and accounting for 6.6% of the above total in 1980 and 6.2% in 1981. The three top privately-owned service bureaus, CSG, Datacrown and

I.P. Sharp, had 1982 revenues of some $150 million, $90 million and $50 million respectively; these three firms currently account for over 20% of the total industry revenues and some 45% of the revenues of the top 34 service bureaus. CSG, the largest Canadian service bureau, consolidated its position in 1982 by acquiring Computel Systems Ltd., the fifth largest.

Concentration is increasing in the Canadian service bureau industry, and the trend is towards large bureaus capable of serving the national or even North American market. A large number of medium and small-sized firms continue to remain in existence, however, providing specialized services or serving geographical niches. Candian service bureaus, on the whole, have been less profitable than their U.S. counterparts, partly because of higher equipment and data communications costs and also due to differences in market size and density.

For the U.S. computer services industry, 1980 revenue estimates range from $13.1-14.9 billion; preliminary estimates for 1982 are in the range of $20-21 billion. Estimates of 5-year compound annual growth to 1985 range from 18.5-21% for the industry as a whole, and 16.5-17% for processing services. The U.S. industry is characterized by more competition and less concentration. In 1980, 177 computer services vendors had revenues of $10 million or more, 17 had revenues of $100 million or more and only 3 (CDC Data Services, ADP and CSC) had revenues exceeding $500 million. No single vendor accounts for more than 5% of the market, and no single vendor has revenues 10 times larger than the leading Canadian vendor.

Table I.1

U.S. and Canadian Telecommunications
and Computer/Communications Services Markets

Market Item	United States (U.S. $ billions)			Canada (Cdn. $ billions)		
	1975 (est.)	1980 (est.)	1985 (proj.)	1975 (est.)	1980 (est.)	1985 (proj.)
Telecommunications Common Carrier Revenues	34	63	115	3.1	6.5	12.0
Computer/ Communications User Expenditures	28	55	120	2.7	6.1	11.8

Sources: Statistics Canada Catalogue 56-201 "Telecommunications Statistics";
Statistics Canada Catalogue 56-203 "Telephone Statistics";
Computer/Communications Secretariat, Dept. of Communications, Ottawa,
"The Growth of Computer/Communications in Canada";
Federal Communications Commission "Statistics of Communications Common
Carriers";
Wirth Report "Telecommunications in Transition: The Status of
Competition in the Telecommunications Industry";
International Data Corporation: Computer Industry Review and Forecast
1976-85, and subsequent EDP Industry Reports;
ADAPSO: 1980 Computer Services Industry Survey.

Table I.2

Preliminary Estimates for Canadian User Costs and
Computer Services Industry Revenues, 1970-1990
(Millions of Current Dollars)

Item	Category	Cost/Revenues ($m)				
		1970	1975	1980	1985	1990
1. User Costs for C/C Services	Total	1,185	2,660	6,090	11,810	19,560
	In-house	985	2,170	4,615	8,095	12,405
2. Software Costs (User and Service Suppliers)	Development		440	880	1,605	2,640
	Maintenance		480	1,120	2,010	3,220
	Other Software (Packages, etc.)		15	40	80	120
3. Computer Services Industry Revenues	Total	150	400	1,030	2,260	4,165
	Machine-Based(1)		305	655	1,205	1,940
	Person-Based(2)		95	375	1,055	2,225

Sources: ° The Growth of Computer/Communications in Canada, March 1978 and
Revised DOC estimates, February 1982.
° Report on Software Related Issues
° Statistics Canada Catalogue 63/222: Computer Services Industry
(1972-80)

Notes: (1) Machine-based includes revenues from data processing, input
preparation and the computer usage component of software development
and information retrieval services.
(2) Person-based includes all costs of programmers, systems analysts,
consultants, etc for other services.

Table I.3

Computer/Communications Services Estimated Revenues for U.S. and Canadian
Suppliers

Revenues	United States			Canada		
	(U.S. $ billions)			(Cdn. $ billions)		
Item	1975 (est.)	1980 (est.)	1985 (proj.)	1975 (est.)	1980 (est.)	1985 (proj.)
Computer Services Industry (total)	6.0	13-15.0	34-35.0	0.4	1.0-1.1	2.3-3.1
Processing Services	3.0	6.9-8.8	15-18.8	0.30	0.6-0.7	1.2-1.4

Sources: Computer/Communications Secretariat, Department of Communications,
Ottawa, "The Growth of Computer/Communications in Canada";
Evans Research Corporation, Toronto, "The Canadian Computer Industry"
and Various EDP In-Depth Reports;
International Data Corporation: Computer Industry Review and Forecast
1976-85, and subsequent EDP Industry Reports;
ADAPSO/Input Ltd.: 1980 Computer Services Industry Survey.

Table I.4

Revenues of the Top Service Bureaus in Canada
(millions of Canadian dollars)

Company Name	Fiscal Year end	Owner-ship	EDP Service Revenues (1)			% of Sample Total		% Annual Growth		Source Code (2)
			1981	1980	1979	1981	1980	81/80	80/79	
1. Canada Systems Group Ltd.	Dec. 31	Can.	101.5	77.9	62.3	16.7	15.3	30	25	A
2. Datacrown Inc.	Dec. 31	Can.	86.2	68.6	60.2	14.1	13.5	26	14	A
3. B.C. Systems Corp.	Mar. 31	Can	57.9	49.1	40.2	9.5	9.7	18	22	A
4. I.P. Sharp Associates Ltd.	Dec. 31	Can.	42.0	35.3	24.7	6.9	7.0	19	43	B
5. Computel Systems Ltd. (4)	Dec. 31	Can.	41.3	38.4	31.0	6.8	7.6	8	24	A
6. IBM Canada Ltd. (3)	Dec. 31	U.S.	37.7	33.6	30.0	6.2	6.6	12	12	C
7. L'Industrielle Services Techniques Inc. (IST)	Dec. 31	Can.	23.8	20.4	19.5	3.9	4.0	17	5	B
8. Control Data Canada (Cybernet Services) (3)	Nov. 30	U.S.	20.3	14.5	–	3.4	2.9	40	–	B
9. ADP Automatic Data Processing Inc.	June 25	U.S.	20.0	16.7	12.0	3.3	3.3	20	39	C
10. Sask Comp	Dec. 31	Can.	16.8 (447.5)	12.8 (367.3)	9.9	2.8 (73.4)	2.5 (72.3)	31	29	A
11. Manitoba Data Services	Mar. 31	Can.	15.5	13.0	11.5	2.5	2.5	19	13	C
12. Canadian General Electric Co. Ltd. (Info. Services) (3)	Dec. 31	U.S.	15.0	14.0	–	2.5	2.8	7	–	C
13. Computer Sciences Canada Ltd.	Mar. 31	U.S.	12.2	11.2	9.3	2.0	2.2	9	20	B
14. Comshare Ltd.	Dec. 31	Can.	10.2	7.6	6.5	1.7	1.5	34	17	B
15. Dataline Inc.	Dec. 31	Can.	9.9	8.2	7.0	1.6	1.6	21	17	A
16. Digitech Ltd. (3)	June 30	Can.	9.0	7.9	7.8	1.5	1.6	14	1	A
17. Nfld. & Labrador Computer Services Ltd.	Mar. 31	Can.	8.4	7.3	6.2	1.4	1.4	15	18	B
18. ACT Computer Services Ltd.	Dec. 31	U.S.	7.5	6.8	4.9	1.2	1.3	10	39	B
19. NCR Canada Ltd. (3)	Nov. 30	U.S.	7.0	7.0	–	1.1	1.4	0	–	C
20. Real Time Datapro Ltd.	Feb. 28	Can.	6.4 (548.6)	5.1 (455.4)	4.3	1.1 (90.0)	1.0 (89.7)	25	19	A

Table I.4 (Continued)

Revenues of the Top Service Bureaus in Canada
(millions of Canadian dollars)

Company Name	Fiscal Year end	Owner-ship	EDP Service Revenues (1)			% of Sample Total		% Annual Growth		Source Code (2)
			1981	1980	1979	1981	1980	81/80	80/79	
21. National Datacentres Corp.	Mar. 31	Can.	6.3	5.2	4.7	1.0	1.0	21	11	C
22. Comtech Group Intl. Ltd.	June 30	Can.	5.8	5.7	5.7	1.0	1.1	2	0	A
23. Riley's Datashare Intl. Ltd.	May 31	Can.	5.6	5.1	4.2	0.9	1.0	10	21	A
24. Alphatext (1981) Ltd.	Dec. 31	Can.	4.9	4.7	5.2	0.8	1.9	4	(10)	B
25. Comcheq Services Ltd.	May 31	Can.	4.8	3.6	2.2	0.8	0.7	33	64	B
26. Cybershare Ltd.	Mar. 31	Can.	4.6	4.3	2.0	0.8	0.8	7	115	B
27. Polycom Systems Ltd.	Sep. 30	Can.	4.5	3.3	2.8	0.7	0.6	36	18	A
28. Boeing Computer Services Canada Ltd.	Dec. 31	U.S.	4.2	4.2	3.6	0.7	0.8	0	17	C
29. Coverall Computer Services Ltd.	May 31	Can.	4.2	2.6	1.5	0.7	0.5	62	73	B
30. MICR Systems Ltd.	Dec. 31	Can.	4.2	4.2	4.0	0.7	0.8	0	5	C
31. Automation Centres of Ottawa Ltd.	Dec. 31	Can.	4.0	3.0	3.7	0.7	0.6	33	(19)	B
32. Computrex Centres Ltd.	Mar. 31	Can.	3.5	3.8	3.4	0.6	0.7	(8)	12	B
33. Cableshare Inc.			2.4	1.5	–	0.4	0.3	60	–	A
34. University Computing Co. Canada Ltd.	Dec. 31	U.S.	1.9	1.3	1.8	0.3	0.3	46	(27)	B
TOTAL			609.5	507.9		100	100	20		

Source: Evans Research Corporation EDP In-Depth Reports, August 1982 and March 1981.

Notes: (1) Include domestic and export revenues.
(2) Source Code: A = Published by Company;
B = Confirmed by Company Official;
C = Estimated by Evans Research Corporation

(3) Estimated Revenues from Service Bureau operations.
(4) Acquired by CSG in 1982.

APPENDIX II

Detailed Review of Canadian Sources of EDP Information

REVIEW OF CANADIAN SOURCES OF EDP INFORMATION

A. Overview

There are five major regular sources of basic information about computer/
communications goods and services in Canada. Four are produced by the
federal government: the annual Computer Service Industry report (Ref. 7),
the monthly and annual commodity export and import statistics (Ref. 9) and
the census of manufacturers (Ref. 8) published by Statistics Canada, and the
annual Review of EDP and Telecommunications in the Government of Canada
(Ref. 12) published by the Treasury Board. Two were annual publications of
the Canadian Information Processing Society: the Canadian Computer Census
(Ref. 10) and the Canadian Salary Survey (Ref. 11); the last was dis-
continued in 1979. The basic characteristics of each of these data sources
will be outlined.

Three occasional or one-time sources provide information which is
particularly relevant to the early and mid-1970's. These are the Tariff
Board report on Computers and Related Telecommunications Equipment, the
DATACOM '76 survey of the Department of Communications, and the telephone
survey of computer/communications users carried out by the Computer/
Communications Secretariat. To these sources, which will also be described,
should be added the Informatics Institute of Canada Survey of 1977. A more
detailed description of these regular and occasional sources is found in the
Computer/Communications Secretariat Growth Paper (Ref. 2).

Evans Research Corporation is now preparing regular annual estimates of the
sales of the 120 or so largest firms engaged in the computing equipment
manufacturing and computing services activites in Canada, as well as
medium-term forecasts. This information is well described in the EDP
In-Depth Reports (Ref. 16). The trade and financial press (Canadian
Datasystems, Computer Data, Computing Canada, the CIPS Review and major
financial papers such as the Financial Times and the Globe and Mail Report
on Business) frequently publish useful descriptive articles on particular
aspects of computer/communications. Some Canadian information is
occasionally published by International Data Corporation and other United
States consulting and market research firms. These sources are often based
on secondary information, and their output should be used with some
discretion.

B. Statistics Canada

There are three main sources of EDP information in Statistics Canada: the
computer services industry census provides information about companies which
lease, rent or sell EDP equipment, or produce EDP services in Canada;
Statistics Canada compiles and publishes information on international trade
in EDP goods from customs documents; and the annual census of manufacturers
provides information on the production of EDP goods in Canada. In addition,
sales of EDP equipment are picked up in wholesale and retail trade
statistics and, more recently, in the Family Expenditure Survey.

1. The Computer Services Industry Report (Cat. 63-222, Annual)

Statistics Canada conducted its first survey of the Computer Service Industry for 1972. This mail survey provides more varied information than any source other than Treasury Board, and has a much wider coverage than the Treasury Board series. The results of the survey are published in Statistics Canada Catalogue No. 63-222 Annual, and this report is of special value in estimating the magnitude of total computer/communications activity in Canada.

The Computer Service Industry report initially related to the following groups of establishments:

(1) Those whose principal source of revenue is the sale of computer services (machine-based or professional), receipts from such sales being 1/3 or more of total operating revenues;

(2) Those whose principal source of revenue is the sale, lease or rental of computers and other data processing hardware, receipts from such sales being 2/3 or more of total operating revenues.

(3) Those who have important secondary revenues from either of the above sources.

The survey provides information on revenues, broken down by type of service and by industry of customer, and on expenditures and employment.

In 1977 the survey reported 596 computer services companies with revenues of $416m, 26 equipment sales or leasing companies with revenues of $797m, and 454 secondary suppliers with revenues of $149m. These secondary suppliers were dropped from the survey after that year. In 1980 the survey reported 1036 computer service companies with operating revenues of $820m, and 29 equipment sales or leasing companies with operating revenues of $1,110m; the corresponding 1981 figures were 1392 computer service companies with operating revenues of $1,102m and 28 equipment sales or leasing companies with operating revenues of $1,411m.

Users of these data must bear in mind the implications of the three-way classification of establishments by principal source of revenue. Some firms which were included in group 1 or 2 in the first survey year are known to have been reclassified to group 3 in the second survey year, and this type of reclassification can produce anomalies in year-to-year comparisons except when data for all three groups of firms are added together. Even when the broadest possible comparisons are made, some year-to-year comparisons appear anomalous, especially in some of the more detailed operating revenue and market totals. These are probably caused by reporting irregularities, which are extremely difficult to contend with, especially in the initial years of a new statistical survey.

The most interesting of these anomalies is in the total for hardware sales and rental. This total, for all three groups of firms reported in the Computer Service Industry report, increased by only 4% from 1972 to 1973, and by 43% from 1973 to 1974. These changes compare with changes in logically related series from other sources as follows:

Selected Equipment Series	1972 to 1973	1973 to 1974	1972 to 1974
	%	%	%
Total Hardware Sales and Rental, CSI	4.4	43.0	49.4
Imports, Electronic Computers and Parts	30.3	20.3	56.8
Estimated Rental Value of Computers (CIPS)	13.3	22.7	39.0
Estimated Federal Government Equipment Rentals (TBS)	25.2	10.3	38.1

Statistics Canada has suggested that hardware sales and rentals by non-respondents may have been overestimated in 1972, the first survey year. However, in view of the relatively consistent total gains shown by all series between 1972 and 1974, the Growth paper interpreted the anomaly as indicating some unknown reporting or coverage deficiency in the 1973 survey data.

Another industry classification problem surfaced in the 1976 report. Certain firms, formerly included in group 2, were declared out of scope because more of their revenues comes from equipment sales than from lease or rental. This creates a discontinuity which is relieved for 1976 by the publication of most of the missing information in a prefatory note. The transfer of manufacturers and vendors primarily engaged in the sale of computer equipment to the Wholesale and Retail Trade censuses after 1977 poses a problem for users of this survey's result.

The loss of the secondary suppliers after 1977 represents a serious reduction in scope and coverage, especially for the computer services activity. In 1977 these secondary suppliers accounted for some $46.8m (5%) of hardware revenues, and some $102m (18%) of computer services revenues.

2. **Commodity Exports and Imports** (Cat. 65-004 and 65-007, monthly and Cat. 65-202, 65-203, 65-207 annual)

Information on international trade in EDP goods is compiled and published monthly by the External Trade Division of Statistics Canada. Exports are published in Statistics Canada Catalogue 65-004. The classification of export goods shows only one statistical class for EDP goods. Imports are published in Statistics Canada Catalogue 65-007. There are two statistical classes for import goods. Information on imports and exports, by commodity and country, is published annually, in Statistics Canada Catalogue 65-202 for exports and Catalogue 65-203 for imports.

A separate class for electronic computers and parts (771-22) was introduced in Canadian import statistics in 1964. This class contains only finished components of computer systems and parts of those systems, and does not include imports of materials from which components or parts may be assembled in Canada. Unit record equipment is covered by class 771-20, which includes

card punching, sorting and tabulating machinery. A class for computer tape (634-78) was introduced in 1971. Identical classes are not available in export statistics because of the secrecy provisions of the Statistics Act, but export class 771-21 covers the same commodities as import classes 771-20 and 771-22, and is known to be principally data processing equipment. Only values are reported in Catalogues 65-202 and 65-203. The value of imports reported under class 771-22 was $1,103m in 1979, $1,653m in 1980 and $2,327m in 1981. The corresponding values for exports under class 771-21 were $504m in 1979, $614m in 1980 and $734m in 1981; re-exports totaled $162m in 1980 and $216m in 1981.

The values for data processing equipment shown in both export and import statistics are based on the reports of exporters and importers to customs authorities. The import values are known to be based, in most cases, on manufacturing cost plus an allowance for profit, and to be usually lower than the prices at which the goods would actually be sold to users in Canada (which must also recover the cost of operating software). Export values for data processing equipment are believed to be usually intra-company transfer values; fairly comparable with import values and also well below market values. Export and import values appear to be reasonably comparable with each other, but in the opinion of the author of the C/CS Growth paper should be increased by a factor of two or more when being compared with such data as the Treasury Board series or the value estimates based on the CIPS Census (Ref.2).

Information compiled according to the C.I.T.C. is published annually in Catalogue 65-207, titled "Imports - Merchandise Trade - Commodity Detail". The tabulation "Imports by Commodities and Countries, C.I.T.C. Detail", available for the first time for 1976, presents information on some 60 separate components of import classes 771-20 and 771-22. Both quantity and value are recorded for most components. For example, 1981 imports included 31,776 digital micro-computers valued at $24.6 million, 9,362 central processor units valued at $450.3 million, 66,108 magnetic disk drives valued at $247.3 million, 80,122 computer output printers valued at $178.3 million, 9,691 keyboard terminals (without video screen) valued at $21.6 million, and 60,635 keyboard-video terminals valued at $104.8 million. A percentage breakdown is given in Table II.1. It must be recognized that these totals include both goods for use in Canada and goods which will be re-exported (usually after incorporation into some further advanced article).

3. Census of Manufacturers: Office and Store Machines Industry
(Cat. 42-216, Annual)

As part of the annual census of manufacturers, Statistics Canada surveys by mail questionnaire all establishments belonging to SIC 318, the Office and Store Machines Industry and publishes the information in Catalogue 42-216, Annual. Manufacturers of EDP equipment are defined as part of this industry. Approximately 30 questions are asked which pertain to EDP equipment. Production of EDP equipment in this industry was valued at $382 million in 1979, $516 million in 1980 and $604 million in 1981. EDP equipment is produced in other industries as well; about $30 million worth in 1979. The 1980 revision of the SIC recognized a new 'EDP equipment' industry, SIC 3361.

C. The Treasury Board Statistics

The federal Treasury Board published in 1975 a "Review of EDP in the Government of Canada, 1974". This was the first public release of statistics relating to government data processing, although data have been gathered intermittently by the Board since 1968. These statistics are now produced each year as a by-product of the government's EDP planning system. In 1979, statistics related to telecommunications activities within the government were added to the review, and its title was changed to "Review of EDP and Telecommunications in the Government of Canada".

The Treasury Board statistics relate to the production and use of EDP services by government departments and by agencies which have the status of departments under the Financial Administration Act. They exclude crown corporations and other commercial or semi-commercial agencies, and even for regular departments they exlcude some special purpose computer applications which do not relate and cannot readily be adapted to general purposes data processing (specialized military applications and the air traffic control system are examples of these exclusions).

The Treasury Board data include tables on the nature of costs incurred to provide and support EDP services (from fiscal year 1967-68), the number and type of EDP staff employed (also from 1967-68), the types of EDP services utilized or expected to be needed and the principal sources of supply (from fiscal year 1973-74), the regional distribution of EDP man-years, and of supply and use of non-government EDP services Tables II.2, II.3 and II.4 illustrate the level of detail available. Most tables include estimates for two years ahead. This could make the report valuable as a guide to likely short-run developments, since the federal government is the largest single EDP user in the country, although the reported costs account for well under 10% of total estimated Canadian user costs.

The departmental returns from which these data are compiled are thoroughly reviewed for administrative purposes. They can be accepted as providing a reliable picture of the magnitude of federal government EDP activity within their defined scope. Data relating to the types of EDP services used and to sources of supply are probably subject to a wider margin of error than those relating to costs. Some EDP cost data have been gathered intermittently since 1968, but data on service type and source were first collected in 1974. The classifications used relate generally to the traditional types of data processing activities. It is difficult find data on the use of applications packages, or information retrieval services.

One omission from the Treasury Board statistics is information on the numbers and types of computers installed in the federal government. This prevents use of this series as an independent check on the coverage of the CIPS Census.

D. Canadian Information Processing Society (CIPS)

1. The CIPS Canadian Computer Census

The CIPS Computer Census has been published each year from 1965. It is a voluntary mail survey conducted by the senior Canadian association of

persons interested in data processing. CIPS defines a computer to be any "device capable of accepting, processing and supplying data under the control of an internally-stored program which it has the ability to modify". Until 1973 the Census attempted to include all central processing units (CPU's) which met this definition, even those CPU's which are incorporated as controllers in another machine such as a key-to-tape unit. Starting with 1974 the Census excluded computers with a rental value below $1,000 per month. This means that virtually all desktop computers and many small business computers were excluded from the coverage of the Census. In the 1981 and 1982 censuses there were some attempts to obtain information on these smaller computers, but the results were very mixed.

The CIPS Census lists each identified computer by location and firm (user), and identifies the computer model, installation date, rental or ownership status, memory size, number of tape drives and a number of other characteristics. From 1976, published detail is limited to computers with a rental value of $2,000/month or more, although the Census still contains complete summaries based on the "rental class" and "industry" of each machine. CIPS will sell copies of its Census tape (lacking only the sensitive rental class information), and will provide special tabulations for a price.

The CIPS Census is without question the broadest and most general indicator of computer use in Canada. The data seem to provide good coverage, within the limits of Census objectives and techniques, for large and medium sized computers (rental class $5K/month and above) and to be quite consistent from period to period. This consistency even applies in such difficult areas as industry classification (although it should not be assumed that the industry classes are necessarily identical with those appearing in other sources). The "feedback" technique used in the Census, whereby last year's answers are reproduced on the current year's Census questionnaire and may be corrected by the respondent as a substitute for re-entering all data, probably makes an important contribution to consistency.

Three important facts about the CIPS Census must be kept in mind. First, it was largely conducted by volunteers, although this may be changing somewhat. Questionnaire design, mailing, follow-up, supplementary enquiries to manufacturers, processing and publication largely depend on the voluntary effort of CIPS members. This limits the attention that can be given to data editing. Second, the CIPS Census form is designed to be filled in by data processing managers, and is limited to information readily available to those managers and releasable by them; this often excludes personnel data. Third, it is a voluntary mail survey, and subject to the coverage limitations of such surveys. While the coverage has remained good and stable for the larger mainframe computers, it has begun to deteriorate somewhat for medium sized computers and seriously for small computers. In the classes A and B, renting for less than $5K/month, the coverage may now be below 50%.

2. The CIPS Canadian Salary Survey

This survey was published each year from 1971, until it was discontinued in 1979. It was also a voluntary mail survey, which used as its basic mailing list the respondents to the previous year's computer census. It distinguished 37 classes of job, for each of which it published the number of employees reported, the high and low salary reported, and a number of averages. Separate tables provided detail for firms whose largest computer was in each of the census monthly rental classes, from firms whose largest computer was under $1K/month, and from a few firms with no computers. Other tables presented the same level of detail for each industry group recorded in the Census, and for nine provinces (detail for Prince Edward Island and the territories was not shown because of the small number of respondents).

The number of "largest" computers reporting to the salary survey was also shown; this number can be compared with the census total for the previous year as an indicator of the salary survey's coverage. Response to this survey appears to have been more in line with typical voluntary mail survey results than is the case for the computer census. Overall response in 1977 stood at about 15% of computers (perhaps 20% when the additional computers in large installations are allowed for), but in the four largest computer groupings it was normally over 30%, and in the fifth was 25% in 1977. The shortfall in coverage was most evident in the case of small computer installations.

Because of the timing of the salary survey, it is believed that its figures are probably more representative of salaries in the latter part of the preceding year and early part of the reference year than of the full reference year. For this reason the salary survey data should be lagged one year (i.e. the 1977 salary survey should be used to represent 1976). This has the effect of reducing the estimated number of computer/communications employees for any year.

E. Occasional Studies

1. The Tariff Board Report

In December 1971, the Minister of Finance requested the Tariff Board to make a study and report on the effect of the Customs Tariff on the production and use of computers and related telecommunications equipment in Canada. The difficulties encountered in carrying out the study were considerable. As a result, the study was not complete until 1976, and the report did not become available until 1977.

Most of the research on which the final report was based actually took place in 1972-74, and the report provides a generally excellent appraisal of the industry in that period. Although there have been many changes since that time, this report is invaluable to an understanding of how computer/ communications activities have developed in Canada, and to the interpretation of relevant statistics.

2. The Department of Communications DATACOM '76 Survey

This survey was conducted in the summer of 1976 to obtain information on likely future demand for data communications services in Canada. The 74 companies who cooperated in this survey were selected as represenative of large, leading-edge users of computers and associated communications. To assist in interpreting the results, information was collected on certain basic characteristics of the firms surveyed, including the size and distribution of their data processing budgets. This is one of the very few available surveys of Canadian user EDP budgets outside the federal government.

Three obvious differences exist between the DATACOM '76 budget information and the concepts incorporated in the Computer/Communications Secretariat's model of computer/communications activity (Ref. 2). These arose from the nature of the DATACOM sample, the type of expenditure information collected, and the comparability of information relating to "service bureaus" with information relating to "purchased computing services".

The DATACOM sample concentrated on firms which were believed to be on the "leading edge" of computer/communications use in Canada. In general, these were very large and very experienced users. They were mostly concentrated in certain industry areas and in central Canada, although a deliberate effort was made to ensure some regional representation. The sample was not selected to be representative of all users or to produce indicators of average use or expenditure. The Secretariat's model, on the other hand, is intended to represent total use. The analysis of the Datacom survey carried out by the Secretariat (Ref. 2) attempted to identify and offset any biases inherent in the DATACOM sample.

The DATACOM survey asked for information on the corporate data processing and data communications budget, while the Secretariat's model deals with cost allocations. The principal conceptual difference between budget and cost information is in the treatment of newly purchased or already owned equipment; DATACOM recognized the limitations of the budget concept by informing respondents that "Purchased equipment should be converted to rental equivalent using 1/40th of purchase price." This is likely to yield a higher figure for owned equipment than would the use of actual depreciation allowances, especially if the depreciation allowances are in line with the capital cost allowance provisions of the Income Tax Act. It would also yield higher figures than the techniques used in compiling information on federal government EDP costs.

Another conceptual difference is that DATACOM asked for information on "service bureau expenditures". The term "service bureau" is usually applied to firms which provide machine-based computing services, and is not usually extended to include suppliers of such other computing services as consulting, systems and programming work, and training activities. The Secretariat's model deals with expenditure on all computing services.

The reported budget data were not always consistent. All firms do not formulate budgets in the same way, nor allocate the same costs to their components. And these differences were reflected in the data reported, especially since the detail requested was limited and the survey form

therefore did not provide an adequate checklist. Misinterpretations of requests for information are also most likely the first time a survey is conducted.

The Secretariat's analysis confirmed these conceptual differences and revealed reporting errors of various types. However, neither the random errors nor the impact of conceptual differences made the DATACOM information unsuitable for use or even difficult to use. On the contrary, the value of this information was comparable to that of the improved cost distributions in the 1974 Computer Service Industry report, which were basic to the construction of the Secretariat's model.

3. Informatics Institute of Canada Survey

In 1976, 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 had to 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 respondents were asked to provide an estimate of expected compound annual 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 (Ref. 2);
- 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 raw data from the survey were compiled during January 1978 and released in a 330 page report (Ref. 14). No attempt was made to analyze the data or to draw any conclusions. These tasks were left to a later stage.

A survey analysis report prepared by the Department of Communications in April 1978 presented forecasts of national computer/communications expenditures for the period 1975-80, developed from the estimates provided

by the respondents of the Informatics Institute survey. The forecasts covered expenditures related to personnel costs, computer/communications equipment and data transmission costs, and indirect costs; these are broken down by industry categories like public sector users (federal, provincial and municipal governments and other public institutions), private sector users (financial, manufacturing, distribution, transportation/utilities) and the computer services industry. The forecasts were correlated to those made using the growth model developed by the Computer/Communications Secretariat (Ref. 2), and found to be somewhat lower than the model estimates.

4. The C/CS Telephone Survey of Computer/Communications Users

During the latter part of 1976 there were some signs of a growing migration of Canadian computing to the United States, and these signs continued and intensified in the early months of 1977. No relevant quantitative information was available, and the Computer/Communications Secretariat therefore undertook to gather some information about the extent of this migration. Two vehicles were used: a telephone survey of known and possible users of computing and a mail survey (in cooperation with CADAPSO) of Canadian suppliers of computing services. The surveys themselves, and the results obtained from them, are described at some length in the Growth Paper (Ref. 2).

A telephone survey was chosen for users partly because of the desire to minimize respondent burdens and partly because of the speed with which some results could be obtained. It limited this survey to a small number of relatively simple questions, but permitted the results of the first two modules to be used to improve the four subsequent modules. A total of 378 usable responses were obtained. There was almost no difficulty in obtaining user cooperation, though some respondents were able to supply only qualitative rather than quantitative estimates.

The six survey modules were drawn from three different (but partly overlapping) universes. These universes, and modules drawn from each, are described in detail in the Growth Paper.

The first three modules (1a - 1c) were conducted on a (former) computer installation basis; the last three (2 - 4) on a business basis. The difference is that one business can have a number of computer installations in different locations, and it was therefore necessary to adjust the first three modules to the "business" level for comparability. This difference does not appear to have affected the quality of the information obtained. The "installation" basis had the advantage of including some government agencies which are not usually listed as businesses, and would otherwise have been omitted entirely.

Each usable reply was checked against its Dun and Bradstreet listings, and the latest sales and number of employees figures obtained. It was not possible to obtain figures for all usable replies in modules 1a, 1b, 1c and 2, and the matching was especially difficult in the case of the first three modules. In all samples the distributions of sales and employee figures were extremely skewed, which led to the analysis being conducted within sales size groupings.

The telephone survey information was used by the C/CS for three primary purposes:

(1) To evaluate the coverage of the CIPS Computer Census;

(2) To develop estimates of the numbers of users of computing in Canada

(3) To develop estimates of the extent to which computing services were and would be imported.

This survey provides a very slender basis for estimates of such importance. Unfortunately, it is all the information that was available to the C/CS for developing the service imports extension of the Growth model.

F. Evans Research Corporation

Evans Research Corporation (ERC) is perhaps Canada's leading market research firm specializing in, and dedicated to the computer/communications and office automation industries. Its publications include the EDP In-Depth Reports, Computing Canada (a data processing newspaper), and Info Age (a monthly magazine for microcomputer users). More than 100 of Canada's top EDP suppliers, and many more EDP users, use ERC services in various forms. These include the Continuous Information Services Program, as well as surveys, trend analyses and forecasts, and industry reports.

ERC conducts an annual survey of over 120 of the largest firms engaged in computer/communications equipment manufacturing and computer services activities in Canada. Based on the results of this survey, it prepares a report entitled "The Top Computer Companies in Canada". The companies are broken down by categories such as hardware suppliers, computer service bureaus, software and EDP consulting firms. Equipment suppliers are further classified as terminal and peripheral equipment specialists, small business and word processing specialists and plug compatible manufacturers. For each company, ERC gives the ownership, fiscal year and annual revenue from EDP-related operations, in addition to the total revenue (the last may be much greater, if the company is engaged in other lines of business). A source code is also given; this indicates whether the data is published by the company, confirmed by an officer of the company, or estimated by ERC. The computer service bureau data from the 1982 survey is shown in Table I.4.

Because ERC provides data at the firm level, it is possible to use this information to analyze the performance of various industry segments, such as the equipment suppliers, service bureaus and software houses; in fact, ERC itself attempts to examine and forecast the performance of such segments. It should be borne in mind, however, that there is a matrix relationship between types of firms and activities. Thus service bureaus, while providing machine-based processing services as their primary activity, could also be important secondary suppliers of software and consulting services. Similarly, a hardware supplier could also provide data processing, sofware and consulting services as a secondary activity; the classic case of this is IBM.

For the above reason, the Growth Model (Ref. 2) analyzes computer/ communications on an activity basis, rather than a firm basis. ERC also attempts to analyze the supply of computer/communication equipment and services on both an activity and a firm basis.

Table II.1

Summary of C.I.T.C. Detail for Imports of
Electronic Computers and Parts (Class 771-22)

Class/ Category	Description of Item	1980			1981		
		Quantity	Value ($ m)	% Total	Quantity	Value ($ m)	% Total
77122	Electronic Computers and Parts (Total)	–	1,652.8	100.00		2,327.5	100.00
77122-20	Ditigal Computer CPUs	7,656	320.4	19.39	9,362	450.3	19.35
77122-21	Digital Microcomputers	9,987	7.5	0.45	31,776	24.6	1.06
	Computer CPUs and Parts Sub-Total (20, 21, 23, 28, 29)	–	371.7	22.49	–	555.6	23.87
77122-51	Magnetic Disk Drives	39,670	176.7	10.69	66,108	247.4	10.63
77122-60	Computer Output Printers	47,270	109.1	6.60	80,122	178.3	7.66
77122-71	Printer Type Terminals	7,938	15.4		9,691	21.6	
77122-72	Video Display Terminals	43,970	71.8	4.34	60,635	104.8	4.50
77122-73	Graphic Display Terminals	685	4.3		2,416	16.9	
77122-74	Point of Sale Terminals	13,196	36.9		11,021	23.2	
77122-75	Bank Teller Terminals	2,169	9.7		4,496	25.6	
77122-76	Intelligent Terminals	539	2.6		295	1.4	
77122-77	Terminals W/Card Reader Cap.	20	.025		28	.028	
77122-78	Terminals, Parts of NES	–	95.3			117.6	
77122-79	Terminals, NES	6,942	12.9		8,216	13.5	
	Terminals, Sub-Total (71-79)	–	249.0	15.07	–	324.7	13.95
77122-88	Parts of Computer Equipment NES	–	338.4	20.47	–	446.1	19.17
77122-89	Computer Equipment NES	–	151.3	9.15	–	201.8	8.67

Source: Statistics Canada Catalogue 65-207, Imports, 1981.
Merchandise Trade - Commodity Detail.

Table II.2

Full EDP Costs and Distribution 1977–78 to 1980–81

(Costs in millions of dollars)

Category	Item	1977–78		1978–79		1979–80		1980–81	
		Costs	%	Costs	%	Costs	%	Costs	%
Direct EDP Costs	Salaries	122.431	39.7	135.531	37.7	142.670	37.5	151.442	38.2
	Consultants	15.481	5.0	19.660	5.5	18.679	4.9	17.253	4.3
	Equipment Rent, Actual	41.654	13.5	50.058	14.0	54.941	14.5	57.450	14.5
	Equipment Rent, Imputed	12.904	4.2	16.032	4.5	17.476	4.6	18.288	4.6
	Equipment Maintenance	6.518	2.1	8.001	2.2	8.606	2.3	9.210	2.3
	Data Transmission	9.679	3.1	12.594	3.5	14.601	3.8	15.671	3.9
	Service Bureaux	30.616	9.9	37.403	10.4	39.158	10.3	39.907	10.1
	Software Acquisition	1.553	0.5	2.073	0.6	2.418	0.6	2.198	0.6
	Production Supplies	7.381	2.4	8.927	2.5	9.225	2.4	9.632	2.4
	TOTAL	248.217	80.4	290.279	80.9	307.774	81.0	321.051	80.9
EDP Support Costs	Employee Benefits	18.344	5.9	20.308	5.7	21.347	5.6	22.647	5.7
	Accomodation	11.966	3.9	13.249	3.7	14.703	3.9	14.869	3.7
	Office Supplies	.922	0.3	1.371	0.4	1.357	0.4	1.659	0.4
	Travel	2.277	0.7	3.007	0.8	3.411	0.9	3.560	0.9
	Printing, Stationery	1.116	0.4	1.313	0.4	1.381	0.4	1.445	0.4
	Telephone, Telegraph	1.382	0.4	1.536	0.4	1.630	0.4	1.702	0.4
	Interest, Imputed	4.789	1.6	5.426	1.5	5.755	1.5	6.074	1.5
	Other Expenses	2.244	0.7	2.417	0.7	2.480	0.7	2.569	0.6
	Departmental Costs	17.183	5.6	19.465	5.4	19.586	5.2	20.416	5.1
	Government Costs	1.738	0.6	2.017	0.6	2.247	0.6	2.548	0.6
	Less: Language Training	–1.619	–0.5	–1.859	–0.5	–1.659	–0.4	–1.634	–0.4
	TOTAL	60.342	19.6	68.250	19.1	72.238	19.0	75.885	19.1
Full EDP Costs	Full EDP Costs (Net)	308.559	100.0	358.529	100.0	380.012	100.0	396.906	100.0

Source: Review of EDP and Telecommunications in the Government of Canada, July 1980.

Table II.3

EDP Service Demand and Distribution – All Suppliers

(Demand in millions of dollars)

Category	Item	1977–78		1978–79		1979–80		1980–81	
		Demand	%	Demand	%	Demand	%	Demand	%
Machine-Based Services	Computer Services								
	Batch, Over the Counter	60.562	19.6	65.249	18.2	67.432	17.7	70.964	17.8
	Batch, Terminal	35.753	11.6	42.241	11.8	41.907	11.0	43.603	11.0
	Text Editing and Processing	2.961	1.0	3.245	0.9	3.489	0.9	3.701	0.9
	Time Sharing	16.775	5.4	22.811	6.3	25.638	6.7	28.072	7.1
	On-line Enquiry	16.926	5.5	20.357	5.7	23.570	6.2	25.438	6.4
	On-line Data Entry	6.054	2.0	7.504	2.1	8.723	2.3	9.516	2.4
	Other	8.553	2.8	11.128	3.1	14.409	3.8	16.245	4.1
	Sub-Total	147.564	47.9	172.535	48.1	185.168	48.8	197.269	49.7
	Other Machine Based Services								
	Data Preparation	27.255	8.8	31.800	8.9	34.250	9.0	37.897	9.6
	Auxiliary and Unit Record	2.614	0.8	3.105	0.9	2.770	0.7	2.816	0.7
	Computer Output to Microfilm	2.095	0.7	2.822	0.8	3.139	0.8	3.318	0.8
	Document Reading	1.493	0.5	1.757	0.5	1.848	0.5	1.935	0.5
	Other	8.628	2.8	8.474	2.3	8.706	2.3	8.471	2.1
	Sub-Total	42.085	13.6	47.958	13.4	50.713	13.3	54.437	13.7
	Total Machine-Based Services	189.649	61.5	220.493	61.5	235.881	62.1	251.706	63.4
Person-Based Services	Systems and Programming								
	Systems Services	40.509	13.1	47.024	13.1	47.488	12.5	47.543	12.0
	Programming Services	49.159	19.9	56.697	15.8	59.024	15.5	58.465	14.7
	Sub-Total	89.668	29.0	103.721	28.9	106.512	28.0	106.008	26.7
	Other Person-Based Services								
	EDP Training	3.487	1.1	4.410	1.2	4.508	1.2	4.739	1.2
	Other	25.755	8.4	29.905	8.4	33.111	8.7	34.453	8.7
	Sub-Total	29.242	9.5	34.315	9.6	37.619	9.9	39.192	9.9
	Total Person-Based Services	118.910	38.5	138.036	38.5	144.131	37.9	145.200	36.6
Total Demand	Total EDP Service Demand	308.559	100.0	358.529	100.0	380.012	100.0	396.906	100.0

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