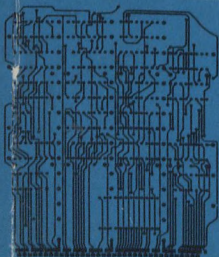The
Canadian
Computer/Communications
Task Force

Background
Papers

1 The Canadian Computer Supply Industry Study

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Papers**

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The Canadian Computer Supply Industry Study

Prepared by:

George R. Forsyth
Assistant Professor
School of Business Administration
The University of Western Ontario

Brian Owen
Doctoral Student
School of Business Administration
The University of Western Ontario

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Part A

Introduction

From infancy a short 25 years ago to a position where its impact is felt in every walk of Canadian life, the Canadian Computer Supply Industry[1] encompasses a broad and growing range of products, services and skills. Described by some as the fastest-growing industry in Canada, it has provided many success stories, as well as an extensive list of corporate failures. The benefits, given the industry's state of development, are often difficult to measure. Whether computers have created more jobs than they have destroyed remains subject to many questions.[2] However there can be little question of the computer industry's economic impact. The long and growing list of companies and institutions directly and indirectly dependent on computers and computer output attests to its effect on all elements of the Canadian economy.

1. Purpose, Scope and Objectives of the Computer Supply Industry Study

In scope, the study encompassed all segments of the computer supply industry, hardware, software and service bureaux. Where available, companies from the five geographical regions of Canada were included in the study of each industry segment. Within each segment the sample was selected to include large and small participants.

The major purpose of the computer supply industry study was to provide the Task Force with a detailed description of the supply industry, its participants, performance and prospects. This included:

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[1] Initially the study was to encompass the computer/communications supply industry. However, since the communications segment of the industry had received substantial attention in earlier studies, it was agreed that this work would centre on the computer supply segment

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[2] Hoos, Ida R., "When the Computer Takes Over the Office" *Harvard Business Review*, Volume 38, No. 4 (1960), pp. 102-12

The Canadian Computer Supply Industry Study

- An indication of the supply industry's prospects through an analysis of:
  - (i) The economic aspects of research, development and technical resources for each segment of the industry.
  - (ii) The resources, financial, research, product-market and organization for each segment of the industry.

- An indication of the ownership and control of the industry's resources.
- An indication of the present state of other key economic factors facing the computer supply industry.

Based on these guide-lines, three broad objectives were set for the computer supply industry study. These were:

- To develop a composite, descriptive economic profile for each of the supply industry segments and sub-segments.

- To develop a descriptive framework for understanding the interactions among companies within the industry segments, as well as the interactions among companies across segments.

- To investigate some of the policy options open to governments, industry and companies in terms of the impact of these options on individual segments and the industry as a whole.

In order to realize these objectives it was necessary to identify current and potential supply industry markets and resources, the industry's strengths and weaknesses and the strategic options open for the effective utilization of the industry resources.

2. The Study Outline

The computer supply industry study, divided into five parts, presents background, analysis and findings based on visits to 70 companies and institutions and interviews with over 150 people intimately associated with the supply industry. (Data for the study was gathered in May-August, 1971.) The emphasis in sample selections centered mainly on ensuring that companies of all types and sizes were part of the data input process. There was no attempt to make a random sampling.

- *Part A* of the report sets forth the purpose, scope and objectives of the study and a brief outline of the key findings.

- *Part B* deals with the supply industry framework which emerged primarily from the need to understand complex segment and company interactions, identifies key factors in industry and company development and integrates industry data. Finally, the framework

provides a base for identifying the meaningful segment activities which might be affected by a broad range of policy options available to the Task Force.
- *Part C* covers the data analysis. This part was structured around two broad sub-headings: the segment strengths and weaknesses,

and the impact of key issues on specific industry segments.
- *Part D* of the report, the industry analysis, embodies the study's findings, conclusions, and implications. Recommendations arising from the study were submitted for consideration as part of a broader report prepared for

Cabinet by the Canadian Computer/ Communications Task Force
Part E presents the conclusions of the computer industry study. Briefly reviewing the main findings, the part dwelt on supply industry services, user involvement in the supply industry, new product development and the nature of competition.

3. General Findings

It was extremely difficult to deal with general findings because of the many differences that exist within the computer supply industry. There was spectacular growth hand-in-hand with rapid decline and, while some would argue that this was characteristic of developing industries, the magnitude and rate of change were substantially more dramatic than anything documented prior to computer industry development. To be meaningful, the findings had to be described through specific reference to segments and, more often, to sub-segments within the supply industry. The detailed findings are presented in Part D of this report. Some broad observations are given below, although it should be kept in mind that the dynamics of this industry do not lend themselves readily to generalizations.

(a) Industry Growth

The absolute size and growth of the computer supply industry were extremely difficult to estimate accurately. Since government agencies, such as Statistics Canada, currently do not separate computer industry activities, no estimates of market size or revenues were readily available. Those government agencies collecting computer industry statistics dealt only with the largest producers of hardware and these figures were often incomplete and out of date. Import-export figures were not separated in such a way that computers and computer-related hardware could be accurately isolated for analysis. Service and software imports could only be estimated on the basis of data gained

The Canadian Computer Supply Industry Study

from the interview sample. From this evidence two aspects of the supply industry became clearly apparent. (See Table 1.)

• A significant portion of the software used in the Canadian market is part of the hardware producers' equipment and service offering.

• Service bureaux also provide an important share of the software available for use in the Canadian market.

The estimates presented in Table 1 were largely on two sources of data:

• Estimates of industry participants in the interview sample.

• Performance of industry participants in the interview sample.

In general, the evidence gathered indicated that the industry growth through 1975 will fall short of the publicly touted figures of 20 to 25 percent per year. Estimates based on industry interviews and performance suggest an average growth-rate of 15 to 18 percent per year. Selected segments within the computer supply industry could grow at rates up to 25 percent per year.

(b) Estimates of the Industry's Participants

In general, industry participants tend to be extremely optimistic regarding future growth potential. Many see their particular sub-segment growing at rates substantially greater than can possibly be justified by past performance or their own estimates for growth in the broader segment in which they participate. The same optimism pervaded estimates for company performance. Many of those interviewed projected company growth-rates in excess of segment and sub-segment estimates. These estimates were offered in spite of the fact that the companies often lacked the necessary skills and capital to expand, and few but the largest have undertaken any significant amount of market analysis or internal planning to cope with the direction and growth they projected.

Table 1

Industry Growth Estimates by
Segment and Sub-Segment

*

OEM
Other Equipment Manufacturers

**

OTC
Over-the-Counter

Segment	Growth	Sub-Segment	Growth
Hardware Manufacture & Supply	12% to 20% (Segment Average 15%)	Mainframe	14%
		Peripheral	17%
		OEM*	20%
		Leasing	12%
		Communications	20%
Software Supply	18% to 24% (Segment Average 20%)	Consultants	20%
		Custom Software	18%
		Standard Software	24%
		Systems Software	18%
Service Bureaux	14% to 25% (Segment Average 17%)	Remote Entry (Multi-Purpose)	25%
		OTC** Multi-Purpose)	16%
		Dedicated (Remote Entry & OTC)	22%
		Raw Time	14%
		Input Services (Keypunch)	15%

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(c) Performance of the Industry's Participants

In an industry characterized by stories of success, as well as a disproportionate number of business failures, past performance and average growth-rates often lacked significant meaning. Furthermore, the estimates presented were complicated by the economic conditions which existed at the time the study was in progress. The computer supply industry, like many other industries, had felt the squeeze of contracted and highly selective buying and there was, as a result, some support for the feeling that pent-up demand would foster purchasing in the short run at rates substantially in excess of recent buying levels. However, there was also evidence, mainly from among the industry's larger suppliers, that both the rate and the type of growth experienced between 1965 and 1969 were not likely to be duplicated in the future. The customer has developed a number of skills which enable him to assess both his needs and the capabilities of suppliers, and this points to a growing emphasis on price, performance and service.

Finally, there was the major factor of government role (direct and indirect) which could dramatically affect projected growth-rates. New, more effective communications networks and lower-cost communications could substantially enhance the growth-rates of remote-entry service bureaux and communications hardware producers. Conversely, any announcement that such facilities were not envisioned before 1980 could temporarily enhance the growth of over-the-counter operations. In addition, decisions to restrict entry by new participants into such areas as service bureaux and software supply could also alter absolute growth, since some new participants could attract additional customers who, in turn, would affect the future growth of hardware, software and service bureaux segments.

(d) Market Research

In general, little assessment of Canadian market needs has been made by computer industry suppliers. As in the past, hardware development which has led to the development of services in other segments is dictated mainly by market forces outside the Canadian scene.

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(e) Corporate Planning

Apart from the large mainframe producers, there was little evidence that formal long-range planning took place within most companies in the industry. The dominance of the mainframe manufacturers dictated a "follower strategy" which, in the opinion of many interviewees, precluded meaningful corporate planning.

(f) Industry Management

Again, with the exception of some of the larger companies in each industry segment, management was technically oriented and often extremely competent in a specific processing mode or application. Unfortunately, these skills were not in sufficient demand to support many company structures and volume requirements forced the management out of their areas of competence in search of new business. There was, in addition, strong evidence to suggest that major gains in software and service bureau business were accruing to those companies capable of dealing with customer problems — namely, those willing to go beyond merely offering a computer facility and simple programming services.

(g) Foreign Ownership

The hardware segment was dominated by foreign-owned companies. Since the hardware segment represented a significant proportion of industry revenue and, more important, it provided leadership for the industry's development, there was little question about the reality of foreign control of the computer supply industry. In software and service bureau segments, where foreign ownership was less pervasive, it was still evident that foreign-owned companies played a major role in both the most profitable and the fastest-growing sub-segments.

(h) New Competition

Several large companies have begun to enter the service bureau segment of the supply industry.[3] These included the chartered banks, the communications companies, a consortium, and some private companies seeking growth opportunities. Evidence suggested that they will create strong competition in one or two sub-segments of the service bureau business. However, it is important to note that the major impact of these new competitors will likely be in areas (small- and medium-size business) that are not now serviced, or in areas (specialized services) where existing service bureaux have thus far failed to penetrate.

(i) Software Segment

Industry interviews suggested that, while software is an identifiable product, software supply as a segment is virtually non-existent. The nature of supply industry development has resulted in software becoming an important vehicle for the sales of equipment and service. The potential for a viable software industry separate from equipment manufacture and service operations has found little support from industry development in the past. It seemed apparent that software development would continue as a key variable in the marketing strategies of the hardware and service bureau segments and, as a result, would be susceptible to pricing tactics that spread software development costs across other products and services.

Most of the evidence gathered dealt directly with applications software. Few of those interviewed (except the mainframe producers) in the supply segments produced and sold operating software extensively. The exceptions were all related to two types of problems encountered by equipment users:

- Where the uses specified at the time of equipment purchase turned out to be different from those subsequently required in the market place; and,

- Where the operating software supplied by the equipment builder, in the opinion of the user, was inadequate. In both cases of this type, the equipment had been supplied by mainframe producers new to the Canadian market.

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[3] Since much of the software used by supply industry customers is part of service packages, entry to the service bureau segment by these companies will no doubt have some impact on software supply

(j) Human Resources

The general demand that once existed for programmers and operators was no longer evident. Systems analysts with experience in industrial and commercial applications which represented large potential markets for computers and computer services remained in demand. Many companies during the period under study were placing strong emphasis on experience because the combination of training and turnover costs made most other alternatives "prohibitively expensive". Contributing to this approach were current market conditions and the availability of experienced people.

(k) Government Role

For most companies in the interview sample the articulation of an appropriate government role was extremely difficult. In response to the specific question, "no role" characterized most answers. However, to other questions, the responses were quite inconsistent with the "no role" position.
Encouragement through research and development grants, a made-in-Canada orientation in purchasing policies, tariff reductions on equipment to lower user costs (and improve user competitive positions), subsidization of communications costs, government-supported data banks and data bank development emerged from subsequent questioning of the supply industry interviewees as potential roles for government involvement in the industry.

A large number of companies from the service bureau segment felt that restrictions were necessary to prevent "unfair competition" from the communications carriers, chartered banks and other entrants to the computer service field.

Part B

The Computer Supply Industry: A Framework for Analysis

Following the pilot-study of five companies, two significant problems became evident. The first involved the inadequacy of the traditional industry segments (hardware manufacture, software supply, service bureaux and communications carriers) as a base for analysing and integrating industry data. The overlap and resulting complexities that existed within and among the computer supply industry segments dictated the need for an industry framework that would permit more detailed understanding of industry interaction. The second problem involved gaps in the data. Many companies in the supply industry were relatively new and thus lacked past performance records. Others were small and kept limited records. Few but the largest in each segment were involved in any form of medium- or long-term planning and fewer still had carried out any meaningful search of potential markets.

Further complicating the study was the recognition that:

- The industry was dynamic not only in its growth-rates but in its various change dimensions.
- Almost all of the industry's participants operated in more than one industry sub-segment and a large number provided services across more than one industry segment.
- The mix of services provided (later defined as *computing capability*)[4] was changing. Essentially hardware-orientated in its early stages of development, the industry is now emphasizing the hardware-software-data base combinations which are further complicated by a growing number of communications options.

For these reasons, as well as the relatively immature state of the industry, it was necessary to develop a generalized framework of the industry functions. In view of the dynamic state of the supply industry, simply reporting what had

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[4] *Computing capability* and *effective computing capability* are defined in detail later in the part. It is sufficient at this point to note that the term "computing capability" refers to the total capability of the current computer service mix available to Canadian users.

happened fell far short of providing the base necessary to cope with the future developments likely to emerge in the Computer Supply Industry. Needless to say, the more sophisticated growth and trends of the future will require even more detailed understanding of the industry's interactions.

The framework included several characteristics essential for an industry analysis. First, there was the consumer problem. Preliminary interviews, as well as subsequent data, indicated two broad consumer categories: *producer users*, those who made direct use of computing capability to enhance the product or service they offered for sale, and *end users*, those who used (or could use) computing capability outside the work setting, where its function had little direct commercial value to the user (*e.g.*, to facilitate study, personal problem solving, information retrieval and home usage) (see Figure 1).

Figure 1
Computing Capability — User Interface
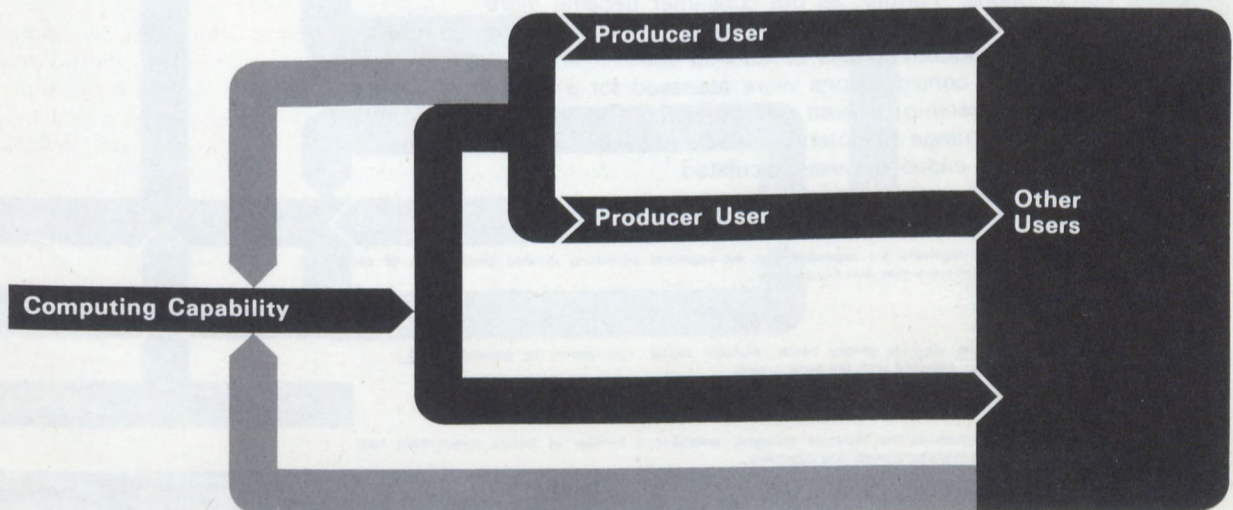
The Canadian Computer Supply Industry Study

The distinction was necessary, not because the category currently existed in any substantial way, but rather because many in the supply industry pointed to it as a market of significant potential in the future.

The second problem involved the development of some concept which would embody, not only the products of the supply industry, but would also take into account the many options available to the user in his search for competitive services. The central concept, entitled computing capability, was devised to recognize that the supply industry's products included hardware, software, data and communications links and that these could be mixed in a variety of ways to provide necessary customer services. Figure 2 indicates the general relationship between hardware and software industry and the user.[5]

1. Effective Computing Capability

It became evident, following the pilot-study and some of the Phase One interviews, that supply industry consumers had entered a period in which the services needed could be acquired (bought, leased or rented) in a wide variety of combinations.[6] Further, as the consumer became more knowledgeable in the area of computers and computer technology, the choices he could confidently assess broadened substantially. System performance and cost considerations were assessed for a number of service options, involving ownership or even direct rental of equipment. To encompass the broad range of potential options available to the user the concept of computing capability was articulated.[7]

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[5] Later in the part, these broad segments are expanded into sub-segments permitting detailed identification of some important dimensions of each segment's activities (see Figure 9).

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[6] Because of internal considerations such as privacy needs, available capital, commitment to personnel, task specifications, etc., not all options are assessed with the same criteria.

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[7] This term, while not used as such in the literature surveyed, embodies a number of factors which have long been a part of the considerations of systems analysts and designers.

Figure 2
Computer Supply Industry Structure

Figure 2
Computer Supply Industry Structure

Producer User

Other Users

Applications

Computing Capability

On-Site Computers

Off-Site Computers

Hardware

Other Product Suppliers

Software

Sub-Unit Assembly

Components
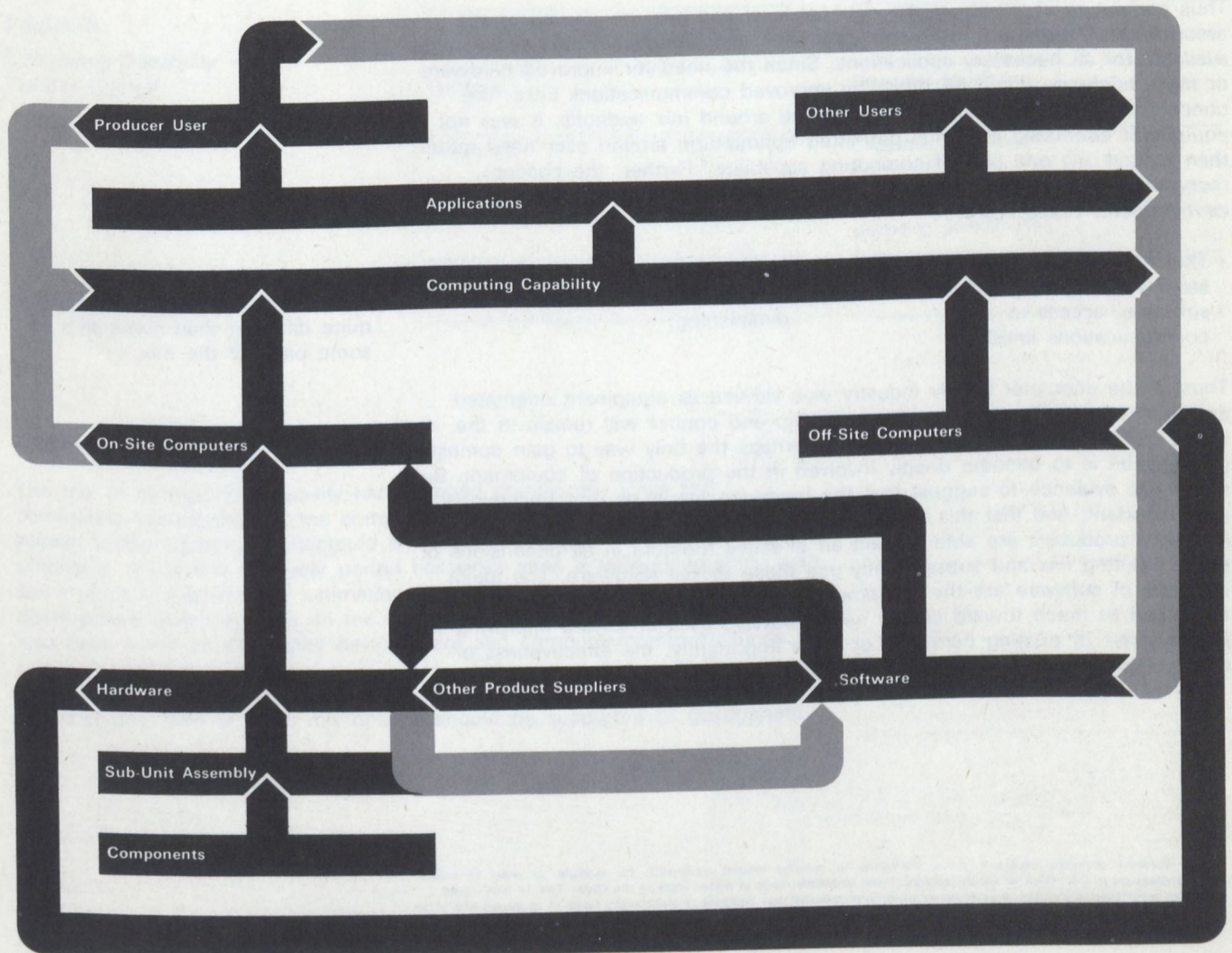
The Canadian Computer Supply Industry Study

Thus computing capability at the national level can best be viewed as the assortment of hardware, software, data bank and communications services available for all necessary applications. Since the need for improved hardware or more hardware could be offset by improved communications links, the concept embraces the potential to optimize around mix tradeoffs. It was not equipment orientated and thus permitted optimization around user need rather than around any one part of computing capability.[8] Further, the concept recognized several factors that will likely have a growing impact on industry development. These were:

- That not all applications require the same service mix (hardware, software, access to data, communications links);

- that the relative importance of equipment in the service mix is diminishing;

- that ownership/control of computing capability (at present) is quite different than ownership of some parts of the mix.

Thus, if the computer supply industry was viewed as equipment orientated and likely to remain so, effective ownership and control will remain in the hands of the equipment producers and perhaps the only way to gain domestic participation is to become deeply involved in the production of equipment. But there was evidence to suggest that the hardware emphasis was becoming less important, and that this trend will continue unless, for example, the hardware producers are able to gain an effective foothold in all dimensions of the computing mix and subsequently use these to sell hardware. The major suppliers of software are the equipment producers and, as a result, it is orientated as much toward selling new hardware as it is toward improving the effectiveness of existing hardware or more importantly, the effectiveness of total computing capability. (See Figure 3.)

[8] This becomes extremely important, since attempting to optimize around equipment, for example, in order to create some employment in the computer supply industry, could ultimately result in higher costs to the buyer. This, in turn, could make the buyer (usually a maker of products in some other industry) less competitive and thereby result in an overall loss of far more jobs than were gained by making an equipment-orientated decision, as opposed to a computing capability-orientated decision. In some cases no doubt, the decisions would be the same — but not in all cases.

Figure 3

Computing Capability —
Current Control

Computing Capability Components	Effective Control
Hardware	Computer Mainframe Producers
Software	Computer Mainframe Producers
Data Bank	Users (including government)
Communications Links	Communications Carriers and Government

2. Concept Background

The mix of computing capability has changed dramatically since the commercial introduction of the computer following the Second World War. Almost totally equipment orientated at its inception, with only limited software emphasis, the twenty-five-year period has since seen a remarkable shift, with some industry experts now estimating greater expenditures on software development than hardware. In the meantime, substantial expenditures have also been made on data bank development and computer/communications systems. (See Figure 4.)

Whether one, two or more mix options should be supported by government,

Figure 4
Computing Capability Development

Computing
Capability

Relative
Importance

Computing
Capability

Hardware

Communication
Facilities

Software

Data Bank

1950   1960   1970   1975   1980
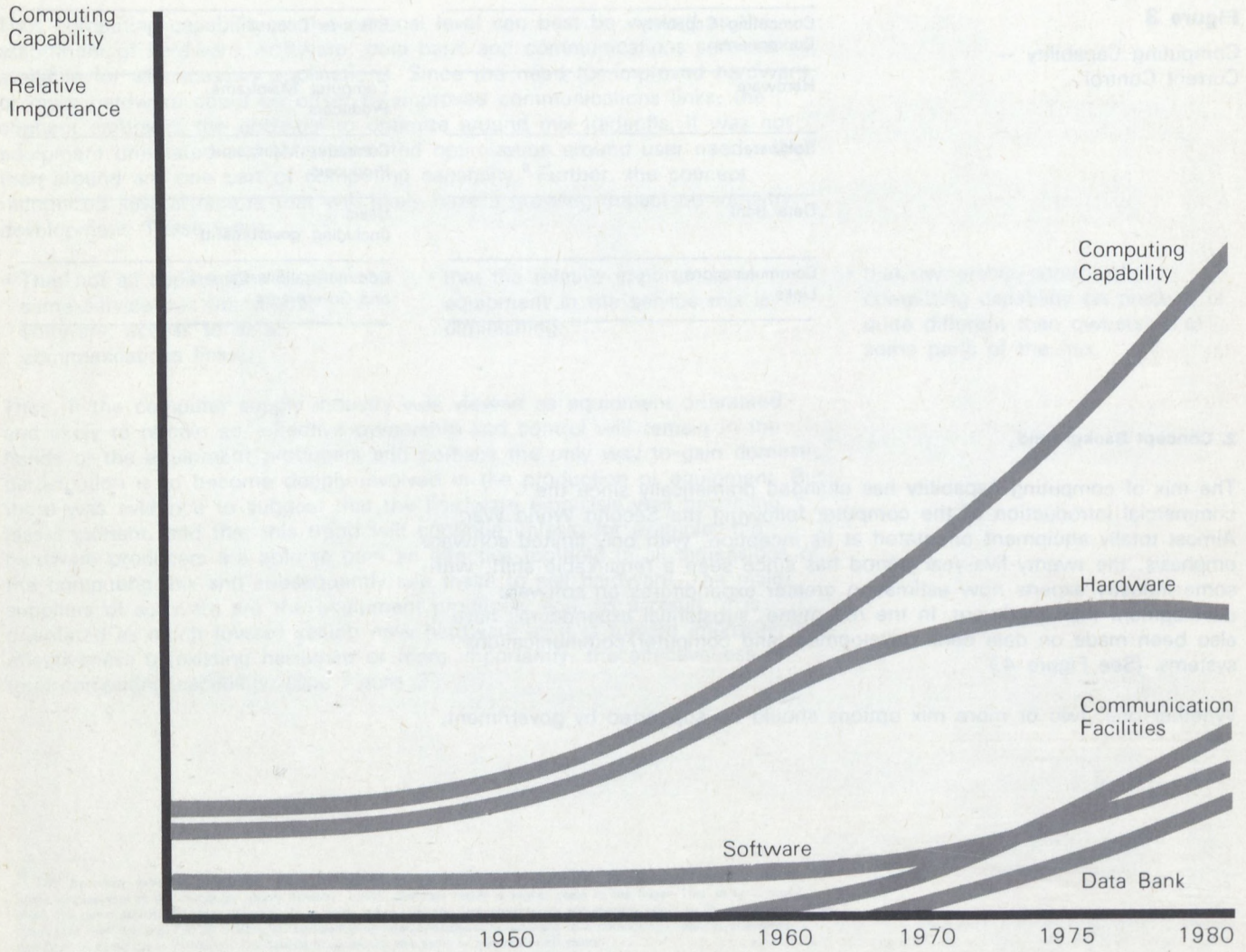
how they should be selected, and to what degree they should be supported becomes relevant only after each is appropriately identified and tested against the broader guide-lines of national sovereignty, competition, employment, balance of trade, etc.[9]

The concept does not imply control by government or any central authority. It is quite possible that the free market mechanism can provide an optimum mix of the variables essential to the development of *effective computing capability*.[10] In fact, within the concept of effective computing capability, private data networks, a domestic equipment industry, or a number of other options can be considered. Whether such a concept leads to more government involvement is a function of the policies it supports or rejects in matching computer capability with user need — not anything inherent in the idea.

The analysis of existing computer services available from the supply industry provided insight into both the service content and the vehicles used for their

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[9] Since the development of policy recommendations was the responsibility of the Task Force, the concept of computing capability was presented as a basis for testing various Task Force policy options for their possible impact on the supply industry and its segments.

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[10] Effective Computing Capability is that portion of the total computing capability in use, or projected use, by the user segment, where

$$\text{Effective Computing Capability (ECC)} = \frac{\text{Total Computing Capability Used}}{\text{Total Computing Capability Available}}$$

Since

Computing Capability (CC) = f (H,S,DB,C) + X

and

$$ECC = f\left(\frac{H_U}{H_A}, \frac{S_U}{S_A}, \frac{DB_U}{DB_A}, \frac{C_U}{C_A}\right) + X$$

H — Hardware
S — Software
DB — Data Banks
C — Communications Facilities
U — Used
A — Available

where the objectives are (optimizing criteria):

(i) To seek an optimum balance among the mix components of computing capability in order to increase the effective use of existing computer capability.

(ii) To keep abreast of technical and market developments in such a way that the future needs for computing capability can be provided at minimum cost to current users.

distribution. In terms of content, computing capability appeared to involve data and software; the vehicles were computer hardware (on-site and off-site computer hardware and, in the case of the off-site equipment, communication links (see Figure2)). To further define and clarify the concept, two factors are considered:

(i)   What are the variables which make up computing capability (discussed earlier)?
(ii) How are these variables currently mixed in the Canadian computer supply industry?

Effective computing capability involved the very basic question of how to keep the supply of computing capability consistent with the need for its existence.

3. The Need for Computing Capability

Effective computing is, by definition, need-oriented. Supply industry data suggested two broad user groups: the producer user, now the only significant group, and the end user, predicted by many in the supply industry as the new base for future industry growth (see Figure 5):

• *The Producer User* — defined simply for the purposes of this study as the user of computing capability to enhance an end product or service. Currently, this represents the major use of computing capability and includes financial and business applications, process-control, engineering and scientific applications, etc.

• *The End User* — defined as the user computing capability for the purpose of enhancing the quality of life and improving the standard of living. Such applications might include personal shopping services, educational services, personal record-keeping, etc.

The importance of these user categories (they can be subdivided for more effective analysis) centres around the types of service each will need. Predicting these changing needs becomes an increasingly important requirement if the rational development of computing capability is to take place. There now are evident differences and these will likely grow as the user base changes. Current producer users have been willing to train specialists to deal with the computer. No doubt end users will insist more and more that the computer be designed to deal with them on quite different terms. The difference alone has implications for equipment design.

communications links, types of data required and even the type of education necessary for training the end user as opposed to the producer-user specialist.

4. Computer Capability and the Supply Industry Analysis

Industry data gathered from companies within the supply industry provided the study with a number of dimensions through which the services of the industry could be assessed. All products and services fill some niche in the provision of computing capability, and in order to investigate the resources of the supply industry it was necessary to segment it into categories which could provide substantially more insight than the traditional hardware, software, service bureau and communications carrier divisions. The dimensions selected are set forth in Figure 6.

Many service/product combinations emerge from the choices within these dimensions. For example, a consulting firm may work on a large number of applications but confine itself to preliminary feasibility analysis of projects and offer no processing mode services whatever. This company's contribution to
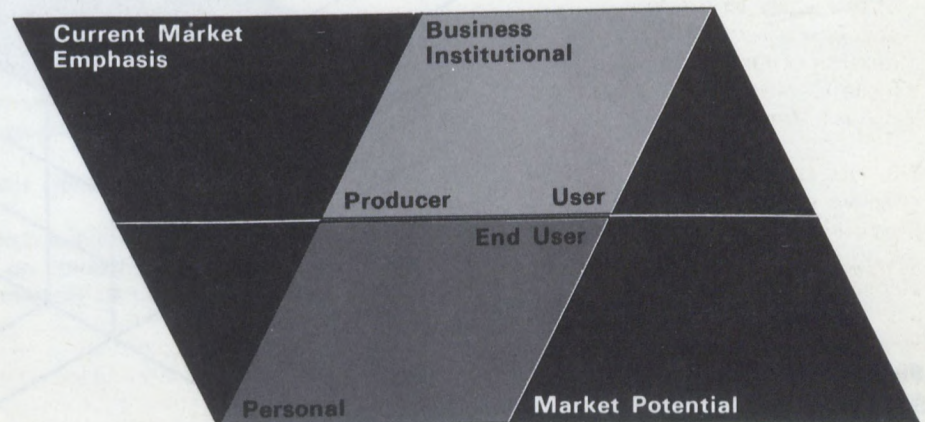
Figure 5
Computer Supply Industry Markets

computing capability is made through ensuring that applications are approached in a proper manner.

Another firm may offer a large computer with a great deal of data processing capability for any application that requires a large machine and complement this with systems/programming assistance. The company which sells hardware to companies for in-house use makes a different contribution again to computing capability.

The classification scheme arising from the supply industry segment dimensions set forth in Figure 6 produces something on the order of 648 possible alternatives to choose from when deciding how to handle a problem using computer techniques (see Figure 7). Considering the large number of possible applications in conjunction with the processing and service configurations, the opportunity to supply unique services is indeed large. This has resulted in the growth of a large number of different firms and helped, in part at least, to

Processing Mode

Systems Mode

Applications Mode
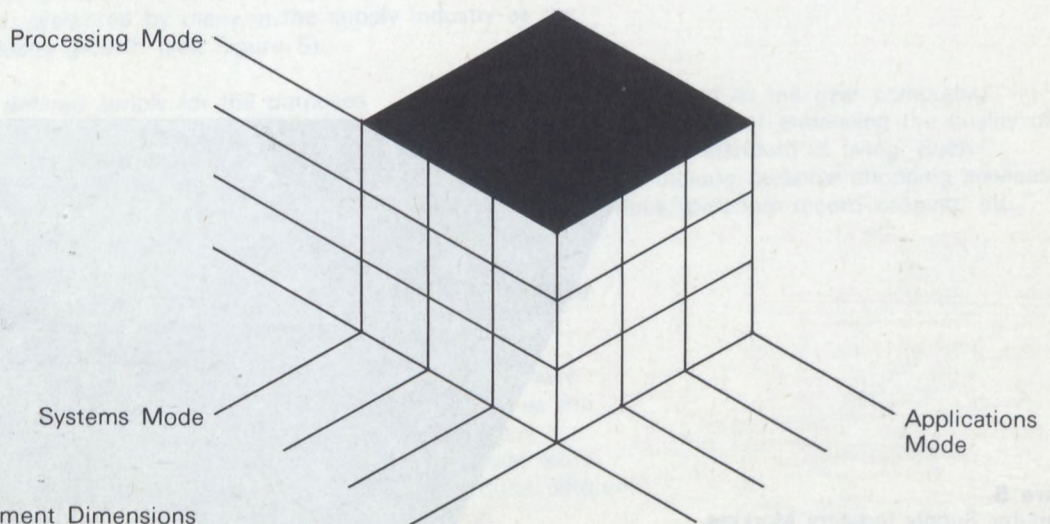
Figure 6

Supply Industry — Segment Dimensions

explain why few of those interviewed see any but the large equipment firms, which provide a wide range of service options, as direct competition.

To develop a manageable set of classifications some of the combinations evident in the interview data were used. These are presented below:

(a) Hardware/Software Systems

These are an integral part of computing capability. H/S systems can be classified within a number of different dimensions. Those chosen are set forth in Figure 8, and they result in a total of eight classifications, each of which is briefly described and illustrated below.

(b) Multi-Purpose, In-House System Utilizing Communications

This is a general-purpose system which is installed on the premises of the ultimate user and which utilizes communications lines to bring data from other locations. An example would be a firm which has branch offices and communicates data to a central location for processing.

(c) Dedicated, In-House System Utilizing Communications

This is a system which is dedicated in the sense that there is no intention of utilizing it for other than a specified type of application. It is installed on the user firm's premises and utilizes communications to bring data from other locations. One example is an airline reservations system.

(d) Multi-Purpose, In-House System Not Utilizing Communications

This is a general-purpose system, which handles all of the computing requirements of an organization. It is on company premises and does not utilize communications facilities. The majority of Canadian business firms use this type of computer facility.

Figure 7
Stages in the Computer Service Process—Different User Applications
and Alternate Means of Handling Each Stage

User Application*	Systems Analysis	Systems Design	Programming	Processing			
1 Business a Financial	User performed Consultants	User designed Consultant designs	User developed Consultant	In- House Computer	owned		company managed facilities management
b Manufacturing c	User performs with assistance from a computer	unique system Consultant	Computer service company assists user		leased		company managed facilities management
Management Information d Financial Services i banking ii insurance iii investment iv credit v taxation	service company	modifies standard package Computer service company assists user develop unique appli- cation package		Off- Site Computer	over-the- counter processing		service co. owns computer service co. leases time
2 Scientific a Routine b Special Project		Computer service company modifies standard package			remote	on- line	time sharing	own computer lease time
c Engineering Design and Applications						batch pro- cessing	own computer lease time
3 Education a Library b Teaching						off- line	own computer lease time
4 Operating a Machine Operating Software							

Figure 8
Hardware/Software Systems — Dimensions

Remote Entry

OTC*
No. Communications

* Over-the-Counter

On-Site

Off-Site

Multi-Purpose
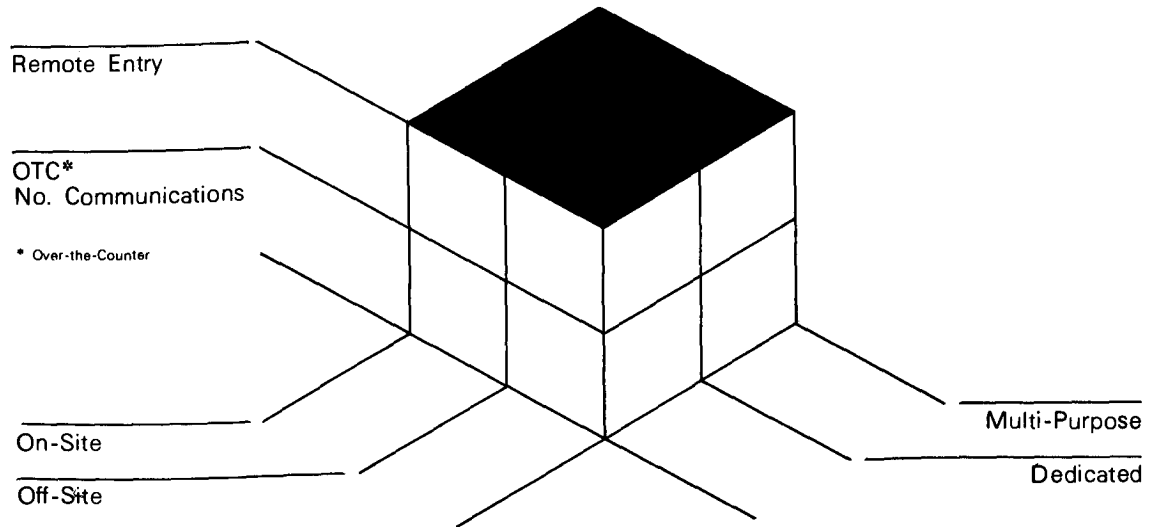
Dedicated

(e) Dedicated, In-House Systems Not Utilizing Communications

An example is a keypunch system such as Consolidated Computer's Key Edit. This is a computer input system dedicated to keypunch applications; it is used on-site and does not utilize communications lines.

(f) Service Bureau, Remote Entry Multi-Purpose System

With a service bureau, the computing system is not located on the service user's premises. Remote entry indicates that the data is received via communications lines. Data may come in either on-line or off-line. The applications handled by such a firm are various. An example is Systems Dimensions Limited. The classification includes both services bureaux which do all the systems/programming work for customers and those that do not do any.

(g) Dedicated, Remote Entry Service Bureau

This is a service bureau, as previously defined, which enables its customers to enter data remotely. The entire system, however, is dedicated to one type of application. An example of this type of service is Key Data Corporation with its standardized product offering.

(h) Multi-Purpose, Over-the-Counter Service Bureau

This type of system offers a range of applications. It is operated on a pick-up and delivery basis, where data is physically brought to, or shipped to, and taken from the computing centre. There are many examples of this type of computer service. Real Time Corporation is one company providing such a service package.

(i) Dedicated, Over-the-Counter Service Bureau

A high degree of specialization is characteristic of this type of firm, as the company dedicates itself to developing excellence in some specific area of application. Remote entry of data is foregone in favour of pick-up and delivery. An example of this type of firm is Comtech, which specializes in payroll systems.

5. Contributions to Computing Capability [11]

There are a number of variables which contribute to computing capability. These include:

(a) Data Base

Many computer applications are not possible without an adequate data base. The extent to which the data has been collected, and is accessible for general use, influences the computer capability (*i.e.*, the more applications that are possible because of an adequate data base, the greater the computer capability).

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[11] See Figure 9.

(b) Mainframe Hardware

The existence of adequate hardware which can perform data processing functions at a reasonable (competitive) price is a major determinant of computing capability. The existence, or introduction, of superior hardware increases computing capability. Computing capability may be increased either because cost is lower, therefore making more applications feasible, or because the operating characteristics of the machine make more applications possible.

(c) Peripheral Hardware

The existence of lower cost and/or of higher performance (*e.g.,* faster) peripheral equipment increases computing capability.

(d) Communications Hardware

As above, the existence of higher performance and/or lower cost communications equipment makes it possible to undertake more applications and/or perform current applications more efficiently, thereby increasing communications capability.

(e) Feasibility Studies

These add to computing capability by indicating when it is feasible to computerize certain applications (*i.e.,* at which point hardware cost/performance and/or software capability make it economically attractive to undertake the development of new applications). Feasibility analysis also adds to computing capability by preventing attempts to develop systems which are not economically sound.

(f) Systems Analysis

This includes identification of all the variables and relationships relevant to a specific situation. Improved performance in this area is an addition to computing capability, since the ability to completely understand a situation and to be able to transfer it to computer language is essential to successful computer applications. Adequate work at this stage can cut costs of software and systems development significantly.

Figure 9
Canadian Computer Industry Structure

End User

Producer User

Computing Capability

Hardware/Software/Data Bank/Communications System

In-House Systems
Communication Multi-Purpose

In-House Systems
Communication Dedicated

In-House Systems
Multi-Purpose

In-House Systems
Dedicated

Service Bureau
Remote Entry Multi-Purpose

Service Bureau
Remote Entry Dedicated

Service Bureau
OTC Multi-Purpose

Service Bureau
OTC Dedicated

Contributions to Computing Capability

Data Base

Mainframe
Hardware

Peripheral
Hardware

Communications
Hardware

Feasibility
Studies

Systems
Analysis

Systems
Design

Programming

Data
Preparation

Communications

Organizations Involved

Data
Services

User Firms

Hardware
Mainframe

Hardware
Peripheral

Hardware
Communication

Other
Equipment

Hardware
Companies

Consultants

Custom
Software

Standard
Software

Operating
Software

Service
Bureau

User
Firms

Universities

All Types

Telephone
Companies

CN/CP

Classification of Firms Involved

Sales
Agents

Design Manufac-
ture Assemble

Leasing
Companies

Component
Suppliers

(g) Systems Design

Systems design is also an important contributor to total computing capability since improvements in systems design result in increased hardware and software utilization and effectiveness.

(h) Programming

Improvements here also add to overall computing capability by reducing the cost of systems development and lowering the per unit cost of hardware time.

(i) Data Preparation

Data preparation continues to play an important role in the total nature of computing capability. Any improvement in data preparation techniques adds considerably to computing capability.

(j) Communications

Although not part of all data processing systems, communications facilities are indeed a part of many and are becoming more important. Improvements in communications systems are essential to increases in Canadian computing capability.

6. Types of Organizations Involved [12]

(a) Organizations Possessing Data Bases

- *Data Services:* These are organizations whose primary function is to provide data service to a number of users. An example is Financial Research Institute (FRI) which supplies the data base for many financial applications. Other examples would be legal data banks, medical data banks or census data banks. These may be either profit or non-profit organizations.

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[12] See Figure 9

• *User Firms:* Many user firms (for example, banks or insurance companies) are dependent upon a bank for their computing applications. Although these data banks are not as a rule accessible to other users, their organization and management is still of vital importance to the success of the computing systems of the users and could be a significant factor in future developments.

(b) Organizations Involved in Supplying Mainframe, Peripheral or Communications Hardware

• *Mainframe Hardware:* Mainframe hardware producers typically supply at least mainframe and peripheral hardware. Examples of these types of organizations are: IBM, Honeywell, Informations Systems, Univac, etc.
• *Peripheral Hardware:* Firms, such as Computrex Centres Ltd., Potter Data Services or T-Scan Ltd., supply only peripheral hardware. The concept of this type of firm is to provide peripheral equipment that is superior to equipment supplied by the mainframe suppliers from a cost and/or performance point of view.
• *OEM (Other Equipment Manufacturers):* These are firms which assemble and/or manufacture systems designated for a specific application, often using components purchased elsewhere. Examples include: Consolidated Computer with its Key Edit product (a computer system oriented to a keypunching applications function), Mohawk Data Sciences, and Ruscom Logics with its custom hardware/software system.

(c) Organizations Involved in Supplying Software Services

• *Hardware Companies:* All the different types of hardware companies undertake systems/ programming activities. The mainframe hardware companies are primarily concerned with systems software, although they also do work with the development of applications software. The peripheral and OEM companies concentrate more heavily on applications software.
• *Consultants:* These companies typically do preliminary studies on potential applications. They also do systems analysis, design and programming on a contract basis. Major consulting firms include such

companies as Woods, Gordon, and Stevenson and Kellogg.
- *Custom Software:* These firms develop software applications on a custom basis. As a rule, each individual project is done for a specific customer and is unique. Examples of this type of organization are: Softwarehouse Ltd., Computel Systems Ltd. and I.P. Sharp Associates Limited.
- *Standard Software:* This type of firm undertakes development of standard software applications packages which it sells to more than one customer. The concept is that development cost can be spread over a number of users. There are

few firms in Canada specializing in standard software, although many service bureaux, software houses and hardware suppliers can provide modified software systems.
- *Operating Software:* These firms develop the operating software for hardware. There are no firms in Canada specifically devoted to developing operating software, although some provide the service on a contract basis. Most of this is done by the mainframe hardware companies.
- *Service Bureaux:* These firms undertake development of software applications to provide service to their clientele. They develop

standard application packages and, in some cases, develop their own operating software.
- *User Firms:* Many user firms, particularly those with in-house systems, work to develop software for their own applications. The emphasis is mainly in applications software with considerable attention to the modification of available applications programs.
- *Universities:* These organizations do a significant amount of software development, some of which is made available for general use. Operating software, custom and standard packages are all made available. The University of Waterloo is an example of such an organization.

(d) Organizations Involved in Data Preparation

Virtually all types of organizations participate in data preparation. Some firms provide a custom data preparation service (*e.g.,* Data Pro).

- *Telephone Companies:* These companies provide facilities for transmission of data between computers and between users and computers.

- *CN/CP Telecommunications:* This organization also provides facilities for data transmission.

7. Classification of Hardware Firms

(a) Sales Agents

Companies that only sell hardware in Canada fall into this category. The manufacturing design and assembly is carried on in some other country.

(b) Design and/or Manufacture and/or Assembly

Companies which, in addition to selling, also undertake at least some of these functions in Canada are included here. Examples are: IBM, Honeywell, and Consolidated Computer. These companies also increase the opportunity for manufacture of components in Canada.

(c) Leasing Companies

Companies which purchase or lease equipment from hardware manufacturers and then lease it to users come under this heading. Examples include: Dearborn Computer and Greyhound Computer Ltd.

8. Summary

Figure 9, ''The Canadian Computer Supply Industry Structure'', summarizes the inputs to computing capability including:

- The organizations involved;
- the contributions to computing capability;
- the vehicles for mixing contributions to achieve computing capability.

Two very basic functions are served. The first stems from dividing the industry segments into sub-segments with different characteristics that will respond differently to market actions, competitive changes, technological change and government policies.

The second function served is one of analysis. If computing capability is composed of the elements suggested and, if, in fact, these elements *can* be put together in a variety of ways, then companies operating in the industry can be profiled within the dimensions set out in Figure 9. The data presented in the following part is based on a profile analysis of the companies interviewed.

Part C

Supply Industry Analysis

As set forth in the original proposal, the supply industry study sought to emphasize, as a basis for researching the industry, a company-environment approach to both data collection and data analysis. This meant that each company would be studied within both the broad context of its industry environment and the narrower context of its competitive segment or sub-segments. To the extent that a company's objectives and strategy were conditioned by its industry environment description, it was necessary that these be defined very clearly in that context. Often, since for many companies objectives and strategy were implicit, their understanding of the environment became the essential guide-line for company planning and operations. Thus, in analyzing and assessing individual company plans and performance, it became extremely important that both the company and its environment be considered in detail (Figure 10). Understanding the companies, their resources and the payoffs received from the various ways in which these resources were employed made a broader understanding of industry possible. Ultimately, describing the computer industry became a function of drawing individual companies and their operating environments together. Only then could the effects of product and service overlaps, and dynamic changes in technology be related to the substantial problems of resource acquisition and allocation to the emerging options available to the industry.

It was in this context that the objectives, strategy, planning, manpower, management and resources of each company were analyzed.

1. Industry Segments

From the pilot-study it was evident that the four simple industry classifications offered in most of the industry literature[13] were inadequate for a detailed

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[13] Typically, the computer supply industry is divided into hardware suppliers, software suppliers, service bureaux and communications carriers. The literature includes consulting studies, government reports, brokerage house reports, etc. The Canadian Computer/Communications Task Force has suggested four slightly different industry categories: Hardware Suppliers, Data Communications Suppliers, Service Suppliers and Other Product Suppliers.

Figure 10
Company — Environment Analysis
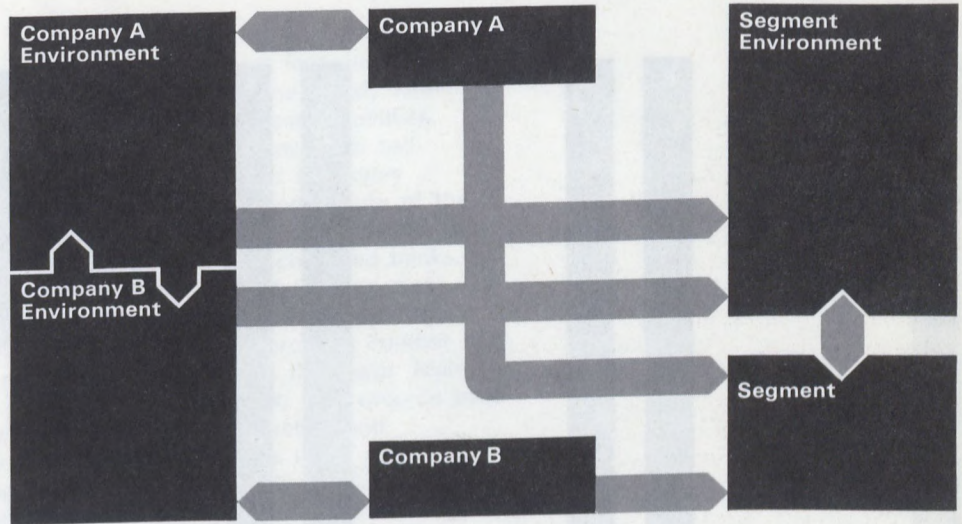
analysis. Many companies operated in more than one segment, or provided different services within a given segment that competed directly or indirectly with services provided in another segment. As the complexities of operating within the computer supply industry became clear, the need for an industry framework became more obvious. Figure 11 explores some of the company-segment combinations evident early in the study.

Company A, a large hardware producer, produced and sold a full range of computer hardware, mainframe and peripheral, offered a wide range of operating and applications software and operated an extensive chain of service bureaux. Company B, owned by Company H, a communications carrier, produced communications hardware and marketed both communications and peripheral equipment. Company C, which owned Company F, sold peripheral hardware, produced and marketed software packages and operated Company F which provided software consulting services as an adjunct to its service bureau operations. Company E provided only software, while Company G, a communications carrier, provided, through a partially-owned subsidiary, a wide

Figure 11
Segment Combinations — Computer Supply Industry

range of service bureau and software services. Subsequent interviews produced a number of additional service combinations, some wholly within the computer supply industry, others offered by chartered banks, utilities, insurance companies, consortium, and other large users seeking to sell services and computer capability under both permanent and temporary arrangements. Figure 12 provides a somewhat over-simplified picture of the industry's segment interaction; this is covered later in more detail within the complex dimensions of products and services offered. The chartered banks, consortia, user suppliers, universities and other industry entrants are also discussed in detail in the latter section of this part. Whether the existing participants in the supply industry favour or object to the growing number of "outsiders" eying the industry for new growth and profits, they exist. Many have unique service strategies and perhaps, more important, the resource base to see their services through the difficult and costly introductory and development periods evident in the industry. In some cases these new entrants to the supply industry bring services not now readily available; in other cases they offer or plan to offer services directly competitive with currently accessible services.

The computer/communications supply industry encompassed four broad segments: [14]

• Computer Hardware
• Software Suppliers

• Service Bureaux
• Communications Carriers

Indirectly, the supply industry contains many additional firms, including those supplying computer paper and cards; equipment maintenance services; transportation services for batch processors; schools providing keypunch

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[14]
Because the Task Force gathered considerable background material on communications carriers, these companies were excluded from the interview sample. As a result, any comments or data referring to the carriers represent the views of other segments of the supply industry as they relate to the services provided by the carriers. The use of the term *computer supply industry* further underlines the areas in which data were gathered. Late in the study the Task Force, using inputs from a number of sources, developed the following definitions of industry segments: *Hardware Suppliers, Data Communications 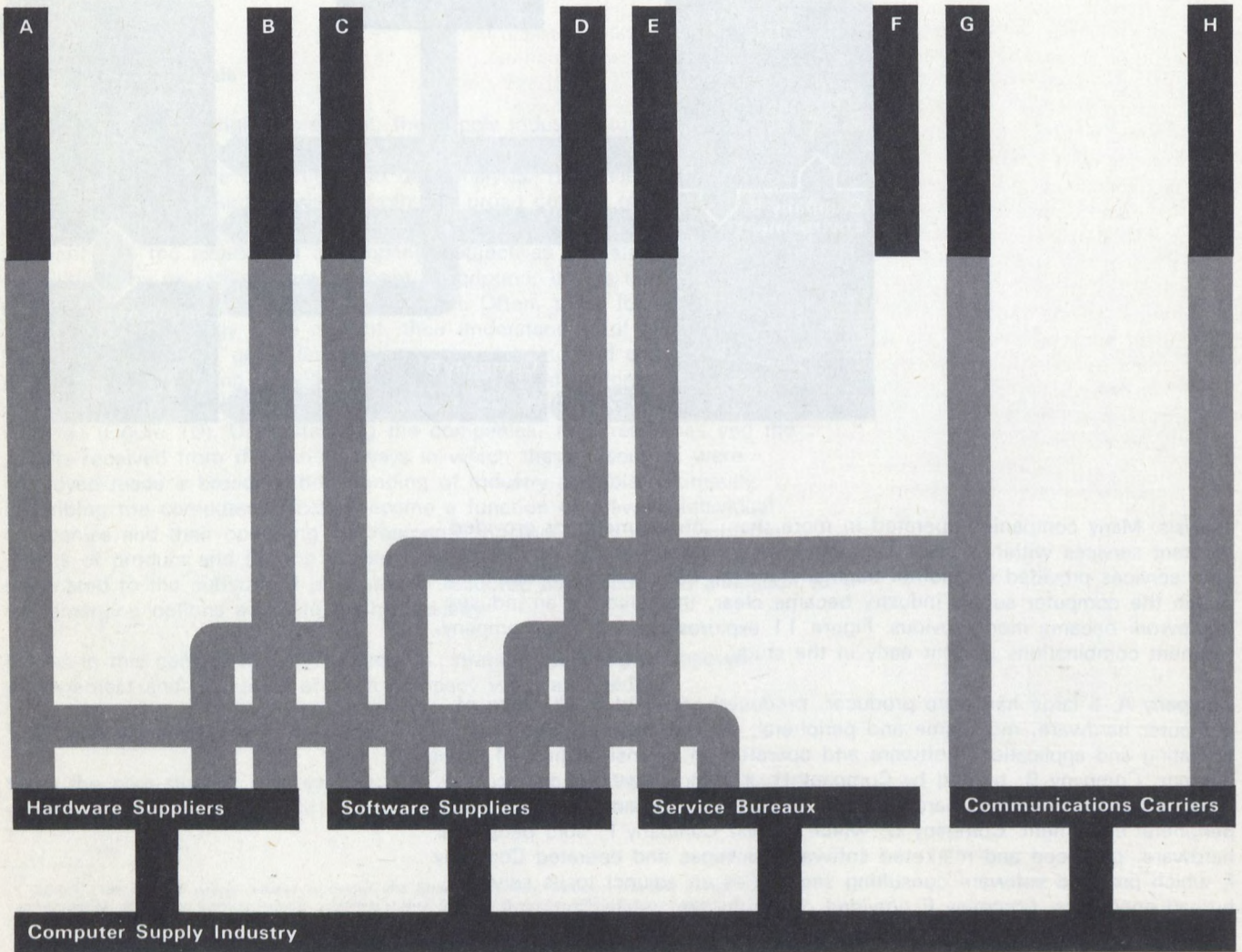Suppliers, Service Suppliers,* and *Other Product Suppliers.* A brief portion of this report later in the part provides a cross-reference to relate to these new segment classes.

Figure 12
Canadian Computer Supply Industry

Hardware Software

Banks

User-
Suppliers

Consortia

Universities

Communications Service
Bureau

Other
Industry
Entrants

Current
Segment
Movement
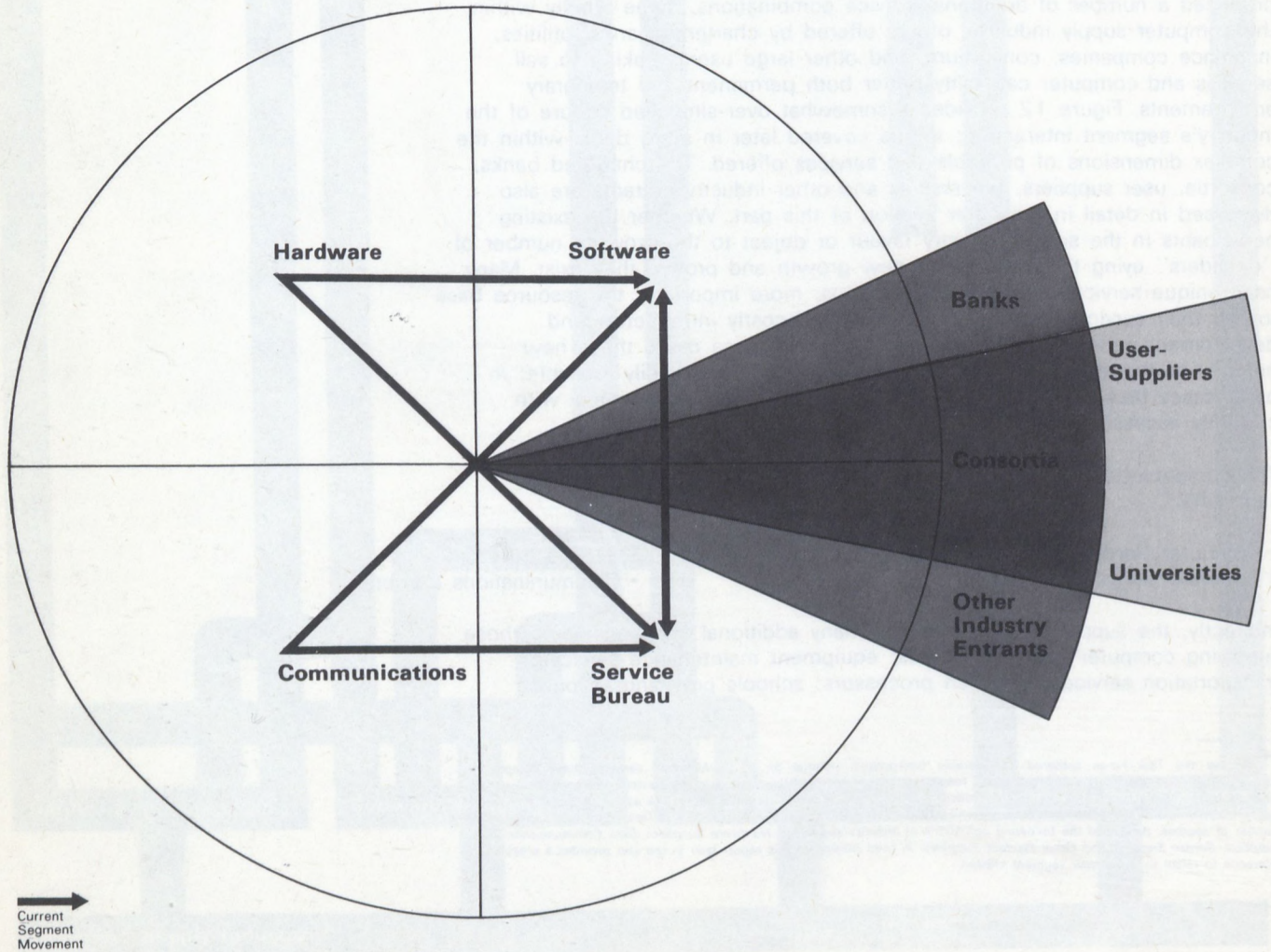
operators; air conditioning firms specializing in climate control for computer facilities; in fact, the list of those indirectly involved with the computer supply industry is almost endless.[15] This study excludes those indirectly involved, although it was evident that they are part and parcel of any total supply industry discussion.

There is another direct supply industry group participating mainly in the service bureau segment — the computer user. Many users, although the number is not yet significant, participate in the supply industry.[16] They sell raw time, software and some services complete with software and consultation. However, where this is done, it is often short-term until internal needs catch up with equipment capacity. Currently, such services are difficult and costly to market. There are few market mechanisms to sell available computer services conveniently and the timing of user requirements often makes the sale of raw time inconvenient.

(a) The Computer Hardware Segment

Dominated almost exclusively by U.S. firms, the hardware segment of the industry remains the focal point for industry development. While traditional analysis separates this segment into mainframe, peripheral and communications equipment, such a separation is difficult to document since, with the exception of IBM, the major producers continue to sell their systems "bundled" making the value of mainframe, peripheral units, software and other services difficult to identify. In fact, the major portion of peripheral equipment, software and service bureau sales remains in the hands of the mainframe producers.

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[15] Classified in the *Other Product Suppliers* segment

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[16] The user-supplier is investigated more fully later in this part.

The Canadian Computer Supply Industry Study

The hardware segment, consisting mainly of IBM and seven other American-owned hardware producers[17] continues to dominate the entire Canadian industry (except communications) in hardware, software and service bureau sales.

Broadly, the hardware segment can be divided into three sections: mainframe, peripheral and communications. The first two are dominated by mainframe manufacturers, although the proliferation of peripheral equipment requirements has created substantial markets for many companies producing only peripheral. However, domination by mainframe manufacturers is still strongly evident, with many peripheral companies designing and building "plug-to-plug" compatible equipment (mainly IBM compatible) in an effort to expand their market penetration. Market development around the systems concept has resulted in buyers specifying one equipment manufacturer as the system supplier. Thus, since the mainframe unit is central, the mainframe producers have had a distinct advantage in supplying all parts of the system (including software). This advantage is particularly evident where the buyer lacks the necessary internal skills to make decisions independent of the mainframe suppliers' proposals. Maintenance and support services were considered extremely important in the sales of hardware and many of the smaller manufacturers (particularly the peripheral equipment producer) were unable to exploit opportunities open to their specialized equipment because of the large after-sales cost involved in maintaining small-volume service areas. This had the tendency to limit potential market areas for those producers to the key areas for computer sales (*i.e.,* Toronto, Montreal, Ottawa) in an effort to develop economic sales-service groupings.

The communications hardware market (for most descriptions this includes "terminals") is split among mainframe, peripheral and communications suppliers. Each of these producers approaches the market with slightly different strategies. The mainframe producers concentrate on communications

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[17] The major producers are IBM, RCA, Univac, Honeywell, Burroughs, National Cash Register, Digital Equipment and Xerox Data Systems. (RCA subsequently announced its withdrawal from computer production.)

hardware sales from an applications point of view, centering on markets with large potential. With some slight variations, the peripheral producer's communications hardware is more specialized, designed for unique applications. The communications carriers, and those companies marketing communications hardware, approach this market as an extension of the broader communications market, offering mainly standard, low-cost equipment suited to a wide range of uses and viewed mainly as an extension of voice communications.

In numbers of units the communications hardware segment is dominated by the communications carriers, although the trend toward more specialized requirements could alter the traditional mix.

(b) The Software Supply Segment

The software supply segment is perhaps the most difficult to define since there are few firms dealing exclusively in the creation, modification and marketing of software. The major contributors to software development are the hardware producers and most of this software is produced to sell hardware. The second largest group of software producers is the service bureaux, although much of what they do could best be classified as software modification. The relatively few companies engaged in software development spread their services over a wide spectrum of industries and applications with some significant success apparent where they have worked in conjunction with major resource industries.

Figure 13 sets out the major market segments for software as well as the suppliers currently involved in supplying these services and products.

(c) The Service Bureau Segment

The service bureau segment includes two distinct types of service offerings: remote entry and over-the-counter batch-processing. This segment contains over two hundred companies offering remote entry or over-the-counter services and, in the case of some larger companies, a combination of both types of service. There are wide variations within the segment in size, revenues, profits, applications and packages offered, and customer bases. The simple breakdown into remote entry and over-the-counter must be again divided into applications and type of system (multi-purpose or dedicated) to . properly evaluate the differences in operations and performance within the service bureau sub-segment.

Several findings, explored in detail in Part D, merit comment here. The problems of foreign ownership are less evident in this segment than in the hardware segment, at least in terms of numbers of companies, although IBM also dominates the service bureau segment. It is more interesting to note, however, that foreign-owned companies do predominate in both the most profitable and the fastest growing sub-segments of the computer service business.

2. New Factors in the Supply Segment

Peripheral to the traditional industry segments are several company industry formats which offer, or plan to offer, services to the computer/communications market. These were treated in four groups as follows:

- Users with surplus capacity;
- user consortia;

- new industry participants
    chartered banks
    communications companies
    other corporate investors;

- universities.

Each brings to the computer services market a set of resources and a potential range of strategy options (defined as different ways of allocating their resources over varying time-periods) that differ markedly from present industry participants. All but one are service-software orientated and at least one other has a major investment in peripheral equipment.

Figure 13
Software Supply

Market

Suppliers

	Consulting	Custom Software	Standard Software	Operating Software

Hardware

Software Supply

Service Bureaux

Consultants

Other

User Firms

■ Limited Involvement   ■ Involvement   ■ High Involvement
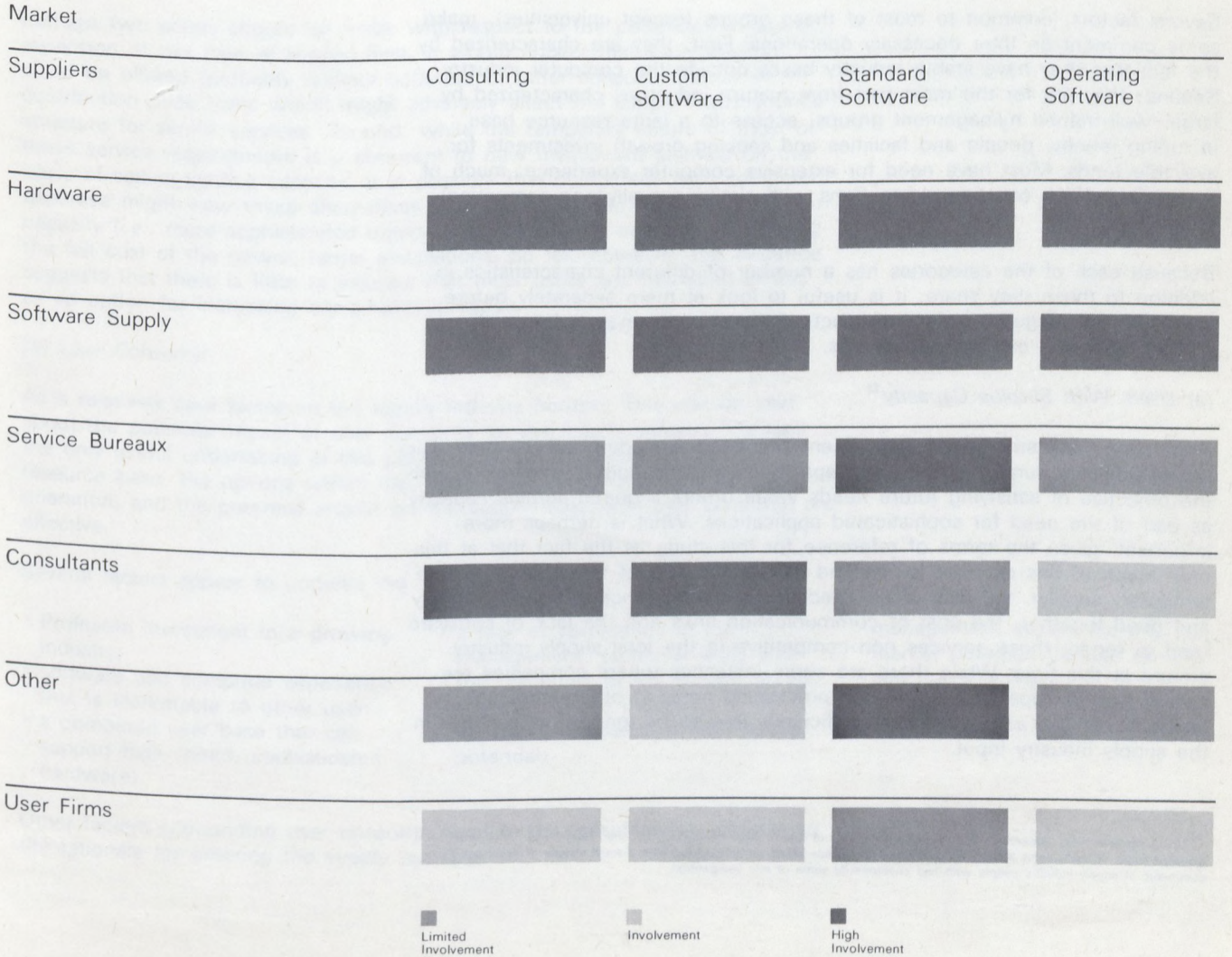
The Canadian Computer Supply Industry Study

Several factors, common to most of these groups (except universities), make some comment on their necessary operations. First, they are characterized by the fact that they have stable industry bases outside the computer industry. Second, they are for the most part from mature industries characterized by large, well-trained management groups, access to a large resource base, including money, people and facilities and seeking growth investments for available funds. Most have need for extensive computer experience, much of it internal, which can be sold to firms with similar (usually non-competing) needs.

Because each of the categories has a number of different characteristics in addition to those they share, it is useful to look at them separately before assessing the range of possible impacts these entrants may make on the current computer industry participants.

(a) Users With Surplus Capacity[18]

Most supply industry people (equipment producers excluded) believe that users have significant surplus processing capacity. Some, no doubt, acquired it with the objective of satisfying future needs while others acquired surplus capacity as part of the need for sophisticated applications. What is perhaps more important, given the terms of reference for this study, is the fact that at this time much of this capacity is ''locked in''. The nature of this capacity (often temporary supply), the lack of an effective brokerage function bringing supply and need together, the cost of communication links and the lack of software tend to render these services non-competitive in the total supply industry picture at this time. While there are some instances where companies are selling surplus capacity (often batch-processing time) to other users, the incidence of this activity appears sufficiently low to be ignored as a factor in the supply industry input.

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[18] It is important to remember that a separate study of users was conducted by the Task Force. This work also explored some of these same areas. The comments herein are based on discussions with a small sample of users and the comments of supply industry people who had encountered some of this competition.

Perhaps two points should be made with respect to the potential for future expansion of this type of supply. First, it would appear that such services could be offered (probably without software or other consultation) on a contribution price basis which might adversely affect the supply industry price structure for similar services. Second, while the temporary nature of most of these service requirements is a deterrent to new investment justified on the basis of selling surplus capacity, it is possible that companies with computer expertise might view these alternatives as a viable method of enhancing their capacity (i.e., more sophisticated equipment) without the necessity of bearing the full cost of the newer, larger installations. So far, however, the evidence suggests that there is little to indicate that most users are interested in this as an option for increasing equipment utilization.

(b) User Consortia

As a relatively new factor on the supply industry horizon, little can be said about the potential impact of user consortia on the supply industry. Perhaps the only useful undertaking at this point in time is to comment on the resource base, the options within the supply industry for this type of operation, and the potential impact on the supply industry if user consortia are effective.

Several factors appear to underlie the consortia concept. These include:

- Profitable investment in a growing industry;
- software and computer experience that is marketable to other users;
- a combined user base that can support high speed, sophisticated hardware;
- a lack of confidence in the management, technical skills and the resources of the service bureau segment of the industry;
- a data bank base that has market potential;
- management experience that has market potential through on-line and batch services.

Other factors surrounding user consortia need to be considered in addition to the rationale for entering the supply business.

The Canadian Computer Supply Industry Study

Typically, the companies involved have surplus resources for commitment to activities that have a high potential return. The base industries from which these consortia are formed are typically mature, have management depth, extensive computer backgrounds and sufficient financial resources to adopt a planned long-term approach to the computer service business. Compare these factors to those evident in the service bureau segment as it now exists and some significant changes might be anticipated if consortia costs are competitive.

Specifically, the consortia have several potential advantages that the typical service bureau cannot offer. These include: management and personnel depth (both technical and operating), a high level of use by the principals providing break-even income, back-up systems and guaranteed performance, sophisticated equipment, data bank and software resources, and financial stability. While it would be inappropriate to suggest that the current service bureau industry has no participants who offer competitive services, there can be no question that the service bureau segment is characterized largely by ill-conceived, poorly managed and marginally financed companies, which tend to reflect on the operations of the whole service segment. For many large users, the traditional type of service bureau is not a satisfactory option for either overruns or special applications. Traditionally, the user has considered renting, leasing, or buying his own equipment as the only satisfactory long-term alternative among those currently available and, with absolute costs rising, the consortia concept may be one attractive way of gaining access to larger, more productive equipment without losing total control.

(c) New Industry Participants

Many of those now entering the computer service industry have substantially different service profiles than existing industry participants. Most come from more mature industries which possess large customer bases (*i.e.*, the chartered banks, and utilities). And while the acquisition of hardware and other facilities represents a significant commitment, their strategy is not equipment orientated. In most cases their move into the computer industry is premised on a broad customer base and the potential involved in expanding into related services for that base. For example, in the case of the chartered

banks, such services as payroll, accounts payable, accounts receivable, inventory services, mortgage and investment services appear to be closely related to the banking service and become economically feasible with sophisticated computer facilities. To this field the banks bring a prior relationship with their customers, built on trust and traditional financial services. The computer permits a significant extension of these traditional services plus the addition of other benefits for which the banks have always had the expertise, if not the facilities, to offer at competitive prices. It is now possible for the banks to offer extensive management services, in competition with many smaller firms whose main strategy has centered around available equipment. No doubt the chartered banks will have the best equipment available, but more important, they have, as part of their base, extensive data banks which could be invaluable as a source for business information systems. And it would seem, in the opinion of the chartered banks, that the services which fall within current and projected capabilities are permissable as extensions of those now permitted under the Bank Act.

Others who have entered the computer services industry seem to have a slightly different rationale, but the nature of their competitive offerings is similar. The major group might be loosely classified as utilities or regulated industries seeking to enhance their return to investment by investing in a growth industry while at the same time improving the services offered to existing customers.

(d) University and Related Service

There is very little evidence to support the oft-heard statement that universities constitute unfair competition for commercial enterprises in the computer services industry. In fact, with perhaps one exception, there are few extensive services for sale, either directly or indirectly, that could be construed as competitive with current industry offerings. Some software is available but most of it appears to be of a highly specialized nature. Computer time within the universities is almost totally consumed by educational, research, and administrative uses. No doubt software and consultation sometimes get into the commercial market under the guise of research, but evidence suggests that it is relatively insignificant in total value.

The Canadian Computer Supply Industry Study

There are, among the facilities of the various universities, specialists in a number of fields who have computerized some aspects of their educational offerings and these have subsequently developed commercial interest. Such involvement, however, is related mainly to the subject matter, which is often unique to the university, not to the existence of subsidized computer time or other tax supported facilities.

Few of the universities contacted have any policies on the sale of computer services. Most feel they should not compete with private firms but, as yet, these have not been able to adopt clear policies on the sale of non-competing services.

The exception, Financial Research Institute (FRI), is just barely so. It is, by charter, a private non-profit organization supported by private companies to research and provide a range of software and data for general financial analysis. The connection with McGill University is now direct. FRI customers buy time on the McGill Computers (IBM 370-155), pay for their own communications lines and use FRI software (often in conjunction with their own software, data and hardware). McGill collects from FRI for the computing time sold; FRI in turn bills each of its member companies on a use basis for computer time. The communications costs are billed by the carrier directly to the member companies. [19]

No doubt some part of the services provided by FRI could be channelled elsewhere. However, our evidence indicates that few service bureaux provide, or could provide, similar services and the customers of FRI, if this arrangement did not exist, would probably do much of their own work. Software is created by FRI staff in conjunction with member company advisors. Some outside consulting is used but this is minimal and the involvement with McGill resources is on a competitive cost-effective basis. In short, FRI is operating on an arm's-length basis with McGill, separately managed by the president and member company advisors, and offering services in a competitive market without undue advantages accruing from its McGill connections.

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[19] The involvement of McGill University in commercial computer offerings is covered in the following reports: Canadian Computer/Communications Task Force. *Branching Out*. and *Background Paper No. 3. Computer/Communications Activities at Canadian Universities* (Ottawa, Information Canada, May, 1972)

3. Summary

Several conclusions can be drawn from the brief discussion on new or potential entrants to the computer service field. While each does not apply to all of the groups, there is sufficient commonality to generalize about all of the new groups except the universities. These, in our opinion, are not currently a significant factor in the commercial supply of computer services.

The others, users with surplus capacity, user consortia, and new industry suppliers, have the potential for sizeable impact on supply industry functions. They are, in general, large companies with significant investments in more mature industries who are attempting to improve growth and profit potentials by combining existing resources with computer service offerings. Conceptually, they are built around management expertise, software resources and extensive data banks. They have the resource potential to build, around specific industry objectives, well-defined strategies with appropriate resources for long-range development and organizational strength, and with the expertise developed in cost-conscious, mature industries. Without exception, each is also making what it perceives to be a logical extension of existing customer services although the method of building the supply base varies.

It is important to recognize that the process taking place in the computer service industry at this time is not unlike that which has taken place in many maturing industries, although the time horizon may be shorter. The rationalization that is currently taking place, partly because of industry developments and partly because of current economic conditions, is fairly typical of most industry development. Growth in the North American market has begun to slow somewhat, the consumer is developing skills which make his purchasing policies less dependent on few suppliers and interchangeability in systems components and software is beginning to affect industry price and service structures. All of which leads to the questions of innovation and competition, given developing industry structures.[20]

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[20] It is not the purpose of this note to deal at length with either the question of innovation or competition but, rather, to recognize that the changes discussed may have significant impact on both innovation and competition.

The Canadian Computer Supply Industry Study

No doubt innovation, at least during the initial stages of any industry's development, is enhanced by the existence of a wide range of companies (and people) with diverse ways of solving similar problems. As the industry begins to mature, many of these companies fall by the wayside, unable to finance their original ideas and incapable of underwriting the research and development of new products and services. During the initial stages of industry growth, many small companies offer some of the more traditional services as a means of supporting the on-going development of new ideas.

However, as the market for traditional services expands, new companies, specializing in such services and thriving on cost-effective offerings, emerge to exploit the market and undercut the small operator. This often results in the loss of revenue that initially provided the necessary support for innovative product research and development. For those who can develop or service special markets which lack the broad appeal necessary to attract larger suppliers, there remains significant potential. For others, mergers, acquisitions, etc. may be the alternative to disappearance.

The question of how much innovation is actually achieved by the small companies in a new industry was difficult to tie down. There can be no question, however, that the disappearance of these companies reduces the options available to serve the market.

From the standpoint of competition, the question of how many suppliers are necessary to maintain an effective competitive balance is also difficult to identify. The main point to be addressed, however, is not how many there should be and who should disappear, but rather how much competition, whatever its form, is needed to insure optimum service at costs which permit Canadian companies to remain competitive in the offering of their products and services to domestic and world markets.

4. Foreign Involvement – Supply Industry Impact [21]

Several studies analysing the world computer industry have dealt at length with the problems of competing effectively in an industry dominated by American-owned resources and technology. Western Europe, Britain and Japan, all highly industrialized and dependent on computer technology and development, face problems similar to those in Canada. And, although the range of strategic options varied from country to country, many of the choices were similar. Such similarities made it necessary for the Canadian industry to be compared with the computer industries of these other countries in order to assist in the identification of possible strategic alternatives for the Canadian setting. Many of the ideas currently discussed by both private and public officials do not sit well with the facts. Canada does not have a significant domestic mainframe industry, [22] nor does this country have any large-scale peripheral equipment producers who could achieve significant penetration of the North American market, let alone the world market, at this point in time. Whether or not the formation of a Canadian industry, to supply some types of systems hardware, was desirable or realistic had to be considered in terms of our broader national objectives. One practical way of looking at a possible Canadian presence in the industry entailed some analysis of European and Japanese deliberations on the subject. [23]

Two aspects of the European approach stood out. These included their general objectives and the priorities assigned to each. It is useful perhaps to re-state several recommendations (objectives) that seemed important to these countries. [24]

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[21] This section is included only to help place the position of Canada's supply industry in context with those of other major industrial nations of the world

[22] Some producers are building mainframe units in Canada; however, the major producers are foreign-owned

[23] A thorough analysis of various foreign strategies concerning their respective computer industries is not the objective of this note. We are concerned only with the considerations of various resource-option comparisons which might also be related to the Canadian situation

[24] "Recommendation 619 (1971) on the Computer Industry in Europe – Hardware Manufacturing", Proceedings of the Consultative Assembly of the Council of Europe, Twenty-Second Ordinary Section, OECD, January 20, 1972, pp 1-2

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Among these were:

- Awareness of the economic and political significance for Europe of the new techniques in data processing, and therefore, of the central importance of investment policy in this field;
- noting, with some concern, the present domination of the computer industry in Europe by American technology and American industry, but appreciating the contribution which this has made to the growth of Europe's technological capacity;
- noting that the emergence of a genuine European alternative has been impeded by the failure to develop a legal and administrative framework, suited to multinational companies;
- insisting that the utmost emphasis should be placed on the efficiency with which the new technology and data processing systems are utilized, and that the development of a strong European-controlled segment of the industry should not prejudice these wider objectives;
- considering it essential, nonetheless, that Western Europe should seek to regain and maintain a position of real technological independence and leadership in a field pioneered by European science and eminently suited to European skills;
- feeling convinced that a coherent and uniform European computer policy, worked out in common by European governments and through co-operation agreements between European-owned computer firms, would contribute significantly to Europe's technological capacity.

Three points seem evident. There is concern over the degree of foreign ownership in the European computer industry. There is value in maintaining a position of leadership and thereby a degree of independence. Finally, neither of these desirable ends should prejudice the broader objective: *that utmost emphasis should be placed on the efficiency with which the new technology and data processing systems are utilized.*[25]

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[25] Committee on Science and Technology of the Consultative Assembly of the Council of Europe, "Report on the Computer Industry in Europe: Hardware Manufacturing" (DOC. 2893, January 15, 1971) (OECD DAS/SPR/71/244; HG/WS/638, April 13,1971)

The introduction stated "... there is no doubt whatever that the efficiency with which the European industry, government and science *uses* computers is likely to transcend in importance the question of whether or not Europe can maintain, or indeed attain, a recognizable economic and technological independence in their production"

The report to the Council of Europe presented a number of interesting comments on the European situation and from these flows the final chapter ''Towards a Viable European Industry''. While it is not our intention to duplicate the work done by the Council of Europe committee, some comparisons between the Canadian, the European and the American situations may serve to clarify and define the options open to Canada in the computer industry.[26]

(a) U.S. Domination

As in Europe, the computer industry in Canada is dominated by American-owned companies (Figure 14). While some of these (IBM, Data General, Honeywell, Digital Equipment, etc.) do produce a few products or components in Canada, the evidence suggests that the hardware sold in Canada is almost totally of American design and something in excess of 80 percent of it is foreign-made. There are no Canadian-owned producers of mainframe units and few Canadian companies producing peripheral equipment.

(b) Major Companies

Eight major companies account for almost 95 percent of Canadian mainframe sales (Figure 15). IBM, although its share of the total Canadian hardware market appeared to be declining slightly, continues to dominate all segments of the computer equipment and service industry. IBM's market share for hardware exceeded 60 percent. Since its service offerings have only recently been unbundled, market shares for software and other services are difficult to estimate[27] It is useful also to note that on the basis of installations, IBM's

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26 *Ibid.* The Report recognizes that the computer industry goes beyond the physical production of hardware. nonetheless it is concerned with the manufacture of computers in Western Europe

27 It should be noted that revenue and market share comparisons can be misleading in that the mix of sales and rentals can affect the total revenues of a company for any year Using an '' if sold '' equivalent produces a more relevant figure if a year-by-year comparison is desired The ''if sold'' basis was used

Figure 14
European Market Share Held by
American-Owned Mainframe
Producers

*

Market	Market Share 1969
U.K.*	54
France*	91
West Germany*	78
All Europe*	72
Canada (All Equipment)	84

Figure 15
Estimated Market Share for
Mainframe Sales*

*

Company	Mainframe Market Share %
IBM	63.0
Honeywell — G.E.	11.0
Univac	7.0
Control Data	4.0
Digital Equipment	3.5
Burroughs	3.5
National Cash Register	1.6
Others	6.0
Xerox Data Systems	1.5

market share will be lower than that based on revenue estimates since, on the average, its installations are often larger and more expensive than those of its competitors.

5. Other Factors in the Canadian Market

While the Canadian equipment market is dominated by American companies and, as a result, supplied by products developed for the U.S. market, there remain some Canadian influences on this process.

The main influences come from government, although some private sectors in the Canadian economy, if encouraged to do so, could provide markets for Canadian-developed products.

(a) The Government

Thus far, government influence in the computer supply industry has stemmed mainly from support programmes and purchasing policy. Because each aspect has impact on the existing industry, and could have substantial impact on selected segments of the industry, they warrant further attention.

(b) Government Action Regarding U.S.-Owned Facilities

As was mentioned above, several of the large computer companies have established production, development and service facilities in Canada. In this respect, the Department of Industry, Trade and Commerce has negotiated a number of arrangements, both through the use of its own programmes and through those of other departments in the federal and provincial governments, to encourage the manufacture of computer hardware in Canada. While there are many objectives involved, two seem uppermost in the federal government approach. These are:

• The establishment of employment opportunities in a growing, high-technology industry.

• The creation of a balance of trade in the computer industry where exports from Canada equal the imports to this country (of computer equipment and components).

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As a result, several companies are producing some lines and components in Canada for the Canadian market, as well as for export to the U.S. market. Among these are IBM, Honeywell, Data General and Digital Equipment. Others are currently preparing for production in Canada. The policy of IT&C, thus far, is to attempt to gain a trade balance on a company-to-company basis, so that internal exports and imports are approximately equal.

(c) Government Support Programmes in General

There can be little question about the value of government support programmes in principle. In practice, the issue is less clear. In the main, federal agencies providing support to the industry seem to emphasize the criteria of new jobs, regional development (tightly related, since regional development has come to mean new jobs in the least attractive employment areas) and balance of payments. And, while such criteria are absolutely necessary, they may be related only incidentally to the needs of the country in terms of the other benefits that could accrue from the computer supply industry. While the agencies supporting industry development (in this case the computer supply industry) may have some implicit strategy guide-lines for specific industries, they are evident in neither the stated objectives of the agencies, nor from an objective analysis of the agencies' decisions.

In practice, the support programmes take too long to process applications and too long to make payments, thus placing some companies in an unnecessary financial crisis. The criteria for acceptable proposals are not clear nor well publicized. Too often, product development is funded, but the high cost of market entry and the establishment of product legitimacy do not qualify for assistance. Programme assistance has helped a number of companies in the product development stage, but many of these products fail in the market because of the cost of establishing the reputation of high technology merchandise. Unfortunately, the emphasis stemming from regional development is one of ''bricks and mortar''. Without support in the market build-up stage, support for these other factors is often wasted.

(d) Federal Government Purchasing Policies

For several reasons the purchasing policies of major Canadian computer equipment buyers, notably the government(s), assume a high degree of importance in the development and profitability of some supply industry segments. Many companies have been able to identify market opportunities and produce both equipment and software suitable for servicing specific market needs. Often, parts of this process are completed with extensive support from major government programmes. But, beyond the development stages, many companies with proven products have three major needs that could be aided by government purchasing policies.[28] These are:

- Continued financial support during the market entry period.

- The opportunity to tailor equipment and systems to real-life applications.

- A need for installations to show in a bid for further sales.

Each of these factors assumes great importance during the period in which a product is attempting to enter the market. New buyers, particularly the small buyers, want to see the system in action, they want to talk to users about performance characteristics, maintenance and service problems. Early penetration of a new product into its projected market is essential because of the high rate of new product development and old product obsolescence. From the fieldwork, it was evident that several companies had developed new products which, because of the companies' weak financial situation, were introduced to the market slowly. These were often displaced by competitive merchandise which, though conceived and developed later, had adequate resources behind it to achieve rapid market penetration.

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[28] There should be no confusion here over the need to support sub-standard technology: the products in mind have been proven. the tests specified under government-aid programmes have been completed and the products are viable

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Government interest in these products, where applicable, preferential purchasing policies (the U.S. government allows between 6 percent and 15 percent on prices for American-produced equipment) and promotion assistance could well do much to help those Canadian producers who currently experience significant difficulties in marketing their new products.[29]

[29] Committee on Science and Technology of the Consultative Assembly of the Council of Europe. *op. cit.*, p. 14. During the 1950's, the U.S. Government provided development contracts for new systems as well as a stimulating dialogue with the user. "The two together [were] a potent force".

Part D

Supply Industry — Data Analysis

The industry structure provided a number of company classifications which took on meaningful dimensions in the computer supply industry. Each of these is discussed with regard to its strengths and weaknesses prior to the presentation of study conclusions in Part E of this report.

The classifications of companies which were analyzed follow from the general industry structure presented in Figure 9.

1. Service Bureaux

These companies fell into two broad segments, those utilizing communications facilities (remote entry) and those without communications facilities (over-the-counter). The companies were not further sub-divided into dedicated and general systems, since the preliminary analysis of these sub-groups indicated little difference in operating characteristics. Subsequent growth and development in the service bureau segment could make these categories useful in future analysis.

In addition to these two groups, one company which was heavily involved in data preparation was considered separately to give an indication of the characteristics and problems facing this type of firm. One company which was strictly a supplier of raw time was also examined separately because of interest expressed in a computer utility which supplied only computing power with no application software.

Table 2 identifies the selected characteristics of over-the-counter service bureaux while Table 3 summarizes the evident strengths and weaknesses of the same supply group. Table 4 presents selected characteristics of the remote entry service bureau group; Table 5 sets forth the strengths and weaknesses of those service bureaux using communications facilities.

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The characteristics of those companies selling data preparation services and raw time are presented in Tables 6, 7, 8, and 9.

2. Software Suppliers

The software suppliers were divided into three broad groupings based on the interview sample. Each provided specialized services in the supply industry context (some companies participated in more than one sub-segment with the dominant group offering custom software (see Table 10)). The custom software group is mainly applications-oriented, with little emphasis on operating software. Table 11 outlines some of the strengths and weaknesses evident in this segment.

Only one supplier specialized in the production and sale of standard software. This company was extremely small, and, as with others who had considered this possible market, saw its major competition in the form of mainframe suppliers and large, on-line service bureaux, both of whom produce standard software offerings as an adjunct to their other products. Tables 12, 13, 14 and 15 present the characteristics of the software consultant, and some of the key strengths and weaknesses evident in this segment.

3. Hardware Suppliers

The hardware supplier segment has been broadly divided into four sub-segments. These are:

• Mainframe Hardware Suppliers
• Peripheral Hardware Suppliers

• Communications Hardware Suppliers
• Other Equipment Suppliers

The characteristics of each are explored in the Tables which follow.

4. Mainframe Producers

The mainframe producers, all of whom were foreign-owned at the time of the study, were in the main engaged in all facets of the supply industry, providing a range of equipment falling in each sub-segment, software, and in some cases, service bureau offerings. Tables 16 and 17 present some of the major characteristics of the mainframe supply segment.

5. Peripheral Hardware Companies

The peripheral hardware companies (this group included those manufacturing and/or selling peripheral hardware but not mainframe) have relatively narrow lines of equipment to offer. Most of it is specialized and as a result the establishment of a viable service base places both economic and geographic limits on their activities in the Canadian setting. Tables 18 and 19 deal with the major characteristics evident in the peripheral supplier sample. Table 20 presents selected characteristics for the other equipment category. Table 21 sets forth the evident strengths and weaknesses of the companies interviewed in this group. Tables 22 and 23 present the characteristics of the companies in the interview sample dealing with hardware leasing.

Table 2
Service Bureau —
Over-the-Counter
(Selected Characteristics)

No. of companies	21
Average no. of employees	42
Average revenue $	793,000
Average no. of locations	1.4
Profitability	9 profitable, 8 break-even, 2 losses, 2 don't know
Ownership	18 are 100% Canadian 1 is 51-60% Canadian 1 is 100% non-Canadian
% Revenue from Canadian firms	72.5
Applications offered	business accounting – 18 scientific – 3
Software offered	standard – 7 modified standard – 11 custom – 2
Processing capability offered	own computer – 15 rent & re-sell time – 6
Customer base	service co's (ins.) – 8 small business – 3 parent firms – 3 oil industry – 3 most customers (18) don't have computer
Nature of expenditures	equipment 20-50% salaries 20-60% overhead 20-50%
Nature of investment	machine purchased – investment machine leased – working capital

Table 3
Service Bureau —
Over-the-Counter

Weaknesses	Strengths
1 Limited financial base of companies 2 Limited resources for work on new applications 3 Financial insecurity and limited resources has lead to a lack of confidence in these companies on part of users and financiers 4 Quality of applications offered — general 5 Managerial ability 6 Lack of planning external — market internal	1 Continuing need for services from firms which can't afford their own computers 2 Lower cost than remote entry processors — no communications costs involved 3 Some specialized applications 4 Initiative of management 5 Low fixed investment required (where equipment leased or time rented)

Table 4
Service Bureau —
Remote Entry
(Selected Characteristics)

No. of companies	6
Average no. of employees	92
Average revenue $	1,922,000
Ownership	4 are 100% Canadian 1 is 71–80% Canadian 1 is 51–60% Canadian
Revenue from Canadian firms as % of total	100%, but 36% of revenue comes from 3 firms which have U.S. ties
Profitability	profitable — 1 break-even — 1 loss — 3 don't know — 1
Average no. of locations	4.3
Applications offered	business, financial — 1 scientific — 4 special — 1
Software offered	standard — 5 assistance to user — 2 don't know — 1
Processing capability	remote entry to large computing system
Customer base	medium to large firms educational institutions government
Nature of expenditures	machine, personnel, communications, overhead
Nature of investment	machine product development

Table 5
Service Bureau —
Remote Entry

Weaknesses	Strengths
1 High cost — low performance of communications facilities	1 Accumulation of expertise in developing area — communications oriented applications can be applied to new applications
2 High initial investment	2 Generally adequate management resources
3 3 to 5 years in normal circumstances to reach break-even — high level of uncertainty during this period	3 Technically knowledgeable in area of computer/communications
4 Tendency for concentration upon scientific applications and other one-time usages	4 Adequate quality of service (users)
5 Little market research — demand difficult to predict	5 High degree of development in specialized areas — specialized applications for number of users.
6 Financial instability of companies creates customer reluctance	
7 Investment community unwilling to back applications development and operations through break-even period	
8 Management talent limited	
9 Dependent on hardware companies for system performance, especially on-line real-time systems.	

Table 6
Service Bureau —
Data Preparation
(Selected Characteristics)

No. of companies	1
No. of employees	63
Revenue $	370,000 (1/2 from data preparation)
Ownership	100% Canadian
Profitable	yes
No. of locations	5
Applications offered	business, financial
Software offered	none
Processing capability	none
Customer base	large manufacturing firm — over-flow work (U.S. firm)
Nature of expenditures	keypunch rental, personnel, overhead
Nature of investment	basically just working capital

Table 7
Service Bureau —
Data Preparation

Weaknesses	Strengths
1 Product offerings regarded by consumer as homogenous — price competition severe 2 Place bids for most contracts, no assurance of continued business 3 High turnover of personnel 4 Low entry costs — severe competition	1 Some differentiation of products is possible on the basis of turnaround and accuracy 2 No severe problems involved in obtaining personnel 3 Large market — continued but slowing growth 4 High variable cost mainly tempo-rary (leased equipment)

Table 8
Service Bureau — Raw Time
(Selected Characteristics)

No. of companies	1
No. of employees	63
Revenue $	1,000,000
Ownership	100% Canadian
Profitability	Hope to break-even by December, 1971
No. of locations	1
Applications area	general
Software offered	none
Processing capability	over-the-counter off-site
Customer base	consulting firms overflow work for companies with same type of system
Nature of expenditures	computer hardware costs (depreciation or lease costs)
Nature of investment	fixed on machinery — if purchased with working capital — if machine leased

Table 9
Service Bureau — Raw Time

Weaknesses	Strengths
1 Strong price emphasis and competition 2 Customer base for overflow work limited to those with similar system 3 Custom moves to "in-house" system as volume warrants it 4 Trend to move user firms with raw time available — contribute to overhead coverage 5 Communications costs for on line new time makes short-term buyers hesitant	1 Firms offering service tend to be stable and well financed 2 Opportunity for firms with surplus computer time to obtain contribution to overhead

Table 10
Software — Custom
(Selected Characteristics)

No. of companies	7
Average no. of employees	20
Average revenue $	395,000
Ownership	7 are 100% Canadian
Profitability	yes — 4 new company — 1 don't know — 2
Average no. of locations	1.6
Applications area	business financial — 4 scientific — 2 general — 1
Software offered	custom
Processing capability	none — 5 rent & re-sell — 2
Customer base	government — 2 service industry — 3 medium business firms — 1
Nature of expenditures	salaries 65–70% overhead 20%
Nature of investment	working capital to finance receivables

Table 11
Software — Custom

Weaknesses	Strengths
1 Attitudes of users — prefer work done in-house 2 Lack of good technical people who understand user needs and business 3 Lack of well qualified people in what is essentially creative business 4 High degree of dependence on economic conditions 5 Problems with continuity of revenue because high percentage of projects are done on "one shot" basis 6 Ease of entry to industry on a small scale basis — many small struggling firms 7 Small size of total market	1 Small number of skilled, creative people can support a large organization 2 Some firms have extremely talented personnel — mainly technical 3 Firms offering service are distributed across country 4 Some evidence of increasing trend for users to supplement in-house personnel with outside assistance

Table 12
Software — Standard
Applications
(Selected Characteristics)

No. of companies	1
No. of employees	5
Revenue $	100,000
Ownership	100% Canadian
Profitability	yes
No. of locations	1
Applications area	business, financial
Software offered	standard
Processing capability	none
Customer base	service bureaux (U.S.)
Nature of expenditures	salaries, overhead
Nature of investment	working capital to finance receivables

Table 13
Software —
Standard Applications

Weaknesses	Strengths
1 Few companies in segment 2 The market for standard packages is limited because it is difficult to find applications with sufficiently broad appeal to attract wide market 3 The costs of development of large, flexible packages are high 4 Competition from imported software 5 Licensing of software by U.S. firms adds to competition 6 Inability to exploit U.S. market	1 Most firms in this segment derive large percentage of revenue from operations in other segments, including hardware companies and service bureaux. This type of software is created largely to sell other primary services.

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Table 14
Software — Consultants
(Selected Characteristics)

No. of companies	3
Average no. of employees	30
Average revenue $	500,000
Ownership	3 are 100% Canadian
Profitability	yes — 2 don't know — 1
Average no. of locations	2
Applications area	general (all 3)
Software offered	feasibility, custom
Processing capability	none
Customer base	medium and large firms, government
Nature of expenditures	salaries, overhead, computer time
Nature of investment	working capital to finance receivables

Table 15
Software — Consultants

Weaknesses	Strengths
1 Consumer billings tend to be high because of heavy learning times and overhead 2 Often get involved in development of applications where background experience limited 3 Lack good technical people with applications experience 4 Both government and private sector sales fluctuate drastically 5 Trend toward fixed cost contracts are vulnerable if cost estimating is not accurate	1 One or small number of key people can ensure success of firm 2 Many consultants have contracts from other areas of business — leads to software consulting

Table 16
Hardware — Mainframe
(Selected Characteristics)

No. of companies	7
Average no. of employees	293
Average revenue $	16,650,000
Ownership	6 are 0% Canadian 1 is 10% Canadian
Profitability	yes — 4 don't know — 3
Average no. of locations	7.5
Applications area	general
Software offered	systems standard
Processing capability	sell or lease in-house systems of all sizes
Customer base	all computer users
Nature of expenditures	cost of goods sold 40-60% marketing field engineering education depreciation software development administrative overhead
Nature of investment	financing, leasing inventory working capital new product introduction costs

Table 17
Hardware — Mainframe

Weaknesses	Strengths
1 High cost of financing new product development and introduction 2 Little control over new developments in Canada 3 No Canadian-owned mainframe producers	1 Control over other segments of computer service industry 2 Access to technology and developments as well as extensive financial resources 3 Canadian division backed by large resources, extensive research and development 4 Strong management relative to balance of industry 5 Emphasis of market research and long-range planning not evident in other segments 6 Large base of competent people — both technical and applications skills — customer-related

Table 18
Hardware — Peripheral
(Selected Characteristics)

No. of companies	3
Average no. of employees	21
Average revenue $	875,000
Ownership	2 are 100% Canadian 1 is 100% foreign-owned
Profitability	yes — 1 no — 2 (both relatively new)
No. of locations (average)	3
Applications area	scientific — 1 general — 2
Software offered	standard custom none
Processing capability	none
Customer base	large firms government
Nature of expenditures	cost of goods sold marketing training service
Nature of investment	working capital

Table 19
Hardware — Peripheral

Weaknesses	Strengths
1 Dependent on pricing policies of mainframe suppliers 2 Most equipment is imported from U.S. 3 Customer is systems-oriented, leading him to purchase peripherals from mainframe producers 4 Limited management skills & resources 5 Financial resources limited 6 Inability and high cost involved in development of "compatible" technology	1 Evidence to suggest that increasing customer skills are permitting some selective purchasing of peripherals 2 Uniqueness of some equipment 3 Quality and performance of some equipment 4 Trend to more compatibility of equipment — some evidence of consumer emphasis on standards 5 Growing number of applications is creating growing market for peripheral equipment in general 6 Competition not intense at present 7 Management enthusiastic and dedicated

Table 20
Hardware — Other Equipment
Manufacturers
(Selected Characteristics)

No. of companies	3
Average no. of employees	189
Average revenue $	776,000
Ownership	1 is 0% Canadian 1 is 80% Canadian 1 is 100% Canadian
Profitability	yes — 1 no — 1 don't know — 1
Average no. of locations	10.3
Applications area	process control — 1 keypunching — 2
Software offered	standard — 2 custom — 1
Processing capability	sell system dedicated to an application
Customer base	service firms all computer users
Nature of expenditures	hardware and software develop- ment overhead
Nature of investment	leasing inventory working capital

Table 21
Hardware — Other Equipment
Manufacturers

Weaknesses

Strengths

1
Limited financial resources —
in segment where expansion is
expensive
2
Cost of new product development,
new product introductions and
sales financing (leasing)
extremely high
3
Management in Canadian-controlled
firms lacks depth and wide varie-
ty of skills necessary to operate
in international markets
4
Market and product demand difficult
to predict
5
Technical expertise available
only in key centres of Toronto
and Montreal

1
Attractive and growing market
2
Hardware/software combination
has consumer appeal
3
Leads to more jobs than software
alone
4
Provides hardware experience for
future development
5
Opportunities for smaller com-
panies in market niches too
small for mainframe producers'
attention

Table 22
Hardware — Leasing
(Selected Characteristics)

No. of companies	2
Average no. of employees	6
Average revenue $	3,784,000
Ownership	1 is 0% Canadian, 1 is 16.3% Canadian
Profitability	yes — 1 don't know — 1
No. of locations (average)	1
Applications area	general
Software offered	none, other than manufacturers
Processing capability	in-house system
Customer base	large users
Nature of expenditures	depreciation on computer inventory
Nature of investment	leasing inventory

Table 23
Hardware — Leasing

Weaknesses	Strengths
1 Pricing policies of hardware companies make leasing companies vulnerable 2 Large financial requirements to obtain inventory of equipment 3 Ownership is non-Canadian 4 Mainly IBM-oriented, vulnerable to IBM actions	1 Opportunity to select from a wide range of equipment those items which have long, high-potential life 2 Companies have strong financial support from parent U.S. firms 3 Apart from equipment inventory companies can operate with minimum personnel 4 Depreciation policies permit lower costs for leased equipment than mainframe producers. Typically, this involves longer lease commitment by user

Part E

General Conclusions

Because different computer processing users require different types of systems to undertake their applications most efficiently, there is a continuing need for a variety of systems. As a result, it appears ill-advised, in the foreseeable future, to concentrate exclusively upon the development of capability in a narrow range of hardware/software, data bank, and communications systems. The industry remains immature and is rapidly developing in the areas of both market and technology. Any decision at this time to support the growth of one segment to the detriment of other segments would be an undertaking involving considerable risk. Overemphasis on the creation of jobs, the balance of payments within the computer industry, or regional development to the exclusion of other developments within the industry could lead to the support of the least viable long-range alternatives.

- Growth in specific segments will be a function of both market demand and changing technology. Because these are difficult to predict at this time it is essential that resource allocations be made in such a way as to maintain a wide range of strategic options for future growth of the industry in Canada.
- From the interviews it appeared that many more users would utilize communications facilities if they were of higher quality and/or lower cost. Communications, then, is one area which, if improved, could change the structure of the hardware/software/data bank/communications system.
- As computer users become more knowledgeable, there is more emphasis upon applications and, consequently, more of a tendency to construct H/S/DB/C[30] systems orientated to an applications base. There is also a growing tendency for supply firms to orient around specific applications rather than selling general-purpose machines with the idea that they can do everything (e.g., Honeywell (Keyplex), Consolidated Computer, Ruscom Logics).
- The implication is that government policy could be orientated towards encouraging development around an applications base which would then necessitate appropriate developments in hardware/software/data bank and communications. The problem is in selecting applications for development. It is, however, appropriate that the potential use (application) provide a basis for system development as opposed to past direction, where developments were centered around the selection of hardware.

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[30] H/S/DB/C: Hardware, Software, Data Bank, Communications.

1. Data Analysis — Computer Supply Industry

The data presented was gathered from field interviews with seventy companies in the computer supply industry.

(a) Computer Services — General

The estimated size of the market for computer services in Canada (1971) including processing, software, etc. is $104 million and annual growth is estimated to be 17 percent. The classification of computer service companies which were interviewed, the total segment sales of each group and the estimated share of market for each segment (based on sample) are shown in Table 24.[31]

From the industry data, it is evident that over-the-counter sales continue to outpace remote entry billings. However, remote entry sales were growing more rapidly than over-the-counter sales at the time of the study. Relatively speaking, the demand for service bureau services is much greater than for software services. It is important to note, however, that service bureaux are substantial contributors to software development, modifications and sales (including imported software).

(b) Company Revenues

The dominant companies in terms of total revenue are the hardware mainframe companies with average revenues of $16,650,000 and 71.5 percent of total industry revenue (see Table 25). The next largest group is OTC service bureau, with 10.2 percent of the revenue. It is, however, important to note that the mainframe companies participate in all major segments of the supply industry except communications.

(c) Computer Supply Concentration

The computer supply industry was concentrated in Ontario with all classes well represented. Table 26 also indicated that:

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[31] The estimate of $104 million was formed on the basis of interviews and represents the projections and estimates of industry participants.

- Other equipment manufacturers (OEM) had a large number of locations, mainly sales offices.
- The hardware industry was concentrated in Ontario and Quebec, close to skilled and technical manpower pools.

- In the case of manufacturing plants in Ontario and Quebec, interviews indicated that government-aid programmes were a factor in the locations selected.
- Software and service bureau locations were not bound by location factors tied to production. A key factor appeared to be

market-service emphasis with OTC bureaux widely distributed. Remote entry operations which required large markets were concentrated in Ontario. (Communications costs are cited as a major factor in this concentration.)

(d) Applications Offered

Table 27 indicates that the majority of companies offered business applications. Over-the-counter processors were primarily business applications orientated, while remote entry processors tended toward scientific and technical analysis applications, although a growing number of business applications were being processed in remote operations.

(e) Software Offered

From Table 28 it is evident that the major developers of standard software were those using it as part of an integrated product offering. Almost all companies in the interview sample possessed some software capability, although not all sold their software capabilities as a separate commodity. It was characteristic of over-the-counter service bureaux to offer modified standard software packages to their clientele. Custom software producers and consultants attempted to achieve similar results by attracting more than one project in the same applications area. Operating software was supplied primarily by the mainframe companies. There were some instances of companies other than the hardware producers which provided operating software but only on a very limited scale.

Table 24
Estimated Breakdown
of Total Computer Services
Revenues — 1971

	Estimated Total Segment Sales of Companies Sampled ($0000)	% of Total Sales for Each Segment	Estimated Sales for Each Segment Applying % (Col. 2) to the $104 Million Estimate ($000)
Consultants	1,500	4.4	4,576
Custom Applications	2,764	8.1	8,424
Standard Software	100	0.3	312
Raw Time	1,000	2.9	3,010
Input Preparation	370	1.1	1,144
OTC Processing	16,661	49.1	51,064
Remote Processing	11,529	34.0	35,360

Table 25
Company Revenues by
Primary Company
Classification

	1 Number of Revenues Figures Estimated or Known	2 Average Revenue for Companies in Segment ($000)*	3 Total Companies in Segment*	4 Total Revenue from Segment (2)X(3)	5 Percent of Revenue for Each Segment
Consultants	2	500	3	1,500	0.9
Custom Software	7	395	7	2,764	1.7
Standard Software	1	100	1	100	0.1
Raw Time	1	1,000	1	1,000	0.6
Input Preparation	1	370	1	370	0.2
OTC Processing	21	793	21	16,661	10.2
Remote Processing	6	1,922	6	11,529	7.1
Mainframe Suppliers	4	16,650	7	116,550	71.5
OEM Suppliers	2	776	3	2,327	1.4
Leasing Companies	2	3,784	2	7,568	4.6
Peripheral Hardware	3	875	3	2,624	1.6

Table 26
Head Office and Total Number of Locations of Companies by Segment

	Mari-times	Quebec	Ontario	Prai-ries	B.C.	Average Total Number of Locations
Consultants		1	2			1
Custom Software	2	1	2	1	1	1.6
Standard Software			1			1
Raw Time			1			1
Input Preparation			1			5
OTC Processing		3	8	6	4	1.4
Remote Processing			6			4.3
Dedicated System Processing			2	1	1	1.75
Mainframe Suppliers		2	5			7.5
OEM Suppliers			3			10.3
Leasing Companies			2			2
Peripheral Hardware			2	1		3

Table 27
Applications Offered
by Companies

	Business (Financial)	Scientific	General	Specialized
Consultants			3	
Custom Software	4	2	1	
Standard Software	1			
Raw Time			1	
Input Preparation	1			
OTC Processing	18	3		
Remote Processing	1	4	1	
Dedicated System Processing	2	2		
Mainframe Suppliers			7	
OEM Suppliers	1			2
Leasing Companies			2	
Peripheral Hardware		1	2	

Table 28

Software Developed and Offered by Companies*

	None	Standard Applications	Modified Standard Applications	Custom	Operating
Consultants				3	
Custom Software				7	2
Standard Software		1		**	
Raw Time	1				
Input Preparation	1				
OTC Processing		7	11	2**	
Remote Processing		6		**	
Dedicated System Processing		4		**	
Mainframe Suppliers		6		**	6
OEM Suppliers		2		1**	
Leasing Companies	2				
Peripheral Hardware	1	1		1**	1

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(f) Processing Capability

Table 29 indicates some cases of custom software houses buying and re-selling computer time, utilizing applications they have developed. Interviews suggested that this was typical of the process whereby software firms were transformed into service bureau operations, usually to obtain continuity and growth in revenue. The over-the-counter service bureaux which buy and re-sell time were usually smaller firms destined (on the basis of past practice) to eventually buy their own equipment as volume developed to justify it.

(g) Customer Base

Table 30 identifies the customer bases for the industry segments covered in the interview sample. The three largest customer groups were manufacturing companies, the service industry, and government, with the service industry currently the fastest growing customer group.

The primary customers for standard software were the computer service bureaux. Service bureaux were also the primary consumers of raw time, further underlining the need for the software/hardware combination to create a saleable package. The only other customer category in the market for raw time was the user seeking processing capability for overflow work although this requirement, in the opinion of industry participants, was not large.

2. Customers with Computers

A large part of the service business handled by the supply industry came from customers with computers. Consultants worked for both those with computers and those without. For those with access to equipment, the major role for consultants involved system improvements, feasibility studies for new equipment and specialized software. For those without, the major role played by consultants involved the feasibility of new systems and the evaluation of options among available systems.

All of the custom and standard software companies interviewed worked for customers already using the computer. The emphasis typically was on custom

Table 29
Processing Capability Offered Customers

	None	Sell Mini-Computer	Sell Other Computer	Lease Computer	Off-Site Over-the-Counter Computer	Off-Site Computer Remote	Buy & Re-Sell Time	Sell Dedicated Hardware/Software System
Consultants	3						2	
Custom Software	5							
Standard Software	1							
Raw Time					1			
Input Preparation					15	3	6	
OTC Processing					3	6		
Remote Processing								
Dedicated System Processing				7	1	1		
Mainframe Suppliers		4	5					3
OEM Suppliers				2				
Leasing Companies								
Peripheral Hardware	3							

Table 30
Customer Base of Companies

	Manufacturing Firms	Education Institutions	Computer Service Bureaux	Service Industries*	Parent Company	Processing Firms**	Government	Don't Know	All Types (General)
Consultants	3						3		
Custom Software	1			3			2	1	
Standard Software			1						
Raw Time			1						
Input Preparation	1								
OTC Processing	5	1		8	3	3	1		
Remote Processing	2	2					2		1
Dedicated System Processing	2	1				1			
Mainframe Suppliers				1			1		4
OEM Suppliers				1					2
Leasing Companies									2
Peripheral Hardware	2						1		1

*
Banks. airlines. insurance companies

*
e.g.. oil

software for specialized applications since the users often had software capability as well.

On the other hand, most over-the-counter processors undertook work for firms which did not have computers. There tended to be a higher level of turnover in the customer base as the OTC customer's volume increased to the point where in-house equipment could be justified.

Remote entry processors performed work almost exclusively for those who had access to computer systems. In part, the difference was explained by the nature of the products offered. The over-the-counter producer emphasized general business packages while the remote entry services offered technical and scientific packages for a large number of users.

In the main, the customers of other equipment manufacturers (OEM) also possessed computers. The specific product/service package offered by OEM tended to enhance the performance of specific functions which may not have been possible if only the main system had been utilized.

3. Nature of New Product Development

The types of new product development by supply industry participants varied widely. New product offerings from consultants centered mainly around work in a new applications area. Custom and standard software firms also concentrated on new applications areas, tending toward hiring people with related applications experience (not necessarily programming experience) as required. As a rule, a move to offer services in a new area was accompanied by, or actually precipitated by, the entry of new personnel into the firm.

New product offerings by the suppliers of raw time stemmed mainly from the acquisition of new hardware. Such product developments were typically price orientated.

Service bureau new products (both OTC and remote entry) involved services in new applications areas, change in the service mode or improvements in the amount of software support offered to the customer.

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The new product offerings of hardware mainframe companies consisted principally of new hardware offerings. The new hardware was primarily developed in the United States. Some development of software was conducted in Canada by the mainframe companies and this represented the major Canadian dimension of new products in this segment.

New products for the OEM segment included development in the new applications area. This involved the development of appropriate software and usually included the combination of various hardware components that were, as a rule, purchased from other hardware suppliers. Development of the small hardware aspects of the system may also be undertaken by firms in this segment. As experience was gained, OEM companies attempted to design more of the hardware aspects of the system internally, and rely less upon outside suppliers. However, none of the firms in this area which were interviewed had, as yet, reached the stage of designing significant portions of the systems hardware themselves, although each stated that total systems-design and manufacture was their long-term objective.

Leasing companies undertook no product development of their own. A new product offering to them consisted of purchasing computer hardware and offering it on lease.

As with mainframe producers, the manufacturers of peripheral equipment were centered in the United States. New product development in the peripheral equipment area typically emphasized specialization and/or cost effectiveness. Major peripheral producers, in an attempt to broaden their market base, have been emphasizing plug-to-plug compatibility with major mainframe producers, but the main emphasis centered on performance in specialized areas.

In general, new product development in Canada was not extensive although some companies in the other equipment segment, peripheral equipment and software segments had developed new products for the supply market. Unique Canadian applications have prompted the development of systems and software with significant market potential in specialized areas but the supply industry remains dependent on U.S.-designed equipment and systems for its viability.

(a) Impetus for New Product Development

Table 31 indicates a general lack of market analysis prior to the introduction of new product offerings.

Customer requests, competitive pressures and the availability of a product from a U.S. parent were the major reasons for offering new products. The latter reason was especially important for hardware companies, while software and service bureau companies tended to respond more to customer request. In this response there was a tendency to become involved in applications areas where expertise was lacking and resources were spread too thinly, often resulting in poor service, high costs and a loss of customer confidence. The problem with responding to what the U.S. parent made available often resulted in the sale of products inappropriate for the Canadian market.

(b) Sources of Finance for New Product Development

Money received from clients for development of specific packages was the common method of financing new product development for software firms and consultants. The implication was that work in a new area would not be undertaken unless there was a client who was willing to pay at least a portion of the bill (Table 32).

Specific sources of funds for development of new products were hard to identify for the hardware group of companies. The mainframe companies get most of their new products from the U.S., so the Canadian funds source was not too relevant, although some of the new product development work done was financed out of current revenues. Leasing companies do not require substantial funds for new product development and peripheral hardware suppliers received most of their new products from the U.S.

The firms which take advantage of government assistance (*e.g.,* PAIT) for product development were the designer/producers of hardware or firms which developed very specific and unique software packages to be used for processing customer data.[32] Firms attempting to duplicate existing products were not eligible for assistance.

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[32] At the time of the study, the Department of Industry. Trade and Commerce was considering grants for software development. though none had yet been approved. except for some integrated hardware/software applications

Table 31
Based for Development and/or Offering of New Products

	Customer Requisitions	External Market Analysis	Internal Market Analysis	Idea of Someone in Firm	General "Feel" for Market	Competitive Pressure	Improve Production Line	Follow U.S. Company	Don't Know
Consultants	3								
Custom Software	3			2	1				1
Standard Software		1	1						
Raw Time				1					
Input Preparation					1				
OTC Processing	5		3	1	3	5	2		2
Remote Processing	3						2	2	
Dedicated System Processing	1				1	1		1	
Mainframe Suppliers	1							6	
OEM Suppliers	2							1	
Leasing Companies							2		
Peripheral Hardware	1				1			1	

Table 32
Source of Financing for New Product Development

	Operating Funds*	U.S. Supplier	Market Debt Equity	Parent Company	Government** Programmes	Client Financing	Don't Know or Not Available	Trade Programmes With Others
Consultants	*					3		
Custom Software	*					7		
Standard Software	*					1		
Raw Time				1				
Input Preparation	*					1		
OTC Processing	10*		1	2		4	3	1
Remote Processing	2			1			3	
Dedicated System Processing	2 1/2**			1	1/2**			
Mainframe Suppliers	1/2**				1/2**			
OEM Suppliers	1/2**				1/2**	1	1	
Leasing Companies							2	
Peripheral Hardware	1	1					1	

*
Indicates that the money received from clients goes into operating funds and is used to complete the project

**
All figures listed as 1/2 indicate a government grant to cover one-half the development cost.

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The major complaint registered against government financial assistance was the time required to process applications for money and the inability of firms who had developed viable products to get money or help during the market entry period which, for many, was critical to their success.

(c) Company Product Development Groups

Table 33 indicates that very few companies have specific groups which were dedicated to new product development. This suggested that most companies were too small to support the overhead of such groups. It also indicated, however, that the development of new applications tended to be approached haphazardly, rather than systematically, by many companies in the Canadian supply industry.

4. Nature of Competition

Table 34 identifies some of the key competitive variables. It was interesting to note that almost all of those mentioned were marketing oriented. Very little mention was made of the technological variables that one might expect to be key competitive factors in a high technology industry. Largely, the approach would appear to reflect the supplier's attitude that most customers remained incapable of assessing technical differences within the range of broad specifications of performance.

Contacts were extremely important for a consulting or software (custom or standard) firm and are necessary before a new firm can hope to enjoy any degree of success. Quality of work, software performance and system effectiveness were most often cited as key variables in the success of these firms.

Price was the important competitive consideration for raw time sales and input preparation, especially for the former. Input preparation firms also

competed along dimensions of turnaround time and quality of work for some clients.

Data processing (remote and over-the-counter) was a more complex area competitively, with clients looking for a much broader range of satisfaction.

In the mainframe hardware area the key competitive factor was reputation. IBM's reputation for total service, supported by a broad base of installations and products, was well known to potential clients and it was against this that other firms had to compete. The statement was made a number of times that, as users become more sophisticated, they relied less upon the reputation of a company and placed more stress upon the technical capabilities of the machinery. Evidence, however, suggested that in many cases, some reverse logic applied as well. In fact, as users became larger, with a greater investment in hardware, the service component became even more critical.

The question of reputation resulted in increased competition between other equipment manufacturers and hardware companies. Other important variables were price and the quality of the system/application. The trend toward more user sophistication enhanced the market for those OEM companies able to provide performance in specific applications.

Leasing companies competed strictly on a price basis. For peripheral hardware companies, price was also extremely important, although compatibility with existing hardware was an increasingly significant factor.

In areas where price was the major competitive variable, the determining factor for success was often the financial resources of the company (or parent). In areas where the competitive variables encompassed a broader range, proximity, applications orientation, industry experience and total service offered potential opportunities for specialized development. Although here, too, financial resources were critical.

Table 33
Product Development Group
in Company

	Yes	No	Don't Know
Consultants		3	
Custom Software		7	
Standard Software		1	
Raw Time		1	
Input Preparation		1	
OTC Processing	4	16	1
Remote Processing	2	2	2
Dedicated System Processing		4	
Mainframe Suppliers	2	4	
OEM Suppliers	1	2	
Leasing Companies	1	2	
Peripheral Hardware		3	

Table 34
Nature of Competition

Listing of Key Competitive Variables

Consultants	Contacts, experience
Custom Software	Contacts, experience, quality of work
Standard Software	Contacts
Raw Time	Price, turnaround
Input Preparation	Price, turnaround, quality of work
OTC Processing	Price, quality of application, data security, financial stability, turnaround
Remote Processing	Type and quality of application, data security, financial stability, turnaround
Dedicated System Processing	Quality of application, service offered, price
Mainframe Suppliers	Service, cost, reputation, software assistance
OEM Suppliers	Contacts, price, quality, reputation
Leasing Companies	Price
Peripheral Hardware	Price, compatibility

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5. Pricing Policies

Pricing policies for all segments tended to reflect some common characteristics. Apparently companies that were profitable, or moving in the direction of becoming profitable, established prices on the basis of full cost and tended to stay away from price cutting to obtain volume. It was also evident that firms capable of assuming the full cost approach were those with unique or relatively unique services (see Table 35).

6. Distribution Channels

By far the most important channel for contacting customers was direct sales. Contacts and referrals were also mentioned as important by a number of service bureaux.

A direct sales force was especially valuable to service bureaux operations and hardware firms. For software and consulting firms the contacts of management and referrals of customers were of more significance.

In addition, some of the new firms involved in the service segment came from established positions in other industries. These contacts were extremely critical; in fact, in some cases, they represented the reason for seeking a position in the computer supply industry (see Table 36).

7. Product Service Promotion

Product promotion, at least in terms of advertising (Table 37), was not regarded by most firms as an effective method of increasing sales. The value of trade shows and conferences was under question from a number of respondents, with some indicating that they were withdrawing from future trade-show exhibitions. Apparently, this was not just a cost-saving move, since at least five companies indicated they were in a better financial position to show this year (1971) than last. These respondents felt that the shows serve little technical or marketing purpose and the money might be more effectively invested in other ways.

Many of those interviewed concluded that advertising and other forms of

Table 35
Pricing Policies of Companies*

	Fixed Full Price	Volume Discount	Negotiable Pricing	Unbundled	Bundled	Discount IBM Price	No Answer
Consultants	Price on full cost basis, using *per diem* rates						3
Custom Software	Most companies try to get open-ended contracts, but customers want 2 fixed-price bids					1	3
Raw Time						1	
Standard Software							1
Input Preparation	1						
OTC Processing	5		1	2	2	1	9
Remote Processing	4	1					
Dedicated System Processing	4						
Mainframe Suppliers	2	2	1	2	3	3	2
OEM Suppliers	1	1	1				1
Leasing Companies	2	1				1	
Peripheral Hardware	1						2

*
Despite what stated policies are, there is evidence to suggest that firms will negotiate
on price if the volume of business is large enough. On small lots of business, it is likely
that they would stick to stated policy.

Table 36
Distribution Channel
Utilized

	Direct Sales Force	Through Agents	Customer Initia- ted	Contacts and Referrals	Don't Know
Consultants			3	2	
Custom Software	4		1	5	
Standard Software	1	1	1	1	
Raw Time		1			
Input Preparation	1	1	1		
OTC Processing	17	3	3	9	1
Remote Processing	6	2	1		
Dedicated System Processing	4			1	
Mainframe Suppliers	7				
OEM Suppliers	2	2	1		
Leasing Companies	2				
Peripheral Hardware	3				

Table 37
Promotion Undertaken

	Direct Mail	Occasional Advertising	Steady Advertising	Seminar	Manuals Documentation	Trade Shows Conference	Public Relation	Nil	Don't Know
Consultants								1	2
Custom Software	2	1	1			1	2	3	
Standard Software	1					1			
Raw Time		1							
Input Preparation	1					1		8	
OTC Processing	6	5	3	2					
Remote Processing	4		2	3	2		2	1	
Dedicated System Processing						1	1		
Mainframe Suppliers	1		6	3					
OEM Suppliers	1		1				1	1	
Leasing Companies		1					1		
Peripheral Hardware	1		1	1	1	1			

promotion were directed mainly toward creating an awareness of the company and, while this might serve some purpose, few felt that promotion and advertising played a direct role in the task of increasing sales or revenues.

8. Company Revenues

Table 38 sets out a number of factors covering the range of company revenues. Consultants fell into the medium-size category. Their revenues were stable, supported by activities in and out of the computer supply industry, indicative of a secure position.

Custom software firms ranged from very small operations (one or two key people) to large producers. Typically, at the upper end, these software producers had significant revenues from service bureau sales. For the most part, custom software firms had high variable cost operations and, as a result, a high degree of flexibility in their service offerings.

As with the software group, over-the-counter firms had a wide range in size. It was possible for these companies to maintain a high variable to fixed cost ratio but often, with growth, they bought or leased equipment, incurring a heavy burden of fixed costs and the inflexibility which often accompanied the decision to acquire hardware.

Remote entry processors were generally larger than OTC batch processors. More often the remote entry operations had on-site equipment and high fixed costs, necessitating high volume to meet break-even costs.

(a) Profitability

The software/consulting area showed fairly stable profitability. This was consistent with the high variable cost structures in this type of business where expenses can, in part at least, be moulded to revenues.

The service bureaux (OTC segment) showed a large proportion of companies at either a profitable or a break-even level. The only two companies who reported a loss were public companies. However, it is important to note that

many of those projecting profits for fiscal 1971 indicated that their profit expectations were marginal (six) and, in all cases, they had suffered minor losses in fiscal 1970 (Table 39).

Remote entry service bureau operations are all unprofitable at present. The nature of these firms, however, must be considered, as they are relatively young, and the process of growth compelled them to make a large investment at the outset and then build up revenue to a point where it would cover all of the costs incurred. Just how many of these firms will eventually move to a position of profitability remains to be seen.

Dedicated system processing enjoyed one of the most favourable profitability positions of the groups interviewed. The indication was that a company can, by concentrating in a particular area, keep overhead costs sufficiently low and generate sufficient revenue to operate successfully.

Mainframe suppliers appeared able to operate profitably in the Canadian market, although some have chosen to offer their services in a limited geographical area (Toronto, Montreal and Ottawa) to minimize costs and provide effective service. Profitability in those firms where the U.S. parent provides product development, management services and technical support is often a function of cost allocation. In some cases, the Canadian companies operated without significant overhead; in others, head office allocations were a significant factor in present profit positions.

(b) Secondary Sources of Revenue

The secondary activity of consultants and software firms was primarily concerned with other types of software activity (*e.g.*, consultants do custom programming and custom software people do consulting, Table 40).

Over-the-counter companies became involved with software work as a secondary emphasis. This suggested that the nature of this type of service bureau business required the continuous development of improved software packages aimed at enhancing service offerings.

Table 38
Range of Company Revenue* ($000)

	100**	100–250	250–500	500–1000	1000–2500	2500–5000	5000–20000	20000
Consultants			1	1				
Custom Software	3	0	3	0	1			
Standard Software	1							
Raw Time				1				
Input Preparation			1					
OTC Processing	5	4	2	5	3	2		
Remote Entry Processing				2	2	2		
Dedicated System Processing			2	1	1			
Mainframe Suppliers				1	1		1	1
OEM Suppliers			1		1			
Leasing Companies						2		
Peripheral Hardware	2				1			

Table 39
Profitability of Companies
(at present)

*

This refers to the case where the
company is new and no operating
results are available.

	Profit Position	Loss Position	Break-even	Insufficient* Data	Don't Know
Consultants	2				1
Custom Software	4			1	2
Standard Software	1				
Raw Time		1			
Input Preparation		1			
OTC Processing	9	2	8		2
Remote Processing	1	3	1		1
Dedicated System Processing	3		1		
Mainframe Suppliers	4				3
OEM Suppliers	1	1			1
Leasing Companies	1				1
Peripheral Hardware	1	2			

Table 40
Other Sources of Revenue

	Consultation	Customer Software	Standard Application	Raw Time	Input Preparation	OTC Processing
Consultants		2				
Custom Software	4		1			1
Standard Software						1
Raw Time						
Input Preparation			1			1
OTC Processing	2	9	9	2	7	
Remote Processing		1	2	1		3
Dedicated System Processing						
Mainframe Suppliers		4	3			1
OEM Suppliers			1			
Leasing Companies						
Peripheral Hardware		1	2			1

Remote Processing	Mainframe Supply	OEM Supply	Lease	Peripheral Hardware	Operating Software	Nothing Else
					1	2
1						
3		1		1	1	2
				1	2	
1			2	7	5	
1			3	1	1	
	1					
			1		2	

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A number of remote entry service bureaux did some over-the-counter business and a small number of OTC firms did some remote entry business as secondary sources of income.

Hardware suppliers were involved in a number of other areas. They were the main contributors to operating software, systems and program consulting and service bureau sales. There were a number of implications. The industry was not composed of a group of specialized companies, each doing one specific task, *i.e.*, there was substantial service overlap among the various types of firms. Any firm planning to enter the industry and specialize in one of these functional areas must recognize the potential competition as well as the market opportunities, given this ability to overlap segments. Any firm planning to enter the industry in an area of specialized application must realize that they have to perform functions in a number of other areas, because of the interrelationship. More important, specialized markets develop slowly and operations which are planned with the long-term objective of specialization may have to offer a range of services if the company is to survive in the short-term.

(c) Major Company Expenditures

Table 41 identifies the key areas of expense incurred by companies in each of the segments.

Several implications of this Table are evident. A small cut in communications costs (considering current services) would not significantly alter the cost structure of remote entry service bureaux.[33] Where a communications cost cut might have some effect is in increasing the demand for services by customers, thereby increasing revenues and thus creating a greater degree of

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[33] This is quite different from the argument that some areas are excluded from service because of the high cost of communications. For example, it was estimated that communications costs might represent up to 35 percent of the total cost to serve a customer in Saskatoon from Toronto.

Table 41
Nature of Company
Expenditures*

	Major Types of Costs Incurred
Consultants	Salaries, overhead (e.g., project expenses, administrative, computer time)
Custom Software	Salaries (65-70%), overhead (e.g., project expenses, computer time) (20%)
Standard Software	Salaries, overhead
Raw Time	Salaries, computer rental or depreciation charges
Input Preparation	Salaries, keypunch rental
OTC Processing	Salaries (20-60%, median 40%), overhead (20-50%, median 20%), equipment (20-50%, median 40%),
Remote Processing	Salaries (systems/programming and operation) (30-50%), overhead (20-40%), equipment (30-60%), communications (10-20%)
Dedicated System Processing	Salaries, overhead, machine costs
Mainframe Suppliers	Overhead, cost of goods sold (40-60%), field engineering, marketing, education, depreciation, software development
OEM Suppliers	Overhead, marketing, hardware & software development
Leasing Companies	Overhead, depreciation on computer investment
Peripheral Hardware	Cost of goods sold, marketing, training, service

profitability. The result would depend on the elasticity of demand for the services of these customers, something which was not within the scope of this study, nor, as far as is known, currently available.

Equipment costs represented the major expenditure for most service bureau and hardware firms. Because of this, if the customs duty imposed on hardware were reduced, the total costs of service bureau firms might also be reduced to some extent. A much more comprehensive study of tariffs would have to be undertaken to provide a complete answer as to the total effect of these costs on service bureau growth.

(d) Nature of Investment

Service bureau operations can be either high investment (low variable cost) or low investment (higher commitment to variable costs) depending on the strategy selected by management. Entry to the industry can be fairly easy if the low investment basis is used (Table 42).

Money to finance leasing inventories was particularly important to firms supplying hardware. During periods where large amounts of funds were required for product development and before lease revenues from new products begin to cover the costs, large working capital resources were required. Thus it was possible for firms to start in software or the service bureau segments with limited capital resources and, once a reputation had been established, it was often possible to find funds for further expansion. Financing of leasing inventories was a very important area for hardware companies and skills in financial management and planning were identified as major requirements.

(e) Funds Sources

Some firms, notably service bureaux, obtained public equity financing when market conditions were more favourable. Given current Canadian investor attitudes, substantial sources of equity funds now appear to be out of the question. Even U.S. underwriters are taking a second look at computer underwritings *(e.g.,* Consolidated Computers). If the industry can demonstrate

Table 42

Nature of Investment

Typically no fixed investment is required. The assets of the firm are largely the people who work for it.

Major Types of Investment

Consultants*	Working capital to finance receivables
Custom Software*	Working capital to finance receivables
Standard Software*	Working capital to finance receivables
Raw Time	Working capital and initial machine investment if equipment purchased; if equipment is leased, only working capital
Input Preparation	Working capital mainly, as keypunches are basically rented
OTC Processing	Working capital and initial machine investment if equipment purchased; if equipment is leased, only working capital
Remote Processing	Same as for OTC Processing
Dedicated System Processing	Same as for OTC Processing
Mainframe Suppliers	To finance leasing inventory and working capital especially with new product
OEM Suppliers	Leasing inventory, working capital
Leasing Companies	Leasing inventory
Peripheral Hardware	Working capital

effective performance over the next three to five years, equity funds should again be a possibility, given favourable overall market conditions.

Table 43 indicates three major sources of funds: parent firms, personal collateral and public financing. The parent firms of mainframe manufacturers were exclusively foreign-owned, while Canadian parent firms clustered in the over-the-counter and remote entry processing segments. A large number of the OTC firms interviewed were financed from the funds of principals and, in a number of cases, growth and new product development were beyond their capital resources.

9. Nature of Production Activity in Canada

The hardware companies were the only firms doing any manufacturing in Canada. Some of the U.S.-owned companies interviewed were producing under arrangements with the Department of Industry, Trade and Commerce. Currently, the hardware segment represents the only major area with a short job potential of any significance.

The output (development) of software was the element which was common to the production activity of most segments. The implications were that companies with an expertise, who currently operate in one segment, can most easily diversify their activities to another segment on the basis of their software expertise and knowledge.

In fact, this was the process which had occurred in a number of cases (*e.g.*, Comtech, Computer Science Canada and Keydata). These were three examples of companies which started out as primarily software companies. As they grew, and found it difficult to maintain revenues on the basis of software only, they subsequently moved into data processing, thereby utilizing the software expertise which they possessed. In the same fashion, a software firm can diversify into the manufacture of a dedicated OEM product by designing a system which includes the appropriate software and data base and also hardware which was specifically suited for the purpose at hand.

Table 44 indicates the major production activities of each segment of the computer supply industry in Canada.

10. Employee Breakdown

The largest employee category, with the exception of the OEM Suppliers and Input Preparation, was technical personnel. This provided some support for the observation that software development was the major factor, common to all segments of the industry (Table 45).

A surprisingly small number of salesmen were employed in the OTC service segment for a business which is sales orientated. However, it should also be noted that the management of these firms usually performed the major sales role.

The sales/personnel ratios are interesting. Leasing companies have the highest ratio but the nature of their business was strictly financial with no production activity whatever. The mainframe companies also have a very high sales/personnel ratio. This was indicative of the fact that they are mainly marketing organizations and do not undertake a great deal of manufacturing activity in Canada.

Software firms group in the area of $16,000 to $20,000 in sales per employee. Input preparation firms have lower sales per employee but their employees on the average receive smaller salaries and are less skilled.

Remote processing firms have higher revenues per employee than did over-the-counter processors. The dedicated system processors achieved a higher sales/personnel ratio than did multi-purpose service bureaux. It appeared possible to achieve more sales revenue with fewer people when the product-service package was concentrated on a specific area.

Table 43
Primary Funds Sources

| | Parent Firm in U.S.* | Sources of Funds (or collateral for funds) | | | | |
		Parent Firm in Canada**	Personal Funds of Principals	Government Guarantees	Public Market in Canada	Don't Know
Consultants	2					1
Custom Software			5			2
Standard Software			1			
Raw Time		1				
Input Preparation			1			
OTC Processing		5	11		5	2
Remote Processing	**	3			3	
Dedicated System Processing	**	1			3	
Mainframe Suppliers	7					
OEM Suppliers	1	1		1	1	
Leasing Companies	2					
Peripheral Hardware	1	2				

*
The parent firm may not actually provide the funds to the company out of their own bank accounts. but they will go to prospective financiars and arrange for or guarantee financing

**
Three of the remote entry processing firms involved both U.S and Canadian principals

Table 44
Nature of Production Activity
in Canada

	Type of Activity
Consultants	Paper output by professional staff — software development
Custom Software	Paper output by professional staff — software development
Standard Software	Paper output by professional staff — software development
Raw Time	Data processing
Input Preparation	Keypunching
OTC Processing	Develop software, process data
Remote Processing	Develop software, process data
Dedicated System Processing	Develop and improve software, process data
Mainframe Suppliers	Develop software, manufacture in Canada (yes 3, no 4)
OEM Suppliers	Manufacture in Canada (yes 2, no 1)
Leasing Companies	No manufacturing or production activity
Peripheral Hardware	Import all equipment (2), manufacture in Canada (1), develop software

Table 45

Employee Classifications

(Average per Firm Interviewed)	Total Employed	Unskilled*	Skilled**	Office	Sales	Technical***	Management	Revenue $/Employment ($000)
Consultants	30							16.65
Custom Software	20	2.9	.9	1.4	.9	12.6	1.9	19.8
Standard Software	5							20.
Raw Time	63	8.	20.	10.	0.	30.	5.	15.9
Input Preparation	63	34.	9.	7.	0.	6.	5.	9.
OTC Processing	41.6	9.0	9.7	5.3	2.6	10.9	3.1	19.2
Remote Processing	93.7	6.7	20.3	14.7	14.7	27.8	6.8	22.8
Dedicated System Processing	28.5	3.3	6.5	3.8	1.8	11.3	2.8	23.8
Mainframe Suppliers	292.9	0.	26.1	23.0	45.1	180.9	13.9	56.5
OEM Suppliers	189.3	0.	53.0	85.5	65.0	53.5	16.5	4.1
Leasing Companies	5.5	0.	0.	2.5	1.	1.	1.	68.4
Peripheral Hardware	20.7	1.7	2.3	3.7	4.7	5.7	2.7	42.3

Note:
Items may not add to totals because a breakdown was not received in some cases

* Includes keypunch operators

** Includes computer operators

*** Includes systems analysts, programmers. etc

11. Stage of Organization[34]

The majority of companies in software and service bureau related areas were primarily dependent on one man for leadership and decision-making. These operations were very vulnerable to larger competitors; they lacked capital, management skills and technical depth. A number of companies in the industry were divisions or subsidiaries of larger companies looking at computer service firms as a means for diversification (Table 46).

This distribution of company types in Table 46 indicated the relatively immature state of the industry. It also indicated the potential vulnerability of companies in the industry. Also, it explained why, in part, there was a relatively small amount of product development and market analysis being conducted (i.e., managements are too busy with short-run operating problems). It helped to explain the reason for the lack of planning by many companies; they have little control over revenues, even to the extent of accurately predicting sales and income.

12. Autonomy

The relatively large number of autonomous custom software firms and OTC service bureaux indicated the process by which these companies were formed. It reinforced the conclusion that they were vulnerable to outside conditions. It also indicated, however, that this was the area of greatest entrepreneurial activity and risk-taking.

The autonomous firms were free to make any decisions they wished on their own. Division or subsidiary organizations on the other hand move, subject in varying degrees, to parent company control (Table 47).

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[34] Thain. D H. "Stages of Corporate Development". *Business Quarterly* (Winter 1969). pp 32-45

Table 46
Stages of Organization

	Stage I	Stage II	Stage III
Consultants	1	2	
Custom Software	6	1	
Standard Software	1		
Raw Time		1	
Input Preparation	1		
OTC Processing	14	6	1
Remote Processing	2	4	
Dedicated System Processing	3	1	
Mainframe Suppliers		5	2
OEM Suppliers	1	2	
Leasing Companies	2		
Peripheral Hardware	3		

Table 47
Degree of Autonomy

	Autonomous Company	Division or Subsidiary
Consultants	1	2
Custom Software	7	
Standard Software	1	
Raw Time		1
Input Preparation	1	
OTC Processing	15	6
Remote Processing	3	3
Dedicated System Processing	2	2
Mainframe Suppliers	0	7
OEM Suppliers	1	2
Leasing Companies	0	2
Peripheral Hardware	1	2

13. Ownership

U.S. ownership and control were concentrated in the hardware type of business, especially the hardware mainframe segment. This was the area where the majority of industry sales fell and where almost all of the significant new product development took place.

Most of the small companies (mainly service bureaux) remained privately owned. Those companies requiring large capital investments were typically public or subsidiary operations with some foreign control. The leasing companies were both American-owned (Table 48).

(a) Canadian Ownership

Table 49 points out the conclusion implied in the previous Table, *i.e.*, that American ownership does not control most of the companies in Canada; however, the companies which were American controlled represent over half of the total computer supply industry sales in Canada.

14. Major Obstacles

Investigation revealed that conservative user attitudes were one of the main impediments to the growth of custom software firms. Many users felt that the industry segment was unstable and lacking in resources. Other users did not recognize the need for services. Additional obstacles for the software companies included the lack of financing and general economic conditions. In similar fashion, the two most often mentioned hindrances to growth for OTC processors were user attitudes and the lack of available financing. Remote processors unanimously mentioned problems with communications (service, rates, etc.) as a further limitation to their growth. Customer resistance seemed secondary (most remote entry customers have computers or computer background).

Mainframe suppliers perceived availability of financing and the market situation as major problems, while the peripheral suppliers were concerned with tariff policies and the lack of sufficient technical and sales personnel.

Table 48
Forms of Ownership

	Public Listed	Public Un-listed	Private	Management &/or Employees	Non-Management (Financiers)	Canadian Parent Company	U.S. Parent Company
Consultants			3	1		2	
Custom Software			7	7			
Standard Software			1	1			
Raw Time			1			1	
Input Preparation*		1	1				
OTC Processing	3		18	14	3	9	2
Remote Processing		3	3	2	3	3	2
Dedicated System Processing	1		3	3		1	
Mainframe Suppliers			7				7
OEM Suppliers		1		1	1	1	1
Leasing Companies	1		1				2
Peripheral Hardware	1		2	1	1		1

Table 49
Percent Canadian Ownership

	None	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	Don't Know
Consultants											3	
Custom Software											7	
Standard Software											1	
Raw Time											1	
Input Preparation											1	
OTC Processing	1							1			18	1
Remote Processing							1		1		4	
Dedicated System Processing											4	
Mainframe Suppliers	6	1										
OEM Suppliers	1								1		1	
Leasing Companies	1		1									
Peripheral Hardware	1										2	

These responses highlighted the fact that the Canadian user is relatively unsophisticated, as well as underlining the more or less universal problem of obtaining sufficient financial resources. They also pointed out that the most significant interface between communications carriers and the computer supply industry was through the remote entry service bureaux. It must be observed, however, that all companies providing a data processing service utilizing remote entry were concerned about equipment. If these were only isolated incidents, they could be written off. However, because all of those interviewed registered concern about communications, it must be concluded that it is highly likely that communications services can be significantly improved. Their major complaints involved, not only costs, but their ability to get action from Canadian carriers regarding new equipment designed to improve the cost effectiveness of remote entry services.

15. Company Objectives

The objectives of companies in all segments can only be classified as being very diverse. In most cases, no quantified objectives existed in the companies. This was particularly so in custom software and OTC processing and less so with the hardware mainframe companies, which, as a group, had done the most in terms of stating objectives. The lack of clearly defined goals was another indication of the immaturity of management, especially in the smaller software and service bureau companies.

The evidence from respondents indicated that few have any idea of market size, relative market shares or market growth. Most use the commonly cited figures of 20 to 25 percent for growth as "target", but beyond this no meaningful objectives are evident — mainframe companies excepted.

16. Appropriate Government Role

There was not much consensus of opinion in this area. A number of companies (fourteen) mentioned that a minimal regulation approach by government would be desirable.

The majority (eleven) of OTC service bureaux wanted the government to prevent unfair competition in the industry by restricting government

departments, universities, common carriers and banks from entering the industry. This was interesting because only one OTC processor mentioned unfair competition as an obstacle to growth or potential growth. The service bureau segment seems to support regulation of these groups as a matter of principle and/or because of the potential threat of long-term competition, but not because they fear it in the short-term.

In the opposite vein, while remote processors had pointed to the common carriers as obstacles to their growth, only one indicated that government regulation was the appropriate avenue for solving the problem. A number of OTC service bureaux (seven) indicated that they felt the communications carriers should be encouraged to offer better service. Most remote service bureau people felt they could do better by negotiating directly with the carriers than by encouraging government to intervene on their behalf. The OTC processors felt that someone else should lead the fight for improved communications, possibly because they have insufficient resources or lack sufficient consensus of opinion to attack the problem themselves.