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Communications Economics Branch
Department of Communications
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The opinions and statements expressed in this paper represent views of the authors. These views are not necessarily those of the federal Department of Communications or of any other department or agency of the Government of Canada.

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1. Introduction and Overview

Over the past century communications has played a key role in the economic, social and cultural development of Canada. It has been, like transportation, an essential element of the economic infrastructure, in view of the great distances which separate metropolitan centres and of the large portions of this country which have remained undeveloped or underdeveloped. Communications has also contributed significantly to the social and cultural fabric of Canada by providing widely accessible networks for interpersonal communications and for the diffusion of information, entertainment and cultural programs to millions of Canadians.

Canada now leads the world in total capacity of telecommunications facilities, of many kinds, on a per capita basis. Telephone penetration is close to 100%. Every business and virtually every home has a telephone. A television set can also be found in almost every home. Cable TV penetration is higher in Canada than in any other industrialized country. The national average is about 50%, but it approaches 80% in Metro Toronto and 95% in the Vancouver area.

In the coming years the importance of communications is expected to grow even further. The economy will become increasingly dependent on sophisticated data communication networks. At the same time, the technological revolution which is now unfolding in the fields of electronics and other information technologies will affect all aspects of our lives, both at home and at work.

The rapid technological change which characterizes the communications sector is fueled by the micro-electronics revolution and concurrent advances in satellite communications, fibre optics, digital transmission and switching. These new technologies are bringing about a confluence of the telecommunications and data processing worlds on the one hand, and on the other creating opportunities for providing new types of communications services to the business office and to the home.

The emerging technology of telecommunications offers the possibility of an eventual network affording universal access to the means of transmitting and receiving information in virtually any conceivable form. The information would be stored in electromagnetic form and transmitted at the speed of light, rather than be stored on printed paper and transported physically from origin to destination. Much of this concept is already technically feasible, and its practicability is not in doubt over the long term. Its rate of implementation, however, is limited to a large extent by existing telecommunications plant and facilities which were designed for more limited services, and by institutional barriers.

These technical changes will not only provide a wide range of new services but, more importantly, they will have a major impact on the Canadian economy. The introduction of the new information technology will cause significant changes in production techniques, in the level of employment and occupational mix, in the size and location of firms, in productivity and in the competitiveness of Canadian industry in foreign markets.

Together with new opportunities, the new technology will also bring new threats. Threats to the economic sovereignty of Canada, if data processing and related management functions tend to migrate from the Canadian branch plants to multinational headquarters abroad. Threats to the cultural sovereignty of Canada, if the position of Canadian media and publishing industries is jeopardized by the unrestrained invasion of foreign media. Threats to employment, if Canadian industry lags behind other countries in adopting the new technology. Threats to the privacy of individual citizens, if the confidentiality of personal data stored and transmitted electronically is not adequately protected. Threats to the stability of society, as it becomes more vulnerable to malfunctions or possible sabotage of its vital electronic systems such as electronic fund transfer networks.

The telecommunications industry is a heavy user of valuable resources, in the form of the electromagnetic spectrum, capital investment, research and development capacity and skilled professional manpower. It does not, however, require large inputs of raw materials or energy. It is therefore unlikely to be negatively affected by the steadily escalating price of energy. In fact, to the extent that this trend encourages a substitution of communication for physical transportation, it can only increase the demand for communications services.

1.1 Outline of the Chapters of the Report

This report examines the Communications sector in some depth; it represents a detailed "micro" view of this sector. A companion report, now

available, looks at the Information Revolution and examines its implications for Canada. The other report presents a "macro" view of the effects which current advances in micro-electronics and transmission technology will have on the economy as a whole.

This report consists of five chapters. Chapter 1 provides an introduction to and an overview of the Communications sector as a whole, relates the contributions of the sector to the total economy, and identifies the main components of the sector. Chapter 2 is a detailed study of the Telecommunications Services sub-sector. It includes a description of the industry structure, an historical analysis of the industry's performance in recent years with respect to revenue, output, productivity and usage of factor inputs, as well as a projection of historical trends to 1985. Moreover, relevant policy issues which may have a bearing on the performance of the industry are analyzed and the likely impact of various technical innovations which may reasonably be expected to be introduced over the next five years is discussed. Chapter 3 is a detailed study of the Broadcasting and Cable sub-sector, using the same approach as in Chapter 2. Chapter 4 describes the new home and business communications services which are likely to be introduced over the next 10 years, and attempts to assess their impact. Chapter 5 presents some broad conclusions.

1.2 Definition of the Communications Sector used in this Report

The Communications sector, as defined by Statistics Canada, consists of all establishments grouped under Standard Industry Classifications (SIC)

543, 544, 545 and 548. SIC 543, Radio and Television Broadcasting, covers establishments primarily engaged in radio and television broadcasting, and in the operation of radio and television broadcasting studios for the purpose of broadcasting programs of entertainment, news, talks and the like. SIC 544, Telephone Systems, groups establishments primarily engaged in providing telephone services. SIC 545, Telegraph and Cable Systems, contains establishments primarily engaged in transmitting messages by telegraph, cable or wireless for a fee; among those covered are telecommunications carriers primarily engaged in providing teletype service, satellite communications, wirephoto service, or a system of co-axial cables for closed circuit communications systems. SIC 548, Post Office, covers establishments primarily engaged in operating a postal service; in practice, this means the operations of the Canadian Post Office.

For the purpose of this report, except in section 1.3, the postal services sub-sector has been excluded from the Communications sector for quantitative analyses, partly because of unavailability of suitable data. But the issues related to electronic mail and message/record communications services based upon communicating word processors are considered in Chapter 4. We are restricting our attention, therefore, to all forms of telecommunications and broadcasting, and excluding those forms of communications which are based upon the physical transportation and distribution of written or printed material.

Excluding postal services, the Communications sector can be sub-divided into two broad sub-sectors, which we will call Telecommunications,

and Broadcasting and Cable Television. These two sub-sectors are described at length in Chapters 2 and 3 of this report; in this section we shall only be concerned with a broad overview.

The Telecommunications sub-sector includes all establishments falling under SIC 544 and 545; a further sub-division may be made into Telephone companies (SIC 544) and Telegraph/Cable companies (SIC 545). The telecommunications carrier industry is characterized by regulation and strict separation between carriage and content. Historically, the carriers have engaged only in the carriage function; i.e. they transmit messages originated by others, to destinations selected by the originators, without in any way modifying the content of the message. Whether this rigid distinction can be maintained in the future, under the confluence of data transmission and data processing technologies, is a moot point. Store and forward techniques and packet-switched networks are the precursors of the intelligent transmission networks which are currently being planned and designed.

The Broadcasting and Cable Television sub-sector can also be sub-divided into the Broadcasting (Radio and Television) companies and the Cable Television companies; the former are referred to as Broadcast Transmission Undertakings (BTUs) and the latter as Broadcast Receiving Undertakings (BRUs). In this sub-sector there is no rigid separation between carriage and content. The Cable Television companies, in particular, can act as providers of information and programming, as well as distributors or carriers.

1.3 Historical Contribution of the Communications Sector to Economic Growth

Table 1.1 shows the contributions of the Communications sector, as defined by Statistics Canada, to the Gross Domestic Product at Factor Cost, and to the total Wages, Salaries and Supplementary Labour Income. From 1952 to 1978 the GDP, in current dollars, has increased from about $22b in 1952 to about $210b in 1978. During the same period the Communications sector increased from $396m (or 1.8% of GDP) in 1952 to $5.67b (or about 2.7% of GDP) in 1978. A similar average growth occurred in wages and salaries payment, which increased from $271m (or 2.2% of total labor income) in 1952 to $3.536b (or 2.7% of total labour income) in 1978.

The Communications sector's share of the GDP increased steadily from 1.79% in 1952 to 2.54% in 1961. It remained fairly constant up to 1966, and then began to exhibit an increasing trend again, reaching a high value of 2.90% in 1972. The share then decreased up to 1976, reaching a low value of 2.46% in that year. The trend seems to have reversed again, however, because the share in 1978 was 2.70%. It would seem, therefore that 2.50% and 3.0% may represent reasonable lower and upper bounds for the GDP share of the Communications sector up to 1985.

The Communications sector's share of the total Wages, Salaries and Supplementary Labour Income increased steadily from 2.24% in 1952 to 2.69% in 1958. After this point, however, there are no clearly discernible trends up to 1978. The share has fluctuated from a low value of 2.53% to a high value of 2.69%; the average for the period 1958-78 is 2.62%. It seems, therefore, that 2.50% and 2.75% may represent reasonable lower and upper bounds for the Wages and Salaries share of the Communications sector up to 1985.

Table 1.1 is misleading, however, in one important respect; all series are expressed in current, rather than constant dollars. The price of communications services has increased less rapidly than that of goods and services as a whole, and the trends in the deflators are also somewhat different, as indicated by Table 1.2. The same may be true of the sectoral and total deflators for wages and salaries, although here there is greater justification for assuming that the trends would be similar.

Table 1.2 shows that between 1971 and 1977, the consumer price index (CPI) increased by 63.2% for all services. During the same period, the transportation services component of the CPI increased by 65.0%, the household utilities component by 80.3% and the combined recreation, education and communications component by 42.3%; but the price of communications services, as represented by the Bell revenues implicit deflator, increased by less than 27%. It should be noted, however, that the communications price indices in Table 1.2 are not directly comparable to the components of the CPI, and there is no CPI component limited exclusively to communications services. Moreover, the Bell deflator is at best a proxy for the price index of the telecommunications component of the communications sector; it ignores the broadcasting and cable television component as defined here. Unfortunately a price index for this component does not exist and it is even questionable whether it can be constructed. This is because the output of the broadcasting industry is difficult to measure since it is not a purchased service by final users. This problem will be discussed in more detail in Chapter 3.

An increase of 27% in the price index from 1971 to 1977 implies a compound annual growth rate of about 4%. If this growth rate for the index continued unchanged till 1985, the value of the index in that year would be 173.1; for compound annual growth rates of 6% and 8% between 1977 and 1985, the price index would increase to 201.6 and 234.1 respectively. An earlier Explor model simulation performed by the Department of Industry, Trade and Commerce had assumed a constant compound annual growth rate of 7.89% for the price index between 1970 and 1985. Using a base of 100.0 for 1971, this growth rate gives price indices of 157.7 for 1977 and 289.5 for 1985. This assumed growth in price is double that which actually occurred between 1971 and 1977, and seems to be the high side for the forecast period 1978-85.

Because of the uncertainty regarding the price index, we have forecast the GDP contribution of the Communications sector in current, rather than constant 1971 dollars. The forecast results, which are based on projections of historical trends, are shown in table 1.3. The forecasts were carried out by fitting a number of functional forms, such as the exponential curve, Gompertz curve and growth curve, to the data for two periods: 1952-1977 and 1966-1977. Forecasts using the last 12 years were consistently higher than those using the longer range, due to the rate of price inflation in recent years. Since there is no reason to believe that the trend of price inflation will not continue, the forecasts presented are based on the last 12 years only. This methodology has been consistently applied to all revenue forecasts in this report. The functional forms have been chosen on the basis of goodness of fit statistics (bearing in mind the problems caused by serial correlation), tracking ability over the last few years, randomness of residual errors and, finally, judgement

regarding the reasonableness of the forecasts. We have also tried to indicate a range, rather than present one specific forecast.

Judged by the above criteria, we feel that the exponential curve gives a reasonable "low" forecast. The compound annual growth rate, constant for this type of functional form, is 12.17%, and the forecast value for 1985 is $11,947m, an increase of 138.32% between 1977 and 1985. By comparison, the actual increase over the 8 year period 1969-1977 was 159.88%.

The Gompertz curve forecast of $17,454m, an increase of 248% between 1977 and 1985, seems to be on the high side. The increasing rate of growth, and the annual percentage change values ranging from 15.56% in 1979 to 19.42% in 1985, would require either an increasing rate of price inflation, or an increasing rate of real growth, or both. Neither of these assumptions seems to be fully borne out by the historical experience to date.

1.4 The Relative Shares of the Components of the Communications Sector

In this section we examine the operating revenue and employment shares of the two sub-sectors, Telecommunications and Broadcasting and Cable Television, which were defined in Section 1.2. The growth of operating revenues and employment is studied by component, by sub-sector and for the Communications sector as a whole. By studying growth at the component and sub-sector level, insights can be developed regarding the homogeneity of the Communications sector. As expected, we find that the growth of revenues and employment is not distributed homogeneously across the components and

sub-sectors. This implies that consistent estimates of growth for the Communications sector are best derived by integrating estimates made at the component level. The major problem, as mentioned earlier, is the lack of a suitable revenue deflator for the Broadcasting and Cable Television sub-sector, which prevents the calculation of a "real output" measure for this sub-sector.

Tables 1.4 and 1.5 show the components, sub-sector and sector totals, sub-sector shares for operating revenues, in current dollars, and numbers of employees for the two sub-sectors. Since component price deflators for operating revenues are not available, these have not been presented in real terms.

The operating revenue share of the Telecommunications sub-sector declined from 80.39% in 1959 to 75.74% in 1978. The decline, however, was not monotonically smooth; the share remained above 80% from 1959 to 1963, and at or above 77% from 1967 to 1972. Between 1967 and 1977, telco revenues increased by 239.82%, telegraph/cable by 189.09% and the Telecommunications sub-sector by 235.54%. Over the same period, broadcasting revenues increased by 226.46%, cable television (because of its very low base) by 954.30%, and the sub-sector by 270.13%. The sector revenues increased by 243.47%, and the average annual percentage growth was 13.13%. Over the period 1972-1977, however, because of increasing inflation, the average annual percentage revenue growth was 15.38%. It is to be noted that the broadcasting revenue statistics include funds received by the CBC from Parliament to cover its operating costs; these funds amounted to $459m in 1977.

The employment share of the Telecommunications sub-sector declined from 78.98% in 1967 to 75.68% in 1978; this employment share was somewhat higher than the corresponding revenue share of 77.08% in 1967 and almost the same as the 75.74% revenue share in 1978. The operating revenue per employee in 1978 was $48,195 for the Telecommunications sub-sector and $48,028 for the Broadcast and Cable Television sub-sector. For the individual components the operating revenue per employee in 1978 was $48,155 for the telcos, $48,713 for the telegraph/cable companies , $47,320 for the broadcasters and $51,615, a significantly higher figure, for the cable television companies.

Employment trends in the components, between 1967 and 1977, were as follows. There was an increase of 27.93% for the telcos, a decrease of 23.41% for the telegraph companies, an increase of 35.39% for broadcasting and an increase of 191.97% for the cable television companies. The total sector employment increased by 27.45%, and the annual average percentage growth was 2.48%. The annual percentage growth between 1972 and 1977 was 3.87%, a considerably higher figure. It is not clear, however, if this higher rate of growth will continue up to 1985; there was a slackening in 1975 and 1976, followed by an increase again in 1977 and 1978.

1.5 The Central Role of Communications to the Economy in the Information Age

"Instant World", the general report of the Telecommission published in 1971, had noted the converging trend in the technologies of communications and computers which, even then, was making it increasingly difficult to distinguish between the interactive services of data processing and transmission. The

predominant theme which emerged from the Telecommission studies was that the technologies of telecommunications and computers, effectively used in combination, could make a striking contribution to economic prosperity and the general quality of life in Canada.

This was before the full extent of the micro-electronics revolution had become evident. Micro-electronics will have an enormous impact on almost every industry, either directly or in conjunction with telecommunications. It will significantly alter the structure and efficiency of the economy, particularly impacting telecommunications, office equipment, retail sales, process control and even products like automobiles. The effects will be as important as those associated with the Industrial Revolution. The Clyne Committee, reporting in March 1979, said "We have come to the conclusion that telecommunications taken in the broadest sense, will form the infrastructure of the new industrial society that is now coming into being around the world".

In this report we have restricted ourselves to studying the telecommunications infrastructure, which accounts for about 2.5% of the Gross Domestic Product. In a companion report, now available, the problems of the Information Economy, which may affect more than 50% of the total output and employment produced by the Canadian economy, have been examined.

2. The Telecommunications Services Sector

This section of the paper describes the Telecommunications services industry, which forms by far the largest segment of the total Communications Sector. An overview of the industry is given first; this includes a definition of its components and a description of the industry structure, ownership patterns and modes of regulation. Revenue performance is studied next; revenue components are identified, shares and trends are described, the problems of measuring output in "real" terms are discused, and revenue projections are made to 1985. Productivity trends are analysed, and the outlook for the production process under the impact of the new technologies is discussed. An attempt is made to assess the outlook for factor demands, including the demand for labour and capital financing requirements. Finally, there is a discussion of the sources of uncertainty, and possible policy changes over the medium term future.

2.1 Introduction and Overview

Due to its geography and dispersed population, efficient telecommunications services are necessary for the development and, indeed, the very existence of Canada. Canada has been, and still is a world leader in this field which has experienced rapid technological change, particularly in the post-war period. The first telephone conversation, the first submarine telegraph cable in North America, reception of the first transatlantic radio signals and, more recently, the first digital data network and non-military domestic communications satellite, were all major Canadian accomplishments in this field.

Today, Canada has almost universally available basic telephone service, a growing data communications network and the world's largest domestic communications satellite system using geostationary satellites.

The Standard Industrial Classificaiton sub-divides the telecommunications carrier industry into two segments. These are labelled as Telephone Systems (SIC 544) and Telegraph and Cable Systems (SIC 545). The first segment consists of establishments which are primarily engaged in providing telephone service; all the telephone companies (Telcos) are included here. The second segment originally consisted of establishments primarily engaged in transmitting messages by telegraph, cable or wireless for a fee. However, it now include Teleglobe, which supplies overseas telecommunications services and Telesat, which operates satellite systems for domestic telecommunications, in addition to Canadian Pacific Telecommunications (CPT) and Canadian National Telecommunications (CNT); the last two have formed the CNCP consortium to provide public message service (telegrams) and a wide range of telecommunications services.

Although there were approximately 333 telephone systems listed in 1977, 15 systems accounted for about 98% of the total telephone activity. Selected data for these telephone systems, together with the four major Telegraph/Cable systems mentioned above, are tabulated in Appendix I. Individual telephone systems are interconnected to form a national network, and Direct Distance Dial (DDD) calling is available between virtually all points in Canada and the U.S. The nine major Telcos, together with Telesat, are members of the Trans-Canada Telephone System (TCTS), a voluntary association formed in

1931 to provide an integrated national telephone network. This association administers the sharing of revenues produced by inter-carrier traffic, and coordinates planning for the national network. The Telcos generate over 90% of the operating revenues and employment in the telecommunications sector.

The Canadian telecommunications carrier industry is characterized by regional telephone company (Telco) monopolies in public, switched-network telephone services, a national CNCP monopoly in public message telegraph service, and a Telco/CNCP duopoly in most other services, including private line voice, data communications and video transmission services. This competition between the two carrier groups, in the supply of private line services that fall clearly outside the family of monopoly telephone services, has been aknowledged as being in accordance with federal government policy.

Ownership patterns vary widely amongst carriers. Bell Canada, by far the largest telephone company, is an investor-owned utility which is vertically integrated with its manufacturing subsidiary, Northern Telecom, and their combined research and development subsidiary, Bell Northern Research. British Columbia Telephone Company (B.C. Tel) and the maritime Telcos are also investor-owned utilities; many smaller Telcos in Ontario, Quebec and B.C. are subsidiaries of Bell Canada or B.C. Tel. Canadian Pacific Telecommunications (CPT) is a wholly owned subsidiary of Canadian Pacific Limited. There are a number of federal and provincial crown corporations, such as Canadian National Telecommunications (CNT), Teleglobe, Alberta Government Telephones (AGT), Saskatchewan Telecommunications (SaskTel) and Manitoba Telephone System (MTS).

Telesat is owned 50% by the federal government and 50% by the nine other members of TCTS.

All telecommunications carriers are subject to some form of regulation. The Canadian Radio-Television and Telecommunications Commission (CRTC) regulates Bell Canada, B.C. Tel, CNT, CPT and Telesat; these carriers represent more than two-thirds of the assets and revenues of the carrier industry. The other major Telcos are regulated by provincial regulatory bodies, except for SaskTel which is regulated directly by the provincial legislature. Since TCTS is not an incorporated entity, there is no direct regulation of "TCTS rates"; regulation has to take place at the level of the individual member companies and this can give rise to jurisdictional problems between the CRTC and the provincial regulatory authorities. Teleglobe, the international carrier, is not directly regulated. It determines rates for overseas services through bilateral arrangements with other international carriers; these rates have to take into account the requirements of governments and operating companies in the countries in which the services terminate, or through which they pass in transit.

Traditional rate-of-return regulation tends to be the prevailing mode. The policy objectives of Bill C-16, the proposed Canadian Telecommunications Act, specify that regulation is to be flexible, adaptable to technological change and advances, and to ensure a proper balance between the interests of the public and the legitimate revenue requirements of the telecommunications industry. Among the policy objectives are also requirements for an efficient telecommunications system, universally available reliable telecommunications services, and just, reasonable and non-discriminatory rates.

2.2 Revenue Performance and Projections

2.2.1 Market Components

The market for telecommunications services can be segmented into four principal categories, each of which has its own characteristics, in terms of demand and supply relationships. These categories are:

a) Voice Communications

b) Data Communications

c) Broadcast (Audio/Video) Transmissions

d) Public Message Service (Telegrams)

The voice market consists of public telephone services, which include local service and long distance message toll services, and private line voice service, which refers to voice services provided over dedicated or switched private lines. Public telephone service is provided by the telephone companies on a monopoly basis. Private line voice services are provided on a competitive basis by the Telcos and CNCP. The voice market currently forms over 85% of the total telecommunications market. It will, in the near future, continue to remain the basic service for residential and small business users. This is a mature market and its average annual growth rate, in nominal terms, has been 13.7% for the period 1972-76.

Data communications is the transmission of information, in coded form, between devices such as computers and terminals of various types. The data communications market forms about 10% of the total telecommunications

market at present, but it is growing rapidly. The market is sub-divided into two sub-categories, the Computer Communications market and the Message/Record market.

Computer communications are defined as communications between a terminal and a computer to obtain a computer-based product or service, or between two or more computers; in each case the transmitted data is processed at a computer. Computer communications may take place wholly over dedicated private lines, or by using the public switched network to access private lines connected to a computer. The first type of service is provided on a competitive basis; the recent CRTC decision on the CNCP Interconnection application will allow the second type of service to be provided competitively in the future, in the territory served by Bell Canada. This segment of the market is growing rapidly; the average annual growth rate, in nominal terms, exceeded 20% for the period 1972-76..

The message record market refers to terminal-to-terminal transmission of messages, with no processing of the data. The message may pass through a computer, but for routing purposes only, and no data processing is involved. The services can be offered on a publicly switched basis (e.g. TWX, Telex), or on a privately customized basis. This market is dominated by CNCP.

The Broadcast (Audio/Video) Transmission market refers to services provided for the transmission of sound for radio and television programs, and video signals for television programs. It forms less than 1% of the total

telecommunications market. Although fully competitive, it is dominated by the Telcos.

The Public Message (Telegram) service, provided by CNCP on a monopoly basis, is a special type of message record service. It forms about 0.5% of the telecommunications market, and its importance has declined steadily during the postwar period. This decline has coincided with the steady growth of long-distance calling and alternative message record services; it seems to be irreversible and is expected to continue.

The size and breakdown of the telecommunications market in 1976 are as follows. The Canadian telecommunications market in 1976 yielded revenues of $3,556 million to the Telcos and CNCP. The voice communications market was $3,178 million, or 89%; of this the public telephone service share was $3,084 million (97%) and the private line voice share was $95 million (3%). The data communications market, including public message (telegram) service, was $353 million, or 10% of the total. Of this total, computer communications accounted for $197 million (56%) and message record accounted for $156 million (44%); the last includes $17 million for public message service. The broadcast transmission market, at $25 million, was 0.7% of the total.

All the above figures are given in current dollars. No reliable deflators are available for these revenues, or for individual services within these markets. The problem of output measurement and comparison is a serious one, and it is dealt with at greater length in the next section.

2.2.2 Problems of Output Measurement

Both the Telcos and the Telegraph/Cable companies produce a large variety of outputs. The diversity in products and services has increased steadily over the last 25 years. The best available output measures are those produced by Bell Canada. These measures consist of current and constant dollar revenue series for Local, Message Toll, Other Toll and Miscellaneous services. The Bell Implicit Deflator for Operating Revenues was constructed from these series, and has been used to obtain deflated revenues for both the Telcos and the Telegraph/Cable companies. Its appropriateness for the second case is questionable, but in no other measure was readily available.

It is instructive to examine some alternative measures of output for the Telcos. Visible outputs include the number of telephones in service, the number of local calls and the number of long distance calls; these are tabulated in Table 2.1 together with their annual percentage changes. The greatest percentage increase in the number of telephones occurred between 1945 and 1957, when Residence Main telephones increased from about 50 to 87 per 100 households. Large percentage increases in the number of long distance messages occurred in 1955-56, with the introduction of Direct Distance Dial (DDD) service, and in 1972-75, following the introduction of the 1 minute call.

Local and Message Toll services provide about 85% of the Telcos' total revenues. Basic local service is currently sold at a flat monthly rate, based upon the number of telephones that can be reached through the local exchanges; business customers pay up to three times more for this service than

residential customers. Substantial local service revenues are derived from extension telephones, and auxiliary services charged on a recurring or non-recurring basis. Because usage sensitive pricing is not applied by the Canadian Telcos to local traffic, there is no direct correlation between the number of local calls and local service revenues. Indicators based on the

Table 2.2 Bell Canada Alternative Output Indicators, 1976

(Indices 1952 = 1.00)

Indicator	Index Value	
	Bell	All Telcos
1. Local Service Revenues, Constant Dollars	6.17	
2. Number of Local Calls	3.71	4.06
3. Total Number of Telephones	4.03	4.31
4. Number of Main Stations	3.54	
5. Number of Residence Main Stations	3.47	
6. Number of Business Main Stations	3.82	
7. Message Toll Revenues, Constant Dollars	10.17	
8. Number of Toll Calls	5.82	7.82

number of calls or number of telephones in service underestimate the revenue growth because auxiliary service revenues are not accounted for; this is illustrated in Table 2.2.

For toll messages, Telco pricing schedules charge by duration of call, distance, time of day, day of week and type of call. Using the number of toll calls as an output indicator underestimates the actual revenue growth, as shown in Table 2.2. This is predominantly because the distance and duration factors are not included in any indicator based upon the number of calls; there has been a significant relative shift of toll calls into the longer distance bands, thus resulting in higher revenues per call.

2.2.3 Revenue Growth to 1977

The growth in operating revenues for the Telcos and Telegraph/Cable companies is shown in Table 2.3, both in current and constant 1971 dollars; the latter series were derived using the Bell Implicit Deflator. The corresponding revenues for the total Telecommunications sector, the annual percentage changes and the Telco percentage share are also shown; this Telco share increased from 91.26% in 1957 to 92.73% in 1977.

Telco operating revenues, in current dollars, had a compound annual growth rate of 10.40% for the period 1952-77 and 12.68% for the period 1966-77, the latter rate reflecting the higher price inflation from 1969 onwards. For constant dollar revenues, the corresponding compound annual growth rates were 9.24% and 9.72%. These growth rates are considerably higher than those

achieved in many other sectors of the Canadian economy, over a comparable period. The average annual percentage change, in constant dollar revenues, was 10.54% over the period 1971-77, but there was a considerable slackening of real growth in 1977. It is not clear, however, whether this slackening in 1977 represents a temporary phenomenon or the start of a new trend.

2.2.4 Revenue Projections to 1985

Operating revenues, in both current and constant 1971 dollars, have been projected to 1985 using historical trends for the period 1966-77. The results are tabulated for the Telcos in Table 2.4 and for the Telegraph/Cable companies in Table 2.5; a range of low and high forecasts are given in all cases. The high forecasts are based on the exponential curve, using the historical compound annual growth rate, and the low forecasts on the growth curve, which has a declining rate of growth over the projection period.

The Telco operating revenues (Table 2.4), in current dollars, increased by 181.80% over the 8 year period 1969-77, from $1367.6m to $3853.9m. Over the next 8 year period 1977-85, they would increase by 113.94% to $8245.2m under the low forecast, and by 143.12% to $9369.5m under the high forecast. It should be noted, however, that the low and high forecasts do not represent strict lower and upper bounds. In constant dollars, the revenues increased by 110.02% over the period 1969-77, from $1455.4m to $3056.6m. Over the period 1977-85, they would increase by 41.37% to $4321.2m, under the low forecast, and by 75.10% to $6342.7m under the high forecast. Again, it should be noted that

very much higher forecasts can be obtained by using a Gompertz curve, which exhibits an increasing rate of growth over the forecast period.

The operating revenues for the Telegrph/Cable companies (Table 2.5), in current dollars, increased by 138.63% over the period 1969-77, from $126.6m to $302.1m. Over the next 8 year period 1977-85, they would increase by 91.89% to $579.7m, under the low forecast, and by 140.19% to $725.6m, under the high forecast. In constant dollars, the revenues increased by 77.88% over 1969-77, from $134.7m to $239.6m. Over 1977-85, they would increase by 51.79% to $363.7m, under the low forecast and by 106.18% to $494.0m, under the high forecast.

For the telecommunications sector as a whole, in the period 1969-77 current dollar revenues increased by 178.14%, from $1494.2m to $4156.0m, and constant dollar revenues by 107.30%, from $1590.0m to $3296.1m. Summing the two sets of projections in Tables 2.4 and 2.5 would give low and high forecasts of $8824.9m and $10095.1m, in current dollars, for 1985; these would represent increases of 112.34% and 142.90% over the operating revenues for 1977. Similarly, in constant dollars, the low and high forecasts for the telecommunications sector operating revenues in 1985 would be $4684.9m and $6836.7m; the increases over the 1977 operating revenues being 42.13% and 107.42% respectively.

2.3 Production Process Outlook

In this section we shall examine historical productivity trends, and also look at the effects which new technologies are likely to have on the production process, in the medium term future.

2.3.1 Productivity Trends

It is customary in economic analysis to use productivity performance in order to measure a firm's progress in the presence of technological innovations. The most satisfactory measure of the growth of productivity, for this purpose, is that of Total Factor Productivity (TFP) growth, i.e. the proportionate excess of output growth over input growth.

No TFP measures are available for the telecommunications industry as a whole, but a number of individual Telcos do produce productivity measures of their own. Since Bell Canada accounts for about 55% of the total Telco output, and a recent DOC study of Bell is available, its productivity growth will be taken as representative of the industry as a whole. Using a Divisia Index of TFP based upon gross output, the DOC study determined a growth rate of 3.67% a year for the period 1952-1976. The official Bell Canada Laspeyres real value-added index shows a productivity growth of 4.03% over the same period.

A TFP growth rate of 3.67% is very impressive, being almost 4 times the rate of growth experienced by Canadian manufacturing during this period. It should be noted, however that this result is highly dependent on the constant dollar output concept used by Bell Canada. Using an alternative measurement of output, messages produced, caused the productivity growth rate

to fall to 1.38%! The 3.67% and 1.38% figures probably represent upper and lower bounds to Bell Canada's actual productivity growth rate. Moreover, technical change is only one of the contributing factors to TFP growth. The DOC study, although very preliminary, does suggest that scale effects and non-marginal cost pricing could also be important elements affecting TFP in the case of Bell.

The main technological changes and innovations which have occurred over this period are the introduction of microwave transmision for long haul links, progressively more sophisticated switching equipment (No. 5 Crossbar, Electronic switching, DMS switches), and the introduction of Direct Distance Dialing (DDD). Digital data networks such as Dataroute (TCTS) and Infodat (CNCP) have come into use since 1974, and packet-switched data networks such as Datapac (TCTS) and Infoswitch (CNCP) are coming into use, but these changes are too recent, and affected too small a proportion of the total output before 1976, to have had much impact on the productivity growth discussed above. Satellite transmission is another innovation which will be used to a much greater extent in the future. All the American carriers entering the "Office of the Future" market have very ambitions plans in this respect, and "sky wars" may soon break out in the U.S.

2.3.2 Effect of New Technologies

The new technologies making the greatest change in telecommunications are very large scale integrated circuits (VLSI), digital technology, opto-electronic systems including fibre optics, satellites, new electronic

information storage and retrieval devices, and specialized software for programmable devices. Breakthroughs in these and related areas are providing great potential cost reductions in switching and transmission equipment, increased flexibility in transmission and processing, increased storage and retrieval capabilities, greater reliability and easier servicing.

Additionally, breakthroughs in these technologies are providing compatibility among different types of signals, allowing voice, data, television, radio and other communications to travel through a single communications medium, with equal ease and without costly conversion. This feature has given rise to the concept of the "Single Integrated Plant" for all telecommunications services, which is naturally championed by the Telcos. In this concept the "Economy of Scope" argument is carried to its logical conclusion.

The Telcos see the switched public telephone network evolving from a narrow-band, analogue network designed essentially for voice communications, to a broadband digital network capable of carrying voice, video, data and many other types of signals. All signals would be transmitted in digital form, thus allowing efficient multiplexing and optimal use of broadband, high-speed, long-haul links. Such broadband, digital switched networks would be capable of supporting all the services which are currently being planned for the "Ofice of the Future" and the "Home of the Future".

The complete replacement of the current public switched network by a broadband switched network will, naturally, not occur with the next 10 years. The replacement of the twisted-pair copper wires which form the local

distribution links, by fibre optic cables or other broadband loops, is a slow process which may take 20-30 years to complete. But the enhancement of the public network with digital switching and transmission facilities is already well underway, and can be expected to make significant progress by 1985.

Special purpose digital network communications services for voice, data, message/record, facsimilie and other sophisticated forms of business communications should be well established by 1985. Two packet switched networks, Datapac and Infoswitch, are currently operational in Canada; these networks are operated by TCTS and CNCP respectively. In the U.S., three major new "intelligent network" services are currently being planned. They are:

a) ACS - Advanced Communications Service, a data communication service proposed by the Bell system; this has run into major delays due to a combination of technical and regulatory problems.

b) SBS - A total communications service proposed by Satellite Business Systems, a joint venture of IBM, Comsat and Aetna Life; this should be operational by 1981.

c) XTEN- Xerox Telecommunications Network, an electronic message service proposed by Xerox, which could also be operational by 1981.

SBS will make use of direct broadcasting satellites, ultra-high speed links (6.3 million bits per second), and rooftop dish antennas for local distribution. Xten will use satellite transmission for the long-haul links, and cellular radio techniques for local distribution. Both systems would bypass the terrestrial, switched telephone network.

The Canadian telecommunications carriers must acquire the ability to compete against these new network offerings. The alternative is to risk the loss of a large portion of the sophisticated business communications market. Upgrading Canadian network service will be a costly process, which will make considerable demands on scarce capital resources. This problem is discussed further in the next section.

2.4 Factor Demand Outlook

The telecommunications sector has been characterized by considerable technological innovation during the past 25 years, and is likely to witness even greater technological change over the next ten years. It is important to examine the effects of this technological innovation upon the level and mix of employment on the one hand, and upon the capital intensity required for production on the other. A commonly held view is that technological innovation increases the capital intensity required for producing a given level of output, while reducing both the total cost and the amount of labour required. However, it is important to determine the impact upon the employment mix, as well as that on the employment level.

2.4.1 Trends in Employment and Output Per Employee

The number of full-time employees working for the Telcos and Telegraph /Cable Companies is shown in Table 2.6, and the revenue output per employee, in constant 1971 dollars, is given in Table 2.7. Since the trends are quite different for the two components of the sub-sector, they will be examined separately.

The number of Telco employees grew from 64,074 in 1957 to 87,546 in 1977, an increase of 36.63%. This increase was not smooth, however, and can be divided into four phases. From 1957 to 1961 the number of employees declined by 12.10%; this was largely due to the introduction of DDD service and the consequent reduction in the number of operators. For 1961-66, the growth was 21.15%, or just under 4% a year. Between 1966 and 1970 the number fluctuated, with no visible growth. For the period 1970-77, the number of employees has increased steadily, the total growth being 28.10%, or just over 5% a year.

The revenue output per employee, in constant 1971 dollars, has increased steadily from $8,168 in 1957 to $34,914 in 1977, an increase of 327.45% which is equivalent to a compound annual growth rate of about 7.5%.

A recent DOC sponsored study of Bell Canada, the largest Telco, has shown that all aggregate inputs to the production process, viz. labour, capital and materials, have inelastic demands with respect to their own prices. Labour and capital and labour and materials were found to be substitutes in production, while capital and materials were found to be weak complements. The study used

four labour categories: telephone operators, plant craftsmen, clerical workers and an aggregation called "white collar" workers, which consisted of executives, foremen, supervisors and other non-supervisory staff. The effect of technical innovation on the mix of employment was found to be quite striking. For a given level of output, an increase in DDD facilities was accompanied by a decline in the numbers of operators and clerical workers, and an increase in the numbers of plant craftsmen and white collar employees. Technical innovation was accompanied by an increase in capital intensity and decline in total employment, but there was a substitute relationship between capital and the numbers of operators and clerical workers, and a complementary relationship with the other two categories.

These effects and trends are illustrated in Table 2.8, which gives Bell Canada's distribution of employees by various categories, at 5 year intervals from 1957 to 1977, as well as the revenue output and the plant in service for those years. The traffic category, largely operators, has declined from 33.8% of the total number of employees in 1957 to 20.1% in 1977. The plant category, which includes craftsmen and maintenance workers, has retained its 35% share; the commercial and marketing category, which includes the bulk of clerical workers, has also remained in the 12-13% range. The major increases have occurred in the comptroller, engineering and other categories, who are primarily "white collar" supervisory or professional workers

For the Telegraph/Cable component of the telecommunications sub-sector, the behaviour is dominated by events within the CNCP consortium. The steady decline of public message service (telegrams), combined with the

innovation of allowing telegrams to be filed by telephone (68% in 1976) and through the use of Telex terminals (24% in 1976), has led to a steady phasing out and consolidation of telegraph offices. In 1961, the total number of employees engaged in the telegraph service was 9,997; by 1976, this had dropped to 1,080. The growth in employment resulting from CNCP's other telecommunications services, and from the operations of Teleglobe and Telesat (established in 1969), was not sufficient to completely offset this decline; the number of employees for the Telegraph/Cable companies therefore declined by 38.50% between 1957 and 1977.

This decline of employment in the labour-intensive public message service, combined with the use of modern technology, very similar to the Telcos, for other telecommunications services, has led to a rapid growth in the revenue output per employee. In 1957, revenue output per employee was $4,492; the corresponding figure for the Telcos was 81.83% greater at $8,168. By 1977, the revenue output per employee had increased to $34,910, an increase of 677.2%, and was almost identical to that of the Telcos. Even allowing for the problem of deflation, it can be seen that the two outputs have been almost equal since 1973. As a working hypothesis, therefore, it may be assumed that the two components of the telecommunications sub-sector have become homogeneous with respect to revenue output per employee, and will continue to remain so for the medium term future.

2.4.2 Telecommunications Plant and Investment Trends

The telecommuniations carrier industry is a heavy user of capital resources. Table 2.9 gives the gross plant at cost, net plant and net plant per per employee for the Telcos and the Telegraph/Cable companies, as well as the Telco percentage share of the net plant for the sub-sector. Two characteristics are noticeable. First, the Telcos have more net plant per employee than the Telegraph/Cable companies, although the difference is decreasing; it was 44.44% in 1967 and 33.33% in 1977. Secondly, as a comparison of Tables 2.3 and 2.9 will indicate, the Telcos' share of net plant is slightly higher than their share of operating revenues for the sub-sector. The Telcos had 91.67% of the total net plant in 1967 and 94.44% in 1977; their corresponding shares for operating revenues were 91.56% and 92.73%. In 1967 the Telcos produced $298 of operating revenues, in current dollars, per $1,000 of net plant, and the Telegraph/Cable companies produced $302. By 1977, these figures had increased to $361 for the Telcos and $481 for the Telegraph/Cable Companies, a difference of 33% in favour of the latter.

The corresponding calculations, using constant 1971 dollars for both operating revenues and net plant, are more difficult to make because a consistent and suitable price index series for telecommunications plant is not currently available in the public domain. Statistics Canada has, however, recently published price indices for capital expenditures on plant and equipment in the telephone industry (Statistics Canada Catalogue 13-568, p. 302). The implicit price index for all expenditure components has a value of 87.1 in 1967 and 178.9 in 1977. If this series is used as a proxy to deflate the net plant for both the Telcos and the Telegraph/Cable companies, then the following

results are obtained in constant 1971 dollars. The operating revenues per $1,000 of net plant in 1967 are $277 for the Telcos and $281 for the Telegraph/Cable companies; the corresponding revenues in 1977 are $512 and $681. Thus one may conclude that the ratio of operating revenues to net plant, which was almost equal for the two groups in 1967, is now almost 33% greater for the Telegraph/Cable companies.

The following breakdown for telephone industry plant is given in Catalogue 56-201, Table 26. On 31 December 1971, the total telephone plant, at cost, was $14,532m; of this total, $13,955m (96.03%) was plant in service and $563m (3.87%) was plant under constructure. The plant in service is further broken down as follows: Land and Buildings $1,148m (8.22%), Outside Plant $4,184m (29.98%), Central Office Equipment $5,357m (38.39%), Station Equipment $2,800m (20.07%) and General and Other Euquipment $466m (3.34%).

Construction expenditures for the Telcos were $1,680m in 1975, $1,800m in 1976, an increase of 7.1%, and $1,905m in 1977, an increase 5.8%. Corresponding construction expenditures for the Telegraph/Cable companies were $77m in 1975, $71m in 1976, a decrease of 7.8%, and $79m in 1977, an increase of 11.3%. For the telecommunications sub-sector as a whole, construction expenditures were $1.755m in 1975, $1,871m in 1976 and $1,984m in 1977.

2.4.3 Future Demand for Investment

The Department of Communications, in cooperation with the Canadian Telecommunications Carriers Association (CTCA), ~~is~~ has prepared a report which

reviews the telecommunications equipment outlays of the principal Canadian carriers for the years 1973-77, and examines what their corresponding requirements are expected to be over the period 1978-82. The main results are summarized in Table 2.10.

This survey, which was carried out in mid-1978, requested the 19 corporate members of CTCA (see Appendix I) to supply information regarding their final 1972-77 expenditures, current 1978 outlays and anticipated 1979-82 spending for the acquisition of central office, outside plant and terminal (station apparatus) equipment. Outlays for the acquisition of land, buildings and vehicles were not included. These categories must, therefore, be excluded in any comparisons with Statistics Canada data for plant and investment. The expenditures reported also include, where applicable, a capitalized element related to the value of labour necessary to bring certain equipment into operation. For all CTCA members, the amount involved is approximately 25% of total spending on equipment.

The principal Canadian telecommunications carriers spent about $6.9 billion during the 5 year period 1973-77, for the acquisition and installation of new telecommunications equipment. Over the next 5 year period 1978-1982, they plan to spend another $9.9 billion, for a total expenditure of $16.8 billion for the decade 1973-82.

The $6,898.4m spend during 1973-77 breaks down as follows: Central Office Equipment $3,113.9m (45.14%), Outside Plant $2,010.4m (29.14%) and Station Apparatus $1,773.8 (25.71%). The planned expenditure of $9,937.3m

during 1978-82 breaks down as follows: Central Office Equipment $4,036.6m (40.62%), Outside Plant $2,9672.2m (29.45%) and Station Apparatus $2,974.4m (29.93%). Thus the decrease in the percentage share of expenditures for central office equipment will be roughly made up by the increased expenditure for station apparatus; the percentage share of expenditures for outside plant will remain almost unchanged.

In absolute terms, central office equipment will continue to be the main area of carriers' equipment expenditures for the years 1978-82, but the great importance attained by this category in the mid-seventies, as a result of the widespread introduction of the electronic switch, may be reduced to a more normal trend level in the coming years.

Station apparatus expenditures for 1978-82 are expected to overtake those for outside plant over the same period. This increase is due to the sustained interest, on the part of carriers since 1975, for the aggressive marketing of all types of terminal equipment, and the rapid increases in labour connection charges which have taken place in recent years.

2.5 Sources of Uncertainty and Policy Changes

Issues related to monopoly, competition, technical change and regulation are central to the performance of the telecommunications industry. These issues deal with how the boundary should be drawn between monopoly and competitive services to best serve the public interest, and how rates should be

established for a variety of such services, in order to meet a set of efficiency and equity goals which are sometimes in conflict.

Rapid technical change is the principal agent which is eroding the traditional monopoly boundaries of the telephone companies. The new technologies have brought new suppliers of telecommunications hardware and services into the market, and created strong pressures for both terminal attachment and systems interconnection to the public switched telephone network. In the U.S., there has been a strong trend towards increased competition for the last 11 years, and competition is now a fact of life for the American Telcos, especially AT&T. There is much less competition in the Canadian telecommunications market; public telephone local and message toll services, which represent over 85% of the total market, are still provided by the Telcos on a monopoly basis, while private line voice, data communications and message record services are provided on a duopoly basis by TCTS members and CNCP. The ~~recent~~ CRTC Decision, Telecom 79-11, approving CNCP's application for two types of interconnection to Bell Canada's local exchange facilities, ~~is~~ was a significant landmark in the history of the Canadian telecommunications industry. But while it improves CNCP's competitive position in the duopoly, it does not necessarily confer similar rights to other potential competitors.

These potential competitors are primarily interested in the fast-developing market for integrated business communications, including sophisticated voice, data, message record and facsimilie services. They can be divided into two distinct categories. The first consists of the American Specialized Common Carriers (SCCs) and Value Added Carriers (VACs); currently,

neither type of carrier exists in the domestic Canadian market. The second category consists of the cable television companies, who could use their wideband local distribution network, in conjunction with long-haul transmission facilities acquired either from the existing Canadian telecommunications carriers, or some other source.

Competition from the cable companies would not reduce Canadian telecommunications revenues, although it would affect the carriers' share of such revenues. Competition by the American SCCs and VACs, especially the giant new entrants, Satellite Business Systems (SBS) and Xerox, could be a very different proposition. The Canadian carriers expect to benefit in a major way from the expansion of the telecommunications market which, it is hoped, will be brought about by the introduction of new home and business services over the next 10 years. SBS and Xerox could, however, acquire a large share of the sophisticated business communications market associated with "Office of the Future" applications, if allowed to operate freely in Canada. Such a situation could further exacerbate revenue losses to Canadian carriers and EDP suppliers caused by trans-border data flows. The problems associated with trans-border data flows are described in a companion report.

The final source of uncertainty stems from Federal/Provincial jurisdictional issues and disputes. Provincial regulatory objectives and interests can differ considerably from federal ones. The provinces are particularly concerned with CRTC decisions which may have an impact on provincially regulated carriers. Most of the provinces intervened, directly or indirectly, in the CNCP Interconnection case. If the CRTC were to lose its

jurisdiction over some of the carriers it currently regulates, which together represent over two-thirds of the revenues and assets of the industry, then these carriers would have to operate in an unfamiliar regulatory climate, which may adversely affect their performance and revenues.

Some measures of Federal/Provincial co-operation are, however, also evident. A joint Working Group has been formed to study issues related to competition policy; it has produced a set of draft objectives and guidelines. Another significant first step towards greater co-operation and consultation between federal and provincial telecommunicatins regulatory agencies occurred with the establishment of an inter-regulatory committee to monitor the current TCTS rate case.

3. The Broadcasting and Cable Television Industry

3.1 Introduction

The cable television and broadcasting industry represents the second major component of the communications sector. Although it is relatively small in terms of its contribution to GDP and of the level of employment it generates, it has, perhaps more than any other industry, influenced the social and cultural life of Canadians. For instance it is estimated that more than 95% of all households in Canada own a TV set and that the average Canadian spends in excess of 20 hours a week watching television. For this very reason this industry has constantly been under public scrutiny and the complex policy issues which arise in this area have been the subject of many lively debates.

The purpose of this chapter is twofold. First of all we shall describe the structure and regulatory environment of the industry, analyze its historical performance in terms of revenues and employment and attempt to forecast the historical trends to 1985. The second part of the chapter will be devoted to an assessment of important developments which may significantly affect the future of the industry and have a major impact on the social and cultural fabric of this country. These include major technical innovations such as fibre optics and direct broadcasting satellites which will enhance considerably the capacity of the networks and the range of services available to final users. We shall also review some of the complex and pressing policy issues which will have to be resolved over the next few years and which can significantly affect both the structure and performance of the industry.

3.2 Industry Structure and Regulatory Environment

Broadcasting is defined in the Broadcasting Act as any radio communication in which transmissions are intended for direct reception by the general public. Broadcasting undertakings fall into two main categories: broadcasters or "broadcasting transmitting undertakings" and the cable companies or "broadcasting receiving undertakings" who distribute signals received off the air and programs they have themselves produced.

In what follows we shall first indicate how the broadcasting and cable components of the industry have been defined in this report and gives a brief overview of the regulatory environment in which the industry operates. The balance of the section will be devoted to a more detailed analysis of the structure and main characteristics of the broadcasting and cable components. This will provide the necessary foundations for analyzing in section 3.3 the past performance and future prospects of the industry.

Broadcasters, as they are defined in this report, include all commercial broadcasting stations (both radio and television), a regional network (Global Communications Limited) and two national networks (CTV Television Network Limited and the Canadian Broadcasting Corporation). Non-commercial broadcasting stations, other than the CBC such as those operated by provincial governments (e.g. OECA) are not included. The cable industry is defined here to include all broadcasting receiving undertakings licensed to operate in Canada by the CRTC. It is to be noted that this definition excludes companies which do not have a receiving antenna and feed programming directly into a cable

distribution system (e.g. closed circuit television) and are not considered as "broadcasting receiving undertakings" under the Broadcasting Act.

The broadcasting industry has both a public and a private component. The public component consists essentially of the CBC which came into operation in 1936 and expanded into television early in the 1950's. Although the CBC is a public broadcasting system, it obtains its national coverage by the use of affiliated private stations. For this reason, it is not possible to draw a precise dividing line between the public and private sectors. In 1977/78, there were 37 CBC owned and operated originating AM radio stations, 97 CBC affiliates, 23 CBC owned and operated FM radio stations, 30 CBC owned and operated television stations and 32 CBC affiliated TV stations.

In private radio broadcasting, there were 245 AM originating stations and 115 FM originating stations as of March 31, 1978. Private television accounted for 39 originating stations.

In addition, there are a great number of rebroadcasting stations, that is, licensed broadcasting stations which do not originate programs, but which are programmed exclusively by off-air pickup from a parent broadcasting station.

Cable systems began to appear in Canada from about 1952. By 1977, there were 467 cable systems licensed by the CRTC including 40 under various stages of development and not operating. The total number of subscribers to these systems was 3.4 million households or 48.5 per cent of total households in Canada.

The Canadian Radio-Television Commission, which was created by the enactment of the 1968 Broadcasting Act, has wide-ranging regulatory powers over all elements of the Canadian broadcasting system: private television, radio and cable television and the CBC. The CRTC is responsible for implementing the Broadcasting Policy for Canada which is laid down in the Act.

In order to carry out its responsibilities, the CRTC was given powers to issue, amend, renew and revoke broadcasting licences, to make regulations regarding programming, to hold public hearings, and to attach conditions to licences.

Two safeguards were reserved: first, the Governor in Council was empowered to give directions to the CRTC on a number of matters such as the maximum number of broadcasting frequencies in a given area, and the classes of applicants to whom broadcasting licences may not be issued. The second safeguard reserved to the Government the right to set aside or refer back licensing decisions of the CRTC.

3.2.1 Television and Radio Broadcasting

Broadcasters of both television and radio signals produce what is basically a public good; that is a product for which it is impossible to exclude additional consumers. Since privately-owned stations are therefore unable to recapture directly from their consumers funds to cover their broadcasting expenses they must turn to other sources for these funds. The most important of these alternative sources in Canada for private broadcasters is advertising revenues from the sale of air time for commercial purposes.

When advertising is the prime source of revenue, broadcasters are really in the business of broadcasting programs to produce audiences. These audiences, or more precisely means of access to them, are then sold to advertisers. Firms in the radio and television industries, the sellers of radio and television time, engage in both competition for audience and price competition of air time.

Revenues sources other than advertising include production and syndication revenue. In addition, the CBC receives funds from Parliament to cover the net cost of operation. In 1977, the net cost of operation amounted to $397 million or 85% of the CBC's total requirements.

Entry into broadcasting markets in Canada is restricted. There are two reasons for this. One is that television and radio broadcasting make use of the electromagnetic spectrum, a scarce public resource. There are many other competing uses of the spectrum in the bands suitable for broadcasting, such as land mobile radio, and hence only a limited number of frequencies in any given area can be allocated to broadcasting. In addition, the need to co-ordinate frequencies to prevent interference with other signals reduces the number still further. Indeed, under existing technology, while the High Frequency Spectrum affords space for thousands of simultaneous voice transmissions, less than five colour TV signals consume an equivalent width.

There is another reason for restricting entry into radio and television markets - the protection of a Canadian cultural identity. For this reason a central focus of regulation of the mass media in Canada has been to protect the revenues of private broadcasters by barriers to entry, in order to

help finance Canadian programming. Moreover, Canadian content quotas have been imposed in an attempt to ensure that such programming is, in fact, undertaken.

3.2.2 The Cable Television Industry

Although cable television was introduced in Canada as early as 1952, the major growth of the industry has occurred since the late 60's as cable distribution expanded rapidly in urban centers.

A cable system consists of a head end which receives and amplifies the broadcast signals received off-air, trunk lines which connect the headend to service areas and distribution cables which link the trunk lines to the customer's television set. In addition, the cable system may also include microwave links between a distant head-end and a local head-end when signals cannot be captured off-air locally.

Because of this particular technology cable systems are characterized by high fixed costs (head ends and trunk lines) and low marginal costs of increasing penetration (distribution cables). Consequently high penetration is a critical determinant of profitability for cable companies and competition is undesirable since lower costs are achieved when there is only one supplier in a given local area.

On the demand side, the high penetration which has been achieved by cable in this country suggests that "free" off-air television is not a good substitute for cable. This is supported by recent studies which indicate that

with existing fees, the demand for cable services is inelastic with respect to price.

Hence both from a demand and a supply point of view cable distribution appears to have significant monopolistic characteristics.

This is reinforced by the high degree of corporate concentration of the industry nation wide. The four largest undertakings (Premier Cablevision, Canadian Cable Systems, Maclean-Hunter Cable TV and Roger's Cable) serve almost 50 per cent of all subscribers in Canada.

Despite these monopolistic conditions the industry has not been subject to the same degree of regulation as other services provided on a monopolistic basis, such as for instance telecommunications services. In particular, no constraints similar to those applied to telephone companies have been imposed on the cable companies' rate of return although the fees they change their customers are regulated by the CRTC. As a result cable companies have been able to achieve extremely healthy profits in recent years and they have considerably diversified their activities.

3.3 Past Performance and Future Prospects - Radio and Television Broadcasting

In the previous section the structure and main characteristics of the broadcasting and cable industries were reviewed. Based on this analysis, we shall evaluate here the part performance of the industry in terms of its revenue, employment and capital formation. Finally we shall assess future prospects for the industry by projecting revenues to 1985.

3.3.1 Revenue Performance

The operating revenues of the broadcasting industry over the period 1956-1977 are shown in Table 3.1, both with and without parliamentary appropriations to the CBC.

Table 3.2

Growth of Revenues in the Radio and Television Broadcasting Industry, 1967-1977

(Current Dollars)

	1967-1977 Percentage Increase	1972-1977 Percentage Increase
CBC: revenues (excluding funds from Parliament)	114	77
CBC: total requirements	210	101
Private sector: television	249	132
radio	205	88
Nominal GNP	213	97

Source: CRTC Special Report on Broadcasting in Canada 1968-1978

The table shows that while the CBC's total requirements grew at about the same rate as GNP, total revenues earned increased at only just over half that rate. This is partly due to the policy decision to abandon

advertising on radio, except for certain proprietary programs. In 1967, revenues earned amounted to about 21 per cent of total requirements; this proportion fell to 15 per cent in 1977.

The private television industry, as a whole, has experienced a very healthy revenue performance. Total revenues in current dollars increased from $95 million in 1972 to $332 million in 1977, or by 249 per cent, and operating profits from $16 million to $81 million, or by 406 per cent.

From 1967 to 1977, the total revenues of private radio stations increased from $89 to $271 million, or by 205 per cent. The rate of growth slowed in the second half of the period, when revenues increased by only 88 per cent as compared with 132 per cent for television.

FM radio has expanded particularly rapidly. Revenues increased from $5.1 million in 1972 to $25.1 million in 1977, representing a growth of 392 per cent, exceeding other radio and television revenues. However, FM revenues represented only 9 per cent of total private radio revenues in 1977.

3.3.2 Recent Employment Trends

Employment trends for the broadcasting industry for the period 1967-1977 are presented below in Table 3.3.

Table 3.3

Employment growth in Broadcasting

Radio and Television Broadcasting

	Number	% Change
1967	18,946	
1968	19,232	1.5
1969	19,541	1.6
1970	19,576	0.2
1971	19,789	1.1
1972	20,124	1.7
1973	21,162	5.2
1974	22,261	5.1
1975	23,497	5.6
1976	24,680	5.0
1977	25,651	3.9
1978	26,851	4.7

Over the period 1967-1977, total employment has increased by 35 per cent compared with revenue growth of 213 percent over the same period.

The distribution of employees by category for 1978 is shown in Table 3.4. Over sixty per cent of the employees in the industry were engaged in program origination.

Table 3.4

Employment in the Broadcasting Sector, 1978

Category	Radio and TV
Program	16,671
Technical	2,007
Sales and Promotion	2,690
Administration and General	5,483
Total	26,851

3.3.3 Recent Investment Trends

Capital expenditures for the major components of the broadcasting industry are shown in Table 3.5. Totals have not been calculated because of different sources and reporting periods for the various components.

Table 3.5

Capital Expenditures - Broadcasting Industry

(Millions of current dollars)

	Private Radio and TV	CBC
1972	18.0	n.a.
1973	15.3	31.0
1974	41.1	57.9
1975	37.2	61.4
1976	36.1	62.5
1977	52.7	64.1

1 year ending August 31 (i.e. 1977 refers to period Sept 1/76 - Aug 31/77).

2 year ending March 31 (i.e. 1977 refers to Apr 1/77 to Mar 31/78).

For private radio and TV, of the total $256 million of property (valued at historical cost), plant and equipment in use in 1977, studio and technical equipment accounted for $105 million, transmission equipment for $36 million, buildings for $54 million, and tower and antenna systems for $18 million.

The recent CBC licence renewal application gives useful information on the CBC's capital expenditures. Table 3.6 is reproduced from the application. It shows that in recent years the CBC's capital expenditures have been divided into two main categories: extension of service and production facilities.

Capital spending for extension of service (primarily under the Accelerated Coverage Plan) increased from $9 million in 1973/74 to $42.1 million in 1977/78. This involved the addition of more than 150 transmission facilities since 1973. The CBC distribution system now involves the Anik satellite, major satellite earth stations, remote satellite receive stations, terrestrial networks, broadcast stations and rebroadcasting transmitters. The CBC is currently reviewing its current and future distribution requirements in the light of new technological developments.

The production facilities of the CBC have been receiving a decreasing share of total capital expenditures since 1973/74, declining from 71 per cent of total capital expenditures to 34 per cent in 1977/78. The licence renewal application goes on to state "Although we will be adding some facilities to extend local and regional programming services, no further major additions to network production capacity are currently planned".

3.3.4 Revenue Outlook to 1985

The forecasts were carried out by fitting a number of functional forms to the data for two periods: 1956-1977 and 1966-1977. Forecasts obtained using the last twelve years were consistently higher than those using the full range of historical data, as would be expected, due to the rate of price inflation in recent years. Since there is no reason to expect that the trend of price inflation will not continue in the current environment, the forecasts presented are based on the last 12 years only. Given this decision, a functional form (or forms) (e.g. exponential, straight line, Gompertz) was chosen on the basis of goodness of fit statistics, tracking ability over the last few years, the

randomness of the errors in the predicted vs actual revenues and judgement regarding the reasonableness of the forecasts. The "best" forecasts, judged by these criteria, are shown for radio and TV broadcasting with and without parliamentary appropriations in Table 3.7 below. We have chosen to show a range rather than one specific forecast, due to the many uncertainties facing this industry, as discussed later in this chapter.

The low forecast is based on an average rate of revenue growth of 12.1% per year without parliamentary appropriations and 12.6% per year with parliamentary appropriations. These figures are in close agreement with recent growth rates and with rates of advertising revenue growth forecast in a recent consultant's report to DOC.[1] That study forecasts radio advertising to grow at 12% per year until 1990, and television advertising revenue to grow at 13.5% per year until 1990. However, a recent forecast by the Television Bureau calls for a 15% rate of growth in television advertising revenues over five years despite substantial rate increases coming into effect in September. Consequently the low forecast may be somewhat conservative.

Advertising prices can be expected to increase, both because of the general rate of price inflation, and secondly, because of the growing importance of radio and television as advertising media. The proportion of total Canadian advertising expenditures going to television increased from 12.4 per cent in 1966 to 14.9 per cent in 1976, and to radio from 9.9 per cent to 11.1 per cent. In this respect, the CTV network in June 1979 announced an

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1. TAMEC - Videotex Services - The Market Potential for Cable.

increase in its advertising rates of 30-40 per cent, citing increased program costs and inflation.

However, advertising revenues may not increase in pace with advertising prices. In determining their expenditures on a particular medium, advertisers take into account the cost per viewer reached. Therefore audience is a very important determinant of advertising revenue.

Total audience can be expected to increase more slowly than in the past. Audience coverage in Canada has effectively reached the saturation point. By 1977, it is estimated that less than 200,000 of Canada's seven million households did not have a television set. In addition, because of the slowing birth rate, the total viewing population of Canada will not grow rapidly over the next six years. Moreover, there are indications of a growing disenchantment with television by the general public and a corresponding reduction of average viewing time. Finally, the carriage of U.S. signals on Canadian cable systems, the growth of provincial television, and the plethora of new services available or expected to be available by 1985 such as videodiscs, pay TV and video games all represent competition for viewing and listening hours to traditional television and radio. All these developments may be expected to have adverse effects on advertising revenues, particularly for commercial broadcasters.

Uncertainty also prevails for public broadcasting systems. Regarding parliamentary appropriations to the CBC, the Clyne Committee report (referenced in detail later) notes that "no federal administration has been willing to take the legislative action that would make long term financing a statutory

obligation. There has been some informal agreement in recent years, but this has not deterred the government from making sharp budget reductions at short notice". In particular, the government has not maintained its commitment to give the CBC an annual 5% increase in its budget over and above inflation, due to fiscal restraint. It is anticipated that the likelihood of substantial public increases in public funding for the CBC in the near future is minimal.

Forecasted revenues may be understated to the extent that broadcasters diversify their sources of revenue by introducing new services which could be transmitted by satellite and distributed by cable, pay television being one possible example.

3.4 Past Performance and Future Prospects - Cable Television

3.4.1 Revenue Performance

Cable television has made substantial inroads in the market in Canada. In 1968, 710,000 households were cable subscribers. By 1977, the number had increased to 3,419,000, or 48 per cent of Canadian households. The total number of operating cable systems increased from 377 to 427.

The principal sources of revenue for the cable industry are subscriptions and installation fees. In 1977, of the total revenue of $215 million, 84.1% came from subscriptions from direct subscribers, 8.1% from indirect subscribers, 5.5% from installation fees and 2.1% from other sources.

Table 3.8 shows the historical growth of operating revenues of the cable television industry. Cable television has been one of the most rapidly growing industries in Canada. Its performance has been much healthier than that of radio and television broadcasting or the economy as a whole. Over the decade 1967-1977, cable television revenues increased 953 per cent, over four times the rate of growth of GNP. As a result, the share of cable television in total broadcasting revenues has increased from six to twenty per cent. A look at the year over year percentage change suggests, however, that this enormous growth is slowing down, as the industry reaches maturity.

There has been an even greater growth in operating profits. These increased from $1.6 million in 1967 to $45.1 million in 1977, or 2,800 per cent!

It is difficult to construct an output measure for cable television. Such a measure would have to take into account not only the number of hookups to cable (including second hookups in cabled homes), but also differences in services provided by different companies at one point in time, and by a given company over time.

A crude measure of output is the number of households subscribing to cable television. Table 3.9 shows the growth of subscribers over the period 1968-1977. In 1968, only 710,000 homes subscribed to cable television service, or 13.2 per cent of all the homes in Canada. By 1977, the number of subscribers had grown to 3,419,000, almost five times as many as in 1968, representing 48.5 per cent of total homes. This growth has been concentrated mostly in large communities for there are vast areas of Canada in which cable

service is not available. The rate of growth was strong until 1973-74, but since then has grown at a steadily slowing pace.

In fact, the extension of cable service is probably approaching its economic limits, since 71.7 per cent of all households were passed by cable by 1977. Saturation tendencies are revealed through penetration rates: the ratio of subscribers to homes passed by cable. These are shown in Table 3.10 below. 67.6% of the households passed, or 48.5 % of total households, subscribe to cable television. In British Columbia, especially, it seems that penetration rates cannot move higher than 85% - 86%, and any gains in subscribers will have to come from increases in the number of households passed and households in the licensed area. In the future, as we shall discuss, the industry can be expected to divert its energy to the provision of new services with new technology.

3.4.2 Recent Employment Trends

Employment trends for the cable industry for the period 1967-1978 are presented below in Table 3.11.

Table 3.11

Employment Growth in Cable Television

Year	Number	% Change
1967	1,657	
1968	1,367	-17.5
1969	1,601	17.1
1970	1,992	24.4
1971	2,180	9.4
1972	2,598	19.1
1973	3,098	19.2
1974	3,691	19.1
1975	4,084	10.6
1976	4,640	13.6
1977	4,838	4.2
1978	5,293	9.4

Over the period 1967-1977, total employment in cable companies has increased by 191 per cent compared with revenue growth of 953 per cent over the same period. Hence, employment in the cable component of the industry increased

much more rapidly than in broadcasting, rising from eight per cent of total employment in the industry in 1967 to sixteen per cent in 1977.

The distribution of employees by occupational category for 1977 is shown in Table 3.12. The predominant category was technical workers, reflecting the focus of the cable television subsector on distribution of broadcast signals, as opposed to origination.

Table 3.12

Employment in the Cable Subsector, 1977

Category	Number of Employees
Program	592
Technical	2,343
Sales and Promotion	409
Administration and General	1,494
Total	4,838

3.4.3 Recent Investment Trends

Capital expenditures for the cable component of the broadcasting industry are shown in Table 3.13.

Table 3.13

Capital Expenditures - Cable Industry

(millions of current dollars)

Year	Cable
1972	42.1
1973	45.2
1974	55.8
1975	55.5
1976	71.0
1977	75.8

In 1977 the cable television industry had property, plant and equipment valued at approximately $222 million representing a capital/labour ratio of $45,800 per employee. Of this total, distribution system and plant accounted for $125 million, subscriber drops and devices for $58 million and head-ends for $12 million.

3.4.4 Revenue Outlook to 1985

A recent consultant's report to DOC states 'Cable television is at a major crossroad. The industry is clearly faced with slower growth in the future. The number of subscribers is likely to grow at a much slower pace than in the past.[2] The report goes on to describe the cable industry's

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2. Ibid. p.58.

strategies for growth in light of the saturation tendencies. Two stand out: expansion into the U.S. market, and improving the range and variety of services in Canadian systems. Within the latter, efforts on broadcast service, through increased local programming expenditures, efforts to introduce pay television, and efforts on non broadcast services such as fire and burglar alarm and videotex services are predominant.

Trend forecasts for the growth in operating revenues of the Cable Television industry are presented in Table 3.14. This forecast assumes that the mild slowing of the growth rate of revenues that has characterized recent years will continue until 1985.

Table 3.14

Forecasts of Operating Revenues of the Cable Television Industry

(Current Dollars)

	$000	Percentage Change
1979	328.7	17.9
1980	384.5	17.0
1981	446.2	16.1
1982	514.0	15.2
1983	587.9	14.4
1984	667.8	13.6
1985	753.8	12.9

This forecast is consistent with the view that cable penetration is reaching its economic limits, and that revenues from the provision of new services will only partially compensate for the slower subscriber growth rate.

There are currently a number of uncertainties which could affect the projected revenue growth. These include, for example, imposition of rate of return regulation on cable television which would probably dampen revenue growth, the status of cable, the carriage by cable of new services, etc. Potential competition to the cable industry is posed by master antenna systems, and direct broadcast satellites.

3.5 Major Sources of Uncertainty and Policy Consideration

As we discussed in the revenue outlook, traditional broadcasting and cable television are not expected to show extraordinary growth in the medium term. Cable is expected to expand more slowly than in the past, since that penetration is reaching the saturation point in urban areas, and it may not be economic to cable rural areas. Neither is a major expansion of broadcasting facilities planned. The Accelerated Coverage Plan is nearing completion. The CBC does not expect any major enlargement of its production facilities. And, as we have mentioned, entry to radio and television broadcasting is restricted.

However, a number of important new developments could significantly affect this outlook. In this section we shall review briefly those developments which can reasonably be expected to take place over the next five years and assess in qualitative terms their likely impact on our forecast. The new developments which will be considered here will include the introduction of new

technologies, the emergence of new services and policy decisions which may significantly affect the industry.

It is widely agreed that telecommunications and broadcasting are entering a period of radical change because of technological developments that are now reaching, or have already reached, the stage of practical implementation. Indeed, the Consultative Committee on the Implication of Telecommunications for Canadian Sovereignty (the Clyne Committee, after its chairman J.V. Clyne) was appointed by the Minister of Communications in 1978 to make recommendations on the role of broadcasting in contributing to the preservation of the sovereignty of Canada with special reference to the use of satellites, the status of cable, the introduction of Pay TV and foreign programming. The terms of reference of the Committee open with the sentence "The Canadian communications system is in the midst of a crisis more profound than any that has affected it since the 1920's". It can thus be expected that the near future will be a time of great uncertainty for this industry, and possibly, a time of major policy changes as Canada adjusts to the information age. The changes that may take place include the question of the status of cable, changes in regulation, jurisdictional questions, the growth of public television, and the introduction of new services. We review below some of the possibilities.

3.5.1 The Status of Cable

The principle of content and carriage separation already governs the operations of the federally regulated telecommunications carriers. They are required to carry the message of any potential customer without undue discrimination, at fair and equitable rates for similar services and without

interfering with the content of the messages carried. A broadcaster, on the other hand, operates its own transmission facilities but does not qualify as a public carrier because it is not in a position to offer the use of its facilities to other parties.

Cable television falls into neither of these categories. A cable company is able to produce and distribute television programming of its own, potentially in competition with the signals of the broadcasting stations it distributes. As well, in the future, it may be expected to compete with the telecommunications carriers for the provision of different kinds of data service In fact, a number of cable companies have recently been given permission by the CRTC to provide non-programming services on a trial basis.

In this regard, the question has arisen whether cable television should be regulated as a broadcasting undertaking, or as a carrier, or as a hybrid. Possible options range from preservation of the status quo to absolute separation, which would cause a complete disruption of the cable industry in its present form. The Clyne Committee proposed an approach which would apply th principle of separation with exceptions authorized by the regulatory body, which would permit public carriers to provide certain content services through arm's length subsidiaries. The final outcome of this debate will, to a large extent, determine the future growth of the cable industry.

The CRTC has, as we have mentioned, wide-ranging regulatory powers over all aspects of the broadcasting system. Through conditions attached to licences, it imposes Canadian content regulation on radio and television broadcasters. With respect to the cable television industry, it regulates the

rates charged and determines the services and channels to be provided. In addition, it has, in the past, imposed policies such as the random commercial deletion policy. Through approval or disapproval of license transfers, it also determines the effective degree of ownership concentration in the industry, and cross-ownership between media.

The Clyne Committee report makes many suggestions concerning CRTC regulation of broadcasting. Their recommendations pertaining to the broadcasting industry are attached as Appendix A.3.1 as an example of the kinds of changes which might be entertained. They include the replacement of the current Canadian content quotas by a points system, and the payment of a proportion of revenues from cable subscription fees into a fund for Canadian television program production.

Until all these regulatory questions are resolved, uncertainty about the future of the broadcasting industry will continue.

3.5.3 Federal/Provincial Jurisdiction

Still another source of uncertainty is the question of the delegation of the regulation of cable television systems to the provinces. Court rulings have established that cable television systems are clearly under federal jurisdiction. Nevertheless, a number of provinces, notably Manitoba and Saskatchewan, have expressed a desire to regulate CATV systems within their boundaries. In the past, the federal government has discussed its willingness to consider delegating the regulation of cable TV to the provinces.

3.5.4 Public Television

Competition posed by the growth of provincially operated public television is another source of uncertainty. In 1972, for the first time, provincial governments were permitted to hold broadcasting licences for the purpose of broadcasting educational programs through arm's length corporations. The definition of educational programming is so broad that provincial television stations can fill many evening hours with entertainment of a very general nature (e.g. TV Ontario's Saturday Night at the Movies). Three provinces now have educational stations: Ontario, Quebec and Alberta.

3.5.5 Increases in Canadian Program Production

The next few years will undoubtedly see an increase in the volume of Canadian program production. There will be an increased demand for Canadian programs to meet the objectives of the Broadcasting Act in the context of the rapidly expanding capacity of the delivery system. The government has been studying initiatives which will encourage this production, such as tax incentives and guaranteed loans. These developments will result in increased demand for performers, writers, producers, etc. A great deal of program production in Canada is carried out in-house by the broadcasting companies. To the extent that this forecasted increase takes place in-house there will be a corresponding increase in employment in the broadcasting industry. Major spill-over effects to independent program producers might also be anticipated.

3.5.6 Satellite Delivery of Programming

Until now, the CBC has been the only regular user of the Canadian satellite system for the distribution of broadcast signals. In the U.S., on the other hand, the past few years have been marked by the proliferation of TV signals being transmitted via satellite to cable systems, due to an "Open Sky" policy and entrepreneurial initiative.

This is about to change. Recent developments in Canada include a change in the government's policy to allow private ownership of earth stations, the establishment of Cable Satellite Network by 52 cable television companies, and an industry-wide Satellite Package Conference. Both satellite distribution to cable head-ends and directly to homes are possible by 1985. These would have the effect of extending basic service to all parts of the country, and of making a number of new programming services available. Given the objectives of the Broadcasting Act to ensure that programming is primarily Canadian, there could be considerable spill-over effects on the Canadian program production industry. As well, a direct spill-over effect could be the manufacture of several hundred earth stations in Canada, creating job opportunities in the space industry.

3.5.7 New Services

New services as a whole will affect the future of the broadcasting industry. In fact, new services to consumers and businesses are foreseen to have such an important impact that the next Chapter of this report is devoted to them entirely. There is another reason for dealing with new services in an integrated manner: at present it is not clear who will provide which services.

In many cases, the technology is such that both broadcasters and carriers could provide similar services.

To the extent that new services compete with existing ones, they may hurt the revenue growth of the broadcasting industry: examples of new services and products in this category are video discs, which will compete with both over the air television and cable TV. Within the industry the introduction of Pay TV will likely divert audience from conventional television, and thus adversely affect advertising revenues (which are based on projected audience). However, new services can also contribute to revenue growth when they are supplied by a segment of the industry. For example, a recent article in Television/Radio Age states that the number and diversity of non-broadcast program services available to U.S. cable systems are transforming cable from a marginal to a very profitable business.

4. New Services and Their Impact

For the purpose of this paper, new services will be defined as those telecommunications-based services which can be provided using existing technology, but which are not currently offerred in Canada on a widespread commercial basis. Many of these services have already been tested, and some of them are being offerred in an experimental or test-marketing mode in other countries like Great Britain, France, Japan or the US. We shall also look at a ten-year implementation horizon, rather than at 1985.

New services may be broadly subdivided into two major categories: business services and home services. These two categories have different demand characteristics, and form distinct sub-markets. In general, it may be expected that the implementation of new business services will take place more rapidly than that of new home services, because the business services cater to demands which exist already.

4.1 Factors Affecting the Supply and Demand for New Services

Three important technological developments have made a whole host of new services feasible at reasonable cost. The first is the development of the microprocessor controlled intelligent terminal; due to major breakthroughs in micro-electronic chip technology, such terminals can now be made available at a cost which is wihin the reach of almost any business firm, and this cost is expected to decline further, at least in real terms, over the next ten years. The second factor is the development of increasingly cost-effective, high speed digital telecommunications links. This process has been aided by advances in

digital transmission, multiplexing and switching; it will be further improved by the use of direct broadcasting satellites and cellular radio distribution techniques. These advances will gradually eliminate the bandwidth capacity constraint of the narrow-band, analogue public telephone netework, and make it possible to transmit large volumes of information more economically. The last development is in the area of software, which is required for two major purposes. This first is to program intelligent terminals to perform a wide variety of tasks which are specific to particular applications; the second is to organize large information bases in such a manner that non-programming users are able to easily retrieve the information they desire. It should be noted that advances in hardware and transmission have outstripped those in software during the last ten years.

These technological developments deal with the supply side of the equation, by reducing the potential cost of supplying such services. The major sources of uncertainty, however, lie on the demand side and in the existence of institutional barriers. As many writers have pointed out, there is a great need for exercising caution when producing implementeation forecasts for new services. The survey by Baran, conducted almost ten years ago and "Branching Out", the report of the Computer-Communications Task Force, both produced large catalogues of potential new service offerings; these have, in a large part, failed to materialize.

DOC has recently completed a pilot study on forecasting the demand for new home and business services, over a ten year time frame. The consultant, R. Hough, makes the following telling argument "What is at issue in these endeavours is not technology, but economic fesibility and market demand, as may

be seen by the fact that many of the same services have been discussed and predicted for as much as ten or fifteen years prior to 1979 and are still not in widespread use - the 'wired city' concept, the 'checkless society' and tele-conferencing as a substitute for travel being several examples".

Economic costs and consumer acceptance are two key factors which affect the implementation of new services. In Canada and the US, however, institutional barriers must be added as a third key factor. In the case of certain services like Pay-TV, or services which may require the interconnection of the telephone and Cable TV networks, this may turn out to be the crucial factor limiting introduction. The question of who can provide what, and the related issue of separation between carriage and content, is a very complex one. The telecommunications carriers are regulated monopolies operating under strict carriage-content separation rules, while the Cable TV companies are largely unregulated. Institutional issues wil be discussed further in section 4.5.

4.2 Description of New Service Possibilities in the Medium Term Future

In this section we shall focus on those services which will be, or are very likely to be implemented, to some degree, by 1990. The technology for these services is available today and requires only evolutionary improvement over the next ten years. It must be realized that new services are not implemented overnight on a massive scale. Widespread implementation requires cost reductions from the high initial cost of prototypes. These cost reductions are attained through further technical development, improved methods of production, and scale economies associated with mass production.

One must also take into account the fact that the massive capital investment in existing telecommunications and Cable TV netowrks cannot be written off instantly. In the medium term, therefore, introduction of new services is likely to be limited to those services which can be offerred over upgrades of the existing networks, or over networks which have already been planned and designed and are currently being implemented. In the first category we would include the Canadian packet-switched networks Datapac and Infoswitch, and upgrades of the Cable TV networks to provide two-way services; in the second, US networks like ACS, SBS and XTEN, all of which should be operational by 1981 unless slowed down by regulatory problems. A new service, to be economically feasible, must be able to share the costs associated with its telecommunications link with other services; the greater the number and volume of such new service applications, the greater will be the reduction in transmission costs over high capacity links.

Over the next ten years, the major new business service possibilities are as follows:

(i) Information dissemination services (broadly referred to as Electronic Mail) to the "Office of the Future", based upon the use of communicating word processors;

(ii) Electronic Fund Transfer Systems (EFTS) for financial transactions between automated clearing houses, deposit-taking institutions and their customers;

(iii) Services to the retail sector based upon the use of Point-of-Sale terminals, such as automated billing, credit verification and inventory management.

All these service possibilities address specific existing requirements, or are substitutes for existing functions. The demand for their introduction stems from the economic fact that productivity growth for office workers and those in the retail and service sectors lags dismally behind the gains made in the agricultural and manufacturing industries over the last 25 years. In the US, for example, it has been estimated that during the 1960s labour productivity for factory workers jumped by 80%, and farm workers enjoyed similar productivity growth; but office worker productivity rose a mere 4%, despite new copiers, dictating equipment and electrical typewriters. The services sector, which accounts for almost 50% of the GNP, has an annual productivity growth of only 1%. The new business services are seen, therefore, as potential tools for enhancing worker productivity in the business office, retail store and service industries.

The demand for new home services is much less clear. The one service for which there seems to be some immediate demand is Pay-TV. There is also some interest, especially in the US, in protection services like burglar and fire alarms; these services are also applicable to business establishments. The same is true of meter readings for utility services such as electricity, gas and water; the utility companies can be expected to base their decisions on economic criteria. What is most difficult to predict is the domestic demand for non-programming services.

These services are described in greater detail in the next section. The "who provides what" question remains largely unanswered at present. There is bound to be major competition between the telecommunications carriers on the one hand, and the Cable TV companies on the other, on this issue. The telecommunications carriers are in a strong position to provide the telecommunications links for many of the new business services, but in Canada are hampered by the carriage-content separation rule from providing services having a programming content. The Cable TV companies would require considerable upgrading of their current coaxial cable networks to provide two-way services and their ability to provide switched network services is questionable: they would also have to form an interconnected, national network, most probably utilizing satellite distribution, instead of the present local and regional networks. These companies, however, are extremely profitable operations at present, and are aggresively seeking new areas for diversification.

4.3 Assessment of Services Likely to be Implemented by 1990

We shall first describe the new business services, like Electronic Mail and EFTS, and then the services to the home and small business. For each service we have given a general description of its characteristics, mentioned the problems relating to its implementation and attempted to provide a qualitative assessment of its probable penetration. It should be stressed, again, that all quantitative estimates are necessarily very tentative, and are used to indicate trends and orders of magnitude, rather than provide precise forecasts.

4.3.1 Communicating Word Processors and Electronic Mail

The business office is the information society's equivalent of the factory in the industrial society. As we have seen, there is a strong economic incentive to increase productivity in the office. The first phase of office automation consisted of stand-alone devices such as electric typewriters, copiers, printers, facsimile machines and even minicomputers. The key to the next phase lies in allowing a new genereation of these products to communicate with each other. By adding the communication function, increased capability can be built in for only a marginal increase in cost.

At the heart of the "Office of the Future" will be the micro-processor controlled, multi-functional intelligent terminal, and an electronic mail system. Canadian and US users are approaching electronic mail by going from non-communicating to communicating word processors, and from low-speed to high speed facsimile machines.

An estimated 500,000 word processors, mostly of the stand-alone type, are already in use in North America, and the annual rate of growth in their numbers exceeds 30%. Stand-alone word processors can already be cost-justified in the typing pools of many large and even medium-sized business offices. There is one crucial difference, however, between an electric typewriter and a word processors. The word processor creates and stores information in digital, electro-magnetic form, which is particularly suited to transmission via digital telecommunications networks.

Over the next 5 years, communicating word processors (CWPs) and high-speed facsimile machines are expected to emerge as the most popular forms of terminal equipment. And in 5 years time a machine which combines features of

both, i.e. one capable of manipulating and storing both text and graphics, as well as transmitting them, could very well be on the market. The cost of CWPs, which today runs at $10,000-$20,000, is expected to be only half as much in real terms by 1987. Automation costs are declining at 10-20% a year, while staff costs are increasing by 6-8%. So the new technologies will become increasingly difficult to resist. The intelligent multi-functional terminal would also be able to replace a number of stand-alone devices such as electric typewriters, non-communicating word processors, teleprinters, date-entry terminals and even facsimile machines. There are approximately 115,000 Telex-TWX terminals in use in the US and about 35,000 in Canada; the numbers of computer terminals also run into the hundreds of thousands. Some estimates suggest that by 1987, over 1.2 million electronic mail terminals may be in use in North America and another 800,000 in Western Europe. According to one of the most comprehensive reports on electronic mail, annual sales of terminals in 1987 will total $1.4 billion in North America (in 1978 dollars) and $1.1 billion in Western Europe.

It must be remembered that electronic mail is not a new concept. In its widest definition, it includes all distribution of textual, numeric and graphic information by electronic means. Several types of electronic mail services are available today in Canada, although they may not be described in those terms. These include message/record services like Telex and TWX, offered by CNCP and TCTS respectively; computer-communications based "mailbox" systems of the type offered by I.P. Sharp Ltd.; and facsimile services like Fascan, offered by Ivor Kaye. What we are talking about, therefore, is an evolutionary consolidation of such services into a general system of electronic communications between business offices, both intra-company and inter-company.

In Canada, CNCP has just announced a service called Infotex, which will be introduced early in 1980. The service will be based upon a network of communicating word processors using CNCP's national, computer-controlled digital switched network. Infotex will enable the electronic transmission of letters and documents intraoffice, interoffice and worldwide. In the US, both the SBS and XTEN networks are aimed at serving this vast new potential market. The SBS network, designed to provide a total communications service to very large multi-location corporations and government agencies, would provide document distribution, computer synchronization for database applications, a company-wide internal telepone system and full-colour video conferencing. XTEN, a cheaper, simpler and slower system, is primarily aimed at document transfer and electronic mail; it would also provide computer interconnection and still-frame video.

The main uncertainty regarding electronic mail in Canada and the US is related to the role of the Post Office versus the telecommunications carriers. Both postal systems are characterized by a steady decline in the productivity and efficiency of conventional postal services; a decline which, ironically, provides much of the impetus for electronic mail. Both postal systems claim a legal monopoly on the distribution of "mail", a term which they have attempted to define very broadly; and both have ambitious plans to enter into the electronic mail business. Both postal authorities are concerned about potentially disastrous diversions of first class mail volumes resulting from widespread use of Electronic Fund Transfer Systems (EFTS) and electronic office communications systems. A study by A.D. Little advised the US Commission on Postal Service that by 1985, 23% of the USPS's first class mail stream, some 17 billion out of a potential total of 73.5 billion pieces, will have been

diverted to electronic communications. The trend in Canada is very similar and although the timing may vary, a similar end result is inevitable. Eighty percent of first class mail today is business related, meaning invoices, bills, payments, statements of account, purchase orders, financial papers and business letters. Financial transactions are the most vulnerable to diversion, largely because they are generated and processed by computers in the first place; as EFT systems (described in section 4.3.2 and 4.3.3) gain increasing acceptance, this diversion can only increase. In 1976, 15% of all US Treasury payments were deposited automatically into bank accounts, and the rate of acceptance was growing monthly. The A.D. Little study etimated reductions in the number of Federal payroll and transfer payment cheques at 45% by 1980 and 75% by 1985.

Although not yet economically feasible, it is now technologically possible to transmit more than 50% of the entire mail stream by electronic means. The telecommunications carriers, who will be the main beneficiaries of this diversion, are deploying Generation III electronic mail systems, which employ electronic transmission at every step. The US and Canadian postal authorities will only be able to offer Generation I systems in the near future; these systems entail conventional pickup and delivery of physical objects from a post office, with electronic transmission beteween post offices. The USPS is currently cooperating with six other national postal authorities on an experimental Generation I system called Intelpost. This may one day grow into the poor man's, or small business man's international electronic mail service of the 1980's, but it is slow and unsophisticated. Neither the USPS nor the Canadian Post Office has any plans to go beyond Generation II systems, where the sender may electronically transmit his messages to a sending post office, but on the receiving end the message gets printed out and handed to a letter

carrier for delivery; both postal authorities are constrained by having to find work for their present armies of letter carriers. Under these circumstances, the ability of the postal authorities to compete with the telecommunications carriers for the lucrative chunks of business mail and communications must be considered doubtful.

If we assume a diversion of 2 billion pieces of first class mail from the Canadian Post Office to the telecommunications carriers by 1990, and further assume that the cost of first class mail remains unchanged in real terms between now and 1990, then this would represent a revenue loss to the Post Office of at least $340 million dollars, in 1979 dollars. The revenue gains to the carriers are more difficult to predict because the number of transactions may be considerably reduced; on the other hand, businessmen amy be quite willing to pay a premium price for a fast and reliable electronic transaction, over and above the cost of first class mail. To place a potential revenue gain of $300-350m in perspective, one should remember that in 1976 the message record market accounted for $156m, and computer communications for $197m in revenues for the Telcos and CNCP.

4.3.2 Electronic Fund Transfer Systems

Electronic Fund Transfer Systems (EFTS) are among the most intriguing, but also the most controversial of all telecommunications applications, because of the potential impact of the instantaneous transfer of funds between corporations, private individuals and governments. They have the potential of basically changing the nature of the current payments mechanism, which is predominantly paper-oriented, to one which is largely electronic, with vast quantities

of financial trannsactions travelling over data networks. The major obstacles to implementation are not technical; they lie in the areas of consumer acceptance and legal issues.

The current system of payments, labour intensive and paperwork producing, is based on cash, cheques and credit cards; only a tiny fraction of payments made to and by the consumer are electronic. Society will be neither cashless nor checkless in the foreseeable future. What has bankers worried, however, is that the paperwork and the cost associated with processing cheques and credit cards is growing by leaps and bounds. One hundred million cheques are written every day in the US, and without automated fund transfers this number would double in the next 10 years. The processing of cheques is expensive, but that of credit card transactions is even more so, up to 50¢ per transaction by some estimates. Electronic fund transfer offers a way to slow down, and later reverse the growth of this expensive paperwork.

There are four main types of electronic fund transfer, representing successive steps towards an EFT society. The first involves transfers of money between deposit-taking institutions (banks and near-banks), to carry out clearing-house operations. This stage has already been implemented by the major Canadian banks. In the US, financial institutions use EFT to transfer about 80% of all payments, amounting to about $275 billion daily. Fed Wire, the US Federal Reserve Communications system, processes approximately 58,000 transactions a day, transferring an average $150 billion in Federal Reserve funds and Government securities between member accounts at the Federal Reserve. CHIPS (Clearing House Interbank Payments System), established by the New York Clearing House Association in 1970, handles an average of 45,000 transactions a day,

transferring $100 billion at the request of US and foreign banks. SWIFT, a message system designed to provide a computerized link between North American and European banks, now links over 570 banks with about 1000 branches in the US, Canada and 17 European countries; it handles over 114,000 message daily.

In the second stage of EFT, there are transfers between the computers of other organizations, such as the government and private corporations, and the computers of the deposit-taking institutions. These transactions are usually made through automated clearing houses (ACHs). Two types of payments move through the ACHs: credit payments, such as direct payroll deposits, which result in funds being added to an individual's account; and debit payments, which transfer funds from an individual's account to that of a corporation - for example, an insurance or mortgage payment. During 1978, an electronic inter-regional ACH exchange was implemented in the US, interconnecting all ACHs through Fed Wire. A start has been made with this stage in Canada, but progress has been slower. The first stage of EFT is transparent to the consumer, and the second stage does not affect him negatively, so there are no problems of consumer resistance up to this point.

In the third stage of EFT, the general public would be able to directly use automated terminals, sometimes referred to as Automated Teller Machines (ATMs) or Customer Bank Communications Terminals (CBCTs), to perform transactions and obtain a variety of banking services. These machines could be located outside the premises of the bank's branches, particularly in shopping centres, airports, factory cafeterias, large office buildings and other strategic locations, and would be available for use (at least in theory) 24 hours a day, 7 days a week. The Bank of Montreal has made a start in this area with its

Instabank services, but the ATMs are still located on the outside fronts of selected branch premises. To operate the ATM, a customer must possess a special, machine-readable bank credit card equipped with a coded magnetic stripe. The other major Canadian banks have not yet followed suit, but may be expected to do so if the experiment is successful. ATMs represent a major tool for the banks to increase their hours of operation, geographical extent of coverage, and reduce staff costs. The use of ATMs is much more widespread in the US; First National City Bank has several thousand bank-card terminals in the New York area.

Since the Canadian banking industry does not suffer from the kinds of restrictions on branch banking that are prevalent in the US, there would seem to be no major legal barriers to the widespread deployment of ATMs in Canada. The major Canadian banks already have large nationwide telecommunications networks for supporting transaction terminals which are used by tellers within their branches, during normal working hours. The transmission links and the computer software required to support the ATMs would probably require incremental, rather than major improvements to existing facilities. The cost of an ATM installation is still substantial (up to $50,000, according to a recent International Resource Development Inc. report), and a substantial amount of traffic is currently required to make it commercially viable. If the consumer demand materializes, however, it may be expected that ATMs will come into widespread use in Canada over the next 10 years. The number of ATMs could eventually rival or even exceed the number of bank branches. The impact and consequences of such a development would be profound, both for public banking habits and upon the employment of tellers and other types of clerical bank staff.

The fourth and ultimate phase of electronic fund transfer would develop if consumers start paying for goods and services in retail outlets like supermarkets, stores, restaurants and hotels by using their credit/payment cards. Superficially, this process may look like the use of the present credit cards, but in actuality it is quite different. In 1965 T.J. Watson, then President of IBM, foresaw the possible revolution in banking as follows:

"In our lifetime we may see electronic transactions virtually eliminate the need for cash. Giant computers in banks, with massive memories, will contain individual customer accounts. To draw from or add to his balance, the customer in a store, office or filling station will do two things; insert an identification into the terminal located there; punch out the transaction figures on the terminal's keyboard. Instantaneously, the amount he punches out will move out of his account and enter another. Consider this same process repeated ... millions of times each day; billions upon billions of dollars changing hands without the use of one pen, one piece of paper, one check or one green dollar bill."

The mechanics of this fourth phase of EFT are discussed in the next section, under Point-of-Sale (POS) systems. The extent to which it spreads over the next ten years will depend largely upon the degree of consumer acceptance or resistance which it will meet. The consumer would, after all, be losing three important benefits which he currently enjoys by using cheques and credit cards. The first is "float", i.e. the credit he enjoys, without payment of interest, between the purchase of a commodity and the actual debiting of his account in payment. The second is the ability to stop payment on a transaction, if he is paying by cheque. The third is the hard-copy, written record which he possesses

of every transaction; this record can be useful for a variety of purposes, including legal ones. For all these reasons, there may be strong consumer resistance to this ultimate phase of EFT, whose primary beneficiaries would be the financial institutions, followed by the sellers of goods and services.

4.3.3 Point-of-Sale Systems

The term applied to the extension of EFT services to retail outlets is point-of-sale (POS) systems. It has been estimated by some authorities that there may be 50 billion electronic point-of-sale transaction made per year in the US, by the year 2000. As mentioned in the previous section, however, there are certain aspects of POS EFT which might encounter strong consumer resistance; the most important being the potential disappearance of "float" from the credit system.

Point-of-sale terminals come in a variety of shapes, sizes, levels of sophistication and costs. All, however, are capable of performing at the lowest of three functional levels. The first level of functioning is as an electronic cash register, in either a stand-alone or shared logic mode. In addition to serving as a cash register, the terminal records transactions in electronic form, so that they can be entered into the processing systems for accounting, sales analysis and inventory management without rekeying the data. The use of POS terminals in this mode is already widespread, especially in supermarkets and department stores which handle a high daily volume of transactions.

At the second level of sophistication, the POS system functions as a cash register and an online credit authorization system. Shared-logic systems,

having access to centralized databases, can function in this manner as long as the credit-worthiness of the customers can be updated sufficiently rapidly to allow the system to have value in practice. At present, manual procedures are used for verifying the credit worthiness of a consumer using a standard credit card like Chargex/Visa or Mastercharge. Online credit verification runs into practical problems if the use of a large number of credit cards is permitted, because each card may have its own, centralized credit database. A certain number of second level POS systems are in operation, especially in the US. Over the next ten years, it is quite possible that the use of such systems will become widespread in Canada.

The third level of POS system, in addition to performing the first two levels of functions, also acts as an online account updating system, with credits and debits being transferred electronically as a part of the transaction. This is a full-scale, fourth phase EFT system, with all the advantages and problems outlined in the previous section. There are no level three POS systems currently in commercial operation, although experiments have been attempted. It is unlikely that this type of POS system can come into widespread use before full consumer acceptance is achieved, and all the legal issues have been resolved.

An important development on the supply side of POS terminals occurred in March 1979, when the Computer Communications Group of TCTS announced the availability of the low-cost Vutran terminal. Vutran is a network-addressing terminal which is designed for short inquiry/response applications, such as credit card authorizations and other EFT applications. It is capable of transmitting and receiving data over the public switched telephone network,

TCTS's packet switched Datapac network, or private line networks. The terminal would rent for $29.50 per month, if regulatory approval is given by the CRTC, and could be mass-produced by the end of 1979. Bell sees the introduction of Vutran as part of the evolution of EFTS in Canada; it will give credit providers an economical means of coping with growing volumes of credit authorization transactions, as well as allow the retailer to process credit/debit transactions more quickly and economically at the point of sale. The Canadian Business Equipment Manufacturers Association (CBEMA) has, however, opposed the introduction of Vutran as discriminatory, unless other data terminal manufacturers are also allowed to provide network-addressing terminals.

4.3.4 Public Information Retrieval Services

Introduction

In this section we are concerned with the growth of public computer-based information retrieval services, generically referred to as Videotex, such as Canada's Telidon system. Computer based information retrieval services are not new. Traditional data base retrieval services using cathode ray tube (CRT) terminals are widely known to and used by business, CANSIM being a well known Canadian example. What is new is the 'public' aspect. These new services are conceived as being available to anyone who has a telephone and a television set, and without requiring special training on the part of the user.

If such services catch on, they could bring about numereous changes in the way information is exchanged and used, and have impacts on many industries. For example, on the one hand, terminal manufacturers would stand to benefit

greatly, while, on the other it is likely that advertising revenues would be diverted from other media.

Initial extimates of videotex peneteration were very high, ranging up to five to seven million Canadian households by the mid 1980's. More recently, these estimates are being rethought in light of the many unknowns regarding these new services. In this section, we will first describe the various types of videotex services and indicate possible industry structures for their provision. We will then look at the revenues which could be generated by such services. A discussion of revenue turns naturally to a review of demand factors. Finally, we will indicate some of the major outstanding issues regarding videotex services. Until these issues are resolved, demand forecasts and impact studies will be based on very tentative assumptions.

One-way Videotex

There are two basic types of videotex services, both of which are in use, either in a market or test mode, somewhere in the world today. One-way videotex (sometimes called Teletext) is an information service in which the subscriber has no interaction with the computer that stores and makes available the information. Transmission can either be by broadcasting or cable. In Canada, this service could develop by both modes of transmission because of our high cable penetration rate. One-way videotex is suitable for information bases in which customers generate a high frequency of access to each page, because each page is transmitted to all the subscribers every few seconds. Examples of suitable information are news, sports, weather, bulletins stock market information, and retail and classified advertisements.

It is not practical to charge a consumer for one-way videotex according to usage. It is practical only to change by the month per channel (e.g. in the case of service provided by cable), or, in some cases, not to charge the user at all. Therefore one-way videotex, as a medium, may attract a considerable volume of source-paid information, such as restaurant listings, real estate advertising and the weather service.

Two broadcast teletext systems, CEEFAX and ORACLE, have been operational in the United Kindgom for three years. It is estimated that over 10,000 UK television sets are equipped with decoders to receive teletext services. In Canada, a test cable-based system has been installed by Grand River Cable TV in Kitchener, Ontario, following the recent decision by the CRTC to allow certain cable TV companies to offer new non-programming services on a trial basis.

Interactive Videotex

Interactive videotex is a two-way service where the subscriber interacts with a computer and then requests his information. Access to the computer could be either from the telephone network, a two-way cable system, or a hybrid telephone (upstream) and cable (downstream) system. There are no limitations on the amount of information that can be stored, and since this service is interactive, it can do things one-way videotex cannot. As well as retrieving information, the system could be used for computation, for ordering goods, for sending messages to another address, etc. In the case of interactive videotex, the user could (and would likely be) charged for information accessed on a usage basis.

Possible Industry Structure

The industry structure for the provision of videotex services involves a number of _____ as of yet unresolved institutional and regulatory aspects. Depending on the solution to these problems, it could evolve in many different ways; nevertheless, in any system we can distinguish four classes of entities which could be involved: a local carrier, a national carrier, information providers and information producers. Information producers would supply the information to be accessed by the subscriber. Information providers would adapt the information to the new technology, market the service, store the information (using either their own or someone else's computer), and provide the videotex service to the user. Carriers would provide the link between the subscriber and the videotex data bank.

Local access facilities can be cable or telephone based for interactive services, or even broadcast based for non-interactive services. Between the computer and the local access facility, there will probably be a network. In many cases this network will be intercity in order to allow information providers to offer service in areas where they do not have a data-base computer. This network could be a value added network based on one of the packet-switched transmission networks. The value added networks could be offered either by the carriers or by the information providers.

Revenue Generation

Based on the above industry structure scenarios, we can see that revenue from videotex services can be generated for the local carrier, the

national carrier, the information provider, the computer operator (where he differes from the provider), and the information producer.

If the local access facility used is cable, there would probably be a monthly connection charge. If the facility is telephone based there could also be a monthly connection charge, assuming the terminal is hardwired to the telephone loop. However, with the advent of telephone jacks, this might prove difficult to enforce. Usage sensitive pricing for use of the local access facilities might prove difficult to implement. Usage charges could only be implemented by modifications to central office equipment (not likely to be economical), or by the videotex interface at the date-base computer. However, this latter device may be owned and operated by someone other than the telephone company which could cause difficulties in implementing usage sensitive pricing.

The major sources of revenues derivable from videotex for established telecommunication carriers would probably be from increased use of their packet-switching networks and basic transmission networks by Videotex value added networks. Cable carriers, if they came into existence, could also obtain revenues from value added networks operated by a possible consortium of cable carriers.

Information providers would have two main sources of revenues: payments from subscribers for accessing information, and payments from the information suppliers. For some types of information, such as advertising, it is likely that the information source rather than the subscriber would pay a fee to the information provider. Estimates of the advertising revenues which could be captured by a cable videotex service provided free of charge to the user range

from $188 million to $275 million five years after introduction, to one billion current dollars ten years after introduction. These revenues would be a result of diverting advertising revenues from other media, especially newspapers and telephone and city directories. For other types of information, the subscriber would be charged for access. The information provider would retain a portion of this fee, while another portion would be passed on to the supplier of the information. Because of carriage-content separation rules, carriers could only operate as videotex information providers through separate companies established for this purpose. Manufacturers of home terminals would receive revenues from the sale of these terminals. Indeed, the potential of the equipment market for creating employment in Canadian manufacturing has been one of the prime reasons for Canadian government interest in videotex. A Canadian videotex system called Telidon, superior to its known European competitors in many important respects, was developed by the Communications Research Centre of the Department of Communications in 1978. If this system were adopted as a international standard, it could have an important impact on the domestic electronics manufacturing industry. Even if sales of terminal were limited to Canada alone, the impact could still be substantial. Videotex "terminals" could either be sold as an add-on to existing television sets, or be incorporated in the television set itself. The cost of the terminal is volume-dependent: estimates for large volume production have been estimated as low as $250 (1978 dollars) for an add-on terminal, and a $200 addition to the value of a set when the terminal is incorporated in the TV receiver.

Demand Factors

Of course, the revenues generated at all stages of the above scenarios depend crucially on the public demand for videotex services. This is an unknown at the present time. A recent Science article sums up the current debate on new information services as follows. "It may be the biggest thing to happen to communication since the radio, or it may be about to rival the Ford Edsel as a marketing disaster. The silence you hear is the sound of breath being held".

Pending further research, we can only indicate upper limits on plausible demand, through a review of general economic and behavioural factors factors such as the structure of household expenditure and observed rates of diffusion of innovations. Initial judgmental demand estimates using this approach have been generated by R. Hough and Associates Ltd. in their recent pilot study for the Department of Communications, referenced earlier in this chapter. Their research indicates that 100,000 terminals appears to be a plausible upper limit for the Canadian domestic market in 1985 based on a monthly expenditure of $25 for videotex usage. Other potentially promising markets are institutions, such as libraries, schools, community centres, etc. and small businesses, which cannot afford the advanced special electronic information systems being taken up by large business.

Another consultant has looked at the market for one-way entirely source paid videotex. Based on the rate at which colour television penetrated the Canadian market, TAMEC estimates that five years after introduction .9 to 1.3 million households will have terminals, and after ten years penetration will rise to 3 to 4.3 million households (of a total ten million households)[FN].

FM TAMEC. Videotex Services the Market Potential for Cable January, 1979.

These widely differing forecasts are both based on reasonable pricing, household acceptance etc. They point to the many unknowns regarding the introduction of videotex. Until soundly-based research data are available, including the cost of videotex equipment, the services which will be available, and the user costs of these services, any projections of videotex acceptance and use must involve highly subjective judgements.

Conclusion: Issues and Problems

Increasing realization is dawning that the introduction of a videotex service is a very complex matter, involving difficult issues in five main areas. These are:

- pricing and marketing strategy
- acceptability of videotex to users
- form and quality of the database
- institutional structures and related legal and regulatory problems
- standards and interworking

With respect to the first issue, sellers of videotex systems are faced with two choices. Because of the great economies of scale involved in manufacturing such systems, either they commit themselves to very large scale operations to take advantage of the scale economies and provide a low cost system from the start, or they start with a small-scale, high-cost system. The former alternative involves a massive gamble on the existence of a mass market for videotex. If this market fails to materialize, the suppliers will be faced with huge losses. The latter alternative may be unable to attract enough users

to ever evolves into a mass market service. Faced with this dilemma, the British Post Office has opted for the former approach.

One of the main difficulties in deciding on a marketing strategy is that very little is known about user acceptance of the system features. Problem areas include the tree search method of information retrieval and the associated delays, the limited graphics capabilities, and the possible opposition between the system's characteristics and habitual methods of using information media. There is some evidence, for example, that most people prefer to 'browse' through newspapers rather than purposefully seek out particular items. It is not even clear whether people will be willing to pay for information on a usage sensitive basis. Another factor affecting user acceptance is the form and quality of accessible data. Videotex is a new medium which requires new writing and graphic composition skills. Problem areas to be tackled include development of content forms that exploit the strength of the medium, selection of material for maximum relevance and impact within the limitation of a videotex frame, effective use of graphics, indexing and routing. As well, the labour costs of data entry and updating are becoming a major issue in the economics of videotex.

The institutional and regulatory structure of the Canadian telecommunications system presents a number of impediments to the introduction of videotex systems. For example, the carriage/content separation principles prevent carriers from establishing a videotex service. Secondly, as we mentioned, the type of network by which users would access the videotex service has not been clearly established. The ownership of and pricing of access to a videotex network are unresolved. In general, the problems of participation by the carriers in videotex services are part of the general problem of rules

governing participation in competitive areas by companies which also offer regulated monopoly services. This is a major policy issue requiring resolution.

Finally, standards are an important issue, both for ensuiring that the consumer can access all information banks with one terminal (i.e. the compatibility problem) and secondly, for encouraging the sales of Canadian-made terminals, both domestically and abroad. Recognizing the importance of standards development, the Department of Communications has been playing an active role in CCITT discussions on the subject.

In concluding this section, we wish to emphasize that in the long run videotex-type services could have an enormous impact on the economy and society. As the Department of Communications press release introducing Telidon stated:

> "... such systems would allow the introduction of such things as electronic newspapers, electronic mail, electronic publishing by individuals, and many other business, entertainment and new home services, delivered electronically to home television receivers... Students could access many data bases for almost immediate display of data or graphics on their TV screens. Architects could transmit drawings to clients across town or across the country. Homebound persons could take university courses. The system would also make possible new outlets for artistic expression. Emergency services such as fire and burglar alarm systems could be provided. People in isolated areas would have access to a wide range of information and entertainment previously available only to those in the urban south." (Department of Communications, August 15, 1978).

What we are dubious about is excessive estimates regarding penetration and use in the medium term.

4.3.4 Pay Television

Pay television refers to a specific program service which is delivered to the public upon the payment of a fee. The fee can be levied either on a "per channel" or a "per program" basis. Since viewers pay fees, they are not subject to commercial advertising interruptions. The types of program most likely to be offered on pay-television are feature length movies, sports, artistic, cultural and educational productions.

Pay-television signals can be transmitted by satellite, by over-the-air transmitters, or can be distributed through cable television systems. Pay per channel systems require less costly technology than pay per program systems.

Pay television is becoming available on a widespread basis in the United States. In 1975, Home Box Office established a pay-TV network using domestic satellites for program delivery. By the end of 1978, American pay-TV enterprises had an estimated 3.5 million subscribers, paying about $8 per month on average. The annual average growth rate has been over 300 per cent in the last three years. Pay-TV operators in the U.S. are now beginning to employ an over-the-air broadcast method (rather than cable) to deliver their programs to subscribers. This service is known as Subscription Television (STV). Scrambled signals are sent over the air to decoder boxes in the homes of subscribers. Fees are generally in the $15 to $20 per month range.

In Canada, hotel pay television was begun in Toronto in 1972. As of 1978, twenty Toronto hotels were provided with 8 to 10 movies per month at a charge of $4.50 per month. Hotel systems are now operational in four provinces.

Closed circuit pay-TV is also available in certain locations. Because these systems do not make use of the radio frequency spectrum, they do not require licencing under the Broadcasting Act.

The CRTC has been receiving proposals for offering pay-television service since 1970. Its first public announcement on the subject, issued in 1972, invited experimental proposals by licences. After a review, the Commission concluded that no submission significantly contributed to the furtherance of the Broadcasting Act objectives. In 1975, it issued a position paper on pay-television, and following public hearings, a policy statement. The view put forward was that pay-TV service applications would only be considered on a case by case basis in situations where such service would clearly present no threat to the free over-the-air broadcasting system. In 1976, the Minister of Communications and the Chairman of the CRTC issued statements inviting a re-consideration of a Canadian pay-television service. Public hearings were held in 1977 to consider submissions regarding the form and function of a structure to control pay TV service in Canada. Following these hearings the Commission concluded that it would be premature to introduce a national pay-television service at this time (March, 1978). Furthermore, it recommended the need for a national policy on pay-TV prior to its introduction. Since then, the Department of Communications has been consulting with interested provincial governments on possible models for a Canadian pay-television industry.

A number of factors now favour the speedy introduction of pay-television in Canada. First, subscription television operators in American border cities such as Buffalo and Detroit will be able to offer their Pay TV service to Canadians within reach of the signals. If the Canadian Pay-TV market is

occupied by foreign systems it will be harder for Canadian systems introduced later to become established. Furthermore, communities in the North are acquiring equipment for illegal reception of American Pay-TV signals distributed by satellite.

Moreover, it appears that effective demand by consumers for Pay-TV is growing in Canada. In 1977, the CRTC conducted a national survey to gain an appreciation of the public's knowledge and attitude to pay-television. The survey results showed a low level of awareness and interest regarding pay-TV. Thirty-eight per cent had heard nothing about Pay-TV, and another 38 per cent only a little. More recently, Complan Research Associates conducted another national survey on Pay-TV in February 1979. It indicates that over one-third of Canadians are "very interested" or "fairly interested" in subscribing to a pay-TV service at a cost of $8 per month.

The cable operators favour a pay-per-channel service, since this method is consistent with the industry's current technology and invoicing systems. The main disadvantage of pay-per-channel is that, in the words of the Clyne Committee, it "would entail the continuing subjection of television audiences to lowest-common-denominator programming".FN Pay-per-program, recommended by the Clyne Committee, is also favoured by broadcasters, program producers, and the Ontario government. Revenues which could be generated on a pay-per-program basis have been estimated for the Department of Communications at $13 million after three years, and $72 million after five years.

FN Telecommunications and Canada, p. 49

Whatever types of systems are introduced, pay-television could be expected to have significant impacts on Canadian industry. It could aid the performing arts by enlarging their paying audience. By providing funding for, and access to national distribution, it could significantly benefit the program production industry. For example, it has been estimated that over $20 million could be made available for program production from this source over ten years. Canadian content could be encouraged by incentives, or regulated by quotas.

Pay-television could also provide a new market for the electronics industry. If a pay-per-program system were introduced, residential terminals would be required to record viewing and decode signals. Over-the-air pay TV, by channel or by program, would also require a terminal to unscramble signals. If such terminals were offered at $100 each, in maturity revenues of $100 million could be generated. However, in the absence of barriers, it is quite possible that a large percentage of the market could be captured by foreign terminal suppliers.

Finally, of course, Pay-TV would benefit the agencies which distributed the signals, whether these be cable TV companies, broadcasters, or some other distributors. The cable TV companies, in particular, view Pay-TV as a way to stimulate further growth in the industry, and have been lobbying forcefully for its introduction. It could also result in increased utilization of Canadian satellite capacity.

On the other hand, industries in competition with Pay TV, such as movie theatres and conventional broadcasting could lose audiences and therefore revenues. Broadcasters have voiced concern about the further fragmentation of

television audiences. In this regard, studies have shown pay-per-program is likely to involve less fragmentation than a pay-per-channel principle. Broadcasters as well as public interest groups, are also worried that introduction of Pay TV will result in "siphoning" of programs, especially new ones, away from conventional television.

In summary, while there are both positive and negative impacts to be expected from Pay-TV, if introduced on a basis consistent with the objectives of the Broadcasting Act, this service could substantially contribute to the stimulation of the cultural industries in Canada, and could provide a service of interest and benefit to Canadians.

Table 1.1 Contribution of the Communications Sector to Gross Domestic Product, and Wages, Salaries and Supplementary Labour Income

Year	GDP at Factor Cost (millions of current $)			Wages, Salaries and Supplementary Labour Income (millions of current $)		
	Total	Comm. Sector	% of Total	Total	Comm. Sector	% of Total
52	22,125	396	1.79	12,073	271	2.24
53	23,060	428	1.86	13,062	299	2.29
54	23,267	475	2.04	13,451	327	2.43
55	25,630	533	2.08	14,369	357	2.48
56	28,658	599	2.09	16,171	402	2.49
57	30,078	656	2.18	17,519	454	2.59
58	31,096	706	2.27	17,982	484	2.69
59	32,827	773	2.35	19,149	504	2.63
60	34,192	841	2.46	20,141	533	2.65
61	35,388	899	2.54	21,009	561	2.67
62	38,377	977	2.56	22,468	589	2.62
63	41,150	1,042	2.53	23,932	633	2.65
64	44,696	1,154	2.58	26,034	664	2.55
65	48,894	1,265	2.59	28,878	738	2.56

Table 1.1 Contribution of the Communications Sector to Gross Domestic Product, and Wages, Salaries and Supplementary Labour Income

(continued)

Year	GDP at Factor Cost (millions of current $)			Wages, Salaries and Supplementary Labour Income (millions of current $)		
	Total	Comm. Sector	% of Total	Total	Comm. Sector	% of Total
66	54,764	1.384	2.53	32,629	825	2.53
67	58,793	1,552	2.64	36,160	931	2.57
68	64,165	1,670	2.60	39,318	1,012	2.57
69	70,778	1,929	2.73	43,949	1,128	2.57
70	75,427	2,105	2,79	47,620	1,242	2.61
71	82,867	2,285	2.76	52,436	1,356	2.59
72	92,719	2,689	2.90	58,549	1,536	2.62
73	109,830	2,938	2.68	67,849	1,738	2.56
74	132,255	3,339	2.52	81,289	2,165	2.66
75	150,726	3,738	2.48	94,625	2,503	2.65
76	172,584	4,230	2.45	109,375	2,904	2.66
77	189,550	5,008	2.66	120,491	3,213	2.67
78	210,880	6,537	2.71	131,308	3,538	2.69
79	239,656	6,537	2.73	145,896	3,968	2.72

Sources: 1. CANSIM Matrix 000563 Gross Domestic Product at Factor Cost, by Industry.

2. CANSIM Matrix 000564 Wages, Salaries and Supplementary Labour Income, by Industry.

Table 1.2

Comparison of Selected CPI Components with Other Price Indices for the Communications Sector

Year	CPI, reclassified by Goods and Services					Personal Consump. Comm. Services	Bell Revenues Implicit Deflator
	Goods	Services					
		Total	Household Utilities	Transport. Services	Rec., Educ. and Comm.		
1961	79.9	66.6	83.6	59.5	72.5	88.7	95.4
1962	80.7	67.8	83.2	60.4	73.9	89.9	94.1
1963	82.1	68.9	83.4	60.9	74.5	89.9	94.5
1964	83.1	70.8	83.0	63.6	75.9	90.4	94.6
1965	84.6	73.6	82.1	70.2	77.8	91.1	94.6
1966	87.8	76.1	82.1	73.9	80.3	92.1	93.8
1967	90.0	80.2	86.4	79.2	84.1	93.0	93.6
1968	93.4	84.4	89.9	81.6	88.0	94.4	93.4
1969	96.3	90.0	91.6	88.9	94.1	96.8	94.0
1970	98.2	95.3	97.2	95.2	96.8	97.1	97.1
1971	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1972	104.6	105.2	102.3	104.0	104.9	104.1	102.2
1973	113.7	111.7	109.4	106.6	109.6	106.7	104.7
1974	128.1	120.5	116.6	115.7	115.3	107.9	106.8
1975	142.0	133.4	131.6	133.3	124.0	109.6	111.6
1976	149.0	149.6	156.9	154.7	132.7	118.3	118.6
1977	160.0	163.2	180.3	165.0	142.3	126.6	126.1
1978							
1979							

Sources: 1. Cansim Matrix 000431, Consumer Price Indices.

2. Cansim Matrix 000530, 003325, Personal Expenditure on Consumer Goods and Services in Current and Constant (1971) Dollars.

Table 1.3

Communications Sector Component of GDP at Factor Cost:

Projections to 1985 (millions of current dollars)

Year	Historical		Low Forecast		High Forecast	
		Percent Change	Expon. Curve	Percent Change	Gompertz Curve	Percent Change
1966	1,384					
1967	1,552	12.14				
1968	1,670	7.60				
1969	1,926	15.33				
1970	2,105	9.29				
1971	2,285	8.55				
1972	2,689	17.68				
1973	2,938	9.26				
1974	3,339	13.65				
1975	3,738	11.95				
1976	4,230	13.16	4,250		4,309	
1977	5,008	18.39	4,767		4,933	
		(12.41)				
1978	5,652	12.86	EXP		GOMPERTZ	
1979	6,537	15.66	6537.0		6537.0	
1980			6975.2	6.7	7518.2	15.0
1981			7852.3	12.57	8750.6	16.39
1982			8839.6	12.57	10236.0	16.97
1983			9951.0	12.57	12035.2	17.58
1984			11202.2	12.57	14226.2	18.20
1985			12610.7	12.57	16908.5	18.85
1986			14196.3	12.57	20210.8	19.53

Average Annual Percentage Change between 1966 and 1977 = 12.41% 12.45/1977-79 = 13.73

Compound Annual Growth Rate between 1966 and 1977 = 12.17%.

Table 1.4

Operating Revenues and Shares of Components of the Communications Sector (millions of current dollars)

Year	Telecommunications			Broadcast, Radio & Cable TV			Sector Total		Sub-Sector Shares	
	Telcos	Telegraph/ Cable	Total	Broadcast & Radio	Cable TV	Total	Revenue	Percent Change	Telecomm (%)	Broadcast &Cable(%)
1957	467.7	44.8	512.5							
1958	507.7	47.6	555.3							
1959	582.3	53.0	635.2	154.9	-	154.9	790.1		80.39	19.61
1960	628.0	58.5	686.5	164.4	-	164.4	850.9	7.70	80.68	19.32
1961	679.3	64.1	743.4	176.6	-	176.6	920.0	8.12	80.80	19.20
1962	733.3	71.4	804.7	195.4	-	195.4	1000.1	8.71	80.46	19.54
1963	775.7	73.6	849.4	211.1	-	211.1	1060.5	6.04	80.09	19.91
1964	847.5	78.7	926.2	237.6	-	237.6	1163.8	9.74	79.58	20.42
1965	934.8	86.1	1020.9	264.6	-	264.6	1285.5	10.46	79.42	20.58
1966	1031.8	95.5	1127.3	299.4	-	299.4	1426.4	10.98	79.01	20.99
1967	1134.1	104.5	1238.6	346.2	22.1	368.3	1606.9	12.63	77.08	22.92
1968	1235.7	116.7	1352.3	367.5	31.3	398.8	1751.1	8.97	77.23	22.77
1969	1367.6	126.6	1494.2	409.5	37.4	446.9	1941.1	10.85	76.98	23.02
1970	1526.2	136.9	1663.1	429.3	54.9	484.2	2147.3	10.62	77.45	22.55
1971	1676.3	146.4	1822.7	452.7	66.6	519.3	2342.0	9.07	77.83	22.17
1972	1871.4	163.2	2034.6	514.2	82.5	596.7	2631.3	12.35	77.32	22.68
1973	2127.1	190.7	2317.8	622.7	107.0	729.7	3047.5	15.82	76.06	23.94
1974	2435.6	230.1	2665.7	684.5	133.4	817.9	3483.6	14.31	76.52	23.48
1975	2861.2	259.1	3120.3	851.8	162.3	1014.1	4134.4	18.68	75.47	24.53
1976	3363.6	278.3	3641.9	965.1	199.2	1164.3	4806.2	16.25	75.78	24.22
1977	3853.9	302.1	4156.0	1056.2	233.0	1289.2	5445.2	13.30	76.33	23.67
1978	4472.3	348.3	4820.6	1236.0	273.2	1509.2	6329.8	16.25	76.16	23.84
1979	5151.4	411.8	5563.2	1409.6	313.7	1723.3	7286.5	15.11	76.35	23.65

Sources: Statistics Canada Catalogues 56-201, 56-203, 56-204, 56-205

Average Annual Percentage Growth 1967-1977 = 13.40%.
Average Annual Percentage Growth 1972-1977 = 15.26%.

Table 1.5

Employment Growth and Shares of the Components of the Communications Sector Number of Full Time Employees)

Year	Telecommunications			Broadcast, Radio & Cable TV			Sector Total		Sub-Sector Shares	
	Telcos (SIC 544)	Telegraph/ Cable (SIC 545)	Total	Broadcast & Radio (SIC 543)	Cable TV	Total	No. of Employees	Percent Change	Telecomm (%)	Broadcast &Cable(%)
1957	64,074	11,159	75,233							
1958	61,400	10,587	71,987							
1959	58,826	10,586	69,412							
1960	57,670	10,279	67,949							
1961	56,322	9,997	66,319							
1962	58,091	10,069	68,160							
1963	58,416	9,826	68,242							
1964	60,829	9,431	70,260							
1965	63,467	9,270	72,737							
1966	68,233	9,161	77,394							
1967	68,431	8,961	77,392	18,946	1,657	20,603	97,995		78.98	21.02
1968	66,699	8,687	75,386	19,232	1,367	20,599	95,985	-2.05	78.54	21.46
1969	66,578	7,860	74,438	19,541	1,601	21,142	95,580	-0.42	77.88	22.12
1970	68,334	7,678	76,012	19,576	1,992	21,568	97,580	2.09	77.90	22.10
1971	69,995	7.553	77,548	19,789	2,180	21,969	99,517	1.99	77.92	22.08
1972	72,671	7,323	79,994	20,124	2,598	22,722	102,716	3.21	77.88	22.12
1973	75,407	7.047	82.454	21,172	3,098	24,270	106,724	3.90	77.26	22.74
1974	81,225	7,163	88,388	22,261	3,691	25,952	114,340	7.14	77.30	22.70
1975	82,866	7,162	90,028	23,497	4,084	27,581	117,609	2,86	76.55	23.45
1976	83,864	6,973	90,837	24,680	4,640	29,320	120,157	2.17	75.60	24.40
1977	87,546	6,863	94,409	25,651	4,838	30,498	124,898	3.95	75.59	24.41
1978	92,873	7,150	100,023	26,851	5,293	32,144	132,167	5.82	75.68	24.32
1979	96,539	7,247	103,786	27,675	5,652	33,327	137,113	3.74	75.69	24.31

Sources: Statistics Canada Catalogues 56-201, 56-203, 56-204, 56-205.

Average Annual Percentage Growth 1967-1979 = 2.87%.

Average Annual Percentage Growth 1972-1979 = 4.10%.

Table 2.1 Numbers of Telephones, Local Calls and Long Distance Messages - Basic Telephone Company Outputs

Year	Number of Telephones in Service (millions)						Number of Messages (millions)			
	Residence		Business		Total		Local		Long Distance	
		Percent Change		Percent Change		Percent Change		Percent Change		Percent Change
52	2.236		1.017		3.352		5483		126.7	
53	2.522	7.96	1.085	6.69	3.606	7.58	5953	8.57	131.9	4.09
54	2.706	7.30	1.154	6.36	3.860	7.04	6210	4.32	137.8	4.44
55	2.915	7.72	1.236	7.11	4.152	7.55	6808	9.64	153.1	11.13
56	3.165	8.58	1.334	7.93	4.699	8.37	7594	11.53	171.3	11.88
57	3.148	7.99	1.409	5.62	4.827	7.29	8077	6.37	178.6	4.29
58	3.632	6.26	1.486	5.46	5.118	6.03	8513	5.40	194.2	8.72
59	3.870	6.55	1.569	5.59	5.439	6.27	9045	6.24	205.4	5.77
60	4.054	4.75	1.674	6.69	5.728	5.32	9365	3.54	215.3	4.81
61	4.284	5.67	1.730	3.35	6.014	4.99	10120	8.06	226.3	5.10
62	4.512	5.32	1.817	5.03	6.329	5.24	10558	4.33	250.2	10.60
63	4.746	5.19	1.910	5.12	6.657	5.17	11065	4.80	257.5	2.92
64	5.003	5.42	2.016	5.55	7.019	5.45	11658	5.36	281.2	9.20
65	5.303	6.00	2.142	6.25	7.445	6.06	12138	4.12	301.6	7.24
66	5.603	5.66	2.290	6.91	7.893	6.02	12846	5.83	323.3	7.20
67	5.935	5.93	2.423	5.81	8.358	5.90	13053	1.61	357.4	10.54
68	6.261	5.49	2.557	5.53	8.818	5.50	13994	7.21	388.0	8.56
69	6.577	5.05	2.719	6.34	9.296	5.42	14597	4.31	434.3	11.93
70	6.896	4.85	2.854	6.97	9.750	4.88	15437	5.76	458.4	5.55
71	7.273	5.47	2.996	6.98	10.268	5.32	16439	6.49	495.4	8.08
72	7.804	7.30	3.183	6.24	10.987	7.00	17777	8.14	571.9	15.44
73	8.249	5.70	3.428	7.70	11.677	6.28	18397	3.49	658.2	15.09
74	8.763	6.23	3.691	7.67	12.454	6.65	19937	8.37	764.2	16.10
75	9.237	5.41	3.928	6.42	13.165	5.71	20341	2.03	853.5	11.68
76	9.758	5.64	4.127	5.07	13.885	5.47	21301	4.72	917.8	7.53
77	10.179	4.31	4.309	4.41	14.467	4.19	22249	4.45	991.4	8.02
78	10.644	4.57	4.528	5.08	15.172	4.87	22987	3.32	1082.6	9.20
79	11.078	4.08	4.761	5.15	15.839	4.40	23886	3.91	1210.8	11.84

Source: Statistics Canada Catalogue 56-203

Table 2.3

Operating Revenues, Annual Growth and Component Shares for the Telecommunications Sector (millions of dollars)

Year	Telephone Companies				Telegraph/Cable Companies				Total Telecomm.			
	Current $(m)		Constant 1971 $(m)		Current $(m)		Constant 1971 $(m)		Revenue $(m)		Percent.	Telco.
	Revenue	Percent Change	Revenue	Percent Change	Revenue	Percent Change	Revenue	Percent Change	Current	Constant (1971)	Change (Constant $)	Percent Share
57	467.7	10.73	481.7	10.86	44.8	10.01	46.1		512.5	527.8		91.25
58	507.7	8.55	581.6	7.66	47.6	6.33	48.6	5.42	555.3	567.2	7.46	91.42
59	582.3	14.69	564.2	8.79	53.0	11.19	51.4	5.76	635.2	615.5	8.52	91.66
60	628.0	7.85	606.8	7.55	58.5	10.54	56.5	9.92	686.5	663.3	7.77	91.47
61	679.3	8.17	657.6	8.37	64.1	9.41	62.1	9.91	743.4	719.7	8.50	91.38
62	733.3	7.95	723.9	10.08	71.4	11.43	70.5	13.53	804.7	794.4	10.38	91.13
63	775.7	5.79	765.7	5.77	73.6	3.13	72.7	3.12	849.4	838.5	5.55	91.33
64	847.5	9.25	836.6	9.26	78.7	6.97	77.7	6.88	926.2	914.3	9.04	91.50
65	934.8	10.30	923.7	10.41	86.1	9.33	89.9	15.70	1020.9	1008.8	10.34	91.57
66	1031.8	10.37	1029.7	11.48	95.5	10.91	101.6	13.01	1127.3	1125.0	11.52	91.53
67	1134.1	9.91	1134.1	10.14	104.5	9.45	111.7	9.94	1238.6	1238.6	10.10	91.56
68	1235.7	8.96	1235.7	8.90	116.7	11.64	124.9	11.82	1362.3	1362.3	9.99	91.37
69	1367.6	10.68	1369.0	10.79	126.6	8.49	126.7	1.44	1494.2	1495.7	9.98	91.53
70	1526.2	11.59	1467.5	7.20	136.9	8.20	131.6	3.86	1663.1	1599.1	6.91	91.77
71	1676.3	9.84	1572.5	7.16	146.4	6.91	137.3	4.33	1822.7	1709.8	6.92	91.97
72	1871.4	11.64	1713.7	8.98	163.2	11.46	149.5	8.89	2034.6	1863.2	8.97	91.98
73	2127.1	13.64	1907.7	11.32	190.7	16.86	171.0	14.38	2317.8	2078.7	11.57	91.77
74	2435.6	14.51	2140.2	12.19	230.1	20.65	202.2	18.25	2665.7	2342.4	12.69	91.37
75	2861.2	17.47	2418.6	13.01	259.1	12.60	219.0	8.31	3120.3	2637.6	12.60	91.70
76	3363.6	17.56	2669.3	10.37	278.3	7.43	220.9	0.87	3641.9	2890.4	9.58	92.36
77	3853.9	14.58	2915.2	9.21	302.1	8.54	228.5	3.44	4156.0	3143.7	8.76	92.73
78	4472.3	16.05	3149.5	8.04	348.3	15.29	245.3	7.35	4820.6	3394.8	7.99	92.77
79	5151.4	15.18	3380.2	7.32	411.8	18.23	270.2	10.15	5563.2	3657.6	7.74	92.60

Source: Statistics Canada Cat. Nos. 56-201, 56-203

Table 2.4 Telephone Companies' Operating Revenues – Projections to 1985

(millions of dollars)

Year	Revenues in Current Dollars					Revenues in Constant 1967 Dollars		
	Historical	Low Forecast		High Forecast		Historical	Low Forecast	High Forecast
		Exp.	% change	Growth	% change		% change	% change
69	1367.6					1369.0		
70	1526.2					1467.5		
71	1676.3					1572.5		
72	1871.4					1713.7		
73	2127.1					1907.7		
74	2435.6					2140.2		
75	2861.2					2418.6		
76	3363.6					2669.3		
77	3853.9					2915.2		
78	4472.3					3149.5		
79	5151.4					3380.2		
80		4679.4	-9.2	5670.7	10.1		3602.3	3804.8
81		5183.7	10.8	6218.4	9.7		3826.2	4195.7
82		5742.3	10.8	6793.2	9.2		4050.9	4629.2
83		6361.1	10.8	7394.0	8.8		4275.9	5110.4
84		7046.7	10.8	8019.1	8.5		4500.3	5644.7
85		7806.1	10.8	8667.0	8.1		4723.7	6283.3
Skipping first 14 observations.								
80		5466.1	6.1	cannot be			3633.4	4555.2
81		6194.5	13.3	fitted			3881.3	5314.2
82		7020.1	13.3				4122.0	6254.8
83		7955.7	13.3				4354.2	7431.1
84		9016.0	13.3				4576.8	8916.4
85		10217.5	13.3				4789.4	10810.9

Table 2.5 Teleco - Telecomm Forecasts - Total Operating Revenues $ current
(Sector Paper)

	Exponential	% change	Gompertz	% change	Growth	% change
79	411.8		411.8		411.8	
80	374.6	-9.03	440.3	6.92	453.6	10.15
81	410.6	9.61	501.0	13.79	498.3	9.85
82	450.0	9.60	571.9	14.15	545.7	9.51
83	493.3	9.62	654.9	14.51	596.0	9.22
84	540.7	9.61	752.5	14.90	648.9	8.88
85	592.7	9.61	867.4	15.27	704.5	8.57

Skipping first 14 observations, so input series is 1966-79

79	411.8		411.8		411.8	
80	434.6	5.53	624.4	51.63	462.9	12.41
81	486.2	11.87	797.7	27.75	517.2	11.73
82	543.9	11.87	1043.2	30.78	574.0	10.98
83	608.4	11.86	1400.0	34.20	633.1	10.30
84	680.6	11.87	1932.7	38.05	693.8	9.59
85	761.4	11.87	2751.9	42.39	755.7	8.92

Table 2.7

Revenue Output per Employee in the Telecommunications Sector
(Constant 1967 $)

Year	Telephone Companies	Percent Change	Telegraph/Cable Companies	Percent Change	Total Telecommunications	Percent Change	Ratios Telco/ Telegraph
57	7516.6		4133.7		7014.9		1.818
58	8415.1	11.95	4593.7	11.13	7876.4	12.28	1.832
59	9591.2	13.98	4849.1	5.56	8943.1	13.54	1.978
60	10521.7	9.70	5501.4	13.45	9556.0	6.85	1.913
61	11677.7	10.99	6203.6	12.76	10084.1	5.53	1.882
62	12456.0	6.66	6995.1	12.76	11649.2	15.52	1.781
63	13107.9	5.23	7394.5	5.71	12285.2	5.46	1.773
64	13755.9	4.94	8243.9	11.49	13016.1	5.95	1.669
65	14549.5	5.77	9177.8	11.33	13870.9	6.57	1.585
66	14944.2	2.71	10400.3	13.32	16003.6	15.38	1.437
67	16572.5	10.90	11662.2	12.13	17354.4	8.44	1.421
68	18526.1	11.79	13430.0	15.16	17938.9	3.37	1.379
69	20555.9	10.96	16114.4	19.99	20086.9	11.97	1.276
70	21483.3	4.51	17157.1	6.47	20629.4	2.70	1.252
71	22473.9	4.61	18190.5	6.02	21394.5	3.71	1.235
72	23575.2	4.90	20401.2	12.15	23284.6	8.53	1.156
73	25301.5	7.32	24347.2	19.34	25220.0	8.31	1.039
74	26348.5	4.14	27147.4	11.50	26413.3	4.73	.971
75	29182.4	10.76	30571.1	12.61	29292.9	10.90	.955
76	31833.3	9.08	31678.3	3.62	31820.8	8.63	1.005
77	33298.0	4.60	33294.2	5.10	33227.4	4.42	1.000
78	33863.0	1.70	34301.4	3.03	33894.4	2.01	.987
79	35016.8	3.41	37285.5	8.70	35175.3	3.78	.939

Source: Statistics Canada Catelogues 56-201, 56-203.

Table 2.6 Employment Growth in the Telecommunications Sector
(Number of Full Time Employees)

Year	Telephone Companies		Telegraph/Cable Companies		Total Telecomm.		
	Number	Percent Change	Number	Percent Change	Number	Percent Change	Telco. Percent Share
57	64,074	6.58	11,159	3.01	75,233	6.03	85.17
58	61,600	-4.17	10,587	-5.13	71,987	-4.31	85.29
59	58,826	-4.19	10,586	-0.0	69,412	-3.58	84.75
60	57,670	-1.97	10,279	-2.90	67,949	-2.11	84.87
61	56,322	-2.34	9,997	-2.74	66,319	-2.40	84.93
62	58,091	3.14	10,069	0.72	68,160	2.78	85.23
63	58,416	0.56	9,826	-2.41	68,242	0.12	85.60
64	60,829	4.13	9,431	-4.02	70,260	2.95	86.58
65	63,467	4.34	9,270	-1.71	72,737	3.53	87.26
66	68,233	7.51	9,161	-1.18	77,394	6.40	88.16
67	68,431	0.29	8,961	-2.18	77,392	-0.0	88.42
68	66,699	-2.53	8,687	-3.06	75,386	-2.59	88.48
69	66,578	-0.18	7,860	-9.52	74,438	-1.26	89.44
70	68,334	2.64	7,678	-2.32	76,012	2.11	89.90
71	69,995	2.43	7,553	-1.63	77,548	2.02	90.26
72	72,671	3.82	7,323	-3.05	79,994	3.15	90.85
73	75,407	3.76	7,047	-3.77	82,454	3.07	91.45
74	81,225	7.72	7,163	1.65	88,388	7.20	91.90
75	82,866	2.02	7,162	-0.0	90,028	1.86	92.04
76	83,864	1.20	6,973	-2.64	90,837	0.90	92.32
77	87,546	4.39	6,863	-1.58	94,609	3.93	92.73
78	92,873	6.08	7,150	4.18	100,023	5.72	92.85
79	96,539	3.94	7,247	1.36	103,786	3.76	93.02

Stats Can Cat. No. 56-201, 56-203.

Table 2.9

Telecommunications Plant, at Cost

(millions of dollars)

Year	Telephone Companies				Telegraph/Cable Companies				Sub-Sector Total		
	Plant at cost ($m)	Accumm. Depreciation	Net Plant ($m)	Net Plant/ Emp.($)	Plant at cost ($m)	Accum. Depreciation	Net Plant ($m)	Net Plant/ Emp.($)	Plant at cost ($m)	Net Plant ($m)	Telco % Share (Net)
67	5,011	1,201	3,810	55,683	494	148	346	38,675	5,505	4,156	91.67
68	5,467	1,347	4,121	61,779	520	161	358	41,268	5,987	4,479	92.01
69	5,998	1,491	4,497	67,548	546	179	367	46,706	6,544	4,864	92.45
70	6,571	1,656	4,915	71,930	571	184	387	50,341	7,142	5,302	92.70
71	7,225	1,882	5,343	76,333	607	199	408	53,995	7,832	5,751	92.91
72	7,960	2,091	5,869	80,763	644	218	426	58,175	8,604	6,295	93.23
73	8,791	2,335	6,457	85,625	789	250	539	76,494	9,580	6,986	92.43
74	10,040	2,633	7,406	91,183	856	292	564	78,702	10,896	7,970	92.92
75	11,426	2,958	8,468	102,190	940	337	603	84,135	12,366	9,071	93.35
76	12,936	3,366	9,570	114,118	978	385	592	84,964	13,914	10,162	94.17
77	14,532	3,854	10,677	121,964	1,030	402	628	91,474	15,562	11,305	94.44
78	16,030	4,343	11,687	125,839	1,161	444	717	100,275	17,191	12,404	94.22
79	17,755	4,984	12,771	132,286	1,299	500	799	110,206	19,054	13,570	94.11

Source: Statistics Canada Catalogues 56-201, 56-203

Table 2.10 Expenditures of the Principal Canadian Telecommunications Carriers for the Acquisition of Telecommunications Equipment (in millions of dollars)

Year	Outside Plant			Central Office Equipment			Station Apparatus			Total	
	Expenditure ($m)	Annual % Change	% of Total	Expenditure ($m)	Annual % Change	% of Total	Expenditure ($m)	Annual % Change	% of Total	Expenditure ($m)	Annual % Change
73	311.6		36.2	356.7		41.4	193.5		22.4	861.8	
		25.87			58.34			44.60			43.51
74	392.2		31.7	564.8		45.7	279.8		22.6	1236.8	
		- 4.26			24.20			47.25			20.40
75	375.5		25.2	701.5		47.1	412.0		27.7	1489.1	
		14.33			5.66			1.67			6.74
76	429.3		27.0	741.2		46.6	418.9		26.4	1589.5	
		16.89			1.15			12.10			8.29
77	501.8		29.2	749.7		43.6	469.6		27.3	1721.1	
	2010.4		(29.14)	3113.9		(45.14)	1773.8		(25.71)	6898.4	
		5.42			- 1.33			10.88			3.96
78	529.0		29.6	739.7		41.3	520.7		29.1	1789.4	
		14.76			5.83			12.04			10.28
79	607.1		30.8	782.8		39.7	583.4		29.6	1973.4	
		- 2.93			8.16			2.73			3.14
80	589.3		29.0	846.7		41.6	599.3		29.4	2035.4	
		- 1.75			- 3.13			4.49			- 0.50
81	579.0		28.6	820.2		40.5	626.2		30.9	2025.3	
		7.39			3.29			2.97			4.37
82	621.8		29.4	847.2		40.1	644.8		30.5	2113.8	
	2926.2		(29.45)	4036.6		(40.62)	2974.4		(29.93)	9937.3	

Table 3.1

Operating Revenues of the Radio and Television Broadcast Industry

Year	Excluding Parliamentary Appropriations		Including Parliamentary Appropriations	
	Millions of Current Dollars	Year Over Year Percentage Change	Millions of Current Dollars	Year Over Year Percentage Change
1956	66.4		n.a.	
1957	76.1	14.6	n.a.	
1958	85.4	12.1	n.a.	
1959	99.9	17.0	154.9	
1960	104.4	4.5	164.4	6.1
1961	110.6	5.9	176.6	7.4
1962	124.4	12.5	195.4	10.6
1963	136.2	9.5	211.2	8.1
1964	153.6	12.7	237.6	12.5
1965	171.6	11.7	264.6	11.4
1966	192.4	12.1	299.4	13.1
1967	214.2	11.4	346.2	15.7
1968	225.5	5.3	367.5	6.1
1969	247.0	9.5	404.0	9.9
1970	263.3	6.6	429.3	6.2
1971	283.9	7.8	458.9	6.9
1972	317.0	11.7	515.0	12.2
1973	377.5	19.1	623.5	21.1
1974	426.5	13.0	684.5	9.8
1975	505.8	18.6	851.8	24.4
1976	604.1	19.4	965.1	13.3
1977	671.2	11.1	1056.2	9.4
1978	788.0	17.4	1236.0	17.0
1979	918.6	16.6	1409.6	14.0

Average annual growth rate 1956-1979	12.2%	(1959-79)	11.8%
Average annual growth rate 1967-1979	12.9%		12.8%

Source: Statistics Canada Catalogue 56-204, Cansim. D30777

Table 3.3

Operating Revenue of the Cable Television Industry

Year	Thousands of Current Dollars	Year Over Year Percentage Change
1967	22,115	
1968	31,286	41.5
1969	37,380	19.5
1970	54,940	47.0
1971	66,620	21.3
1972	82,464	23.8
1973	106,973	29.7
1974	133,433	24.7
1975	162,273	21.6
1976	199,215	22.8
1977	232,958	16.9
1978	271,520	16.6
1979	313,747	15.6

Average annual growth rate 23.7% estimated.

Source: Statistics Canada Catalogue 56-205.

Table 3.4

Cable Television Subscribers

Year	Number of Households (Thousands)	Year Over Year Percentage Change
1968	710,000	30.1
1969	924,000	26.0
1970	1,164,000	20.2
1971	1,399,000	20.9
1972	1,691,000	23.7
1973	2,092,000	22.8
1974	2,570,000	11.5
1975	2,865,000	9.7
1976	3,144,000	8.8
1977	3,417,000	8.7
1978	3,775,633	10.4
1979	4,084,198	8.2

Average annual growth rate 16.8%.

Statistics Canada Catalogue No. 56-205.

Table 3.5

Forecasts of Operating Revenues of the Radio and Television Broadcasting Industry, 1978-1985

(thousands of current dollars)

With Parliamentary Appropriations

	Low	Percentage Charge	High	Percentage Charge
1979	1409.6	14.0	1409.6	14.0
1980	1458.6	0.3	1756.5	24.6
1981	1636.2	12.2	2102.9	19.7
1982	1835.4	12.2	2539.4	20.8
1983	2058.9	12.2	3094.3	21.9
1984	2309.6	12.2	3806.2	23.0
1985	2590.9	12.2	4728.5	24.3

Without Parliamentary Appropriations

1979	918.6		918.6	
1980	904.3	-1.6	1036.4	12.8
1981	1013.3	12.3	1162.9	12.2
1982	1135.4	12.0	1297.7	11.6
1983	1272.2	12.0	1440.1	11.0
1984	1425.5	12.0	1589.5	10.4
1985	1597.3	12.0	1745.2	9.8

Table 3.6

Forecast of Total Operating Revenues of the Cable Television Industry

Current Dollars

Year	Exponential Model	% change	Gompertz Model	% change	Growth Model	% change
1978	273.2		273.2		Model	
1979	313.7	14.82	313.7	14.82	cannot	
1980	457.5	45.84	385.9	23.02	be fitted	
1981	570.6	24.72	448.2	16.14	to the	
1982	711.6	24.71	516.7	15.28	data.	
1983	887.4	24.70	591.4	14.46		
1984	1106.7	24.71	672.4	13.70		
1985	1380.3	24.72	759.6	12.97		

Table 3.7

Employment Growth in Broadcasting

Year	Number	% change	Television Number	% change	Total Number
1967	18,946		1,657		10,603
1968	19,232	1.5	1,367	-17.5	20,599
1969	19,541	1.6	1,601	17.1	21,142
1970	19,576	0.2	1,992	24.4	21,568
1971	19,789	1.1	2,180	9.4	21,969
1972	20,124	1.7	2,598	19.1	22,722
1973	21,172	5.2	3,098	19.2	24,270
1974	22,261	5.1	3,691	19.1	25,952
1975	23,497	5.6	4,084	10.6	27,581
1976	24,680	5.0	4,640	13.6	29,320
1977	25,651	4.0	4,946	6.6	30,489
1978	26,851	4.7	5,293	7.0	32,144
1979	27,675	3.1	5,652	6.8	33,327

Statistics Canada Catalogue No. 56-204, 56-205.

Table 3.9

Additions to Fixed Assets - Broadcasting Industry

(million of dollars)

	Private Radio and TV	CBC	Cable
1972			42.1
1973			45.2
1974		31.0	55.8
1975	37.2	57.9	55.5
1976	39.1	61.4	71.0
1977	52.7	62.5	75.8
1978	47.1	64.1	82.0
1979	57.1		100.1

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