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AN ECONOMIC ANALYSIS OF THE CANADIAN
COMPUTER SOFTWARE INDUSTRY

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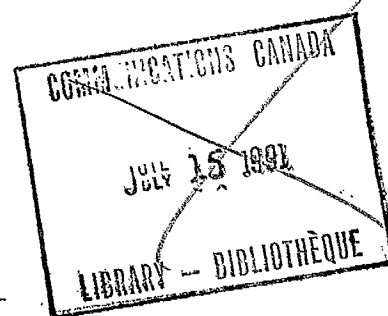
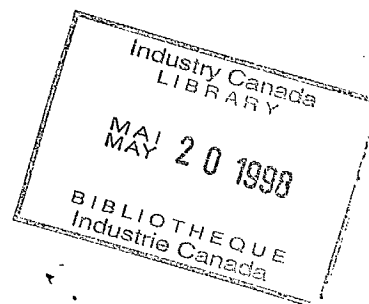
Economic and Marketing Analysis Division
Industry and Economic Development Branch
Technology and Industry Sector
Department of Communications

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COMPUTER SOFTWARE INDUSTRY

Prepared in the Industry and Economic Development Branch
Department of Communications

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The information contained in this publication was derived by Evans Research Corporation in the winter of 1982-83. Although the research methods and sources used are deemed reliable, the completeness or accuracy of the information cannot be guaranteed. In this rapidly changing environment, technology, company structures and products are not static and therefore the information presented in this report is always subject to change. The opinions expressed in this report are based on certain interpretations of available information, and are also subject to change. In any case, they should not be construed as representing the official position of the Department of Communications.

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Management Science America (Canada) Ltd.	
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Real Time Datapro.....	
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EXECUTIVE SUMMARY

1. The Canadian market for computer software was estimated at \$608 million in 1981, up from \$457 million in 1980. Included in these figures are sales of unbundled software. Sales of bundled software, and special purpose software such as video games and telecommunications software are not included. This market is expected to grow at an annual rate of 28% during the 1980's, reaching \$5.4 billion by 1990.

The fastest growing sector of the market is applications software. The market for this software in 1980 and 1981 was estimated at \$114 million and \$161 million respectively. It is expected that sales of applications packages will reach \$2.2 billion in 1990, showing an average annual growth of 34% in the 1981 to 1990 period.

The system development or custom software sector is expected in the future to play a relatively less important role in the software market. Sales for this market sector were estimated at \$215 million in 1980, accounting for 47% of the market. It is expected that its share of the market in 1990 will decrease to 25% or \$1.4 billion.

2. Currently, there are approximately 1,000 firms who supply software to the Canadian market. Revenues from the 516 largest suppliers were captured in this study. These 516 firms' revenues are estimated to account for 98% of the total market.
3. There are 53 suppliers who had software revenues of more than one million dollars in 1981; their combined revenues are estimated at \$470 million and accounted for 77.3% of the total market of \$608 million. Of these 53 key software suppliers, 28 are foreign owned. The software revenues of these 28 foreign owned companies accounted for 54.3% of the total market in 1981. The remaining 25 Canadian owned key software suppliers generated revenues which accounted for 23% of the market in 1981.

Twenty-four of the 53 key software suppliers are hardware manufacturers. In 1981, these companies' software revenues were estimated at \$326.4 million, which accounted for 54% of the total market. It is expected that this vendor group's pre-eminence in the Canadian software market will gradually be eroded. It is estimated that by 1990, the software houses and EDP consulting firms will have 42% of the market while the hardware manufacturers will have only 38% of the market.

4. There are an estimated 4,300 personnel directly employed by computer equipment and service suppliers in commercial software development in Canada. This means that software development personnel account for approximately 10% of total employment in EDP vendor companies in Canada. It must be understood that much larger numbers of personnel are engaged in the in-house development and maintenance of software which is not sold commercially.
5. A number of trends currently characterize the Canadian software industry. The use of off-the-shelf packages is increasing, because of the economics of custom developed software. Secondly, software is quickly becoming a critical factor in the buyer's decision to purchase a particular computer system. In recognition of this, the hardware vendors are increasingly making use of software as a marketing tool for their equipment. Thirdly, recent mergers and acquisitions in the software industry indicate that suppliers are attempting to consolidate their positions within the industry and purchase software technology instead of re-inventing it.
6. The success of a software product is dependent upon the intelligent use of available financing, in-house managerial and technical expertise, identifying market demand, strong marketing, utilization of the most effective distribution channels, and the exploitation of export markets.

Canadian owned software suppliers encounter three major obstacles to the success of their software products: the limited size of the Canadian market; Canadian perception of domestic products; fierce competition from well-known U.S. firms whose products are freely available in Canada.

7. The federal and provincial governments in Canada offer a wide variety of programs directed towards the high technology industry in general. There are, however, no programs that are specifically designed to develop an indigenous software industry.

There are divergent views as to the role the Canadian federal government should play in fostering the growth of a software industry. However, one thing is clear. At present, there is no co-ordinated approach by all levels of government to the development of a Canadian owned software industry. This lack of co-ordination can be detrimental to the emergence of a strong Canadian software industry, that is competitive in both domestic and export markets.

CHAPTER 1

INTRODUCTION

1.1 Scope and Limitations of the Present Study

This report is based on a study done by Evans Research Corporation (ERC) for the Department of Communications, entitled Overview of the Canadian Software Industry. The major objective of the study was to provide an overview of the Canadian computer software industry, and examine its competitive position, strengths and weaknesses in the North American and international markets. Intended as an overview of the current state of the Canadian computer software market, this present report is a working document which can provide the basis for further research and discussion in the field of software. Because of resource constraints and lack of hard information, firmware and software for several related areas such as videogames and various types of equipment such as telecommunications products, simulators, process control equipment, etc. had to be excluded from the scope of this study. The relationship between firmware and software is explored, however, in Section 4.1.

The information contained in this document was obtained by utilizing both primary and secondary research methods.

In the winter of 1982-83, the researcher conducted an initial telephone survey of the leading computer companies in Canada, as determined by ERC's In-Depth Report entitled Top Computer Companies in Canada (Ref.1); the purpose was to obtain information concerning these companies' software revenues and employment figures for fiscal 1980 and 1981. Consistent fiscal 1982 information was not available at the time of this survey, as many companies were still operating in fiscal 1982.

Despite a response rate of just over 50%, many companies refrained from providing all, or even parts, of the requested information, primarily for reasons of company policy. This included the Canadian subsidiaries of some of the largest foreign owned equipment manufacturers, whose software related revenues consequently had to be estimated by ERC, using a variety of methods. This lack of first-hand information introduces an element of uncertainty regarding the estimates of the software related revenues of equipment manufacturers as a whole, and of those market segments where they are most active, such as certain areas of systems software. All estimates and forecasts by the Canadian market were prepared by ERC.

Additional information was collected from personal interviews with 14 selected software suppliers, as well as from existing secondary literature available in a number of industry publications and journals, newspaper articles and company profiles (Ref. 2,3,4,5). A number of U.S. sources (Ref. 2,3,6) provided quantitative estimates and forecasts for the U.S. and West European markets, which were taken into account by ERC in preparing its own quantitative assessments for these two markets.

1.2 Classification of Software and Sources of Supply

Software, as defined for the purpose of this report, is a set of programs, procedures, rules and routines used to instruct the computer in performing specific functions. It is software which allows the power of computer hardware to be utilized for performing useful, information processing tasks.

There are primarily three types of software discussed in this report: systems software packages; applications software packages and custom system development. Systems software is that which directs the fundamental operation of the computer, while applications software is that which instructs the processor how to perform specific end user tasks. Systems software packages include operating systems, compilers and interpreters, high level languages and

applications generators, data base management systems and communications software; utility packages such as sort/merge programs and programs which copy files from one medium to another have also been included in this category for the purpose of this report. Applications packages are designed to perform specific tasks such as word processing, electronic mail, inventory control, accounting functions, financial analysis and many other applications.

System development includes the customized development of both systems and applications programs to meet the requirements of specific customers or groups of customers, on a contractual basis, by software houses, third party organizations and equipment manufacturers. In-house system development and maintenance, carried out by even an organization's own staff, is excluded from this category because it does not normally result in a commercial transaction. It is useful to note, however, that in-house system development still accounts for a much higher proportion of total user EDP costs than software purchases.

The development and sales of both systems and applications software packages is conducted by a diversified group of suppliers in the information processing industry. Included in this group are manufacturers of microcomputers, minicomputers, mainframe computers, word processors, service bureaux, original equipment manufacturers (OEMs), systemhouses, distributors, third-party companies, terminal and peripheral equipment specialists, software houses, and EDP consulting firms.

CHAPTER 2

OVERVIEW OF CANADIAN SOFTWARE FIRMS

2.1 Distribution of Software Suppliers

In 1982, there were more than 1,000 software supply firms in Canada. From this population, 516 were identified for this study and segmented into two broad categories, on the basis of annual revenues derived from software related sales. The remaining 500 or more firms have estimated combined revenues that account for less than 2% of the total market; they were not included in this study.

The first category consists of 53 firms having total software revenues of \$1 million or more during 1981. They are the key software suppliers in Canada. These 53 firms are identified in Exhibit 1, which ranks the top 121 EDP firms in Canada by their 1981 software revenues, and in Exhibit 2, which ranks the same EDP firms by software revenues as a percentage of the company's total EDP revenues. Exhibit 1 also shows that 45 of the top 121 EDP suppliers had 1981 software revenues less than \$1 million, while 23 did not report any revenues from software related sales.

The 53 key software suppliers dominated the market in 1980 and 1981. This group's software revenues were estimated by ERC at \$353.18 million in 1980 and \$469.98 million in 1981, which accounted for 77.3% of the total estimated market of \$456.83 million in 1980 and \$608.27 million in 1981. The revenues of this key group grew by 33.1% from 1980 to 1981.

The second category consists of 463 firms having annual software revenues of less than \$1 million. Included in this group are a number of "cottage-type" companies which conduct business out of the proprietor's home,

as well as a number of established smaller companies with relatively larger annual revenues. The software revenues generated by this group were estimated by ERC at \$103.65 million in 1980 and \$138.29 million in 1981, which accounted for 22.7% of the estimated total market in each of the two years. The revenues of this group increased by 33.4% from 1980 to 1981.

2.2 Software Suppliers by Vendor Type and Country of Ownership

The majority of the 53 key software suppliers in Canada provide other products or services in addition to software. Exhibit 3 shows that the 24 hardware manufacturers dominate the group of key software suppliers. The major importance of the hardware manufacturers for the Canadian software industry is evident in that these vendors together generated an estimated \$326.4 million or 54% of the total software revenues in 1981. These vendors are listed by hardware type in Exhibits 10-13. Since these hardware manufacturers do not usually report their software related revenues separately, their importance as software suppliers and distributors may sometimes be overlooked.

IBM Canada Ltd. dominated this group of hardware manufacturers. In 1981, its ERC-estimated software related revenues of \$182.1 million accounted for 55.8 % of the 24 hardware manufacturers' combined software revenues, and 29.9 % of the total software market. It must be noted that the problems involved in estimating the software related revenues of IBM Canada Ltd. necessarily introduce an element of uncertainty in the aggregate estimates.

Exhibit 4 shows that of the 26 U.S. owned key software supply firms, 20 are hardware manufacturers, 3 are service bureaux and 3 are software houses; as opposed to this, 8 of the 25 Canadian owned key software suppliers are software houses and EDP consulting firms, 8 are service bureaux, 5 are OEMs and systemhouses while only 4 are hardware manufacturers. The remaining 2 key software suppliers are British and Dutch owned; these firms are principally hardware manufacturers.

Although 25 of the 53 key software suppliers are Canadian owned, domination of the software industry is markedly non-Canadian. Of the total software revenues of \$608.27 million estimated for the software industry in 1981, some \$404.3 million or 66.5% was generated by non-Canadian firms (see Exhibit 6); U.S. owned firms alone accounted for some \$398.10 million or 65.5% of the total. The 28 foreign owned key software suppliers had estimated software revenues of \$330.1 million in 1981, or 54.3% of the total market.

In contrast, software revenues of only \$203.97 million, or 33.5% of the total, were generated by Canadian owned software suppliers. The 25 Canadian owned firms among the top 53 suppliers had revenues of \$139.9 million in 1981, or 23% of the total market.

Of the remaining 463 software firms with revenues less than \$1 million, 79.1% or 366 companies are Canadian owned. Ninety-two of the remaining ninety-seven non-Canadian firms are U.S. owned, while two are British, two are West German, and one is Dutch.

2.3 Employment

Evans Research Corporation estimates that in 1982 some 4,300 people were employed in commercial software development and maintenance in the Canadian software industry. It is difficult to ascertain even an approximate employment figure, due to a lack of statistical information and company reluctance to divulge this type of information. This figure only includes those people directly involved in the initial development of a software system, and in the maintenance and modification of existing software systems. It does not include clerical, administrative, managerial, marketing or sales staff. As shown in Exhibit 7, this figure accounts for 11.1% of the estimated total employment of the 516 identified software suppliers. To see this figure in its proper context, however, it must be remembered that perhaps 10 times this number of analysts programmers, and support personnel, who are employed by firms and institutions using computer systems, may be engaged in in-house

software development and maintenance.

The 53 key software suppliers employed approximately 2,566 persons in 1982 in software development. This accounts for 60.3% of the estimated total number of employees engaged in commercial software development in Canada for that year.

The remaining 463 cottage-type and established small businesses employed an average of three people each in software development. It is accepted that a disproportionate share of total employees among this group are involved to some degree in software development.

As illustrated in Exhibit 7, the largest employers of people in software development are the service bureaux, which employed 886 people in this area in 1982. This figure accounts for some 20.8% of the total number employed in commercial software development in Canada in 1982.

Although mainframe vendors, with 675 people, rank third in number of people employed in software development, they rank ahead of service bureaux, minicomputer vendors and consulting firms in terms of the average number of employees in software development per firm. This higher concentration of software development employees can be attributed to the following factors:

1. The traditional preference of customers to deal directly with the mainframe manufacturers, concerning both the hardware and system software components of a large scale system, has necessitated larger numbers of employees in software development.
2. The development of bundled and unbundled systems software and applications software is more complex for large processors than for minicomputers or microcomputers. Therefore, software development at this level tends to be more labour intensive.

CHAPTER 3

MARKET SIZE AND GROWTH FORECASTS

This chapter presents an assessment of the current state of the software markets in Canada, the U.S. and Western Europe, as well as forecasts for growths to 1990. Each market is broken down into three constituent sectors: Systems software packages, applications software packages and system development or custom software. For each sector and the software market as a whole, estimates are given for revenue size and forecast growth rates to 1990; the market share of each sector is also calculated. The quantitative assessment and forecast is presented in Exhibits 8 and 9 for Canada, 18 and 19 for the U.S. and Western Europe. All forecasts are made in nominal terms, both with respect to revenues and growth rates.

It must be emphasized that given the uncertainties regarding the size and composition of the current base, as well as the assumptions involved in extrapolations to 1990, these forecasts should be seen as one possible scenario, rather than a firm, quantitative picture. One would expect however, that the main trends in the three markets would be similar, since they are subject to similar technological and economic factors.

3.1 Canada

3.1.1 Actual Size

The size of the Canadian software industry, as measured by the revenues of the 516 identified software suppliers was estimated by ERC at \$456.83 million in 1980 and \$608.27 million in 1981. Total software revenues during the period from 1980 to 1981 increased by \$151.44 million, representing a growth rate of 33%.

3.1.2 Forecast

As shown in Exhibit 8, ERC forecasts that the Canadian software industry will experience an average annual growth rate of 28% during the 1980s. The market is expected to reach \$1 billion by the end of 1983 and \$5.4 billion by the end of 1990. The sizes, growth rates and market shares of the three sectors are discussed further below.

Systems Software Packages

ERC forecasts that sales of systems packages will experience an average annual growth rate of 31% from 1980 to 1990. The market for systems packages is estimated to be \$1.8 billion by 1990. This growth rate can be attributed to a number of factors:

1. Sales of computers will show steady growth during the rest of the 1980's. This, in turn, will contribute to the growth of systems software packages.
2. As users integrate office and factory functions and implement more sophisticated computer applications, there will be a steady growth in the demand for such systems software as network management/communications software, systems control subsystems, installation management software, and data and terminal access systems.
3. High EDP departmental costs, coupled with one to three year applications backlogs, will be instrumental in encouraging increasing numbers of end users to develop their own systems. To meet this demand, there will be a high growth in application development tools, such as fourth generation languages and high level problem oriented languages. For the purposes of this report, end user programming using such applications development tools is not considered as custom software development of the traditional type, since the latter is either done by a centralized DP department or

contracted out to software development firms.

4. Sales of application support products such as data base management systems (DBMS) will show steady growth, due to the demand for integrated systems which have to manage increasing amounts of information, characterized by increasingly complex data relationships and structures.
5. The recessionary economy has had the effect on many organizations of encouraging a careful examination of the EDP expenditures, so as to improve their cost effectiveness. While curtailing additional purchases of hardware to upgrade their main EDP installation, it is anticipated that many organizations will endeavour to improve their existing system performance and improve throughput by purchasing additional and/or improved systems software.

Applications Software Packages

The sales of applications software will experience the greatest growth; ERC forecasts an estimated average annual growth rate of 34% from 1980 to 1990. The market for applications software in 1990 is estimated to be \$2.1 billion. The reasons for this growth are as follows:

1. The cost/effectiveness of applications packages is attractive to the user, when compared with the increased costs of in-house and contracted custom software; this trend is spreading from scientific and engineering applications to commercial ones.
2. As applications packages become more sophisticated and easier to learn, users will find more office tasks and functions to automate.
3. The expanding use of microcomputers in businesses, as reflected in their increased sales, will contribute significantly to the sales of applications packages; this is because most microcomputer users have

neither the time nor the ability to write their own applications programs.

Custom System Development

As indicated in Exhibit 8, ERC forecasts that the market for system development or custom developed software will not grow as quickly as the other two sectors. The market for system development in 1990 is estimated to be \$1.3 billion.

This decline in market share is due to the following factors:

1. The high costs of in-house or contract custom developed software is making it a less desirable option if suitable alternatives are available, particularly in a recessionary economy. It is faster and less traumatic to implement a system with applications software packages or using applications generators, as opposed to the time and man-hours required to develop custom software applications in the traditional manner.
2. The forecast decline in the demand for system development software will be taken up by the increasing availability of less expensive, and steadily more sophisticated, off-the-shelf applications and systems packages.
3. The aggressive thrust among hardware manufacturers and independent software houses to provide pre-packaged "total hardware/software solutions" for users at many product levels and in most vertical market applications will diminish the need for custom software to address each such application.
4. The increasing user-friendliness of applications generators will allow many organizations to develop or customize their own applications software, without going to outside firms for assistance. This process is

greatly strengthened by the establishment of Information Centres to support and encourage end-users to do their own applications development.

3.1.3 Share of the Market by Vendor Type

Hardware Manufacturers

ERC estimates that the thirty-three hardware manufacturers who supply software in Canada had aggregated software-related revenues of \$258 million in 1980 and \$331 in 1981, accounting for 56% and 54% of the market respectively. (See Exhibit 9 and Exhibits 10 - 17). The group is dominated by IBM Canada Ltd., which is estimated to have accounted for 56% of the above revenues in 1980, and 55% in 1981.

ERC forecasts that sales of software by this group will experience an average annual growth rate of 23% and are estimated to reach \$2.0 billion by 1990; however, the hardware manufacturers' share of the commercial software market is expected to decrease from 56% in 1980 to 38% in 1990. This decrease in market share can be attributed to the following factors:

1. Growing competition from other software suppliers, such as software houses and EDP consulting firms, in the applications and, to a lesser degree, the systems software market.
2. The general perception among users that applications software developed by hardware manufacturers is not as sophisticated or as efficient as that developed by independent software houses and EDP consulting firms.
3. The traditional tendency of hardware manufacturers to concentrate on systems level software rather than applications software. It should be noted that many manufacturers are now working closely with independent software suppliers and, in effect, are conceding selected vertical

markets to their affiliated software houses.

Software Houses and EDP Consulting Firms

ERC forecasts that sales of software by software houses and EDP consulting firms will increase dramatically throughout the 1980's, with an estimated average annual growth rate of 33% and estimated sales of \$2.3 billion in 1990.

This group's share of the Canadian software market is forecast to increase from 30% in 1980 to 42% in 1990, due to the following factors:

1. This group has established a good reputation for development of applications software, therefore it will benefit from the growing popularity of applications packages.
2. Many end-users perceive the standalone software products developed by this group as superior to software developed by other suppliers. Since software development is this group's forte, users will continue to perceive this group as experts and their purchasing decisions will reflect those perceptions.

Service Bureaux

Of the top 30 service bureaux in the Canadian Information Processing Industry, ERC estimates that 24 firms accumulated software revenues of \$50.62 million in 1980 and \$64.04 million in 1981. These software revenues accounted for 11% of the market in 1980 and 10.5% of the market in 1981.

ERC forecasts that software revenues by service bureaux will increase to \$858 million in 1990, which will be a cumulative sixteenfold increase of \$807 million from 1980 figures. This group's share of the software market is expected to increase from 11% in 1980 to 16% in 1990.

The service bureaux are expected to become increasingly involved in the market for software products as a result of the following factors:

1. With the decreasing cost of hardware and increasing availability of software products, the service bureaux can be expected to experience declines in their present time sharing revenue base. To compensate for these losses, it is predicted that service bureaux will respond by becoming increasingly involved in the development and sales of software products.
2. Some service bureaux have the necessary software development expertise and company infrastructure to facilitate their entry into the software products field, with comparatively little initial development.

OEM'S, Systemhouses, Distributors and Third Party Companies

Sales of software by this vendor group, as shown in Exhibit 9, are forecast by ERC to be \$161 million in 1990, a cumulative increase from 2% in 1980 to 3% in 1990. As the software market expands, it is predicted that this group's involvement in actual development of new software or modifications of other software packages will increase.

Terminals and Peripheral Equipment Specialists

This is the smallest group of software suppliers; ERC estimated their share of the market in 1980 at 1%. Their share of the market is forecast by ERC to increase to 2% of the total software market in 1990. During the same period, the software revenues of this group are forecast to grow at an average annual rate of 34%.

There is no substantial evidence that this group of vendors will increase its involvement in the development of software beyond increasing the level of sophistication of their current products.

3.2 United States

3.2.1 Actual Size

The figures for the estimated growth of the United States software market, as shown in Exhibit 18, include revenues generated from sales of unbundled software and sales of custom software as well as educational services in the professional services category; the system development sector is therefore proportionately somewhat larger than the Canadian one. All figures for the United States and Western Europe market are given in U.S. dollars.

These figures, as provided by Input Ltd. (a California based market research firm), show the size of the U.S. software market to be \$4.7 billion in 1979 and \$6.1 billion in 1980, with an annual growth of 30%. This would indicate a market approximately 15 times larger than the Canadian one, with a comparable rate of growth.

Sales of systems software accounted for 23% and 25% of the software market in 1979 and 1980, respectively, while sales of applications software for these same years accounted for 19% and 18% of the market. The market share for system software in 1980 was comparable to that of Canada, while the share for applications packages was 7% less; this difference in market shares merits further study.

3.2.2 Forecast

Many observers expect the market share of system development to decline during the 1980's; ERC anticipates a decrease from 57% in 1979 to 29% in 1990. This decline can be attributed to the same reasons that are expected to affect sales of this software in Canada: growing cost of in-house or custom contract software development; increasing availability of less expensive, more sophisticated, off-the-shelf applications and systems packages; aggressive

thrusts by hardware manufacturers and independent software houses to provide pre-packaged, total hardware/software solutions for users.

Sales of systems software are forecast by ERC to experience an average annual growth of 27% in the U.S., with revenues increasing from \$1.1 billion in 1979 to \$15.1 billion in 1990. The share of the market, in terms of revenues, is expected to increase from 23% in 1979 to 34% in 1990. Although the forecast growth rate is somewhat lower than the Canadian one, the eventual market share in 1990 is the same. This increase can be attributed to the growth of database management systems, applications generators and fourth generation languages, the higher cost of systems packages vis-a-vis applications packages, and the increased end-user base of who will wish to use computers directly, rather than through a programmer intermediary.

As in the Canadian software industry, the greatest growth in the U.S. software industry will be in sales of applications packages. ERC forecasts that with an expected average annual growth rate of 31.2%, sales will increase from \$900 million in 1979 to \$17.4 billion in 1990; this group's market share will increase from 19% to 39% during this same time period. Again, the forecast growth rate is somewhat lower than the Canadian one, but the eventual market share in 1990 is the same. The reasons, while paralleling those given for Canadian growth, are threefold: applications packages are less expensive than custom software, while often being able to provide almost the same level of functionality in many cases; they are able to address a larger number of vertical markets; the increasing use of the microcomputer, which is more applications software intensive, and the increasing availability of cost effective applications packages designed for microcomputer users.

3.3 Western Europe

As seen in Exhibit 19, the software market in Western Europe is forecast by ERC to grow by an estimated 29% annually to 1990, a growth rate quite comparable to the 28% forecast for the Canadian market. In 1980, the total

software market was some \$2.6 billion according to Input Ltd, or approximately 6 times larger than the Canadian market. In 1990, the size of the market is estimated to reach \$33.2 billion.

ERC forecasts that sales of applications packages, with an estimated average annual growth rate of 42% will experience the most dramatic growth; revenues are forecast to increase from \$400 million in 1980 to \$13.3 billion in 1990. Consequently, sales of applications packages are forecast to account for 40% of the total market in 1990, which will be a 24% increase in market share from 1980. Although the forecast growth rate is considerably higher than the U.S. and Canadian ones, the eventual market share in 1990 will be virtually the same.

It is forecast by ERC that sales of systems software will increase from \$700 million in 1980 to 10.6 billion in 1990 and will account for 32% of the total market in the latter year. From 1980 to 1990, sales of systems packages are expected to experience an average annual growth of 31%. The forecast growth rate is almost identical to the Canadian one, and the eventual market share in 1990 only slightly lower.

The largest portion of the total software market in 1980 and 1981 was system development. In 1980, system development revenues were estimated by Input Ltd. at \$1.5 billion, or 57.7% of the total market. In 1990, ERC forecasts that system development revenues will reach \$9.3 billion, but will account for only 36.5% of the total market. System development revenues are expected to experience an average annual growth of 20% between 1980 and 1990, which is again comparable to the 21% forecast for the Canadian market in this sector.

The explanations for the anticipated dramatic growth in sales of applications packages, the steady growth in systems packages, and the decline in market share of sales of custom systems development are parallel to those given in the section regarding the Canadian software market.

CHAPTER 4

CURRENT TRENDS

4.1 Major Trends

A number of trends have characterized the software industry in North America over the past few years. These main trends and some of their underlying factors are described below:

1) Increase in the utilization of off-the-shelf packages

Due to the economics of in-house system development, the use of off-the-shelf packages has become more attractive, both on a timeliness and a cost basis. The ratio of package purchase price to in-house development cost may in extreme cases approximate 1:50 for systems software in the mainframe area. For microcomputer applications software, the ratio could be much higher. In either category, this ratio renders the make-or-buy decision obvious, if an off-the-shelf package with all the required functional capabilities is available.

Secondly, well designed off-the-shelf packages appeal to a large end user community, due to features such as user-friendliness and ongoing maintenance, enhancement and support.

2) Scarcity of Qualified Programmers

The availability of computing power is increasing much faster than the supply of trained programmers. Many organizations face delays of 1 to 2 years in getting their applications systems developed in-house, through the data processing department. The scarcity of qualified programmers, in conjunction with the escalating costs and delays of internal program

development, has encouraged an increasing number of users to purchase off-the-shelf packages, or make increasing use of applications generators or high level 4th generation languages.

3) The Total Hardware/Software Solution

The increase in the availability of applications software products can also be traced, in part, to the strategies of the software vendors themselves. Some software suppliers currently provide total solutions for particular vertical markets. These companies develop software packages, or procure other vendors' software packages, and integrate them with the appropriate hardware to provide a total or turnkey solution to the needs of their customers.

4) Applications Generators - Software Productivity Tools for the 80's

The popularity and use of applications generators or 4th generation languages is increasing and this trend is expected to continue through the 1980's. This is partly due to the shortage of qualified programmers, which has created a huge backlog in applications software development in companies of all sizes. Secondly, the cost of contracting outside professional services companies to develop custom software is climbing rapidly. Thirdly, by using applications generators, increasing numbers of end users who are not computer professionals can be trained and encouraged to develop their own applications programs, thus freeing up scarce qualified programming resources for other tasks. James Martin, the famous computer industry analyst, is the best known proponent of the use of these productivity enhancing tools. As stated earlier, this type of end user programming is not considered to be a part of custom system development, for the purpose of this report.

5) Software - The Purchasing Determinant

The gradual education of the customer has produced a user population which is more sophisticated in determining its needs and requirements. Although in the past computer systems tended to be purchased on the basis of competitive hardware, there are indications that some customers now base their hardware purchases on the availability of software, making it a key purchasing determinant.

6) Software Providers in Transition

There are three major market forces that are likely to affect both the size and the structure of Canada's software industry, in the short and medium term.

Firstly, 1982 was a record year for mergers and acquisitions in the computer industry. Many of the mergers and acquisitions reflected a growing realization, by hardware manufacturers and software vendors alike, that software will play an increasingly important role in the computer industry's future. The acquisition of computer software companies is a manifestation of the belief in the industry that it is costly and counter-productive to re-invent software.

Secondly, 1982 also saw many business liaisons developing between hardware and software vendors. Some hardware vendors are increasingly endorsing products developed by software vendors; in order to cover vertical markets for which they are unable to provide sufficient coverage.

Thirdly, some software providers have made the gradual transition from being primarily custom software development firms, to mainly being providers of off-the-shelf and semi-custom software products. This switch is mainly due to the decreasing profits generated by sales of

custom software, and the vendors' ability to leverage custom developed solutions to the needs of many individual clients by converting a particular solution to a generalized product.

7. Exploitation of International Markets

In the past, Canadian software suppliers have generally limited their market coverage to the domestic scene. However, concerted efforts are being made by some leading firms like Quasar Systems Ltd. and Systemhouse Ltd. to penetrate international markets and exploit untapped opportunities. The major U.S. software product firms have been more successful in this respect; examples include Management Science America (MSA), Cullinet, SAS Inc., Applied Decision Research (ADR) and Microsoft, among many others.

8) Hardware Vendors and the Importance of Software

The traditional hardware vendor now recognizes software as both a necessity for marketing hardware and a lucrative prospective market. While in the past many hardware firms devoted their primary resources to hardware development, leaving a void in the software area, this emphasis is now changing. Since IBM's unbundling of its hardware and software in 1969, most of its hardware competitors have followed suit. Software revenues generated by this group are estimated to account for the largest share of the Canadian software industry revenues. However, this is not to say that the hardware vendors will continue to dominate the software market.

Firstly, independent software suppliers are well entrenched in their share of the applications market. As hardware becomes cheaper and more generic, users will have more money and time to shop for applications software which supports a specific industry.

Although the hardware manufacturers employ large contingents of programmers, mainly in systems software development, the lure of a wider variety of software challenges is said to attract some of the more innovative analysts and programmers to the independent houses.

Thirdly, the hardware manufacturers seem to have acknowledged the applications software lead enjoyed by the independent suppliers. Many of the major manufacturers are actively pursuing joint arrangements with the independents in the development and marketing of vertical market packages. The strength of the hardware manufacturers lies in their distribution networks, which can be used to market software as well as hardware products. Many small software suppliers, on the other hand, lack both marketing skills and easy access to a distribution network. Thus there is scope for a synergistic relationship between the two parties.

4.2 Firmware

Firmware is the implementation of software functions or logic in hardware. The concept of firmware has received an enormous boost with the growth of the ability to design and mass manufacture special purpose VLSI chips. Although "hardwiring" software has been a topic of discussion in the industry for the last few years, the idea is not a new one. The term firmware was first coined by Asher Opler in the 1960's, to suggest a different way of producing software and executing it.

Proponents of firmware, mainly hardware-oriented people or organizations, feel that the following benefits can be obtained from this technology:

1. Faster production;
2. Cheaper distribution;
3. More efficient performance;
4. Better safeguarding.

In an article in Computerworld dated June 12, 1978, Frank stated that the cost of conventional programming could be reduced, by 1990, to five cents per line of code by adopting the process of putting software on silicon chips.

However, there are a number of questions concerning firmware that should be considered in assessing its likely role:

- i) how would the firmware suppliers deal with an undetected error once the product was being used in the market?;
- ii) could product enhancements or add-ons be facilitated in the same manner as conventional software products?;
- iii) how could firmware be as flexible as software?;
- iv) would third party companies be able to develop firmware for a particular computer, or would this be the sole domain of the computer manufacturer?

One must remember that when Asher Osler introduced the concept of firmware, he had in mind constructing software at one level lower than what the standard machine code would allow. At that time, hardware was very costly and optimal efficiency in program execution was a major concern. The benefit that would accrue from this process would be the ability to produce a dedicated machine, that would optimally perform a specific application or function. We are now entering a stage in information processing where multi-functionality and integration are required. What was once considered a benefit of firmware, now would be seen as a major step backwards.

Firmware is suitable for handling program logic which can be frozen, and which is executed repetitively. Language compilers fall into this category. Many microcomputers now have Basic interpreters/compiler built into their circuitry, and other compilers available in the form of plug-in chips. Other

applications could include chips for implementing communications protocols, or encryption/decryption of data transmissions. Firmware is much less suitable for handling application programs which are subject to regular modification and enhancement.

It must be remembered that firmware usually starts as software. The initial stage of its creation demands similar skills, and draws on the same pool of scarce programming resources, as do many types of software products. The decision to turn a particular piece of software into firmware is based on both technical and economic factors which, naturally, will vary from cases to case.

It is difficult to determine what ramifications firmware will have on the future of the software industry in Canada. However, it is unlikely that the traditional methods of developing software or the major players will change in the foreseeable future. As stated earlier, because of resource constraints, the area of firmware had to be excluded from the scope of this study.

CHAPTER 5

PROBLEMS ENCOUNTERED BY CANADIAN SOFTWARE COMPANIES

One of the competitive hurdles faced by Canadian owned software package suppliers in achieving success is competition from the established U.S. owned firms in the Canadian and U.S. software markets.

As discussed in Chapter 2, 26 of the 53 key software suppliers in Canada are U.S. owned. The software revenues of these firms accounted for 54% of the total 1981 software market in Canada, and an even higher proportion of the market for package software, since these firms do comparatively little custom system development work. In contrast, the 25 Canadian owned key software suppliers generated revenues which accounted for 23.1% of the total Canadian market in 1981. Although reliable estimates of revenues generated in 1981 by Canadian owned software suppliers from the U.S. software market are not available, they are comparatively miniscule; certainly much less than 0.5% of the estimated market of U.S. \$7.4 billion. The dominance of established U.S. owned software suppliers in the North American software market will present a difficult obstacle for Canadian firms, both existing suppliers and new entrants, during the next five years.

Since the marketing and distribution of packaged software is characterized by economies of scale, the small size of the domestic Canadian software market is an impediment to the success of Canadian suppliers. A competitive U.S. supplier enjoys access to a domestic market which is some 15 times larger, and regional markets in California and the northeastern U.S. which are larger than the total Canadian market. One of the final processes involved in bringing a product to market is testing it within a sample base of the intended user community. Unfortunately, the intended user community in Canada is sometimes too small to extract a sample base to test a new product, so the test sample has to be extended to the U.S., thus increasing the

relative cost faced by the Canadian supplier.

Intertwined with the preceding problems are the perceptions of some customers in Canada. Canadian software companies may have difficulty selling their products domestically because some Canadian customers, as one company official pointed out, perceive Canadian products to be inferior unless they have passed the test of acceptance in the U.S. market. U.S. customers seem to have no such inhibitions or reservations; the experience of I.P. Shar Associates and Quasar Systems Ltd. seems to indicate that superior Canadian products can be successfully marketed there. Both these firms, however, were able to build their international marketing successes on the firm foundation of a domestic market base, and the importance of such a base should not be overlooked.

5.1 Prerequisites for Success - Canadian Software Suppliers

One of the fundamental requirements in the fostering of an indigenous software industry is an understanding and recognition of certain prerequisites for success. During the study, many company officials stated their opinions as to the prerequisites for Canadian firms to be competitive and successful in the software industry. The main ones are as follows:

1) Financing

It is crucial that firms trying to enter the software market secure proper and adequate financing to cover the operating expenses the company will incur during its early stages of existence, including prototype research and development, and costs involved in introducing products to the marketplace. New entrants without tangible assets have great difficulty in raising both equity and debt financing; consequently they are often under-capitalized and suffer from continuous cash flow problems.

2) Personnel and Management Resources

In addition to securing adequate financing, a firm must attract and retain high calibre personnel. A medium sized software vendor with annual sales in the \$5 million range should ideally have an effective general manager to ensure that the company meets its defined objectives; a financial officer to scrutinize and control company expenses; an above average technical staff to develop a portfolio of products; a market research and public relations staff with above average abilities to identify areas of opportunity and to promote the company's products utilizing all available channels. Such human resources are clearly impractical for a startup, or a small firm with revenues less than \$1 million. Cost control is one area which often tends to break down, leading to cash flow problems.

3) Identification of a Product Niche

Due to the competitive nature of the software industry, it is essential that Canadian firms identify areas of opportunity, with the objective of finding a product niche for the company. It is especially important for small and medium sized Canadian firms to determine such niches, given the intense competition which characterizes the North American and global software market.

4) Provide a Solution in Demand

Stand alone solutions, such as simple word processing packages, are still in demand; however, a firm is likely to be more successful if it provides the client with a total solution to his requirements. Some suppliers have benefited by providing integrated hardware/software solutions; others by working in conjunction with hardware suppliers to add value to their products. This approach is consistent with a niche seeking strategy.

5) Marketing Program

The most frequently mentioned prerequisite for success following the need to have a product which satisfies a market demand, is the need for an effective marketing program. Although development of the company's products should take precedence in the initial stages, sales of the product will depend to a large extent on a co-ordinated and effective marketing strategy.

6) Transition to a Software Developer

It was suggested that the aspiring Canadian software firms should consider becoming software product distributors as well as developers, to ensure success. Some firms in the past have had great success in starting as providers of professional services or distributors of software products developed by other suppliers, and then making the gradual transition into a full-fledged software developer. This strategy has allowed these companies to build up cash flow in order to secure financing of software product research and development.

7) Export Market

Many Canadian firms find it necessary to pursue export markets in order to support their ambitious plans for growth. These firms have generally found the costs of establishing a direct foreign marketing and distribution presence too much to absorb. Consequently, they have to enter into licensing and distribution arrangements with local suppliers, to secure an effective marketing and distribution capability in such foreign markets. The choice of a good local distributor or agent is often critical to success in penetrating a foreign market.

CHAPTER 6

ROLE OF THE GOVERNMENT

There are no federal government programs designed specifically to assist software companies or the growth of the software industry in Canada. However, there are a number of programs designed to encourage the development of "high technology" industries and to assist firms involved in these industries. The major programs are described below.

1) Industrial and Regional Development Program (IRDP)

The Industrial and Regional Development Program (IRDP) was set up by the Department of Regional Industrial Expansion (DRIE) in June, 1983 (Bill C-165).

This program was intended to replace the following programs administered by the old Department of Industry, Trade and Commerce: Enterprise Development Program (EDP), Support for Technology Enhanced Productivity (STEP), Co-operative Assistance Program (IAP), Regional Development Incentives Act (RDIA), Montreal Special Area Program, and Magdalen Islands Special Area Program.

IRDP will become the new department's major instrument to support industrial development and reduce economic disparities among regions. It is designed with business in mind and will be delivered more efficiently, through the local regional offices of DRIE.

IRDP will be available to manufacturing and processing companies and related service industries in all parts of Canada; software product firms are a recognized category for assistance. The program will provide added incentives to companies in the more economically disadvantaged areas; the amount of assistance available is geared to the perceived needs of the

locality involved. For this purpose, Canada is divided into 4 tier groups according to a development index based on employment, personal income, and provincial fiscal capacity. These tier groups are: Tier Group I (e.g. Metro Toronto), Tier Group II (e.g. Hull, Que.), Tier Group III (e.g. Antigonish, N.S.), and Tier Group IV (e.g. Cornerbrook, Nfld.). Areas in Tier Group IV will receive the largest amount of assistance while Tier Group I areas will receive the smallest amount of assistance. The development index will be updated annually to take account of the changing local economic conditions.

IRDP assistance is given under the following six headings, which correspond to various phases of the corporate and product life cycle: Industrial Development Climate, Innovation, Establishment, Modernization/Expansion, Marketing, and Restructuring.

Financial support available under IRDP varies between 25% to 75% of total project costs, depending on the tier group of the locality and on the nature of the project involved.

The size of the proposed projects involving capital costs is also subject to some requirements. In Tier Group I the minimum approved capital costs is \$100,000 while in Tier Group IV this limit is \$5,000.

Eligible to apply for aid are individuals, partnerships, corporations, cooperatives and non-profit organizations, regardless of ownership or taxation status, if the project is undertaken in Canada. Aid may be given in the form of grants, contributions, participation loans and loan guarantees. DRIE plans to spend some \$2.5 billion in direct assistance to industry in the 1983-85 period.

2) OCS (Office Communication System Program)

The OCS Program is a federal government project administered by the Department of Communications (DOC), with the support of the Department of

Regional Industrial Expansion. The objectives of this program are: to develop Canadian capability in office systems; to encourage research and development; to encourage the manufacturers of integrated office systems in developing marketing expertise for these systems; to act as a testing ground with the hope that these products will achieve worldwide recognition. As a part of Phase II of this program, five OCS Field Trials are being conducted in selected departments of the federal government.

3) IRAP (Industrial Research Assistance Program)

Companies contemplating further product development are eligible for assistance under IRAP. This program, administered by DRIE and associated with the National Research Council, provides eligible companies with financial assistance which may cover as much as 50% of the total project cost. The major stipulation is that the company must conduct its project in conjunction with a Canadian university.

4) New Technology Employment Program

This program is designed to further research and development in technical innovations for manufacturing, product and process development and small scale energy conservation programs. In doing so, grants are available to pay 75% (up to a maximum of \$290.00 per week) of the wages of scientific and technical personnel hired for R&D purposes. This program is associated with the National Research Council.

5) PEMD (Program for Export Market Development)

PEMD is administered by the Department of Regional Industrial Expansion, and provides services to help meet the needs of Canadian exporters, particularly those without previous experience in export marketing.

6) Small Business Loans Program

Under the auspices of the Department of Regional Industrial Expansion and the Small Business Loans Program, the federal government has an excellent mechanism to spur the development of indigenous small firms in Canada. This program provides financing to companies considering creating a new business, expanding an existing business or purchasing new equipment. The Small Business Loans Act (SBLA) will, however, expire in 1985.

6.1 Views of Industry Regarding Government Involvement

During the compilation of the ERC study, 29 representatives of a group of selected companies expressed their opinions regarding the present Canadian Government involvement with and support of the software industry in Canada. In addition, many offered suggestions as to how the current level of government involvement could be improved.

It should be noted that the views in this section were gathered prior to the April 1983 federal budget and prior to the proposals made by various industry sources regarding the treatment of software for tax purposes. Since then, software seems to have been given a more favourable tax treatment under the existing Income Tax Act, and changes to the Act are under consideration.

As shown in Exhibit 20, the views expressed regarding government involvement covered a very wide range. They varied from recommendations for direct intervention in the identification of areas of opportunity in the software industry and financing of products and firms, to recommendations for a minimal government role, with the exception of formulating policy and encouraging the existence of a free market. The major criticisms and suggestions are as follows:

1) Creating an Environment for Fostering a Canadian Software Industry

Almost all suggested that every effort should be made to ensure the existence of a positive financial, legal and regulatory environment which will help to foster a dynamic and competitive software industry in Canada. The creation of such a positive climate may, however, require changes to current institutional attitudes towards the developers of intangible goods like software products.

Many suggested that government should provide tax incentives to new software firms, so that they do not at their formative stage have to bear the burden of unnecessarily high taxes, which might be detrimental to a company's progress and maturation as a corporate entity.

As one company representative pointed out, governments tend to tax modifications to existing software packages in the same manner as car repairs. The software industry interprets this as a clear example of the government's lack of knowledge of software development and its insensitivity towards the livelihood of struggling software firms. Faced with constantly changing consumer demands, software vendors must continually modify and enhance their packages. They often develop totally different functional capabilities, requiring substantial research and development. Repairs to a car, on the other hand, do not improve the original product but rather simply restore it to its original condition.

It was suggested by some that the role of the government should include the establishment of standards in certain areas that the entire industry can follow. The establishment of the "PLP" standard for Telidon was seen by the software industry as a positive step. However, it was also stressed that the government should ensure that regulations are not so stringent that the flow of ideas and their development into products is restrained.

2) Allocation of Grants and/or Subsidies

Many software industry representatives were very critical of the current involvement of the federal government in the allocation of grants and subsidies to the high technology industry. As seen in Exhibit 20, 8 of the 29 industry respondents felt that the government's record of allocating grants has been poor. They felt that the government tended to make poor investment decisions and to spend tax dollars improperly, rather than to support those firms that are acclaimed winners.

Others felt that given the competitive structure of the industry, the government has been preferential in its allocation of grants to specific companies. To improve this situation, some company officials suggested that applications for grants from specified government programs should be better scrutinized to ensure good investment of tax dollars.

3) Market Research, Identification of Areas of Opportunity,
Marketing Support and Business Advice

With the Japanese model in mind, the Canadian software industry believes that the Canadian government is not utilizing its vast human resources to their full potential. Given the large staffs in industrial and economic development-related departments and the network of embassies, consulates and trade offices, some members of the industry believe that the Canadian government can play a leading role in identifying areas of opportunity, and providing software companies with accurate market research information, marketing assistance and sound business advice.

4) Qualifications of the Government and Its Credibility Within Industry

Despite repeated attempts through the years to create a closer relationship between government and business, sections of the business community still cling to a traditional mistrust of the government and its

ability to enhance industry in Canada.

One solution, as suggested by certain company officials, would be to make available information that would be of help to individual firms as well as the industry as a whole in reaching their objectives. Market research information such as assessment of market sizes and growth trends, comparative analyses of Canadian strengths and weaknesses, and identification of areas of opportunity in both domestic and international markets clearly fall into this category. An individual firm may be unable or unwilling to pay the price for procuring such information, but if it is provided by the government to industry as a whole, it could help to improve the decision making process in many firms.

5) Research and Development

A software vendor's continued existence often depends on its ability to channel sufficient amounts of capital and human resources into research and development, as well as to benefit from similar R&D carried out by government, quasi-government or government-funded institutions. A major issue among company representatives was the marginal research and development expenditures by the Canadian government. Expenditures on research and development accounted for 1.07% of the Gross National Product in 1981 and this is expected to increase to 1.5% by 1985. According to representatives of software companies, this increase is not enough. Actual R&D expenditures should account for at least 2% of the GNP.

Secondly, most representatives stated that in the past the government has not provided the proper R&D tax incentives for software companies. According to them, without a change of government policy, the possibility of Canada becoming a world leader in software products will never be realized.

CHAPTER 7

CONCLUSIONS

The quantitative assessments in this report are necessarily tentative, because of the quality of the underlying data and the assumptions involved in making forecasts to 1990 for a dynamic market. Certain broad conclusions can, however, be drawn. These are outlined below:

1. The software market will be a high growth area during the 1980s, in Canada, the U.S. and Western Europe.
2. All three markets are characterized by certain similar basic trends. Thus the use of applications packages, applications generators and systems packages is expected to grow rapidly, while traditional custom development is expected to lose market share. This is primarily due to the high cost of custom development, the relative scarcity of qualified programmers, and the increasing functional capabilities of packages and applications generators.
3. The market for applications packages, applications generators and systems software is at least North American in scope, and in many cases global in nature. The large IBM and IBM-compatible hardware base, both at the mainframe end and the 16-bit microcomputer end of the scale, gives package developers a huge and growing target market.
4. The Canadian software market is dominated by U.S. owned firms, except in the area of custom development. Canadian owned suppliers are very weakly represented in areas like systems packages and applications generators; many Canadian firms simply distribute packages developed abroad.

5. Prerequisites for success in the packaged software market include at least the following:
 - i) Identifying a product niche and providing a software product for which there is an adequate demand;
 - ii) Securing adequate financing;
 - iii) Aggressive marketing and access to a good distribution network;
 - iv) Exploitation of foreign markets, to benefit from economies of scale.
6. The major competition to aspiring Canadian software suppliers comes from established U.S. firms. This is particularly true for the North American and West European markets.
7. There is a wide range of industry views regarding the appropriate role of the federal government in promoting the development of a vigorous and competitive software industry in Canada. There is agreement, however, that the government must do more to provide a positive economic, legal and regulatory environment for the development and growth of the industry.

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EXHIBITS

EXHIBIT 1TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by 1981 Software Revenues)

<u>Company</u>	<u>1981 Ranking</u>	<u>1981 Software Revenues</u>	<u>1980 Ranking</u>	<u>1980 Software Revenues</u>
IBM CANADA LTD	1	182.1	1	145.9
DIGITAL EQUIP.(CAN)	2	37.9	2	24.6
SYSTEMHOUSE LTD.	3	26.0	3	16.2
CANADA SYS.GROUP	4	20.3	7	14.0
B.C. SYS. CORP.	5	19.7	4	18.6
CONTROL DATA CANADA	6	18.1	5	16.3
NCR CANADA LTD.	7	15.2	6	15.0
SPERRY INC.	8	12.7	8	10.6
BURROUGHS INC.	9	11.4	9	9.4
DMR & ASSOC. LTD.	10	11.2	10	7.1
QUASAR SYSTEMS LTD.	11	10.7	12	5.4
HEWLETT-PACKARD	12	8.9	11	7.0
GEAC COMPUTER LTD.	13	7.0	13	4.7
BAILEY & ROSE LTD.	14	5.0	17	3.0
I.P.SHARP ASSOC.LTD.	15	4.4	18	2.6
COMPUTEL SYS.LTD.	16	4.1	15	3.8
ISS INFO. SYS. SERV.	17	3.52	21	2.38
COMPUTECH CONS.CAN.	18	3.9	19	2.5
MSA CANADA INC.	19	3.1	16	3.2
AES DATA LTD.	20	3.1	25	1.8
TANDY (RADIO SHACK)	21	3.0	---	N/A
STS SYSTEMS LTD.	22	3.0	20	2.5
DATA GENERAL(CAN.)	23	2.9	11	2.3
PHILIPS INFO SYS.	24	2.8	24	2.0
TRW CAN.(DATAPOINT)	25	2.8	22	2.2
CINCOM (CAN.) LTD	26	2.8	23	2.2
CULLINANE CAN. LTD.	27	2.6	53	.5
XEROX CANADA INC.	28	2.3	26	1.7
WANG CANADA LTD.	29	2.2	39	1.1
MOHAWK DATA SCI.	30	2.2	27	1.7
NFLD & LAB.COMP SER.	31	2.1	28	1.6
SYDNEY DEV. CORP.	32	2.1	75	.23
APPLE CANADA LTD.	33	1.9	34	1.2
ACT COMP.SER.LTD.	34	1.9	45	.8
UNIVERSITY COMP.	35	1.9	32	1.3
HONEYWELL LTD.	36	1.8	31	1.4
CTS COMPUTER SYS.	37	1.8	35	1.2
LE GROUP BST LTD.	38	1.8	29	1.5
CABLESHARE INC.	39	1.7	40	1.1
CGE(INFO. SERV.)	40	1.6	33	1.3
TANDEM COMP.CAN.	41	1.5	54	.5
ICL CANADA LTD.	42	1.5	30	1.5
NAS CANADA LTD.	43	1.5	36	1.2
TYME SYSTEMS LTD.	44	1.5	46	.8

Source: Evans Research Corporation

Continued

EXHIBIT 1 (Continued)

TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by 1981 Software Revenues)

<u>Company</u>	<u>1981 Ranking</u>	<u>1981 Software Revenues</u>	<u>1980 Ranking</u>	<u>1980 Software Revenues</u>
FOUR PHASE SYS. LTD	45	1.3	37	1.2
DYAD COMPUTER SYS.	46	1.26	43	1.02
IST INC.	47	1.2	42	1.0
PRIME COMPUTER(CAN)	48	1.2	41	1.1
ELECTROHOME LTD.	49	1.2	44	.9
NABU MANU. CORP.	50	1.1	---	N/A
COMPUTREX CENTRES	51	1.1	38	1.2
OMNITECH GRAPHICS	52	1.1	88	.05
ADP INC.	53	1.0	47	.8
AHEARN & SOPER INC.	54	.9	48	.7
NELMA DATA CORP.	55	.8	59	.4
NORTHERN TELECOM	56	.792	49	.63
PERKIN-ELMER(CAN.)	57	.7	50	.6
REAL TIME DATAPRO	58	.64	52	.51
STC CANADA INC.	59	.6	66	.3
SASKCOMP	60	.6	60	.4
COMPUTER SC.CAN.	61	.6	51	.6
COMMODORE BUS.MACH.	62	.6	61	.4
OLIVETTI CAN. LTD.	63	.5	55	.5
TEXAS INSTRUMENTS	64	.5	56	.5
DATALINE INC.	65	.5	62	.4
CENTRONICS CAN.INC.	66	.5	57	.5
DIGITECH LTD.	67	.5	63	.4
NIXDORF CANADA LTD.	68	.5	76	.2
MICOS INC.	69	.5	67	.3
MARITIME COMPUTERS	70	.45	64	.35
POLYCOM SYSTEMS LTD	71	.45	65	.33
BOEING COMP.SERV.	72	.42	58	.42
TEKTRONIX CAN.INC.	73	.4	77	.2
AUTOMATION CEN.	74	.4	68	.3
G.A. COMPUTER LTD.	75	.4	69	.3
NORPAK LTD.	76	.35	74	.25
AMDAHL LTD.	77	.3	84	.1
LANPAR TECH. INC.	78	.3	70	.3
CONS. COMP. INC.	79	.3	78	.2
DATA TERMINAL MART	80	.3	79	.2
NAT. DATACENTRES	81	.3	71	.3
GREYHOUND COMP.	82	.3	72	.3
PLESSEY PER. SYS.	83	.3	80	.2
D.E. McMULLEN&ASSOC.	84	.26	73	.26
ANDERSON JACOBSON	85	.25	82	.18
ITT CANADA LTD.	86	.2	85	.1

Source: Evans Research Corporation

Continued

EXHIBIT 1 (Continued)

TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by 1981 Software Revenues)

<u>Company</u>	<u>1981 Ranking</u>	<u>1981 Software Revenues</u>	<u>1980 Ranking</u>	<u>1980 Software Revenues</u>
RECOGNITION EQUIP.	87	.2	86	.1
VOLKER-CRAIG LTD.	88	.2	87	.1
DIGITAL BUS.COMP.	89	.2	81	.2
NORANGO COMP.SYS.	90	.18	83	.15
ESE LIMITED	91	.1	89	.05
K.O. MAIR & ASSOC.	92	.1	90	.05
MATROX ELECT. SYS.	93	.09	91	.05
COMCHEQ SERV. LTD.	94	.08	92	.05
COVERALL COMP.SERV.	95	.08	93	.05
CYBERNEX LTD.	96	.078	94	.05
COMTECH GROUP INTER.	97	.05	95	.05
RILEY'S DATASHARE	98	.02	96	.01
DATA CROWN INC.	99	0.0	97	0.0
MAI CANADA LTD.	100	0.0	98	0.0
MEMOREX CANADA LTD.	101	0.0	99	0.0
GANDALF TECH. INC.	102	0.0	100	0.0
CHERNEY-MILLS INC.	103	0.0	101	0.0
MANITOBA DATA SERV.	104	0.0	102	0.0
GENERAL DATACOMM	105	0.0	103	0.0
COMSHARE LTD.	106	0.0	104	0.0
COMTERM INC.	107	0.0	105	0.0
TELEX-TULSA COMP.	108	0.0	106	0.0
ZENTRONICS DIV.	109	0.0	107	0.0
DEVELCON ELECT.LTD.	110	0.0	108	0.0
DASCO DATA PRODUCTS	111	0.0	109	0.0
DATAMEX LTD.	112	0.0	110	0.0
NCR COMTEN INC.	113	0.0	111	0.0
CYBERSHARE LTD.	114	0.0	112	0.0
MICR SYSTEMS LTD.	115	0.0	113	0.0
DP CONSULTANTS	116	0.0	114	0.0
ZAVITZ ELECTRONICS	117	0.0	115	0.0
BOOTHE COMP. LTD.	118	0.0	116	0.0
COMPUTER UT. MAN.	119	0.0	117	0.0
ALTEL DATA	120	0.0	118	0.0
ALPHATEXT INC.	121	0.0	119	0.0
DATATECH SYSTEMS	---	N/A	---	N/A
TOTAL		\$486.77		\$365.72

Source: Evans Research Corporation

EXHIBIT 2

TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by Software Revenues as a percentage of the company's total EDP Revenues)

<u>Company</u>	<u>1981 Rank</u>	<u>Percentage of 1981 EDP Revenues</u>	<u>Total 1981 EDP Revenues (Millions)</u>	<u>1980 Rank</u>	<u>Percentage of 1980 EDP Revenues</u>	<u>Total 1980 EDP Revenues (Millions)</u>
CULLINANE CAN.	1	100.0	2.6	1	100.0	.5
BAILEY & ROSE	2	100.0	5.0	2	100.0	3.0
COMPUTECH CONS.	3	100.0	3.9	3	100.0	2.5
MSA CANADA INC.	4	100.0	3.1	4	100.0	3.2
CINCOM SYS.CAN.	5	100.0	2.8	5	100.0	2.2
UNIVERSITY COMP.	6	100.0	1.9	6	100.0	1.3
QUASAR SYS.LTD.	7	96.4	11.1	7	94.7	5.7
ISS INFO.SYS.SERV8		95.0	3.7	8	95.0	2.5
SYSTEMHOUSE LTD.	9	85.3	30.5	9	83.9	19.3
DMR & ASSOC.LTD.	10	60.0	18.7	10	60.0	11.9
DYAD COMPUTER SYS11		60.0	2.1	11	60.0	1.7
LE GROUP BST LTD.12		50.0	3.5	12	50.0	3.0
SYDNEY DEV. CORP	13	42.9	4.9	13	38.8	.6
OMNITECH GRAPHICS14		39.2	2.6	23	16.0	.3
B.C. SYS. CORP	15	34.0	57.9	14	37.9	49.1
STS SYSTEMS LTD.	16	33.3	9.0	15	36.8	6.8
COMPUTREX CENTR.	17	31.0	3.5	16	31.6	3.8
NFLD.& LAB.COMP.	18	25.0	8.4	19	21.9	7.5
CABLESHARE INC.	19	25.0	6.6	17	25.0	4.2
TYME SYSTEMS LTD	20	25.0	5.9	20	20.0	4.2
CTS COMPUTER SYS.21		25.0	7.0	18	25.0	4.7
ACT COMP. SERV.	22	24.0	7.5	26	11.0	6.8
CANADA SYS. GR.	23	20.0	101.5	21	20.0	77.9
GEAC COMP.LTD.	24	20.0	34.2	22	20.0	23.6
NABU MANU.CORP	25	15.7	7.0	----	----	N/A
DIGITAL EQUIP.	26	15.0	252.6	24	15.0	163.7
PLESSEY PER.SYS.	27	15.0	2.2	28	10.0	1.8
IBM CANADA LTD.	28	12.0	1,517.7	25	12.0	1,216.5
G.A.COMPUTER LTD	29	12.0	3.7	29	10.0	2.7
HEWLETT-PACKARD	30	11.0	81.0	27	11.0	63.5
CONTROL DATA CAN.31		10.0	181.3	30	10.0	162.6
NCR CANADA LTD.	32	10.0	152.4	31	10.0	150.1
BURROUGHS INC.	33	10.0	114.0	32	10.0	94.0
I.P.SHARP ASSOC.	34	10.0	42.0	57	7.0	35.3
COMPU TEL SYS.LTD.35		10.0	41.3	33	10.0	38.4
DATA GENERAL(CAN)36		10.0	29.0	34	10.0	23.0
TRW (DATAPOINT)	37	10.0	28.0	35	10.0	22.0
MDS CANADA LTD.	38	10.0	22.3	36	10.0	16.5
APPLE CAN.LTD.	39	10.0	20.1	----	----	0.0
TANDEM COMP.CAN.	40	10.0	15.7	37	10.0	5.2
ICL CANADA LTD.	41	10.0	15.0	38	10.0	15.3
FOUR PHASE SYS.	42	10.0	13.4	39	10.0	12.4
PRIME COMPUTER	43	10.0	13.0	40	10.0	10.0
ELECTROHOME LTD.	44	10.0	12.0	41	10.0	9.2
NELMA DATA CORP	45	10.0	7.6	42	10.0	4.2
PERKIN-ELMER(CAN)46		10.0	6.8	43	10.0	6.1
REAL TIME DATAPRO47		10.0	6.4	44	10.0	5.1

EXHIBIT 2 (Continued)

TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by 1981 Software Revenues as a percentage of the company's total EDP Revenues)

<u>Company</u>	<u>1981 Rank</u>	<u>Percentage of 1981 EDP Revenues</u>	<u>Total 1981 EDP Revenues (Millions)</u>	<u>1980 Rank</u>	<u>Percentage of 1980 EDP Revenues</u>	<u>Total 1980 EDP Revenues (Millions)</u>
MICOS INC.	48	10.0	5.0	45	10.0	3.2
MARITIME COMP.	49	10.0	4.5	46	10.0	3.5
POLYCOM SYS.LTD.	50	10.0	4.5	47	10.0	3.3
BOEING COMP.SER.	51	10.0	4.2	48	10.0	4.2
AUTOMATION CEN.	52	10.0	4.0	49	10.0	3.0
D.E McMULLEN	53	10.0	2.6	50	10.0	2.6
ANDERSON JACOB.	54	10.0	2.5	51	10.0	1.8
DIGITAL BUS.COM.	55	10.0	2.2	52	10.0	2.2
NORANGO COM.SYS	56	10.0	1.8	53	10.0	1.5
SPERRY INC.	57	9.0	141.0	54	8.0	132.0
NIXDORF CANADA	58	8.0	5.8	55	8.0	2.9
TANDY(RADIO SH.)	59	7.5	39.7	---	---	22.3
AHEARN & SOPER	60	6.4	14.0	58	5.5	12.8
CENTRONICS CAN.	61	5.5	9.1	56	7.4	6.8
XEROX CANADA	62	5.0	45.2	59	5.0	33.9
WANG CANADA LTD	63	5.0	44.5	60	5.0	21.0
CGE(INFO.SERV.)	64	5.0	31.0	61	5.0	26.0
IST INC.	65	5.0	23.8	62	5.0	20.4
ADP INC.	66	5.0	20.0	63	5.0	16.7
COMPUTER SC.CAN	67	5.0	12.2	64	5.0	11.2
COMMODORE BUS.	68	5.0	11.9	65	5.0	7.4
TEXAS INSTR.	69	5.0	10.0	66	5.0	10.8
DATALINE INC.	70	5.0	9.9	67	5.0	8.2
DIGITECH LTD.	71	5.0	9.0	68	5.0	7.9
NORPAK LTD.	72	5.0	7.0	69	5.0	5.0
NAT. DATACENTRE	73	5.0	6.3	70	5.0	5.2
GREYHOUND COMP.	74	5.0	5.9	71	5.0	5.1
SASKCOMP	75	4.0	16.8	73	3.3	12.8
TEKTRONIX CAN.	76	4.0	9.0	72	4.0	6.0
NORTHERN TELECOM	77	3.0	26.4	74	3.0	21.0
DATA TER.MART	78	3.0	8.5	75	2.0	7.5
K.O.MAIR&ASSOC.	79	2.44	4.1	86	1.52	3.3
HONEYWELL LTD	80	2.1	86.0	85	1.9	68.6
PHILIPS INFO.	81	2.0	140.0	76	2.0	100.3
OLIVETTI CAN.	82	2.0	26.5	77	2.0	24.0
LANPAR TECH.	83	2.0	16.4	78	2.0	15.0
CONS. COMP.INC.	84	2.0	15.3	79	2.0	11.9
ITT CANADA LTD.	85	2.0	9.5	80	2.0	7.2
RECOGNITION EQ.	86	2.0	8.1	81	2.0	6.3
VOLKER-CRAIG	87	2.0	7.6	82	2.0	6.3
COMCHEQ SERV.	88	2.0	4.8	83	2.0	3.6
COVERALL COMP.S	89	2.0	4.2	84	2.0	2.6

EXHIBIT 2 (Continued)TOP COMPANIES IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

(Ranked by 1981 Software Revenues as a percentage of the company's total EDP Revenues)

<u>Company</u>	<u>1981 Rank</u>	<u>Percentage of 1981 EDP Revenues</u>	<u>Total 1981 EDP Revenues (Millions)</u>	<u>1980 Rank</u>	<u>Percentage of 1980 EDP Revenues</u>	<u>Total 1980 EDP Revenues (Millions)</u>
AES DATA LTD.	90	1.8	172.8	88	1.2	155.4
CYBERNEX LTD.	91	1.5	5.2	87	1.5	3.1
AMDAHL LTD.	92	1.1	72.6	94	.58	43.0
STC CANADA LTD	93	1.0	56.4	89	1.0	28.8
NAS CANADA LTD.	94	1.0	15.0	90	1.0	12.0
ESE LIMITED	95	1.0	10.0	91	1.0	5.4
MATROX ELECT.	96	1.0	8.7	92	1.0	4.7
COMTECH GR.INT.	97	1.0	5.8	93	1.0	5.7
RILEY'S DATASH.	98	.5	5.6	95	.5	5.1
DATA CROWN INC.	99	0.0	86.2	96	0.0	68.6
MAI CANADA LTD	100	0.0	47.1	97	0.0	39.4
MEMOREX CANADA	101	0.0	40.5	98	0.0	30.8
GANDALF TECH.	102	0.0	40.2	99	0.0	26.2
CHERNEY-MILLS	103	0.0	15.9	100	0.0	20.7
MANI.DATA.SERV.	104	0.0	15.5	101	0.0	13.0
GENERAL DATACO.	105	0.0	13.9	102	0.0	12.5
COMSHARE LTD	106	0.0	10.2	103	0.0	7.6
COMTERM INC.	107	0.0	9.5	104	0.0	6.0
TELEX-TULSA	108	0.0	9.0	105	0.0	6.0
ZENTRONICS DIV.	109	0.0	8.0	106	0.0	4.0
DASCO DATA PROD.	110	0.0	6.2	107	0.0	5.1
DATAMEX LTD.	101	0.0	5.7	108	0.0	4.8
NCR COMTEN INC.	112	0.0	5.2	109	0.0	2.5
CYBERSHARE LTD.	113	0.0	4.6	110	0.0	4.3
MICR SYSTEMS	114	0.0	4.2	111	0.0	4.2
DP CONSULTANTS	115	0.0	3.6	112	0.0	3.0
ZAVITZ ELECT.	116	0.0	3.2	113	0.0	2.6
BOOTHE COMP.LTD.	117	0.0	3.0	114	0.0	2.9
COMPUTER UT.MAN.	118	0.0	2.6	115	0.0	2.1
ALTEL DATA	119	0.0	15.0	116	0.0	12.0
GENERAL DATACOM	120	0.0	13.9	117	0.0	12.5
ALPHATEXT INC.	121	0.0	4.9	118	0.0	4.7
DATATECH SYST.	---	N/A	6.5	---	N/A	4.8

Source: Evans Research Corporation

EXHIBIT 3

ESTIMATED SOFTWARE REVENUES OF THE 53 KEY SOFTWARE
SUPPLIERS BY VENDOR TYPE IN THE CANADIAN SOFTWARE INDUSTRY

<u>Vendor Type</u>	<u>No. of Firms</u>	<u>Total 1981 Software Revenues (\$ Millions)</u>	<u>Total 1980 Software Revenues (\$ Millions)</u>	<u>Percentage Growth 1980-1981</u>
HARDWARE MANUFACTURERS	24	326.4	254.4	28.3
Mainframe Manufacturers	6	227.6	184.8	23.2
Minicomputer Manufacturers	11	82.4	61.8	33.3
Microcomputer Manufacturers	3	6.0	1.2	400.0
Word Processor Manufacturers	4	10.4	6.6	57.6
SERVICE BUREAUX	11	59.4	46.9	26.9
SOFTWARE HOUSES AND EDP CONSULTING FIRMS	11	72.18	43.73	65.1
OEM'S SYSTEMHOUSES, DISTRIBUTORS AND THIRD PARTY COMPANIES	5	9.2	6.05	52.1
TERMINAL AND PERIPHERAL EQUIPMENT SPECIALISTS	2	2.8	2.2	27.3
TOTAL	53	469.98	353.18	33.1
GRAND TOTAL		608.27	456.83	

Source: Evans Research Corporation

(Continued)

EXHIBIT 3 (Continued)

<u>Vendor Type</u>	<u>Percentage of Total 1981 Software Revenues Generated by the Key 53 Software Suppliers</u>	<u>Percentage of Total 1980 Software Revenues Generated by the Key 53 Software Suppliers</u>	<u>Percentage of Total 1981 Canadian Software Market</u>	<u>Percentage of Total 1980 Canadian Software Market</u>
HARDWARE MANUFACTURERS	69.4	72.0	54.1	56.5
Mainframe Manufacturers	48.4	52.3	37.7	41.1
Minicomputer Manufacturers	17.5	17.5	13.7	13.7
Microcomputer Manufacturers	1.28	.3	1.0	.3
Word Processor Manufacturers	2.2	1.9	1.7	1.5
SERVICE BUREAUX	12.6	13.3	9.8	10.4
SOFTWARE HOUSES AND IDP CONSULTING FIRMS	15.4	12.4	12.0	9.7
OEM'S SYSTEMHOUSES, DISTRIBUTORS AND THIRD PARTY COMPANIES	2.0	1.7	1.5	1.34
TERMINAL AND PERIPHERAL EQUIPMENT SPECIALISTS	.6	.6	.5	.5
TOTAL			77.9✓	78.4

Source: Evans Research Corporation

EXHIBIT 4

GEORGAPHIC DISTRIBUTION OF 53 KEY SOFTWARE SUPPLIERS IN CANADA

COUNTRY OF OWNERSHIP	TYPE OF VENDOR	LOCATION					Quebec		B.C.		Alberta		NFLD.	TOTAL
		Metro Toronto	Metro Ottawa	Kichener	London	Barrie	Metro Montreal		Van. Vic.		Edm.	Cal.	St. John's	
United States	Mainframe	6												6
	Minicomputer	8	1											9
	Microcomputer	1				1								2
	Word Processor	2												2
	Serv. Bureau	2									1			3
	OEM, System-house, Dis. &													
	3rd Party Spec.													0
	Ter & Per Spec.	1												1
	Software Houses	3												3
	Sub-total	23	1			1					1			26
Canada	Mainframe													0
	Minicomputer	1												1
	Microcomputer		1											1
	Word Processor						1							1
	Serv. Bureau	3			1		1		1		1		1	8
	OEM, System-house, Dis. &	1	1				3							5
	3rd Party Spec.													
	Ter & Per Spec.			1										1
	Software House	1	3				1		2	1				8
	Sub-total	6	5	1	1		6		2	2		1	1	25
Netherlands	Word Processor						1							1
	Sub-total						1							1
United Kingdom	Minicomputer	1												1
	Sub-total	1												1
TOTAL		30	6	1	1	1	7		2	2	1	1	1	53

EXHIBIT 5SOFTWARE SUPPLIERS IN THE CANADIAN SOFTWARE INDUSTRY BY
COUNTRY OF OWNERSHIP

<u>Country</u>	<u>Top EDP Companies (1) Reporting Software Revenues</u>	<u>Key 53 Software Suppliers</u>
UNITED STATES	40	26
CANADA	52	25
UNITED KINGDOM	2	1
BAHAMAS	1	-
FRANCE	1	-
ITALY	1	-
NETHERLANDS	1	1
TOTAL	98	53

Source: Evans Research Corporation

(1) As provided in Evans Research Corporation's EDP In-Depth Report entitled, "The Top Computer Companies In Canada."

EXHIBIT 6

VENDOR'S SHARE OF THE CANADIAN SOFTWARE MARKET BY COUNTRY OF OWNERSHIP

<u>Country</u>	<u>1981 Software Revenues (\$Millions)</u>	<u>1980 Software Revenues (\$Millions)</u>	<u>Percentage Change</u>	<u>Percentage of Total 1981 Market</u>	<u>Percentage of Total 1980 Market</u>	<u>Percentage Increase 1980-1981 Market</u>
(1) United States	398.19	308.86	29.5	65.5	67.6	-2.3
(2) Canada	203.97	143.17	44.0	33.5	31.3	+2.3
West Germany	.5	.2	150.0	.08	.03	+ .04
United Kingdom	1.8	1.7	5.9	.3	.4	- .1
Netherlands	2.8	2.0	40.0	.5	.4	+ .01
Italy	.5	.5	0	.08	0.1	- .02
Bahamas	.6	.4	50	.1	.1	-
Total	608.27	456.83	33.1	100.06	99.84	

Source: Evans Research Corporation

- (1) Includes 55% of revenues generated by those software suppliers with less than \$1.0 million total software revenues.
- (2) Includes 45% of revenues generated by those software suppliers with less than \$1.0 million total software revenues.

EXHIBIT 7

ESTIMATED EMPLOYMENT IN SOFTWARE DEVELOPMENT IN CANADA IN 1982

<u>Type of Software Vendor</u>	<u>Total Number Of Employees</u>	<u>Number of Employees In Software Development</u>	<u>Percentage In Software Development</u>
Mainframe	17,765	675	3.8
Minicomputer	7,310	731	10.0
Microcomputer	2,450	69	2.8
Word Processing	3,775	189	5.0
OEM'S, Systemhouses, Distributors and 3rd Party Companies	1,850	93	5.0
Service Bureaux	8,604	886	10.3
Terminal and Peripheral Equipment Specialists	1,375	69	5.0
Software Houses and EDP Consulting Firms	1,990	343	17.3
Other (1)	<u>1,600</u>	<u>1,200</u>	<u>75.0</u>
TOTAL	38,201	4,255	11.1

Source: Evans Research Corporation

(1) Estimated 400 firms with Total Software Revenues less than \$1 million.

EXHIBIT 8

CANADIAN SOFTWARE INDUSTRY FORECAST TO 1990

<u>SOFTWARE TYPE</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
SYSTEM SOFTWARE						
- \$ Millions	128	174	233	313	425	568
- % Growth		36	34	35	36	34
- Percentage of Total Market	28	29	29	30	30	31
APPLICATIONS SOFTWARE						
- \$ Millions	114	161	223	310	434	596
- % Growth		41	38	39	40	37
- Percentage of Total Market	25	27	28	30	31	33
SYSTEM DEVELOPMENT						
- \$ Millions	215	273	341	428	540	669
- % Growth		27	25	26	26	24
- Percentage of Total Market	47	45	43	41	39	37
TOTAL	457	608	797	1,052	1,399	1,833
- % Growth		33	31	32	33	31

<u>SOFTWARE TYPE</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>Average Annual Growth Rate 1980-1990</u>
SYSTEM SOFTWARE						
- \$ Millions	741	952	1,202	1,493	1,824	
- % Growth	30	28	26	24	22	31%
- Percentage of Total Market	32	32	33	33	34	
APPLICATIONS SOFTWARE						
- \$ Millions	798	1,049	1,356	1,721	2,146	
- % Growth	34	32	29	27	25	34%
- Percentage of Total Market	34	36	37	39	40	
SYSTEM DEVELOPMENT						
- \$ Millions	807	955	1,107	1,256	1,395	
- % Growth	21	18	16	14	11	21%
- Percentage of Total Market	34	32	30	28	26	
TOTAL	2,346	2,956	3,665	4,471	5,365	
- % Growth	28	26	24	22	20	28%

Source: Evans Research Corporation

EXHIBIT 9

ESTIMATED SOFTWARE REVENUES BY VENDOR TYPE IN THE CANADIAN SOFTWARE MARKET
FORECAST TO 1990

<u>Vendor Type</u>	<u>Actual</u>		<u>Forecast</u>			
	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
① HARDWARE MANUFACTURERS						
- \$ Millions	258	331	419	533	683	860
- % Growth		28	26	27	28	26
- Percentage of Total Market	56	54	53	51	49	47
② SERVICE BUREAUX						
- \$ Millions	51	64	89	124	173	238
- % Growth		27	39	39	40	37
- Percentage of Total Market	11	11	11	12	12	13
③ SOFTWARE HOUSES AND EDP CONSULTING FIRMS						
- \$ Millions	135	194	263	359	493	666
- % Growth		44	36	37	37	35
- Percentage of Total Market	30	32	33	34	35	36
OEM'S, SYSTEMHOUSES, DISTRIBUTORS AND THIRD PARTY COMPANIES						
- \$ Millions	9	13	18	25	34	46
- % Growth		43	37	38	38	36
- Percentage of Total Market	2	2	2	2	2	3
TERMINAL AND PERIPHERAL EQUIPMENT SPECIALISTS						
- \$ Millions	4	6	9	13	18	26
- % Growth		42	42	42	43	40
- Percentage of Total Market	1	1	1	1	1	1
TOTAL						
- \$ Millions	457	608	797	1,052	1,399	1,833
- % Growth		33	31	32	33	31

Source: Evans Research Corporation

continued.....

EXHIBIT 9 (Continued)

ESTIMATED SOFTWARE REVENUES BY VENDOR TYPE IN THE CANADIAN SOFTWARE MARKET
FORECAST TO 1990

<u>Vendor Type</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>Average Annual Growth 1980-1990</u>
① HARDWARE MANUFACTURERS						
- \$ Millions	1,056	1,275	1,512	1,761	2,012	
- % Growth	23	21	19	16	14	23%
- Percentage of Total Market	45	43	41	39	38	
② SERVICE BUREAUX						
- \$ Millions	318	419	542	688	858	
- % Growth	34	32	29	27	25	33%
- Percentage of Total Market	14	14	15	15	16	
③ SOFTWARE HOUSES AND EDP CONSULTING FIRMS						
- \$ Millions	879	1,141	1,457	1,827	2,253	
- % Growth	32	30	28	25	23	33%
- Percentage of Total Market	37	39	40	41	42	
OEM'S, SYSTEMHOUSES, DISTRIBUTORS AND THIRD PARTY COMPANIES						
- \$ Millions	62	80	103	130	161	
- % Growth	33	31	28	26	24	33%
- Percentage of Total Market	3	3	3	3	3	
TERMINAL AND PERIPHERAL EQUIPMENT SPECIALISTS						
- \$ Millions	35	44	55	67	80	
- % Growth	36	26	24	22	20	34%
- Percentage of Total Market	2	2	2	2	2	
TOTAL						
- \$ Millions	2,346	2,956	3,665	4,471	5,365	
- % Growth	28	26	24	22	20	28%

Source: Evans Research Corporation

EXHIBIT 10TOP MAINFRAME VENDORS IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
IBM CANADA LTD	182.1	145.9	12.0	12.0	C
CONTROL DATA CAN. LTD.	18.1	16.3	10.0	10.0	C
SPERRY INC.	12.7	10.6	9.0	8.0	B
BURROUGHS INC.	11.4	9.4	10.0	10.0	B
HONEYWELL LTD.	1.8	1.4	2.1	1.9	C
NAS CANADA LTD.	1.5	1.2	1.0	1.0	B
AMDAHL LTD.	.3	.1	1.1	.58	B
TOTAL	227.9	184.9			

Increase of \$43.0 or 23.3%

Percentage of Total Software Revenues. 37.8% 41.1%

Average Software Revenues per company that reported software revenues. 32.6 26.4

Average Software Revenues per company that reported software revenues of \$1 million or more. 37.9 30.8

Source: Evans Research Corporation

EXHIBIT 11TOP MINICOMPUTER VENDORS IN THE CANADIAN INFORMATION PROCESSING
INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
DIGITAL EQUIP. OF CAN.	37.9	24.6	15.0	15.0	B
NCR CANADA LTD.	15.2	15.0	10.0	10.0	C
HEWLETT-PACKARD(CAN.)LTD	8.9	7.0	11.0	11.0	C
GEAC COMP.CORP.LTD.	7.0	4.7	20.0	20.0	B
DATA GENERAL(CAN.) LTD.	2.9	2.3	10.0	10.0	C
TRW CANADA(DATAPOINT)LTD.	2.8	2.2	10.0	10.0	C
MOHAWK DATA SC. CAN. LTD.	2.2	1.7	10.0	10.0	B
TANDEM COMPUTERS CAN.LTD.	1.5	.5	10.0	10.0	C
ICL CANADA LTD.	1.5	1.5	10.0	10.0	C
FOUR PHASE SYSTEMS LTD.	1.3	1.2	10.0	10.0	C
PRIME COMPUTER CAN. LTD.	1.2	1.1	10.0	10.0	B
PERKIN-ELMER CAN. LTD.	.7	.6	10.0	10.0	C
TEXAS INSTRUMENTS CAN.LTD	.5	.5	5.0	5.0	B
NIXDORF CANADA LTD.	.5	.2	8.0	8.0	B
MAI CANADA LTD.	0.0	0.0	0.0	0.0	B
TOTAL	84.1	63.1			
Increase of	\$21.0 or 33.3%				
Percentage of Total Software Revenues.	14.0%	14.0%			
Average Software Revenues per company that reported software revenues.	5.6	4.2			
Average Software Revenues per company that reported software revenues of \$1 million or more.	7.5	5.6			

Source: Evans Research Corporation

EXHIBIT 12TOP MICROCOMPUTER VENDORS IN THE CANADIAN INFORMATION PROCESSING
INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
TANDY ELECT.(RADIO SH.)	3.0	N/A	7.5	N/A	A
APPLE CANADA LTD.	1.9	1.2	10.0	10.0	C
NABU MANU. CORP.	1.1	N/A	15.7	0.0	B
NORTHERN TELECOM LTD.	.79	.63	3.0	3.0	B
COMMODORE BUS. MACH. LTD.	.6	.4	5.0	5.0	C
TOTAL	7.39	2.23			
Increase of	\$5.16 or 201.2%				
Percentage of Total Software Revenues.	1.2%	.5%			
Average Software Revenues per company that reported software revenues.	1.5	.4			
Average Software Revenues per company that reported software revenues of \$1 million or more.	2.0	N/A			

Source: Evans Research Corporation

EXHIBIT 13TOP WORD PROCESSING COMPANIES IN THE CANADIAN INFORMATION PROCESSING
INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
AES DATA LTD.	3.1	1.8	1.8	1.2	C
PHILLIP INFO. SYS. LTD.	2.8	2.0	2.0	2.0	C
XEROX CANADA INC.	2.3	1.7	5.0	5.0	C
WANG CANADA LTD.	2.2	1.1	5.0	5.0	C
NELMA DATA CORPORATION	.8	.4	10.0	10.0	B
OLIVETTI CANADA LTD.	.5	.5	2.0	2.0	C
TOTAL	11.7	7.5			
Increase of	\$4.2 or 56%				
Percentage of Total Software Revenues.	2.0%	1.7%			
Average Software Revenues per Company that reported software revenues.	2.0	1.3			
Average Software Revenues per Company that reported software revenues of \$1 million or more.	2.6	1.7			

Source: Evans Research Corporation

EXHIBIT 14TOP SOFTWARE HOUSES AND EDP CONSULTING FIRMS IN THE CANADIAN
INFORMATION PROCESSING INDUSTRY 1

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
SYSTEMHOUSE LTD	26.0	16.2	85.3	83.9	B
DMR & ASSOC.LTD.	11.2	7.1	60.0	60.0	B
QUASAR SYSTEMS LTD.	10.7	5.4	96.4	94.7	B
BAILEY & ROSE LTD.	5.0	3.0	100.0	100.0	B
COMPUTECH CONS. CAN.	3.9	2.5	100.0	100.0	B
ISS INFO. SYS. SERV.	3.52	2.38	95.0	95.0	B
MSA CANADA INC.	3.1	3.2	100.0	100.0	B
CINCOM(CANADA)LTD.	2.8	2.2	100.0	100.0	B
CULLINANE CANADA, LTD.	2.6	.5	100.0	100.0	B
SYDNEY DEVELOPMENT CORP.	2.1	.23	42.86	38.83	A
DYAD COMPUTER SYSTEMS	1.26	1.02	60.0	60.0	C
TOTAL	72.18	43.73			

Increase of \$28.45 or 65.0%

Percentage of Total
Software Revenues 12.0% 9.7%

Average Software
Revenues per Company
that reported software
revenues. 6.6 4.0

Average Software
Revenues per Company
that reported software
revenues of \$1 million
or more. 6.6 4.0

1 NOTE: These figures do not include those firms with annual total
revenues below \$1.8 million.

Source: Evans Research Corporation

EXHIBIT 15

TOP SERVICE BUREAUX IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

Company	Estimated Software Revenues (\$Millions)		Percentage of Total EDP Revenues		Code
	1981	1980	1981	1980	
CANADA SYSTEMS GROUP	20.3	14.0	20.0	20.0	B
B.C. SYSTEMS CORP.	19.7	18.6	34.0	37.9	A
I.P.SHARP ASSOC.LTD.	4.4	2.6	10.0	7.0	A
COMPUDEL SYS.LTD.	4.1	3.8	10.0	10.0	C
NFLD & LAB.COMP.SERV.	2.1	1.6	25.0	21.9	A
ACT. COMP. SERV. LTD.	1.9	.8	24.0	11.0	B
UNIVERSITY COMP.CO.CAN.	1.9	1.3	100.0	100.0	A
CABLESHARE INC.	1.7	1.1	25.0	25.0	B
IST INC.	1.2	1.0	5.0	5.0	C
COMPUTREX CENTRES LTD.	1.1	1.2	31.0	31.6	A
ADP INC.	1.0	.8	5.0	5.0	C
REAL TIME DATAPRO LTD.	.64	.51	10.0	10.0	B
SASKCOMP	.6	.4	4.0	3.3	B
COMPUTER SCIENCES CAN.	.6	.6	5.0	5.0	C
DATALINE INC.	.5	.4	5.0	5.0	C
DIGITECH LTD.	.5	.4	5.0	5.0	C
POLYCOM SYSTEMS LTD.	.45	.33	10.0	10.0	C
BOEING COMP.SERV.CAN.LTD.	.42	.42	10.0	10.0	C
AUTOMATION CENTRES	.4	.3	10.0	10.0	C
NATIONAL DATACENTRES	.3	.3	5.0	5.0	B
COMCHEQ SERVICES LTD.	.08	.05	2.0	2.0	C
COVERALL COMPUTER SERV.	.08	.05	2.0	2.0	B
COMTECH GROUP INTERN.	.05	.05	1.0	1.0	B
RILEY'S DATASHARE	.02	.01	.5	.5	B
DATACROWN INC.	0.0	0.0	0.0	0.0	B
MANITOBA DATA SERVICES	0.0	0.0	0.0	0.0	B
COMSHARE LTD.	0.0	0.0	0.0	0.0	B
ALPHATEXT INC.	0.0	0.0	0.0	0.0	B
CYBERSHARE LTD.	0.0	0.0	0.0	0.0	B
MICR SYSTEMS LTD.	0.0	0.0	0.0	0.0	B
TOTAL	64.04	50.62			

Increase of \$13.42 or 26.5%

Percentage of Total Software Revenues. 10.6% 11.2%

Average Software Revenues per Company that reported software revenues. 2.7 2.1

Average Software Revenues per Company that reported software revenues of \$1 million or more. 5.4 4.3

EXHIBIT 16

TOP OEM's, SYSTEMHOUSES, DISTRIBUTORS AND THIRD PARTY COMPANIES
IN THE CANADIAN INFORMATION PROCESSING INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
STS SYSTEMS LTD.	3.0	2.5	33.3	36.8	B
LE GROUP BST LTD.	1.8	1.5	50.0	50.0	B
CTS COMPUTER SYSTEMS	1.8	1.2	25.0	25.0	C
TYME SYSTEMS LTD.	1.5	.8	25.0	25.0	B
OMNITECH GRAPHICS SYS.	1.1	.05	39.2	16.0	B
AHEARN & SOPER INC.	.9	.7	6.4	5.5	B
MICOS INC.	.5	.3	10.0	10.0	B
MARITIME COMPUTERS LTD.	.45	.35	10.0	10.0	C
G.A. COMPUTER LTD.	.4	.3	12.0	10.0	C
LANPAR TECH.	.3	.3	2.0	2.0	C
DATA TERMINAL MART	.3	.2	3.0	2.0	B
GREYHOUND COMPUTER	.3	.3	5.0	5.0	C
D.E. McMULLEN & ASSOC.	.26	.26	10.0	10.0	C
DIGITAL BUSINESS COMP.	.2	.2	10.0	10.0	B
NORANGO COMPUTER SYS.	.18	.15	10.0	10.0	C
K.O. MAIR & ASSOC.LTD.	.1	.05	2.44	1.52	B
CHERNEY-MILLS INC.	0.0	0.0	0.0	0.0	B
ALTEL DATA	0.0	0.0	0.0	0.0	B
ZENTRONICS DIV.	0.0	0.0	0.0	0.0	B
DASCO DATA PRODUCTS	0.0	0.0	0.0	0.0	B
DATAMEX LTD.	0.0	0.0	0.0	0.0	C
DP CONSULTANTS	0.0	0.0	0.0	0.0	C
ZAVITZ ELECTRONICS LTD.	0.0	0.0	0.0	0.0	B
BOOTHE COMPUTER LTD.	0.0	0.0	0.0	0.0	C
COMPUTER UTILITY MAN.	0.0	0.0	0.0	0.0	B
DATATECH SYSTEMS LTD.	N/A	N/A	N/A	N/A	B
TOTAL	13.09	9.16			

Increase of \$3.93 or 42.9%

Percentage of Total Software Revenues. 2.2% 2.0%

Average Software Revenues per company that reported software revenues. .8 .6

Average Software Revenues per company that reported software revenues of \$1 million or more. 1.8 1.21

Source: Evans Research Corporation

EXHIBIT 17

TOP TERMINAL AND PERIPHERAL EQUIPMENT SPECIALISTS IN THE
CANADIAN INFORMATION PROCESSING INDUSTRY

<u>Company</u>	<u>Estimated Software Revenues (\$Millions)</u>		<u>Percentage of Total EDP Revenues</u>		<u>Code</u>
	1981	1980	1981	1980	
CGE INFO SERVICES	1.6	1.3	5.0	5.0	C
ELECTROHOME LTD.	1.2	.9	10.0	10.0	B
STC CANADA INC.	.6	.3	1.0	1.0	C
CENTRONICS CANADA INC.	.5	.5	5.5	7.4	B
TEKTRONIC CANADA INC.	.4	.2	4.0	4.0	C
CONSOLIDATED COMPUTER INC.	.3	.2	2.0	2.0	C
NORPAK LTD.	.35	.25	5.0	5.0	B
PLESSEY PERIPHERAL SYS.	.3	.2	15.0	10.0	B
ANDERSON JACOBSON CAN.	.25	.18	10.0	10.0	C
ITT CANADA (ITT COURIER)	.2	.1	2.0	2.0	C
RECOGNITION EQUIP. (CAN.)	.2	.1	2.0	2.0	C
VOLKER-CRAIG LTD.	.2	.1	2.0	2.0	C
ESE LIMITED	.1	.05	1.0	1.0	C
MATROX ELECT. SYS. LTD.	.09	.05	1.0	1.0	B
CYBERNEX LTD.	.08	.05	1.5	1.5	B
MEMOREX CANADA LTD.	0.0	0.0	0.0	0.0	B
GANDALF TECHNOLOGIES	0.0	0.0	0.0	0.0	B
GENERAL DATACOMM IND.	0.0	0.0	0.0	0.0	B
COMTERM INC.	0.0	0.0	0.0	0.0	C
TELEX-TULSA COMP. PROD.	0.0	0.0	0.0	0.0	B
DEVELCON ELECTRONICS	0.0	0.0	0.0	0.0	B
NCR COMTEN INC.	0.0	0.0	0.0	0.0	C
TOTAL	6.37	4.48			

Increase of \$1.89 or 42.2%

Percentage of Total
Software Revenues. 1.1% 1.0%

Average Software
Revenues per company
that reported software
revenues. .4 .3

Average Software
Revenues per company
that reported software
revenues of \$1 million
or more. 1.4 1.1

Source: Evans Research Corporation

EXHIBIT 18
U.S. SOFTWARE INDUSTRY FORECAST TO 1990

Software Type	1979	1980	1981	1982	1983	1984	
SYSTEM SOFTWARE							
- \$Millions	1,100.00	1,500.00	2,009.40	2,632.91	3,433.56	4,458.96	
- %Growth		36.4	34.0	31.0	30.4	29.9	
- Percentage of Total Market	23	25	27	29	31	33	
APPLICATION SOFTWARE							
- \$Millions	900.00	1,100.00	1,637.24	2,360.74	3,322.80	4,594.08	
- %Growth		22.2	48.8	44.2	40.8	38.3	
- Percentage of Total Market	19	18	22	26	30	34	
SYSTEM DEVELOPMENT							
- \$Million (1)	2,700.00	3,500.00	3,795.42	4,085.55	4,319.64	4,458.96	
- %Growth		29.6	8.4	7.1	5.7	3.2	
- Percentage of Total Market	57	57	51	45	39	33	
TOTAL	4,700.00	6,100.00	7,442.00	9,079.00	11,076.00	13,512.00	
% Growth		30	22	22	22	22	
<hr/>							
	1985	1986	1987	1988	1989	1990	Average Annual Growth 1979-1990
SYSTEM SOFTWARE							
- \$Millions	5,796.40	6,837.40	8,341.56	10,176.88	12,415.78	15,147.34	
- %Growth	29.4	18.5	21.9	22.0	22.0	22.0	27.0%
- Percentage of Total Market	35	34	34	34	34	34	
APPLICATION SOFTWARE							
- \$Millions	5,769.40	7,038.50	8,832.24	11,074.84	13,876.46	17,374.89	
- %Growth	25.6	22.0	25.5	25.4	25.3	25.2	31.2%
- Percentage of Total Market	35	35	36	37	38	39	
SYSTEM DEVELOPMENT							
- \$Million (1)	4,945.20	6,234.10	7,360.20	8,680.28	10,224.76	12,028.77	
- %Growth	10.9	26.1	18.1	17.9	17.8	17.6	14.8%
- Percentage of Total Market	30	31	30	29	28	27	
TOTAL	16,484.00	20,110.00	24,534.00	29,932.00	36,517.00	44,551.00	
% Growth	22.0	22.0	22.0	22	22	22	22.2%

Source: Extrapolated from data provided by Input and Hambrecht & Quist (does not include bundled software revenues).

(1) Includes consulting and educational services to upgrade or enhance clients electronic processing staffs as well as custom developed software.

EXHIBIT 19

WESTERN EUROPE SOFTWARE INDUSTRY
FORECAST TO 1990

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
<u>Software Type</u>						
SYSTEM SOFTWARE						
- \$Millions	700.00	922.35	1,187.69	1,601.86	2,102.4	2,767.82
- % Growth		31.8	28.8	34.9	31.2	31.7
- Percentage of Total Market	26.9	27.5	28.1	28.7	29.2	29.8
APPLICATIONS SOFTWARE						
- \$Millions	400.0	600.37	862.24	1,278.14	1,800.0	2,554.2
- % Growth		50.0	43.6	48.2	40.8	41.9
- Percentage of Total Market	15.4	17.9	20.4	22.9	25.0	27.5
SYSTEM DEVELOPMENT						
- \$ Millions	1,500.0	1,831.28	2,176.73	2,701.39	3,297.6	3,965.97
- % Growth		22.1	18.9	24.1	22.1	20.3
- Percentage of Total Market	57.7	54.6	51.5	48.4	45.8	42.7
TOTAL	2,600.0	3,354.0	4,226.66	5,581.39	7,199.99	9,287.99
% Growth		29.0	29.0	29.0	29.0	29.0

	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>Average Annual Growth 1980-1990</u>
<u>Software Type</u>						
SYSTEM SOFTWARE						
- \$Millions	3,642.38	4,791.4	6,380.29	8,230.58	10,617.45	
- % Growth	31.6	31.5	33.2	29.0	29.0	31.3%
- Percentage of Total Market	30.4	31.0	32.0	32.0	32.0	
APPLICATIONS SOFTWARE						
- \$Millions	3,594.45	5,023.25	6,978.45	9,645.21	13,271.81	
- % Growth	40.7	39.8	38.9	38.2	37.6	42.0%
- Percentage of Total Market	30.0	32.5	35.0	37.5	40.0	
SYSTEM DEVELOPMENT						
- \$ Millions	4,744.67	5,641.49	6,579.68	7,844.77	9,290.27	
- % Growth	19.6	18.9	16.6	19.2	18.4	20.0%
- Percentage of Total Market	39.6	36.5	33.0	30.5	28.0	
TOTAL	11,981.5	15,456.14	19,938.42	25,720.56	33,179.52	
% Growth	29.0	29.0	29.0	29.0	29.0	29.0%

Source: Input and Evans Research Corporation Estimates.

EXHIBIT 20.

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
IST	-should make all information available to industry			-has to invest intelligently -more structured approach to grants -support too many small enterprises that don't know where they are going	-regulations should be far more open -gov't should protect consumers
NABU	-don't have depth in the economy -only nation in the world that has to go to the U.S. to test products	-need a "software centre"		-need tax incentives to create an environment for fostering an industry	-Systemhouses and Art Benjamins should not be allowed to die. -Visicorp "Visicalc" would never survive here
CSG	-not marketers but should encourage marketing and strong business sense -has to be market demand not gov't push (i.e. Telidon) -continue role in promoting Can. products abroad.	-provide R&D incentives for Canadian companies -"software centres!"- let us see if the other high tech work out (i.e. Ont. Gov't BILD Program) -government should not get involved in development		-too much gov't funding to date - generally failed (markets didn't grow fast enough)	-not a large enough market for industry to develop -won't have an MSA -have to export
BELL NORTHERN RESEARCH		-no software centre, would not really employ more people	-encourages wrong directions. Should have a better way of disseminating information.	-gov't track record for investment is terrible	

Source: Personal interviews with industry representatives.

Continued

EXHIBIT 20 (Continued)

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
IBM					-company's policy is not to disclose information. However, respondent did indicate that the firm is committed to full cooperation with the federal government
DMR		<ul style="list-style-type: none"> -utilize existing R&D centres more, such as Universities -Gov't should increase its' R&D expenditures to 2% of GNP -increase R&D in products in which there is market demand. -don't create R&D centres but support industry R&D -don't create silicon valleys 	<ul style="list-style-type: none"> -government should play leading role in re-enforcing Cdn. strengths, i.e. banking, transportation, fish, forests mining, communications 	<ul style="list-style-type: none"> -Cdn. co's need funding to compete on the international scene 	<ul style="list-style-type: none"> -gov't should ensure that Canada stay ahead in its areas expertise and specialization -gov't should provide direction, consult with industry, and info industry
	<ul style="list-style-type: none"> -should know what other countries and other gov'ts are doing (i.e. Swedish gov't initiatives) -concentrate on world markets 		<ul style="list-style-type: none"> -should have bilateral meetings with industry to determine opportunities 		
NORPAK				<ul style="list-style-type: none"> -with aid of grants gov'ts can provide initial impetus and boost to the firm -gov't has been fairly effective here 	

Source: personal interviews with industry representatives

Continued ...

EXHIBIT 20 (Continued)

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
OCRA			-determination of software opportunities should be left to private industry	-tax benefits for companies -instead of bailing out companies, let them die	-provide standards
ONLINE PEOPLE	-should market software as a company	-companies should provide R&D investment on their own (i.e. Sydney Development Corp.)		-gov't does not know how to fund small Canadian software firms -shouldn't give away grants but should act as an investor - recover royalties on R&D -gov't should not be selective	-need gov't. No real economic climate in Canada
REAL TIME DATAPRO		-R&D policy should be flexible	-bureaucrats don't know products	-still taxing software like shoes -shouldn't tax a growing industry	-DOC excellent in determining standards -should be their primary role, loosen regulations
MSA		-should fund R&D and that's it			-gov't involvement detrimental to the free enterprise system
NORTHERN TELECOM				-need better tax incentives to avoid brain drain to the U.S.	

Source: personal interviews with industry representatives

Continued

EXHIBIT 20 (Continued)

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
QUASAR		<ul style="list-style-type: none"> -companies conducting a tremendous amount of R&D already, just have to encourage it -gov't should increase deficit to increase R&D -gov'ts should allow R&D tax shelters 		<ul style="list-style-type: none"> -should support the winners -too much time already spent on supporting the losers -grants put gov't in position of picking & choosing which companies will receive them -gov'ts have not been good at selecting recipients -tax incentives give co. the resources to start -create a tax environment for investment MURB's 	
MPS	<ul style="list-style-type: none"> -gov't should have a good market research department 	<ul style="list-style-type: none"> -more research grants i.e. IRAP 		<ul style="list-style-type: none"> -gov'ts should provide tax incentives 	
SYSTEMHOUSE	<ul style="list-style-type: none"> -need funds for 	<ul style="list-style-type: none"> -increase gov't expenditures on R&D -R&D tax credit 		<ul style="list-style-type: none"> -gov'ts should provide more liberal tax regulations 	

Source: personal interviews with industry representatives

Continued

EXHIBIT 20 (Continued)

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
ABACUS COMPANY LIMITED					-gov't should stay out
QUANTUM SOFTWARE SYSTEMS LTD.					
WINDMILL SOFTWARE INC.		-gov't should provide investment incentives for R&D		-gov't should provide tax credits -gov't tends to fund companies with poor products -these companies should be left to die naturally and not propped up the gov't	
BRAINWARE INC.	-gov't should provide info as to what products are available			-grants are better than tax credits because company has the need for upfront money to develop software	
HILINE DATA SYSTEMS INC.	-gov't doesn't even know what programs they make available to industry.				-gov't should change its attitude towards software; see it more as manufacturing -feeling that gov't doesn't understand the computer industry
OFFICESMITHS INC.					-feels trials like OCS great idea because it provides customer environment for new products.

Source: personal interviews with industry representatives

Continued

EXHIBIT 20 (Continued)

VIEWS OF INDUSTRY REGARDING GOVERNMENT INVOLVEMENT

<u>Company</u>	<u>Marketing Assistance</u>	<u>R&D</u>	<u>Opportunity Identification</u>	<u>Tax Structure Allocations of Grants and Subsidies</u>	<u>General Comments</u>
BAILEY & ROSE	-gov'ts should encourage marketing	-gov'ts clarify R&D policy regarding R&D funding (i.e Sydney Limited Partnership) -gov'ts encourage R&D funding			-gov'ts should use their purchasing power to create an industry
ARTHUR ANDERSON					-gov't should not cut-off funding to companies such as Art Benjamin & Assoc. too early (Act I & II were state of-the-art products)
POLYMATHIC COMP. CORP.				-gov't should provide tax credits and incentives	
CAPSCO					-gov't should increase copyright protection -less government involvement the better
J.D. COX ASSOCIATES		-gov'ts should increase R&D expenditures			-so many U.S. packages -Canadians at a disadvantage
MANIC SYSTEMS INTERNATIONAL LTD.					-no comment
STS					-no comment
BLUE CHIP SOFTWARE				-gov'ts should fund company's initial foray into the market -initial 6-12 months startup	

Source: personal interviews with industry representatives

APPENDIX A

COMPANY PROFILES

CANADA SYSTEMS GROUP LTD.

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Mississauga, Ontario

L5K 1B1

(416) 822-5200

1.0 COMPANY BACKGROUND

Canada Systems Group Limited (CSG) is the largest service bureau in Canada, a position which it reinforced in 1982 by acquiring Computel Systems Ltd., the fifth ranked service bureau. In fact, CSG has won the distinction of being ranked among the top 20 service bureaus in North America, and of being the first Canadian-owned computer services organization to have revenues exceeding \$100 million.

Since its inception 12 years ago, CSG has qualified as a genuine Canadian success story in the information processing industry along with GEAC, Mitel, Gandalf, Quasar and Northern Telecom. CSG is equally owned by the T. Eaton Co. Ltd., Gulf Oil Canada Ltd., Stelco Inc., and Royal Trustco.

2.0 FINANCIAL HIGHLIGHTS

CSG's total EDP revenues for 1980 and 1981 were \$77.9 million and \$101.5 million respectively, showing an increase of \$23.6 million or 30% from 1980 to 1981. Following the acquisition of Computel, the restated EDP revenues for 1981 and 1982 were \$136.7 million and \$140.6 million respectively. In terms of total EDP revenues, CSG ranked 11th in 1980, 9th in 1981 and 7th in 1982 among Canada's top EDP suppliers.

CSG's software revenues accounted for 20% of its EDP revenues in 1980 and 1981, or \$14 million and \$20.3 million respectively. On the basis of software revenues alone, CSG ranked 7th in 1980 and 4th in 1981. In

terms of software revenues as a percentage of EDP revenues, CSG ranked 21st in 1980 and 23rd in 1981. Exhibits 1 and 2 show CSG's rank compared to other software suppliers.

3.0 CORPORATE ORGANIZATION

Canada Systems Group reorganized its corporate structure in 1980 by dividing the company's activities among three distinct groups; the Processing Services Group, the Professional Services Group and the Industry Services Group. During 1982, however, the Professional Services Group was "rationalized" and its divisions were reorganized.

The corporate headquarters of Canada Systems Group is located in Mississauga, Ontario. In addition, the firm has a number of branch offices located in Montreal, Ottawa, Toronto, Don Mills, Mississauga, Winnipeg, Edmonton, Vancouver, and Washington. The branch offices in Los Angeles and San Francisco were closed when the west coast processing services activities of the Multiple Access Division (U.S.) were divested.

During the period 1971-1981, CSG's staff increased seven fold from 200 to 1,500 employees. However, as part of the company's retrenchment strategy during 1982, CSG cut its staff by almost 500 employees, reducing employment by the beginning of 1983 to a little more than 1,000 people.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

CSG's principal areas of business are on-line computer services, industry-specific processing services, and professional services. CSG provides expertise in the following areas: business accounting, data management and database management, engineering and scientific

applications, financial planning and management sciences, and solutions for the banking, brokerage, insurance, finance, retail and wholesale distribution sectors.

The company's general computer-based services include interactive, remote batch and COM processing, facilities management and laser printing. The industry specific services include engineering applications, financial planning, management science and graphics to scientific and engineering clients; income tax processing to chartered accountants; processing and administrative services to banking, brokerage insurance and investment clients; proprietary database services including DUNSKEY, demographics, Canadian trademarks and patents, and CHOICES; business accounting to manufacturers and distributors; high technology minicomputer applications such as taxi dispatch systems and process flow monitoring systems; and turnkey systems to manufacturing, property management, retail and distribution clients.

There are two divisions that have responsibility for the development and sales of software products. The Business Information Systems (BIS) division develops and sells proprietary software products, primarily to CSG's processing service clients. The vast majority of this software consists of systems packages. BIS has also developed and sold applications packages to clients in the banking, insurance and financial community.

The Advanced Technology Systems Division (ATSD) also develops and sells software for specific industrial applications. For instance, ATSD has developed a minicomputer-based fluid flow system, SCADA, which is available but has not received much exposure to date. It is a turnkey system designed to be sold to the large utility companies.

On occasion, CSG has acquired the marketing rights to certain software products. For instance CHOICES, a package developed by the Federal

Government and designed to assist manpower consultants to link unemployed persons with job opportunities, is currently being marketed by the Federal Systems Division in Ottawa. CHOICES has also been implemented as a microcomputer-based package, which can currently be used on Commodore and Apple hardware.

Advanced Technology System Division in has also sold a minicomputer-based dispatch system to Blue Line Taxicab in Ottawa, and is currently marketing the product in the rest of Canada and the United States.

5.0 1983 - CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

CSG's foremost goal in 1983 and beyond is to continue to provide effective and efficient computing services to clients in Canada and the United States, and to consolidate its position as a leading service bureau in these geographical areas.

In 1983, CSG will pursue a policy of financial restraint along with identifying new markets, securing new customers, and developing new software.

CULLINET CANADA, LTD.

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1.0 COMPANY BACKGROUND

Cullinet Canada, Ltd. is a wholly owned subsidiary of Cullinet Software of Westwood, Massachusetts. Prior to February 1, 1983, the U.S. parent firm was known to Cullinane Database Systems, Inc.

Founded in 1968, Cullinane Database Systems, Inc. was one of the first independent companies to specialize in the field of computer software products. In addition, Cullinane Database Systems, Inc. was the first computer software company to be listed on the New York Stock Exchange. In its industry, Cullinane is perhaps the most marketing oriented company, although MSA runs a close second. This has been a key factor in its success.

The first software product the company developed and offered in 1970 was a report generator called CULPRIT. CULPRIT was the first independent report generator which could interface with and access IBM's database management system IMS. The company's second major product entitled the EDP-Auditor, was actually a version of the CULPRIT report generator. The EDP-Auditor was designed to allow non-programmers to perform auditing tasks such as confirmations, file footing, and exception analysis utilizing a comprehensive library of generalized audit routines, thereby allowing independent audits of the "paperless trails" created by EDP-based accounting systems.

In 1973, Cullinane Database Systems introduced its Integrated Database Management System (IDMS), a series of integrated database-related software packages designed to operate primarily on IBM's 360/370, 303X and, later, 43XX and 308X computers. At that time, IDMS was the first CODASYL-compatible system adhering to the ANSI Cobol, Fortran, PL/1 and Assembler language standards. With this step, Cullinane evolved in earnest as an IBM-compatible, independent software vendor. IDMS is the foundation of Cullinet's present product line.

From 1974 onward, Cullinane Database Systems introduced a variety of innovative systems and applications packages centered around IDMS, and has been successful in attracting customers from every major industry. Some of Cullinet's clients include: Dun & Bradstreet, European American Bank, Aetna Life and Casualty Company, Lloyd's of London, Regency Electronics, the Los Angeles Times, the Boeing Company, and the Hertz Corporation. Installations using Cullinane's products more than quadrupled from some 900 in 1977 to 4100 in 1982. According to a senior manager of Cullinet Canada Ltd., 99% of the company's customers continue to purchase software products from Cullinet.

Cullinane acquired the assets of Computer Audit Systems Inc. in 1977, enabling the company to provide EDP software for IBM and non-IBM users. Cullinane made its first move into the microprocessor and personal computer field with the acquisition of Computer Pictures Corporation, of Boston, Massachusetts, in 1982.

Prior to 1981, penetration of the Canadian market had largely been coordinated from the United States. Canada was initially viewed as being part of the U.S. domestic market. This proved to be counter-productive. Canada's geographical size necessitated that a corporate entity be established in Canada and given the clear mandate of promoting Cullinane's products in this market area.

In 1981, Cullinane Canada, Ltd. was established, with head offices located in Toronto, Ontario. During the first quarter of 1983, the name Cullinane Canada, Ltd. was officially changed to Cullinet Canada, Ltd. The Canadian company, to date, has only coordinated the sales of the company's database management systems. The sales of computer audit retrieval systems are still directed from the U.S. corporate headquarters.

2.0 FINANCIAL HIGHLIGHTS

Software sales accounted for 100% of Cullinet Canada's total EDP revenues for the fiscal years ending April 30, 1980, 1981 and 1982; these were \$500,000, \$2.6 million and \$4.0 million respectively. During the period from 1980 to 1981, the firm's revenues increased by \$2.1 million, representing a growth rate of 420%. The revenue growth from 1981 to 1982 was 54%, but 1983 revenues are expected to increase by some 100% over the 1982 level. To place this in the context of the parent firm's total operation, it should be noted that Cullinet Software had revenues of U.S. \$17.7 million in 1980, \$29.3 million in 1981, \$49.3 million in 1982 and \$78.6 million in 1983.

The company's growth in Canada can be seen not only in its increase in software revenues but in its rank relation to other major players in the Canadian software industry. As shown in Exhibit 1, Cullinet ranked 53rd in 1980 in terms of software revenues. In 1981 however, it placed 27th. As expected, Cullinet ranked very high on the basis of its software revenues as a percentage of total EDP revenues; as shown in Exhibit 2, Cullinet was ranked No. 1 in 1980 and 1981. With revenues of \$4 million in 1982, Cullinane ranked 6th in the top 15 companies in the software industry in Canada. Clearly this is tremendous growth for a company which has only been in business, as an official company in Canada, for a

90

little more than three years.

Cullinet Canada does not conduct any research and development in Canada. However, the parent firm allocates a minimum of 10% of total revenues towards research and development.

3.0 CORPORATE ORGANIZATION

The head office of Cullinet Software is located in Westwood, Massachusetts. The company has twenty Marketing and Technical Support Centres in the United States in the following cities: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Edison, N.J., Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh, San Diego, San Francisco, Seattle, St. Louis, and Washington, D.C.

The parent company has ten foreign subsidiaries and affiliates located in Australia, Belgium, Canada, Brazil, France, Ireland, Mexico, the Netherlands, New Zealand and the United Kingdom. In addition, the firm has seventy representatives who distribute Cullinet products in Australia, Chile, Colombia, Denmark, Finland, Greece, Hong Kong, India, Indonesia, Israel, Italy, Japan, Korea, Malaysia, Norway, Peru, Philippines, Puerto Rico, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Taiwan, Venezuela and West Germany.

Cullinet Canada, Ltd. has its head office in Toronto, and branch offices located in Ottawa, Richmond (Vancouver) B.C., and Montreal. In 1980, the firm employed 3 people. Currently, the company employs 25 people across Canada with 13 located in the Toronto office.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Cullinet Canada offers database software, application software and decision support systems for a general and/or specific clientele.

Software Products

A. Database Software

Cullinet's database management software is at the foundation of its solution to the problem of information management. The database managements products organize and control the corporate data resource, facilitate data access and application development, and serve as the tools to build Cullinet's database application software.

1) IDMS/R

IDMS/R is a database management system that stores, retrieves, and manipulates data contained on direct access storage devices, in IBM mainframe computer environments. IDMS/R, the most recent version, was announced in April 1983; Cullinet claims that it is the first commercially available database management system to combine the full advantages of both network and relational DBMS architectures in a single system. Since its introduction in 1973, IDMS has been constantly enhanced to include accessory software products to extend its flexibility and range of capabilities. These accessory software products are described in the following paragraphs.

Major Accessory software products include:

2) Integrated Data Dictionary (IDD)

The IDD is the key to database integration and is the central facility for all Cullinet's database software components. It

documents the source and use of all data for all Cullinet database management and applications software.

3) IDMS-DC

IDMS-DC is an advanced, full-function teleprocessing monitor, fully integrated with IDMS/R and designed for efficient processing of online, transaction-oriented applications.

4) Universal Communications Facility (UCF)

UCF allows applications written under IDMS to run under any other teleprocessing monitor, without modification.

5) Distributed Database System (DDS)

DDS is a software tool that allows applications programs running on multiple mainframe computers to access and update common databases.

6) Application Development System (ADS)

ADS OnLine is designed to allow rapid online development and execution of both retrieval and update programs for IDMS/R; ADS/Batch centralizes and simplifies the tasks of validating transaction files and updating an IDMS/R database. Both facilities serve to improve programmer productivity.

7) INTERACT

Interact is an interactive system for program development, text entry, editing and formatting, and document preparation.

8) On-Line Query (OLQ)

On-Line Query is an inquiry response system that provides conversational access to IDMS databases from terminals, in order to satisfy ad hoc information retrieval requests by application developers and end users.

9) CULPRIT

CULPRIT enables programmers and non-programmers to retrieve selected data from IDMS databases and other computer files and generate reports of their own design.

10) EDP-Auditor

This is a comprehensive library of CULPRIT routines that perform auditing tasks, such as confirmations, file footing, exception and summary analysis, and sampling.

11) OnLine English (OLE)

This query system allows users with no data processing background to access information in an IDMS/R database, by entering simple, English-language requests.

12) ESCAPE

ESCAPE is designed to facilitate conversion for the growing number of computer users who wish to migrate from a non-IDMS database processing environment to an IDMS environment.

B. Applications Software

Cullinet application software uses a common IDMS/R database, to provide a high level of integration among applications which are designed to perform specific business activities. Cullinet currently offers complete applications software in the areas of banking, financial planning and manufacturing. Specific products include:

1) CIS - Customer Information System

CIS is an applications package designed for the banking industry by the Boatmen's National Bank of St. Louis. This package was purchased by Cullinane in 1980. Integrated with IDMS, this package is intended to offer banks cross referencing capabilities. It supports most major bank applications such as: demand deposit account, savings account, certificates of deposits, installment loans, major credit cards and debit cards for automated teller machines.

2) Cullinane Integrated Manufacturing System (CIMS)

CIMS is an on-line, interactive, IDMS-based system designed for the manufacturing sector. CIMS includes bill of materials, inventory, materials requirements planning (MRP), shop floor control (SFC), master production schedule (MPS), order entry, purchasing and costing.

C. Decision-Support Software

Designed with the executive and decision maker in mind, Cullinet's decision support software products provide desk top access to the corporate data resource managed by the database management and applications software. They include:

1) Cullinet Personal Computer Software (CPCS)

This is a collection of fully integrated decision support tools for use on an IBM Personal Computer. CPCS tools include relational database, electronic spreadsheet, graphics, document processing and electronic mail capabilities.

2) Information Database (IDB)

This is a mainframe software product that links CPCS to the mainframe, providing decision makers with direct and convenient access to the corporate data resource, for use with the CPCS tools. Both CPCS and IDB were announced in April 1983. Cullinet also announced a joint venture with Apple Computer, providing them with a similar access to mainframe computers via an IDB link.

3) TREND-SPOTTER

Trendspotter is a graphics information system for top management. It presents data in high-quality graphic form for fast, direct and easy analysis and visualization.

5.0 1983 - CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

The strategies of Cullinet Software are twofold in the short and medium term.

- 1) The company believes that success in the information processing industry is dependent upon reacting to developments by IBM. Cullinet is committed to following the IBM mainframe standard and developing software to address the IBM mainframe environment. Therefore Cullinet will continue to enhance, modify, and develop software for the huge and growing target represented by over 30,000-40,000

installed and on-order IBM and compatible systems in the medium to large scale performance range (i.e. U3XX, 303X, 308X).

- 2) The firm recognizes and acknowledges that microcomputer software is a major area of opportunity. Although substantial software has been written for personal and/or microcomputers, the development has been sporadic, uncoordinated, and unfocused. Cullinet intends to provide an integrated approach to software development for microcomputers, very similar to its IDMS concept. The company intends to develop this integrated concept for the IBM PC. It is the opinion of the company that the IBM/PC, which became the best-selling microcomputer for business applications in 1983, will continue to take away market share from Apple, Commodore, and other microcomputer vendors.
- 3) Cullinet thinks that the utilization of computer technology, in particular the use of microcomputers, in such vertical markets as banking, manufacturing, and the professions, will increase substantially in the coming years. In fact, Cullinet estimates the worldwide market for microcomputers alone will be \$3.4 billion by 1984. With the concern for increased productivity by both small and large corporations, users are looking towards the microcomputer as a viable productivity tool. If sales of microcomputers increase as expected, Cullinet believes the market for microcomputer software will escalate dramatically.

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DIGITAL EQUIPMENT OF CANADA LIMITED

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Kanata, Ontario

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(613) 592-5111

1.0 COMPANY BACKGROUND

Digital Equipment of Canada (DEC) is Canada's second largest computer equipment manufacturer and the largest manufacturer of minicomputers. These minicomputers are utilized for a wide variety of commercial, industrial, educational, medical, and government applications.

The company was incorporated in 1963 and is a wholly owned subsidiary of Digital Equipment Corporation of Maynard, Massachusetts; the U.S. parent became the second largest computer equipment manufacturer, after IBM, in 1981. Since 1963 the Canadian company has grown from a one man sales office to a full service corporation employing over 1,700 people.

2.0 FINANCIAL HIGHLIGHTS

DEC's total EDP revenues in 1980, 1981 and 1982 were \$163.7 million, \$252.6 million and \$294.9 million respectively. This represents an increase of \$88.9 million and a growth rate of 54% for 1980-81; the corresponding figures for 1981-82 are \$42.3 million and 17%. By way of comparison, it should be noted that the parent U.S. firm had revenues of U.S. \$2.7 billion in 1980, \$3.4 billion in 1981 and \$4.0 billion in 1982. DEC placed 2nd in 1980, 1981 and 1982 in ERC's list of Top Computer Companies in Canada.

DEC's software revenues were estimated at 15% of its total EDP revenues in 1980 and 1981. Software revenues were estimated at \$24.6 million in 1980 and \$37.9 million in 1981, representing an increase of \$13.3 million

and a growth rate of 54%. Sales of system software accounted for the majority of DEC's software revenues, although exact figures are not available.

In relation to other companies in the Canadian software industry, Exhibit 1 shows that DEC placed second, in both 1980 and 1981, in revenues derived from software.

By contrast, as shown in Exhibit 2, DEC placed 24th in 1980 and 26th in 1981, on the basis of software revenues as a percentage of the company's total EDP revenues.

DEC's decline in rank, from 24th in 1980 to 26th in 1981, is largely due to the presence of independent software suppliers who are far more dependent upon software sales for their corporate sustenance.

3.0 CORPORATE ORGANIZATION

Digital Equipment of Canada is divided into two major groups, customer service and sales. Customer services include field services, educational services, software services, manufacturing, computer special systems group, and accessories and supplies.

In addition to its head office in Kanata, Ontario, DEC has a network of fourteen branch offices, eight field service offices and eight field service remote locations. Overall, DEC employs 1,700 people across Canada, of which some 200 are software specialists. Fifty-three of DEC's software specialists are based in Kanata, while the remaining 145 are

located in 16 software sales offices spread across Canada.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Although DEC's primary area of business expertise is the development and manufacture of minicomputers, it offers systems and applications packages to complement these hardware products. The VAX general-purpose computer line remains the company's major revenue contributor in the computer category. By making heavy use of micro processors at the low end of the line and downsizing the VAX product line, DEC has almost completely renovated its old line of PDP-11 minicomputers with low cost microprocessor-based systems and high-performance 32-bit systems. As a result of the success of these minicomputer systems, DEC has emerged as a major player in the Canadian software industry.

Software Products

In the software area, DEC produces good systems programs for its products. Communications management software is an area of strength, enabling DEC to compete both for the network data processing business of large users, and also in the office automation area, DEC tends to use outside developers for applications software, especially for its desk top computer lines.

DEC has developed and is currently marketing software products in the following engineering applications fields:

1. General Chemical
2. Civil Engineering
3. Computer Aided Design and Drafting
4. Computer Aided Manufacturing
5. Earth Resource Engineering

6. Electronic Engineering
7. Engineering Libraries
8. General Engineering Tools
9. Management and Administration
10. Optical Engineering
11. Power Systems Engineering
12. Structural Engineering

5.0 1983-CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

DEC's Software strategy is threefold:

- 1) DEC acknowledges that the availability of software is fast becoming a major determinant in purchasing a hardware system. DEC will endeavour to develop a comprehensive portfolio of products, not only for its PDP 11 and VAX series computers, but for its hardware only entries in the microcomputer field. Consequently, at least 50% of the company's R&D expenditures will be allocated towards the development of software products.
- 2) Increasingly, consumers are demanding more software for specialized vertical markets. Consequently, DEC will be instituting a program to increase its portfolio of software addressing Canadian industrial diversities.
- 3) With the introduction of its Rainbow, Decmate, and Professional Series (models 325 and 350) microcomputers, DEC will be concentrating on the development of general and vertical market software for these processors.

or

In developing its overall strategies, DEC has shown an increased willingness to cooperate with other computer/communications companies. Examples include its adoption of the Xerox Ethernet local area network standard, and announcements of a joint strategy with Northern Telecom and ROLM for developing multi-media, office-related products. The acceptance of its micro computer line has, however, been disappointing compared to the phenomenal success of the IBM PC in 1983. DEC will have to fight hard in the medium term to retain its No. 2 position.

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DMR & ASSOCIATES
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1.0 COMPANY BACKGROUND

DMR & Associates is an independent Canadian data processing and management consulting firm whose head office is located in Montreal, Quebec. The firm was founded in 1973 by three data processing professionals, Pierre Ducros, Serge Mielleur and Alain Roy, each with many years of industrial experience.

In 1974, the firm created a technical support group composed of experts in the fields of telecommunications, and large scale hardware and operating systems. In the same year, the firm introduced its development services and opened two offices in Ottawa and Quebec City.

DMR's initial foray into the minicomputer field began in 1975 with the employment of seasoned professionals in this field. It was also during this year that the company started to offer consulting services to hardware suppliers and large service bureaux. It also created an international division, due to a major consulting assignment in Algeria, and opened a branch office in the City of Toronto.

In 1976, DMR & Associates completed its first major project involving the project management of the results system for the Montreal Olympic Games. In addition, the company concluded similar management consulting assignments in the financial, manufacturing, and distribution industries, and in the public sector. By 1977 the firm had a professional staff of over 100 persons.

In 1978, DMR & Associates became a fully active member of the Canadian Association of Management Consultants, and opened two new branch offices in Edmonton and Calgary. Due to its experience with the Montreal Olympics the firm was able to continue similar work in Munich, West Germany, for the Moscow Olympic Games held in 1980.

Since 1979 the firm has made major inroads towards penetrating the U.S. and offshore markets. In particular, DMR established an American subsidiary with its head office in Boston, Massachusetts in 1981 and an Australian subsidiary, with a head office in Melbourne in 1982.

2.0 FINANCIAL HIGHLIGHTS

The financial highlights of DMR and Associates are indicated in the following table:

	Financial Year Ending May 31			
<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	
Total Revenue (\$M)	11.9	18.7	27.7	34.4
Annual Revenue Growth (%)	-	57.1	48.1	24.2
Total Software Revenue (TRX0.66) (\$M)	7.9	12.3	18.3	22.7
Revenue (TRX0.60) (\$M)	7.1	11.2	16.6	20.6

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For the purpose of this report, the revenues for 1980 and 1981 have been taken as the revenues for the fiscal years ending on May 31, 1980 and 1981 respectively. On this basis, in terms of overall 1981 EDP revenues, DMR & Associates ranked 35th on ERC's list of Top Computer Companies in Canada. This was an increase over its previous 1980 ranking of 38th.

Software related revenues accounted for some 66% of the company's total EDP revenues in 1980, 1981 and 1982. Application software development accounted for about 60%, and system software development for about 6%(1). Total software revenues increased by \$4.4 million in 1981, \$6.0 million in 1982 and \$4.4 million in 1983. Since these revenues were estimated as a constant fraction of total revenues, their annual growth rate would, of course, be the same, i.e. 57.1% in 1981, 48.1% in 1982 and 24.2% in 1983. Revenues earned outside Canada by the company's international operations are expected to amount to some \$2.4 million in fiscal year 1983.

As shown in Exhibit 1, DMR & Associates placed 10th in 1980 and in 1981 on the basis of their software revenues. The company also ranked 10th in 1980 and 1981 on the basis of software revenues as a percentage of their total EDP revenues (see Exhibit 2).

3.0 CORPORATE ORGANIZATION

DMR & Associates has two distinct divisions, the Canadian Division and the International Division. Both these divisions offer the company's basic services in each of their market areas.

The Canadian division offers services across Canada through a network of permanent offices located in St. John's, Quebec City, Montreal, Ottawa, Toronto, Edmonton, Calgary and Vancouver. The number of working

employees in Canada was 551 at year end 1982.

The International Division is fully operational and offers services in Algeria, Australia, United States and Zimbabwe. This division has two branch offices located in Boston, Massachusetts (which opened in the 4th quarter of 1981), and Melbourne, Australia (which opened in the 4th quarter of 1982). The International Division is coordinated from the head office in Montreal, and presently employs approximately 20 people.

The upper echelons of the firm include the principals located in Montreal, and the managing partners in each of company's permanent offices in Canada and abroad. The bulk of the company's employees are located in Montreal, with the remaining branch offices having staff sizes relative to their business activity.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

DMR & Associates offers services in four major areas: Strategic Planning and Education, Management Consulting, Project Management and Development Services, and Technical Services. As Mr. Ducros pointed out, the firm is "not a service bureau or OEM or distributor and/or manufacturer of hardware and software". Rather, DMR is involved in what has been called the 'solutions game', in which the company is commissioned to evaluate a client's problem and data processing needs, and to implement a solution (incorporating the most appropriate hardware and software). The following is a concise description of the company's services.

1) Strategic Planning and Education

DMR & Associates offers a wide range of services in this area of business expertise including: corporate, functional, data processing and business

systems strategic planning, management information systems courses, for executives and users customized information processing briefings, project management and structured development techniques seminars and technical data processing courses.

2) Management Consulting Services

DMR is committed to providing professional consulting advice to corporations regarding any aspect of the data processing field. Thus, the types of consulting advice the firm is able to offer are the following: organizational studies, EDP review and audits, security and confidentiality review and audits, feasibility studies, analysis of information processing requirements, hardware, software and services selection, preparation of tender documents, analysis and evaluation of proposals, recommendations and plans for implementation, contract preparation and negotiation, establishing methodologies and standards for systems development and operations departments, management of information processing centres, and market analysis, product design, product evaluation and preparation of business cases for data processing equipment and service suppliers.

3) Project Management and Development Services

DMR also provides what may be referred to as a 'hands-on' or 'on-site' service in which the firm will manage the installation of hardware and software, plan and manage systems development and implementation projects, provide project estimation, audit reviews, provide advice on applications systems architecture with emphasis on structured techniques, and train user personnel.

4) Technical Services

Of the four service areas that DMR & Associates offers, technical services is the most unique. The employees involved in this area are technically oriented, relying on extensive experience in the implementation of solutions to the problems of lack of communication among computers. The services include: operating systems generation, optimization, modification and conversion, data base requirements planning, package selection, generation and optimization, analysis and simulation of telecommunications networks, communications network management planning, capacity planning, contingency planning, benchmark specification and supervision, design of data centres, physical planning and installation of computer equipment.

Software Products

DMR & Associates has been very successful in evaluating existing software products and modifying them for use by particular clients. For instance, the company modified an on-line banking system developed by the Saskatchewan Credit Union Central for banking clients in Ontario, Quebec and Brisbane, Australia. Similarly, a cheque payment control system (CPCS), developed for the Bank of Montreal to run on IBM hardware, was modified to be used for similar purposes by two Canadian banks and a bank in the New England area of the United States. The firm is currently modifying this package for use by a major banking institution in Australia.

The company has also developed a reputation for developing results systems for major sports events such as the Montreal and Moscow Olympics. DMR has recently been commissioned to apply this experience to install a results system for the 1984 Olympics in Los Angeles and is presently

negotiating a similar contract for the 1988 Olympic games in Seoul, South Korea.

The technical services division is also involved, on an on-going basis, in the research and development of solutions to the problem of lack of communication in the field of office automation.

5.0 1983 - CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

There are many facets to DMR's overall corporate strategy in 1983 and beyond, of which software product development and modification will be two interdependent ones. During the economic recession of 1982, the company made a commitment to achieve financial stability at the expense of market share. With the difficulties experienced by Systemhouse as a result of its rapid expansion still very much in mind, DMR has decided that a policy of gradual corporate and services expansion is the best one to pursue. Despite this policy of gradualism, the firm plans to announce the opening of a new branch office located in Regina, Saskatchewan.

Second, DMR is committed to outdistancing its competition both in Canada and abroad, and consolidating its position as a leader in providing professional advice in the whole field of data processing management. DMR's major competitors in the field of management consulting are Woods Gordon and Thorne Kellogg Stevenson in Canada, and Arthur Anderson in the United States. In the area of product implementation, DMR competes in Canada directly with Quasar and Systemhouse, as well as other regional software firms.

Third, DMR & Associates will increase its exposure in those vertical markets in which the firm has acquired a good reputation. For instance, the company will continue to provide advice and develop and/or modify

software packages for the banking and insurance sector, manufacturing sector, government sector, and transportation sector.

Fourth, the firm is determined to promote its expertise in providing total solutions to clients. Thus, DMR acknowledges that it must keep abreast of all major developments in the information processing industry and has subsequently instructed its staff to make this a major portion of their activities.

Fifth, Pierre Ducros sees the firm moving more definitely into the field of office automation, as a consulting firm and as a contributor to the realization of a concept.

Finally, like so many other Canadian firms, there comes a point in the growth of a company when the domestic market appears limited. Consequently, DMR will be positioning itself to further exploit the export markets in 1983 and beyond.

(1) As shown in the Exhibits that are included, the Consultant used the initial estimate of 60% of total EDP revenues provided by a company representative to aid in the determination of the size of the markets in 1980 and 1981. Recent information from DMR and Associates indicates that software revenues as a percentage of total EDP revenues is actually 66%. Sixty per cent relates to application software development. The additional 6% consists of the writing of systems software. Although significant to DMR and Associates, this increase has no significant effect upon the size of the overall Canadian software market.

IBM CANADA LTD
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1.0 COMPANY BACKGROUND

IBM Canada Ltd. is a wholly owned subsidiary of International Business Machines Corporation of Armonk, New York, which is by far the largest computer manufacturer in the world. With worldwide revenues of U.S. \$29.1 billion in 1981 and U.S. \$34.4 billion in 1982, IBM dominates the computer industry. In 1981, 48% of IBM's revenues were generated from foreign operations, and it accounted for some 35% of the worldwide revenues generated by information processing companies based in the United States.

The presence of IBM in Canada dates back to 1911, with the merger of three subsidiaries of U.S. firms: The International Time Recording Company, The Tabulating Machine Company, and The Computing Scale Company. The new firm called itself the Computing-Tabulation-Recording Company, with its Canadian headquarters located in Montreal. In 1917, the Canadian operation adopted the name International Business Machine Company Limited, and the logogram IBM was used for the first time anywhere in the world. The present company name, IBM Canada Ltd., was adopted in 1969.

2.0 FINANCIAL HIGHLIGHTS

IBM Canada Ltd's gross revenues in 1980, 1981 and 1982 were \$1,506 million, \$1,845 million and \$2,204 million respectively. Export revenues accounted for 30%, 29% and 26% of the company's gross revenues in 1980,

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1981 and 1982 respectively. Revenues generated from exports were \$451 million in 1980, \$522 million in 1981 and \$529 million in 1982.

As estimated by Evans Research Corporation, IBM Canada Ltd's total EDP revenues were \$1,216.5 million in 1980, \$1,517.7 million in 1981 and \$1,890.0 million in 1982. This amounts to an increase of \$301.2 million and a growth rate of 25% in 1980-81; the corresponding increase and growth rate for 1981-82 are \$372.3 million and 24.5%.

Evans Research Corporation estimates that IBM Canada Ltd's revenues from software related sales accounted for 12% of the company's total EDP revenues in 1980 and 1981. Software revenues were estimated at \$145.9 million in 1980 and \$182.1 million in 1981, showing an increase of \$36.2 million and a growth rate of 25%.

As shown in Exhibit 1, IBM Canada Ltd. is unequivocally the leader in the Canadian software industry, from a revenue point of view. IBM's closest competitor is Digital Equipment of Canada, with software revenues estimated at \$24.6 million in 1980 and \$37.9 million in 1981.

However, when ranked by software revenues as a percentage of total EDP revenues, IBM was 25th in 1980 and 28th in 1981. This interesting statistic indicates that IBM's software revenues, relative to other companies, declined in 1981. Yet sales of software increased, in dollar terms, by 25%.

While IBM Canada Ltd. does not release figures for the amount spent on software R&D, the following information is available. The expenditures of the IBM Canada Laboratory in Toronto were about \$22 million in 1981 and \$35 million in 1982. According to an IBM Canada Ltd. company representative, the major portion of the activities in the laboratory is related to the development of software products.

3.0 CORPORATE ORGANIZATION

IBM Canada has 25 branch offices in 12 cities across Canada, and locations with a resident manager in 12 other cities across Canada. In addition, the firm has 3 Customer Education Centres, 5 Product Centres (Toronto, Montreal, Edmonton, Calgary and Vancouver), 2 Manufacturing Plants and a Development Laboratory in Toronto. The company offers Datacentre Services to customers on a network that runs coast to coast.

At year end 1982, IBM Canada Ltd. employed 11,580 people. Of this total, 3,801 people were employed in manufacturing and research and development.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

IBM is not in the business of developing and selling software as is, for example, a software house. Rather, IBM develops and sells both systems and applications software which complements and enhances its hardware offerings, and thereby provides complete information systems for its customers.

Keeping this in mind, IBM has accumulated a portfolio of software products for its various processors that is one of the largest and most comprehensive in the world. The company provides an extensive array of systems-level and applications software across the entire spectrum of machine types. While much of this software has been developed internally, IBM is increasingly accepting and promoting software developed by third party companies. One recent IBM software catalogue lists almost 500 software packages developed by third parties, across some 60 application areas.

MANAGEMENT & PLANNING SOFTWARE GROUP INC.

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1.0 COMPANY BACKGROUND

Management & Planning Software Group (MPS) is a service bureau and software house. The firm was recently created as a result of an amalgamation of two associated firms, MPS Management Consultants Ltd. and Apex Computing Resources.

MPS had its beginnings in the early 1970's. The company's first product was MPS-F, a fully integrated financial modelling and planning system. It was developed during the period from 1973 to 1974, and was formally introduced into the market in 1974. Initially, MPS-F was designed for and used by major service bureaux such as Computer Science Corporation, Systems Dimensions Limited (now owned by Datacrown), and Multiple Access Limited (now a part of Canada Systems Group).

In 1979, MPS Management Consultants Ltd. established their own service bureau, Apex Computing Resources, to market their MPS-F product. This decision reflected the feelings of management that the firm could profit more from marketing and servicing their own product. Apex Computing Resources was to be used as a stepping stone towards further sales of their MPS-F package to potential clients.

Although MPS-F was clearly MPS's major product, the firm also developed other software products for selected vertical markets such as the airline and agriculture industries. The firm has also been involved in the

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distribution of various software products in Canada for U.S. firms. For instance, MPS is the Canadian distributor for ORACLE, a relational database management system developed by Oracle Corporation of Menlo Park, California.

In November 1982 MPS introduced IDSS (Interactive Decision Support System), which will succeed MPS-F as the firm's major product.

2.0 FINANCIAL HIGHLIGHTS

MPS's total EDP revenues for the year ending November 30, 1981 were \$825,000. Sales of software accounted for approximately 30% or \$247,500.

The company's total EDP revenues grew by 45% to \$1.2 million in 1982. The firm's 1982 software revenues were estimated at \$360,000, accounting for 30% of its total revenues. According to Mr. Thadaney, the President of MPS, the firm's total EDP revenues are expected to reach the \$1.5 million level in 1983. Software revenues are estimated to reach \$450,000. If achieved, the company's total and software revenues will experience a growth rate of 25% in 1983.

The company's software research and development expenditures were \$95,000 in 1981, or about 11.5% of the company's total EDP revenues. The software R&D expenditures in 1982 were \$120,000, increasing by only 10% over 1981 figures. It is expected that software R&D expenditures as a percentage of the company's total revenues will stabilize in the 10% range in 1983.

3.0 CORPORATE ORGANIZATION

MPS is a small and tightly organized firm. The company recently amalgamated two associated firms, which offered totally different services - time sharing and software products, with the objective of avoiding duplication of corporate functions.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Areas of Business Expertise

MPS's areas of expertise are financial modelling and planning, management science/operations research, and database management applications. Products and/or services based upon these areas of expertise are offered in each of the firm's four business areas.

The first business area is its time sharing service. This service, offered since 1979, is based on a DEC VAX 11/780 computer located in Toronto. It is accessible from any city or major town in Canada or the United States via the Datapac and Telenet Communications Networks.

The next two of the company's areas of business are closely related. MPS offers consulting services and educational training in its three major areas of expertise. Educational training is provided, usually at customer request, to ensure that clients can use the products and services to effectively meet their needs in these areas.

MPS's predominant area of business is the development of software products. The products that are developed reflect the company's business interests. The following section describes MPS's products in more detail.

Software Products

Management & Planning Software Group Inc. develops software products in the areas of financial modelling, data base management, decision support, management science and operations research. These products are currently implemented on IBM, DEC, and a variety of other computers; they are marketed directly in North America and on a licensed basis elsewhere. Potential customers include both industry and governments.

A. Financial Modelling and Planning Systems

MPS-F

MPS-F is a modelling and planning system primarily designed for business planners to develop corporate strategies, and control a firm's operations.

MPS-F has been used for a variety of applications including budget preparation, cash flow analysis, investment analysis, sales forecasting, market share studies, tax analysis, merger and acquisition analysis, profitability studies, financing alternatives, manpower allocation, capital budgeting, pro forma analysis, salary planning, demand & supply forecasting, profit and loss balance sheet forecasting, branch income & expense consolidation, and production planning.

IDSS (Interactive Decision Support System)

IDSS is a new-generation decision support system and is regarded by MPS as the successor to MPS-F. IDSS is designed for use by a wide array of users including senior management officials, financial and accounting personnel, corporate planners, financial analysts, economists and policy analysts.

IDSS incorporates a number of features such as a full screen work sheet facility, automatic error detection and editing, report generation, virtually unlimited model size (each worksheet can have over 10,000 rows and 1,000 columns), business graphics (various charts can be produced in up to eight colours), and a 'HELP' facility which removes the constant need to refer to a user manual.

IDSS also incorporates a "Data Dictionary", which ensures consistency in the IDSS model, and powerful data management facilities.

B. Database Management Systems

ORACLE

ORACLE is a relational database management system that is different from a conventional DBMS in that it presents data to users in a familiar form - a table - and provides a language especially designed to operate on tables. It was developed by the Oracle Corporation of Menlo Park, California. MPS is a licensed distributor for this product in Canada.

ORACLE uses the SQL data language, an easy to learn, English like language. SQL provides query, data manipulation, data definition, and data control capabilities. In addition, ORACLE offers a complete set of software productivity tools allowing for quick design and development of new applications, and for increases in the productivity of data processing professionals.

ORACLE is in use on IBM and DEC computers at over 250 commercial and government installations in 16 countries around the world. It is available on the following series of computers: IBM 370, 43XX, 30XX and 308X; DEC VAX-11 and the DEC PDP-11.

ORACLE is designed to address the following functional areas: finance and accounting, manufacturing, marketing and sales, and security analysis. Particular applications include general ledger, account payable and receivable, production and inventory control, sales tracking and market analysis, and portfolio management and risk assessment.

C. Operations Research

FEEDMIX

FEEDMIX is a computer based feed formulation system. This system provides information regarding the least cost for a product based on either old (inventory) or current (market) costs, minimum/maximum and actual amounts of nutrients, and effect on product costs due to the decrease or increase in the cost of any one ingredient. The user can also query, modify, add, delete or list any or all of the information kept on the computer system. MPS currently has FEEDMIX systems installed at Martin Feeds Mills in Kitchener, Ontario, the University of Guelph and Fortamix (a division of B.A.S.F.) in Georgetown, Ontario.

PACS (Personalized Airline Crew Scheduler)

PACS is a personalized airline crew scheduler that organizes individual schedule preferences according to rank choices. Although this product is designed for the airline industry, it requires customization for use by individual airline companies. The company has one installation of this product to date, at CP Air.

5.0 1983 - CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

Since the company's inception in 1973-1974, its fortunes have largely depended upon the success of its MPS-F product. MPS-F has been the major pillar of the company, both in terms of software sales and service bureau use by clients who utilize the company's time sharing service.

Although the company has a considerable portfolio of software products, its intentions are to direct its emphasis towards the success of a small number of products. With the introduction of IDSS in November 1982, the successor product to MPS-F, the company will continue this strategy in the foreseeable future.

To improve the marketing and use of its IDSS product, MPS will rely upon both its time sharing service and direct sales. The time sharing service is a vehicle which the company uses to introduce a client to the product, and to enable its use during a testing and familiarization period. In the long term, the client will be encouraged to purchase the product outright, and install it on a computer of his choice.

Mr. Thadaney, President of MPS, believes that the success of a product depends, to a major extent, on the vendor's ability to provide a comprehensive, effective and on-going educational program to allow users to benefit from the new system in a positive manner. The firm will therefore continue its educational and training program for clients and prospective clients.

MPS has established its base as a vendor involved in the development and marketing of financial modelling and planning systems in Canada. The objective of the firm in 1983, and beyond, is to pursue new markets for its products. However, being constrained by a relatively small staff and limited capital resources, the firm has decided to engage, wherever possible outside Canada, in licensing and distributor arrangements.

MPS is particularly interested in penetrating the United States and European markets. Recently, the firm concluded a licensing agreement for its IDSS product with a British firm, with the intentions of breaking into the British market. MPS also recently negotiated a licensing arrangement for its IDSS product with Knowledge Systems International, a distributor located in Johannesburg, South Africa. Negotiations are being conducted with various U.S. firms to distribute the IDSS product in the United States.

There is an additional product thrust which MPS will undertake in 1983. With the blossoming of the microcomputer industry, MPS is now in the process of determining a point of entry into that applications software market. Mr. Thadaney expects that the company's response and objectives regarding the growing need for microcomputer software will be settled sometime during 1984.

As a result of the recession and its impact on the airline industry, Mr. Thadaney expects that sales of the PACS system, will be marginal. Therefore, it is unlikely that the firm will apply any additional resources to the research and development of software products for this vertical market.

Research and development expenditures will not increase dramatically over fiscal 1981 and 1982 levels. The company has made a concerted effort to ensure that R&D expenditures would not exceed 10% of its total revenues. This frugal strategy will be adhered to in 1983. According to Mr. Thadaney, a small company must carefully monitor its cash flow and avoid R&D expenditures that are disproportional to total revenues.

MANAGEMENT SCIENCE AMERICA (CANADA) LTD.

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1.0 COMPANY BACKGROUND

Management Science America (Canada) Ltd. is a wholly owned subsidiary of Management Science America (MSA), Inc. of Atlanta, Georgia. Although MSA has been actively marketing U.S. software products in Canada for some time, it was only recently, in the middle of 1981, that the company set up a subsidiary in Canada to coordinate the its activities in this country.

Management Science America, Inc., is a noted leader in the field of applications software. It is a public company and its stock is traded on the U.S. National Over-the-Counter Market (Symbol MSAI). It is the first independent software products company to achieve an annual revenue exceeding U.S. \$100 million from software-related sales:

MSA Canada provides financial, human resources and manufacturing applications software for mainframes and minicomputers. With the recent acquisition of Peachtree Software Inc. by its American parent, the firm is well poised to address the microcomputer market in Canada.

2.0 FINANCIAL HIGHLIGHTS

MSA Canada's total revenues for fiscal 1980, 1981 and 1982 were \$3.2 million, \$3.1 million and \$5.1 million respectively. Revenues generated from the sales of software in these years accounted for 100% of the

company's total revenues. To place this in the context of the parent firm's total operation, it should be noted that MSA Inc. had revenues of U.S. \$ million in 1980, \$ million in 1981 and \$ million in 1982.

As shown in Exhibit 1, MSA Canada ranked 16th in 1980 and 19th in 1981 in terms of software revenues. MSA Canada ranked 4th in 1980 and 1981 in terms of software revenues as a percentage of total EDP revenues.

3.0 CORPORATE ORGANIZATION

MSA Canada maintains headquarters in Toronto, Ontario, and has two branch offices located in Montreal and Calgary. The company had a third branch office located in Vancouver, British Columbia but it was closed down in calendar 1982 due to a limited customer base. The company currently employs 44 people in Canada, 37 of whom are located in the Toronto office, three are located in Montreal, and four are located in Calgary. At the end of fiscal 1983 (December 31), MSA Canada expects to have 45 persons employed with the firm.

MSA Canada is a part of a much larger U.S. based multinational software company that employs over 1,500 people in the United States and the rest of the world. Management Science America, Inc., has branch offices located in twenty-one U.S. cities including Atlanta, Boston, Chicago, Columbus, Dallas/Fort Worth, Denver, Houston, Los Angeles, Minneapolis/St. Paul, New York, Philadelphia, San Francisco, Seattle, Washington, D.C., and Winston-Salem.

Including MSA Canada, Management Science America Inc., has seven subsidiaries: MSA International, Inc., with office in London, Brussels, Atlanta, Singapore, Kong Kong and Oslo; Management Science America (Australia) Pty. Ltd. with offices located in Sydney, Melbourne and

Auckland, New Zealand; Peachtree Software Incorporated with offices located in Atlanta and San Francisco; Peachtree Software International Ltd. located in London, and Peachtree Software (Australia) Pty. Limited in Sydney. In addition, the firm has agents for their products located in Tokyo, Japan and Johannesburg, South Africa.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

MSA Canada supplies a variety of applications software in the following areas: financial applications, human resources management, manufacturing and microcomputer software.

1. General Ledger/Financial Information and Control System

This system is designed for accountants and provides general accounting, budgeting and planning, cost accounting and management, and financial statement preparation for all industries. In addition, this system provides control of all accounting entries and key statistics, and gives organizations an accurate base of information for financial and management reports, as well as compliance with industry, regulatory and statutory requirements.

2. Accounts Payable and Purchase Order Control

This system controls the payables function and conserves cash by automatically applying payment terms to invoices, preventing duplicate payments, automating voucher entries to the general ledger, and reconciling cheques. The system projects cash, supplies a bank requirements register, and handles the reimbursement of employee expenses.

During 1981, Purchase Order Control facilities were added to integrate Accounts Payable with Inventory and Purchasing.

3. Inventory and Purchasing

This system provides purchase order status and activity, designates inventory status and history, provides supplies usage and cost reporting, produces suppliers catalogues and purchase order capabilities. The system also provides the ability to calculate economic order quantities, and facilitates effective decision-making by highlighting exceptional inventory conditions.

4. Accounts Receivable

This system simplifies the task of receivables management. System auditing of discounts, calculation of finance charges, and ability to charge the customer automatically enables receivables personnel to work more effectively. The system is designed to interface with Dun & Bradstreet and NACIS credit information.

The system has online capabilities including cash applications, credit inquiry, account maintenance, and exception reporting.

5. Forecasting and Modeling

This MSA system is designed for planning, forecasting, budgeting and senior management reporting. It provides for instantaneous answers to "What If?" questions without programming expertise.

6. Fixed Assets Accounting

This system provides management with information to control assets, calculate depreciation and comply with tax laws and regulations.

7. Payroll

The payroll system is intended to provide the user with a reliable method of monitoring and controlling payroll costs.

8. Personnel Management

This personnel management and reporting system addresses the key areas of employment, manpower planning, benefits administration, and government compliance. This system also provides management with a clear picture of its employee workforce with comprehensive reports.

9. ALLTAX

Having complete compliance with Canadian payroll tax regulations, the ALLTAX system is intended to function as part of a customer's payroll system and is a standard feature of MSA's Payroll System. ALLTAX calculates federal and provincial taxes and Unemployment Insurance, Canada Pension Plan and Quebec Pension Plan contributions.

Over 3,000 organizations in Canada and the United States utilize MSA's ALLTAX systems.

10. ALLTAX REPORTER

The ALLTAX REPORTER is a new system which provides the user with the opportunity to purchase ALLTAX without MSA's Payroll System.

11. Colour Graphics

Enables users to translate business information into distinctive computer generated charts and graphs. MSA Colour Graphics operates on IBM colour graphic hardware and software.

12. Online Products

All MSA products are terminal oriented and feature special tools for increased efficiency and flexibility including: Easy Screen, a screen generator; Easy Audit, a screen formatting program providing instant access to available information and Easy Plan, a realtime interactive budgeting module of the General Ledger/Financial Information and Control System.

13. System 43

MSA has developed a full line of business applications, entitled System 43, designed for the new IBM operating system for the 4321/4331 computers. System 43 provides general ledger, accounts payable and receivable, fixed assets, inventory and purchasing, forecasting and modeling, and payroll and personnel reporting.

14. Manufacturing Systems

MSA purchased these systems from the Xerox Corporation. These products have been offered in the IBM/DOS marketplace and will be introduced to the IBM/OS user community.

The manufacturing systems include: Manufacturing Standards, which maintains information on a company's manufacturing process; Inventory Record Control, to maintain inventory and monitor use of materials; Historical Forecasting, which analyzes historical demands for parts and

stock items used in the manufacturing process and projects future demand; Master Production Scheduling, which aids in the planning for, and control of impact upon capacity and available materials; Material Requirements Planning, to provide time-phased requirements for materials; Capacity Requirements Planning, which establishes the equipment and resources needed based on an organization's overall production plan and schedule;

Shop Floor Control, to monitor actual manufacturing activity against the plan; Procurement Management, to monitor the status of purchase orders from the time they are issued throughout the manufacturing cycle; Product Costing, which develops complete unit cost information; and Manufacturing Accounting, which measures the actual cost incurred during the manufacturing process and compares it to the standard cost of each product.

15. Capital Expenditure Tracking System (CETS)

This system monitors, controls, and reports on capital projects from budgeting approval through completion. CETS helps managers to stay within budget and target-date guidelines, whether purchasing equipment or managing a major plant expansion. Capabilities include comparison of actual cost to budget, calculation of estimated completion date, materials reporting, and quantity tracking by invoice and purchase order.

16. Order Processing System

This is an online order entry system designed to facilitate customer order processing. The Order Processing System allows easy order entry, automatic exception checking, online distribution support, automatic invoicing and instant access to customer information.

17. Foreign Exchange System

This system is designed to monitor exchange information and calculate realized and unrealized gain or loss on currency exchange.

18. Microcomputer Applications Software

With the acquisition of Peachtree Software Incorporated on June 23, 1981, MSA has a solid presence in the market for microcomputer-based business and office productivity software.

These applications software packages are written using Microsoft's BASIC, CIS COBOL and assembly language.

The list of MSA-Peachtree applications range from general ledger to PeachText (word processing) to electronic mail to various payroll packages. All packages are compatible with many major types of microcomputers.

19. Executive Peachpak (tm)

Executive Peachpak provides a micro/mainframe link between MSA online systems and a desk-top personal computer. This link allows the use of data resident on a mainframe with applications packages running on a microcomputer.

Applications include PeachCalc, an electronic spreadsheet; Business Graphics; PeachText, a word processing package; List Manager, a mini-personal database to track address files and other personal notes and appointments; Telecommunications, which allows direct communications to other microcomputers; and PeackLink, which provides the link to MSA mainframe software.

5.0 1983 CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

MSA Canada's strategies in 1983 and the rest of the decade are threefold. First, the company will endeavour to address IBM users in Canada with their portfolio of software products, with the objective of increasing their market share. Currently, 80% of MSA's customer base consists of IBM users.

Second, Management Science America Inc., has designated the manufacturing sector as a growing vertical market for mainframe and microcomputer software. According to the General Manager of MSA Canada, manufacturing systems are forecasted to approach 20% of the total applications software market by 1985. MSA's response to this potential market was to expand its product line with the purchase of the Arista Manufacturing Systems from Xerox Corporation in January 1982. It is MSA's intentions to integrate these manufacturing systems with their financial and human resource systems, to capitalize on this potential marketplace. As a subsidiary of the parent company, MSA Canada will be addressing the Canadian manufacturing sector with these applications products.

Third, with the acquisition of Peachtree Software Incorporated in June of 1981, MSA (and consequently MSA Canada) will be able to address the growing microcomputer software market with a proven portfolio of products. In addition, MSA will endeavour to utilize these microcomputer products in their attempts to penetrate the manufacturing sector.

Finally, MSA will continue to address the needs of the IBM mainframe user community, which represents a huge and growing number of mainframe installations worldwide. This commitment to the development of software for this community was seen in the company's involvement in a pre-release field trial of the new IBM operating system known as Small System Executive (SSX). SSX is the operating system for the IBM 4321 and 4331 computers. As a result of this opportunity, MSA has developed a full

line of applications software for these machines, called System 43.

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QUASAR SYSTEMS LIMITED
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1.0 COMPANY BACKGROUND

Quasar Systems Ltd., renamed COGNOS Incorporated on January 1, 1984, is a privately owned Canadian firm located in Ottawa. From its early beginnings in the late 1960's to the present, Quasar has been successful in acquiring a reputation as a world leader in the development of software products for the Hewlett Packard 3000. Quasar has also been successful in consolidating its image as a major consultant firm offering professional services in the information systems industry.

Quasar Systems Ltd. is one of Canada's leading software firms. The company has joined the ranks of other Canadian firms such as Mitel, Gandalf and Northern Telecom as a major success story, not only in the domestic market but in international markets as well.

Quasar Systems Ltd. was founded in 1969, the same year that IBM unbundled its software. As a result of this unbundling a whole new industry was created and an opening emerged for firms devoted to the development of custom software.

In 1969, Quasar Systems Ltd. consisted of a small group of EDP professionals dedicated to the application of management science and computer technology to client information problems. During the period from 1969 to 1975 the company experienced slow but gradual growth in both company size and total revenues. The firm grew one to three branches, with forty employees, located in Toronto, Ottawa and Montreal. Total EDP revenues in 1975 were \$1.3 million.

During the next stage of the company's development from 1975 to 1979, Quasar expanded its operations in Western Canada. Four additional branch offices were established in Calgary, Edmonton, Vancouver and Victoria. The number of employees increased from 40 at the end of 1975 to over 160 consultants by the end of 1979. Total EDP revenues for the fiscal year ending 1979 were \$3.7 million. The firm was well on its way to establishing itself as a major supplier of turnkey systems for the Hewlett Packard 1000 and 3000 series computers. By the end of 1979, Quasar had installed ten turnkey systems.

Recognizing the growing demand by clients for reliable, cost-effective and sophisticated software packages, in 1979, Quasar formed an entirely new division with the mandate of developing and marketing software products. The company's objective was to improve programmer productivity, by providing applications generators as well as developing applications packages for the HP 3000 end user community.

Since 1979 Quasar has experienced tremendous growth. The company added further branches in Halifax and Winnipeg, bringing the Canadian branch office total to nine. It was also during this phase that Quasar made its major thrust into the United States and overseas markets. In 1980, the company established a wholly owned subsidiary, Quasar Systems Inc., in San Francisco. Further sales offices were opened, as required, in the following major U.S. cities: Atlanta, Boston, Cincinnati, Chicago, Dallas/Fort Worth, Greensboro, Los Angeles, Newport Beach, New York, Philadelphia, San Francisco and Washington, D.C. To date, there are fifty people currently employed with Quasar Systems, Inc.

During this stage of the company's development, Quasar made major steps towards establishing a presence in overseas markets. In May 1982, the company established a wholly owned subsidiary, Quasar Systems Ltd, in Berkshire, England. In addition, Quasar negotiated major agreements with

firms to distribute its products in the Far Eastern markets of Singapore, Hong Kong, Australia and New Zealand.

As a response to the growing demand for software products, in 1981 Quasar acquired the assets of the Palo Alto Group, a California software company with a product called DOLLARFLOW. With minor modifications, Quasar was able to integrate this decision support system within its existing portfolio of products in a short period of time.

The shift in the company's main activity from professional services to development and marketing of computer software products has required changes in the Canadian operation and branch office structure. The Victoria and Halifax branches were closed in 1982, and the Edmonton branch in 1983. In August 1983 the professional services operations of the Vancouver, Calgary and Toronto branches were spun off and sold to United Information Services, a U.S. firm. At the end of 1983, in addition to the head office in Ottawa, Quasar had Canadian branch offices in Montreal, Toronto and Winnipeg.

2.0 FINANCIAL HIGHLIGHTS

The financial highlights of Quasar Systems Ltd. are indicated in the following table:

	Financial Year Ending August 31				
	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Total Revenue (\$M)	3.7	5.7	11.1	18.6	18.6 ⁽¹⁾
Annual Growth (%)	-	54.1	94.7	68.7	
Computer Software Products					
Revenues (\$M)			2.8	9.7	
% of Total			25.6	52.0	
Annual Growth (%)				242	
Professional Services					
Revenues (\$M)			8.2	8.9	
% of Total			74.4	48.0	
Annual Growth (%)				9.0	

- (1) The 1983 total revenue figure excludes professional services revenues from the Canadian operation which was spun off and sold to United Information Services. It should be compared with the restated 1982 revenues.

Quasar's EDP revenues for the year ending August 31, 1980 were \$5.7 million, placing the company in 59th position among the top computer companies in the Canadian computer industry. From the end of fiscal year 1979 to the end of fiscal 1980 Quasar's EDP revenues increased by 54%.

For the fiscal year 1981, Quasar reported total EDP revenues of \$11.1 million, which was a dramatic 95% increase over the preceding fiscal year. Quasar improved its position relative to other companies in the Canadian computer industry, moving from the 59th to 52nd position. Revenues generated from the professional and custom software development activities were \$7.8 million and this accounted for 70.3% of the company's total revenues. Sales of computer hardware generated revenues of \$380,000 and this portion accounted for only 3.5% of the total revenues. Revenues generated from sales of the company's computer software products were \$2.8 million and accounted for 25.2% of the company's total revenues.

Exhibit 1 shows that in relation to other companies in the information processing industry, Quasar placed 12th in 1980 and 11th in 1981 on the basis of software revenues.

Quasar's revenues for the year ending August 31, 1982 were \$18.6 million, which was an increase of 68.7% over 1981 revenues. Sales of computer software products accounted for \$9.7 million or 52.0% of Quasar's total revenues; this was a 242% growth over 1981 sales of software products. Revenues generated from the professional and custom software development activities were \$8.9 million and these accounted for the remaining 48.0% of the company's total revenues. Revenues from professional services increased by approximately \$733,000, showing a moderate growth rate over the preceding year of 8.9%. Quasar did not report any sales of computer hardware for the fiscal year 1982.

Despite this banner year for Quasar, it should be noted that expenses increased by 73.5% over 1981 expenses, to \$17.7 million. As a result, net income showed a moderate increase of \$268,000 for 1982 from \$616,000 in 1981 to \$884,000 in 1982, a growth rate of 43.5%. Earnings per common share were .48¢ for 1982, compared to .41¢ for 1981.

It is interesting to note the definite shift in emphasis towards sales of computer software products instead of professional services, as evident in Quasar's revenues reported for fiscal 1982. According to Mr. Michael Potter, President and Chief Executive Officer of Quasar Systems Ltd., 87% of revenues from sales of software products are now generated outside Canada; this can be broken down as 75% from the United States and the remaining 12% from overseas markets including the U.K. and the Far East. The balance of Quasar's 1982 revenues was derived from the Canadian market. Quasar does not offer any custom software development and/or consulting services outside Canada.

As pointed out by Mr. Potter, Quasar has had an average growth rate of 72% over the last three years. The major reason for that growth has been the sale of software products. One of the contributors has been the installation of about 1700 units of Quasar's highly successful report writer, QUIZ, in the United States. In total, Quasar has some 2800 product installations in 30 countries.

With the successful conversion of Quasar's POWERHOUSE technology to other major hardware systems such as the DEC VAX and the Data General line, in addition to the HP 3000, Mr. Potter anticipates that a revenue base of \$50 million is certainly achievable by the mid-1980's.

Like many software firms, a major portion of Quasar's activities is in Research and Development. During 1982, Quasar expended over \$1.8 million on R&D or 9.8% of total revenues. These expenditures include costs

incurred in the development of products already in the market place and those products that were still under development. In 1982, R&D expenditures increased by 208.1% over 1981 R&D expenditures of \$593,327. In 1981, R&D expenditures accounted for 5.6% of Quasar's total EDP revenues.

Of special note was Quasar's acquisition of the Palo Alto Group for the sum of \$1.3 million, of which their financial planning tool 'DOLLARFLOW' was valued at \$1.1 million. Modification of this financial package only required a small R&D investment to incorporate it into the company's current line of software products, although Quasar has recently invested \$900,000 in a major enhancement program for DOLLARFLOW. The enhanced product, called POWERPLAN, was released in the spring of 1983.

3.0 CORPORATE STRUCTURE

Quasar Systems Ltd. restructured its senior management team during 1981 to facilitate the management and control of the company's growth over the next five years. Corporate management is now organized functionally into operations, marketing, finance, and research and development.

Quasar has experienced dramatic growth in its number of employees, which increased from approximately 85 in 1978 to a high of 350 in 1983. It was about 300 at the end of 1983, after the divestiture of the professional services operation in Vancouver, Calgary and Toronto. The company understands that its business is highly labour intensive and therefore has put substantial priority to acquiring highly qualified data processing professionals.

The marketing, sales and distribution functions are clearly an important facet to the livelihood of software companies. Recognizing this fact,

Quasar has built up a direct sales force with offices in 17 locations, and has a third party network of over forty distributors representing Quasar in 22 countries around the world.

4.0 AREAS OF EXPERTISE AND SOFTWARE PRODUCTS

Areas of Expertise

There are two facets to Quasar's business activities. First, the company has established expertise in the development of custom software for energy, natural resource, distribution, manufacturing, financial, and government applications. Examples of Quasar's clients are Ontario Hydro Corporation, Canadian Pacific Railway, MacMillan Bloedel, Northern Telecom, Bank of Montreal, Montreal Engineering, Canadian Medical Association, Hewlett Packard, City of Calgary, and the Canadian Council of Churches.

Second, Quasar has also established itself as a world leader in the creation and marketing of proprietary software products, with the objective of increasing the productivity of data processing resources and bringing computer technology closer to the end-users.

Software Products

Quasar's proprietary software products fall into two broad categories, productivity tools and financial packages. Productivity tools, such as Quasar's QUIZ and QSCHEMA, are products that assist the programmer in the development of applications software. Quasar's financial packages are application products that allow the end-user to carry out a required task such as pro forma projections and sales analysis.

A. Productivity Tools

QUIZ

QUIZ is a report writer for HP 3000 users; it has the capability of providing significant increases in the volume and development of application reports. QUIZ is easy enough to be used by end-users and yet has a rich set of commands to satisfy the most demanding DP professional.

There are currently about 1700 QUIZ units installed on HP 3000's in 22 countries, with the majority located in the United States. The average cost of this product is approximately \$7,000.

QUICK

QUICK is an application development tool for the HP 3000. Using QUICK, there is no longer any requirement to program the interface between application screens and the user's database. Applications developed by QUICK are full production systems capable of data entry, inquiry, and file maintenance.

There are two programs in the QUICK package: (1) QDESIGN is the program in which operational screens are designed; and (2) QUICK is the program in which operational screens are run.

QTP

QTP is a volume transaction application development tool for HP 3000 users. This product eliminates programming for ad hoc and periodic volume processing, including global updates, month-end batch processing and file manipulation. It allows the user to specify standard batch functions in a simple, logical and straightforward manner.

DICTIONARY PLUS

DICTIONARY PLUS is the data dictionary for all Quasar's productivity tools - QUIZ, QUICK, and QTP. The dictionary provides centralized definition of data structure and attributes, which is in turn used by the companion products to realize their dramatic productivity gains for users.

POWERHOUSE

POWERHOUSE is a unified set of products based on a consistent style of interaction with the computer. The components of POWERHOUSE are QUIZ, QUICK, QTP and DICTIONARY PLUS. POWERHOUSE is completely compatible with the HP 3000 operating system, IMAGE, KSAM and DICTIONARY/3000.

POWERHOUSE software is currently installed in over 1,500 HP 3000 sites throughout the world.

B. Financial Packages

MULTIVIEW

Quasar's MULTIVIEW financial software consists of MULTIVIEW GL, a powerful on-line package for General Ledger and Financial Reporting, and MULTIVIEW AP for Accounts Payable.

MULTIVIEW GL

MULTIVIEW GL, Quasar's General Ledger package, delivers on-line flexibility and reporting power to any size or type of business with an HP 3000 computer. It is fast to install, adapts inexpensively to any magnitude of organizational change, and opens a new horizon for cost-effective measurement of financial performance.

MULTIVIEW GL's features include: project, product, line-of-business reporting; multiple consolidation of the same transactions; actual, budget, historical and statistical comparisons; high-speed transaction entry; multi-company processing (multiple charts of accounts, multiple year-ends, multiple periods); project, non-financial, fixed amount and variable percentage budgeting.

The MULTIVIEW Financial Report Writer is an innovative spreadsheet-type report writer and a primary feature of MULTIVIEW GL. Its use can be learned by an accountant in one or two days, yet it produces virtually any complexity of financial statement, analysis or operating report.

MULTIVIEW AP

In addition to Accounts Payable reporting functions, MULTIVIEW AP will handle invoice entering and processing, disbursement preparation, check production and check reconciliation processing. It has multi-company processing capabilities.

MULTIVIEW AP processes various types of transactions, including debit notes, credit memos, adjustments, paid invoices, and manual and voided checks. Extensive audit controls and reporting capabilities are included. A wide range of features and options allows users to tailor the system to their own unique requirements.

POWERPLAN

POWERPLAN is a unique decision support system for financial analysis, modelling and planning, designed specifically for the HP 3000 family of computers. The product is easy to learn and can be used by any executive or manager - regardless of previous experience with computers. POWERPLAN systematically addresses the major clerical tasks of combining the figures and calculation rules used in individual reports into a network of interrelated reports. With POWERPLAN's advanced consolidation

features, the conventional time-consuming and error-prone effort of transposing numbers from individual reports to consolidated statements becomes a straightforward task of combining single reports in the network; values 'flow' directly from one report to another.

Other principal features include: an interface to data files in POWERHOUSE applications; built-in financial functions; computer graphics; direct report referencing; and automatic report production. POWERPLAN's menu-driven system of screens provides convenient access to all critical planning functions and the tutorial style of the 'Portrait of a Plan' user manual makes computerized financial planning comprehensible to everyone.

The entry price for the base module called POWERPLAN-Executive is \$6,600 (\$5,500 U.S.). The three additional options: POWERPLAN-Plus, POWERPLAN-Fast Plan and POWERPLAN-DSG Link are available as a set of 'building block' modules, enabling the user to acquire the product with the capabilities to match both present and eventual requirements.

Since its release in March 1983, POWERPLAN has been installed in over 200 locations.

5.0 1983 - COMPANY STRATEGY AND PRODUCT DEVELOPMENT

It is clear that Quasar's success can be attributed to finding a niche in the development of applications development software and applications products for the HP 3000. With most of the industry concentrating on the development of software for IBM hardware, a definite gap was left for the development of software for competing vendor hardware that had already achieved a reasonable share of the market. This emphasis on the development of applications generators and applications software will

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continue to be the major thrust of the firm during 1983 and the following years. Quasar's strategy for the rest of the 1980's is threefold.

First, Quasar will continue to enhance and extend POWERHOUSE in order to maintain its position on the leading edge of fourth generation language software. Specific enhancements in such areas as graphics capability and end-user query and report writing capability are already underway.

Second, Quasar will make POWERHOUSE available on several major minicomputers, and (probably) for the microcomputer market. The company has already invested significant resources in the development of a machine independent prototype of POWERHOUSE and has implemented a DEC VAX version of the software, ready for release in the Fall of 1983.

Third, Quasar will continue the development of applications products in the areas of general accounting and financial planning. It will ensure a high level of integration between these products and POWERHOUSE, in order to provide a "total solution" for their clients.

Quasar does not offer any consulting services outside Canada. The firm is gradually phasing out its traditional custom software development and consulting services and is in the process of re-establishing its image as primarily a software products development firm. According to Mr. Potter, the custom development industry is a low-growth, low-margin segment of the business. The future of Quasar clearly lies in the development and marketing of its existing and new software products.

REAL TIME DATAPRO

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1.0 COMPANY BACKGROUND

Real Time Datapro is a medium-sized Canadian service bureau specializing in general insurance and municipal government systems. The company became a recognized supplier as a result of a number of events. In 1969, Real Time Corporation became a public company. In 1970, the company appointed as its President Mr. Gerry Meinzer, who brought to the firm the experience he had accumulated as an employee of IBM. In the same year, the corporation acquired the assets of the Univac Information Services Division of Sperry Rand in Canada. Later in 1974, Real Time Corporation merged with Datapro (formed in London, Ontario in 1962) and subsequently became known as Real Time Datapro Ltd.

Since 1974 the company has focussed its energies on entrenching its position as a service bureau offering services and software products to the insurance companies and agents, and local governments. The company is also an OEM for GEAC Computers.

2.0 FINANCIAL HIGHLIGHTS

Total EDP revenues for fiscal year 1980, 1981 and 1982 were \$5.1 million, \$6.4 million and \$9.0 million respectively. This represents a gain of \$1.3 million and a growth rate of 25% in 1981; corresponding figures for 1982 are \$2.6 million and 41%. In relation to other companies in the Canadian computer industry, Real Time Datapro placed 74th in 1980 and 80th in 1981.

Real Time Datapro's revenues generated from sales of software products (as distinct from its time sharing services) accounted for an estimated 10% of its total EDP revenues in 1980 and 1981. The company's software revenues grew by 25% from \$510,000 in 1980 to \$640,000 in 1981. As shown in Exhibit 1, the company placed 58th in 1981, down from 52nd place in 1980, in terms of its software revenues compared to other companies in the Canadian software industry. This decline in position relative to other companies in terms of software revenues reflects the fact that the company's prime area of business is processing services.

The company's continued existence depends upon a commitment to further research and development. Real Time Datapro's livelihood, in particular, depends upon a continual process of upgrade and modification of existing products, as well as the development of newer state-of-the-art software products. Thus, as Mr. Meinzer pointed out, the firm ensures that a threshold level of 10% of total EDP revenues is directed towards research and development. For 1980 and 1981, total research and development expenditures were estimated at \$510,000 and \$640,000 respectively, exhibiting an increase of \$130,000 and a growth rate of 25%.

The largest portion of the company's total EDP revenues (including sales of software products) comes from the general insurance industry; however, specific figures are confidential information.

3.0 CORPORATE STRUCTURE

Real Time Datapro is a public company with a head office located in Don Mills (Toronto), Ontario. The firm has branch offices located in Montreal, Ottawa and London, England.

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In conjunction with GEAC Computers, Real Time Datapro Ltd. set up Real Time Insurance Systems in London, England. This branch became operational in the 3rd quarter of 1982.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Real Time Datapro provides software solutions and turnkey solutions to general insurance companies and municipal governments. The following section describes the company's software products.

Software Products

A. Municipal Government

1. Property Assessment Tax Management

An application package providing a variety of features ranging from tax certificates processing, mortgage company analysis, four year tax receivable and payment distribution, and daily audit reports.

2. Financial Management

An application package offering up-to-date reporting on accounts payable, cheque reconciliations, general ledger, commitment and encumbrance accounting, budget comparisons and financial reporting for council members, heads of departments and the accounting department.

3. Water Billing

An application package that processes flat rate or metered billing, minimum bill by consumption or dollar amount, estimated billing, and a

variety of reports.

4. Maintenance Management and Activity Management Sub-System

An application package that providing the following features: crew cards, foreman's card, contract expense/recoveries input, progress payment certificates, and annual budget input.

5. Parks & Recreation Registration System

An application package giving full applicants status, random registration on selected courses, 'first come-first served' registration on normal courses, full course status, full location status, primary and secondary options, and fee cancellation and exchange.

6. Parks & Recreation Facilities Management

An application package providing the capability to book facilities in advance on a daily, weekly, monthly and yearly basis. and access details of each displayed time slot.

B. General Insurance

1. The AAA (Automated Agency Accounting) System

An application package which provides the user with receivables control, administrative invoices and renewals, automatic letter writing, and electronic shopping.

2. On-Line General Insurance System

A modular, on-line applications package allowing insurance companies to control, manipulate, and present insurance policy and financial information.

5.0 1983 - CORPORATE STRATEGY AND PRODUCT DEVELOPMENT

Real Time Datapro has a number of avenues which it will explore in 1983 and the following years. First, with the establishment of Real Time Insurance Service Ltd., in London, England, the company has taken a major step towards penetrating the export markets. The United States, with its large number of municipalities and insurance organizations, presents a possible market for Real Time Datapro. According to Mr. Gerry Meinzer, the firm is currently conducting an evaluation of that market. In addition, the company expects to move into the Australian and Hong Kong markets shortly.

Second, Mr. Meinzer believes that the company is well positioned to become a major software vendor as well as a service bureau. According to Mr. Meinzer there has been substantial interest in the firm moving in that direction. This is one area which the company will consider more carefully in 1983 and beyond.

Real Time Datapro Ltd. is involved in the business of providing and selling proprietary software products to the members of the insurance industry and local governments, but it is not without competitors. One of the company's fiercest rivals is Policy Management Systems (PMS). PMS has an insurance system that runs on IBM equipment. One of the reasons that Real Time Datapro Ltd. moved so quickly to establish itself in England was to beat PMS to the British market. This strategy of beating the competition to the markets will continue in the future.

Policy is another major product that is providing substantial competition. It was developed by a firm in New Zealand and is currently being used by Canada Systems Group (CSG) on Perkin-Elmer equipment. A third major competitor is Basic Four, which has been instrumental in the development of innovative software for the insurance industry and local governments during the last few years.

The key to staying ahead of the competition, according to Mr. Meinzer, is to produce software products that are state-of-the-art. This is the company's major goal in the upcoming years.

SYDNEY DEVELOPMENT CORPORATION

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1.0 COMPANY BACKGROUND

Sydney Development Corporation ("Sydney") is one of Canada's most visible software development firms and system integrators. Sydney has been involved in the design, development, and marketing of software products since 1978.

Sydney is a public British Columbia corporation, which was incorporated on April 21, 1966. Shares of Sydney Development Corporation trade on the Vancouver Stock Exchange and the Toronto Stock Exchange.

During the 1980's Sydney has been actively acquiring the assets of various software firms. In January 1981, Sydney acquired all the issued shares of Easy Data Systems Ltd., a North Vancouver, British Columbia developer of computer systems for libraries and accounting. In June 1981, Sydney's Texas subsidiary purchased the assets of Medicomm Corporation, a Dallas, Texas developer of computer systems for medical and dental offices. On April 1, 1982, Sydney acquired the assets of English Bay Systems, Inc., a Vancouver, British Columbia developer of investment management computer systems for the brokerage industry. As of June 1982, Sydney had acquired the assets of two additional firms. Sydney acquired all the assets of Artech Integrated Accessories Ltd., an Ottawa based manufacturer of computer games. Sydney also recently acquired 50% of S.P. Support Links, a British firm located in London, England which is involved in the development of software.

2.0 FINANCIAL HIGHLIGHTS

Sydney's total EDP revenues for 1980, 1981 and 1982 were \$642,483, \$4.9 million and \$8.0 million respectively. Total EDP revenues therefore increased by 66.3% from 1980 to 1981, and 63.3% from 1981 to 1982. Of these revenues, sales of software products accounted for some 36% and 43%, or \$233,500 and \$2.1 million respectively, in 1980 and 1981. Sales of software products increased by some 800% from 1980 to 1981.

The remaining 64% and 57% of the company's revenues in 1980 and 1981 were generated from research and development fees, consulting and course fees, sales of computer hardware, and other related items. By far the largest segment after software products are the research and development fees. These fees accounted for about \$1.42 million or 29% of Sydney's total revenues in 1981. They were not counted in 1980.

In 1980 and 1981, consulting and course fees accounted for 52.7% and 15.8% respectively of the company's revenues. This shows a decline in percentage terms of 36.9%. In actual terms however, consulting and course fees increased from 1980 to 1981 by approximately \$437,000 or 129%.

In 1980 and 1981, sales of computer hardware accounted for approximately 4.4% and 2.7% of Sydney's total revenues. Although sales of computer hardware as a percentage of total company revenues is declining, revenues generated from this area alone increased by \$105,000 or 448% from 1980 to 1981.

In short, it is evident that the greatest growth in Sydney's total revenues is from the sales of software products, followed by research and development fees.

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Sydney's total revenues were \$8.0 million for 1982 (i.e. the fiscal year ending March 31, 1983), an increase of 63% over 1981. This encouraging growth in sales is largely due to the strong performance of Sydney's Investment Management System, successful penetration of the U.K. market, and the improved performance of the company's Medicom division.

Sydney is also expecting very positive results from its "Evolution" video game. This should contribute considerably to the company's expected revenues in the short term.

The company's earnings in 1981 were \$565,501 (which included income tax recoveries and the gain from the sale of a subsidiary company, Business Display, Inc.), compared to a loss of \$256,654 the previous year. Earnings per share for 1981 (year ending March 31, 1982) amounted to 8.6¢ per share from continuing operations and 12.7¢ per share after extraordinary items compared to a 5.8¢ loss and a 10.5¢ loss respectively for the previous year.

3.0 CORPORATE ORGANIZATION

Sydney Development Corporation currently employs 220 employees, in its home office and branch offices located in Canada, and in its various subsidiary companies throughout the world. Sydney employs 140 people in Canada, with the remaining eighty individuals located in the company's foreign locations.

The Canadian operations of the company are centered around the head office located in Vancouver, and the four branch offices located in Ottawa, Toronto, London, and Vancouver. In June 1981 Sydney established Sydney Research Corporation, to act as the General Partner of the limited partnerships which would engage in the business of developig and marketing innovative computer packages and which would be affiliated with

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Sydney through contractual arrangements for the development and marketing of those products. On July 1, 1982 Sydney Research Corporation established and signed an agreement with Sydney Advanced Technology (1982) Limited Partnership (the "Limited Partnership"). The "Limited Partnership" is an ambitious and inovative R&D tax shelter program designed to encourage investment in the development of software products.

The international operations of the firm are operated by Sydney Development International Ltd., a holding company located in Barbados. Underneath the umbrella of this holding company, Sydney has two subsidiaries located in the United States, Sydney Data Products Inc., located in San Diego, California, and Medicomm Corporation, located in Dallas, Texas. In the United Kingdom, Sydney's operations are conducted by Sydney Development Company located in London, England.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Sydney Development Corporation is an exciting software development firm. The company provides a number of software solutions, including hardware if requested, to selected vertical and horizontal markets throughout Canada, the rest of North America, and throughout the world.

The following list of products is broken down into two categories, those that are currently available to the user and those still under development.

Available Products

1. CONQUER

This is a state-of-the-art interactive database management system designed for use on large mainframe computers; it currently runs on IBM 370,30XX, 308X and 4300 series or equivalent machines, running under VM/CMS or MVS/TSO. This product utilizes a high level command and data definition language, in order to permit implementation by non-technical users. The price is \$17,000.

2. THE PORTFOLIO MANAGER

This is a complete portfolio management system for pension funds, investment counsellors, financial planners, corporate officers, insurance companies and stock brokers. It is a comprehensive and flexible tool for the modern funds manager. The PORTFOLIO MANAGER provides support in three broad areas: funds management, marketing and client services, and office productivity.

In the management area the package provides portfolio analysis, technical analysis, instant communication with financial and news databases, security trading histories, and corporate data. The following marketing and client services are provided - performance measurement, up-to-date valuations, graphic representations of performance and asset mix, and aggregate performance reports. Finally, the PORTFOLIO MANAGER provides high quality printouts of portfolio reports, word processing, financial modelling and electronic filing.

The PORTFOLIO MANAGER belongs to a family of investment management systems which Sydney is providing and will be providing for stock brokers, financial planners, and investments advisors. The systems are

intended for multi-terminal use by brokerage houses. The price of the system is based on the number of accessing terminals, and is typically in the range of \$1,000 per terminal.

3. REAL ESTATE ANALYSIS SYSTEM

This is a state-of-the-art microcomputer system, specifically designed to assist executives and other decision makers in the evaluation and analysis of real estate opportunities. The system is designed for use by investors, developers, residential and ICI brokers, appraisers, analysts, planners, consultants and construction companies in the real estate business.

The REAL ESTATE ANALYSIS SYSTEM features four integrated modules: real estate investment analysis, contemporary financing, brokers' statements of adjustment, and property record keeping.

The real estate investment analysis module allows rapid analysis of investment opportunities in the real estate market. This module has three elements. The first program, the development potential analysis program, provides indicators of the profitability of real estate development and redevelopment opportunities. The second element, the development pro-forma analysis program, performs period-by-period (months, quarters, years) analysis of the land development process. The third and final element, the property yield analysis program, provides for contemporary analysis of yields and returns to equity in established real estate ventures.

The contemporary financing module provides the means to analyze real estate financing arrangements and to handle basic administrative functions. The options in this module include mortgage financing, mortgage brokerage and disclosure, mortgage discounting, innovative financing, and portfolio analysis.

- -

The brokers' statement of adjustment module is designed to produce final copies of the closing statement for real estate property transactions, for both the vendor and the purchaser. Program features include: tax adjustments, tax arrears, new mortgage financing, vendor financing, assumed and assigned mortgages, fees and disbursements, additional items to be included in the sale, and interest adjustments.

The property record keeping module has two purposes. First, as a stand-alone program it is designed to maintain property lease data for each tenant. Second, the program is a front-end data source that provides a link to the real estate investment analysis module.

The minimum hardware configuration required to operate the REAL ESTATE ANALYSIS SYSTEM includes the following:

- APPLE II or APPLE II PLUS Micro-Computer with 64K RAM (Random Access Memory)
- Display Monitor
- 80 column printer
- One disk drive (5 $\frac{1}{4}$ inch)

The approximate cost of this computer system is \$4,500.

The REAL ESTATE ANALYSIS SYSTEM is delivered in a product package containing the following:

- A comprehensive user guide
- System diskettes
- System enabling feature

The programs are written in UCSD PASCAL and contain over 30,000 lines of code. The price of the package is \$1,895.

4. CUSTOM DRAPERY AND INTERIORS BUSINESS SYSTEM

This is a comprehensive microcomputer system which is designed for the specific needs of the Drapery and Interiors Business. The system is intended to enable managers to increase the effectiveness of the staff, monitor order processing, business results, and the company's financial position very closely, and facilitate quick and effective decision-making.

The system is directed at the following segments of the Drapery and Interiors business: regional chains, national chains, department stores, independent retailers, interior designers, decorators, and drapery manufacturers.

The system's functions are grouped into three main areas. Order entry, processing, and sales reporting are used to monitor a customer order within the order cycle. The inventory and purchasing functions of the system are essential ingredients in the operation of a successful drapery and interior design business. With this system a perpetual inventory is maintained for each item in stock. Purchase order information is stored and can be viewed and updated on a normal or exception basis. With the business analysis and management reporting feature, the user has the capability to track the status of a customer order, monitor inventory, purchases, costs, financial information and overall profitability.

The CUSTOM DRAPERY AND INTERIORS BUSINESS SYSTEM operates on an IBM Personal Computer. Required configuration includes the following:

- IBM PC with 128K RAM (Random Access Memory)
- Display Monitor
- 80 column printer
- Two disk drives (5 $\frac{1}{4}$ inch)

The CUSTOM DRAPERY AND INTERIORS BUSINESS SYSTEM is delivered as a product package which contains:

- A comprehensive user guide
- System diskettes
- System enabling feature

The system is menu driven and features user prompting. Programs are written in UCSD Pascal and a relational data base is utilized to provide multiple index inquiry capability into system files.

5. THE SYDNEY INTERIORS ESTIMATORS

This is a microcomputer based system designed for salespersons, contractors and jobbers who perform estimates in the interiors industry. There are four estimators' packages, the Residential Custom Drapery Estimator, the Commercial Drapery Estimator, the Floor Covering Estimator, and the Cabinet Estimator.

The minimum hardware configuration required to operate the SYDNEY INTERIORS ESTIMATORS is a standard 16K EPSON HX-20 with Tape Cassette Unit.

6. THE EASY DATA INTEGRATED LIBRARY SYSTEM

This is a fully integrated, functionally comprehensive in-house library automation system for the control of all major library functions:

acquisition, cataloguing, inquiry, inventory management, and circulation. It utilizes a mini-computer on an online basis, with an accounting module to ensure total library management and control. The system can be operated by library personnel with no previous technical training. The

price of the system ranges from \$20,000 to \$50,000, depending on the functions required.

7. EVOLUTION

This is a computer game developed by Don Mattrick and Jeff Sember for Sydney Development Corporation. Essentially, the game player starts as an ameoba and tries to advance up the evolutionary chain to become a human being. This goal is attained by successfully reaching six steps.

EVOLUTION can be played on many popular microcomputers, including the Apple II, Apple II Plus, Commodore 64, IBM PC or Coleco Cartridge. The game sells for approximately \$35.00 in Canada.

8. QUEST FOR FIRE

This is a computer game that incorporates the B.C. and Wizard of ID comic characters. The game sells for approximately \$35.00 in Canada.

9. COMPUMED/PARAMED AND COMPUDENT

These form a family of software packages designed to provide medical and dental offices with automated record-keeping, patient accounting, insurance calculation, billing, patient recall, and other accounting and administrative functions particular to medical and dental practices. Prices for these systems range from \$18,000 to \$80,000 for a complete system. The price depends on the size of the practice which the system is required to support.

COMPUMED AND PARAMED are currently only available in the United States. COMPUDENT is available in the United States and British Columbia. All three products will be available in the rest of Canada in the near future.

Applications' Systems to be Developed

1. Nursing Home System

This is a microcomputer system designed for the needs of the health care industry. Sydney will be directing this product initially to the U.S. and Eastern Canadian markets, where the private sector operates the majority of extended health care facilities. Sydney estimates the potential market in North America to be 50,000 systems. The company estimates that the product will sell for approximately \$5,000 to \$7,000. Development costs for the Nursing Home System will be about \$600,000.

2. Micro Construction Management System

This system will be designed to allow the contractor to prepare an initial estimate and schedule of the job to be performed for the customer. Sydney estimates the potential North American market to be 200,000 systems. The company estimates the price of the product will be \$7,000 to \$12,000. The cost of development is anticipated to be \$900,000.

3. Income Tax Planning System

This system will allow a tax planner/consultant to make a number of calculations and develop scenarios regarding the effect a particular change in financial strategy will have on a client's final tax position. The system will allow the tax planner/consultant to prepare the client's actual return for filing.

The estimated selling price of this package will be between \$5,000 and \$7,000. There will be an annual update fee of \$55 to \$1,000 in order to keep the tax functions current. Sydney estimates the potential Canadian

market to be 5,000 systems. Estimated development cost for this package is \$750,000.

4. Micro-Quest System

With this system, it is anticipated that users will be able to build databases of historical and operational information. This will be a unique system, due to its ability to extract summaries and arrangements for data according to specifications not necessarily anticipated at the time the data was entered into the computer. The system will utilize a simple, English-like language to enable the user to select information from the database according to a set of criteria.

The product will be directed toward small businesses or organizations that deal with large amounts of information on a daily basis. Sydney estimates the cost of developing this product will be \$300,000. The potential North American market is estimated to be 500,000 systems. The price of the system will range from \$1,000 to \$1,500.

5. Oil and Gas Accounting System

This microcomputer based system will be designed to enable small resource based companies to deal with the increasing accounting and reporting procedures required for investors and governments. Estimated development cost is \$350,000. The price will range from \$5,000 to \$10,000 and the estimated potential North American market is 2,000 systems.

6. Bond and Option Pricing System

This system will provide managers and analysts of fixed income securities with the Brennan and Schwartz model for pricing. The system will be implemented on a personal computer and it will handle the valuation of

Government Bonds, callable bonds, and bond options. The estimated cost of development is \$400,000. The estimated market price range is \$10,000 to \$20,000. Potential market population in North America is 2,500 systems.

7. Art Store System

This system will allow the art store operator to structure his inventory in accordance with customer preferences and will facilitate the handling of customer enquiries and special orders. In addition, this system will provide small business accounting functions. The estimated cost of developing this system is \$300,000. The market price range will be \$5,000 to \$6,000 and the estimated potential North American market is 50,000 systems.

8. Video Store System

The video cassette industry is one of the fastest growing sectors of the economy. Sydney is developing a Video Store System that will ease the problems of circulation, tracking, and financial and statistical reporting. The estimated cost of development is \$350,000. The price of the system will range from \$3,500 to \$4,500, and the potential market in North America is estimated to be 20,000 systems.

9. Personal Investment Manager

This proposed microcomputer system is intended for serious private investors and small investment clubs, for use in recording transactions, and maintaining, evaluating and analyzing portfolios. The system will also provide various tax reports and commission information, and the user to model and track various investment strategies on a continuing basis. The system will be extendable to include additional personal

financial matters such as insurance, taxation records, net worth statements, household accounting, and personal income tax planning. The estimated development cost is \$500,000. The estimated market price range is \$250 to \$300 and the estimated potential North American market is 1,000,000 systems.

10. Educator Kits

These are designed to fulfill the need for courseware in the educational environment. Each Educator Kit will be centered around specialized software with appropriate curriculum design, lesson plans, support and trouble shooting, and will cover a complete, self-contained curriculum for the subject.

Potential markets include schools, industrial and public training establishments, foundations and hospitals, as well as parents and therapists. The estimated development cost is \$600,000. The estimated market price range is \$9,000 to \$13,000.

11. Micro-Library System

This microcomputer based system will provide small organizations a library automation system. Estimated development cost for this system is \$500,000. The potential market in North America for this product is 20,000 systems and the estimated price range is \$3,500 to \$4,000.

5.0 1983 - CORPORATE STRATEGIES AND PRODUCT DEVELOPMENT

Sydney Development Corporation has two major goals which it will be pursuing in 1983 and beyond. First, according to company officials, the company will be putting considerable efforts into penetrating the U.S.

and European markets. In addition, there are plans to eventually position the company in the Far East markets.

Second, like many software firms, Sydney Development Corporation has found it counterproductive to re-invent the wheel, or develop products that are already out in the marketplace. Although Sydney Development Corporation will be encouraging new product development, energies will be directed towards converting existing mini-computer software for the microcomputer market.

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1.0 COMPANY BACKGROUND

Systemhouse is Canada's largest independent computer systems consulting and software development company. There are two main business activities that Systemhouse addresses that are fundamentally software related: a) the custom design, development and implementation of information systems and b) the development, marketing, delivery and support of proprietary software products. In a recent brochure, Systemhouse described itself as "an organization of computer systems consultants dedicated to providing a complete range of professional services for the planning, development, implementation and operation of information systems, without being constrained because of affiliations with equipment manufacturers or computer services suppliers".

Systemhouse was incorporated as a company in July 1974. The company's goal was to create a "business which would relate the information requirements of computer users to the state of the art of hardware and software technology". Since its beginnings in 1974, Systemhouse "has been committed to the acquisition and development of expertise in evolving technology and the application of specialized system design and development in project management".

In June 1980, the company was converted from a private to a public corporation. Systemhouse stock began trading over the counter on June 17, 1980 and was finally listed on the Toronto Stock Exchange (TSE) on November 10, 1980. It was with the proceeds of this new issue that

Systemhouse embarked on a program to finance the development of its distribution network and the introduction of its proprietary software products.

2.0 FINANCIAL HIGHLIGHTS

The financial highlights of Systemhouse Ltd. are indicated in the following table:

	Financial Year Ending August 31				
	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Total Revenue (\$M)	14.3	19.3	30.5	39.8	49.5
Annual Growth (%)	39.9	34.8	58.2	30.4	24.3
Professional Services					
Revenues (\$M)		13.1	23.2	28.9	
% of Total			75.8	72.7	
Annual Growth (%)				25.0	
Products					
Revenues (\$M)		3.2	6.1	10.3	
% of Total			20.0	25.8	
Annual Growth (%)				68.2	
Other Revenues (\$M)			1.2	0.6	
Earnings (Losses)					
Operating (\$M)			2.1	(12.2)	(13.9)
Net (\$M)	0.8	1.4	2.1	(29.5)	(28.7)

Systemhouse's total EDP revenues in 1980 and 1981 were \$19.3 million and \$30.5 million respectively. From 1980 to 1981 the company's EDP revenues increased by \$11.2 million, representing a growth rate of 58%. On the basis of the firm's total EDP revenues, Systemhouse place 31st and 26th among the top companies in the Canadian computer industry in 1980 and 1981.

Of Systemhouse's total EDP revenues, software related revenues accounted for approximately 85% in 1980 and 1981. The company's software revenues were \$16.2 million in 1980 and \$26.0 million in 1981. During the period from 1980 to 1981, the company's software revenues increased by \$9.8 million, representing a growth of 60.5%.

As shown in Exhibit 1, Systemhouse was the 3rd largest software supplier in the Canadian software industry in 1980 and 1981. By contrast, however, Systemhouse placed 9th in 1980 and in 1981 on the basis of software revenues as a percentage of the company's total EDP revenues (See Exhibit 2).

The largest portion of Systemhouse's software revenues in both 1980 and 1981 were derived from sales of custom developed software, which accounted for approximately 81% and 76% of Systemhouse's total revenues in 1980 and 1981 respectively. Total revenues generated from sales of custom developed software were \$13.1 million in 1980 and \$21 million in 1981.

The company's sales of software products accounted for 19% in 1980 and 20% in 1981 of the total software revenues generated. Total software revenues generated from sales of proprietary software products were approximately \$3.2 million in 1980 and \$5 million in 1981. During this period revenues from sales of software products increased by \$1.8 million representing a growth of 56%.

Systemhouse did not generate any revenues from sales of computer hardware in 1980 and 1981.

Despite Systemhouse's positive growth in 1980 and 1981, the company's financial fortunes were very disappointing for the year ending August 31, 1982. Gross revenues were \$39.8 million and total operating revenue was \$33.2 million. Total expenses for fiscal 1981 were \$45.4 million resulting in an operating loss of approximately \$12.2 million. Added to a loss for non-recurring items of some \$17.3 million, the firm ended up with a net loss of \$29.5 million in 1982.

Systemhouse's negative position was partly due to excess computer hardware inventory worth \$1.12 million, the discontinuation of their Autoplot, Automap, and Autochart products and the write-off of the \$4.2 million in these graphics systems. The key contributor, however, was the unexpected costs incurred in the company's branch office expansion into United States, and the failure of revenues to keep pace with costs. Operating and administrative costs for the year ended August 31, 1982 increased by 76% over the preceding year, compared with a revenue increase of only 30%.

There was no significant improvement in the company's financial fortunes for the year ending August 31, 1983. The company had an operating loss of \$13.9 million on revenues of \$49.5 million. The company also announced an extraordinary loss of \$14.8 million, after writing off all software product development costs; this brought Systemhouse's total losses for the 1983 financial year to \$28.7 million. The sum of the losses for the 1982 and 1983 financial years now stands at some \$58.2 million.

3.0 ORGANIZATION STRUCTURE

Systemhouse's business activities are currently carried on by six main divisions. The first division, Canadian Operations, has the responsibility for marketing, selling, and delivering software services and products in Canada.

Systemhouse Inc., the U.S. Operations division, has the same divisional responsibilities in the United States. The number of employees engaged in activities in this division is about 60.

The third division of Systemhouse is the Healthcare Systems division. This division currently employs some 30 people and is responsible for product development, as well as the marketing, selling and delivery of services and products for the healthcare market.

The Commercial Systems division and Technical Systems division are responsible for developing and supporting the proprietary and licensed software product offerings of the company in their respective marketplaces. The Commercial Systems division employs some 38 people, while the Technical Systems divisions employs about 40 people.

The sixth division is Research & Development, whose mandate is to research evolving technologies and develop state-of-the-art products.

Systemhouse has branches located in ten Canadian cities and six cities in the United States. The company recently closed down its branch office in Saint John, New Brunswick due to lack of market demand. The Canadian branch offices are located in the following cities: Halifax, Montreal, Ottawa, Toronto, London, Winnipeg, Edmonton, Regina, Calgary, and Vancouver. The U.S. branches are located in Boston, Washington, Cleveland, Chicago, San Francisco, and Los Angeles.

4.0 AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

Areas of Business Expertise

Systemhouse's areas of business activities and software products offering are divided into two groups: Professional Services and Proprietary Products.

A. Professional Services

Systemhouse provides professional services in two principal areas: (i) custom software development (ii) the services required in connection with the installation and support of sales of software packages. Typical customers for custom tailored services have been large users of computer hardware in both the private and public sectors. These customers generally do not have the expertise to define and implement improvements necessary for better exploitation of their existing computer facilities and therefore request the services of a consulting firm such as Systemhouse.

Many organizations contemplating purchasing computer hardware and software with the hope of mechanizing their organization's structure, and improving employee productivity, approach firms like Systemhouse to obtain advice regarding their information requirements, and to identify the most effective and economical hardware and software solutions that could be implemented to satisfy the clients' requirements.

B. Proprietary Products

As a result of Systemhouse's professional services activities, the company has been able to modify its customized programs and market them to the general marketplace. This has allowed Systemhouse to offer

applications packages for particular vertical markets. These proprietary products have been segmented to cover various industries and applications.

In addition to the development of software products, Systemhouse has also obtained the rights to sell certain licensed products.

Software Products - Commercial Systems

1. The General Manufacturing System ("GMS")

Systemhouse acquired GMS from Process Kinectics Ltd. for approximately \$3.2 million. Systemhouse expects that GMS will become one of the leading software products assisting manufacturing companies in improving their productivity and profitability. GMS is a fully integrated management system that supports and improves financial, inventory, and manufacturing control. According to the Vice-President of Commercial Systems, there are 20 GMS systems currently installed in Canada. At present, the GMS runs on Hewlett-Packard hardware. The average cost of the GMS package is \$75,000. The total hardware/software system costs approximately \$225,000. GMS was formally introduced onto the market in 1983.

2. Production and Controls System ("PACS")

PACS is designed to provide small to medium sized manufacturers with the information needed to control inventory and production. Systemhouse entered into a licensed agreement with a United States software developer, MRM, to sell the PACS product in the North American market. PACS runs on the Wang VS computer and sells for the average cost of U.S. \$65,000. With accompanying hardware, PACS generally sells between U.S. \$80,000 and U.S. \$200,000.

3. Digital Business System ("DBS")

DBS is a fully integrated system for distribution companies and is designed to facilitate customer order entry, strengthen financial control and provide cost reductions through inventory management. Systemhouse has expended \$3.2 million in the development of DBS which is now installed at fourteen sites across Canada and one in the United States. The average cost per installation of a DBS system including hardware is \$130,000. Systemhouse is planning to introduce DBS to the American market during 1983.

4. Automated Distribution, Accounting and Management ("ADAM")

ADAM is a set of software programs licensed from Creative Data Systems of Cleveland, Ohio that runs on Wang VS computers. The system is designed to assist distribution companies with their accounting and management information needs. Systemhouse has sold six systems in Canada and one in the United States, at an average price of \$130,000 per system including hardware.

5. The Office Manager ("TOM")

Systemhouse has non-exclusive rights to sell the TOM Distributor Business Management System, which includes accounts receivable, accounts payable payroll, fixed assets, general ledger, order entry, sales analysis, inventory control, purchase order control, and bill of materials. Systemhouse sells this product to small distribution firms which generate less than \$15 million in annual revenues. TOM runs on Wang 2200 computers: the VP, SVP, LVP, and MVP. TOM was developed by The Office Manager, Inc. located in Seattle, Washington. Systemhouse has successfully sold fifty systems in Canada and twenty-five systems in the United States. The average price per TOM system is \$57,500.

Software Products - Halthcare Systems

1. Hospital Financial Management System ("HFMS")

Systemhouse's initial entry into the development of software products began as a result of a co-operative effort with Hewlett-Packard to develop a comprehensive financial management system for hospitals operating on the Hewlett-Packard 300 computer. During the years that followed Systemhouse allotted considerable resources to develop the HFMS System for the Canadian market and the Hospital Administrative System (HMS) for the United States market. Hewlett Packard has exclusive rights to HMS until 1985, at which time Systemhouse will be able to enter the United States market. In May 1982, Hewlett Packard purchased HMS outright for the sum of \$2.4 million. In addition, Hewlett-Packard has non-exclusive marketing rights to HFMS outside the United States after October 1984.

2. HFMS is a comprehensive, on-line financial management system aimed at the needs of the hospital administrator. It includes the following application requirements: general ledger, accounts receivable, inventory, purchasing, accounts payable, payroll and personnel functions. HFMS is designed for medium to large hospitals but is also may be used in smaller institutions.

Systemhouse has installed HFMS in four hospitals. The average installation cost including hardware is \$480,000.

3. Central Registry/Admission, Discharge, Transer (CR/ADT)

CR/ADT is Systemhouse's newest healthcare software product and was released in September of 1982. CR/ADT is a companion product to HFMS, and provides the control of all functions relating to the pre-admission,

discharge and transfer activities of all patients. This product is a real-time system which facilitates the reduction of labour costs and paperwork. As pointed out by a company representative, CR/ADT has instigated further product development in the area of patient care systems including products related to pharmacy, laboratory, radiology and dietary applications.

The product has just recently been released for sale for a price of approximately \$45,000. Total hardware/software installation cost of this product is expected to be \$367,000.

Software Products - Graphics Systems

1. Civil Engineering and Design Systems - Computer Aided Drafting and Design (CEADS-CADD)

Systemhouse acquired the license to market in Canada and in the United States a computer aided drafting and design system. CEADS-CADD provides facilities for automated production of engineering drawings using Hewlett-Packard equipment. The system is totally interactive and driven by a selection of functions displayed in menu form on the operator's video screen.

Systemhouse has installed eighty systems and signed software licenses with over twenty end-users. The average installation cost to the end-user in Canada and the United States is approximately \$167,000 and \$162,000 respectively.

2. SHL-RAMS Mapping System

SHL-RAMS is a computer assisted information and mapping system designed to meet the needs of various commercial and government organizations

including natural resource companies, utility companies and general mapping organizations. The system incorporates the latest in interactive graphics technology and can be used on a range of Hewlett-Packard computer systems.

To date there are two SHL-RAMS systems installed since the products release in the spring of 1982. The system has generated aggregate revenues of \$410,000. A third system is currently being installed for a cost of \$270,000.

Software Products - Process Control Systems

1. Building Energy Management Systems (BEMS)

There are two BEMS that Systemhouse markets; one is intended for building complexes of at least 500,000 square feet, and the second is intended for use in smaller buildings. Both systems are designed to monitor and control heating, ventilation, and air conditioning, and can provide a number of different energy management tools. BEMS have been installed in a few Canadian sites, and there are a further five systems to be installed shortly for an aggregate price of \$4,600,000.

2. Supervisory Control and Data Acquisition and Control System (DACS)

Systemhouse has developed a software package which enables organizations such as the hydro companies and sewage authorities, to carry out the continual task of sensing, supervising, measuring, controlling, or the display of physical phenomena. DACS integrates commercially available sensors, remote microprocessors, central computers and display units to carry out the above mentioned tasks. Systemhouse has recently begun work on two contracts with a combined value of over \$2 million to install DACS systems for water and sewage treatment and hydro-electric utility appli-

cations.

Software Products - Data Base Management Systems

1. MINISIS

MINISIS is an on-line data base management system, that runs on the HP 3000, which is suitable for business and government. This is a user friendly system with a powerful command language and report generator, with full formatting capabilities.

MINISIS was developed and is licensed by the International Development Research Centre, a Canadian crown corporation. Systemhouse has an exclusive license until 1985 to market and support this product in North America and is in the process of establishing non-exclusive agencies in other countries. MINISIS has been installed on nineteen sites at an average cost of \$22,000 per system.

Telidon/PLPS 3000

Telidon/PLPS 3000 is a software product that permits Telidon/PLPS videotex terminals to access databases resident on HP 3000 computer systems. There is currently no other videotex product available in North America for the HP 3000. Systemhouse has installed one Telidon/PLPS 3000 at a price of \$25,000.

Software Products - Computer Operating Systems/Productivity Tools

1. SYSTEM/COP/3000

SYSTEM/COP/3000 is a productivity tool that enhances the development of applications, and improves the efficiency of the operating system in an

HP 3000 environment. This productivity tool was originally developed by Systemhouse as part of the HFMS development. Three systems have been installed at a current selling price of \$40,000.

Specialized Services and Products

Videotex Systems and Services

Systemhouse offers consulting and implementation services in the videotex marketplace. In particular, the company has designated a speciality group with extensive capabilities in the areas of planning, feasibility investigation, requirements analysis and design activities to be responsible for field trials, prototype developments, and full commercial system implementations.

Systemhouse has received orders from thirteen clients for a total value of \$1.2 million in videotex systems, of which \$500,000 has been delivered to date.

Office Automation Systems

Among end users of computer hardware and software and communications equipment, there is definite interest being generated in integrating all office functions. As a result of this blossoming interest, Systemhouse has for the last eighteen months been funding a major research and development program to address this concern for integration. A prototype of an office integration system has been completed and is currently undergoing testing and evaluation.

Systemhouse has been selected as the contractor for the Canadian Department of National Defense, to conduct a 200 workstation field trial of an integrated office automation system that will be based on that

prototype. The total value of this field trial is in excess of \$3 million.

This integrated office system product is not scheduled for public release until 1984. Systemhouse believes that this system will propel the company into the position of a major leader in the office integration field. The system will include features such as information creation/editing, electronic messaging/mail, electronic filing, forms handling, spread sheet processing and administrative support systems.

5.0 1983 - COMPANY STRATEGIES AND PRODUCT DEVELOPMENT

Systemhouse's objective in the medium term is to recover from the losses the company suffered during fiscal 1982 and 1983. This will be achieved in a number of ways.

Until a few years ago, Systemhouse's activities almost exclusively revolved around conducting "custom tailored" development of software for clients on a one-on-one basis. Although system development is still a major facet of Systemhouse's business, the company recognizes that the trend is shifting towards the development of software products, or "off-the-shelf" software.

Using existing work completed on various individual client projects, Systemhouse is reacting to this trend by developing a portfolio of software products geared toward specific vertical markets. Currently, this portfolio includes financial systems for hospitals, manufacturing systems for large, medium and small manufacturers, financial and inventory control systems for large to small distribution firms, operational systems for hospitals, interactive graphics systems for the civil engineering and drafting fraternities, energy management systems

for large and small buildings, data acquisition and control systems for various utilities and municipal authorities, a data base management system for both government and business, and a computer operating system or productivity tool to allow the development of applications' packages by the client in-house.

Second, Systemhouse has recognized the opportunities that exist in the move to the automated office. Thus, Systemhouse has allotted substantial capital and manpower towards the development of an office integration system. It is the company's belief that this system will be a major software innovation towards integrating all word processing, data processing, and communications functions within the office environment. Clearly, the underlying objective is to put the office automation tools in the hands of the end user, instead of solidifying the responsibility for information processing with the traditional data processing specialists.

Systemhouse was selected to develop and install the office integration system in the Canadian Department of National Defense, as a part of the Office Communications Systems Program Field Trials. The company is relying heavily on the success of this project, for two major reasons. First, due to its poor fiscal showing in 1982 and 1983, Systemhouse has lost considerable corporate stature within the high tech community. This has also been accompanied by a decrease in investor confidence. Second, Systemhouse is seen by industry analysts and investors as a company that has possibly lost the edge in state-of-the-art technologies. The success of their office integration system could eradicate that perception, and could conceivably thrust Systemhouse into the forefront of leading Canadian and international software houses capable of supplying state-of-the-art software products.

Third, Systemhouse has taken a major step towards addressing the "solutions" industry. The primary focus of Systemhouse's strategy will be to ensure that the company is able to provide a "total solution" to the client's processing problems.

Fourth, Systemhouse has undertaken a number of austerity measures to return to a position of profitability. The company reduced its number of employees from a peak of 1,067 in 1981 to the current level of 788 in October 1982; extended the work week from 37.5 to 40 hours in hopes of increasing productivity; implemented a 10% reduction in executive salaries; and deferred all employee salary revisions for the short term.

In addition, three regional offices in the United States, located in New York, St. Louis and San Diego have been closed, and the staff at remaining U.S. branches has been trimmed to reflect business prospects.

Finally, the company will concentrate on the sale and delivery of software products through its existing office locations, and will concentrate its development activities on completing the enhancement and packaging of its existing group of products.

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1.0 BACKGROUND

From its inception in 1957, the University of Waterloo has grown to be one of Canada's major universities. The university has six major faculties - Arts, Engineering, Environmental Studies, Mathematics, Human Kinetics and Leisure Studies, and Science.

As of October 1982, there were 16,112 full-time students enrolled in the University of Waterloo, making it the third largest in Ontario and eighth largest in Canada. Total enrollment (including full-time, part-time, graduate, undergraduate, and correspondence students) was 21,980.

The University of Waterloo is a well known leader in university research in the fields of Engineering, Mathematics and Science, both in Canada and around the world. The annual output of graduates from these three disciplines alone accounts for two-thirds of the university's total graduate class.

The University of Waterloo graduates more students in Honours Chemistry and Honours Physics than any other university in Canada. Ten percent of all engineering graduates in Canada are from this university. Further, the University of Waterloo produces approximately thirty percent of Canada's Ph.D's in Computer Science.

The University of Waterloo was the first to pioneer and introduce the concept of co-operative education in Canada. The university offers co-operative programs in each of its faculties and now has the second

largest co-operative enrollment in the world - approximately 8,000 students and 1,500 employees.

The University of Waterloo is one of the largest recipients of bilateral research contracts with industry. In particular, the university has been the benefactor of large bilateral research contracts with many computer companies, such as IBM Canada Ltd. and Digital Equipment of Canada.

As a result of the university's concentration in the fields of engineering, mathematics and science, and its research contracts with computer companies, the university has become heavily involved in the research and development of computer hardware and software.

Under the administration of the Institute of Computer Research, the University of Waterloo has seven computer research groups that provide a practical research environment, under academic direction, for studying the computer field, as well as developing computer software and hardware products. A more detailed analysis of each group's activities and products is found in subsection 3.0 entitled "Organization, Areas of Business Expertise and Software Products".

2.0 FINANCIAL HIGHLIGHTS

During the 1981-1982 fiscal year, the University of Waterloo's total revenues were \$133 million. Net income after expenses was \$1.2 million which, with the exception of \$4,000, was generated by the Computer Systems Group.

The University's total revenues increased by \$21 million or 15.8% during fiscal year 1982-1983, to \$154 million. Net income after expenses for this period was \$1.57 million. Of the total net income, 1.4% or \$22,000

was generated by the engineering faculty and .7% or \$10,000 was generated by individuals. The remaining 97.9% was generated by the mathematics faculty, in particular the Computer Systems Group.

The existence of the University of Waterloo in the Waterloo region creates an estimated annual cash flow of \$250 million.

Each year the University of Waterloo receives grants from the federal government, and is commissioned on a contract basis to conduct research in almost every one of its academic activities: the arts, social and behavioural science, the humanities, engineering, environmental studies, kinesiology, recreation, mathematics, and the physical sciences.

Total research funding for fiscal year 1981-1982 was \$19.2 million. Of this total, \$12.5 million or 65% were direct grants from the federal government. The remaining research funds came from contracts with the federal government (\$4.6 million or 24% of the total), and with the private sector (\$2.1 million or 11% of the total).

The University's research funding increased by \$5.6 million or 29% to \$24.8 million during the 1982-1983 fiscal year. The federal government provided \$16.1 million in direct grants (65% of the total), while research contracts from government and the private sector accounted for the remaining 35% or \$8.7 million. Research contracts from the federal government amounted to \$3.5 million or 14%. Private industry contracts amounted to the remaining \$5.2 million or 21%.

3.0 ORGANIZATION, AREAS OF BUSINESS EXPERTISE AND SOFTWARE PRODUCTS

The University of Waterloo is a leading educational institute involved in computer software research, design and development. The development of

software is coordinated by an umbrella organization entitled the Institute of Computer Research (ICR). ICR has seven member groups, of which six are involved in the development of software. The activities of these six groups, and the types of software products developed by them, are outlined below.

A. The Computer Systems Group (CSG)

The Computer Systems Group (CSG), under the direction of Dr. J.W.(Wes) Graham, develops general purpose systems software such as language compilers, editors and productivity tools. Some of CSG's better known products, which are used both domestically and internationally, include:

1. WATFOR and WATFIV - fast compilers for the Fortran language, particularly suited for the compilation and execution of simple, small programs
2. WATBOL - a compiler for Cobol.
3. WIDJET - an interactive editor.
4. WATERLOO BASIC - interactive Basic.
5. WATERLOO PASCAL - a compiler for Pascal.

A more exhaustive list of CSG products is provided in Tables 1 and 2.

These software products operate on a variety of machines including IBM, DEC, and Commodore. CSG currently distributes over 50 pieces of software, with over 3,000 user installations throughout the world, and generates the bulk of the University's revenues from the sale of software products.

Although CSG's mandate is to develop software for on-campus use, this group's software products have generated considerable interest in the rest of Canada and the world, from educational and non-educational institutions alike. According to Dr. Graham, of the 3,000 installations using CSG products, 1,500 are non-educational organizations.

Eighty percent of CSG's customers are located in the United States. Of the group's total revenues of \$2 million in 1982, eighty percent or \$1.6 million was generated from the United States, \$200,000 or ten percent from abroad, and \$200,000 or ten percent from inside Canada.

B. The Software Portability Group

The Software Portability Group was formed in 1975 to study research problems associated with software portability. The group's goal has been "to develop a programming technology that allows inexpensive movement of software from one computer environment to another, and that allows easy adaptation of programs to changes in the environmental and program specifications."

The group also provides a research environment for Master's and Ph.D students in areas such as operating systems, real-time programming, compiler construction, software engineering, software portability, and hardware design.

The group has developed the following products:

1. THOTH

This is a portable operating system. Initially, THOTH was developed on a NOVA/2, it consisted of 70,000 lines of code and required thirty-five man-years of effort. It was eventually ported to a MADCOMP IV/35 in one man-year, a Honeywell Level-6 in 1.5 man years, and to a Cyber 18 in 1.5

man-years, by people outside the group.

2. PORT

This is a portable operating system designed for personal work stations and shared server stations connected by a local network.

The Software Portability Group has been successful in transferring this technology to industry. A number of companies in Canada and the United States have purchased licenses for the use of software developed by this group. This has enabled the group to raise a substantial portion of its financial support from private industry.

C. The Software Development Group

The Software Development Group, under the direction of Dr. M.W. Gentleman, provides a software production environment, under academic supervision, for apprenticing and researching in practical computer science.

In particular, this group produces software under contract for many private companies, including Honeywell, NEC, Bell Canada, Varian, Cadillac Fairview, and others.

The Software Development Group has produced a number of products, including compilers (for Basic, B, C, BCPL, Pascal, APL, and various assemblers), operating systems' components such as file systems tools, page printer software, communications software, design of user interfaces (timesharing command interface and electronic mail), various software tools, and office automation tools (editors, formatters, photocomposition and spelling correction).

The Software Development Group comprises approximately 20 people, includ-

ing professional staff, graduate and undergraduate students, and faculty members.

D. The Computer Graphics Laboratory (CGL)

The Computer Graphics Laboratory (CGL) is co-directed by Drs. J.C. Beatty and K.S. Booth. It has two functions: to teach graduate and undergraduate students, and to perform research in the field of computer graphics.

The research activities of this group involve a number of areas, including documentation graphics, visible surface algorithms, geometric modelling, and interaction techniques. It is the intention of this group, as indicated with their work in documentation graphics, to develop tools for illustrating digitally typeset documents, and to apply these tools to the creation of Telidon databases.

Not unlike other ICR computer research groups, the Computer Graphics Laboratory has developed close ties with industry. Currently, CGL has close ties with Electrohome, NRC, MPS Associates, and Tektronix. The group is also exploring further relationships with other private companies.

E. The Computer Communications Networks Group (CCNG)

The Faculties of Engineering and Mathematics jointly administer the Computer Communications Networks Group (CCNG). The group conducts research in the following areas: switched data networks, distributed processing, local area computer networks, networking protocols, videotex, satellite channels, and network performance evaluation.

The group has developed the following software:

1. SHOSHIN

A Japanese word meaning "beginner's mind", SHOSHIN is a distributed software testbed. The system is based on a network of LSI-11/23s connected by a high-speed, parallel, TDM bus (also developed at CCNG). SHOSHIN is used as a tool for research into distributed software and algorithms.

2. WATERLOO/TELIDON

This was developed to facilitate a large Telidon trial system (including thirty Telidon terminals).

CCNG is also developing a local area network called WELNET. WELNET is a bus oriented network, which uses an innovative multipole access technique called Distributed Scheduling Multiple Access. Both the hardware and the software for WELNET are being developed by CCNG.

CCNG has been quite successful in soliciting financial support through directed research contracts with both industry and government.

F. The Pattern Analysis and Machine Intelligence Group (PAMI)

The Pattern Analysis and Machine Intelligence Group (PAMI) conducts research in the software related areas of image processing, pattern recognition, computer-aided design (CAD), and machine intelligence.

Image processing research includes the analysis of LANDSAT and biomedical data, as well as scene recognition for robotics and other machine intelligence systems. Pattern recognition activities include fundamental development of new theories and methodology for analyzing and classifying

complex data. Machine intelligence research includes the following diverse areas: human vision modelling, speech recognition, computer-generated music, image interpretation via structural pattern recognition and computer graphics, and machine intelligence information systems.

The PAMI laboratory has only recently been established. The amount of research contracts is expected to increase substantially in the next year.

5.0 1983 - CORPORATE STRATEGIES AND PRODUCT DEVELOPMENT

The University of Waterloo has built a reputation as a growing organization involved in the development of state-of-the-art software, and the leading source of computer science graduates for the Canadian software industry. The university will endeavour to build upon this reputation during 1983 and the remaining years of the current decade.

Second, the various university groups involved in the development of software will attempt to acquire greater exposure in the market for their products. The Computer Systems Group, the most visible of the seven groups, will continue to develop new products and modify existing packages for use by the University of Waterloo, and promote the applicability of these products for other educational and non-educational institutions.

Third, it is expected that the engineering faculty will increase its involvement with the private sector. This faculty is conducting considerable research in the field of computer software, much of which can be used in a practical environment.

Fourth, the University of Waterloo has been very successful in building a mutually dependent and good working relationship with various computer vendors. During 1983 and the following years, the University of Waterloo will endeavour to consolidate its position as a source of primary research for private industry, with the objective of soliciting the necessary research funds.

TABLE 1

UNIVERSITY OF WATERLOO's SOFTWARE PRODUCTS

	IBM 360/370, 30XX, 308X, 43XX	IBM SERIES/1	DEC VAX	DEC PDP/11	
					R H
	D		C	R	S S
	O		O	S R	X X
	S		M	T T	/ /
	M T C D /	R	P V	S /	1 1
	O V S M O V	P	A M	/	1 1
	S S O S S S	S	T S	E 1	D M
WATFOR	X		X	X X X X	X
WATFIV	X X X X X X				
WATBOL	X X X X X		X	X X X X	X
Waterloo Pascal	X X X X				
Waterloo BASIC	X X X				
Interactive Language Interpreters	X		X		
HOSTCM	X		X	X	
M1	X X X X				
LP1	X X X X				
LISP	X X X				
PROLOG	X				
WIDJET		X		X X	

TABLE 2

UNIVERSITY OF WATERLOO's MICROCOMPUTER SOFTWARE PRODUCTS

	IBM PC MS/ DOS	Commodore SuperPET	Commodore PET
Waterloo microAPL	X	X	
Waterloo microBASIC	X	X	
Waterloo microCOBOL	X	X	
Waterloo microFORTRAN	X	X	
Waterloo microPascal	X	X	
Waterloo microEditor	X	X	
Host Development Utilities	X		
SuperPET microPIP		X	
SuperPET Terminal Emulation		X	
6502 Development System		X	
Waterloo BASIC			X

Source: WATNEWS, Computer Systems Group, February 1983.

TABLE 2

UNIVERSITY OF WATERLOO's MICROCOMPUTER SOFTWARE PRODUCTS

	IBM PC MS/ DOS	Commodore SuperPET	Commodore PET
Waterloo microAPL	X	X	
Waterloo microBASIC	X	X	
Waterloo microCOBOL	X	X	
Waterloo microFORTRAN	X	X	
Waterloo microPascal	X	X	
Waterloo microEditor	X	X	
Host Development Utilities	X		
SuperPET microPIP		X	
SuperPET Terminal Emulation		X	
6502 Development System		X	
Waterloo BASIC			X

Source: WATNEWS, Computer Systems Group, February 1983.

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AN ECONOMIC ANALYSIS OF THE CANADIAN COMPUTER SOFTWARE INDUSTRY

DATE	NAME OF BORROWER NOM DE L'EMPRUNTEUR

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1984

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