TELIDON SYNTHESIS STUDY

REGULATORY, INDUSTRIAL, MARKETING AND SOCIAL ISSUES

(VOL. IV)

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Department of Communications
Contract 12ST.36100-2-4017 ÓST-82-00106

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March 31, 1983

PREFACE

This summary study comprises the fourth and last volume of Wescom's national evaluation of the Telidon field trials in Canada. This work chronicles the evolution of Telidon from government labs through field trials and evaluates the field trial results and the emergent industrial, regulatory and social issues which this nascent technology raises. After reviewing Telidon's competing and complementary technologies, the Canadian regulatory traditions under which these issues will be interpreted are described, and specific recommendations are made prescribing regulatory possibilities for broadcast Teletext, telephone Videotex, and cable Teletext and Videotext.

Finally, policy/marketing initiatives are recommended for Canada in the microelectronics/Videotex and Teletext areas.

The authors are grateful to the Telidon firms for providing valuable information, and to the Department of Communications for their assistance in the preparation of this report. In particular Dr. Barry Bragg, Dr. Dorothy Phillipps and Mr. Jim Feeley were most helpful.The authors would like to thank Tina Awram and Nancy Baird for their word processing expertise and Linda Saunders for her research assistance.

EXECUTIVE SUMMARY

Introduction

The Synthesizing Study comprised the fourth and last volume of Wescom's national evaluation of the Telidon field trials in Canada. The work chronicles the evolution of Telidon from government labs through field trials, evaluates the field trial results and discusses the emergence of industrial, regulatory and social issues which this nascent technology raises. The work suggests directions for Canadian society, government and industry in the Videotex, Teletext and information technology areas.

To conduct this work, Wescom was asked by the Department of Communications to review all available research dealing with the field trials being conducted in Canada through 1982. In addition, secondary background studies were also provided and were incorporated into this study. In addition to the available research studies produced by DOC and the service operators, Wescom complemented the available information with its own previous works on Videotex. Where necessary, in-depth interviews and discussions were held with industry spokespeople. In most cases the field trial information was available only in secondary form, and as a result only limited use was made of primary data.

The majority of information dealt with the three main trials currently underway: B.C. Tel, Bell Canada Vista and Manitoba Tel Project Elie. In addition, reports were incorporated from the OECA trial, Cantel and N.B. Tel Project Mercury.

Objectives

The objectives of this study as specified by the Department of Communications were:

1. To integrate the results from the four analysis contracts, relevant background studies and additional information that may be required to provide a complete picture for Canada of the potential social and economic effects of Telidon.

2. To provide an assessment, and to suggest directions for, Canadian society, government and industry in the Videotex, Teletext and information technology areas.

3. To review and evaluate the process of using field trials as a means to transfer the Telidon technology to the extent resources permit, to document the process by which Telidon was developed in government labs and transferred to Canadian industry.

Emergent Issues

Videotex policy issues may be divided into social and industrial development policy, and also into short term (emergent) issues and long term issues. The industrial development policy issues are of critical importance, since if the proper industrial measures are not instigated to foster a Telidon industry, the social policies for it will be irrelevant. In this work we have supposed a limited business diffusion of Videotex/Teletext -- rather than a widespread consumer adoption -- and have concentrated on emergent policy issues which directly involve industrial structure, development and support in Canada.

These emergent policy issues involve:

- standards;
- forms of industrial access;
- nature of competition; and
- the regulation of content.

Standards

The ability to set industrial standards partially determines who controls which market shares. Also, the setting of standards may

crucially affect future market viability of any new technology, and a profusion of competing and incompatible standards in any communications medium may force information providers to accommodate their provision of services often to one brand of a technology.

Currently neither the CRTC in Canada nor the FCC in the US have set standards for Teletext, but for Videotex the American National Standards Institute has supported the AT&T Telidon compatible standard -- called the North American Presentation Level Protocol Syntax, or NAPLPS. The CCITT Videotex Working Group has approved three standards for Videotex systems throughout the world. These are the so-called Alphageometric (NAPLPS), the Alphamosaic CEPT Format endorsed by the Conference of European Post and Telecommunications Administration, and Japan's Alphaphotographic Captain System. The task at the present time is to develop common functions within these three systems to facilitate their interconnection.

An important development with respect to the microelectronics in the broader perspective of industry is the fact that the images and pictures developed using NAPLPS codes can be displayed and manipulated on a standard personal computer. Personal computer software has now been developed by several Canadian companies which will enable the display of Telidon Videotex pictures.

Guaranteed Access

Regulations concerning form and extent of access will affect the diversity of Videotex/Teletext content. Access guarantee is presently a function of the specific type of Videotex delivery system used. Although common carriers must provide interconnection to all who wish it, broadcasters and the cable companies are not required to guarantee access to anyone. Policy options for the terms of access of systems operators and information providers for Videotex/Teletext might involve:

1. A common carriage model could be followed to ensure access to the public telecommunications networks.

2. Under the common carriage model a carrier could be permitted to operate Videotex systems through an arms-length subsidiary. In this case, external information providers would be guaranteed access to the communications network, but not to the Videotex system.

3. Alternatively, carriers themselves could be allowed to act as Videotex systems operators, with an accompanying responsibility to provide access for all external information providers.

4. Finally, a carrier could be permitted to operate a Videotex

system and to exercise selective decision making regarding which services were included in it.

(Teletext, however, presents quite different conditions of access compared to Videotex. Most importantly, the idea of unlimited capacity that underlays the idea of common carriage is not present.)

The Nature of Competition

The recent deregulatory changes in the US (according to which telephone and computer companies are allowed to enter each others' respective businesses) affect the question of which industries in Canada should be allowed to enter the Videotex market. In other words, given the scarcity of domestic information provision, should both telephone and cable companies be permitted to offer Videotex services? The industry's future competitiveness will directly hinge on the regulatory issues that concern which IP's and systems operators are guaranteed access to systems and what types of services (information retrieval, interactive services, etc.) they will be allowed to offer.

The "separation of carriage and content" principle arises in the context of Videotex/Teletext industrial competition, since in

many cases it seems likely that firms which provide the communications network to distribute Videotex will also be information providers, or at least Videotex systems operators.

Policy options with respect to the separation of carriage and content include:

1. Apply the content/carriage separation principle to all telecommunications carriers who wish to provide Videotex/Teletext services.

2. Apply a carriage/content separation principle to common carriers which are engaged in Videotex services, but do not apply this principle to the hybrids (i.e. cable companies) or to the broadcasters.

3. Allow carriers to operate Videotex systems, but prohibit their determination of content (with some possible exceptions such as white or yellow pages of the telcos).

4. Selectively apply a carriage/content separation policy for Videotex/Teletext systems at the level of the specific types of services offered. Thus, in the Canadian north a telco might be allowed to offer telemedicine or messaging services if none are available.

5. Eliminate carriage/content separations for Videotex/Teletext.

The Regulation of Content

In Canada there is a strong regulatory tradition, instigated for cultural protectionist reasons, to increase Canadian content. The specific ways such content regulations are applied partially determine which medium emerges as the predominant Videotex/Teletext carrier. Policy options with respect to the regulation of content over Teletext and Videotex involve:

1. Self-regulation by the information providers or by system operators (when the latter are also IP's), i.e. self-imposed content regulation.

2. Medium-specific content regulations, i.e. differing regulations for cable, broadcasters and common carriers.

3. Selective applications of existing regulatory practices pertaining to obscenity, equal access, etc.

Evaluation of Field Trials

Although the results of the Canadian field trials have been

evaluated in detail in other parts of this research program, particularly the marketing and social studies, the synthesis study did reveal key points resulting from the evaluation of the field trials. At the time of the writing of this report, 24 field trials were in progress. Eleven of these were operated by the telephone companies, one by broadcasters -- the CBC -- five by cable companies, four by federal, provincial or municipal government agencies, and three by educational institutions. An emphasis on a selected set of field trials was necessary in these studies, since they constituted the prime source of data. These were: B.C. Tel, Manitoba Tel's Project Elie, Bell Canada's Vista, OECA, WETA in Washington and N.B. Tel's Project Mercury.

In assessing and evaluating the field trials, consideration was given to the goals and objectives of each of the following:

1. the federal government;

2. hardware suppliers such as Microtel, Norpak and Electrohome;

3. system operators such as telcos, cable companies and broadcasters;

4. information providers;

5. sub-IP's, comprising small page creation firms placing their

pages on behalf of clients with an umbrella or end-page supplier or information suppliers actually implementing the production; and

6. users.

Field trials have been dominated by the involvement of the telephone companies, with eleven of the telephone company trials accounting for the placement of approximately 1,500 terminals, or about 75% of the total number in place.

The Telidon program was created by the Canadian federal government in 1978 to transfer the Telidon technology from government research laboratories into the private industry. Total funds allocated to date for Telidon have comprised approximately $47.5 million for a variety of activities including research and development, public trials, standards lobbying, promotional activities, and industry and public sector exploitation. In its initial Telidon program, the field trials were defined as having four basic purposes:

1. To promote the introduction of Telidon terminals in the field trials.

2. To stimulate the service users who might take advantage of Telidon's inherent capabilities.

3. To demonstrate the superiority of Telidon over competing systems.

4. To create a government/industrial vehicle which might take Telidon to the marketplace.

However, more specific governmental goals for the program involved:

1. To place operational Telidon services in all major urban centres in Canada utilizing telephone and cable by 1985.

2. The instigation of two national Teletext services in French and English.

3. To have Canadian manufactured Telidon terminals and adapters available as standard over-the-counter retail products in merchandise stores across the country.

4. To make Telidon the North American standard for Videotex.

5. To develop an operational mobile Videotex service for aircrafts, ships and automobiles.

6. To provide a provincial government public information service over Telidon.

7. To instigate a viable electronic publishing industry in Canada.

8. To develop an export industry supplying Telidon hardware, software and content.

Some of these were excessively optimistic goals. For example, the 1985 goal for Telidon terminals was 500,000 with total expenditures in excess of $100 million per annum by the consumer on Telidon services; an estimate that business service expenditures would be approaching $1 billion per annum, and that the export of turnkey Telidon systems would account for earnings in the range of $150 million per annum. Finally, it was thought that there would be growth rates of around 30 percent per year in the Videotex/Teletext industry.

The goals of the service providers also involved:

1. The assessment of Telidon's technical capabilities.

2. To encourage spinoff activities and evolution in new types of applications; to encourage a base of new business around which the Videotex system might operate, e.g. the growth of small IP companies, graphic design companies, equipment suppliers, etc.

3. To assist in the development of a marketing plan for service providers which would result from the assessment of the user pilot trials, with specific reference to IP goals involving learning about what types of content are most valuable for business and consumer markets.

4. To understand what market segments exist for the consumer, the business sector and the public, and to gain some notion of how much consumers would be willing to pay for Videotex/Teletext services.

5. To know how quickly market sectors such as retail, banking, travel, electronic mail, etc., will view Videotex/Teletext services as a worthwhile cost efficient medium.

6. To gauge some sense of the mass market appeal of Videotex/Teletext services.

7. To aid in the development of standards in sections such as education. Here the field trials were viewed as a means of evaluating Telidon as an educational medium in its own right and to examine various delivery modes -- cable, telephone, television and broadcast.

The Canadian Experience -- Trial Diversity and Growth

In the 24 Telidon field trials conducted or planned for implementation across Canada, most offer only information retrieval to residents and business markets, but a significant number of terminals are placed in public locations.

In addition to the 11 current trials being conducted by phone companies, five cable trials involved a total of 524 terminals and various Canadian governments have developed four tests for Telidon, with the largest being the Ontario Teleguide system (1,200 projected terminals), and the federal government's Cantel project (comprising 100 terminals). Finally, Telidon educational experiments have involved the placement of 258 terminals, and the CBC broadcast trial will involve a placement of a further 500 terminals.

Market Response

A summary of the key findings from this evaluation reveals:

The manner of implementing field trials introduced significant restrictions and limitations on interpreting user response and on the estimation of market demands for future services. Whereas

initially the field trials were designed to provide a laboratory or experiment in which various responses to Telidon programs could be assessed, this in fact was not capable of being carried out primarily because of the minimal amount of co-operation between the field trial operators and because of the lack of co-ordination at the early stages of trial development and implementation.

It is not yet known what the Videotex/Teletext products will actually comprise, and furthermore the existing market projections for both Telidon hardware and software have been shown to be widely inaccurate. Projections, made over the past three years, have ranged anywhere between 40,000 terminal installations on upwards of 500,000 by 1984.

This study suggested a complete reassessment of the demand forecasting methodology is required for assessing the potential for Telidon penetration in the residence and business market. Such a reassessment has to be based fundamentally on a totally restructured demand estimation model which takes account of more of the factors of the marketplace and product attributes than have been done to date.

Commercial viability of the Telidon product cannot be directly

assessed as a result of the response to field trial services. In many of the trials the desire of page creation companies and service operators to generate short term revenues rather than to refine their techniques and investigate actual applications for Videotex/Teletext has led to very limited content development and hence a high degree of user rejection after initial enthusiasm. Moving too rapidly into a market phase has meant that very little information can be tapped to substantiate possible future sales.

At the present time a reassessment of various applications and implementation strategies is taking place among most of the large-scale operators, and in only a few limited examples are full-scale commercial operations now being implemented. It is worth noting that those that are the most successful are not the ones which emerged from the field trial activity (i.e. Grassroots).

Service operators have viewed the trials for the most part as a chance to offer them information related to the technical, physical and human resources necessary to provide a Telidon service offering. The trials have enabled the successful evaluation of technical capabilities of Telidon equipment and modes of service delivery. Hardware has been evaluated, networks have been assessed, and the carrying capacity of optic fibres vs copper wires and broadcasting are all now well known and established.

Responses of system operators and those involved in the trials, and those who are hoping to learn more about the market response, indicate that to date many questions remain unanswered about what potential exists in the various market sectors of residence and business. Further efforts need to be placed, therefore, in examining these sectors relative to the types of applications which would be needed and desired.

Emerging results from the trials in progress have, however, provided some indication of the relative success of various configurations and alternatives which have been tested:

1. There has been a movement away from the provision of a full range of the integrated services which might include utilities monitoring plus Videotex into a combined format. This has occurred mainly for managerial and not technical reasons.

2. There has been an extremely slow development and implementation of transaction and messaging capabilities.

3. Telidon users have been able to access a multitude of data bases through telephone connections to remote locations using gateways, e.g. B.C. Tel users may connect directly to the Grassroots data base in Winnipeg.

4. There has been an increased interest in the development of targeted and application specific Telidon content.

5. Most users have expressed general satisfaction with the Telidon equipment such as keyboard and terminal, and dissatisfaction with keypads.

6. Information retrieval has been the primary application in most trials and content quality is paramount. There has occurred general dissatisfaction with the quality of the data bases, and many users have expressed initial interest and then subsequent disappointment -- a type of Edsel effect.

7. The emergence of specific targeted audiences for information retrieval services has emphasized the opportunity of the Videotex market while affirming the need for increased investment in data base design and quality of production.

8. There has occurred a moderate response by in-house business users to present Telidon configurations, specifically of data bases developed for trials, and an expressed interest in messaging services.

9. There is a substantial number of people who have interacted with Telidon terminals, with an average of 3,000 sessions per week reported for B.C. Tel, Vista and Elie field trials.

Applications Emerging from Field Trials

One important lesson emerging from the field trials is the realization of the need to direct information to special user groups and to design data bases organized around a specific application. An emerging area for on-line information, and one which has also been already successfully implemented in Telidon, is agribusiness. Typified by Grassroots in Winnipeg, 320 users pay $50 per month to access a wide range of agricultural-related information. There is every reason to expect such agribusiness use of Videotex and interactive electronic services will continue to grow. A second growth area involves on-line transaction services such as bill paying, investment data and electronic shopping.

Information retrieval has been the primary application in most trials, and content quality has been shown to be paramount. Dissatisfaction with the quality of the data bases has occurred, with many users expressing initial interest and then subsequent disappointment with trial service offerings.

There has occurred a moderate response by in-house business users to present Telidon configurations, specifically for the data bases as developed in the trials. Interest has been expressed for messaging, but a quality service has yet to emerge. These,

however, are likely to be brought about in the next year. This will stem from the increase in competition in the telecommunications market for electronic messaging services.

To date there has been a penetration of less than 5,000 terminals within the Canadian marketplace. Although this has stimulated the terminal manufacturing sector somewhat, terminals are still very expensive -- averaging close to $2,000 -- and are restricted in their functions to display and information retrieval. In the future it is expected that these terminal prices will come down below $1,000 and are likely to be somewhere in the neighbourhood of $600. The important question which remains, however, is whether these types of terminals, with their limited capabilities, will offer enough benefits to the user, either in the home or business market, to justify an expense of $600. Of more significance is the fact that now there is a merging of technologies whereby Telidon can be integrated as software into personal computers. The market for this service is likely to expand much more rapidly than if one simply waits for the price of Videotex terminals to come below $1,000.

Industry Evolution

The Page Creation Industry

There is evidence emerging from the trials that the page creation and information provider sector of Telidon services is growing. The page creation sector has consisted usually of a number of umbrella organizations which serve creators and designers of pages submitted by participating companies, organizations and government agencies. At the present time there are an estimated 50 different organizations which provide page creation in the Canadian Telidon field trials. Although firms such as Dominion Directories and Infomart are leaders in terms of their integrated approach and in terms of the number of pages they have been able to put on various systems, there is also a large number of smaller firms which have emerged and are competing for an expanding page creation market. The early development of companies such as Infomart which have provided large and integrated systems has its benefits in terms of field trial activities. While they have been dominant in the market, they have also been instrumental in forming spin-off companies which emulate their production capabilities on a smaller scale. Also, many larger IP companies have expanded initial page creation services to providing systems and the development and marketing of entire turnkey Telidon systems.

The past two years of growth of the field trial activities suggest that a fledging Telidon industry is developing, involving:

1. Page creation companies.
2. Terminal production and hardware.
3. Systems operation.
4. Limited software development and applications development.

Also, a number of the Telidon industry firms are now pursuing commercial ventures in the private sector and developing in-house Videotex private systems and, on an international scale, in the U.S. market. Field trials have essentially served as the prime focus behind this emerging industry over the past few years.

One section of the Telidon industry which has generated a significant amount of revenue is page creators. Presently there are approximately 31 companies involved in the Telidon industry which offer commercial page creation services within Canada. Cumulatively, these companies have created approximately 200,000 pages of Telidon-based information.

In addition to the field trial related activities already discussed, three commercial Videotex services have already emerged in Canada: the Grassroots service providing Telidon-based infor-

mation to farmers throughout Manitoba; the international service on Telidon presented by Teleglobe in which terminals are located in Canadian embassies throughout the world; and the Faxtel information service of Toronto which is a closed user group service offering stock and news. In addition, there are also two government operated public information services: Cantel (the federal government's task force on service to the public); and the Teleguide service of the province of Ontario Ministry of Industry and Tourism.

In a related context, new technological developments have resulted from the field trial activities. There have been at least three generations of IP terminals as well as at least three major developments in terms of user terminals, plus software which enables existing technologies such as personal computers to be utilized as Telidon terminals.

Investment and Revenues

With respect to expenditures on Telidon over the past two-and-a-half years it is estimated that for each dollar spent by the federal government on Telidon, three to four dollars has been generated by the Canadian private sector.

Although it is difficult to estimate the precise amount of revenue which has been generated by Telidon-related firms, if one assumes a standard $35 per page cost for page creation, then it is clear that upwards of $6 million has been generated merely in the page creation phase of this industry. Also, many companies offer consulting and advice to clients on matters such as page layout design and development, and if one assumes charges for such consulting of the order of $45-$75 per hour then it is apparent that this portion of page production alone has generated well over $10 million.

In terms of Telidon hardware, firms such as Microtel, Norpak, Electrohome and Northern Telecom have produced terminals for the field trials, and if an average price of $2,000 is assumed per terminal, then a revenue has been generated of approximately $11 million from hardware manufacturing alone; i.e. merely for user terminals.

System Operators' Perspective

The information contained herein was gathered by means of a survey conducted by Wescom with industrial representatives from 26 Telidon-related companies. These included four cable companies, seven telephone companies, nine page creation and Video-

tex service companies, and six hardware and software manufacturers.

This survey asked the respondents a series of questions pertaining to the role of their firm in the field trials and what they expected to gain by field trial participation.

One of the most significant activities in the field trials involved the need to identify a potential population for Telidon services. In general the IP's felt that even after a year and a half of field trial activity, potential target markets for Telidon had not really been identified. For example, in the Bell Canada Vista trial it was still unclear whether a residential market would constitute the prime sector as opposed a business market. Other participants reacted more positively to the issue of the way in which trials have identified potential target groups. However, in these cases, precise numbers of users and their characteristics were not provided or offered to substantiate claims of success.

Within the Videotex service provider sector there was a uniformly negative response toward the role that the field trials had played in identifying potential target markets for Telidon. A number of the IP's asserted that this lack of identification was

a function of the inability to clearly define a variety of potential market users before the trial had been undertaken.

Summary

In summary it may be concluded that:

1. The manner of implementing field trials introduced significant restrictions on interpreting user responses and on the estimation of potential market demands for future services.

2. The trials have successfully enabled the technical capabilities of Telidon equipment and modes of service delivery to be evaluated.

3. Very little activity in the trials has been directed towards evaluating the range of new computer and telecommunications technologies which are competing with Telidon.

4. Survey responses of systems operators indicate that many questions remain about the target market for new services and potential which exists in various residential and business markets.

5. Considerably more efforts need to be placed in the development of serviceware, software, content and specialized ap-

plications such as transaction, banking and transit information systems.

6. Targeted applications which emerge from the trial and which offer likely potential are:

   - agriculture
   - tourism
   - banking
   - specialized users, i.e. stockbrokers, retailing
   - transit information systems.

7. To date there has been a penetration of less than 5,000 terminals in Canada. Although this has stimulated the terminal manufacturing sector, terminals are still very expensive ($2,000) and are restricted to display and retrieval. This terminal penetration is significantly less than originally estimated for 1983 (40,000).

8. The private sector has expressed a significant amount of caution in assessing the prospects for Telidon, supported by a feeling amongst most industrial representatives that the field trials have not been as effective as expected in specifying future target market segments.

9. Wescom statistics indicate that over $100 million has been invested by the private sector in the Telidon industry, with

at least 55 firms now directly involved. The government to private investment ratios are estimated at 1:3.

10. The trials have encouraged some limited development of content, but this has been focused more on technical and software improvements than on actual applications.

11. Internationally, the trials have helped establish interactive Telidon as an international standard. Opportunities have also emerged in the U.S. market, particularly with respect to the AT&T standards adoption. A modified alpha-geometric approach has been adopted as an international standard by CCITT, and there are now at least five Telidon tests in the international market.

12. There has been extensive testing of equipment enhancements, including:

- the inclusion of macro PDI's
- colour display enhancements
- the evolution of the Telidon decoders Mark I-III.

13. Public awareness has been increased through media coverage, trial participation and interaction with the public terminals.

14. International Telidon equipment and software sales have been encouraged as a result of this domestic commitment.

Policy and Regulatory Recommendations

After reviewing the Canadian and US regulatory traditions governing newspapers, the broadcasters, the telephone companies, computers, mail and the cable companies, a number of regulatory approaches to Teletext and Videotex are presented.

It is argued that there are essentially two forms of regulation:

1. classic rate regulation, which establishes a return any firm is entitled to earn on its total investment; and

2. structural regulation, which pertains to the scarcity of a given information resource, and entry conditions.

With Videotex/Teletext, rate regulation could be imposed on the level of charges consumers pay for information, or on fees which advertisers or information providers, say, might pay to enter pages into a data base. However, since the purpose of rate regulation is to protect consumers from monopolistic pricing, this form of regulation should not be applied to electronic publishing. Rate regulation could inhibit potential service providers, and such regulation might distort incentives in electronic publishing, since the systems operators would have real incentives to increase their return by artificially inflating the rate bases.

Structural regulation, in the context of Videotex/Teletext, relates mainly to whether broadcasters and cable operators will program or control Teletext (a service using a limited resource, the vertical blanking interval of TV), and to the separation of carriage and content.

1. Broadcast Teletext

Although vbi Teletext functions on a broadcasting frequency, it makes little sense to treat it as regular broadcasting, subject to content rules, since their imposition could inhibit the development of Teletext, and imposition of content rules could be as easily circumvented in this media as they have been in others. Rather, it is recommended that vbi Teletext be classified by the CRTC as a non-regulated service and not subjected to content rules or regulations.

Teletext is essentially a data service; it does not present traditional broadcasting problems, since the Teletext user controls how the information is displayed, and it would be inappropriate to apply the past rules developed in broadcasting to this new technology. Many of the regulatory stances which could maim Teletext development are tied in with its broadcast status.

2. Telephone Videotex

With respect to the issues of separation and access, it is recommended that the telephone companies should be permitted to originate and offer Videotex/computer-based information, data and transactional services, utilizing an arms-length relation and without rate regulation, but with the provision that they be required to provide equivalent access to systems operators and information providers who wish to instigate their own Videotex services. Instead of merely mimicking US deregulatory measures several years after they occur, Canada should act now and go further to give phone companies a measure of competitive advantage in this new area, with the aim of strengthening the Canadian Videotex/Teletext industry. While a common carrier model should be maintained to ensure access to switched phone networks, telephone companies should be permitted to operate Videotex systems, with responsibility for content. (This provision should not be subject to any specific content regulations such as a specified amount of Canadian content, but should rather be governed by general regulatory matters pertaining to obscenity, equal political access, etc.)

3. Teletext and Videotex on Cable

Cable TV in Canada has been given a "hybrid" status by the

regulatory agencies, exhibiting characteristics of both a programmer of content and a carrier. Again, our recommendations involve further deregulation of cable. Cable companies should be allowed to provide Videotex/Teletext information and transactional services without being subject to access provisions, according to which they must provide access to their cable networks by other systems operators or information providers. This suggestion reflects the role of the cable operator as a retailer or a selective packager of services to subscribers. Regarding Teletext, cable operators would require CRTC approval for channel usage. Problems of diversity -- of either type of content or information source -- could be dealt with as they arise. The question of arms-length subsidiary arrangements is less central than the designation of the cable operator as a retailer or packager or services, with a degree of selective control over content, subject to regulatory monitoring. At later times, if necessary, further regulatory provisions may be developed -- to provide interconnect access, for example, to outside Videotex system operators if cable evolves into an information utility medium. Finally, given the nature of Videotex/Teletext content, where "information" and "advertising" easily blend and advertising support may become significant, cable regulations must be amended to allow "advertising" on services of this sort.

The general deregulatory stance proposed here, involving the elimination of a separations policy, will encourage vertical integration and Videotex/Teletext coalitions, involving carriers, broadcasters, newspapers, cable companies and financial sources. A stringent separations policy, on the other hand, would essentially prevent vertical integration in information and service provision. While access to the switched phone network is guaranteed for small information providers, the development of larger IP's, able to withstand and compete with foreign products, is essential. Diversity, meanwhile, is fostered by: assured access to the public phone network; attractive provisions for a number of industries to enter Videotex/Teletext services; liberal participation by carriers in content provision to encourage the development of distinct sources of information in a given community.

Finally, in the latter part of this study, international marketing initiatives for Videotex are presented and 26 policy recommendations are made (pp 233-243).

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1.0 INTRODUCTION

This work suggests directions for Canadian society, government and industry in the Videotex/Teletext and information technology areas.

In the past, this area has often encompassed futurist speculation about wired cities and integrated electronic homes. But any assessment of, and suggested directions for, Videotex/Teletext in Canada must be grounded on a realistic understanding of what has thus far occurred in this industry and not on rhetoric which has arisen in this field. Thus, it is clear that, as yet, no one knows what the Videotex/Teletext products will actually comprise, and market projections of Telidon hardware and software have been wildly inaccurate. It is instructive that at Videotex 82 in New York, the commonly echoed theme of many workshops was, "Where is the market and what are the applications?" It seems that since the first 1980 Videotex conference in London, industry, government and researchers always have been on the verge of defining where Videotex will go, yet three years later essentially the same questions still remain about the technology and its future potential to industry and to the marketplace.

This should not surprise us. These technologies have existed a miniscule amount of time, and the first uses of any new technology are almost never its eventual mass social uses; also, the

initial social impacts are often far removed from final mass impacts. Thus the telephone was first thought of as an office dictaphone, and in the last century the finest business minds of North America met and decided that the new invention really had no significant uses and was a technology in search of a market. After all, there were always messenger boys. It is also apparent that our time expectations are unreasonable since it usually requires between one to eight decades for a new technology to diffuse through society.

It is also clear that there has been a neglect of content and applications and that hardware has been excessively emphasized. Serviceware -- those services, software and content which will prompt users to acquire Telidon and to pay for its operation -- still remains most uncertain in Telidon plans and underdeveloped in comparison to hardware, and the information providing function has been concentrated in one large consortium.

1.1 Emergent and Industrial Issues

Videotex policy may be divided into questions of social and industrial development policy, and also into short term (emergent) issues and long term issues. The emergent issues pertain to matters which arise as the technologies are being introduced, while the latter pertain to issues which arise after extensive consumer adoption. The industrial development policy issues are

of critical importance, since if the proper industrial measures are not instigated to foster a Telidon industry, the social policies for it will be irrelevant.

Tydeman et al. have attempted to identify the major emergent and long term policy issues arising from a "widespread adoption" of Videotex/Teletext consumer services such as teleshopping, mail, messaging, education, retraining, etc. These are summarized in Exhibit 1.0.

EXHIBIT 1.0
Applications and Issue Themes

	Applications	Other Generic Classes Involved	Policy Issue Themes
Information Retrieval:			
1	Electronic yellow pages	Transactions Messaging	Guarantee of access Competition Content regulation Consumer protection Industry structure
2	Education/ retraining	Computing	Content regulation Copyright Privacy and security Equity of access Industry structure Employment

3	Storefront medicine (medical information accessed by professionals or consumers)	Messaging Transactions Computing	Content control Privacy and security Consumer protection Industry structure Employment
4	Multiple listing service (e.g. real estate, travel packages)	Transactions	Guarantee of access Privacy and security Consumer protection Industry structure Employment
5	Real-time job market	Messaging	Copyright Privacy and security Equity of access Consumer protection Industry structure Employment
6	Consumer information (comparative pricing and performance ratings)	Computing	Consumer protection Industry structure
7	Electronic library	Messaging	Copyright Equity of access Industry structure
Messaging:			
8	Electronic mail		Standards Guarantee of access Competition Privacy and security Equity of access Consumer protection Industry structure Employment International trade and communications
Transactions:			
9	Home banking and shopping		Standards Content regulation Privacy and security Consumer protection Industry structure Employment

Computing:			
10	Video games and interactive gambling	Transactions	Standards Content regulation Privacy and security Consumer protection Industry structure
Telemonitoring:			
11	"Electronic mother" (electronic information, support and monitoring from cradle to grave)	Information retrieval	Privacy and security Equity of access

Source: John Tydeman et al., Teletext and Videotex in the United States: Market Potential, Technology, Public Policy Issues", Data Communications, McGraw-Hill, New York, 1982, p.182.

In this work we are supposing a limited business diffusion of Videotex/Teletext -- rather than widespread consumer adoption -- and are concentrating on emergent policy issues which directly involve industry structure, development and support in Canada. These comprise the following:

1. How will Canada's regulatory traditions for cable, the telcos (telephone companies) and broadcasters be applied to Videotex and computer-telecommunications systems in general? How are regulatory measures likely to further or impede development of the industry?

Are the principles behind the existing regulatory measures even relevant to Videotex (i.e. Canadian content, access rules, use of advertising, etc.)?

2. What are the effects of recent changes in the U.S. regulatory climate on the development of Videotex and computer telecommunication systems in Canada? Given the FCC (Federal Communications Commission) regulatory change by which IBM is allowed to enter telecommunications and AT&T is allowed to enter computing, what effect do these have on the relevance of carriage/content in Canada? Will this principle now impede industries?

3. What are the industrial implications of Videotex/Teletext for the development of Canada's high tech industries? For example, given the fact that Telidon is really a communications protocol -- a means of transmitting, displaying and retrieving information -- what are the implications of a concentration on equipment manufacturing if Telidon flourishes rather through software for personal computers?

4. How can competition among the cable, telco and broadcasting industries be encouraged so that a better quality of services and competitive sources of infor-

mation actually emerge? What is the role of standards?

5. What are the policy implications specifically concerning the publishing industry and electronic publishing?

6. What are the correct principles and policies to enhance serviceware provision for Videotex and Teletext?

7. What are the implications for transborder data flow? Is it possible that widespread adoption of computer telecommunication systems will increase the hegemony of parents over their Canadian subsidiaries?

8. Given that within a few years personal computers will be as powerful as larger computers used in present artificial intelligence research[1], and given a greater commercialization of intelligent "expert systems" programs for home, education and small business use, what are the economic implications for Telidon?

In summary, emergent policy issues involve:[2]

- standards

- forms of industrial access
- nature of competition
- regulation of content
- development and export support of content and software.

1. Standards

The ability to set industrial standards will partially determine who controls which market shares.

Thus far, the Videotex standard debate has centered around the graphics sophistication requisite for services. The tradeoff is, "The more sophistication built into the system at the outset, the higher the initial cost versus adopting an outmoded or soon to be dated technology."[3]

One of the main themes in the Videotex 82 conference in New York was that before the Videotex/Teletext industry can advance, the issue of display standards must be decided. Although the British continued to press their marketplace approach, several executives, such as Hiro Kawamoto of Sony, noted that foreign manufacturers will not build extensive amounts of Videotex equipment until a single display standard is established in North America.[4]

The standards question is also pressing because of the slowness

with which a Videotex mass consumer market is emerging. Costs of equipment such as receiving terminals and decoders, and costs of page creation, will remain high until a mass market and economies of scale have been achieved. But a cheap mass market will not emerge until some degree of standardization has been achieved.

The policy issue here is not whether Videotex/Teletext standards should be adopted, but what standards are optimal and at what level they should be applied.

The contravailing opinion, however, is that market forces should be the informal standards setting mechanism, and that there is no necessity for formal Videotex/Teletext standards. As Tydeman has noted, formal standards setting agreements often take more than half a decade, during which time de facto industrial standards have implicitly emerged incorporated in manufacturers' equipment, in which investment is so heavy that manufacturers may not be willing to change.

The setting of standards may critically affect the future market viability of any new technology, and a profusion of competing and incompatible standards in any communications medium may force IP's to accommodate their provision of services, often to one brand of the technology.[5]

Standards setting agencies may vary from international organiza-

tions, such as the International Telegraph and Telephone Consultative Committee (CITT) and the International Organization for Standardization (ISO), to industrial leaders such as IBM and Fujitsu whom, given their control of a specific market segment, may implicitly set standards according to which competitors will have to adhere if they wish to interconnect their equipment.

Since, in addition to the interconnectibility and interchangeability of equipment, standards may affect the cost, quality and friendliness of equipment, many related Videotex organizations have a real interest in standards setting. These organizations range from systems operators and hardware providers to information and software providers, and national policy formulating agencies.

Any Videotex/Teletext system is comprised of four parts: the user terminals, communication linkages, computer data bases, and terminal equipment for the IP's to add information to the system. Videotex standards are required so all of these components may work together harmoniously, and standards issues arise when different elements of a Videotex/Teletext system are controlled by competing parties and organizations.[6]

Standards involving the ways in which data and information are presented are crucial, since multiple standards here will necessitate a proliferation of incompatible equipment for both user

and information provider terminals.

One possibility in the standards debate is that Videotex and Teletext could develop into quite separate and distinct services, with the former focusing on information retrieval/business services, while the latter might become a mass medium information service only. In this case, display standards could remain distinct, and one would not be faced with the situation in which a technically sophisticated display standard for one (i.e. a Telidon compatible standard for Videotex) would impose too sophisticated and costly standards on the other (Teletext).

Currently, neither the CRTC in Canada nor the FCC in the U.S. has set standards for Teletext, but for Videotex the American National Standards Institute has supported the AT&T Telidon-compatible standard -- called the North American Presentation Level Protocol Syntax, or NAPLPS.

The North American Presentation Level Protocol Syntax has itself received endorsement from several North American standards organizations, including the September 1982 support of the American National Standards Institute, and the CCITT Videotex working group has approved three standards for Videotex systems throughout the world: the so-called alphageometric North American Presentation Level Protocol Syntax, the alphamosaic CEPT format which was endorsed by the Conference of European Post and

Telecommunication Administration, and Japan's alphaphotographic Captain system. In November 1982, this working group decided that any single international standard is not practical, since incompatible systems throughout the world are already operating in accordance with incompatible formats. The standardization focus is now turning to the task of developing "common functions" within these three systems to facilitate their interconnection.[7]

One critical factor in the standards fight involves proponents of a specific standard lining up chip and equipment manufacturers behind it. Already, large hardware and chip producers have adopted the North American Presentation Level Protocol Syntax for graphics. The Intel Corporation, Digital Equipment and Tektronix announced in mid-1982 that this standard would be incorporated into future manufactures, with the basic idea of providing universal graphics capability by the use of this standard in their graphics-producing products. But although these and other firms have embraced this Telidon-compatible standard for Videotex, they are also simultaneously advocating another graphics standard called the Virtual Device Interface for non-Videotex applications.

Firm level support assumes more significance if the FCC and the CRTC procrastinate in deciding various standards issues, since Intel manufactures VLSI chips which are incorporated into Videotex terminals; Tektronix is a supplier of video display equip-

ment,[8] and Digital is planning to manufacture Videotex systems.[9]

An important development with respect to the microelectronics in the broader perspective of industry is the fact that the images and pictures developed using NAPLPS codes can be displayed and manipulated on a standard personal computer. Personal computer software has now been developed which will enable the display of Telidon Videotex pictures. Several Canadian software products have been developed which allow this capability:

1. Telegraph -- developed by Microtaure of Ottawa
2. Tayson software of Calgary, Alberta
3. MVI Microstar software of Ottawa, Ontario
4. Ashdune Software Inc. of Ottawa
5. Async Inc. of Toronto
6. Alphated Systems Ltd. of Edmonton

In addition, hardware manufacturers are now using this standard in their products, e.g. Norpak jointly with Rockwell International.

2. Guaranteed Access

The regulations concerning form and extent of access will affect the diversity of Videotex/Teletext content.

Access guarantee is presently a function of the specific type of Videotex delivery system utilized. Although common carriers must provide interconnection to all who wish it, broadcasters and the cable companies are not required to guarantee access to anyone. Since, as we shall see, Canadian cable is considered to be a "hybrid" instead of a common carrier, cable operators have no obligation to provide interconnection to cable networks to outside information and service providers, such as home security companies. Subject to regulatory approval, cable operators offer a select set of services to their subscribers, acting as retailers of services, with a degree of choice in what they offer.

Access may refer to:

1. the access of Videotex/Teletext systems operators to communication networks such as cable and phone;

2. the access by outside information providers to Videotex systems; and

3. the access by outside information providers to an umbrella IP who provides a gateway.

Entry barriers encountered by information providers may range from CRTC regulations, which exclude firms from specific markets

(such as the telcos in computer service markets) to non-competitive pricing via cross-subsidization and to monopolistic control.

Policy options for the terms of access of systems operators and IP's might involve:

1. A common carriage model could be followed to ensure access to the public telecommunications networks.

2. Under the common carriage model, a carrier could be permitted to operate Videotex systems through an arms-length subsidiary. In this case, external information providers would be guaranteed access to the communications network, but not to the Videotex system.

3. Alternatively, carriers themselves could be allowed to act as Videotex systems operators, with an accompanying responsibility to provide access for all external information providers.

4. Finally, a carrier could be permitted to operate a Videotex system and to exercise selective decision making regarding which services were included in it.

The telecommunications networks of both telephone companies and cable operators could potentially provide Videotex services,

given the near-term state-of-the-art of their respective technologies. Once a two-way capacity over cable is established, system ability to accommodate interactive services approaches the "unlimited capacity" conditions that characterize telephony, and that underlay the notion of common carriage in which no restraints are placed on input to the system.

Thus both industries could potentially operate under similar access conditions in the provision of Videotex: both could be required to act as common carriers, for instance; or both could be allowed to provide Videotex systems with selective functions regarding content.

Alternatively, different terms could exist for telephone and cable companies. For example, arguing that the nature of a cable service, and its regulatory background, present different conditions from those of a telephone company, cable companies could be allowed to exercise selective functions in services offered to subscribers, while telephone companies operated under the common carriage model. The perceived benefits, or restraints, that would result for either industry if a differential approach were adopted should be roughly balanced -- in the interests of fairness, inter-industry competition and practicality (to minimize debilitating regulatory debate).

Teletext presents quite different conditions of access compared

to Videotex. Most importantly, the idea of unlimited capacity that underlays the idea of common carriage is not present. It is likely that Teletext will occur either in the very small vertical blanking interval (vbi) of an existing off-air broadcaster, or over cable-TV channel. In the first case, the question of access regards whether the TV broadcaster or an outside party will program the vbi. With cable Teletext, or Cabletext, the number of channels available is limited and access could be governed by a number of different approaches:

1. By regulatory allocations and priorities which entirely determine content.

2. By regulatory allocations and priorities which partially determine content.

3. By regulatory guidelines which influence content.

4. Through selective decisions exercised by the cable operators, subject to some form of regulatory approval or review.

5. Through selective decision by the cable operator alone.

6. On a first-come-first-serve basis (whereby, like a common carrier, a cable operator must provide access when asked), until capacity is used up.

Options, of course, include combinations of these.

There is also a meaning of access in the sense of who is allowed to receive Videotex/Teletext information, as discussed in the accompanying study on social impacts (Volume 4). However, the present problem concerning user access, as Lesser notes, "is more one of whether they (the users) will want to use Videotex and how much, rather than whether they will have the opportunity."[9a]

3. Nature of Competition

Given that the structure of the marketplace will influence and reflect the extent of competition, and given that under absolutely free market conditions competition between Canadian and U.S. information providers is "one-sided", a main issue here involves what regulatory, tax and fiscal measures might be instigated to support Canadian content companies.

In particular, the recent deregulatory changes in the U.S., (according to which telephone and computer companies are allowed to enter each others' respective business) affects the question of which industries in Canada should be allowed to enter the

Videotex market. Given the scarcity of domestic information provision, should both telephone and cable companies be permitted to offer Videotex services? The industry's future competitiveness will directly hinge on the regulatory issues that concern which IP's and system operators are guaranteed access to systems, who will be permitted to enter the Videotex/Teletext market, and what types of services (retrieval, interactive, etc.) they will be allowed to offer. Since several important potential IP's in Canada presently supply carriage, the conditions of foreign competition imply a reexamination of the separation of carriage and content, and of both the gains and detriments that this tradition entails.

The "separation of carriage and content" principle arises in the context of Videotex/Teletext industrial competition since, in many cases, it seems likely that firms which provide the communications networks to distribute Videotex will also be information providers, or at least Videotex system operators. This situation prevails in a number of Videotex trials in the U.S. and Canada.

Although the separation principle has not been applied to cable, broadcasters or newspapers in Canada, it has been applied to the telcos, since it is thought that cross-subsidization by telcos of computer services over the phone lines would give them an unfair advantage.

In some Canadian trials, the communications network provider (e.g. B.C. Tel) is also the Videotex systems operator, and also provides an IP role via an arms-length subsidiary (in this case, Dominion Directories). Although as we shall see in the U.S. considerable regulatory care has been taken to ensure that the dominant carrier, AT&T, will not abuse its monopolistic power, the 1982 deregulatory decision by the U.S. Justice Department allows AT&T to present Videotex phone services. However, the specific types of information they might present is not yet decided.

Policy options with respect to the separation of carriage and content include:

1. Apply the content/carriage separation principle to all telecommunications carriers who wish to provide Videotex/Teletext services.

2. Apply a carriage/content separation principle to common carriers which are engaged in Videotex services, but do not apply this principle to the hybrids (i.e. cable companies) or to the broadcasters.

3. Allow carriers to operate Videotex systems, but prohibit their determination of content (with some possible

exceptions such as white or yellow pages of the telcos).

4. Selectively apply a carriage/content separation policy for Videotex/Teletext systems at the level of the specific types of services offered. Thus, in the Canadian north, a telco might be allowed to offer telemedicine or messaging services if none are available.

5. Eliminate carriage/content separations for Videotex/Teletext.

4. The Regulation of Content

In Canada there is a strong regulatory tradition, instigated for cultural protectionist reasons, to increase Canadian content. Although there is a considerable variation in these content rules across differing media -- such as off-air broadcasting and cable -- the specific ways content regulations are applied may partially determine which medium emerges as the predominant Videotex/Teletext carrier.

Content regulation is, of course, directly related to industrial access. Thus in Canada, unlike the U.S., networking among cable systems has not been allowed. The cable companies are also not

allowed to create and transmit their own content (with the exception of the community channels). The question of who is guaranteed access to content creation over the new telecommunications media in Canada will most directly affect the new industry's scope, and given the lack of IP's in most of Canada's media, there are excellent reasons for policies and deregulatory measures to encourage a diversity of Videotex/Teletext content.

Regulatory content issues involve both Canada's competitive position vis a vis foreign (mainly U.S.) information providers, and internally relate to the issue of who is allowed to enter Videotex/Teletext markets and what content they are allowed to provide.

Another aspect to content regulation concerns the nature of the content itself: questions of quality; editorial concerns such as truthfulness; the use of advertising (particularly important given that Videotex/Teletext content may blend advertising with information). These questions have been faced in different ways with preceding media.

Videotex/Teletext also raise a new content issue: that of access procedures. For example, given the current tree structure searching procedures of Telidon, in several of the field trials there were incidences in which a popular file, such as entertainment, assembled by an information provider, was replaced by a

similar file created by an umbrella information provider, and the first file was inconveniently buried fifteen steps down in the tree structure.

In the common carriage model, the carrier evidently bears no editorial responsibility for content. With newspapers, on the other hand, editorial responsibility exists along with a tradition of "freedom of the press". Since the broadcast spectrum is considered to be a scarce public resource, broadcasters have traditionally been subject to content regulations in the public interest. Within the restraints of regulation, the broadcaster makes content decisions. If the CRTC applies a broadcasting framework to Teletext, a broadcaster would present a Teletext magazine in which he determined the entire content and also sold advertising in it. Where cable companies have programmed content (i.e. the community channel) they have been treated essentially as broadcasters but have not been allowed to carry advertising.

An alternative framework for regulating broadcast Teletext involves the Subsidiary Carrier Authorization (SCA) of the FCC, involving FM radio broadcasts. Such permits any FM radio station to lease part of their signal to another firm for services. With broadcast Teletext, any station might lease its vbi to a non-affiliated information provider; in that case the question of whom specifically is responsible (or liable) for content is undetermined.

While there are a number of possible models for content regulation of Teletext and Videotex, a basic problem remains: any Videotex/Teletext system may involve communication networks, systems operators and information providers, and there are presently no rules prescribing clearly defined areas of content responsibility.

If Videotex is eventually regulated along the lines of electronic publishing, systems operators will then be partially liable for specific content, but if systems operators assume roles similar to the common carriers (as in the Prestel case), they will not be allowed to exercise content control but also will not be legally responsible for content.

In both Canada and Europe, national bodies of Videotex IP's have been started which are attempting to anticipate some of these regulatory issues pertaining to Videotex advertising, pricing and information quality.

Policy options with respect to the regulation of content over Teletext and Videotex involve:

1. Self-regulation by the information providers or by system operators (when the latter are also IP's), i.e. self imposed content regulation.

2. Medium-specific content regulations, i.e. differing regulations for cable, broadcasters and common carriers.

3. Selective applications of existing regulatory practices pertaining to obscenity, equal access, etc.

5. Development and Export Support

Given the possibility that Canada may act as a passive market importing both hardware and content, perhaps the most critical set of emergent issues involves what specific forms of development and export support measures the government should instigate for the Videotex and microelectronics industries in general, beyond the subsidy program. With respect to a number of crucial economic indicators, such as balance of payments in high technology items and the extent of industrial foreign control, Canada more resembles some of the newly industrialized countries than it does other OECD countries; thus the applicability of microelectronic support measures in such countries to the Canadian situation becomes of central interest.

1.2 Social Impacts

When Harold Innis wrote of changes brought about in the ancient world as chipping hieroglyphs on stone was replaced by writing on papyrus,[10] he described a "transformative" technology -- one whose implementation resulted in social and cultural consequences, which for a century afterward could not even be visualised.

The microprocessor, or computer on a silicon chip the size of a fingernail, is a transformative technology. Its rate of adoption is presently at least an order of magnitude faster than the traditional time lag of fifty to a hundred year between invention and first commercial use of a new technology. Microprocessors were invented in 1971.

Videotex and Teletext, however, are merely one application of microchips amongst virtually thousands, ranging from computer-aided design to perscoms (personal computers), and thus far the diffusion rate of Videotext/Teletext through businesses and homes is comparatively slow in relation to the diffusion patterns of their competing and complementary technologies which will be subsequently discussed.

Although this summary study focuses on the short term (emergent) industrial issues raised by this new technology and also posits a

limited (business) diffusion of Videotex/Teletext over the next half decade, should something resembling Telidon eventually become the much-heralded "information utility", it will have widespread social consequences affecting the nature of our institutions, our social and personal relations, and our cultural structures. Some of these predicted social impacts are presented in Exhibit 1.1. Decisions on policy issues also involve social impacts and Exhibit 1.2 presents the relation between selected policy and social issues. Each of the issues in these two exhibits have been analyzed in the accompanying three volumes of this Telidon evaluation.

The problem then arises of how to identify these social impacts in such a way that their negative facets may be alleviated and their socially positive facets may be strengthened.

EXHIBIT 1.1

Social Impacts Arising from Widespread Adoption of Videotex/Teletext

- Employment impacts
- Effects on language and literacy
- Controls of information input
- Social isolation or increased leisure time
- Privacy concerns
- Access - for the inputting of information

- Computer crime
- Vulnerability of the system
- How to ensure diversity of content
- Impacts on lifestyles
- Equity of availability, e.g. terminal placements
- Institutional impacts, e.g. on banking, newspapers, travel agencies, etc.
- Autonomy
- Means of finance for community/public interest information
- Regulatory issues, e.g. separation of content and carriage
- Control over content - by whom, for whom
- Accountability
- Computer literacy - the public's familiarity with computers and issues
- Health concerns
- Shifts in information sources
- Depersonalized form of information, lack of human interaction
- Lack of existing Canadian databases
- Impact of cross ownership, media concentration and joint ventures
- Disparities in income - information rich vs information poor
- Use by special needs groups (the handicapped)

The problem, however, with attempting to identify long term, transformative social effects of any new technology is that the prognosticators are inevitably wrong. The British, for example, were the original Cassandras in predicting dire labour displacements resulting from diffusion of chips,[11] and yet, in spite of certain industries such as the Swedish watchmakers being decimated by chip usage, these predictions have not emerged in western economies, (due, in part, to the job creating effects of microprocessors).

EXHIBIT 1.2

Policy Issues re Social Impacts		Impact
(a)	What happens if access for all information providers is not guaranteed?	Access
(b)	Can controls be placed on unwanted advertising to the home?	Privacy
(c)	What protections should be put in place to protect individuals against impulse buying if there are transaction capabilities?	Consumer Protection
(d)	What standards should be developed to ensure a minimum standard of computer literacy?	Equity of Access
(e)	What potential exists for decreasing the stratification which might exist between the information rich and information poor in society, and what structures can be put in place to ensure access?	Equity of Access

(f)	What developments in hardware, software and firmware can be encouraged to facilitate the widest possible use and interaction with Telidon among all groups?	Access
(g)	What are the potential demands for training and skills development?	Employment
(h)	If Telidon is used for health and and medical purposes, what safeguards should be placed on records and ensuring confidentiality?	Confidentiality
(i)	What are the legal issues which need to be addressed when community groups place "advice" on Telidon?	Consumer Protection
(j)	What laws apply in assessing the quality and taste of information placed on Telidon?	Consumer Protection
(k)	What are the implications of recording inquiries about information of national interest?	Social Integration
(l)	What laws and rules need to be put in place re fraud or piracy of information and software?	Consumer Protection
(m)	If electronic shopping comes into a mass appeal, what impact will there be on pricing, i.e., will pricing be analogous to the floating currency exchange?	Consumer Protection
(n)	What are the implications of publishing re electronic transfer and display of magazines or books? What controls can be placed on content to ensure cultural diversity?	Cultural Diversity
(o)	Will new rules and structures have to be developed with respect to job searching and skill assessment?	Employment

(p)	Are there mechanisms for individuals to define "privacy" levels for protection of information and messaging?	Privacy
(q)	If Telidon is used for electronic mail, how will users not connected be serviced?	Social Integration
(r)	If electronic funds transfer is used, what will be the impact on costs of service to customers who desire personal services?	Consumer Protection
(s)	What levels of security and confidentiality need to be ensured before such services are put into place?	Consumer Protection

Social theorists are usually wrong about long or short term transformative social effects of new technologies. These effects are inevitably unanticipated ones. It is quite possible, then that the social impacts of Videotex, should it be widely adopted, will include none of the items which have been endlessly and repetitively predicted, such as labour displacement.

Social effects of a new technology such as Videotex are usually unanticipated because there is virtually no real means of predicting them. One is almost in the realm of pure speculation, which is often given a respectable facade by the applicability of a patina of social science research methodology. Thus a number of governmental agencies ranging from the Department of Communications and the CVCC to the Social Sciences and Humanities Research Council have conducted structured conferences and

seminars to determine the potential areas which will be socially impacted by the new technology. In general it has been found that "Groups could be impacted which might not yet be clearly visible, and no predictions about social impacts can be made for the long term."[12]

Concern for Videotex's social effects, however, should not be considered as separate from the broader field of data communications, data banks and the merging of computer-communications systems in general. More properly, Videotex systems should be viewed as a subset of the developments which are taking place in this merging of two hitherto distinct technologies.[13] Privacy, for example, is considered to be a fundamental right of individuals and a right which should be assured for all involved with electronic data communications. However, the proliferation of computer-communications systems and the facility for developing large data banks with interlinking capabilities (and not merely Videotex) may represent a real threat to personal freedom.

Accordingly, the protection of privacy and individual freedoms can be enhanced through developing a variety of system configurations for computer-communication systems (including Videotex). For example encouragement of special user groups and open access to computer commmunication systems are necessary to avoid manipulation and covert uses of information and user files.[14]

Social Impact Data in the Canadian Field Trials

Throughout the Canadian field trial experience, sporadic attempts have been made to gather data relevant to social effects of Videotex/Teletext. Types of data collected have involved:

(a) Pre-trial qualitative research -- in many cases conducted in focus group or personal interview format, for example: Bell Canada Qualitative Groups held in Toronto and Montreal; B.C. Tel Pacific National Exhibition demonstration personal interviews; B.C. Tel pre-trial in-depth discussions; N.B. Tel initial qualitative discussions; N.B. Tel profiling information.

(b) Pre-trial interviews -- measuring attitudes, images, expectations, technology awareness, knowledge and awareness of services, media behaviour and demographics.

(c) On-going trial assessment -- survey-based measures of on-going system performance, usage, preference of information, perceived utility of system attributes and information content. On-going measures of attitudes, perceptions and images.

(d) Tracking and recording of user statistics, taking account of:

- terminal location
- access time
- session length
- type of information accessed
- frequency of information access.

(e) In some instances, self-monitoring and administration of Telidon user diaries. (These methods indicate information consumption patterns, media behaviour, daily activities and Telidon usage).

(f) Post-trial qualitative assessments, group discussions and quantitative measures of attitudes, images and perceptions. Follow-up measures of activity and time use behaviour.

Throughout the field trials then, there has been:

(a) A lack of focus on direct measurement of social issues.

(b) An emphasis has been placed on immediate or direct impacts with a limited view of social impacts stemming from an over-reliance on analogies from "environmental" tradi-

tions. Longer term and indirect effects have not been addressed.

(c) Measurement of direct effects was limited to sub-sectors of the trials, representing small groups which are not necessarily reflective of their representation in society.

(d) Field tests have focused on response to a limited service offering which has not adequately reflected the possible implications of Videotex implementation in the future.

(e) There has been a great deal of emphasis on assessing impacts either from a negative perspective or from an emphasis on individual level concerns.

(f) A number of issues, e.g. access, are dependent on examining usage data. This data has, in many cases, not been collected by the field trial operators.

(g) The field trial reports which have been reviewed to date reveal very limited direct assessment of social issues. Efforts have been directed where applicable to content -- related to community databases and public information. That, to a large extent, represents the attention given to social issues by field trial operators.

(h) Where issues relating to social concerns have been raised, these have been directed toward existing service configurations -- primarily information retrival. That context may not be the configuration of Videotex which emerges in its ultimate mass acceptance. Transactional capabilities and two-way services are likely to have significant transformative impacts on the individual as well as society. Very little assessment or evaluation of these issues has been conducted in the field trials.

(i) Assessing impacts would require the extraction of changes in key factors, with time a critical dependent measure. As well, control group comparisons are critical in sorting the real from the spurious results in the evaluations. In most cases, while initial design specifications raised the issue of control groups and adequate time periods for measurement in practical terms, these criteria were made expendable. Thus, time frames of observation are extremely short in most cases, meaning that patterns of behaviour were not established or control groups were not monitored, severely limiting comparative assessments.

(j) Trial implementation and operations have, quite naturally, been directed toward identifying "users" and the "target market". Assumptions in many of the trials have been made about who constitutes the "leading edge" user. Thus,

assessments are made not on cross-sections of a community or group, but rather on a unique (usually affluent) sub-group.

Exhibit 1.3 summarizes predicted social issues, the corresponding types of data measures which have been taken in the various Canadian trials which pertain to these issues, their availability, and the methodology of obtaining them.

EXHIBIT 1.3

Issue	Types of Measures in Field Trials	Availability/Data Types/ Method
Privacy	Pre-trial discussions with users, IP's and industry experts (no direct measurement)	Pre-trial report, published paper and background studies, seminars and working sessions
Access to Current Services	Inference from trial designs, e.g. terminal placement operating hours, public terminal locations and community services	Tracking data, evolution data, field trial operating plans. Requires: -inference from various trials about user response times, length of sessions -demographic segmentation
Vulnerability Dependency Technophobia	No direct measures, only some reference in pre-trial discussions	

Social Participation	Usage data from residential and community based trials; special user group evaluation	
Education	OECA, WETA - other trials evaluation of preference for information and new services	
Health & Safety	Impacts on handicapped & physically impaired	Various trial components proposed this but little data available
Autonomy	No direct measures	
Lifestyles	Pre-trial, post-trial impact on activity time use at the individual level	Most trials' evaluations contain limited reference to this area - comparisons between trials not possible
Family Structure	Pre and during trial measures; post trial measures	Evaluation studies from trials not available; comparisons not possible
Community Involvement	Response to community data bases; involvement of community organization; content of social and community relevance	Discussion with community operators on coordination of community data bases
Cultural	Only limited pre-trial assessment; background reports re: electronic publishing impact	Discussion with users and operators
Employment Impacts	No assessment of these issues to date; some reference from other studies on automation, labour displacement studies	No information directly available; some projection in economic studies and forecasts

Social Integration	Pre-trial discussions; assessments of emerging services, e.g. telebanking, teleshopping; some literature on substitution of travel	Examination of related studies dealing with altered patterns of behaviour, work times, recreation and leisure, learning
Literacy	No direct measures; some discussion in literature; trial data examines user response	Inference based on target users vs actual users; analysis of variations between user groups across trials using evaluation studies
Access (Societal)	No direct assessment of broad implications; some discussion in background studies, e.g. telematique vs privatique	Studies of other technologies and analogous services
Consumer	No direct assessment; some discussions with consumers and potential users; some assessment in workshops and seminars, CVCC - work, etc.	Discussion required with agencies and advocacy groups, regulators
Office Impacts	Activity analysis in business trial context; pre-trials measured in B.C.; associated studies on office automation	Synthesis of business components of the various field trials; review of relevant ongoing office automation studies
Access to Knowledge	No direct measures available; some discussions with users and potential trial participants	Inference from other studies; computer industry experts; assessment of analogous technologies

1.3 Evaluation of Field Trials

In this work we have also reviewed and evaluated the process of using field trials as a means to transfer the Telidon technology and documented the process by which Telidon was developed in government laboratories and transferred to Canadian industry.

At the present time, field trials are being conducted by all of the major telephone companies in Canada as well as by cable and broadcast organizations. In each case, these field trials involve the provision of Telidon user terminals, Telidon software, page creation terminals, a host computer and a transmission mechanism. Services have been provided to residential, business and public locations in urban as well as rural areas. There has, as well, been a variety of transmission mechanisms used including broadcast, telephone lines and optic fibres. These field trials vary in size, in their basic objectives and in the character of the information provided for user access.

In 1979, Hickling and Johnson provided an outline of proposed activities to the D.O.C. for the introduction of Telidon activities in Canada. Field trials were identified at that time as key components in an overall strategy for introducing Telidon to Canada and in encouraging industry to participate in its development. In their strategic plan, field trials were encouraged for the following reasons:

1. To promote the introduction of Telidon terminals to the Canadian field trials.

2. To stimulate the development of service users which take advantage of Telidon's inherent capabilities.

3. To enable Telidon to demonstrate its superiority over competing systems.

4. To demonstrate the cooperation between government and industry in the development of the potential for Telidon, and to bring the various parties together in establishing a vehicle which can take the product to market.

The current state of service provision, its diversity of geographic location and field trial character suggest that, to some extent, each of these objectives have been achieved. This is supported further by the movement today of a number of field trial operators toward a market trial phase, where pricing will be introduced to subscribers. However, there are a number of important questions which remain to be addressed and which constitute critical areas in assessing field trials as a means for transferring the technology.

Assessment and evaluation of the trial process, in fact, requires the identification of the goals which have been specified by each of the parties involved. These parties involve:

1. The Federal Government; D.O.C.
2. The field trial operators.
3. The information and serviceware providers.

Within each group, a diversity of objectives are likely to be found for instituting field trial activity.

Our evaluation thus proceeds from the perspective of a diverse set of objectives and purposes among participants. The objectives outlined in the Hickling Johnson study essentially reflect macro level and strategic objectives for the Federal Government in encouraging industrial development of Telidon. Studies by Hough and Associates have provided details of the role of field trials from the service provider perspective and emphasize their operational features and micro level objectives. It is important to consider both when providing the evaluation of the field trial process.

Wescom's experience with a number of field trials has confirmed their limitations, as originally defined by Hough[15] in a discussion of trial features. Essentially, these revolve around the short-term span of the trials and the primitive level expected for the serviceware in the early months. Other weaknesses in the field trial method have also emerged which have had significant impacts on the way services have evolved, and in the subsequent

view and opinions expressed by users. These weaknesses severely limit the extent to which commercial viability can be assessed as a result of the response to trial services. This has left the technical critiera as the only realistic measure of the services -- leaving important marketing and commercial questions difficult to resolve, even after trials have taken place. In some trial situations, the desire of page creators to generate revenue rather than refine techniques and investigate applications has led to very limited page development, and hence a high degree of user rejection after initial enthusiasm. That situation raises a question about the extent to which field trials can be used to assess a service offering from the operator perspective.

Service operators have, in most cases, viewed the field trials as mechanisms to identify the technical, fiscal and human resources necessary to provide a viable Telidon service offering. In most cases, the bulk of activity in the trial operation has focused on technical issues such as network capability, hardware and software requirements. Monitoring of trial activity has been made in order to measure user response, network loading and network capacity. This information will be used to provide projections for a full service offering.

While there is no doubt field trials have given operators the chance to experiment and to test services, there are other areas which are less definitive. These are related to the nature of

the trials which have developed, their scope and purpose, and the level of service which has been provided. In particular, questions arise about the extent to which trials have enabled a service to be provided which allow industry to proceed to market trials or full commercial offering.

Other questions which must be addressed are the extent to which field trials have enabled a wide enough audience to become familiar with the services, and whether enough diversity exists in the range of operators. The trials in the majority of cases have been conducted by large, established communications carriers, with very little evidence emerging of the viability of alternative service configurations. Where local networks have been formed, they have been quite independent from these commercial services. Thus, the field trials may have proven useful to those interested in large centralized services, but less successful in stimulating diverse and small scale, non-commercial applications. At the same time, it may be argued that field trials have served mainly to begin a process, and that subsequent small scale or specialized services should evolve naturally from these "core" trial activities.

A number of issues for assessing field trials are related to the strategic concerns of industrial development and to the operational aspects. In particular, these are concerned with:

1. The extent to which field trials have provided a much needed public awareness within the test areas and elsewhere.

2. The extent to which field trials have fostered the emergence of groups who wish to become involved in Telidon as information providers or special user networks.

3. The extent to which field trials have encouraged the investigation of issues and impacts resulting from the introduction of the technology, such as privacy, special needs and applications, and access; and the extent of policy development which can be based on field trial activity research.

4. The impact of field trials in stimulating further research and development into Telidon software, hardware and related services and industries.

1.4 Documentation of Transfer of Telidon from Government Laboratories

Part of this work deals with the investigation of events which have led to the current state of Telidon services. This requires a review of developments in several areas, including:

1. Engineering and technology.
2. Product evolution.
3. Research and development.
4. Software and serviceware.
5. Industry response and service configurations.

This will involve the documentation of the significant events leading up to the current product configuration.

Key Design Stages

1969 - Basic research into interactive visual communications at C.R.C.

1969-73 - Hardware and software developments producing the necessary software to establish a capability in interactive graphic communications.

- Development of P.D.I.'s.

1973-79 - Hardware and P.D.I. communications protocols refined.

- Basic philosophy to require that the terminal contain its own intelligence and the picture-coding scheme.

1979-82 - Refinement of presentation hardware and page creation terminals.

Finally, as Telidon has evolved, a series of issues relating to policy, regulation and industry stimulation have emerged. These issues have served to direct the current views of industry and government, and are largely shaping the future for Telidon services.

A survey of Telidon industry experts was conducted as part of this study and presents their views concerning future developments and policy measures requisite to foster a Telidon industry.

2.0 A BRIEF HISTORY OF TELIDON

Telidon was invented at the Communications Research Centre of the Canadian Department of Communications. The Communications Research Centre (CRC) had been engaged in several years with interactive computer graphics and computer design for applications in Canada's space satellite program. In 1969, research and development was begun into a new and interactive visual communications system.

Between 1969 and 1970, effort was concentrated into building the requisite hardware and software to advance Canadian capabilities in this interactive graphics area. This research led initially to a new interactive programming language (IGPL) and to a preliminary definition of picture description instructions (PDI's).[16] In the intervening years, until 1979, both the Telidon hardware and various communication protocols involving PDI's were evolved to a point where the Telidon terminal contained its own intelligence.

There were a number of possibilities for Telidon's display technology to transmit pictorial and alphanumeric imagery. The Telidon developers correctly saw that it would be incorrect to design a picture coding scheme which was tied to a particular display technology. A number of coding schemes are actually tied to a particular display technology but Telidon's alphageometric

PDI coding scheme was not tied to any particular display technology.

As early as 1975, the Communications Research Centre had given a contract to Norpak Limited of Parkenham, Ontario, to develop a interactive colour display technology which was based on the work that the CRC had previously done. This small $15,000 contract led to further work between the CRC and Norpak to develop specialized terminals and other colour display systems.

By the end of 1977, the CRC research on interactive graphic systems had resulted in three patent applications: one for a touch sensitive input mechanism for computerized graphic displays; one for a new interactive visual communications system; and the last for a new interactive graphics programming language.

During this same time, Bell Canada had been investigating the development of Videotex technology based on an alphamosaic coding scheme, and in previous work the CRC had duplicated an alphamosaic system within two months. One CRC researcher, H. Bown, saw that this duplicated system was inferior to the interactive computer graphics systems that had been developed at the CRC. Consequently, Bown's CRC team was authorized to develop a new Videotex system which utilized picture description instructions and the actual alphageometric format which had been patented by CRC.

The first Telidon terminal had a public demonstration in August 1978, and in that month the Department of Communications announced its first four-year Telidon development program, which was funded at a level of $9.7 million.

Under this first Telidon program, the Department of Communications utilized a number of means to encourage the private sector and government agencies to utilize Telidon technology -- such as field trials and public demonstrations of the technology to the Canadian private sector and foreign firms and governments, lobbying in the Telidon standards fight, international marketing efforts, and the formulation of policies to deal with social and political effects of the new technology.

To monitor and guide these activities, the Department of Communications created the Canadian Videotex Consultative Committee (CVCC). This committee includes representatives from the broadcasting and cable industries, the telecommunications carriers, the Department of Communication, educational institutions, communications equipment manufacturers, and consumer and civic groups. Also, a number of Videotex sub-committees were formed.

Several of these committees have played significant roles in the development and growth of the Telidon industry. The $10.5 million Industry Investment Stimulation Program was proposed by the

marketing and industrial strategy committee, and recommendations of the education sub-committee resulted in a large number of educational projects which were approved under the Telidon support program.

In February 1981, the Department of Communications approved a $27.5 million increase in funding of the Telidon program for 1981 to 1983. The motivation behind this increase was to increase the fiscal stimulation to the Canadian Telidon industry and to encourage the private sector to assume responsibility for marketing and further industrial growth.

In addition to these technical and political developments, a considerable government and industrial infrastructure has arisen to meet the objectives of the Telidon program. In the words of Doug Parkhill, the initially funded Telidon programs' objectives were, "To promote development of a national Videotex infrastructure through appropriate standards, regulations and technology; and to encourage the creation of a viable Telidon industry producing hardware, software, systems and services, to appropriate joint government-industry research and development, product development, promotional activity and support of market trials and operational systems."[17]

In a general sense these objectives have been filled, and in Canada the Telidon industry comprises a complex grouping invol-

ving competitive and subsidized enterprises, regulated monopolies and government groups. The main role of the government in this effort has been a catalytic one, to assemble these various elements into a working industrial infrastructure with a common Telidon standard.

The main objective of the Telidon support program was to transfer this government-developed technology to Canadian industry and business. The main means the government has used to accomplish this task is by financial support of Telidon field trials. The field trials have allowed the government to stimulate Telidon hardware production, usage and testing.

In subsequent Telidon developments, in 1979 the International Telegraph and Telephone Consultative Committee (CCITT), the United Nations agency responsible for standards for international telecommunications, recommended the adoption of Telidon's protocol as one of the three world Videotex standards. By May 1981, American Telephone and Telegraph (AT&T) announced that it was adopting a Telidon compatible Videotex protocol. This announcement essentially involved the establishment of a single Videotex standard for North America.

Present research on enhanced Telidon features encompasses work on:

1. A new colour capability which will allow virtually any shade of colour to be transmitted and displayed.

2. A new feature which will allow the repetitive display of a string of PDI's which are stored within the terminal.

3. Using dynamically redefinable character sets to allow more efficient transmission of special symbols.

4. Using alphamosaic graphics to permit access to encoded data.[18]

Investigations are also underway to incorporate sound and voice channels into Telidon[19]. The aim of this research is to incorporate digital techniques for storing and transmitting sound and voice analagous to the ways PDI's are used for visual data. Further work is also being undertaken to transmit photographic-like images over Telidon. There is also research into means to improve the production of Telidon pages.

> "The automatic generation of Telidon data from wire new services, stock market quotations, commodity exchanges, weather data, etc., is well known. Experiments are being carried out to convert conventional hard copy originals automatically into PDI's through the use of pattern recognition techniques ... to reduce the amount of human effort required to produce pages. Further efficiencies can be provided through the use of voice recognition techniques to supplement or even replace manually operated input devices of information provider systems."[20]

Extension of Telidon Program

In February 1983, it was announced that the federal cabinet was about to approve funding of $23 million for a two-year extension of support of the Telidon program. Although the subsidy program was planned to end in its fourth year, the federal government decided to further fund Telidon.

The major areas of funding involve further research and development, content and serviceware development, government applications and international marketing. It is planned that the Department of Communications will administer around $7 million and the rest will be administered by External Affairs and Supply and Services.

3.0 EVALUATION OF FIELD TRIALS

Although the results of the Canadian field trials have been evaluated in detail in the accompanying market study, this section presents a summary evaluation of the principle results of the Canadian field trials of Telidon.

Presently field trials are being conducted by virtually all of the major Canadian telephone companies plus cable and broadcast organizations. In these trials services have been provided to business, residences, and public locations in rural and urban areas. The trials have utilized a variety of transmission means including optic fibres, television broadcast and the telephone lines.

Cumulatively these trials have provided a large laboratory setting in which relative merits of various configurations of Videotex and Teletext might be assessed. However, due to the lack of centralized coordination in the trials, cross comparisons of the results are difficult. In many cases trials are still in progress, and final evaluations and results must wait until completion.

Of the 24 trials in progress presented in Exhibit 3.1, 11 are operated by phone companies; one by a broadcaster (CBC); five by

cable companies; four by federal, provincial or municipal government agencies; and three by educational institutions. Field trials have been dominated by the involvement of the telephone companies, with 11 of the current telco trials accounting for approximately 1,500 terminals or about 75 percent of the total number of terminals.

In assessing and evaluating the field trials, it is important to realize that there is a need to identify goals and objectives which have been specified by each of the groups and parties involved. These latter involve:

1. The federal government.

2. Hardware suppliers such as Microtel, Norpak and Electrohome.

3. The systems operators -- the telephone companies, the cable companies, broadcasters and Infomart.

4. Information providers such as Dominion Directories, L.M. Berry, etc.

5. Sub-IP's -- which comprise either small page creation firms who place their pages on behalf of clients with an umbrella or end page suppliers, or information

suppliers such as Dominion Stores in Toronto or the Vancouver Visitors and Convention Bureau.

6. Users (business, residential or public).

Each of these parties has a unique perspective on what he or she attempts to gain from the field trials. From the government perspective the essential question involved, "How effective was the field trial process in fostering the development and spread of Telidon into the private sector?" In this section then we will evaluate the field trials from three perspectives: the federal government, industrial representatives and the end users.

The Canadian federal government created in 1978 the four-year Telidon program which was designed to transfer this technology from governmental research laboratories into private industry. Total funds allocated to date for Telidon have comprised approximately $47.5 million for a variety of activities including research and development, public trials, standards lobbying, promotional activities, and industrial and public sector exploitation.

In its initial Telidon program, the field trials were defined as having four basic purposes:

1. To promote the introduction of Telidon terminals in the field trials.

2. To stimulate the service users who might take advantage of Telidon's inherent capabilities.

3. To demonstrate the superiority of Telidon over competing systems.

4. To create a government/industrial vehicle which might take Telidon to the marketplace.

However, more specific governmental goals for the program involved:

1. To place operational Telidon services in all major urban centres in Canada utilizing telephone and cable by 1985.

2. The instigation of two national Teletext services in French and English.

3. To have Canadian manufactured Telidon terminals and adapters available as standard over-the-counter retail products in merchandise stores across the country.

4. To make Telidon the North American standard for Videotex.

5. To develop an operational mobile Videotex service for aircrafts, ships and automobiles.

6. To provide a provincial government public information service over Telidon.

7. To instigate a viable electronic publishing industry in Canada.

8. To develop an export industry supplying Telidon hardware, software and content.

Some of these were excessively optimistic goals. For example, the 1985 goal for Telidon terminals was 500,000 with total expenditures in excess of $100 million per annum by the consumer on Telidon services, an estimate that business service expenditures would be approaching $1 billion per annum, and that the export of turnkey Telidon systems would account for earnings in the range of $150 million per annum. Finally, it was thought that there would be growth rates of around 30 percent per year in the Videotex/Teletext industry.

The goals of the service providers involved:

1. The assessment of Telidon's technical capabilities.

2. To encourage spinoff activities and evolution in new types of applications; to encourage a base of new business around which the Videotex system might operate, e.g. the growth of small IP companies, graphic design companies, equipment suppliers, etc.

3. To assist in the development of a marketing plan for service providers which would result from the assessment of the user pilot trials, with specific reference to IP goals involving learning about what types of content are most valuable for business and consumer markets.

4. To understand what market segments exist for the consumer, the business sector and the public, and to gain some notion of how much consumers would be willing to pay for Videotex/Teletext services.

5. To know how quickly market sectors such as retail, banking, travel, electronic mail, etc., will view Videotex/Teletext services as a worthwhile cost efficient medium.

6. To gauge some sense of the mass market appeal of Videotex/Teletext services.

7. To aid in the development of standards in sections such as education.

Here the field trials were viewed as a means of evaluating Telidon as an educational medium in its own right and to examine various delivery modes -- cable, telephone, television and broadcast.

The Canadian Experience -- Trial Diversity and Growth

In the 24 Telidon field trials conducted or planned for implementation across Canada, most offer only information retrieval to residents and business markets, but a significant number of terminals are placed in public locations.

In addition to the 11 of current trials being conducted by phone companies, five cable trials involved a total of 524 terminals and various Canadian governments have developed four tests for Telidon, with the largest being the Ontario Teleguide system (1,200 projected terminals), and the federal government's Cantel project (comprising 100 terminals). Finally, Telidon educational experiments have involved the placement of 258 terminals, and the

CBC broadcast trial will involve a placement of 500 terminals.

Market Response

Emerging results from the trials in progress have now provided some indication of the relative success of various configurations and alternatives which have been tested:

1. There has been a movement away from the provision of a full range of the integrated services which might include utilities monitoring plus Videotex into a combined format. This has occurred mainly for managerial and not technical reasons.

2. There has been an extremely slow development and implementation of transaction and messaging capabilities.

3. Telidon users have been able to access a multitude of data bases through telephone connections to remote locations using gateways, e.g. B.C. Tel users may connect directly to the Grassroots data base in Winnipeg.

4. There has been an increased interest in the development of targeted and application specific Telidon

content.

5. Most users have expressed general satisfaction with the Telidon equipment such as keyboard and terminal, and dissatisfaction with keypads.

6. Information retrieval has been the primary application in most trials and content quality is paramount. There has occurred general dissatisfaction with the quality of the data bases, and many users have expressed initial interest and then subsequent disappointment -- a type of Edsel effect.

7. The emergence of specific targeted audiences for information retrieval services has emphasized the opportunity of the Videotex market while affirming the need for increased investment in data base design and quality of production.

8. There has occurred a moderate response by in-house business users to present Telidon configurations, specifically of data bases developed for trials, and an expressed interest in messaging services.

9. There is a substantial number of people who have interacted with Telidon terminals, with an average of 3,000 sessions per week reported for B.C. Tel, Vista and Elie field trials.

Applications Emerging from Field Trials

One important lesson emerging from the field trials is the realization of the need to direct information to special user groups and to design data bases organized around a specific application. An emerging area for on-line information, and one which has also been already successfully implemented in Telidon, is Agribusiness. Typified by Grassroots in Winnipeg, 320 users pay $50 per month to access a wide range of agricultural-related information. There is every reason to expect such Agribusiness use of Videotex and interactive electronic services will continue to grow. A second growth area involves on-line transaction services such as bill paying, investment data and electronic shopping.

Industry Evolution

The Page Creation Industry

There is evidence emerging from the trials that the page creation and information provider sector of Telidon services is growing. The page creation sector has consisted usually of a number of

umbrella organizations which serve creators and designers of pages submitted by participating companies, organizations and government agencies. At the present time there are an estimated 50 different organizations which provide page creation in the Canadian Telidon field trials. Although firms such as Dominion Directories and Infomart are leaders in terms of their integrated approach and in terms of the number of pages they have been able to put on various systems, there is also a large number of smaller firms which have emerged and are competing for an expanding page creation market. The early development of companies such as Infomart which have provided large and integrated systems has its benefits in terms of field trial activities. While they have been dominant in the market, they have also been instrumental in forming spin-off companies which emulate their production capabilities on a smaller scale. Also, many larger IP companies have expanded initial page creation services to providing systems and the development and marketing of entire turnkey Telidon systems.

The past two years of growth of the field trial activities suggest that a fledging Telidon industry is developing, involving:

1. Page creation companies.
2. Terminal production and hardware.

3. Systems operation.
4. Limited software development and applications development.

Also, a number of the Telidon industry firms are now pursuing commercial ventures in the private sector and developing in-house Videotex private systems and, on an international scale, in the U.S. market. Field trials have essentially served as the prime focus behind this emerging industry over the past few years.

One section of the Telidon industry which has generated a significant amount of revenue is page creators. Presently there are approximately 55 companies involved in the Telidon industry, of which 31 offer commercial page creation services within Canada. Cumulatively, these companies have created approximately 200,000 pages of Telidon-based information.

In addition to the field trial related activities already discussed, three commercial Videotex services have already emerged in Canada: the Grassroots service providing Telidon-based information to farmers throughout Manitoba; the international service on Telidon presented by Teleglobe in which terminals are located in Canadian embassies throughout the world; and the Faxtel information service of Toronto which is a closed user group service offering stock and news. In addition, there are also two government operated public information services: Cantel (the federal

government's task force on service to the public); and the Teleguide service of the province of Ontario Ministry of Industry and Tourism.

In a related context, new technological developments have resulted from the field trial activities. There have been at least three generations of IP terminals as well as at least three major developments in terms of user terminals, plus software which enables existing technologies such as personal computers to be utilized as Telidon terminals.

Investment and Revenues

With respect to expenditures on Telidon over the past two-and-a-half years it is estimated that for each dollar spent by the federal government on Telidon, three to four dollars has been generated by the Canadian private sector. The following Exhibit presents estimates for financing by both government and industry.

Although it is difficult to estimate the precise amount of revenue which has been generated by Telidon-related firms, if one assumes a standard $35 per page cost for page creation, then it is clear that upwards of $6 million has been generated merely in the page creation phase of this industry. Also, many companies offer consulting and advice to clients on matters such as page layout design and development, and if one assumes charges for

such consulting of the order of $45-$75 per hour then it is apparent that this portion of page production alone has generated well over $10 million.

In terms of Telidon hardware, firms such as Microtel, Norpak, Electrohome and Northern Telecom have produced terminals for the field trials, and if an average price of $2,000 is assumed per terminal, then a revenue has been generated of approximately $11 million from hardware manufacturing alone; i.e. merely for user terminals.

System Operators' Perspective

The information contained herein was gathered by means of a Wescom phone survey conducted with industrial representatives from 26 Telidon-related companies. These included four cable companies, seven telephone companies, nine page creation and Videotex service companies, and six hardware and software manufacturers.

This survey asked the respondents a series of questions pertaining to the role of their firm in the field trials and what they expected to gain by field trial participation.

One of the most significant activities in the field trials involved the need to identify a potential population for Telidon

services. In general the IP's felt that even after a year and a half of field trial activity, potential target markets for Telidon had not really been identified. For example, in the Bell Canada Vista trial it was still unclear whether a residential market would constitute the prime sector as opposed to a business market. Other participants reacted more positively to the issue of the way in which trials have identified potential target groups. However, in these cases, precise numbers of users and their characteristics were not provided or offered to substantiate claims of success.

Within the Videotex service provider sector there was a uniformly negative response toward the role that the field trials had played in identifying potential target markets for Telidon. A number of the IP's asserted that this lack of identification was a function of the inability to clearly define a variety of potential market users before the trial had been undertaken.

Summary

In summary it may be concluded that:

1. The manner of implementing field trials introduced significant restrictions on interpreting user responses and on the estimation of potential market demands for future services.

2. The trials have successfully enabled the technical capabilities of Telidon equipment and modes of service delivery to be evaluated.

3. Very little activity in the trials has been directed towards evaluating the range of new computer and telecommunications technologies which are competing with Telidon.

4. Survey responses of systems operators indicate that many questions remain about the target market for new services and potential which exists in various residential and business markets.

5. Considerably more efforts need to be placed in the development of serviceware, software, content and specialized applications such as transaction, banking and transit information systems.

6. Targeted applications which emerge from the trial and which offer likely potential are:

   - agriculture
   - tourism
   - banking

- specialized users, i.e. stockbrokers, retailing
- transit information systems.

7. To date there has been a penetration of less than 5,000 terminals in Canada. Although this has stimulated the terminal manufacturing sector, terminals are still very expensive ($2,000) and are restricted to display and retrieval. This terminal penetration is significantly less than originally estimated for 1983 (40,000).

8. The private sector has expressed a significant amount of caution in assessing the prospects for Telidon, supported by a feeling amongst most industrial representatives that the field trials have not been as effective as expected in specifying future target market segments.

9. Wescom statistics indicate that over $100 million has been invested by the private sector in the Telidon industry, with at least 55 firms now directly involved. The government to private investment ratios are estimated at 1:3.

10. The trials have encouraged some limited development of content, but this has been focused more on technical

and software improvements than on actual applications.

11. Internationally, the trials have helped establish interactive Telidon as an international standard. Opportunities have also emerged in the U.S. market, particularly with respect to the AT&T standards adoption. A modified alphageometric approach has been adopted as an international standard by CCITT, and there are now at least five Telidon tests in the international market.

12. There has been extensive testing of equipment enhancements, including:

- the inclusion of macro PDI's
- colour display enhancements
- the evolution of the Telidon decoders Mark I-III.

13. Public awareness has been increased through media coverage, trial participation and interaction with the public terminals.

14. International Telidon equipment and software sales have been encouraged as a result of this domestic commitment.

4.0 COMPETING AND COMPLEMENTARY TECHNOLOGIES

The purpose of this section is to provide an overview of areas which will influence the growth of Videotex/Teletext and Telidon services in Canada over the next decade. Five major areas have been investigated:

1. Artifical intelligence and Videotex.
2. Information retrieval, on-line data bases and Videotex.
3. The integrated office, computer graphics and Videotex.
4. Computer-based instruction and Videotex.
5. The cable industry and Videotex.*

All of these areas, excepting cable, involve mainly business rather than household applications.

Perhaps the central result of the field trials thus far is that it is a fallacious assumption to think that the public or consumers presently have real needs for information that may not be obtained with equal facility from other sources. It is clear there was not really a significant amount of Videotex information in the field trials that the average consumer cannot obtain from other more direct and less costly sources. As one author has

* A sixth area, "Videotex and the Software Industry", is considered to be of such importance that it is discussed in the concluding policy section of this report.

noted, "A newspaper would have to cost at least $10 before a person would consider converting to an electronic medium for the same information."[21] Even if terminals were low priced, instead of the current price of around $2,000, virtually all computerized information services cost too much for the average consumer to utilize.

This section describes trends within the particular industrial sectors noted above and extracts the significant factors which are likely to impact on Telidon development -- a complete market analysis within the traditional frameworks was not intended, and it would be speculative if attempted at this stage of product development.

An alternative market and pricing structure for Videotex services in Canada has been provided by Lesser, who first defines six Videotex market segments: Videotex brokers, information providers, storage providers, service providers, distribution providers and users. Founded on this characterization of the Videotex market, he then uses the traditional theory of property rights as an analysis framework to determine market alternatives. Specifically, Lesser notes that if economic efficiency is made paramount in the provision of Telidon services, then what he has called a non-attenuated set of property rights (defined as "a set of property rights which provides exclusive ownership and unrestricted trade") is required.

In other words, if a stringent set of property rights is applied, such an efficiency objective cannot encompass also the non-efficiency or social goals which have been proposed for Telidon and some "attenuation of property rights" may be called for.

Lesser proposes a three-tiered price structure -- with one tier free to users, the second based on a flat subscription rate (with no user sensitivity) and the third involving user sensitive pricing schemes which involve incremental charges for additional data base use.

In other words, to achieve social "non-efficiency" goals with Telidon, he raises the possible need to restrict the amount of Videotex content which advertisers may sponsor if one desires that small IP's and public interest groups are to have unbiased access to the Videotex market.[21a]

Although this work has considerable merit in delineating the relations between primary structures and social goals for Videotex, in the following discussion we are concentrating more on practical and applied marketing issues rather than theoretical ones.

The field trial results and general market experience suggest that Videotex and Telidon face extremely tough competition in the

market for information retrieval services. So far the experience has dictated that information content must be highly directional and offer real utility to a user. Videotex service operators also must provide a linkage to a wide variety of useful data bases, utilizing, when necessary, gateway procedures for facilitating access to a diversity of information.

The growth of more versatile presentation and transmission technologies will also impact Telidon services. Similarly, the growth of personal computers (perscoms, as the Japanese call them) with extremely sophisticated graphic enhancements has been estimated at 38%-75% annually. Their diffusion, along with the emergence of cable services, will place further pressure on implementing stand-alone Videotex or Telidon services.

The current development of cable in Canada presents the most direct threat to telephone company opportunities in the provision of Telextext and Videotex offerings. The business market is still the prime focus for telephone companies' Videotex efforts, but the growth of dedicated networks still poses a threat. Although the cable industry is still mainly restricted to one-way services, the increased popularity of Teletext services indicates that this may not be a problem for information retrieval services. All of these opportunities suggest that the cable industry may have a much larger opportunity for the provision of

Videotex/Teletext services than the telephone companies, especially in residential markets.

Integrating Videotex into existing office equipment offers one of the most likely future scenarios. Videotex is well-suited to being bundled into a number of current office services and providing direct competition to other manufacturers in the areas of integrated office equipment. Such a cumulative or additive approach to Videotex fits in well with general trends in integrated office applications. However, the main constraints on Videotex presently are its high price and limited software for applications. However, the knowledge of exactly what services to provide is only now emerging from the field trials. Speculative applications, even when well thought out, have often failed. For example, in the business environment, closed user groups were thought of as the main Videotex audience, but experience has already indicated that the capabilities of Telidon are really no match for personal computers and existing information retrieval technologies for these types of applications.

In spite of the considerable policy interest in Canada concerning the use of Videotex as a delivery mechanism for computer learning, Videotex and Teletext seem to offer little mass market use in the computer learning and computer retraining area now in spite of the considerable policy interest in Canada in this development.

Network providers and systems operators must examine the full spectrum of hardware and software for accessing any data base or providing other transaction capabilities. Personal computers, management workstations and such all have varying levels of penetration in business/residential markets, and presently both of these have far greater penetration than do Telidon units. However, network provision and linking users to central sources via gateways such as INet present good possibilities to gain revenues from the transmission and storage of data bases and for transactional operations.

The highly supported and subsidized Videotex/Telidon industry in Canada is presently focused almost entirely on meeting requirements of the field trials and experimental services. Subsidization efforts have been directed almost entirely to the hardware area. Although the field trials will continue to provide the main impetus to this industry over the next couple of years, a reduction in government support will occur and the industry then will have to demonstrate its own viability. Two-way capabilities, display graphics, transactions, messaging, education and retraining, are all potential applications of Telidon, which will require significantly more technical development to compete with competing technologies and systems. Although all of these applications benefit from computerized display and transmission means,

whether or not Telidon offers a relative advantage can only be assessed with careful planned evaluations.

In our attempts to identify future opportunities for Telidon and to structure scenarios for future service configurations, we have given attention to the broad economic and market forces which will likely impact this industry. These include factors such as economic trends, future communications growth, government policy and regulation.

In any assessment of future market growth of new services, it is simplistic to think that traditional models of product introduction and development or market response may be used as an analysis framework. Such is primarily because these products are as yet undeveloped, and there are very few analagous products which may serve as comparisons. Accordingly, assumptions which are implicit in traditional marketing models (in which identification of market sizing, estimates of sales and buying behaviour and market shares are often quoted) bear little resemblance to the current stage of development for Telidon. In fact, the critical factors involved in its future growth are its possible applications and bundling it into existing equipment and services which may serve as complements or substitutes.

4.1 Videotex Product Definition

There is still a real need to provide a clear definition of Videotex. In many cases, Videotex has a multiplicity of capabilities and characteristics, but in general it can be viewed in a generic sense as a computer technology that significantly enhances the way in which graphic and textural material can be displayed and also simplifies the processes necessary to accomplish remote access retrieval and exchange of computer-based information. Videotex is predominantly a technological advance in software, a new way of packaging computerized data which enables one, as one author puts it, to achieve "the widespread dissemination of textural and graphic information by wholly electronic means, for display on low-cost terminals, under the selective control of the recipient, in using control procedures easily understood by untrained users."[22] However, experience with Videotex services over the past couple of years has made it evident that a number of terms involved in this definition of Videotex should be viewed more as product promotion than definition. As another author has written, "Although this practical systems perspective has undoubtedly contributed to a more widespread awareness of Videotex and its capabilities, it would also appear to have engendered a rather fuzzy and unprecise understanding of the product itself, as opposed to its many applications."[23] Videotex, in other words, while resisting a facile definition, may be workably defined as computer-based information

which is disseminated from a remote source and appears as a response to a user's demand. Such a concept includes not only information retrieval but also transactions which are affected through interaction with a source computer; for example, the involvement of funds transfers such as electronic banking and electronic messaging, and dialogues between users and the computer such as those used in computer-based instruction.

Videotex also implies some mass market appeal, since its developers envisioned a user-friendly, computer-based service which diffuses widely through homes and businesses. Telidon is the Videotex system developed by Canada's Department of Communications, and its unique feature is the use of PDI's, i.e. picture description instructions which transmit information in alphageometric form through programming instructions.

Each of the following sections reviewing competing and complementary technologies presents an overview of the industrial and marketing characteristics of that technology and attempts to illustrate their implications for Telidon development.

4.2 Artificial Intelligence and Videotex

One of the new technologies of particular relevance to Videotex developments is artificial intelligence -- the branch of computer science which attempts to induce computers to respond as if they

were intelligent. But AI programming processes ideas and facts rather than only numbers. Many AI programs use inference rules of normal programming but as applied to concepts -- for example, "If an animal has tusks, then it is not a cat" -- while other systems relate large networks of empirical facts which tell a computer how individual parts of information are related. Utilizing such a network, a computer may "know" that only mastedons and elephants have tusks but that elephants are not extinct.

In solving problems, the new AI software manipulates this body of empirical knowledge in ways analogous to human reasoning; i.e. while sorting through a body of knowledge, AI programs have the ability to decide on their own sequence of steps rather than following precise decision rules.

One of the most important contemporary results of AI involves expert systems programs -- computerized consultants which allow a computer to act as a smart assistant in areas of technical expertise.

4.2.1 Expert Systems

One significant property of expert systems programs is that, if asked, they can present their reasoning in a form which human beings comprehend. Such a property is labelled the "transparency" of a program and is extremely useful as a programming aid.

Specifically, a main use of expert systems is now to design, service and program computers which are too complicated for human beings to interact with directly. Examples of expert systems include the following:

1. MYCIN -- An intelligent helper which aids in administering antibiotic drugs and which can diagnose spinal meningitis and related infections and prescribe treatment during a critical two-day period, during which there is not yet much relevant diagnostic information.

2. SACON -- A spinoff expert system from MYCIN which utilizes rules from structural engineering to advise how to use and apply engineering software systems.

3. GUIDON -- Another spinoff from MYCIN is a computer-aided learning tool containing multiple knowledge bases, one pertaining to rules about tutoring and another to knowledge rules about the subject matter being taught. GUIDON actually elicits and corrects answers from students.

Commercial developments are expected to be extremely rapid here, and the head of the Japanese fifth generation computer project, Dr. Tohru Moto-Oka, has predicted that within five years, "AI applications will be far more important and profitable than traditional computing".[24]

4.2.2 Impact on Videotex

One aspect of AI research most immediately applicable to future developments of Telidon technology is that of non-procedural query languages. During the 1970's many of the AI researchers not involved in the development of expert systems programs were trying to induce computers to communicate in natural languages such as English and French. They reached approximately the same conclusions of the experts systems researchers, that one may induce a program to converse intelligently about a specific domain of knowledge only if that domain is restricted enough -- such as restricted business data bases. Software which utilizes a natural language to search a corporate data base is called a non-procedural query language, and these are now undergoing significant world commercial development.

One such language developed by the Artificial Intelligence Corporation of Massachusetts is called Intellect, and by 1983 Intellect has been sold to more than 300 firms in the United States.

By using Intellect a manager may ask questions of the firms' data base without using a computer programmer to translate these commands into a code which the computer understands. Most business data bases are normally used by less than five to eight persons at any installation (who are normally computer experts),

but Intellect-like systems typically have around 50 users in any frim, most of whom are computer naive. Intellect-like natural query languages will render the tree structure search capabilities of Telidon and simple key word search procedures obsolete.

4.3 Information Retrieval, On-Line Data Bases and Videotex

As part of this study we have examined information retrieval and on-line data bases in Canada. Both the computer user base and software industry in Canada are in a state of flux with respect to on-line data bases. In recent years, industry revenues which have been derived from leasing and sales of hardware are diminishing as the share of total market profits, while software service revenues are increasing. The proliferation of stand-alone microcomputers and the trend to remote processing both provide evidence of a more diversified market.

The Canadian data communications market is characterized by

1. The increasingly important role of stand-alone microcomputers which are not part of time-sharing systems, but which, with appropriate software, can tap into the information resources and transactional capabilities of a Telidon system.

2. The existence of a fast-growing population of alpha-

numeric data terminals in the form of both video displays and teleprinters.

3. A growth of electronic publishing in the form of on-line data base access with the data normally in alpha-numeric form and an increasing emphasis on commercial rather than governmental and research applications.

This growth in information retrieval has been supported by revenues in the interactive and over-the-counter service sector, as well as an overall growth in firms supplying such services. Of direct relevance to future Videotex services is the on-line data base activity.

Between 1980 and 1982, this on-line data base market experienced growth rates of 30% yearly and is forecast to reach $2 billion by 1985 for North America. Most activity occurs in the U.S where the computer services companies, time-sharing firms and publishing houses are all avidly participating in the development of electronic text publishing and on-line data bases. The industry is involved primarily in industry-specific information. But a growing consumer market is also being developed which provides on-line data bases for accessing a large number of information sources. In both segments, it is apparent that a growing market exists and that demand will continue to grow at rates between 20% and 30% over the next half decade. A critical elements in the

success of this industry is the ability of vendors to develop user-friendly access procedures.

Provision of Canadian on-line services is currently dominated by U.S. suppliers (more than 90% of the data bases). However, growth of new services has been rapid, with over 700 current data bases increasing at a rate of roughly 15% to 20% per year. Most of these are industry and application specific.

In Canada it has been mainly computer service companies and over-the-counter time-sharing firms such as I.P. Sharp or Comshare which have provided on-line data bases. These have focused on highly specialized industry segments such as pharmaceuticals, mining and aviation, and these types of specialized services represent the largest growth areas in the on-line data base industry in Canada. In several Canadian field trials of Telidon, attempts have been made to exploit the growing number of data terminals through the use of INet as a gateway to make such data bases accessible by Telidon terminals.

4.3.1 Canadian Data Base Use

One study of on-line bibliographic data bases in Canada has estimated that the potential user population was about 6% of the total Canadian population, or 1.4 million persons.[24]

In 1979 there were 161,280 on-line data base searches conducted in Canada -- a figure which represented only about 11% of the potential user market, or .007% of the Canadian population. At that time on-line searching was a highly specialized service used by a small number of Canadians. (Such a situation is rapidly changing as user search skills improve through the use of perscoms hooked up to services such as Compuserv and The Source.) On-line service centres were almost entirely used by government and academic institutions (comprising a total of 54% of searches). Commercial and industrial organizations accounted for 26% of searches, and the lion's share of the on-line search market was held by Dialog, Orbit, Can/ole and QL Systems.

It is instructive to note that the most popular means of conducting searches was through a search intermediary, who conducted the search on behalf of the end-user (in 84% of total searches). Such a fact illustrates the obvious lack of user-friendliness for facilitating searching by end users, and such a feature epitomizes the problems involved in the use of data bases which were not designed for public access.

The total world-wide public data base market was worth approximately a billion dollars U.S. in 1980, while the Canadian market was estimated in the range between 20 to 45 million dollars, or approximately 5% to 7% of this world market. The most active providers of commercial on-line information included The Source,

Infoglobe, Infomart and the Dow-Jones News Re-trieval Services.

To illustrate the growth in these services, at the end of 1982, Infoglobe, the Canadian service, had approxiately 1,300 regular users, of which about 15% were located in the United States.

The 1982 revenues were approximately a million dollars, or an average sale of $700 to $800 per user. However, the growth rate for Infoglobe between 1981 and 1982 was 100%, while the 1982 growth projection was approximately three-quarters of this figure.

4.3.2 Specialized Data Bases

One of the most significant features in marketing new information services is the need to direct one's information to specialized groups of users and to design data bases around a particular application theme. Illustrative of this observation is Dow-Jones which has founded their services on financial news and stock market quotations. Another area for on-line information data bases, and one already successfully implemented by Infomart, is agribusiness. Grassroots, in which users pay $50 per month to access farm-related information, already has more than 300 subscribers.

A number of recent forecasts have suggested that there is reason

to expect that Videotex use for agribusiness will continue to grow. For example, it is estimated that between 50% and 75% of commercial farms in the United States will have perscoms by 1990. Agricultural applications which have emerged in the Telidon trials and commercial services involve:

1. Crop and livestock control and management reports, which feature data such a pesticide use, feeding and fertilizer use.

2. Advice on marketing products and livestock, including legal and accounting advice.

3. Commodity and financial reports, including prices, trends and market volumes.

4. Government information.

5. Regulatory information.

6. Guidelines for agribusiness bookkeeping.

7. Weather data which emphasizes currency and geographic proximity.

8. Teleshopping.

In addition to this North American service, a number of international services already have been implemented. For example, in the French Teletel service, which includes agriculturally-orien-

ted data. Also, in Prestel efforts have been made to create agricultural pages, and Prestel now publishes a separate directory to locate agricultural information.

4.3.3 Transactional Capabilities

A related growth area for information retrieval and on-line data bases are transaction services which are on-line. Already a number of North American services have emerged in the area of on-line banking. Many transactional services now offer bill-paying, stock quotations investment data, publications and electronic shopping.

The increase in interactive banking services has occurred mainly in the United States. In many cases, closed Videotex systems are being utilized which offer a link between the customer and the bank. In the U.S., a main marketing thrust by systems operators has involved the use of Videotex's two-way capability as a vehicle for providing banking and related transactional services. Many analysts in fact believe that transactional capabilities will be the main catalyst for the commercial success of Telidon applications. In such cases, a transaction capability provides an upgrade of what has previously been only an essential information retrieval function.

The Canadian movement toward home banking has been considerably

more constrained than that in the U.S. due to a more conservative business attitude and stricter controls. But the American experience is an indication of the popularity and demand which exists for transactional services. One lesson already learned in this context is that systems operators such as bank and trust companies will have to seed the market with terminals to provide an access to clients and customers. However, in the banking context, any ability to provide transaction services necessitates that a systems operator must provide an adequate technical/network support to the user base. The basic requirement here is the ability to process an extremely large number of transactions in a mainframe processing computer.

A related factor increasing the market growth of banking transaction services is the growth of shared networks for automated teller machines, or multi-branch banking systems. It may be ultimately that such networks are accessible from the home, thus facilitating direct-funds transfer and on-line purchases of goods and services.

A related transactional service involves home-shopping. When such services have been provided in Canada and Britian, the response has been moderately successful. Similarly, the development of transactional ticketing for travel has been often raised as a possible transaction service for Videotex.

In summary, transactions applications for Telidon which seem to be emerging at the present time include teleshopping and remote reservations, home banking and bill-paying services. All of these have already experienced significant growth in the United States, and Exhibit 4.1 presents a break-down of expenditures connected with bill-paying and banking.

Fees included comprise services such as overdrafts, safety deposits and cheque-writing. Such considerable expenditures reinforce the potential productivity gains which might result with the application of Videotex or Telidon services to electronic banking. In Canada, the annual costs of cheque processing have been estimated to be in the order of a billion dollars annually and eight billion dollars in the United States in 1980. This Exhibit also indicates the growth of transactional retail sales and services which necessitate reservations. Non-store sales in the United States exceeded $100 billion in 1981.[25] Of this amount, $36 billion was spent on products which were sold through all forms of direct mail marketing. Equivalent estimates for Canada range between $10 and $13 billion, respectively. Many of these transactions were done on personal computers.

EXHIBIT 4.1

Transaction Expenditures (Based on U.S. Data)

	Total 1980 Expenditures ($ billions)	Average Household Expenditures per Month	Percent Estimated Annual Growth 1980-1990
Banking and Bill Paying:			
- Banking fees	1.95	2.05	3.6
- Postage for payment of bills	1.20	1.25	2.8
Teleshopping:			
- Direct marketing sales	36.00*	37.50	10.0
Services Requiring Reservations:			
- Airline travel	6.60*	6.90	3.9
- Vacation lodging	4.95*	5.15	3.8
- Entertainment admissions	14.65*	15.25	3.7

* These figures represent the total values of goods and services purchased.

All figures are for U.S. banks in U.S. dollars.

Source: Teletext and Videotex in the U.S., Tydeman, T. et al., McGraw Hill, 1982.

4.3.4 Personal Computers

Until mid-1978 almost all of the small microprocessor-based personal computers in North America were sold almost exclusively to computer hobbyists and were used for home experimenting, learning games, computer networking, making graphics and personal business. By 1975, the first year of real sales of perscoms in North America, a little under 20,000 were sold, but by 1980, over 500,000 had been sold, with predominant contenders being Commodore, Apple and Radio Shack. The market for personal computers (or perscoms) has thus shifted from computer hobbyists towards business professionals such as doctors and dentists who use them for payroll and accounting purposes, mailing lists, and toward managers and engineers in large corporations who utilize them as private workstations. However, the expected large consumer market for perscoms to be used as home educational tools, selling for $1,000 or less, has simply not taken off.

By 1981, the small microprocessor-based perscoms began to invade the markets of the minicomputer manufacturers such as IBM and Xerox, and increasingly, managers in large firms were buying their own Radio Shack TRS80 perscoms, rather than using the firm's computer department. Also, since some large offices of big corporations now have dozens of perscoms, personal computer manufacturers are now equipping their machines with abilities to

communicate with other computers and networks as the mainframe IBM computers already do.

Until around mid-1981, then, the perscoms were the domain of electronic firms such as the Tandy Corporation and firms manufacturing only microcomputers, such as Apple. But since corporations began to order such computers in batch for their engineers and managers, larger manufacturers entered the market. In mid-1981, the Xerox Corporation was the first major producer of office equipment to enter the perscom market, soon followed by IBM.

The personal computer market is expected to grow by 75 percent during 1983. Annual sales growth of 300 percent is also predicted during 1983 for business microcomputers.[26] Finally, during 1982 the Canadian microcomputer and peripheral market increased 75 percent to $200 million. More than half of all personal computers sold in Canada are used for word processing, and these perscoms may cost a fraction of the cost of computers dedicated to word processing. According to Wescom estimates, in January, 1983, there were 58,000 microcomputers in Canada -- including perscoms plus other types of micros.

Advanced Resources Development, the Massachusetts consulting firm, has predicted that the demand for business software packages will enable 16 bit processor-based microcomputers to

capture a major market share of the desk-top office computers during the next half-decade, asserting that this type of processor would comprise almost half the value of North American shipments by 1986. Since CPM became the standard operating system for perscoms, the product life of 8 bit based perscoms has been extended by the massive number of application packages which were developed for them, comprising more than 5,000 software packages for business financial planning, accounting, word processing and so forth.

The next generation of perscoms will have a vastly increased processing power and will enable the usage of applications software packages which actually are "user-friendly" (almost no software presently is) and for graphics capabilities. Advanced Resources Development reports that sales of perscoms will exceed $2 billion by 1986, with more than 7 million perscoms shipped between 1982 and 1986.[27]

Canadian perscom entries include Hyperion, a 256 bit machine which is IBM compatible (i.e. will run IBM software), and the Rainbow 100 of Digital Equipment of Canada Ltd. of Kanata, Ontario. The Rainbow 100 has an 8 bit and 16 bit processor chip. It thus spans both generations of perscom software.

Another Canadian perscom competitor is the Persona, produced by the Nelma Data Corporation of Mississauga, Ontario. This 64K

machine has two 5-1/4 inch disk drives and a 12 inch green on black monitor.

Over the first half of 1983, increased competition is expected in perscoms retailing for between $700 and $1,000 U.S. (There are desk top computers presently on the market priced in the range of $100-$400, but these computers can do very little beyond running games and are intended for home entertainment.) The president of the Tandy Corporation predicts that, "A whole new market segment seems to be evolving in the $300-$1,000 range."[28] It is also anticipated that IBM is about to unveil a new machine called the "Peanut" which will be priced in this range. The Peanut will comprise a computer and keyboard which plugs into a TV. This cheap IBM perscom will not be marketed through the IBM product centres, but it is anticipated that it will be marketed through large retail organizations such as Sears Roebuck & Co.

4.3.5 Convergence of Videotex and Personal Computers

There is a trend for Videotex capabilities to be incorporated into perscoms. By September 1979, the British Post Office allowed a perscom manufacturer to place modules which would allow users to access the Prestel services. In Canada and the U.S., Apple II perscom users can access Dow-Jones industrial averages and information services such as The Source and Compuserve. Norpak, one of the Canadian manufacturers of Telidon terminals,

has manufactured Telidon interface cards for Apple computers which enable them to function as Telidon terminals. There are other instances of Canadian firms manufacturing Telidon-compatibility features for perscoms, but these often cost half as much as the perscom itself.

4.3.6 Personal Computer Networks

A personal computer is essentially an intelligent terminal. It may function either as a stand-alone storage and computing device or as a Videotex receiver, but at the beginning of 1983, Videotex systems are still considerably more expensive than personal computers.

With an increase in the number of personal computers in North America, there has also been a growth in perscom networks. Compuserve and The Source, which both operate on time-sharing computers with information sent over the phone lines to users with perscoms and modems, are examples of these networks.

The Source offers sophisticated keyword search methods, and both The Source and Compuserv have graphic services which rival Telidon. Although The Source and Compuserv both offer comparatively sophisticated down-loading for a wide variety of software, one of their uses so far has been computerized messaging between owners of perscoms. However, such computer-aided messaging is not new,

and large multi-national enterprises and national and international banks and Japanese trading companies have long had international computer networks. Illustrative of such a network is the European Laboratory Computer Network of IBM. Such a network is used for the development of software in five European countries, and with this network, any support work for software involved in the logical design of large-scale integrated circuits doesn't have to be duplicated in each facility.

But perhaps the most striking development in North America has been the growth of personal computer networks. Both The Source and Compuserve now offer computer-aided messaging, time-sharing computing done via the phone lines over outside mainframe computers, word processing, telesoftware of all sorts down-loaded into perscoms, mathematical and statistical software packages, and the ability to write software at home. With such down-loaded software packages, an owner of a personal computer can access software for home finance, or any software that he cannot write himself.

The personal computer market is being driven by several factors, including growth of computer hobbyists and the decline of computer business service organizations.

Time-sharing business computer services, we have seen, enable firms to utilize large, high-cost external mainframe computers.

Such services are used by firms which can't afford their own in-house computer, or in cases where in-house computing would be more expensive than the service. However, with the cheap perscoms invading small businesses, such an advantage is rapidly disappearing.

Many observers have noted that, unfortunately, the predominant manufacturers of perscoms are making the same error that the mainframe and minicomputer manufacturers made in early development. They are building software that cannot communicate with products of other manufacturers. Thus, a great amount of money is being put into software that is not portable from one system to another.

The main reason for the rapid diffusion of personal computers is probably the increased availability of small business software. Typical of perscom software manufacturers for small business is Personal Software Incorporated, which produces the popular "Visi-series" of business software, Visicalc, Visiplot and Visitrend. Each of these packages retails for about $200.

Apple, IBM, and Xerox have been producing user-friendly machines which are a blend of perscoms and executive workstations. They operate almost entirely by pushing a pointer, called the mouse, on the screen to a spot which contains a pictorial representation of an office function (such as filing), and hitting one of sev-

eral commands. Such a machine requires extremely sophisticated and elaborate software.

Both The Source and Compuserv combine a messaging network with time-sharing applications and information services. In a sense, they are unique because they offer an eclectic mixture of services which might appeal simulataneously to individual and corporate interests. Each of these serves an audience of approximately 13,000 subscribers, who access the services either with perscoms or terminals. Both of these services are at the leading edge in the diffusion of computer-based services outside of the corporate environment. As such, they have been of considerable interests to analysts speculating about the market for home Videotex.

The Source Telecomputing Corporation, which is majority-owned by Readers' Digest, is a computer service company located in Virginia, which users access by phone and the Tymnet or the Telenet packet switched networks.

The Source services comprise transactions, i.e., teleshopping, interactive services such as games, information searches and messaging. The mail and messaging functions of The Source are its most frequently used services.

Compuserve, which is owned by H. & R. Block, initially sold data

processing to large firms, allowing them to access its mainframe computers located in Columbus, Ohio through Tymnet.

Commercial services of Compuserve include an electronic mail services called Infoplex. Although Compuserve initially sold excess time and a number of services, mainly to computer hobbyists, it has expanded its off-hours services into a Compuserve Information Service which sells electronic mail services and a variety of information at a rate of around $5 an hour for connect time. The Compuserve Information Service also includes securities information (Microquote) and services for personal finance. Their Micronet software exchange allows users with intelligent terminals or perscoms to down-load software into their personal computers. Compuserve, in connection with Associated Press, also makes a number of U.S. newspapers electronically available.

Both Compuserve and The Source present a number of features contributing to their success. First of all, they can be accessed by a variety of perscoms and terminals. Secondly, they offer low rates which are facilitated by the use of otherwise idle computer capacity. Finally, billing is simplified by utilizing ordinary credit cards.

Contrasting with time-sharing services, one means of networking personal computers involves the CROSS-TALK software product.

CROSS-TALK enables microcomputers with a CP/M operating system to message with each other, with mainframe computers and with services like The Source and Compuserve.

4.3.7 Radio Software and FM

One technology competing with Videotex as a medium for downloading software into terminals is FM radio. Since software is merely information, it may be transferred via floppy discs, video discs, cassettes, memory chips, Videotex systems or simply transmitted over phone lines, satellite, cable or combinations of these. With such "telesoftware", software is downloaded into perscoms. In fact, a national corporation was formed in 1982 in the United States to shoot software over the FM radio throughout the U.S. to persons owning Apple II's and Apple III's perscoms. INC Telecommunications is planning to deliver software digitally by satellite to 220 public radio stations in the U.S. which will then piggyback the software onto their regular broadcast signal. This development involves the first mass distribution channel for independent computer programmers, but the market for such telesoftware is actually quite new and only a few firms, such as The Source and Compuserve, distribute software to users in this way.

FM radio stations have baseband subchannels called "SCA's" which are capable of carrying data communications, and the FCC, toward the end of 1982, began examining the uses of the SCA, including

continuous transmission via subchannels for data and audio communications. Presently SCA's may be used for broadcast purposes only when the FM radio station is on the air, and such frequencies are presently utilized to broadcast music, news and entertainment listings. But availability of such a data transmission capability via the FM radio may "open up thousands of new outlets for services, including Teletext look-alikes. According to FCC statistics, less than 27% of FM stations with SCA capability are using it -- which means that the unused SCA potential for all FM stations nationally totals about 84,500 hours per day."[29]

4.3.8 Summary

The potential impact of information retrieval and on-line data bases over Videotex and Telidon services is promising. Canada currently has more than 900 accessible data bases, and the range and types of information available are continuously expanding. However, experience reveals that information content of such data bases must be highly directed to the user, and Videotex service suppliers must also provide linkage to a variety of data bases (rather than simply creating data bases) using, if necessary, gateway procedures for facilitating access. Specialized data bases such as those developed for stock brokers or the agriculture sector represent an opportunity for Videotex. In these cases, information is directed to a targetted audience and is

continuously updated.

Of particular relevance here will be the impact of INet. The INet service allows communication between computers, data communications equipment and terminals which would otherwise be impossible because of different protocols, character coding schemes and transmissions speeds.

Exhibits 4.2 and 4.3 present a summary of factors which will impinge on the development of on-line data bases in Canada. They present an overview of positive features of Videotex and also outline opportunities and threats for product development.

EXHIBIT 4.2

Information Retrieval,
On-Line Data Bases and Implications for Videotex

Positive Features of Videotex	Negative Features of Videotex
- Low cost display mechanism	- Need to develop gateways
- Ease (relative) of use for terminal operation	- Lack of knowledge about the data bases
- Simple user command language	- Need for compatible user instructions
- Widely dispersed terminal locations possible	- Need to convert standard on-line information to Telidon-compatible codes
- Linkage via telephone, cable or broadcast	- Current cost of hardware
- Useful in business and residence locations	- Variation in user charges
- Serve as a multi-data base display technology	- Unknown reliability and quality of terminal equipment
- Large number of data bases available	- Competition from personal computers
- Combining of data bases possible	- Lack of hard copy output
- Increased development of directed data bases	- Need for updated catalogue of available information
	- Inexperience of Telidon page creation companies

EXHIBIT 4-3

Information Retrieval - On-Line Databases - Opportunities

	Application	1) Market Size/Type	2) Competitive Technology	3) Opportunities	4) Threats
1.	Public Databases	Medium-large businesses, Small businesses, Small residence market, Consulting and research, Professionals	Existing terminals, Alternative media modes, Management workstation	Linkage of several databases, Display in colour	No print compatibility, Start-up costs, Maintenance costs
2.	Financial Stock Market	All businesses, upscale residential user, Professionals, Hobby users	Newspapers, Brokerage houses, TV, Existing on-line systems	Value added displays of trends, On-line updating, Transactions to brokerage houses	Regulation, Slow development of transaction capabilities
3.	Electronic Yellowpages	Business and residence	Private directories, Alternative directories	Established directory, Infrastructure	Need to seed market with terminals, No revenue for use
4.	Linkage to Commercial Databases (Dow Jones Source)	Medium size upscale residence user - with PC's, Some business, Service organizations, Finance	Existing and rapidly growing PC placement	Ease of use, Linkage to several services, No need for modems if using Videotex terminal	Growth of personal computers and other display devices
5.	News, Current Events, Sports (National)	Public locations, Residence	Existing PC's, TV, Radio, Teletex	Ease of use, Payment by usage	Improper costing, Inability to get timely information, Redundant information
6.	Local Content	Urban areas, Rural communities, Special interest groups	Community TV, Cabletext, Bulletin Boards, Newspapers	Ease of use, Networking and local storage	Local quality, Need for sponsorship, Indeterminant funding
7.	Specialized Databases: Agriculture, Travel Jobs, Gov't News, etc.	Small business, Public locations, In-home, Closed user groups, Clubs, Organizations	Existing computer services, Personal computers, Broadcast news	Wide variety of applications	Growth of personal computers, Cost of production, Terminal placement
8.	Entertainment	Home market	Personal computers, TV, Video discs	Linkage - Program guides, Interaction, Variety of games and information	Personal computers, Lack of disposable income

* P.C.'s - personal computers, microcomputers, e.g. Apple, Osborne, etc.

EXHIBIT 4-3

(continued)

Information Retrieval - On-Line Databases - Opportunities

	Application	1) Market Size/Type	2) Competitive Technology	3) Opportunities	4) Threats
9.	Newsletters	Medium-large companies, Professional organizations, Clubs, Investors, Collectors, Professionals	Print media	Established network of users, Cost of print and timing of material	Cost of linkage using high tech.
10.	Real Estate Information, Housing, Hotels, Motels	Buyers and sellers, Travellers, Analysts	MLS, Print, Micro display systems, Catalogues	Timely information, Layouts, Rates, Terms, Traffic routes, etc.	Existing MLS services, Existing data files on housing, CMHC, On-line databases
11.	Transit/Travel	Travellers, Tourists, Tour groups, Foreign visitors, Visitors and convention services, Very large potential for linkage on national and international scale, Intra-urban - 400-500,000 in Vancouver	Travel reservation systems, Airline reservations, Hotel reservations system, Voice - Telephone, Computer notice - Teleride	Packages of information, Direct reservations, Ticketing, Tour availability, Direct sales to buyers	Airlines and travel agents resistance, Public resistance, Need for consultation
12.	Language Services	Major urban markets Italian, Chinese, French, East Europeans (large-size)	Voice services, Video cassettes, Tape recorders	Aid ethnic groups in integration, Special channels and databases for foreign languages	Resistance to technology, Lack of interest for investment
13.	Captioning	Hard of hearing, Visually impaired, Handicapped - 1% of Canadian population*	Cable TV, Special services, Technology, Printers	Special needs groups	Investment required for relatively small Canadian market
14.	Education	Students, Home learning market, Part time education, Correspondence market, Non-credit courses - users	TV, Cable, Radio, Knowledge network, Microcomputer	Linkage to variety of schools, Direct access to courses, Selection and booking of courses	Inability to place timely info (e.g. changes in course availability, etc.) on system, Significant design requirements, Assessment of user needs

* Estimates vary from 1% to 10% of the population. Definitions depend on degree of disability and other factors.

EXHIBIT 4-3

(continued)

Information Retrieval - On-Line Databases - Opportunities

	Application	1) Market Size/Type	2) Competitive Technology	3) Opportunities	4) Threats
15.	Medical Telemedicine	Hospitals, Paramedics, Clinics, Remote services, Very large potential user market, Drug companies, Pharmaceuticals, MD's	Satellite broadcasting, Cable TV	Remote communities, Emergency service numbers, Informing public of procedures for emergencies	Liability to sponsor agency, Industry association resistence, Regulation and policy
16.	Advertising	Consumer market 500,000 homes in Canada, Public locations, Malls, Public buildings, Specialized business markets - Industrial marketing	TV, Radio, Newspapers, Directories, Display Boards	Direct marketing, Direct shopping	Regulation, CRTC, Inability to develop transaction capabilities, Who pays!, Yellow pages

4.4 The Integrated Office, Computer Graphics and Videotex

The third area examined in this section pertains to market trends and technological advances occurring in business, including word processing, electronic messaging and computer graphics.

Both electronic messaging and word processing are leading edges of office automation. Computer graphics is predominantly a means of enhancing text-based applications and is a fast-growing applications area in itself. For example, special graphics terminals are being used to display data in an easily comprehended format for computer-naive decision-makers and to support professional needs which contain a design component.

Another major trend in office automation is the integration of traditionally disparate applications. An integrated office might typically include word processing, facsimile transmission, electronic filing for storage and retrieval of documents, word processing, computer-aided messaging, and communications linkages to corporate files which are located outside the company via digital satellite systems such as IBM's packet switch business communications satellite, the SBSI. All of the above functions might be accessible from a single TV-like terminal or workstation sitting on a desk.

Market advances for such integrated office equipment are anticipated to involve from tens to literally hundreds of billions of dollars a year within a half decade in North America.

Sales involving stand-alone word processors (as opposed to perscoms) are expected to drop by 25 percent during 1983, but there will be a 10-15 percent increase in sales of "clustered word processing stations".

A significant portion of the word processing market will end up with microcomputers such as the Apple. This firm is marketing its LISA computer as a small to medium sized business computer with special emphasis on word processing.

Any computer manufacturer which does not incorporate the abilities to easily process both data and text is likely to be cut out of the market, and manufacturers such as AES and Wang who made computers aimed entirely at the office automation market are remarketing them as general office automation tools which can process both text and data. Manufacturers who made data processing packages are quickly adding text processing capabilities.

Most of the original office equipment manufacturers which have traditionally produced only one part of such office equipment are frantically attempting to extend their products. Phone companies are diversifying into computer and data processing in addition to

voice, and the computer companies are diversifying into data transmission. However, the main problem thus far with integrated office equipment is that each manufacturer has been creating word processors, executive workstations, small business computer terminals and other equipment which communicates only with their own equipment. But this problem is being partially alleviated with the development of local business computer networks such as Xerox's Ethernet.

The basic idea of Ethernet is that of a local cable business communication system which enables computer talk between word processors, printers, electronic file cabinets and intelligent terminals. Each of the office machines in Ethernet is smart enough to make a decision whether or not to transmit a message, so there is no necessity for a central or host computer to control traffic on the cable. Xerox has been actively pushing this Ethernet concept as an industry standard and has already gotten the Digital Equipment Corporation and Intel to design chips for it.

In the marketplace for integrated office equipment, Telidon presents a flexible software protocol which has possible applications as a complement to several services which are already well established.

4.4.1 Canadian Market Overview

The Canadian market for office and computer communications equipment and software is expected to grow by 30 percent throughout 1983. Microcomputers are one of the fastest growing segments, with 58,000 units installed in Canada by the end of 1982. One study by the Financial Post indicated 609,000 micros had been sold in North America in 1981. That study also estimated there were currently approximately 1.2 million micros now in North American use at the end of 1982.

Growth estimates for the microcomputer sector vary but range between 30 and 75 percent annually. This sector, when combined with the word processing industry, accounted for 11 percent of revenues generated by the Canadian computer industry in 1980. The largest growth area in office automation in Canada is in word processors. The installed Canadian base was estimated at 30,000 in 1981, and 1982 forecasts have indicated that the Canadian market for word processors annually generates around $200-300 million of revenue. The projected market growth between 1982 and 1984 is roughly 20-30 percent, with more optimistic projections resulting in a $1-2 billion Canadian market by 1984. The top suppliers for Canadian word processors comprise:

AES	33%
Micom	22%
IBM	14%
Wang	12%
Xerox	7%

It should be noted, however, that these are dedicated word processors, and this table does not include growth figures for microcomputers used as word processors.

Presently there are more than 50 firms involved in marketing word processing products, and Exhibit 4.4 presents estimates for the installed base of word processors and communicating word processors in both Canada and the U.S.

There are a number of ways of obtaining word processing, the most commonplace of which is the purchase of a stand-alone word processing unit. Other systems for word processing involve:

1. Time-shared word processing.
2. Shared resource systems.
3. Over-the-counter word processing.
4. Personal computers as word processors.

EXHIBIT 4.4

Communicating Word Processors:
Estimated and Forecasted Installed Base

Year	Total Word Processors	Communicating Word Processors
Canada:		
1978	19,000	1,000
1985	85,000	21,500
U.S.:		
1978	90,000	25,000
1982	315,000	194,500
1984	715,900	212,500

Sources: Frost & Sullivan, 1980; R.W. Hough & Associates, 1980.

One of the major developments in word processing involves so-called multi-function work stations in which diverse office functions, including word processing, are accomplished on a single piece of equipment.

Communicating word processors, of course, offer another method of electronic messaging. Although presently less than 10 percent of the communicating word processors sold are used for this purpose, communicating word processors have a promising future. There are considerable attempts to alleviate compatibility problems through standardization in word processing equipment and via the instigation of services such as Infotex which incorporate compatibility. Yet, in spite of these advances, it requires considerable managerial effort on the part of an organization to establish intra-corporate communications.

A related major development is the use of perscoms as word processors. Users who find prices of word processing equipment (typically $4,000-$10,000) too high are turning to the comparatively inexpensive microcomputers. Microcomputers may be applied simultaneously to word processing, data processing, messaging, and so forth.

4.4.2 Private Branch Exchanges

The main problem with the new communicating word processors, as with all of the new communications technologies, is that they have become an electronic tower of Babel. The equipment of different manufacturers cannot communicate with each other. However, one of the ways this problem is being alleviated is with expanded PBX's (private branch exchanges), which route and switch both digital data and phone calls within the office and from outside, and which are facilitating local business communications networks which may handle facsimile transmission, cheques, data and both normal and stored voice.

The small microprocessor-based private branch exchange was initially conceived of as a replacement for a large roomful of traditional telephone switching equipment, and the main idea was to use such PBX's to connect office phones to the outside. But given a large number of new PBX's which may handle both voice and data, local area business networks have arisen which can route digital data in the same way that they traditionally switched phone calls. Thus, they enable office communication between text editing terminals such as word processors, high speed facsimile machines, executive work stations, personal computers and printers.

Typical of such new business PBX's is the Information Switching Exchange of the Data Point Corporation. Just like old PBX's, the Information Switching Exchange can perform operations on phone calls from outside such as routing outgoing long distance phone calls to the cheapest line, forwarding calls, redialling when the number is busy, automatic dialling of frequently called numbers and so forth, but the Information Switching Exchange can also move information around an office in the form of words and data in the same way that they switch phone calls.

With this continued convergence of computers and communications, manufacturers of data processing equipment such as the Data Point Corporation will increasingly be entering the new office communications and office automation markets.

4.4.3 Telidon Opportunities

Videotex opportunities are suggested by the following three models for the integrated office. Firstly, when a word processing application is offered, it may drive the purchase of in-house Videotex systems which resemble the local shared resource systems being acquired for word processing presently. Secondly, personal computers with appropriate Videotex software may accomplish word processing and other integrated office functions on a stand-alone basis, while Videotex access via a software packet may accomplish messaging, add-on services and information re-

trieval. Finally, office applications may occur through external Videotex services.

The reason why word processing is important from the viewpoint of Videotex suppliers is that, first of all, word processing is an applications area that might drive a market. This fact has implications for suppliers of in-house Videotex systems which could compete with shared resource word processing systems, and also for suppliers of Videotex terminals which could either perform word processing on a remote time-shared basis or on a stand-alone basis through personal computer/Videotex terminal units. Secondly, word processing will often be the leading application in either a cluster of electronic applications or in the implementation of an integrated office system. Thus, suppliers of Videotex services should position themselves as additive service suppliers which are accessed through equipment acquired solely for word processing.

4.4.4 Electronic Messaging

Electronic messaging involves the electronic exchange of information that may be visually displayed or printed. Here one should make a distinction between electronic mail and simultaneous messaging. The latter always involves real time messaging in which a sender and receiver are in the same time zone. With electronic mail, on the other hand, the sender and receiver do not have to

be simultaneously present. Thus, electronic mail refers predominantly to store and forward services. Such services will have great utility, particularly in the advantages they offer over existing phone services.

Electronic messaging services might involve facsimile, teletypewriters (telex/TWX), communicating word processors, computer-based messaging services, computer conferencing and voice mail systems.

Growth of electronic messaging is dependent on major advances in packet switched networks which have facilitated low cost, long distance telecommunications. Also, the local area communications technologies, which have been previously discussed, involving updated private branch exchange systems, have also advanced electronic messaging.

Canadian messaging services are anticipated to produce a total of $1.5 billion annual revenue by 1984, with an annual projected growth rate of 30 percent per year through mid-decade, although moderate growth rate is projected for TWX and telex services, with the installed units increasing from a 1980 figure of 41,000 to merely 43,000 in 1984. (Revenues for these two are currently around $400 million annually in Canada.) An extremely rapid growth is expected in the market for high speed facsimile equipment, which at the present time has an installed base of approxi-

mately 10,000 units. This number is anticipated to increase to more than 30,000 by 1985, with present revenues of $60 million growing to $100 million by this date. Xerox controls 28.9 percent of this market, with QWIP having a 26.9 percent market share.

Facsimile

Because of the renewed interest in electronic messaging, facsimile is receiving increased attention recently. The number of North American "fax" units increased by more than 50 percent between 1977 and 1980, and growth rates of up to 17 percent over the next few years have been predicted in the U.S. by the Yankee Group. A conservative estimate of the number of fax units in Canada in 1981 is approximately 12,000 and, as shown in Exhibit 4.5, a growth to 28,000 units has been predicted by 1985.

It is extremely difficult to make predictions for facsimile markets because:

1. Due to the development of communication systems integrating both sophisticated printers and scanners, a decline in the total number of traditional facsimile sending and receiving units will occur.

EXHIBIT 4.5

Projections for Types of Electronic Messaging

	1978	1985
Communicating Word Processors:		
- Canada	1,000	21,500 (Hough, adjusted)
- U.S.	25,000	212,500 (Frost & Sullivan)
Computer-Based Messaging Systems (CBMS):		1982:
- Terminals	5,000	65,000
- Messages	18M	275M (Yankee Group)
Facsimile:		
- Canada	8,000	28,000 (Hough)
- U.S. (1979)	276,000	505,000 (IRD)
	185,000	450,000 (Yankee Group)
Voice Mail	N/A	$1B 1990: $3B (IRD)
Wideband Private Corporate Business Communications, Satellite-Based (SBS, W.U., RIA, etc.)	1981: 425M	1982: 660M (Business Week, Jan. 11, 1982)
Wireband Electronic Mail		1982: $8B 1986: $2.8B (IRD)

2. Although a growth in high speed facsimile units is expected, sales of slow speed units are anticipated to decline. Also, facsimile's share of the overall electronic messaging market is anticipated to decrease due to growth in electronic mail in both text and graphics.

Teletypewriters--Telex and TWX

Telex services in Canada are offered by CNCP Telecommunications. TWX is operated by the telephone companies. Combined, the TWX/Telex network has more than 1 million terminals. The Source recently started a worldwide news service for all telex terminals connected to it. Telex has more than a half million customers worldwide in 200 countries. In the U.S. there are more than 75,000 telex and 60,000 TWX subscribers, and both are operated by Western Union. In Canada there are more than 40,000 telex users but only 4,000-5,000 TWX terminal users. Although there are international compatibilities between the two services, in Canada they are not compatible.

Both TWX and telex are now a geriatric telecommunication service whose growth curves have peaked some time ago. In fact, telex was introduced by CNCP in 1956, and by 1976 the growth rate for both telex and TWX had slowed to 6 percent per year.

Both TWX and telex have basic limitations. Their large network of terminals is suited to very slow transmission speeds. Telex sends only 60 words per minute. Telex terminals are quite simple and cannot utilize electronically stored material to any significant extent. Telex services, however, comprise a vast in-place network for simple electronic messaging and show a number of compatible trends with other electronic messaging systems, as shown in Exhibit 4.7.

Computer-Based Messaging Systems

Computer messaging systems have their origins in the ARPA net of the U.S. Department of Defense in the late 1960's. Although there are few estimates available for the number of terminals in public or in-house private computer messaging systems, the estimated terminal population in Canada was 220,000 terminals in 1978. The U.S. Yankee Group has estimated growth rates of 100 percent per year for terminal connections to computer messaging systems.

Management Workstations

While current growth in sales of executive workstations is slow, Exhibit 4.8 indicates that by 1985 total value of the sales of these will constitute $2,096.3 million in the U.S. The main requisite features of systems involve information retrieval, computer messaging and word processing by very simple means.

EXHIBIT 4.6

Facsimile Equipment Projections
U.S.

Year	No. of Units			
	Frost & Sullivan	Yankee Group	International Resource Development	International Data Corporation
1979	130,700	185,000	276,000	-
1980	-	-	-	209,500
1982	185,000	281,000	379,000	-
1985	268,000	450,000	505,000	425,500

EXHIBIT 4.7

Developments in Teletypewriter Services

Starting Point	A Mature Service, In Widespread International Use. Slow Growth for Some Years.
Terminal Improvements	- Upgraded electronic terminal
"Mail" Services	- Automatic send/receive terminals - SAFT (Store-And-Foward-Telex)
Compatibility	- Established technical compatibility between Telex and TWX teletypewriter terminals - Receipt of transmissions from communicating word processors, through INFOTEX
Additive Services	- Telepost (telex transmission plus postal delivery); telex input for cables and telegrams, etc. - TELENEWS data base offered experimentally by telex.

CORPORATE EXPANSION INTO NEW AREAS OF MESSAGING	Telex's INFOTEX service provides an intelligent network for communicating word processors, designed as the Canadian component of a TELETEXT document transmission network.

EXHIBIT 4-8

Management Workstations
Dollar Value of Shipments — U.S.
(in millions)

	1980	1981	1982	1983	1984	1985
Conversational CRT	17.3	18.7	19.4	18.5	14.7	14.2
Editing CRT	207.6	228.7	223.6	209.7	187.5	159.0
Clustered Terminals	50.4	118.5	210.0	332.4	498.0	711.6
Single Station Processor	25.0	32.0	39.0	47.0	55.0	62.0
Clustered WP	15.75	29.7	51.0	87.4	140.1	203.5
Desktop Computer	78.6	126.6	195.0	282.1	380.2	496.0
Management Workstation	-	9.0	30.0	100.0	250.0	450.0
TOTAL VALUE	394.7	563.2	768.0	1,077.1	1,523.5	2,096.3
%		43%	36%	40%	41%	38%

IDC, Report on the Management Work Station, May 1981, Page 1

Desired Workstation Features

	Number of Respondents Rating this Feature					Percentage Rating Features as "Very Important" or "Vital"
WS Feature	Unimportant	Useful	Important	Very Important	Vital	
Integrated WP and Data Access	0	2	6	30	20	[illegible]
Privacy Control	0	3	6	18	31	[illegible]
Computer based Message System	3	2	12	21	19	[illegible]
Filing System	1	7	14	22	12	[illegible]
Status Files	0	12	19	18	2	39%
Graphic Displays	3	15	17	18	0	34%
Tickler System	2	21	24	8	1	16%
Meeting Schedule and Calendar System	5	35	10	5	2	12%
Color Displays	8	27	16	3	0	6%

Summary

Perhaps the main trend in office automation is the integration of different functions which hitherto were distinct. This integration has been accomplished through the establishment of connections such as local area networks which link together activities such as data processing, word processing and the display of graphics. The fundamental building block of this integrated office concept is the multi-functional work station, where all of the above capabilities are available in a single terminal.

Telidon Applications

Videotex has a possible number of business applications. Exhibit 4.9 presents Videotex features with appropriate business applications. It seems likely that the main way that Videotex will be sold will be by attaching, integrating or bundling itself into a number of services and being presented as part of a package. The main way to do this is through Videotex/Telidon software. This cumulative or additive approach to Videotex accords with the general trends and integrated applications we have been examining. The main current inhibiting factor is price, with most terminals still costing over $2,000 and hard copy output available only at exhorbitant costs.

EXHIBIT 4-9

Videotex Features and Applications

Ease of Use

Integrated Office:

In the integrated office, desktop terminals will be used by white-collar workers, demanding highly user-friendly technology.

Messaging:

Managers and professionals will message directly through desk-to-desk terminals.

Graphics Display

Business Display Applications:

- Enhanced presentations of numeric data for trend analysis, performance comparisons, sales information and stock market performance.
- Pie charts, histograms and illustrative diagrams.

Demonstration and Design Graphics:

- Presents both product demonstrations, illustrations or promotional material as well as product and performance information.
- Videotex is able to combine all applications in one terminal.

Industry Standardization

Messaging, Word Processing:

Videotex standards may appear as a strength, in a market plagued by incompatibilities.

Additive Approach to Services

Messaging:

Messaging may be marketed as an attractive secondary service.

Where messaging can function as a primary need for the acquisition of equipment, further Videotex services such as information retrieval can be marketed.

The purchase of Videotex equipment and/or services can be presented as a means to both accomplish primary needs in the office such as word processing, and to gain secondary applications such as messaging, information retrieval, etc.

Word Processing:

Videotex as an intelligent network for communications among word processors.

EXHIBIT 4-9

(continued)

Videotex Features and Applications

Ease of Use	Graphics Display	Industry Standardization	Additive Approach to Services
			Word Processing, Integrated Office:
			Videotex systems used for word processing and other integrated office applications. (Word processing drives the market for equipment purchase.)
			Videotex as a local in-house system.
			Time-shared office automation services, through a remote Videotex system (for text processing, mes-saging, information retrieval, etc).
			Microcomputer/Videotex units, with software for word processing and other integrated office functions on an independent basis, plus access to Videotex for messaging, information retrieval and other add-on services.

EXHIBIT 4-10

Trends in Electronic Messaging and Videotex Potential: Competitive Threats and Opportunities

Trends	Technology: Facsimile	Telex/ TWX	CWP	CBMS/ Computer Conferencing	Voice Technology Example	Videotex Potential
Equipment & Networks:						
1. Compatibility	X	X	X	X	X	X
2. Intelligent Networks	X	X	X	X	X	X
3. Multi-functional terminals	X	(X)	X	X	X*	X
4. Shared Resources	-	-	X	X	X	X
5. Local Area Networks	X	-	X	X	X	X
Service Related:						
6. A Sophisticated** Service Industry (relative development)	high	medium	low	high	low	?
7. Additive Applications	-***	X	X	X	X	X
8. Integrated Office Services	-	-	X	X	-	possible

CWP = Communicating Word Processor
CBMS = Computer-Based Messaging System

* Terminals such as Displayphone may integrate voice services with general computer-based applications such as information and other services.

** Support services will become increasingly sophisticated.

*** Highly unlikely that facsimile would develop capabilities for colour computer transmission. There are better ways of transmitting colour (e.g. graphic terminals).

EXHIBIT 4.11

Summary of Videotex Potential in the Automated Office: Opportunity Areas

(1) Add-on services available to private Videotex systems, i.e. private systems purchased for specific internal applications could utilize additional external Videotex services for messaging, information retrieval, etc.

(2) Videotex as an intelligent network for communication among word processors.

(3) Videotex systems used for word processing and other integrated office applications. (Word processing drives the market for equipment purchase.)

   (a) Videotex as a local in-house system.

   (b) Time-shared office automation services through a remote Videotex systems (for text processing, information retrieval, etc.)

   (c) Microcomputer/Videotex units, with software for word processing and other integrated office functions on an independent basis, plus access to Videotex for messaging, information retreival and other add-on services.

4.5 Videotex and Cable

This section focuses on the cable industry and its relation to Videotex/Teletext. The Canadian cable industry presently enjoys a substantial subscriber base to its traditional television services. Its present growth areas involve pay TV delivery and promotion, expansion into the U.S. market, and non-programming services.

Since cable is a "hybrid" technology, possessing characteristics of both broadcasting (with its supply of TV programming) and of a telecommunications carrier, in its early years cable was placed into a restrictive environment, limiting its role as a redistributor of TV broadcasting signals. Recently this role has widened, and cable has now established itself as a real industry and no longer is an interloper in the domains of the telephone companies and broadcasters. This industry may accordingly be expected to strongly participate in a variety of non-programming and programming services. Although there have been some movements toward broadcasting/cable alliances, the telephone companies and the cable companies are in an adversarial role.

There is presently considerable uncertainty about the regulatory status of cable with respect to non-programming services; the CRTC has indefinitely postponed a number of regulatory decisions

governing cable, and within the next couple of years split jurisdictional decisions will probably occur which shift some of the responsibility for cable to the provinces. It is even possible that eventually some provinces may nationalize cable companies to serve as public utilities.

Over the short term, however, the CRTC stance towards cable would appear as supportive. In the past couple of years a number of major mergers have been approved, and new information channels have been authorized; also, the CRTC has encouraged experimentation with new services. These decisions have collectively supported the hybrid role of cable in granting to it limited activities in the origination of content (the community channels) and also delayed decisions on regulating cable as a common carrier. (Also, the CRTC is probably attempting to encourage attractive and viable cable services to forestall the appeal of satellite dishes since Canadian content may not be controlled over satellite). As documented in later chapters, the Canadian Broadcast Act which, in the past, served as a basis for restrictive cable legislation, is not readily applicable to business communication services or non-programming subscriber services. Finally, the Department of Communications, with its new broadcasting policy, recently authorized the cable companies to pick up and transmit American programming from satellites.

Already the Canadian cable industry has established itself as a competitor in two-way services over cable. Major Canadian cable firms such as Canadian Cablesystems are active in the U.S. market, and the industry there has gained considerable experience in tiering of services and the solicitation of advertising and in marketing new television programming services. The regulatory environment for cable in Canada is quite dissimilar to that of the U.S.; however, the Canadian cable industry may be encouraged by U.S. trends to instigate new information services, and the U.S. models may provide more liberal regulatory responses towards this industry on the part of the CRTC.

The cable industry has instigated two types of networks: networks of residential subscribers which comprises this industry's historical base and main activity; and also institutional networks which serve non-residential locations such as businesses and public agencies. Although Canadian business networks have not been significantly developed yet, these networks comprise potentially lucrative business markets for voice, data, image and facsimile transmission. New cabling is often required for such downtown networks, and two-way capabilities and other suitable business features can be included in their design. This business market has also been targetted by suppliers of local area networks, which connect business areas to equipment and which are being rapidly developed by suppliers of office automation equipment.

Cable, however, offers a broadband capacity for either business or residential markets which is thousands of times larger than the capacity of the narrowband telephone lines. Such a technical specification renders cable suitable for picture quality resolution applications, such as teleshopping, and for the downloading of software, computer learning or computer games.

The Canadian residential cable networks were established many years ago for basically one-way transmission of a small number of channels to homes. Although new U.S. systems which are being installed have over 100 channels and two-way capabilities, Canadian systems often require upgrading to instigate such two-way services. Videotron Ltd. in Montreal, for example, has been pioneering with packet-switched technology over cable TV, and cable systems in Vancouver are in the process of being upgraded to 54 channels. Within the next three to four years, then, cable systems in most major markets will possess capabilities which allow two-way interactive services.

Technological changes in addressable terminals will also allow content to be sent to specific subscribers, which will facilitate pay services. Point-to-point communications may be achieved in any system with two-way capabilities plus addressable terminals; e.g. any message might be sent to a subscriber "upstream" to the cable head end, and transmitted from there "downstream" to be

received at a local specific address. From a technical viewpoint, then, cable is a powerful transmission medium for both Teletext and Videotex services in the home and business markets. Such addressable systems allow content to be received by specific, authorized subscribers, and addressability which is computer controlled may be connected to automatic billing systems. Terminal use is also encouraged by the business practice of cable operators of renting equipment, and cable operators may purchase terminals in bulk quantity at low prices. Videotex terminals could thus be rented with little capital outlay on the part of subscribers.

New equipment has also been developed which will support cable operators in providing text channels. Such equipment might allow for locally-inputed content, remote keyboard input and external automatic feeds. Satellite data and graphic sources utilizing Teletext-type transmission may be accommodated with decoders placed at the cable head end. Several Canadian cable companies are also exploring graphic enhancements through standard text displays. Each of these developments will facilitate the role of the cable operator as a supplier of text-based information services.

Videotex Implications

All of the above developments for Canadian cable creates a direct threat to the opportunities of telcos in providing Videotex and Teletext services. Although the cable companies and telcos have similar levels of residence market penetration, cable will experience future short term growths as a result of pay TV, and a business environment will thus be the prime focus area for telco efforts in Videotex. The present inhibiting factor for the cable industry is the restriction to one-way services.

In summary, most indicators would suggest that cable has considerably greater opportunity in the provision of Teletext and Videotex services than do the telephone companies; in providing Teletext, the cable companies have a distinct advantage of limited and full channel operation. Also, Videotex services may operate on two-way cable and packet cable, while the phone companies may operate Videotex services on local telephone loops or packet switched networks. Although as of this writing the telephone companies have a greater penetration and certainly more capability for Videotex services, such a competitive advantage may be eroded by a number of related factors, which are outlined in Exhibits 4.12 and 4.13.

EXHIBIT 4.12

Comparison of Cable and Telephone Communication Attributes

		Cable	Telephone Co.
1)	Penetration	86% Residence 0% Business	97% Residence 95% Business
2)	Communication Linkage Cost	$10-$30 per month	$6.45-$17.90 residence* per month $11.40-$59.05 business* per month
3)	Transmission Speed	8M bit/sec	300-1,200 bit/sec
4)	Interface Unit Cost	$300-$400	$150-$300 - modem

* For single line and one telephone (prices vary according to geographic area).

EXHIBIT 4.13

Cable TV

Implications for Provision of Videotex

Attributes	Opportunity	Threat/Constraint
1. Subscriber Base	- 86% in Canada; still expanding - Growth of pay-TV will encourage purchase of addressable decoders - increased willingness to pay for services - Establishedpattern of monthly fees for service	- Need to replace equipment with two-way capability - Increased trend to two-way cable - Increased cost to provide tiered service
2. Industry Developments	- Corporate mergers have solidified the industry, allowing greater economics of scale 1982 gross revenues $464 million profit 1981 - $18 million 1982 - $12 million - More flexible regulatory environment enhancing the scope of operations - Recognized need to tier services - Success of Teletext in Europe and trials in U.S. - Overbids on new franchises - Potential fall-outs as companies show inability to maintain contracts - Industry shake-up possible	- Slower growth 1981-1982 than expected - impinging on expansion to non-programming services - Division of the industry to broadcast and content components - Teletext preferred to Videotex, and cannabalizing that opportunity

EXHIBIT 4.13

Cable TV

Implications for Provision of Videotex
(continued)

	Attributes	Opportunity	Threat/Constraint
3.	Business Base	- Growth of institutional networks for business services - Current experience in U.S. with business news andtargetted programming - Broadband capacity transmission of data and downloading software (NABU strategy)	- Two-way capability control by equipment suppliers - Lack of experience in the busness environment - Growth of telephone companies - interconnect - Slower economic growth inhibiting business investment in new services
4.	Experience	- Currently supply information retrieval services - Dow Jones financial news, consumer news, cabletext electronic program guides, established advertising base	- Need to develop experience in Videotex, Teletex capability - Investment in new equipment
5.	Technology Base and Trends	- Current upgrading of system network - Expanded channel capacity and addressable converters - Vancouver - upgrading 35-54 channel capacity - Videotron - packet-switched technology - Higher resolution capability	- Investment required to upgrade expensive and long-term - scale for return - Uncertainty of recovering revenues for non-programming services

4.6 Computer Learning and Videotex

This section focuses on computer learning as a specialized form of interactive information retrieval. We will examine the implications of Videotex for formal education, the independent instruction market and the industrial training market.

Education has provided a nurturing marketplace for computer learning, establishing an R&D base in universities and facilitating a lean but sustained use through weak early years of computer learning.

Annual education spending comprises approximately 8 percent of the gross national product, with more than $28 billion spent on education in 1982. Approximately two-thirds of this amount went to elementary and secondary schools, with $7 billion being spent on college and universities.

4.6.1 School Personal Computers

By the middle of 1982 there were more than 10,000 perscoms in Canadian schools, which represented a total hardware investment of more than $20 million. Most of these purchases have been made during the last year. As Exhibit 4.14 shows, the total number of perscom units increased at rates of between 30-115 percent in a single six-month period across Canada.

EXHIBIT 4-14

Education Statistics
(Elementary/Secondary and Post-Secondary)

	Elementary/Secondary					Post-Secondary				
Province	No. of Schools	Enrollment	No. of Micro-computers (estimate)*	Ratio: Students/ Micros	% Growth in Six Month Period	No. of Colleges & Institutes	Enrollment Full Time****	No. of Universities	Enrollment: Full Time	Enrollment: Part Time
B.C.	1,890	537,000	1,050	500/1	75	19	18,160	6	31,890	15,430
Alberta	1,465	451,000	1,000	450/1	33	18	18,080	5	31,500	13,630
Saskatchewan	1,050	210,000	600	350/1	115	3	2,440	3	14,740	9,040
Manitoba	825	217,400	500	450/1	na	8	3,630	7	16,590	11,860
Ontario	5,020	1,882,700	5,500	350/1	30	30	81,400	21	161,800	89,800
Quebec	2,840	1,189,300	250**	4,700/1	na	83	133,600	7	91,700	100,700
New Brunswick	487	151,700	300	500/1	na	9	2,000	4	11,520	4,100
Nova Scotia	614	184,200	500	375/1	43	14	3,000	10	18,570	6,280
P.E.I.	74	26,400	100***	265/1	200	2	780	1	1,300	700
Newfoundland	661	146,000	50	3,000/1	na	6	2,330	1	7,420	3,680
Total	15,027	5,017,300	9,850			192	265,420	65	387,030	255,720

* March 1982, Fischer, Linda and Brown, F., "Science Education and Computers in Canadian Schools", a report prepared for a Science Council Workshop (Toronto: EHL Research and Evaluation Group, March 1982).
** Interview Tom Rich, Dept. of Education, July 1982.
*** Ministere de l'education du Quebec, 1982.
**** Part-time enrollment figures not available.

Other Sources: Statistics Canada Catalogue 81-220, Advance Statistics in Education 1981-82, Tables 1, 3, 7 and 8. 1980-1982 figures.

A recent U.S. survey found computer learning in over 50 percent of all U.S. educational institutions. Such an increase was due predominantly to a diffusion of perscoms. Another study predicts the use of perscoms in more than 95 percent of U.S. schools within five years.[30] A third study has predicted that the perscom school market will exceed 250,000 by 1985, and by that time a total of 1 million units will be in place.[31]

Most Canadian-purchased perscoms for school use are U.S. made, with predominant contenders being Radio Shack, Commodore, Apple and Bell & Howell, who market an enhanced Apple unit. Commodore perscoms predominate in terms of total numbers sold because of their use in Ontario, but the mix of perscoms differs from province to province, and in Saskatchewan and B.C. the most popular perscom is an Apple.

Thus, incompatible systems within use in the provinces make this market for software publishers almost impossible since these three perscoms will not run the competitor's software. In the United States these three incompatible systems predominate, and there the schools also make local purchase decisions. However, market size is obviously larger with 100,000 perscoms being sold in 1981 alone, as compared to total sales for Canada which comprised 5,000 units during 1981. In the U.S., Apple has sold more than 50,000 microcomputers to schools, with more than half of these sales occurring in 1981. Apple is also seeking to consoli-

date its school position by offering to donate an Apple perscom to every school in the United States in return for tax write-offs on these donations.

Unfortunately most marketing information available concerning computer learning in schools pertains to hardware sales and not software, for which there is little data available. However, it is known that software costs now average around $375 per personal computer as compared to average hardware costs of $1,600 (U.S.).[32] Also, the proportion of hardware to software costs has been steadily rising, since hardware costs are rapidly falling. Most educational package software is terrible, and there is a real demand for package software by teachers who have perscoms but don't want to write their own programs.

Within computer learning, the perscom has become essentially a vehicle for content, and software for computer learning is now a main part of the educational computing market. Major purchase decisions are now swayed by the availability of tolerable software for a specific perscom, and contents suppliers face severe problems including the facility with which teachers may copy diskettes and the incompatibilities which sever the market. The school market for computer learning in Canada, then, is not extremely attractive in spite of this rapid diffusion of perscoms.

4.6.2 Post-Secondary Formal Education

Post-secondary formal education in Canada comprises university students and students in colleges and vocational/technical institutes. Also, there are virtually hundreds of thousands of part-time students in Canada, for whom Statistics Canada does not collect figures. There is also scant data on the use of computer learning in post-secondary learning institutes, but several universities and colleges stand out in the use of computer learning; a major project in Ontario has recently developed six semester-length tutorials, and the University of Alberta has been offering computer-based instruction for a number of years. The individualization project which has involved the Ontario Institute for Studies in Education has developed courseware. This project also has involved the Ontario College of Applied Arts and Technology, the Ontario Ministry of Colleges and Universities and the National Research Council. Also, several Toronto-area colleges with multiple campuses now use computer learning material through a CAN network.

Most post-secondary institutes, when they have been involved in computer learning at all, have usually used large mainframe computers connected to multiple terminals. Such a model of computer learning more resembles computer usage in training rather than in schools. However, it is precisely in post-secondary

institutes that expertise in computer learning software and hardware will have to be developed.

4.6.3 Part-Time Education

Part-time education has significantly increased at the university and institute level. For example, several years ago in B.C. part and full-time enrollment in universities or provincial institutes was essentially equal, but by 1980 full-time enrollment had risen slightly (to 18,000), although the part-time figure doubled to 30,000 (B.C. post-secondary enrollment statistics, 1979-1980). There are more than 500,000 part-time students in Ontario as compared with 92,000 full-time enrollments (Ontario Ministry of Education statistics).

There has also been a considerable growth in continuing education, evolving from the notion of learning as a leisure activity or as a means of acquiring work skills. As an example of this, in 1979 in Ontario over 100,000 part-time university students were taking non-credit courses.

4.6.4 Special Forms of Education

Special forms of education may include specialized education to physically or mentally handicapped or problem learners; the teaching of basic skills (more than 20 percent of the Canadian

population does not have nine years of school); language training and distance education utilizing the new electronic technologies.

In the area of distance education, Britain's Open University has registered more than 80,000 adults, and courses utilize printed materials over radio and television. The open university has already used new technology such as Videotex and also uses perscoms combined with videodiscs and cassettes. The Canadian Athabasca University is similar to Britain's Open University, although smaller, and specializes in distance education. In 1980, more than 350 students were enrolled.

B.C.'s Knowledge Network also provides an educational TV channel over satellite which is available on cable. In Britain, the BBC has been selling $400 personal computers in connection with a computer literacy course they've offered on BBC 1. Using CEEFAX, their Teletext system, they've been downloading telesoftware into home computers.

Computer learning is only beginning now in most formal educational settings, mainly in an effort to reduce costs. Computer learning is used mainly as a supplement rather than an alternative to traditional teaching since, in the past, it's utilization meant cost increases rather than reductions.

4.6.5 Industrial Training

Training and retraining annually costs the Canadian government and industries more than $4 billion years. This figure comprises government money spent on manpower retraining programs and training programs within the public service. It also includes industrial retraining (estimated at $2 billion) and $600 million annual training costs for the military. Such figures also include training expenditures and salaries and wages of teachers, which comprise roughly half of all training costs. There is little information available about training programs within industry. There is also considerable overlap between government supported training and training which is supported entirely by industry itself. Thus, in several programs, the Canadian government pays a percentage of an employee's wages to a firm if that employee is being trained, and this wage share varies from program to program. It is also somewhat risky to estimate the percentage of computer-based training that might replace standard training and retraining methods.

Although considerably greater sums are yearly spent on education than on training, the market conditions for the latter are much more attractive, since typical patterns involved in computer training comprise major purchases of hardware and authoring software, utilizing systems like CAN and TICCIT, which necessitate

substantial course development efforts. Computer training often reduces training time by more than 30 percent.

In one 1979 survey by the Economic Council of Canada[33], more than 60 percent of the firms surveyed carried out some form of industrial training within the past year. With respect to costs of training, Betcherman has reported that, "This is a subject on which virtually no information is available, at least within the public domain."[34] (The most expensive training involved that for blue collar workers which tended to be of 52 weeks or longer, and usually mixed classroom with on-the-job training. An average cost per trainee for fabrication of products was $15,700, while a month long clerical course cost an average of $411. Conservative estimates for yearly training costs by industry are approximately $2 billion).

There is no doubt that computer-based training is growing, and one U.S. survey carried out in 1980[35] found that computer training was being utilized in 21 percent of 113 companies surveyed, as compared with 10 percent in a 1978 study.

There are also trends in training which are appropriate to the use of computers. Firstly, more training is done in off-the-job rather than on-the-job, and there is also a trend in "generic skills training". Such an approach groups together skills which may be common to a number of occupations. In B.C., for example,

apprenticeship programs have been replaced with training modules which teach basic principles in clusters, such as electronics and mechanical trades. Such generic training is often then followed by specialized instruction on the job.

Computer simulation may also be utilized to reduce costs of expensive lab equipment, and remote delivery gives the ability to train at any time. For appropriate applications, then, computer training makes strong financial sense. For example, B.C. Tel has significant training needs and spends more than $10 million per year on training employees. Over 250 B.C. Tel employees yearly take a course called Digital Logic, which deals with computer operations throughout the B.C. Tel system. The total cost to B.C. Tel for this training is more than $1 million annually. When this course was converted to computer form, the total training time was reduced from ten to five days, and course development costs comprised $175,000; one time equipment costs for a TICCIT system supporting 20 terminals were $0.5 million. Thus $375,000 is annually saved by B.C. Tel by computerizing this training course, and it is anticipated that this system will pay for itself within three to three-and-a-half years.

On-Site Computer Training

Perhaps the most promising application area of computer training comprises industrial job skill training and staff development programs. The rapid growth of computer-based training and industry is accounted for by two main factors:

1. Although labour costs are rapidly rising, costs of computer-based activities are decreasing. Often programmed instruction material which is delivered by the teacher can be more creatively delivered by a computer, and any investment in computer-based training is usually justified by cost savings and the reduction in training staff.

2. Costs and time associated with employee travel time in course attendence are eliminated with the use of remote terminals. Also, courses no longer have to be scheduled in such a way that a large number of people can get together at the same time.

Computer-based training packages may advance job skills involved in office procedures, sales and marketing techniques, production line assembly operations and industrial health practices. Staff development may also be aided through selective refresher courses. For all of these reasons, large firms with the finan-

cial resources will increasingly develop in-house computer-based training systems. For smaller firms, however, the use of computer-based training will depend on the existence of external professionals with an expertise in this area.

4.6.6 The Consumer Market

The consumer market for computer learning and training comprises learning outside of either formal educational institutions or industrial organizations which train their own employees. Computer learning in this context is often a sort of leisure pastime, which might provide practical instruction and teach new skills. Computer learning in the consumer market is dependent almost entirely on perscoms, i.e. personal computers which are available for individual use.

Sale of perscoms are multiplying rapidly, and show the most rapid growth of any product in the computer industry. In 1981 in the United States, more than 865,000 perscoms were sold, with a total value of $1.4 billion. This was a 70 percent increase over the previous year.[36] The Evans Research Corporation has noted that perscom sales in Canada exceeded $100 million in 1981 and were greater than double this figure in 1982.

According to Evans, the percentage of perscoms sold in 1981 for home and hobby was only about 14 percent, approximately equiva-

lent to the percentage sold for education. This study also related that 60 percent of microcomputers are purchased by small businesses, and 11 percent are used within large corporations.[37]

Most studies have shown that there is actually little actual educational use made of perscoms in spite of the fact that microcomputer manufacturers have recently begun presenting game computers as offerring educational possibilities. In the home, most perscoms are used for computer games.

This situation may be changed with the advent of new applications such as LOGO's turtle graphics. Turtle graphics enable children to learn without teaching, and LOGO itself emerged after many years of serious research on how children acquire concepts, mainly based on Piagetian thought. LOGO is both fun and educational, and undoubtedly other software packets merging learning and games will follow.

Actually, patterns of consumer purchasing involving fun and entertainment are not predictable and may be motivated by the prestige of being the first purchaser of a new product or simply by conformity to buying something that everyone else has. The video game market illustrates both of these aspects. By mid-1982 there were more than 8 million video game units in the United States.[38] Some models sell for $150 with limited potential to be upgraded and perform very simple computing functions. Most soft-

ware for video games retails for about $20 and up, and although Atari dominates, several new companies have sales growth amounting to $50 million within a year and a half.

There is a more pragmatic aspect to the home market. Many people often need practical how-to books to accomplish specific tasks. The sales of such books provide some indication of the demand for home learning material, but such book sales are not generally segmented from general book sales. However, publishers such as Self-Council Press are doing very well. This Vancouver-based firm had sales which doubled to $1.5 million between 1978 and 1981.[39]

In the home market, telecommunications delivery of content may be convenient. Advertisers might eventually lower the price of how-to material by subsidizing content software when it relates to their products. As an example of this situation, Eastman Kodak might sponsor photography lessons if inexpensive media were available. Here vast sums are spent on advertising in the consumer market, and total advertising comprises approximately 1.2 percent of the gross national product in Canada and is even higher in the United States.

Another aspect of the consumer market for learning and instruction relates to informal training. The previously discussed statistics on post-secondary education indicate a trend for

persons to take general interest courses as continuing education. There are now millions of highly educated persons in North America who have difficulty "spending" their leisure time. This leisure time might include how-to material, learning games and general history concerning art, travel, history, language study or anything else for that matter. There is also a real audience for instruction on how to use microcomputers and in writing software. Clearly, as the microcomputers continue to diffuse, the consumer, training and education markets will merge.

4.6.7 Applicability of Telidon

Both Videotex and Teletext might be used to deliver pages for computer learning for virtually any application, and there have been a number of Canadian experiments using Telidon in education. The Ontario Educational Communications Authority, for example, in cooperation with the Department of Communications, initiated the Telidon in Education project in 1979.

Related early work has also examined the combination of Telidon into existing computer learning systems. At the most basic level, Telidon has been used as a delivery mechanism for computer learning. However, Telidon terminals will have to be extremely cheap to gain any significant degree of penetration. Other linkages between Telidon and computer learning -- e.g. involving the use of an entire Videotex network as an on-line delivery

mechanism for computer learning, or the downloading of Videotex software for local execution -- has yet to be explored.[40]

A major problem here, however, involves the fact that any computer learning program is usually much more complex than the majority of present Videotex applications.

Also, the menu approach in Telidon is particularly limiting, and most Telidon units do not have keyboards which allow any degree of flexibility in student responses.

Although Telidon might provide a widespread distribution network for computer learning material, the educational uses of Videotex remain basically uncertain. Although Videotex was initially conceived of as a mass market product, the nascent computer learning industry had already restrategized its marketing focus in the area of private in-house systems within large business organizations. One possible exception here is the possibility of utilizing Telidon over the cable network, as is one of the strategies of the NABU Corp; however, this notion is yet too recent to have any market repercussions yet.

Teletext, in the meantime, is more technically limited than Videotex -- with the size of a Teletext data base being restricted to 200 pages using the vertical blanking interval in a television signal or 4,000 pages using a full channel on cable.

Also, Teletext is essentially oriented toward television technology, using a TV for display plus a keypad without alphanumeric characters for input. However, the 4,000 pages available on any cable channel could certainly allow a substantially sized program, and hybrid systems may combine one-way Teletext with phone connections back to a central computer. All of these factors make Teletext an unlikely medium for computer learning.

In summary, despite an intense Canadian policy interest in their development, both Videotex and Teletext as a content delivery means apparently offers little now to the mass market for computer learning. Software downloading appears more promising, and downloading could be accomplished through either Videotex or Teletext. Also, Telidon terminals have been developed with some processing capability (similarly for a number of in-house Videotex systems), and both of these are in accord with trends in computer learning more than the notion of the network connection to a distant content source. The use of Telidon in computer learning may occur in response to future market needs, but the precise nature of this use can be neither easily predicted or imposed. An overview of some of the more probable educational opportunities for Telidon is provided in Exhibit 4.15.

EXHIBIT 4-15

The Education and Training Market and Videotex

	Application	1) Market Size/Type	2) Competitive Technology	3) Opportunities	4) Threats
1.	Education - Formal in School	Large in the elementary schools, Medium in college and university	Microcomputers, Computer learning software and and courseware, Knowledge networks	Distance education, Linkage to micro's, Development of unique education programs, A clearing house function serving a variety of institutions	Lack of courseware, Micro software, Financial constraints, Expensive production
2.	Education - Informal Self Taught	Residence market, Long term quite large, Aging population using re-education extensively	Existing part-time services, Micros, Extension courses, TV, Radio, Cassettes, Discs	Linkage with existing technology, Hybrid systems, Delivery mechanism	Growth of broadcast cable, Micro software, Video discs and machines, Transmission costs
3.	Industry Training	Large corporations of all types, Sales force training, Retail organizations	Standalone systems, Existing computer services, Cable casting, Traditional training packages	Generic courseware sales to corporations, Training through industry associations and trade unions, Home training, Language training	Lack of investment in training, Need very specific courseware, High expense for development
4.	Independent Instruction	Short term minor home market, Medium and long term large home market with high potential for use	Microcomputers, Video discs, Print and hobbyist trends, TV, Radio	Linkage through micros, TV, FM radio, Growing demand for instructional courseware, Courseware sharing, Locally produced material	Telecommunication costs, Access ports availability, Telidon Videotex terminals

4.6.8 Educational Microcomputing

The provincial government of Ontario recently announced that a prototype educational microcomputer will be produced in August of 1983.[41] Ontario is planning to buy $10 million worth of these educational micros and has also announced that they will be spending an additional $5 million to develop Canadian educational software for them. The government will give grants of up to 75 percent to any schools who wish to purchase this machine. During 1982, the combined micro purchases by elementary and secondary schools exceeded 10,000, and this figures is expected to be greater than 500,000 units before 1990.

The new educational microcomputer will be built and designed by CEM Corporation of Toronto. Two types of machines are planned -- one model which will utilize a standard 16 bit microprocessor, and the second utilizing a 32 bit microprocessor. A data storage device will be incorporated into both computers which will allow them to be connected to other machines within a local area network. The 16 bit model will cost $1,800 (or $450 after a grant has been given) and the 32 bit model will cost $3,750 (or $938 with a grant).

Having now reviewed technologies which are possible complements and competition to Telidon, we turn to an examination of Canadian regulatory traditions governing the telecommunications media.

5.0 CANADIAN AND U.S. REGULATORY TRADITIONS

Policy decisions affecting Videotex, Teletext and information technology in general may arise from a number of sources -- ranging from regulatory bodies such as the CRTC to standards-setting industry organizations. Policies may arise from both judicial and regulatory bodies at the national, provincial or even local level. Videotex policy is also influenced by existing Canadian regulatory traditions affecting related media such as cable TV, broadcasters, telephone companies and computer services, since both Videotex and Teletext may involve a combinatory use of all these media.

Since these technologies may also involve new transactional applications such as electronic mail, shopping and banking, they are also being forged within a regulatory tradition governing the non-electronic equivalents of each of these new applications. This section, then, examines the regulatory climate in which Videotex and Teletext are emerging and also delineates the basic policy issues which the new technologies raise. The Canadian environment will be treated at length in the following pages after an introduction to U.S. traditions.

The United States has a lengthy tradition of separating communications media such as newspapers, mail and phone. These regulatory traditions for these respective media are summarized

by Tydeman et al. in Exhibit 5.0. However, changes in information technology, specifically the merging of computers and communications technologies, are causing problems in the established traditions. As a result, the U.S. regulatory climate has been undergoing considerable changes during the past decade, with a general trend away from regulation, culminating in the Telecommunications Deregulation Bill of 1981.

EXHIBIT 5.0
U.S. Regulatory Traditions*

Component Technology	Traditional Regulatory Assumptions	Challenging Factors
Newspapers	No government involved; constitutionally guaranteed free press promotes multiplicity of voices	Electronic newspapers utilizing telephone lines and cable TV systems currently being tested
Broadcasting	Locally based radio-TV with licencee serving as public trustee; limited spectrum must be regulated to ensure public interest	Multiplicity of video sources including distant signals on cable, pay programming, videocassettes and videodiscs
Telephone	Telephone service provided on non-discriminatory basis through monopoly common carrier; rate and rate-of-return regulation; no content regulation	Increasing competition for equipment and services

*Source: Tydeman, John et al., op. cit., p.171.

Component Technology	Traditional Regulatory Assumptions	Challenging Factors
Computers	No direct government intervention; market-driven technology	Merging of computer technology and communications technology
Mail	A government monopoly for first-class mail; uniform rates; cannot be used for illegal purposes; limited subsidy for distribution of books, periodicals and newspapers; universal service guaranteed	Electronic mail already commercially available

A word must be said about the U.S. regulatory traditions for cable TV, a major means of delivering Teletext/Videotex. In the U.S., cable awards are issued on a local level: franchises are given to operators by local city governments. However, cable regulations are set by the federal FCC (Federal Communications Commission). Most cable regulations were directed to protecting local broadcasters from "imported" channels originating elsewhere, and extensive deregulation has recently occurred.

Under existing U.S. rules, or lack thereof, any cable firm may provide home information services and control service access. But as Tydeman notes, "As cable penetration increases, there may be pressure for some access policy concerning cable systems. Information and service providers who are excluded from a major

market may ask policymakers for relief."[42] Meanwhile, in the U.S. (unlike Canada) under certain conditions cable operators have been required to cede access to entire channels (for leased use or community purposes).

With respect to the direct regulation of common carriers, the FCC, according to Title III of the Communications Act, regulates all common carriers and attempts to determine if any new changes or practices which they make in their operations are "just".

The U.S. has no real Videotex/Teletext policy, but as early as 1956, in the so-called Consent Decree, Bell agreed not to engage in unregulated activities such as the sale and leasing of computer equipment and services if these were not part of their normal telephone service. Thus, Bell was forbidden to either provide cable TV or sell time on its own computers.

Given the continuing blending of communications and computers, by 1971 the FCC, in a decision called Computer Inquiry I, ruled that all data processing was outside its jurisdiction; as the 1956 Consent Decree excluded AT&T from any unregulated business, this decision banned AT&T from engaging in virtually any computer-related business services. However, in Computer Inquiry II in 1980, the FCC identified two types of services: basic services (the use of transmission media for the delivery of information) and enhanced services (comprising everything else besides

transmission, i.e. the storage and retrieval of data). The first type of service was subject to the usual rate regulations, while the latter was not, and under this ruling AT&T was allowed to enter portions of data processing, but only through subsidiaries. Finally in 1982 Bell divested its 22 local phone companies, and in return the U.S. Justice Department freed them from the Consent Decree of 1956, allowing phone companies to enter the hitherto forbidden computer business. The AT&T divestiture essentially rendered the Computer Inquiry II distinctions irrelevant.

5.1 The Basics: Diversity in Information Sources

5.1.1 Telcos

Canadian telephone companies operate under the role of the "common carrier", a concept transferred to electronic communications from the physical transport of goods, by which a common carrier must be prepared to carry goods for any person or to carry any passenger, no matter who they may be. Content and carriage functions are fundamentally separated and the idea of non-discrimination and non-preferential treatment is central. The Railway Act, which governs those telecommunications carriers which are federally regulated (Bell Canada, B.C. Tel, CNCP Telecommunications, Telesat Canada), speaks emphatically against any discrimination or preference with respect to tolls. Other telephone companies (except Sask Tel, which is self regulated) are respon-

sible to a Public Utility Board for setting rates, and in the three prairie provinces telcos are provincially owned; universally, however, common carriage prevails.

At the same time, telcos universally have been viewed as "natural monopolies" because of compelling economies of scale and massive investment in plants, and have been regulated for attendant responsibilities, limiting their rates of return, for example.

The intent in the common carrier approach is a clear one, to ensure that any parties wishing to send their messages to any recipients should be able to do so on an equal basis. The identity of the sender and the content of the message receive no special consideration. The common carrier approach is the broadest possible in terms of granting access; anyone may input into the system.

It assumes, however, a virtually unlimited capacity to handle input. While this suits the switched, point-to-point service of telephone companies, quite different principles arose with "scarce resources" media, where input of content is physically very limited. Broadcasting was the first such medium.

5.1.2 Broadcasting

As a broadcasting historian tells it, AT&T did in fact attempt to

transpose the carrier principle of operations into radio (defined by AT&T as "radio telephony") to further its aspirations to extend a monopoly position for telephony into radio. AT&T had a notion for a "telephone booth of the air", by which individual companies would purchase a block of air time and fill it with their program content plus promotional messages. The plan failed in practice; reluctantly, the AT&T-owned stations provided programming itself, while the customer purchased air time for commercial messages only, and the pattern of commercial broadcasting was set.[43]

Apart from such historical asides, broadcasting has been viewed consistently as the use of a scarce resource, the radio spectrum. In the Broadcasting Act, radio frequencies are public property, and for a broadcaster to utilize them, a licence and the assumption of certain responsibilities are required.

Canada's Broadcasting Act includes a number of content provisions. Some have translated into Canadian content rules, which are perhaps most prominent in the public eye, but other provisions broadly concern diversity and freedom of expression. Licencees, the CRTC has noted:

> ... have a responsibility for programs they broadcast, but the right to freedom of expression and the right of persons to receive programs subject only to generally applicable statutes and regulations, is unquestioned;

and

> ... the programming provided by the Canadian broadcasting system should be varied and comprehensive, and should provide reasonable balanced opportunity for the expression of differing views on matters of public concern ... [44]

(The CBC is further enjoined to provide "a balanced service" for people of different ages, interests and tastes, as well as to express Canadian identity.)

The CRTC has interpreted Parliament's ideals as follows:

> The Commission considers that Parliament, in the Broadcasting Act it enacted, made clear its intention that the broadcasting system should strengthen and enhance the open, democratic political system and culture of Canada, characterized by freedom of expression, diversity of tastes and the availability to the public of the widest possible range of opinions.[45]
> (emphasis added)

5.1.3 Cable TV

In the tightly constrained operations of broadcasting where there are limited VHF channels in an area and each broadcaster programs a single channel, cable TV appeared as the media of abundance, with multi-channel capacity. The CRTC was relatively restrained (compared to the rhetoric of the day) in the promise it perceived for cable television:

> ... cable television can also contribute forecefully to the achievement of the fundamental objectives of Canadian broadcasting. It can widen the choice of programs offered to Canadians. Not only can cable television systems provide programmes from the United States, but they might some day, via satellite, give access to programmes from other countries of the world like France and Great Britain. They can also provide more means of communication for education under provincial authority; make local community expression easier; offer channels of distribution for more numerous kinds of social information, more diverse sources of knowledge and more varied styles of thought within our country.

Yet, in practice, cable companies also presented a case of scarce resources, though not in the same sense as broadcasters. Once a licence has been granted to a broadcaster to use a particular frequency, the broadcaster works with an 18-odd hour day to program content on that single channel. The broadcasters' decision-making concerns choice of content, and is constrained by time, now in effect its "scarce resource" to be allocated. The cable company's primary function is to assemble a package of channels of programming (provided in the main by off-air broadcasters) which it offers to its subscribers. It's "scarce resource" is channel space. (Although, with converter service, the midband channels are under no strain at this time in Canada, disputes about which channels appear on the basic service bear out this scarcity.)

As a result, cable licencees have been subject to certain required allocations and priorities in channel usage, which

essentially ensure that Canadian (as opposed to U.S.) education and community channels have a place in basic service.

Regulation of cable has not been simple. Though it has not been fully treated as a "natural monopoly" by regulation, a cable company has an exclusive licence for an area, and functions much like a carrier in that it passes on signals originated by others (i.e. broadcasters) to its subscribers. At the same time the cable company programs certain channels -- in particular the community channel (which it is required to provide). The CRTC has considered that cable TV licencees do not "make the kinds of programming and editorial decisions that give rise to concerns about content and diversity "expressed for broadcasters,"[46] and has endorsed a "hybrid role for cable as programmer and carrier".[47] Nonetheless, these concerns are not fully resolved and will receive increased attention with new information services.

It may be more useful to treat the cable company as a retailer of services, and to focus the concern about diversity of content upon the choices of those channels of material already programmed which the company packages, subject to CRTC approval.

The CRTC has become involved in a dispute between Canadian Cablesystems and Bell Canada. Bell has argued that Canadian Cablesystems should be forbidden from providing a subscriber Teletext service since Teletext is not a broadcasting service as defined

under the Broadcasting Act.

5.1.4 Computer Services

The computer service industry presents an entirely different history: it is an unregulated activity in which any willing participant is permitted to compete and demands relatively low entry and capital costs. Services make use of telecommunications carriers, public or private, and the industry's aims are to promote access and terminal attachment to these systems to facilitate its activities. Government policy goals for this industry, to the extent that they have been articulated, have stressed sovereignity and benefits for Canadian industry, though some statements imply a concern for diversity and opportunity for entry:

> It is government's objective to foster the continued development of efficient and reliable nation-wide systems of publicly-accessible facilities for use equally in the provision of, or access to, computer or data communication services by any sector of society.[48]

Additional statements in a 1973 Green Paper on Computer Communications stressed competition and access to transmission facilities. Subsequently, however, there has been an official silence on regulation. Government apparently presumes a broad and diverse participation in the industry, in a competitive environment with low entry barriers.

Anyone, then, can offer a data base information retrieval service, using a common carrier, and an open market competitive approach has been used to develop content according to demand. Where this demand takes us in terms of diversity remains to be seen.

5.1.5 Newspapers

Newspapers, too, have operated in a market that is essentially unregulated regarding who can enter and what content they can provide. The philosophy behind this stance is founded on a belief that diversity of opinions should be allowed expression.

The idea of "freedom of the press" is time-honoured, dates back centuries, and has been closely associated with issues of human rights and democratic objectives. In the U.S., the First Amendment guaranteed the maintenance of a free press, while in the United Kingdom and Canada the advocacy of an unfettered press was associated with the need for a free marketplace of ideas in a democratic society. As such, concentration of ownership has been seen as a particular threat to the public interest. It can only appear as an irony that, of the five industries examined here, newspapers, which operate in an enshrined, non-regulated open marketplace, have consistently tended to belong to fewer and fewer voices as ownerships have concentrated.

The "electronic newspaper", though still in an embryonic state, is nonetheless clearly an heir to the rhetoric of the press; open access and wide diversity of content are foreseen, even to the point of the "every person a publisher" idea, by which any individual could offer data bases accessible to all (via an appropriate telecommunications infrastructure). The basic philosophical link between the free press and democratic society has been extended to the new technologies since their earliest days.

> ... it would seem to be a fundamental principle of public policy in a free society to strive to maximize participation and diversity, and strongly oppose anything which could foster concentration of control. For it seems obvious that such control of the electronic media, whether by state or private interests, would represent a serious threat to the freedom of expression that is the lifeblood of a democratic community.
>
> ... it is therefore of vital importance that we establish now, while systems like Telidon are still in their infancy, those fundamental principles concerning freedom to publish and freedom from censorship that lie behind the time-hallowed slogan, "Freedom of the Press".[49]

5.1.6 Summary

Regulatory concerns about diversity of opportunity for information sources are fundamental. While these concerns have not been our sole rationale for regulation (which also involves protection of the public from monopoly prvileges, cultural expression and

benefits to Canadian industry), they lie very deep in our attitudes, and relate to central beliefs:

> If well-informed public opinion is an essential of sound public policy, then the channels through which information flows to the public have an importance which cannot be over-emphasized.[50]

In sum, where there are no constraints on physical capacity, unconstrained input of content has been encouraged by:

1. The "common carriage" principle in telephony to ensure that all messages from all sources are carried on equal terms.

2. The "freedom of the press" ethos for newspapers.

3. An unregulated marketplace for computer services.

Where capacity is limited, allocations and priorities in usage of time on a channel granted to a broadcast licencee, and in usage of channel space for cable operators, have been applied to ensure access for certain kinds of information.

There is a tension here between two sorts of regulatory measures, taken when the marketplace appears to fail in the opportunity it offers to information sources:

1. With telephony and other instances of unconstrained capacity, regulation ensures non-discriminatory treatment of messages carried.

2. With broadcasters and cable companies, regulation causes certain content to be treated preferentially to ensure a place in a physically limited medium.

Where a non-discriminatory attitude toward content has been taken, it is worth noting that while telephony has been robustly diverse in content because it is a point-to-point service characterized by individual and unique inputs, Videotex is a service that may implement a one-to-many asymmetric information flow over the telephone lines. (Network capacity can even be questioned.) With newspapers, economics have assaulted the theoretical freedom of any party to enter the market. (Computer services are still too new, at present, to be telling in terms of diversity of sources.)

Finally, a critical point about any concern with expression and diversity is that a focus on any one industry is a myopic one. At issue is the diversity of sources of opinion available to individuals in a particular locale. A greater number of media outlets may or may not increase the editorial voices heard (or seen), depending on cross-ownerships and on the re-appearance of the same content producers in different media. The variety of sources of information readily available, overall, in a community must be kept in mind.

6.0 THE CANADIAN REGULATORY FRAMEWORK

Without detailing specific regulatory events for each of the relevant industries, this section briefly describes the regulatory framework that has been applied to each in Canada.

6.1 Telephone Companies - Common Carriage

Telephone companies essentially have certain requirements as common carriers to guarantee against unjust discriminations or preferences toward would-be users. As noted earlier, the principle of common carriage was inherited from practices associated with the physical transport of goods.

A second aspect to the idea of common carriage, in addition to non-discriminatory access is the fundamental separation of carriage and content. Legislation has expressed this separation as follows: the telecommunications carrier shall

---act solely as a common carrier, and shall neither control the contents nor influence the meaning or purpose of the message emitted, transmitted, or received as aforesaid.[51]

As previously noted, however, with the age of data processing and computer services, the separation of content and carriage has become more complex. The provision of videotex services exposes

a number of grey zones in the treatment of data that lie between the origination of content and outright "influence of meaning" of the data sent.

6.1.2 Natural Monopoly

In general, a telephone company's responsibilities are governed by regulation as a "natural monopoly". This economic, public utility principle maintains that regulation must temper market forces because of the unworkability or inefficiency of pure market competition. Competition fails because of:

1. The capital requirements, the burden and size of investment entry requirements;
2. Economies of scale, since efficiency resides with size;
3. Price inelasticity, since service alternatives are not readily available.

Under these conditions, market forces fail to protect the interests of the consumer and are replaced with a regulatory institution to protect the consumer from extortionate or unfair rates and to ensure a fair rate of return for the firm.

The monopoly privilege in telephony has been accompanied by a number of regulated responsibilities: fair rates and rate of

return; equity of service (including cross-subsidizations from urban to rural customers); and the granting of interconnection access to other carriers (as in the CNCP Interconnect case).[52]

6.1.3 Market Entry

Although in no case, with the exception of Newfoundland, has a telephone company been restricted to providing merely basic monopoly service, telcos have had restrictions placed on them concerning which other service markets they may enter. (Even when a telco engages in an unregulated service, however, an indirect regulation occurs insofar as revenues are included in rate of return calculations.)

Bell Canada is atypical in that it has some specific limits placed on its activities in a Special Act of Incorporation: neither Bell nor its subsidiaries may hold a broadcasting or cable-TV licence; it must act solely as a common carrier; and it "can neither control the contents nor influence the meaning or purpose of any messages emitted, transmitted or received".[53]

The major question of telco participation in unregulated services has occurred with data processing, an extremely tempting activity to which the facilities for telecommunications services could easily be applied. Bell's special provisions about control and influence of messages are ambiguous regarding "data processing"

and may be even more ambiguous in relation to a very primitive computing service like Videotex.

More generally, the data processing role for telcos grates against the non-discrimination principle of common carriage. This became problematic some years ago in both Canada and the United States, we saw, as telcos attempted to expand data communications activities. Data processors also protested against possible cross-subsidizations of unregulated competitive services by the regulated monopoly services, unfair competition and a potentially dangerous concentration of power.[54]

The device used to settle this problem has been the arms-length corporation. In 1973, a government position paper stated that:

> To increase the likelihood of a strong Canadian presence, the entry of the federally regulated common carriers into the computer services industry should be permitted through the mechanism of a separate arms-length affiliate, subject to conditions preventing abuse of their privileged position.[55]

But the only further direct statement made by the federal government to this effect has been a set of guidelines in December 1974 by the Ministers of Finance and Communications.[56] These guidelines are less than helpful for Videotex, as their definition of data processing could leave room to argue that Videotex, in simple forms where the basic information content remains un-

changed, is not "data processing".

In summary, the arms-length affiliate arrangement seems to be generally accepted as a means for telcos such as Bell to enter computer service markets (and Bell has already formed one suitable subsidiary). Yet actual requirements for federally regulated carriers to enter computer services activities are not firmly established, and Videotex would appear to present an ambiguous instance of "data processing" in any case.

6.2 Broadcasting

6.2.1 Canadian Presence

While goals for broadcasting have used terms of diversity, such as "varied and comprehensive" programming and "balanced opportunity" for the expression of differing views, in practice regulation has responded to scarce-resource conditions.

In terms of spectrum usage, both stations and networks must be licenced. More generally, policy has tried to ensure a place on the airwaves for Canadian material. Since the time of the Aird Commission (the first Royal Commission on Broadcasting in 1929), U.S. material has appeared as an overwhelming tide, and protective measures have been taken. Foreign ownership of Canadian stations has been curtailed. A public agency, the CBC, has been

set up with a mandate to "contribute to the development of national unity and provide for a continuing expression of Canadian identity". Canadian content regulations have required all licencees to allocate a certain number of hours in their daily schedule to Canadian material.

6.2.2 Content Characteristics

Besides allocations for certain broad kinds of content -- required hours of Canadian material and limits on advertising minutes per hour -- broadcasters have certain editorial responsibilities for the content itself. These are treated by allocations or, more often, by prohibitions, some of which put the broadcaster in a role of editorial liability.

A number of directives relate to the subject matter of broadcast:

1. Certain lotteries and fixed contests are prohibited.
2. Content about birth control and venereal diseases shall not be broadcast unless "appropriate".
3. Appeals by charities and other non-profit organizations must receive CRTC permission.
4. Classified ads are limited to one hour per day, at certain times.
5. Advertising is restricted for unauthorized insurance companies; investments; and mining, oil and natural

gas properties; for alcoholic beverages and cigarettes; and for a number of food, drug and patent medicine items, for which the approval of both a federal government department and the CRTC is required for advertisements.

6. For content of a partisan political nature, time must be allocated on an equitable basis to all parties and rival candidates.

Other regulations relate more to the nature or quality of the content:

1. Nothing unlawful must be broadcast.
2. Content must not be abusive of race, religion or creed; or obscene, indecent or profane.
3. False or misleading news must not be broadcast.
4. Where advertising is not clearly demarcated from a (non-live) program, the ad should be signalled or otherwise indicated.

There is a fairly extensive set of responsibilities then, about the nature of broadcast content, ranging from responsibility for truthfulness, to censorship on a "good taste" or moral basis.

6.3 Cable-TV

Although only one cable-TV licencee per area is granted, making the licence in effect a local monopoly, cable has not been regulated as such. Rates have been controlled, and equity of service is required (-- fees for installation and service are the same for all subscribers, with a few specific exceptions --),[57] but rate of return regulations have not been applied. Clearly the cable industry shows economies of scale and heavy capital investment that restricts market entry. The arguable point about whether cable exhibits public-utility characteristics is price inelasticity -- that is, whether consumers are responding to a nearly-indispensible service for which alternatives are not readily available. Despite high penetration and a capacity for a wide range of services, cable has been treated as a discretionary income service for which "members of the public who can afford it are willing to pay to receive a wider choice of programming",[58] and regulation has viewed cable specifically as an adjunct to broadcasting to try to minimize its "economic threat" to that industry.

6.3.1 Broadcasting Industry Protection

Cable-TV has been defined in regulatory terms as a "broadcast receiving undertaking", referring to a cable company's reception of off-air broadcast signals for retransmission to its subscri-

bers' homes. This definition, and most cable policy, served to "integrate" cable in a broadcasting framework.

> In developing and refining its cable television policy, the dilemma the Commission faces, therefore, is how to enable cable television to provide the wider choice of service that the public demands without destroying free over-the-air broadcast service, which is the only service available to many Canadians and which must remain the primary element of the Canadian broadcasting system. Simply expressed, the continuing problem is how to integrate cable television into the Canadian broadcasting system as a full contributing partner to the system.[59]

A number of policies were devised for cable-TV to this end, mainly to control the "fragmentation" effect, as the United States border stations shown on cable-TV drew viewers away from Canadian stations. While in both Canada and the United States, the stance taken towards cable as a threat to local broadcasters has been re-assessed as somewhat overprotective, these industrial concerns provided the primary motivation for cable regulation in the past and continue to wield influence regarding the introduction of new services which could fragment audiences or siphon advertising revenues.

6.3.2 Jurisdictional Concerns

A second motivating concern in the federal government's regulation of cable-TV has been the will to retain jurisdiction over cable. (Several provinces have asserted their desire for provin-

cial control.) From the federal view of cultural policy as a basis in broadcasting, some measure of control over the content appearing on cable-TV has been viewed as essential.

However, when cable does not operate only to retransmit off-air signals, federal jurisdiction has been disputed. This places non-programming services, in particular, in a jurisdictional no-man's land. As will be discussed later, the CRTC has laid some claim to this area but has not been eager to enter it since such a move would surely invite controversy. For the moment, then, control resides in a cable regulation which states that a cable licencee shall not use its channels "except as authorized or required" by the CRTC.[60] However, in 1979 certain non-programming services were granted a two-year experimental basis of operation and subsequently extended for a further two years.

While the federal approach is a restrictive one for cable services, the industry prefers a federal master, given in particular that the prairie provinces, eager for jurisdiction over cable, may prefer to integrate cable with their crown corporation telephone systems.

Jurisdictional concerns, then, have had considerable indirect regulatory influence over cable-TV and have contributed to a restrictive stance about which services cable systems may offer

in addition to straight re-transmission of broadcasts. Two sets of such services are now before the Commission: cable-satellite networks (other than pay-TV, which was licensed in 1982 after a lengthy regulatory delay); and non-programming services including Videotex and Teletext.

6.3.3 Channel Usage

Certain cable regulation has actively sought to counter the effect of United States stations on Canadian broadcasters' advertising revenues: simultaneous substitution (when a Canadian broadcaster's signals, with commercials, are substituted for the same show being carried on a U.S. channel) is one such regulation, and actual deletion of U.S. commercials was practiced in a number of cases by licence amendment. However, for the most part, cable regulations assign priorities or set out allocations for channel usage.

Regulations also prescribe a detailed order of priorities for broadcast stations, favouring CBC and educational stations, local stations and Canadian stations generally (as opposed to those from the U.S.). A place on basic service is allocated for a community channel, for the use of an educational authority. For the community channel, there are certain provisions to allocate

time equally for partisan political content and to provide "balanced opportunity" for expression on matters of public concern.[61]

Overall, a cable company can use its channels only as authorized by the CRTC.

In sum, apart from policy interventions to protect the advertising of Canadian broadcasters, actual cable regulations deal mainly with channel capacity as a scarce resource, subject to allocations and priorities, and exert general control over what can be transmitted. This is in direct contrast to the common carriage responsibilities of telcos to provide access to all; it is also distinct from broadcasting, since allocations concern channels, not time, and since editorial responsibilities are lacking (apart from a few provisions for the community channel which cable companies program themselves). A further point is that cable companies, have had no access requirements, whereas in the U.S. the community channel is viewed in terms of access; the cable licencee has played a programmer role for this channel in Canada.

6.3.4 Cable Supplied Content

The local cable company has a responsibility for the community channel:

> Just as an over-the-air broadcasting licence carries with it direct social commitments, so the community channel must become a primary social commitment of the cable television licencee.[62]

At one point this "commitment" was proposed in terms of a percentage of revenues, but instead an indirect incentive exists whereby support for such a channel is one factor that the CRTC considers in licensing.

Certain provisions for the channel concern its content. Non-community programming, advertising, feature films and any off-air signals are prohibited.

While the channel functions as a programming responsibility rather than a requirement to grant access, "free and open access" has nonetheless been a stated intention. Citizen participation has been cited as the "most important element" in programming, and the CRTC has specified actions which a cable company should take to encourage participation.

Cable's other programming initiative has been "special programming" channels. The original concept was discussed by the CRTC in 1971, where the Commission argued it was unfair for cable to make use of TV signals without any reimbursement. It was suggested that cable systems purchase Canadian broadcasts (with original commercials) for replay.[63] In 1975, (in deference to the

misgivings of broadcasters that these channels might siphon their audiences away) the Commission decided to implement special programming channels on a case-by-case basis only, and again gave priority to "re-run" channels with purchased broadcasts. In the event, a small number of channels have provided "other programming services not provided by off-air broadcasters",[64] such as children's or multi-lingual content.

Cable's programming role, then, has been a confined one, and both community and "special" channels have their roots in CRTC policy. However, more recently, the cable industry's willingness to provide special channels, particularly by satellite, has found the CRTC reluctant. Meanwhile, cable's role as both a programmer as well as a distributor of content is subject to chronic complaints, particularly by telecommunications carriers.

Cable companies may also originate content as a closed-circuit radio service, and in these cases paid advertisements are allowed if service is in a foreign language. Presumably this does not harm off-air broadcasters. Advertising on the community channel is not permitted, nor is advertising on special programming channels (unless it is part of the purchased broadcasts described above), but a recent CRTC report has stated that "there is nothing inately repugnant about advertising on an optional channel" and recommended that proposals be treated on a case-by-case basis. In the U.S., meanwhile, advertising on cable is rapidly

increasing.

The cable industry is without doubt the most complex and uncertain Canadian telecommunications industry in terms of regulation. Particularly uncertain are future jurisdictions and the role of cable as programmer and/or distributor of content. The CRTC has endorsed a "hybrid role", but a number of new programming and non-programming services will intensify the controversy about this position, and the regulatory delays which have occurred with these services bear tacit witness to this controversy.

More clarity could be possible by viewing the role of cable as a retailer of services programmed by others. This is the function cable primarily fulfills, assembling an attractive package of channels (some with high subscriber appeal, some required by regulation), which were programmed by off-air broadcasters in the past. Currently in the U.S., cable operators purchase the services of satellite programmers (such as Home Box Office Pay-TV or Nickelodeon, a children's channel usually offered to subscribers with no extra charge), and again the model is the same: the cable operator packages the channels, while an independent programmer has assembled the content for each. The cable operator in these cases is neither a carrier or a content programmer, but a retailer who exercises choice in building a selection of services to offer subscribers. (It follows that in this model cable's efforts in actual programming, apart from the community

channel, would require an arms-length arrangement.) Appropriate regulation would address itself to channel usage by allocation and priority, as has traditionally been done.

6.4 Computer Services

6.4.1 Unregulated Competition

"Computer services" include data processing (the largest component), development of systems and software, and sales and rentals of software packages.

As previously discussed, these activities have been conducted in an open marketplace, with some restrictions on entry for telecommunications carriers, solved by arms-length affiliate arrangements.

6.4.2 Privacy

With personal data increasingly stored in data banks, privacy problems are growing. One concern is that individuals be able to check and correct information stored about themselves. (This problem is partially addressed for government data banks by freedom of information legislation.) Another major problem is "secondary usage" of a data base -- combining it with other data

bases or selling it, as is commonly done in the "junk mail" trade.

Canada has relatively few privacy provisions, though we may see more in the years to come. Canada has, in fact, less measures than the U.S., although potential privacy problems are sometimes cited as a danger with storage of Canadian data banks in the U.S. Though certainly such U.S. storage means reduced control over content and use of Canadian data banks, it has, to date, not meant less privacy protection than at home, and privacy protestations in international discussions of transborder data flows have often overlaid a more genuine concern for economic losses.

6.4.3 Transborder Data Flow

"TBDF" has received intense attention in many countries recently, and regulation is a distinct possibility. There are tendencies in Europe, for example, to keep data banks in the country of origin. Discussion includes the issues of personal privacy (often somewhat falsely emphasized), national sovereignity (including national security) and employment.

Outward data flow (or "imported" computer services) occurs, particularly in Canada, because of extensive U.S. ownership of Canadian firms, since multi-national corporations can often handle data processing more efficiently in a centralized way in

their home country. Meanwhile, numerous federal and provincial acts affect the storage of data. The new Bank Act, for example, requires that all banks in Canada do their data processing here. But there are no overall regulations for TBDF, and it appears that little effort is made to enforce many of the existing provisions.

The Canadian government has made some dire predictions about losses in revenues and potential employment due to TBDF. Yet the computer services industry in Canada has disputed the figures used, (arguing that surveying was done some years ago when the southward trend was at its peak), and stands generally against regulation of data flow on the grounds that countering regulation in other countries could damage their own export trade.

In summary, the regulatory traditions in Canada concerning the telecommunications industries have centered upon these issues: what types of boundaries should be implemented between sectors (the separation of carriage and content); who should have access to differing services; the necessity for Canadian content; the issue of the control and ownership of differing media and industries; and the entry issue, i.e., who may offer a specified service.

Given then, the regulatory traditions applied to each of the telecommunications media discussed in this section, and given the fact that Videotex/Teletext, depending on the delivery configuration, may involve a blending of telephony, cable-TV, computer services, broadcasting and the newspapers, what aspects of the regulatory traditions associated with these industries (if any) should Videotex inherit?

7.0 REGULATORY APPROACHES TO TELETEXT/VIDEOTEX

The evolution of new technologies continuously invalidates the attempts of regulators to rationally guide and direct their effects by legal means, and as Charles Dalfen has written:

> "This invalidation is not entirely due to lack of imagination, or even to the formidable strength of vested interests. In large part, it is due to the fact that no new technology or technological application is a clear lineal descendent of a previous one, but in fact inherits characteristics from different technologies and services, and has unique features of its own. Decisions are therefore required as to how it is to be characterized, and which regulatory framework and provisions, if any, are appropriate."[65]

To date, despite sporadic attempts to grapple with the question, the regulatory approach to new services such as videotex and teletext remains undefined. Various activities are taking place on an experimental basis, and the CRTC has announced an intention to hold hearings on such topics at some point in 1983.

This study has reviewed the regulatory frameworks for five major industries involved in videotex/teletext. Furthermore, there will be several physical means of delivering services: videotex may be delivered by cable, telephone or broadcasting (when information is requested over the phone and delivered off air), while Teletext may be delivered over a full TV channel, in the vertical blanking interval (vbi) -- that part of the TV screen which is blank when the picture is rolling -- by FM radio; or by

cable with full or partial channels.

Under all of these delivery configurations, however, the regulatory policy issues of access and entry remain more or less the same, with the exception of the vbi teletext.

7.1 Rate Regulation vs Structural Regulation

Richard Neustadt and others[66] have argued that there are essentially two forms of regulation: classic rate regulation, which establishes a return any firm is entitled to earn on its total investment, and structural regulation, which pertains to the scarcity of a given information resource, and entry conditions. The first type of regulation has traditionally been applied to the telephone companies in Canada since they have a monopoly position.

With videtoex/teletext, rate regulation could be imposed on the level of charges consumers pay for information, or on fees which advertisers or IP's, say, might pay to enter pages into a data base. However, since the purpose of rate regulation is to protect consumers from monopolistic pricing, this form of regulation should not be applied to electronic publishing. Rate regulation could inhibit potential information and service providers, and such regulation would distort incentives in electronic publishing, since systems operators would have real incentives to

increase their return by artificially inflating their rate bases. Also, there are major practical problems with rate regulation of electronic publishing. For example, "Regulators might have to review operators' decisions on the value of individual pieces of information or decide how to apportion the investment in a computer" used simultaneously for electronic publishing and other services."[67]

Structural regulation in the context of videotex/teletext relates mainly to whether broadcasters and cable operators will program or control teletext (as services using a limited resource), and to the separation of carriage and content.

If parties who own transmission channels are allowed to create content, it is argued that they may exclude competitors. The main problem, however, with a responding policy to separate carriage and content, especially in a country like Canada with a paucity of information providers, is that automatic exclusion of carriers from providing content and services will eliminate valuable competitors from these areas.

A compromise here might involve a modified separations policy which gives the transmission companies more leeway than pure transmission. For example, the British Post Office, which provides Videotex transmission in that country, is allowed to do billing and to manage Prestel's data base. The British impose a

separation rule at the exact point at which information enters the BPO computers.

It would seem that the necessity of both a separation of carriage and content and access rules are dependent on the number of carrying media available in the relevant Videotex and Teletext markets. Presently, Videotex and Teletext have many potential outlets, ranging from telephone to cable and broadcast.

7.2 Broadcast Teletext

Since the vertical blanking interval of television is a scarce public resource, it has been suggested that broadcast Teletext should be subject to direct regulation in the public interest. Dalfen has suggested two possible approaches as to who may actually use the vertical blanking interval:[68] the existing broadcaster under his or her broadcasting licence, or an unaffiliated party might be licenced by the CRTC to operate a broadcast Teletext service, leasing the vbi from the broadcaster. Narrowband Teletext (the 200 pages of the vbi) is so small that this space can really accommodate only one publisher.

In the latter case, given the possibility that an outside party might wish to offer a Teletext service which the user pays for instead of a service which is supported by revenues from advertising, it would not appear that such a situation would fall

under the legalistic definition of broadcasting at all. However, given the limited capacity of broadcast Teletext (approximately 200 pages) an outside programmer may be more attracted by the availability of full cable channels for Teletext purposes.

With respect to content regulation, it has been argued that broadcast Teletext over the vbi is part of a broadcaster's responsibilities as defined under the Broadcasting Act, and that the Television Broadcasting Regulations -- including all Canadian content regulations, the balance requirement of the Broadcasting Act, and rules prescribing equitable time for political candidates -- are applicable. Although there are problems in applying Canadian broadcasting regulations without modification to Teletext, the real issues involve:

1. whether such rules are even applicable to broadcast Teletext; and
2. given the ease with which content rules have been circumvented in other industries such as pay-TV, can the spirit of such rules be effectively enforced?

Aside from technical problems, the current form of content rules do not meaningfully apply to Teletext, since they apply to continuous programming scheduling instead of information which may be accessed by the user at his or her discretion.

As a practical matter, it seems likely that the CRTC will allow the broadcasters to control their entire licenced signal, including the vbi.

But although vbi Teletext functions on a broadcasting frequency, it makes little sense to treat it as a regular broadcasting, subject to content rules, since their imposition could inhibit the development of Teletext, and imposition of content rules could be as easily circumvented in this media as they have been in others. Rather, vbi Teletext should be classified by the CRTC as a non-regulated service and not subjected to content rules or rate regulations. System operators should have the freedom to select content, to create pages, "and to switch back and forth between free and pay services".[69]

In objection to this line of thinking, it has been noted that the vbi is a part of the normal broadcasting signal. However, there are some significant differences between Teletext and broadcasting. Teletext is basically a data service; it does not present traditional broadcasting programs, since a Teletext user controls how the information is displayed, and it would be inappropriate to apply the past rules developed in broadcasting to this new technology.

Many of the regulatory stances which could maim Teletext developments are tied in with its broadcast classification, and the CRTC

should establish a new non-regulated status for narrowband Teletext.

7.3 Telephone Videotex

Although with the recent "attachment" decision, anyone may attach equipment to Bell's lines in Canada, the phone companies are monopolies, and the main policy issue here is whether or not the carriers should be allowed to provide Videotex information content and whether telephone Videotex should be regulated according to rate of return.

As a result of Computer Inquiry II, Videotex services in the U.S., we saw, were classified as "enhanced services" and thus were unregulated. Restricting regulation to basic services only, the U.S. Federal Communication Commission felt that a competitive market approach for such new services as Videotex was preferable, and the entire deregulation policy of the FCC has been based on the fact that enhanced services are the subject of extensive competition, and that there are thousands of U.S. computer service firms which are unregulated and which offer computing services over the phone network.

However, critics have argued that:

1. The monopolistic position of a telephone company allows them to use regular monopoly revenues to subsidize any enhanced services.

2. Telephone companies can use their control of transmission lines to place restraints on competitors.

3. Undue concentration would occur if a telephone company is allowed into the electronic publishing industry.

These issues are currently in front of the U.S. Congress, and since Bell telephone systems serve more than 80% of U.S. telephone subscribers, a central part of this debate is AT&T's role in Videotex. Although Bell has informed Congress that it is not interested in the electronic publishing business, it is interested in putting its print information services, such as yellow pages, into Videotex form. Bell's adversaries, the newspapers, have argued that computer based yellow pages may contain any type of advertising, and may be daily revised. Thus, they argue, if AT&T is allowed to put up Videotex services over monopoly transmission lines, they will be able to preclude or drive out competitors. Aware of these arguments, the Senate, in a series of Bills, has been attempting to limit AT&T's Videotex service to weather, time and directories. Bill S.898 also allows Bell to provide computer storage of Videotex content supplied by other firms, but they must use an arms-length subsidiary, and such a

data base storage facility must be open to all other information providers. Finally, AT&T is forbidden to edit the content of such data. However, there are no restrictions on allowing AT&T to provide interactive Videotex services such as electronic banking and mail.

In Canada, several telephone companies are participating in field trials for Telidon. At present, phone companies subject to federal regulations are prohibited from providing Videotex content -- by the separation of carriage and content. With the exception of some provincially regulated telephone companies, which are not subject to federal regulation, all telephone companies which wish to provide Videotex information under present CRTC rules will be required to perform this function through arms-length subsidiaries, so carriage-content separation will not be violated. (This issue is also relevant to other federally-related carriers besides telephone companies, such as CNCP Telecommunications, which offers a Telenews Service over the Telex network.)

At one extreme, it has been argued that the phone companies be restricted to the sales of equipment and the transmission of information, and thus be entirely excluded from the information provider role. Nonetheless, if the telephone companies use arms-length subsidiaries for Videotex information provision, they could commercially produce yellow pages and directories without

violating carriage/contents separation.

Excepting the telephone companies themselves, any outside party who wishes to provide Videotex information should be allowed access to the public telephone network. Dalfen has suggested that:

> "... to the extent that technical limitations such as limited network capacity and inadequate software interfaces may place constraints on access, these should be removed, and adequate Videotex capacity and software should become part of the general service which telephone companies are required to provide."[70]

With respect to the interconnection of terminals which customers have privately purchased, attachment and interconnect would be permitted according to the CRTC decision concerning interconnect with Bell Canada.[71]

With respect to the issues of separation and access, the telephone companies should be permitted to originate and offer Videotex/computer-based information, data and transactional services, utilizing an arms-length relation and without rate regulation, but with the provision that they be required to provide equivalent access to systems operators and information providers who wish to instigate their own Videotex services. Instead of merely mimicing U.S. deregulatory measures several years after they occur, Canada should act now, and go further to give phone companies a measure of competitive advantages in this new area, with

the aim of strengthening the Canadian videotex/teletext industry. While a common carrier model should be maintained to ensure access to switched phone networks, telephone companies should be permitted to operate videotex systems, with responsibility for content. (This provision should not be subject to any specific content regulations such as a specified amount of Canadian content but should rather be governed by general regulatory matters pertaining to obscenity, equal political access, etc.)

7.4 Teletext and Videotex on Cable

Cable TV in Canada, we have seen, has been given a "hybrid" status by the regulatory agencies, exhibiting characteristics of both a programmer of content and a carrier.

If any cable operator should want to present full channel Teletext information, he would have to seek authorization from the CRTC. The resultant CRTC decision would then be based on such factors as the uses to which Teletext channels were being put, issues of media concentration and cross-ownership, the quantity of channels available in a specific location, and so forth.

Apart from developing content themselves, cable operators could acquire and present Teletext/Videotex services in two ways: assembling a package of material derived from outside information providers; or leasing capacity to a systems operator. (In the

former case, the cable operator itself acts as the system operator.) Under either arrangement, cable operators are prevented from assuming an information creation role, but act with some say concerning what types of packages they assemble.

Again, our recommendations involve further deregulation of cable. Cable companies should be allowed to provide Videotex/Teletext information and transactional services without being subject to access provisions, according to which they must provide access to their cable networks by other systems operators or information providers. This suggestion reflects the role of the cable operator as a retailer of a select package of services to subscribers.

Regarding teletext, cable operators would require CRTC approval for channel usage. Problems of diversity -- of either type of content or information source -- could be dealt with as they arise. The question of arms-length subsidiary arrangements is less central than the designation of the cable operator as a retailer or packager or services, with a degree of selective control over content, subject to regulatory monitoring. The initial aim of policy should be to stimulate Canadian industry. At later times, if necessary, further regulatory provisions may be developed -- to provide interconnect access, for example, to outside videotex system operators if cable evolves into an information utility medium.

Finally, given the nature of Videotex/Teletext content, where "information" and "advertising" easily blend and advertising support may become significant, cable regulations must be amended to allow "advertising" on services of this sort.

The general deregulatory stance proposed here, involving the elimination of a separation policy, will encourage vertical integration and Videotex/Teletext coalitions, involving carriers, broadcasters, newspapers, cable companies and financial sources. A stringent separations policy, on the other hand, would essentially prevent vertical integration in information and service provision. While access to the switched phone network is guaranteed for small information providers, the development of larger IP's, able to withstand and compete with foreign products, is essential. Diversity, meanwhile, is fostered by: assured access to the public phone network; attractive provisions for a number of industries to enter videotex/teletext services; liberal participation by carriers in content provision, to encourage the development of distinct sources of information in a given community.

7.5 Foreign Content Competition

Although it is admittedly unlikely that accurate comprehensive long term development policies can be forged at this time for such an infant industry as Videotex, this section presents a basic overview of policy trends with respect to foreign competition.

The Canadian record in telecommunications technologies -- ranging from cable television to direct broadcast satellites -- is one of innovation in product research, development and engineering, and a concommitant failure to plan for and autonomously determine what these new telecommunications technologies would transport -- the actual information content. Thus far, Telidon has been no exception to this tradition, and one main reason that the Telidon field trials have had mixed success is that the information content was simply not extensive or diversified enough. Briefly, information providers will not create content for Videotex/Teletext until there are some proven commercial needs for such information and services. But home and business consumers will not use the services until there is a wide diversity of useful information and data available.

It is feared that foreign competition in content could affect national level services, limiting the number of nationally opera-

ting Canadian firms which may be profitable. As David McDonald has suggested:

> "Predictably, the greatest revenues from the mass information market will be for the largely nation-wide networks. These, it is a safe assumption, will be counted upon to support more specialized and local services. Yet extensive foreign competition with our national information networks will curtail the possibility of cross-subsidization, a principle quite common in the Canadian experience, as varied as telephone rates in sparsely populated areas, advertising revenues from national television schedules which go to local programming, and even fiscal transfer payments to the have-not provinces."[72]

Apart from the fact that this whole scenario assumes the context of home Videotex along the telephony model, (while the business contextfor Videotex thus far appears morepromising), there are a number of detriments to policy measures to protect Canadian companies from foreign Videotex/Teletext competition. For instance, it has been proposed as a strategy for Canadian Videotex that: limits be placed on the entry of foreign Videotex material and packages. But such rules have been easily excluded by the Canadian television broadcasters, since with television (unlike radio where such rules have actually worked) set royalty rates are not paid, and the actual Canadian content appearing is unrelated to budget expenditures. Also, quotas on foreign Videotex content would be rather ineffectual without regulations restricting Videotex-like related facilities of multinationals operating privately over satellite, telephone, cable and broadcast.

A second policy measure resulting from this protective stance involves the use of commercially profitable foreign Videotex/Teletext content to support or subsidize Canadian Videotex. This situation involves the same paradox which allows the CBC to present "Dallas" during prime time to obtain revenues to upgrade competing Canadian productions. It also makes funding of Canadian works (whether in Videotex or televison) dependent on the competition's success. Under this measure, Infomart or Maclean-Hunter might use the profits from distributing American packaged business information to subsidize, say, a file on Canadian mining data.

Better than such prohibitive or circuitious solutions, we shall see, would be to instigate tax reductions and incentives for software and content which would allow Canadian companies to more cheaply create and export Videotex products and serviceware.

Having now reviewed specific regulatory recommendations for Videotex/Teletext over telephone, television and cable, we turn to an examination of related policy support measures for Videotex and microelectronics hardware and software in Canada. It should be remembered here that Videotex is merely one application of microelectronics among thousands, and that Telidon measures should accordingly be viewed within the context of Canadian microelectronics policies.

8.0 VIDEOTEX AND MICROELECTRONICS POLICY

Any discussion of technological and industrial development policy in Canada must be founded on the realization that Canada, first of all, is not a large enough country that its internal market alone can support sales growth and product diversification of informatics products and services.

For reasons of size and because of our proximity and close trade ties to the U.S., Canada, unlike Brazil and Japan, must implement a technology strategy which does not involve a protected market stage; we cannot protect our nascent microelectronics industry from imports from our major market, the U.S. We cannot create a microelectronics industry behind high protective barriers, even if the Japanese and Brazilians have.

The underlying assumption of this analysis is that the competitive edge of virtually all microelectronics technologies now emerging in industrialized economies -- Videotex and Teletext, office and switching equipment, speech recognition, robotics, telecommunications, artificial intelligence, personal computers and educational computing -- will lie increasingly in the software and serviceware rather than the hardware component. It is now not predominantly the people who manufacture equipment, but also those who devise and implement ingenius new uses for the

equipment who will benefit. However, devising new uses, modelling a human task which has not been automated before, is accomplished through software.

If one includes serviceware creation as part of software, this situation is also true of Videotex and Teletext. Subscribers will not pay for services until there is an array of useful content available, and content creators will not put expenditures into the creation of information bases until there is a proven market.

Software now accounts for more than 80 percent of the total costs of products incorporating chips,[73] and at the same time as the software component assumes such economic significance, it is becoming invisible and even more intangible as it is encoded onto read-only memory chips (ROM's) and directly incorporated into the hardware itself. (This is called firmware.) However, an understanding of strategies concerning the development of these embedded technologies may spell the difference between success and failure in Videotex/Teletext. This observation does not imply that one should ignore hardware manufacture in Canada, but that considerably more support should be given to software/content production and export.

Also, given the fact that most Canadian data bases are imported from the United States (such as System Development Corporation's

Dialogue and Lockheed's Orbit), the problem of transborder information (and not merely data) flow becomes a paramount policy issue with respect to Videotex content development. Also, much software will increasingly be incorporated into computers and computer terminals, and when software is separately developed in parent firms, it is sold to Canadian subsidiaries via inter-firm transfer pricing. It is nearly impossible for governments to attach value to any services traded on an inter-firm basis, and such a problem is compounded when the traded items are "information-intensive", such as software.

Regardless of major efforts to make software writing more methodical and "scientific", it remains a labour intensive process whose development time is comparably unpredictable. It does not follow the normal rules governing other production processes, since estimates of total development time and total costs are often off by several magnitudes. (Often when one adds people to a software writing project, development increased.

In Canada, there have been few attempts to develop applications generators to lower the page creation cost in Videotex and Teletext content. This situation has arisen because the Canadian software industry is comparatively less developed compared to those of other industrialized nations. In the United States, for example, firms specializing in applications generators -- software tools which increase the productivity of the programmer

performing specific tasks -- have become a major sector of the software industry, given the slow productivity increases in software writing.

During this decade, major changes will occur in the nature of computer software. Emerging from these changes will be fifth generation computers capable of simulating intelligence, non-procedural query languages through which a person who knows little about computers can interact with business data bases, the computer recognition of speech, firmware or software which is burned into the circuitry of microprocessors, and expert systems programs which are capable of encoding informal rules and intuitions of a technical expert and utilizing these as advisory tools for accomplishing human tasks.

But these changes in the nature and sophistication of computer software will have major effects on the Videotex/Teletext technology and markets. For example, with the anticipated artificial intelligence-based "contextual keyword search" -- that is, searching by keywords in which paragraphs containing associated concepts are also automatically retrieved -- the tree structure search procedure of Telidon will become obsolete.

Another high probability scenario we have seen involves the possibility that Telidon will become mainly a software package for personal computers and other equipment. This requires a

brief explanation.

No firm has yet produced a perscom which can utilize anyone's software, irregardless of language. Such a perscom is called a universal emulator. Software written on an Apple presently will not operate on a TRS-80, and Radio Shack software won't run on Xerox or IBM perscoms. However, much of the work concerning emulator perscoms is occurring in Japan, and already there are more than ten Japanese firms which are working on perscoms which are plug-compatible with IBM's. When perscom emulators become available as a commercial product, it is widely predicted that hardware for personal computers will become a standard commodity as telephones are now. Under such a scenario, Videotex may become a software package for perscoms. This observation has stringent implications, we have seen, for Telidon marketing strategies.

8.1 The Relevance of Policies in the NIC's

When we normally look for technology policies and strategies in Canada, our scope involves comparisons with the policies and strategies of other OECD countries. However, with respect to a large number of critical economic indicators, such as the extent of foreign control in industry and the balance of payments for technology, Canada more resembles some of the newly industrialized countires (NIC's) such as Brazil and South Korea than

it does the United States or Japan. Technology policy and industrial strategies in the NIC's are thus of relevance to Canada.

Such policies are being forged against the following background.

The world microelectronics industry is comprised predominantly of large, multi-national corporations which operate on a global basis. To utilize cheap labour, they have, until now, located labour-intensive parts of manufacturing in developing countries. But microelectronics technologies are altering this situation in the following ways:

1. The instigation of computer-aided design and computer-aided manufacturing (CAD/CAM) is now involving the return to the developed countries of assembly portions of these manufacturing industries. The main effect of CAD/CAM worldwide is to entirely eliminate the unskilled labour component from manufacturing.

2. Consumer products which incorporate chips in the developed countries are quickly becoming cheaper than the developing countries exports based on cheap labour, and in spite of GATT, the developed countries have instigated protectionist barriers against third world products by using special case clauses, duties and import quotas.

As a response to this situation, one component of several developing countries' industrial/technology strategies involves the creation of expertise in software writing for integration in production techniques and for export to other countries. Many of these countries have realized that, "By avoiding imports of services, the foreign exchange savings could be greater in the medium term than the cost of installing equipment, while at the same time developing local expertise and capabilities."[74]

This realization is of direct relevance to Canada, whose balance of payments in computer hardware continues to grow and whose domestic computer and office automation industry cannot supply the demand. In fact, Canadian trade deficits for office equipment and computers exceeded $2 billion in 1982. Although exports amounted to $890 million, imports rose to $3 billion, creating a new trade imbalance in this sector of $2.1 billion (mainly accounted for by the import of word processors and perscoms). This trade imbalance is almost $1 billion greater than the 1980 imbalance of $1.2 billion.[75] Predictions by groups such as the Evans Research Corporation involve a $5 billion deficit in this area by 1986. In the same article, James Flood, manager of the Canadian Business Equipment Manufacturers Association, has stated that he does not believe that "Ganadian industry can supply (this market)."[76]

It is clear then that:

1. Future balance of payment considerations will depend more directly on software and serviceware for information utilities than on hardware production.

2. If this is the case, national marketing strategies and technology policies are required which optimize the use of Canadian software expertise through the support of a selectivity of applications -- involving higher level applications software and serviceware (information content and interactive services) for information utilities.

But to understand the importance of software support, one must first understand something of the structure of the Canadian software industry.

8.2 The Canadian Software Industry

Software is normally thought of as comprising systems and applications software, the former describing how data moves in and out and through computers (i.e. prescribing the computer's metabolism), the latter directing a computer to perform a specific task, such as monitoring process control in industry, creating a financial forecast, or analyzing factors affecting crop size.

However, applications tools or applications generators -- involving software which aids the software writer to construct specific applications -- are becoming so important that these applications tools now comprise an entire sector of the software industry. Applications tools may aid a programmer with comparatively few writing skills to describe general characteristics of the program he or she wishes and then to receive an automatically written program from the generator itself. Programming productivity is increasing so slowly that many firms have now emerged which specialize in these software productivity tools.

Systems programs -- software to move data in and out of computers, communication lines and storage, to schedule work and regulate access with several users -- have been in general commercial use since the beginning of the 1960's and have undergone continuous maintenance and modification since that time. But restructuring of systems software has involved such enormous capital costs that new techniques for operating systems have been difficult to implement since so much money has already been invested in the old, modified systems.

According to several studies, by 1985 North American software sales will comprise almost $34 billion, or approximately 60 percent of the size of the hardware business. However, since many computer users perform their own programming, these figures are misleading and should be much higher.

Previous to 1969, IBM and virtually all other computer firms gave software away free along with computers. In the early days of computing, any computer would cost several million dollars and was used almost exclusively by multi-national firms and government. Today however, some of the new personal computers cost merely hundreds of dollars, and the cost of software writing has risen, both in absolute dollar levels and with respect to the price of the hardware itself. It is generally conceded that when one incorporates a chip into a new product or a production process, that the software accounts for more than 70 percent of the total costs of manufacturing. However, in the early days of computing the ratio of software to hardware costs was about 1 to 4. By 1981, this proportion had reversed.

Software comes in three forms: 1) the supplying of pre-written software packages which are sufficiently flexible to be adapted to an end-users' needs; 2) custom software written from scratch, which is designed to fulfill some users unique need; and 3) firmware, or software embedded into the actual circuitry of read-only memory chips and incorporated into products and manufacturing processes.

Although most of the software in the world is in custom form, there is a real tendency toward the use of software packages since it may cost a firm several hundred thousand dollars to

solve a problem by customized software, while a pre-written software package which performs the jobs with equal facility may cost merely several thousand dollars.

Toward the end of 1981, a preliminary report of an inter-governmental Canadian task force which was examining transborder data flows presented an initial picture of the Canadian software industry.

Unfortunately, their figures did not include costs for any software embedded in Canadian products such as Videotex terminals, flight simulators, resource equipment, PBX's, etc. They also exclude Canadian software expenditures for perscoms or education software (courseware).

8.3 Software Productivity

When we compare productivity gains in software with those of hardware manufacture, software gains seem inconsequential. Although there have been tremendous gains in computer speed, memory and equipment cost reductions, "the function provided by software", in the words of one author, "not only defies simple numeric characterization, it also does not have, at this point, a useful taxonomy."[77]

Although hardware costs are decreasing tremendously compared to

costs of writing software, thus facilitating the possibility of new applications, such applications always require new software, which is now the main bottleneck to the further merging of computers and telecommunications systems in North America.

Although software and hardware production are frequently compared, Bacon[79] has noted that such comparisons are quite misleading since these two have different properties. First, the hardware is normally replaced from time to time with improved hardware, while software is cumulative. In fact, during the 1950's and 1960's, most commercial data processing programs and systems software were initially re-written and modified, usually in undocumented forms. In fact, many significant business applications were initially written in archaic ways which are difficult to maintain. However, to replace all of this badly written software would cost North America more than $50 billion.

Secondly, while the effects of hardware apply to the immediate user environment, the effects of the software's logic are connected quite intimately with any users' work patterns. "Since most of the early business software dealt with office processes which were already systemetized, such as accounts, inventory and scheduling, etc., most of the easy applications have already been written. In fact, much work which is normally associated with designing software is actually systemetizing the task which a user requires. This systemetization must always be performed

before the software can actually be designed.

Thirdly, software's logical structure is more complex than that of hardware. In any large business computer, software is responsible for the logical structure of 10^{12} bytes of information -- several orders of magnitude larger than the number of logical circuits in the central processing unit of a typical large business computer.

Many North American firms have created computer communication systems for visual images, voice and data -- varying from local area business networks to packet switched satellites. However, many computer communication networks operate according to incompatible standards. Information which may be retrieved from one source may be stored in a differing format and retrieved by different methods of access in another. Protocols for transmitting data are also incompatible. All of these problems involve software.

Although Telidon equipment has been manufactured in Canada, manufacturers of mainframe and mini and micro computers are almost entirely subsidiaries of foreign firms, and Canada has several captive chip producers and producers of custom chips. However, there are many Canadian firms incorporating customized and semi-customized chips into products which vary from Videotex terminals and word processors to communication satellites, PABX's, machine

control devices, navigation equipment, remote sensing and educational microcomputers.

Most Canadian software production is centered in Ontario. In fact, in 1981 Ontario possessed more than 56% of Canada's software firms, 59% of Canada's consulting firms, 47% of its computer service bureaus, 59% of all of Canada's electronic data processing sales and retail outlets, and over half of Canada's computer installations.

In the area of software development, most applications writers are centered in the Toronto/Montreal region, but much of the software for operating systems and data base management for mainframe computers comes from foreign sources, and if a subsidiary develops unique software, the parent often reaps the economic benefits.

Most Canadian software production involves business programming such as general ledger, accounts payable, and so forth. Such "low level" programming requires comparatively unsophisticated software skills and can be performed by persons who know high school math. This type of programming is also quite amenable to being both packaged and automated, and produced off-shore in countries such as India, where software writing costs are about a tenth of the cost of programming in Canada.

Canadian software firms comprise, in general, two types: firms producing and maintaining new applications packages, and those which maintain and market foreign (mainly U.S.) software.

Wescom statistics indicate that marketing of foreign products is beginning to dominate Canadian software production. Increasingly, firms are marketing agents for comparatively trivial U.S. software products such as word processing, business accounting and numeric analysis.

Developing strength in the world software industry, then, necessitates that fiscal/tax incentives be instigated to direct activities and investment away from marketing and toward higher-level applications such as AI, expert systems programs, process control, Videotex applications generators and resource software.

Given the importance of software, serviceware and content creation for future Videotex developments in Canada and the international marketplace, it is instructive to briefly examine Canada's software competition. In addition to the United States and other countries, this competition will soon include Japan.

Software Competition

Manufacturers in the west generally believe that the Japanese have succeeded by licensing and modifying western technology

(more than $10 billion worth over the last decade), and that in the area of original software writing they're simply not competitive with western nations. However, the Japanese government and computer industries now have concerted programs to develop software which will make their programming as competitive as that in the west. Toward the end of 1981, the information technology promotion agency of Japan's Ministry of International Trade and Industry (MITI) launched a software technology centre which focuses on software for Videotex and microcomputer languages. The Japanese private sector is also making major efforts to develop computer software. Hitachi Ltd. now has 26 software subsidiaries, with about 10,000 total software employees. Hitachi usually starts a new software subsidiary for each new product line or market area it is involved with, and such subsidiaries are presently concentrating on robotics, computer-aided manufacturing and automotive microcomputers.

Fujitsu Ltd. has also opened a new software development factory, with an initial funding of $26 million, and both Toshiba Corp. and Nippon Electric Co. (NEC) have also been starting new software subsidiaries. Although software was not seen in Japan as a distinct commercial product as early as it was in western countries (thus inhibiting early development of independent software houses), the Japanese now realize that the U.S. computer lead is a software lead, and it committed more than $100 million to software development over the next two years.

8.4 Defining Technology Demand

Of particular relevance for Canadian policymakers are instruments in developing countries defining technology demand. These instruments relate to measures which affect the behaviour of industrial firms, industrial demand for technology, and industrial growth and structure.

Instruments involved in defining technology demand may be divided into the following:

1. Government procurement power.
2. Industrial finance mechanisms.
3. Export promotion mechanisms.
4. Fiscal measures which relate to financial treatment given to firms such as price control mechanisms, credits and subsidies.

Specific export programs utilized by the Korean government, for example, include tax exemptions on imported material used in the manufacture of exported goods, a reduction of 50 percent of income tax on all export revenues, and a 100 percent reduction on business tax for all exports. The Koreans also introduced preferential interest rates on loans for exports, whereby an exporter could borrow up to 90 percent of his requirement at 6

percent interest.

Other developing countries have instigated indirect tax rebate certificates for exports, according to which an exporter of high technology items may obtain a certificate of rebate of indirect taxes and use this certificate to pay his total tax rate if, and only if, his exported product contains a national component that is greater than a set percentage. One country, for example, uses this certificate system to cover exporters of management services, technology and engineering services. Certificates may be utilized to pay any type of corporate taxes.

In Canada, the Ontario Microelectronics Task Force recommended in 1981 that software programming and design be treated as research and development and that the definition of R&D be further expanded to include all marketing and pre-production costs -- also that sales tax exemptions should be granted to software producers as it presently is to those of hardware -- and that tax and fiscal incentives such as accelerated depreciation allowances, the pro-rating of equipment used in software writing and manufacturing investment tax credits be applied to the software industry as they presently are to the Canadian hardware industry.

However, given the extraordinary fiscal and taxation support given to the software and informatics industries by Canada's competitors, especially the NIC's, these measures are not suf-

ficient to aid the emergent Canadian informatics industries. Tax and fiscal measures enacted in other countries in support of informatics industries include a 200% exemption of taxation on all computer and software exports, the instigation of special tax reserves to support export marketing costs and export financing in general, allowing any foreign export losses as deductions from domestic profits, the tying of specific tax incentives to the quality of export performance, low interest loans, etc.

A second reason why these measures may not be sufficient is simply because many Canadian software firms are now making the transition from mainly custom to packaged software with huge capital outlays in a recessioning period.

Canadian government financial and taxation programs to aid microelectronics, software and serviceware industries have been insignificant and have been mainly limited to assimilating software to R&D benefits, which themselves, as we shall see, compared to the R&D benefits of several countries, are quite limited.

8.5 Videotex and Microelectronics Policy Initiatives

In the following recommendations we first examine Videotex-related measures and then pass on to general measures related to microelectronics hardware and software in Canada. Specific regu-

latory recommendations for Teletext and Videotex over cable, broadcast TV and the telephone networks have been made in sections 7.2 through 7.4 of this work, and the interested reader is referred to those sections.

1. Given the rapid diffusion and new uses of perscoms, financial/tax support should be made available to firms to provide cheap software packages which convert commercially-produced personal computers, work stations and word processors into Telidon-compatible user and information provider terminals. Some perscoms, such as the Apple II and the IBM, now possess some of those capabilities. Many do not, and Telidon should be marketed worldwide as software for perscoms, work stations and other equipment.

2. Government incentives to the Telidon industry will still be required over the next five years. However, direct grants and subsidies alone are not effective. Alternative approaches such as low cost loans and tax incentives for research, development and marketing of Videotex software should be instigated.

3. Telidon services should be integrated into the federal government's commitment to office automation, satellite programs, mobile communication services, etc.

4. Telidon product development for business applications should be encouraged as part of on-going research conducted by the federal government.

5. Further government funding should be directed predominantly to those firms which have a demonstrated need for assistance due to undercapitalization. Restrictions should be placed on direct assistance to foreign controlled IP subsidiaries operating in Canada.

6. Initiatives for the use of Telidon in public locations, libraries, etc., should be undertaken. These will aid in market awareness and provide experience and familiarity with Telidon services. Such initiatives require that more efforts be placed on content development and software.

7. The social impacts and effects which can be attributable to Videotex are unknown. Attempts at "assessing" these have proven to be elusive, and such efforts have tended to "create" issues. Research in this area should, rather, be directed toward realistic short term social impacts of Videotex adoption.

8. Approaches to Telidon product marketing should con-

sider service tiering, which will encourage the presentation of "grades" of services such as information retrieval. These should be considered in tandem with tiered pricing which reflects the cost of the service offering.

9. Teletext services should be developed on the CBC in both official languages.

10. Appropriate Canadian industries such as banking should be encouraged to provide capabilities for Telidon transaction services and be provided with the appropriate regulatory environment to offer such services.

(We now turn to more general recommendations pertaining not merely to Videotex/Teletext in Canada, but to the entire area of microelectronics hardware and software.)

11. One instrument used by some countries is a more flexible taxation system than that of Canada to support software and research and development in general. In some countries, for example Singapore, 200 percent of reinvestment of any firm's profits in R&D activities are tax-exempt, and before the manufacturing use of any new innovative process, tax exemptions are granted

to prototype development and manufacture start-up phases.

It is recommended that Canadian R&D incentives involving microelectronics products (not merely Videotex/Teletext) should be extended to cover engineering design and manufacture start-up costs, and firms should also be able to write off costs of training personnel in microelectronics/software areas. The precise amount of exemption should also be significantly increased, i.e. doubled, so Canadian initiations will be competitive with other nations.

12. Export diversification incentives -- in several countries a series of tax drawbacks have been implemented for firms which export high technology goods and services with a specified percentage of national content. Such a graded drawback scale should be established in Canada, giving priority to exports of high technology goods and software/services, and low priority to exports of raw and semi-processed natural resources. Since one of the intentions of such diversification incentives is to enlarge the Canadian export market from predominantly the U.S., export incentives in the form of drawbacks and tax exemptions should be region-specific -- they should be higher for

Pacific Rim and South American countries.

13. Additionally, Canada should instigate tax exemptions for all imported informatics components used in the production of exported informatics products, goods and services such as Videotex, Teletext, software and such, and should instigate a significant reduction in business taxes on exporting informatics revenues to non-U.S. areas. To encourage the formation of Canadian informatics exports consortia, further export tax concessions should be granted when informatics exports such as Telidon are done by Canadian controlled export consortia.

14. Of particular interest to Canadian planners is Singapore's industrial strategy to convert itself into an area of software expertise for Asia and the world.

Specific incentives directed toward software development and exports include the Capital Pioneer Status Incentive, under which Singapore allows total exemption of any firm's taxes for up to ten years, with these exemptions being granted only to firms which engage in local Singaporian software training and development, and the International Consultancy Service Incentive, which makes available a 20 percent tax rate qualifying software export products. A mini-

mum requirement here, however, is $1 million revenue per year for overseas projects. It is recommended that Canada make available to foreign firms the appropriate equivalents of Singapore's International Consultancy Service Incentive and Capital Pioneer Status Incentive.

15. Given the rapid and current commercial developments in AI (artificial intelligence) in the U.S., Japan and other countries, the considerable range of its present and potential industrial and business applications, and the cost savings involved in substituting expert systems for human consultants, it is apparent that Canada must develop expertise in this field. Accordingly, it is recommended that the government:

- Survey and identify the potential commercial applications of artificial intelligence, with special attention to expert systems.

- Determine priority areas (such as limited natural language query of business data bases) in which AI will have major short term economic effects of the range of the next five years.

- Examine the software training requirements requisite for AI programming proficiency and for the

incorporation of AI software into commercial products.

- Examine policy options and development strategies for best appropriating the benefits of Japanese and U.S. AI research, and for stimulating Canadian research and product development in AI applications.

16. Since the Canadian software and computer sector is comprised mainly of small and medium sized firms, and these have extreme difficulty in obtaining development financing, especially of software, their capacity to obtain financing must be enhanced. Since it is also almost impossible to establish barriers to physical importation of software produced offshore, it is recommended that the Canadian government cooperate with funding agencies to ensure that financing is provided for the development of Canadian software and serviceware.

This funding should encompass all phases of software manufacturing and also software marketing during its first year.

17. It is further recommended that the Canadian government cooperate with Canadian funding agencies to give priority to develop Canadian data processing software to replace that purchased from foreign subsidiaries.

18. It is further recommended that the government instigate a program of fiscal and taxation incentives for firms which have ongoing investments in the development of software products.

19. Since the informatics market is a world market, it is recommended that the government promote fiscal incentives and activities aimed at increasing exports of software, serviceware and computer services.

20. In order to expand domestic and export markets for Canadian producers of software and computer services, it is recommended that the government issue regulations and fiscal incentives which give preference to software services and equipment produced by the Canadian private sector, excluding those cases in which purchase within Canada is considered uneconomical.

21. Since it is in the Canadian national interest to create a software market not tied to specific foreign computer manufacturers, given the extent of multi-

national penetration of Canadian industry, especially in the informatics areas, it is recommended that computer and software costs be more clearly defined and separated with respect to imports and that the government adopt regulations which preclude the inclusion of software prices or services on the same import licence with hardware equipment.

22. Given the fact that the Canadian education/training system does not provide sufficient levels of software training, it is necessary to improve the efficiency of Canadian software production. It is thus recommended that the government rapidly examine the necessary measures to ensure that Canada has sufficient personnel necessary for training in software production. Here it is further recommended that the government evaluate the quality of existing software training courses and assess their relationship to the job market, that existing graduate study programs in computer software be maintained and enlarged, and that special incentives be granted to multi-national subsidiaries located in Canada which will engage in sophisticated software training of Canadians.

23. Given the fact that it is imperative to increase training in the production of industrial automation

software, it is recommended that research, training and teaching in process automation software be encouraged within the Canadian university system.

24. Preferential immigration support treatment should be given to microelectronic technicians, engineers and programmers from partially English speaking countries, such as Singapore, Hong Kong, South Korea and India, who could work in microelectronic areas such as Videotex and Teletext software, resource software, artificial intelligence and such.

25. As in Brazil and Singapore, the federal government must use tax incentives and procurement policy to promote software development, especially in the areas of applications generators, natural resource software and artificial intelligence. The present government initiatives for software are quite inadequate, and comprise either direct subsidies or limited tax write-offs.

26. Software and serviceware fiscal support must include support for the development, commercialization and export of Canadian products; also, the use of procurement to support software in all government industrial retraining programs; fiscal assistance of government

enterprises to invest in innovative new software companies, and also to make available to them special credit lines and low interest loans.

If Canadian software is not of the highest quality, it will ultimately cost users money, and there will be a real economic disincentive to use it, a tendency which is reinforced by the general Canadian suspicion of Canadian products.

8.6 International Marketing Initiatives

In general there are two sets of initiatives which might be carried out in connection with the international marketing of Telidon. The first set comprises activities such as showing Telidon technology at international and domestic trade fairs and efforts to have Telidon-compatible standards for Videotex adopted by national and international standards agencies and equipment manufacturers. Such activities have been carried out by the government and are necessary but not sufficient to engender international Telidon sales.

The second set of activities, which has been only sporadically engaged in by the government, and less so by the Telidon industry, involves the formulations of international marketing plans in terms of specific applications.

1. Market Assessment -- The first stage of such a market plan involves a market assessment of trends in competing and complementary technologies -- of the type which is described in the accompanying marketing study. No one is going to purchase a Telidon terminal costing over $2,000 when one can purchase, say, a Commodore personal computer in the same price range and convert it into a Videotex terminal by purchasing a cheap software packet. Such a market assessment, in other words, examines the ways Telidon may be bundled into related technologies and sold as a package.

2. Market Intelligence -- This second stage involves the determination of specific applications and application areas in which Telidon might have uses. It is the appropriateness of applications rather than inherent technological capabilities -- the much-heralded graphics capability -- which will sell Telidon. This determination of applications areas should be carried out along geographical lines, by regions of the world, and must contain in-depth assessments of the main firms operating in that application area in a specific region of the world (size of firm, industrial infrastructure, means of penetration, export potential, etc.).

3. The third stage of such a marketing plan involves the priortization of areas of market potential by geographical region. For example, a number of city governments in the newly industrialized countries of the Pacific Rim are in the process of installing major rapid transit systems and have expressed interest in Videotex-based public transit information systems. Brazil, as we shall see, is in the process of converting from industrial to agricultural development as a national strategy. In spite of sales already lost to the French in the Sao Paulo Videotex trials, Canadians already have a considerable expertise in agricultural-based Videotex systems.

4. The fourth stage of such a plan involves identification within a specific market area of the key firms and agencies operating in that area, with the idea of making exemplary sales in terms of specific applications.

A related albeit separate marketing aspect which should be simultaneously pursued involves bundling Telidon into packages of related telecommunications technologies and offering them as part of the Canadian development aid effort supported by mixed credit financing.

Also of crucial importance now are the types of fiscal/tax export and marketing support measures discussed in the recommendations.

Given the export opportunities for Canada in the NIC's of the Pacific Rim and elsewhere, of direct interest are the ASEAN nations (Association of Southeast Asian Nations). While the western economies have been damaged by recessions and high interest rates, the economies of southeast Asia have showed remarkable growth in the 1970's, ranging from an average of 14% for Singapore to a low of 6% for the Phillipines. (This compares with an average 4% annual growth rate for Canada during the same period.) Also, the ratio of fixed capital formation to GNP was greater than 35% for Singapore and averaged around 25%-30% for Malaysia, Indonesia, the Phillipines and Thailand. As the ASEAN economies mature they will become more protectionist; thus the time to enter these markets is now.

Singapore, a shopping window for Asia and China, offers major Videotex, computer and software export opportunities for Canada in the areas of computer communications, transportation and finance systems. In South Korea there is an equivalent interest in Canadian high technology, especially in cable technology and computer software. Korea's 1982 Five Year Plan has changed industrial emphasis away from essential manufacturing industries toward high value-added technology manufacturing.

In addition to the NIC's of the Pacific Rim, countries like Australia and New Zealand are experiencing resource booms, and throughout the world there will be export opportunities for information systems and software in resource industries. Australia, Indonesia and China have all placed increased emphasis on petroleum exploration and mining. Although the "first round effects" of this trend are trade diverting, a real potential exists here for a substantial trade creation centered around the production of software and systems in process oriented activities in these resource sectors.

Also of immediate Canadian export interest in the microelectronics and software areas are newly industrialized countries outside of the Pacific Rim, such as Brazil.

Under the Brazilian model of industrial development, foreign capital was induced to finance domestic industry. As a result of massive industrialization during the past two decades, the value-added manufacturing has risen from $11 billion in 1960 to $57.4 billion in 1980. However, during this time exports rose from $3.2 billion to more than $20 billion, and foreign borrowing exceeded $70 billion in 1982. But inflationary prices for oil imports and interest on foreign debts was greater than the total export income. The government has thus decreased its industri-

alization focus and has increased the prominance of Brazilian agriculture.

Brazil, already one of the four largest world markets for computers and software in the world, recently forbade free importation of computer software by multi-national subsidiaries. The purpose is to build up Brazil's own data processing and service industry. However, in reality they are deciding this issue on a case-by-case basis, and since Brazil's development strategy has changed from a focus on industry to agriculture, there are major Canadian export opportunities in agricultural Videotex information systems and software.

In all of these developed and developing countries, microelectronics exports from Canada will benefit not predominantly from hardware but through providing the software, the expertise, and the consulting and engineering services involved in capital projects.

In addition to competitive export financing, one function the government could provide is excellent contemporary information concerning high technology buyers and sellers, off-shore industrial trends, market information for specific products and high technology product lines, any new plans for large-scale capital projects abroad, the awareness of financial intermediaries, etc.

Since the traditional exports of Canada have been raw or standard fabricated materials with less than a third of exports being manufactured products (of all types and not merely high technology products), Canadians have not developed an international marketing ability equivalent to other trading nations. This must be engendered.

9.0 REFERENCES

1 Russel Wills, Softech | A Microelectronics Planning Guide for Ontario", Ministry of Industry and Trade, Toronto, 1982.

2 The copyright issue is usually considered in this context. This issue with respect to Videotex/Teletext has centered around the question of protecting the rights of software producers, since Videotex enables a firm to download computer software into intelligent terminals. However, given the ease with which one may copy software packages, and the large costs of software relative to hardware purchases, it would appear likely that this copying industry will grow more rapidly than software downloading, and that given the nature of the technology, it is almost impossible to prevent software copying by legal means which do not offend consumers. There is even commercially available packaged software now such as "Pirate's Friend", which enables one to break and copy a software disc which has been encrypted.

3 Tydeman et al., "Teletext and Videotex in the United States: Market Potential, Technology, Public Policy Issues", McGraw Hill, New York, 1982, p.184.

4 International Videotex News, June 29, 1982.

5 A similar situation has arisen with personal computers, most of which will not run the competition's software.

6 Tydeman et al., op. cit., pp. 194-5.

7 International Videotex/Teletext News, December 1982, p.5.

8 International Videotex/Teletext News, June 1982, p.3.

9 Op. cit., p.1.

9a B. Lesser, "Alternate Market Structure for Videotex Service in Canada: The Public Policy Implications," Centre for Development Projects, Dalhousie University, July 1982.

10 Harold Innis, The Bias of Communications, Toronto, University of Toronto Press, 1951.

11 See, for example, John Sleigh, Brian Boatwright, Peter Irwin and Roger Stanyon, "The Manpower Implications of Microelectronics Technology", Crown Publications, London, 1979.

12 Barbara Robertson, "Considerations Related to the Potential Social Impact of Communications Technology", Department of Communications, undated.

13 Peter J. Booth, "Privacy in Videotex: Summary Report", Group West, Vancouver, March 1981.

14 Ibid.

15 Roger Hough and Associates, "A Study to Forecast the Demand for Telidon Services Over the Next Ten Years", Dept. of Communications, December 1980.

16 H.G. Bown, C.D. O'Brien and W. Sawchuk, "Telidon Technology Development in Canada", Department of Communications, Ottawa, undated, p.1, and

H.G. Bown, C.D. O'Brien, W. Sawchuk and J. Storey, "Telidon: A New Approach to Videotex System Design", IEEE Transactions on Consumer Electronics, Volume CE-25, No. 3, July 1979.

17 Douglas F. Parkhill, "Developments on the Canadian Scene", Paper Presented at the Viewdata '81 International Conference and Exhibit, October 6-8, 1981, London, England, p.2.

18 W. Sawchuk, "Trends in the Technical Development of Telidon", Viewdata '82 Proceedings.

19 Ibid.

20 Ibid.

21 David A. Keith, "Canada Must Seize Chance to Supply Business Services", CIPS Review, November/December 1982, p.14.

21a Lesser, op. cit.

22 Michael Tyler, "Electronic Publishing: A Sketch of the European Experience", Teletext and Viewdata in the U.S., Institute for the Future, Menlo Park, 1979.

23 Peter Booth, "Videotex Opportunities: A Summary of Issues and Implications for B.C. Tel", Wescom Ltd., Vancouver, B.C., September 1982, p.4.

24 G.H. Deshatelates, "The Survey of On-Line Search Service Centres in Canada", March 1980.

25 John E. Cooney, "With Video-shopping Services, Goods you See on the Screen can be Delivered to Your Door", Wall Street Journal, July 14, 1981, Cited in Tydeman et al., 1982.

26 The Financial Post, October 9, 1982, Special Report.

27 Report on Computers, the Globe and Mail, Monday, February 28, 1983, p.1.

28 As quoted in Wallace Immen, "Data, Text Functions are Being Integrated", Report on Business, the Globe and Mail, Monday, February 28, 1983, p.R3.

29 International Videotex/Teletext News, September 1982, p.7.

30 Frost & Sullivan (1982).

31 Creative Strategies International, Cited in Greg Kearsley and Beverly Hunter, "Electronic Education", (in prep., 1982).

32 Financial Post, February 27, 1982.

33 Gordon Betcherman, "Skills and Shortages: A Summary Guide to the Findings of the Human Resources Survey", (Ottawa: Economic Council of Canada, 1980).

34 Op. cit., p.58.

35 Kearsley, op. cit.

36 Dataquest Estimates. The Financial Post, Special Report, February 27, 1982, Joan Feldman, "U.S. Computer Markets Record Good Growth Despite Recession."

37 Evans Research Corporation, 1981.

38 Business Week, May 24, 1982.

39 Globe & Mail, March 15, 1982.

40 J.W. Brayham and D. Godfrey, "A Marriage of Convenience: Videotex and Computer Aided Learning", Computers and Education, Volume 6, 1982.

41 Report on Business, The Globe & Mail, Friday, March 25, 1983.

42 Tydeman, op. cit., p.180.

43 Eric Barnouw, Tube of Plenty: The Evolution of American Television, New York, Oxford University Press, 1978.

44 Broadcasting Act, 1970, R.S.C., c.B-11, Sections 3(c) and 3(d).

45 Decision CRTC 78-669, October 12, 1978.

46 Decision CRTC 79-9, January 9, 1979.

47 CRTC, "A Review of Certain Cable-Television Programming Issues", Ottawa, March 1979, p.9.

48 Department of Communications, "Computer/Communications Policy: A Position Statement by the Government of Canada", Green Paper, Ottawa, 1973.

49 D. Godfrey and D. Parkhill, eds., Gutenberg Two, Toronto, Press Porcepic Ltd., 1979, p.78.

50 Special Senate Committee on Mass Media, Report, Vol. I, The Uncertain Mirror, Ottawa, 1970, p.4.

51 S.C. 1967-68, c.48. s.6, The Bell Canada Special Act.

52 CNCP Telecommunications: Interconnection with Bell Canada, CRTC Telecom Decision 79-11, May 19, 1979.

53 Bell Canada Special Act, op. cit.

54 Godrey, D. and Parkhill, D., eds., Gutenberg Two, op. cit.

55 Department of Communications, "Computer/Communications Policy: A Position Statement by the Government of Canada", op. cit., Statement 15.

56 "Federally Regulated Carriers and Chartered Banks Participation in Commercial Data Processing", Joint Statement of the Ministers of Finance and Communications, January 6, 1975.

57 Cable Television Regulations, CRC, c.374.

58 CRTC, "Policies Respecting Broadcasting Receiving Undertakings (Cable Television)", December 16, 1975, p.4.

59 Ibid., p.2.

60 Cable Television Regulations, CRC, c.374.

61 Ibid.

62 CRTC, "Policies Respecting Broadcasting Receiving Undertakings (Cable Television)", December 16, 1975.

63 CRTC, "Canadian Broadcasting: A Single System", A Policy Statement on Cable Television, Ottawa, July 16, 1971, pp.20-25.

64 Decision CRTC 79-9, January 9, 1979.

65 Charles Dalfen, "Regulatory Aspects of the New Technology", Report prepared for the Royal Commission on Newspapers, April 1981, p.106.

66 R. Neustadt, G. Skall, M. Hammer, "The Regulation of Electronic Publishing", Federal Communication Law Journal, #3, Vol. 33, 1982.

67 Ibid, p.354.

68 Dalfen, op. cit.

69 Neustadt et al., op. cit., p. 360.

70 Dalfen, op. cit., p.120.

71 CRTC Decision, May 19, 1979.

72 David McDonald, "Great Expectations", Speech to the Canadian Bar Association, 1981.

73 Russel M. Wills, "Microprocessor-Based Media", International Development Research Centre, Ottawa, 1981.

74 Juan Rada, "The Microelectronics Revolution, Implications for the Third World", Uppsala, 1981, p.58.

75 Globe and Mail, February 11, 1983, p.B5.

76 Ibid.

77 Glen Bacon, Science, Vol. 215, February 12, 1982, p.775.

78 Ibid.