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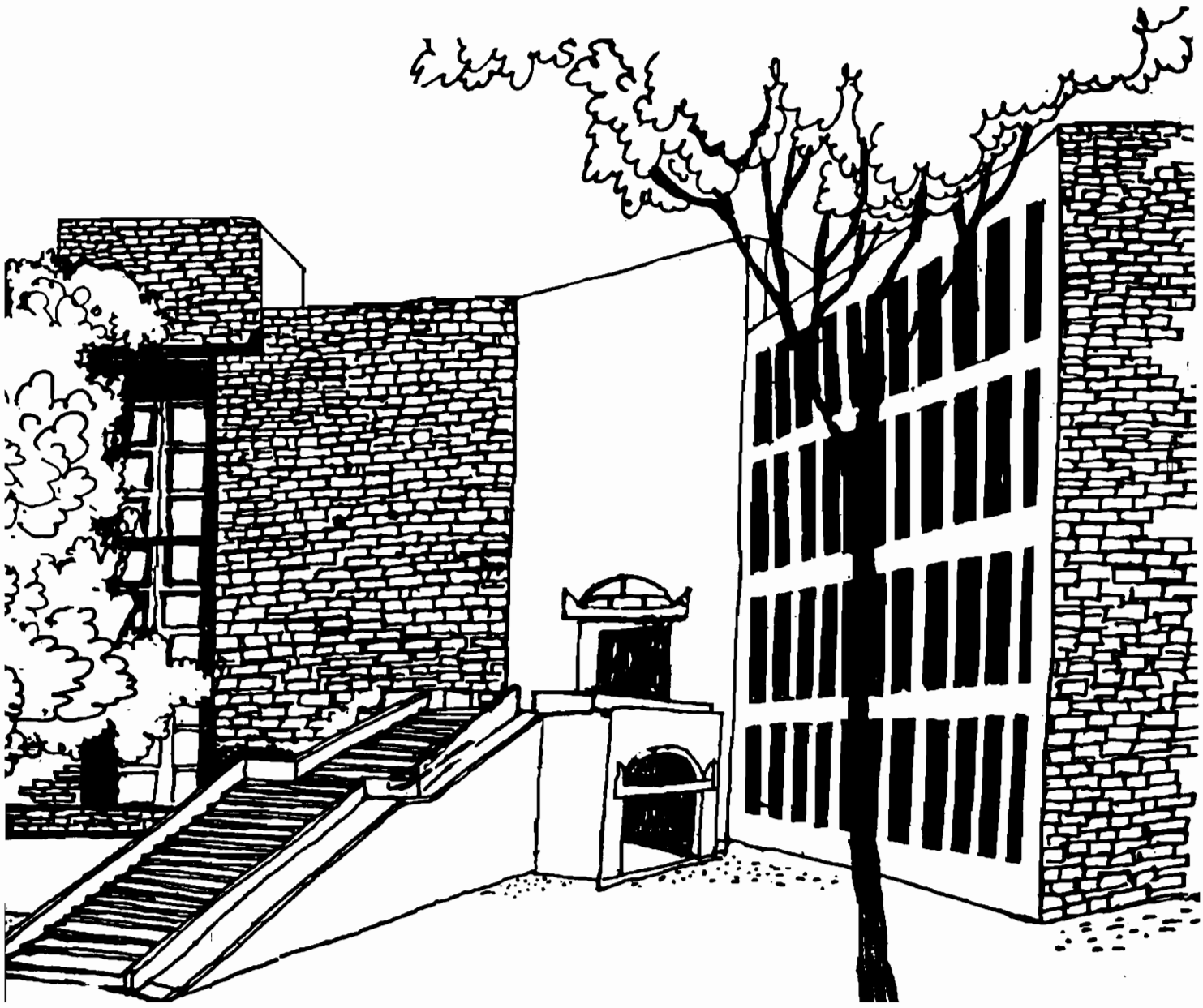

SYNERGY IN GOVERNMENT POLICIES AND GLOBAL COMPETITIVENESS OF TWO CANADIAN INDUSTRIES: AN EMPIRICAL STUDY

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1995

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SYNERGY IN GOVERNMENT POLICIES AND COMPETITIVENESS OF TWO CANADIAN INDUSTRIES: AN EMPIRICAL STUDY

This study by the Indian Institute of Management, Ahmedabad, India and the Research Centre for Technology Management, Carleton University, Ottawa addresses itself to the question of how government policies affect the performance and competitiveness of industries with a view to identify policy prescriptions that could enhance their competitiveness. Rather than looking at individual policies and assessing their impact, this study looks at sets of policies so as to identify the synergy or lack of thereof, among the various policies.

The Context of the Study

The study is undertaken in the context of Canada's need to improve its global competitive position with regard to relatively more sophisticated industries. A better understanding of the Government's role in enhancing the competitiveness of its industries may be very useful in arriving at workable policy prescriptions.

The Conceptual Framework

We have used Michael Porter's "Diamond" framework for our analysis[1]. In this framework, four factors, acting together, are seen as determining the global competitiveness of an industry: the factor conditions, home demand conditions, the state of development of related and supporting industries, and the strategy, structure and rivalry of the domestic firms. The role of government policies, as Porter sees it, is in influencing and shaping the above factors rather than being a factor itself. When underlying competitive advantage in one or more factors are present, government policies can reinforce them and help the build up of the diamond, but cannot, by themselves create advantages. The government's role is not to support uncompetitive industries through subsides, protection through tariff barriers etc., but as a pusher and challenger who creates conditions in which the "diamond" can pick up. Rather than identifying and promoting industries, the government's role is to create more general signals and create conditions under which winners can emerge.

Using Porter's framework for analysis, the study addresses itself to the following issues:

(i) Role of the government. Should it that of a mere stimulator and a catalyst, or should it have a more direct role?

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[1]. Michael Porter (1990), Competitive Advantage of Nations. (London: Macmillan).

(ii) Role of the home demand. How important is it to have a large and sophisticated home base for export competitiveness?

(iii) Are there areas of dissynergies in government policies? If yes, what are they?

We are fully aware that in a free market economy like Canada, the role of government interventions may be much less than in regulated economies like India. All the same, the government policies do play a role even in a free market economy and especially so in regulated industries like telecommunications carrier industry.

Methodology for the Study

We have selected the Canadian telecommunications and software industries for our study. The former was chosen due to the degree of government intervention in this industry in the carrier segment; and the international competitive potential of the equipment segment. The software industry was chosen because of the competitiveness as shown by steady increases in product and service exports. Interviews were conducted with industry members, industry associations and government policy makers over the summer of 1994 and early 1995.

THE CANADIAN TELECOMMUNICATIONS INDUSTRY

An Overview of the Industry

The Canadian Telecommunications industry, considered a part of the Information Technology industry, has two segments: the carrier segment and the equipment segment. The total revenues in the telecommunications industry in 1992 was C$ 21 billion (carriers: C$ 15 billion and equipments: C$ 6 billion)[2]. The industry's real growth rate in 1990 was 8.6 per cent as against the growth rate of 0.3 per cent for the national economy of Canada[3]. The industry employs about 125,000 people and its share in the Gross Domestic Product (GDP) at factor cost and 1986 prices has grown steadily from 1 per cent in 1970 to 1.8 per cent in 1980 and 2.7 per cent in 1990[4].

The carrier industry operates Canada's telecommunication services networks. It also links Canada with the other countries. Its equipments command a global presence. The equipment industry exported 35 per cent of its products in 1990 and 41 per cent in 1992; one of the Canadian

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[2]. Industry, Science and Technology Canada, Information Technologies Statistical Review, 1993 (SIC 3351 & 3359; SIC 4821), pp.41,55.

[3]. Information Services, Industry of Canada, Communications: Factsheet (Ottawa: Industry Canada) (Mimeo publication) (Year of publication not mentioned).

[4]. Communications Canada (1990), Telecommunications in Canada: An Overview of the Carriage Industry. (Ottawa: Industry Canada), pp.5. (Publication No. FS-90-3810E).

telecommunications equipment manufacturers, Northern Telecom, with world revenues of US$ 9 billion is the fifth largest telecommunications equipment manufacturer in the world[5], 39 per cent of whose revenues were generated in Canada. In 1992, Canada's share in the world exports of telecommunications equipment (US$ 70.9 billion) was 2.1 percent[6]. The R&D expenditure in this sector stands out as the highest among all sectors in Canada: $ 1.4 billion in 1990, constituting about 24 per cent of Canada's total R&D effort. A sample of 11 smaller Canadian telecom equipment companies reported that R&D expenditure of these companies averaged 12.6 per cent of the revenue; Northern Telecom spent $ 1.09 billion in R&D in 1991 or 11.6 per cent of its sales[7].

A Brief History of the Industry

To understand the government policies in telecom industry, especially with regard to regulation, it is essential to get an idea of the history of this industry[8].

In 1876, Alexander Graham Bell pioneered the World's first long distance telephone transmission, a 16 km one way transmission between Brantford and Paris, Ontario. In 1880 the Bell Telephone company of Canada (Bell Canada) was incorporated through an Act of Parliament and chartered to promote telephone service to all of Canada. This charter provided Bell Canada with a virtual monopoly for about five years. In 1885, the government revoked Bell's patents and as a result numerous small companies offering competitive services to Bell sprang up. Many of these companies were in the Atlantic provinces and some in the prairies. Bell sold its facilities in these provinces: in the Atlantic provinces to various interests, mainly the Maritimes Telegraph and Telephone Company, Nova Scotia, formed in 1911, and in the prairies, to the Provincial governments. The telephone operations in Alberta, Saskatchewan and Manitoba were operated as provincially owned public utilities. In British Colombia, telephone services were provided by the British Columbia Telephone Co. (BC Tel), a subsidiary of General Telephone and Electronics Corporation of the United States. To provide services in the north, the Federal Government created Northwestel. Bell Canada operated largely in Ontario and Quebec.

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[5]. The four bigger companies are Alcatel (France, turnover: $ 12.4 billion), AT&T (U.S., turnover: $ 12.0 billion), Ericsson (Sweden, turnover: $ 6.6 billion) and Siemens (Germany, turnover: $ 6.6 billion). The revenues are as on 1989.

Source: Communications Canada estimates. In 1989, NT had revenues of $ 6.1 billion.

[6]. Canada ranked 12th in its share in 1992. Japan was the first with a share of 29.8 percent ; U.S. second with 13 percent; and Germany third with 6.3 percent. Source: UN World Trade Database.

[7]. Data obtained from the Industry Science and Technology, Canada, Insight (Diskette).

[8]. For the data on the history of telecom industry, we have relied mainly on John C. Strick, The Economics of Government Regulation: Theory and Canadian Practice (Toronto: Thompson Educational Publishing, 1990).

In 1921, a number of telephone companies formed the Telephone Association of Canada (TAC) to solve common technical problems and to develop a Canadian telephone network. It may be noted that Telephone Association was not a holding company; it was rather an association of its members. Originally the members of TAC were: Maritime Telegraph and Telephone Company (MT&T); the New Brunswick Telephone Company (NB Tel); Bell Canada; Manitoba Telephone System (MTS); Saskatchewan Government Telephones (Now Saskatchewan Telecommunications - Sask Tel); Alberta Government Telephones (now AGT Ltd.) and British Columbia Telephone Company (BC Tel). Later, Avalon Telephone Company (now Newfoundland Telephone) and the Island Telephone Company Ltd (Island Tel) of Prince Edward Island joined in 1957 and 1975 respectively. The Telephone Association of Canada was replaced by the Trans Canada Telephone System (TCTS) which was renamed as Telecom Canada in 1983. In January, 1990, the Telecom Canada carried out a reorganization and was renamed the Stentor Alliance.

Telecom Canada was neither a company nor a corporate entity; it owned no property. Its facilities were owned and operated by the member companies who, by means of a master agreement, interconnected their facilities to provide a nation wide telephone network. Telecom Canada played the important function of division of revenues generated by long distance, interprovincial telephone calls, but did not prevent the members from entering into any arrangements for the interchange of telecom traffic between them or enter agreements with nonmember companies. Telecom Canada itself was not regulated by any Government; each member company has its own regulator. The same applies to the new Stentor Alliance also, and in this paper when we refer to the Telecom Canada, it may be understood to mean the Stentor Alliance also, unless otherwise stated. Exhibit 1 gives the major telephone companies of Canada and their regulating agencies.

To handle the satellite communications of the telephone companies, broadcasting companies and businesses, Telesat Canada, jointly owned by the federal government and the major telecommunications carriers in the ratio of 50:50 was formed in 1969. This company joined the Telephone Association in 1975 and was privatized in 1991. Telesat was given a monopoly over domestic communications satellites and operates as a carriers' carrier.

To handle overseas communications, both by cable and satellite, Teleglobe Canada was formed in 1975[9]. This company, however, does not handle communications between Canada and the U.S.; these are arranged through technical and operating agreements between Canadian and U.S. telecommunications carriers. Teleglobe was privatized in 1987.

There were telegraph companies in Canada, most of which were subsidiaries of Railway companies. Two of the major Railway companies, Canadian National and Canadian Pacific, jointly launched cooperative communications services after World War II. They introduced Telex in 1956, and in 1964, completed a cross Canada microwave network. The two companies formed CNCP Telecommunications, to provide telegraph services and a microwave system offering private line and

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[9]. Actually, Teleglobe Canada was formed from the Canadian Overseas Telecommunications Corporation, formed in 1948.

data communications services for business community. CNCP had its own relay system and switching centres but leased local loops from telephone companies. Canadian Pacific bought out its partner in 1988 and renamed CNCP as Unitel Communications Inc., after selling a 40 per cent interest to Rogers Communications Inc[10]. Recently in 1992 AT&T has acquired a 22.5 percent stake in Unitel[11].

Thus the telecommunications carrier industry has developed as a complex system with numerous competitors and with different ownerships and regulatory agencies. The provinces' control over their companies and the Crown immunity of two companies (MTS and Sasktel) made a unified regulatory system very difficult. It was only in 1989, after a Supreme Court decision, that member companies under Telecom Canada were brought under Federal (CRTC)[12] regulation.

On the other hand, the telephone equipment industry developed as unregulated. But effectively, the largest company, Northern Telecom (NT) (Northern Electric till 1976) had a big advantage in that Canada's largest carrier, Bell Canada had a controlling interest in NT. Bell Canada had, for a long time, prohibited connection of terminal equipment not approved by it on the grounds that "inferior" equipments could result in the impairment of telephone service and damage to its system, and CRTC, for a long time, upheld this contention. The only approved supplier was NT which thus had a monopoly over the manufacture and sale of equipment for the Bell system. Other provinces had also similar regulations, but those carriers with the exception of BC Tel were not integrated into equipment manufacture, and hence pursued open purchase policies. Thus manufactures other than NT could supply to these non Bell companies.

Two cases filed by smaller equipment manufacturers with CRTC during the 1970s led eventually to an interim decision in 1980, and final decision in 1982[13] by CRTC holding Bell's requirement as unreasonable. It laid down that subject to conformity with specified technical standards any terminal equipment could be purchased by the subscribers, and interconnect them to Bell's system.

This decision led to a rapid proliferation of new telecom equipment manufacturers and sellers. By 1982, there were nearly 120 terminal attachments vendors in Ontario, Quebec and British Columbia

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[10]. Communications Canada (1992), Telecommunications in Canada: An Overview of the Carriage Industry (Ottawa: Industry Canada), pp.7 (DDS Cat. No. Co22-44/1992E)..

[11]. As on April 1995, the pattern of shareholding in Unitel was: Canadian Pacific: 48 percent; Rogers Communications Inc.: 29.5 percent; and AT&T: 22.5 percent. Ottawa Citizen, April 21, 1995.

[12]. CRTC is the Canadian Radio-television and Telecommunications Commission, the main federal regulatory body of Canada in Telecommunications.

[13]. Telecom Decision 82-84.

alone[14]. Other provinces followed suit, as in Alberta in 1981. The provinces started allowing equipment to the public, who were no longer obliged to rent them from the telephone companies.

It must be emphasized, however, that at least as far as Northern Telecom was concerned, even though it had a monopoly over equipment supply to Bell's territories till 1980, it had always a major presence in the U.S. It sold to the U.S. market from its Canadian manufacturing facilities, and also had its manufacturing facilities in U.S. In fact, now NT produces 50 percent of its output in U.S., and in 1984, it had 85 percent of the digital central office switch market in U.S.[15]

Exhibit 2 shows the growth in revenues in the carrier industry, in the number of access lines, both business and residential, and in the number of toll calls. The same data are presented graphically in Exhibits 3 and 3(a). The revenues showed a steady growth till 1990, after which there was a decline during the year 1990-91. Even though they have recovered after 1991, the growth is still seen to be less than in the earlier years. This may be a signal that the carrier industry, despite the somewhat freer environment has not been able to improve its total revenue. Although, with the saturation in the coverage, a certain levelling off of the revenues from the basic services is to be expected, the growth in the demand for value services including data services experienced all over the world can be expected to contribute substantially to the growth in the overall revenues. This does not seem to be taking place. The government policy changes also do not seem to have made much of an impact on this industry, as far as the total revenues are concerned. The number of access lines show a steady growth, both in the residential and non residential sectors; there has been no acceleration here either, in particular in the business segment. This is slightly surprising, given the increase in the scope of the value added services in this area. This should perhaps be watched more carefully

Exhibit 4 gives the manufacturing shipments over the years 1982 to 1993 and exports over the years 1984 to 1992, and Exhibits 5 and 5(a) give the data in a graphical form. The manufacture of equipments has been steadily increasing, with no noticeable discontinuities. The exports as percentage of production has been significantly declining till 1989, but increased in 1989 - 90. There was a small decline in 1990 - 91, but after 1991, we notice a steep rise. Perhaps the domestic demand not rising sufficiently quickly, the Canadian firms looked outwards for their market and increased their competitiveness.

Government Policies: Broad Policies

Canada is basically a free market economy, and the Government intervention is kept to the minimum. However, compared to many other free market economic, notably U.S., Canadian Government does seem to play a somewhat greater role in the macro economy. For example, the

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[14]. Strick, Op.Cit., pp.165.

[15]. Michael Porter, Canada at the Cross Roads: The Reality of a New Competitive Environment. (Ottawa: Ministry of Supply and Services, 1991), pp.112.

expenditures by the government on R&D in Canada is nearly equal to that by industry, while in most of the OECD countries the share of the industry is more: about 60 percent.

It must be borne in mind that the government's policy has generally been to support initiatives that benefit business generally rather than industry specific programmes. This has been especially so after a state owned enterprise, Microsystems International, set up in early 1970s failed. Only two strategically directed industry specific programmes, the Special Electronics Fund (SEF) and the Strategic Technology Enhancement Programme (STEP) were introduced in the IT area in the period from 1975 to 1985.

The National Research Council (NRC) was set up in 1917 to plan and coordinate research activities. In 1978, science and engineering research were separated from NRC to a newly created National Sciences and Engineering Research Council (NSERC)[16]. But NRC and NSERC are Crown corporations and it has always been difficult to establish good coordination among the policies framed by other agencies under Industry Canada.

A direct result of such lack of mechanisms for coordination has been fragmentation of initiatives across provinces. For example, in the early 1980s, the Department of Regional Industrial Expansion (DRIE) yielded to pressures to establish Microelectronics Centres in most provinces instead of concentrating its programme funding in one or two regions[17]. This resulted in fragmentation of the effort and reduced overall usefulness[18].

The Network of Centres of Excellence (NCE) initiative attempts to promote collaboration between researchers from different regions. This initiative, however, does not seem to have any device for screening of its projects by the industry, and as such generates more "academically excellent" knowledge than knowledge that is useful in improving the competitiveness of industry. The perception of the utility of this initiative by the industry seems to be as being not very useful to the industry[19].

The Canadian Network for the Advancement of Research in Industry and Education (CANARIE) is an initiative launched in 1993 which effectively assessed and implemented a programme designed to meet industry requirements. The component of the programme which is related to telecommunications equipment involves establishing a fibre optic network which will allow equipment manufacturers to test equipment and communications software on an evolving communications medium. Access

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[16]. Erik Arnold and Ken Guy, Parallel Convergence : National Strategies in Information Technology (Connecticut: Quorum Books, 1986), pp.157.

[17]. Porter, Op.Cit., pp.216.

[18]. Ibid.

[19]. Interviews with industry personnel.

to such testing facilities are normally quite expensive and thus through the CANARIE facility, the government effectively subsidizes the industry by providing this low cost facility. This is seen as very useful by the industry executives, especially the smaller firms.

There are a number of research institutes such as the Canadian Institute for Telecommunications Research (CITR) and the National Wireless Communications Research Foundation (NWCRF) which address evolving Technological issues. Yet, on the whole, the industry seems to view these government initiatives rather dimly, in that they do not always address the problems of industry, and most firms seem to prefer intramural R&D.

There seems to have been a number of programmes and initiatives which are "across the board", i.e., applicable to all industries.. An important policy instrument of the government has been the treatment of R&D expenditures for tax purposes. In the sixties, 100% of deduction was allowed for both current and capital expenditures on R&D. In 1977, R&D tax credits of 5 per cent was introduced.[20] This was enhanced to 10 per cent in 1978 (25 per cent for small businesses), and an additional 50 per cent deduction for incremental expenditures was introduced.[21] In 1983, the additional 50 per cent was replaced by an extra 10 per cent in tax credit rates, i.e., the credit rate was enhanced to 20 per cent (35 per cent for small businesses). There was also introduced a partial refundability of unused credits. In 1984, the 35 per cent credit was limited to $2 million expenditure per annum. In 1985, the terminology of Scientific Research and Experimental Development (SR & ED) was introduced; 100 per cent refundability of the 35 per cent credit for current expenditures was introduced. In 1987, the earlier carry forward period of seven years permitted in 1983 was extended to ten years, but in the next year, R&D expenditure base was reduced by the R&D tax credit availed of in the previous year. Thus, in a sense, the tax credit itself became taxable. Refundability of large corporations was eliminated, and buildings were made ineligible for R&D tax credits and accelerated deductions. (They are depreciated on an ordinary basis).

This scheme has remained substantially unchanged till now. There have been some small changes in 1992, '93, and '94 especially concerning small businesses.

Three points related to these schemes are to be noted. First, the tax credits are in addition to the deduction from income that can be claimed for both current and capital expenditures (although the base for calculating this deduction is reduced by the tax credit). This adds up to a sizeable tax incentive. Second, the entire scheme has no special component for encouraging incremental R&D expenditures; thus, there is no incentive, from the tax angle, for firms to increase their R&D expenditures. Third, after 1983, there has only been a reshuffling of tax credits rather than any substantial increases in the incentives. In fact, the changes in 1987 could have acted as a net disincentive.

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[20]. Only the general tax credit is noted above. In certain designated regions, there were different rates for tax credits.

[21]. Same comment as footnote 20 above.

In addition to the above incentives, which are given by the federal government, provinces also offer their own tax incentives. The detailed tax treatment and rates vary from province to province, and in general, it can be stated that the credit is around 20 per cent and the provincial tax credits take into account the tax credits given under federal schemes.[22] The effective cost, after taxes and tax incentives of doing $1 of R&D works out to be about $0.50 in Canada varying from $0.439 in Manitoba, $0.446 in Nova Scotia, $0.479 in Quebec, and $0.509 in Ontario to $0.583 in Newfoundland and Prince Edward Island (for large firms). For smaller firms, these figures vary from $0.394 in Quebec to $0.555 in Newfoundland.

The Conference Board of Canada has developed an index named the B-Index, defined as the effective cost of doing $1 of R&D divided by (1-tax rate) to compare the tax incentives across countries for doing R&D. A comparison of this index across countries shows that Canada has one of the most attractive R&D tax incentives in the world. The B-index for Canada varies from 0.69 to 0.78 for large companies and 0.48 to 0.62 for small companies. The U.S. has a B-index of around 0.90 while Japan ranges from 0.93-1.00; Korea 0.81-0.89; France 0.91; Germany 1.06; Sweden 1.02; and U.K. 1.00. This, therefore, ought to provide a major competitive advantage for Canadian firms.

Government Policies in Telecom Industry

Regulation

The carrier industry in Canada is heavily regulated. The government, through the CRTC, controls (i) the nature of competition (ii) the tariffs charged and (iii) the investments undertaken by the companies.

In its early years, the telephone industry was unregulated. The withdrawal by the government of Bell Canada's patents in 1885 did lead to competition, but the consumers were, on the whole, dissatisfied with the services and rates. The telephone companies tended to concentrate their services to the more populated urban areas, and neglect rural areas. Smaller companies complained of anticompetitive practices by Bell which included predatory pricing and the refusal of Bell to permit the independents to interconnect with Bell's local and long distance lines[23].

In 1906, federal government introduced regulation into the industry. It was empowered to approve all telephone rates of Bell Canada and permit interconnection of other telephone companies into the Bell network. In 1967, the responsibility of regulating the portion of telephone industry was transferred to the Canadian Transport Commission. In 1976, the Canadian Radio-Television and Telecommunications Commission (CRTC) was made the regulatory body of all companies under

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[22]. For details, see Jacek Warda, Canadian R&D Tax Treatment (Ottawa: Conference Board of Canada, 1994) (Report 125-94).

[23]. Strick, Op. Cit., pp.157.

federal jurisdiction. CRTC companies account for more than 75 per cent of the total operating revenues in the industry.

CRTC has enunciated five principles which govern its policies. These are:

1. Provision of efficient, just and reasonably priced telecommunications services;

2. Universal accessibility of basic telephone service;

3. Prevention of abuse of monopoly position by carriers;

4. Ensuring financial viability of the companies; and

5. Reduction of regulation, or its being made more flexible, when called for[24].

The last goal is interesting, for it provides not for regulation, but for deregulation, if called for.

CRTC approves all rate changes of companies under their jurisdiction. It can examine the extent and quality of services provided, and the carriers' construction programme, including issues of depreciation and renewal and amortization of their equipment. It conducts public hearings on major issues. CRTC approval is also required for changes in conditions of services, issue of shares by carriers, concluding connecting agreements with other telecom companies etc. Unlike FCC of U.S., CRTC has jurisdiction over both local and long distance tariffs (in U.S., local rates are under the domain of state regulators).

There were certain important decisions by CRTC and the Courts of Canada that had a great impact on the industry. We present them briefly in terms of the issues involved.

1. Interconnection with other Networks. In 1976, CNCP Telecommunications filed an application with CRTC to require Bell Canada to allow the interconnection of certain CNCP facilities with Bell's exchange facilities (at a price, of course). This would enable CNCP to send data messages between computers and private line voice services to a larger number of users than was possible under its own network. This was opposed by Bell Canada on the basis of the "natural monopoly" argument - that the telephone industry requires considerable investments and hence it is not in the interest of consumers to have duplication of these investments by competing companies: hence the industry is a natural monopoly - and the "creaming" argument - that CNCP was attempting to take away the lucrative sectors in long distance communications from Bell, and this would lead to poorer and costlier services to local and remote area consumers. This meant effectively that these services were cross subsidized. CRTC upheld CNCP's application and permitted it to connect with the Bell system in 1979. Similar access was given for CNCP to connect with BC Tel in 1981, though in both the

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[24]. Canadian Radio - Television and Telecommunication Commission, Annual Report, 1987-88 (Canada: Ministry of Supply and Services), p.5. The goals are not reproduced verbatim.

The Telecommunications Act of 1993 gave the right, on the part of CRTC to forbear from regulation any segment of the industry where it finds that "sufficient competition" exists (though it does not define what constitutes sufficient competition).

In September 1994, CRTC introduced a rate rebalancing scheme. This decision opens local telephone service to competition from any would be players, including cable TV companies. The century old method of profit based regulation has effectively been replaced with a price cap scheme. According to the current CRTC Chairman, Mr. Keith Spicer, the latest CRTC decision was motivated by the need for a greater reliance on market forces in telecommunications[27].

4. Regulation of Rates. Like in most countries in the world, the long distance services in Canada cross subsidize local services, and frequently "value added" services - like data services - subsidize the local services even more. CRTC controls all tariffs essentially through a mechanism of control over rate of return on investment. Essentially this means that the CRTC looks at the ROI earned by the company and its future projections as a result of any proposed tariff hike and ensures that this is excessive. In this system, the tendency to overcapitalize is always present; hence CRTC looks at the investment plans too. Lastly, it devotes considerable energies to ensure that the rates in competitive services are not set below cost and be subsidized by high returns on monopoly services. Despite all this, however, if a firm does attain a higher ROI than stipulated (this is usually a range), the telephone company can be asked to refund the excess profits to the subscribers in the form of a credit as happened with Bell Canada in 1985 and 1986[28]. The question of whether CRTC in fact had such a power to order the return of "excess" profit was decided in the affirmative by the Supreme Court in a judgement in 1989.

Other Policy Initiatives in the Telecom Industry. The trend in Government policies has generally been towards encouraging market forces to play a greater role. In 1987, the Government issued a new Telecommunications Policy. One of its objectives was "to create a viable competitive market place for telecommunications services and equipment in all regions of Canada"[29].

The Policy established two types of carriers. Type I carriers are those who own and operate transmission facilities. Here the objective was to facilitate limited entry and strong competition in the provision of essential telecommunications infrastructure. Type II carriers are those who use facilities based from Type I carriers in order to provide services to the public. Here the objective is to provide full unregulated competition in order to promote innovation and enhance the competitiveness of the Canadian telecommunications industry.

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[27]. Globe and Mail, September 17, 1994.

[28]. For details, see Strick, Op. Cit., pp. 162.

[29]. Communications Canada, Government Telecommunications Planning Framework and Review (Ottawa: Industry Canada) (Year of publication not mentioned).

Based on this frame work, the new Telecommunications Act was introduced and we have noted earlier how this Act also emphasizes competition.

There have been liberalization on many other fronts like in microwave licensing and satellite earth stations. Now the law permits many users to own and operate earth stations. The government has licensed a number of operators for nationwide paging services.

Exhibit 6 gives the various government policies over the years at a glance.

Canada's Telecommunications "Diamond"

Demand. Canada has had one of the most sophisticated demand conditions in the world in the area of telecommunications. Canadians demanded and received high quality telephone service at reasonable prices. The penetration levels in Canada at 98 per cent is among the highest in the world and this is particularly remarkable when we consider that vast areas of Canada are remote and costly to access.

The government itself is an important customer, with annual telecom billings of C$ 482 million in 1992-93. This, by itself, however, may not have contributed much to the demand conditions. Of greater influence over demand were government policies.

The government policies affected demand in two ways. Firstly, its emphasis on the telecommunication facility being accessible to all regions, however remote they are, forced telecom companies to find innovative ways of attaining this objective. Examples of these innovations include: the world's longest microwave system between Sydney, Nova Scotia and Victoria, B.C. (5400 km)(1958); Bell Canada's Tropospheric Scatter System to provide cost effective service to remote areas of the eastern Arctic (1950s); the launch of Anik I, the world's first geostationary satellite (1972); the world's first nationwide digital data transmission network (1973) and the first local digital central office switch (1976)[30]. The second was the government policy of allowing private ownership in the carriers industry as well as in equipment industry. This forced the companies to be very demanding regarding their equipment and components; hence a very sophisticated equipment industry came to be built up. Besides Northern Telecom, which emerged as among the world's giants, other equipment suppliers also emerged, with their own competencies. For example, Mitel's PBXs and Newbridge's multiplexers have been successful in penetrating foreign markets.

The way in which the carrier industry developed in Canada provided a stimulus to standardisation of equipment. Signal compatibility between different switching equipment became a very important consideration for NT which overcome the problem through its modular design. This design became one of its competitive strengths.

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[30]. Porter, Op. Cit, pp.106.

The integration of U.S. and the Canadian systems also led to a high degree of sophistication of demand. The U.S. provided both a large and sophisticated market, and the close relationship between the two countries provided a consistently high quality demand from both countries. In equipments, the manufacturers, especially NT, always had been suppliers to U.S. market on a large scale and even had manufacturing operations there. In 1993, 60.3 percent of the total Canadian exports of telecommunications equipment were to the U.S.[31] This led to the need for a consistently high quality demand that existed in both countries. Though Bell Canada purchased its equipment from NT, the latter was not a captive supplier; it had to sell its equipment to Bell Canada at least at the same price (if not lower) than the price at which it sold its equipment to other telecom companies, whether in Canada or outside. This forced NT to be cost effective and innovative.

Lastly, the close relationship between Bell, a monopoly carrier till recently and NT seemed to have been made use of positively by both companies. Bell got very high quality equipment from NT while NT used Canada as a testing ground for its equipment[32].

The relatively high degree of industrialisation, especially in Ontario and Quebec, provided also a big and demanding market for data services and even private line voice services. Indeed, with the high penetration levels already achieved, there seems to be the big potential market. Here the government's recent initiative in permitting Unitel to use Bell's lines, and competition in long distance services are likely to have a major favourable effect.

Factor Conditions. Factor conditions in the telecommunications industry refer to the availability of basic research infastructure, quality standards, availability and productivity of skilled workers etc.

The basic research infrastructure is quite strong in the industry. As mentioned, the CITR and NWCRF are government sponsored institutes for research in telecommunications. These centres provide the Canadian firms with access to research information without incurring the associated capital costs.

Industry members have been instrumental in setting quality standards. These standards have translated into domestic laws and international yardsticks for measuring quality. NT, the leader played a major role in establishing standards for telecom equipment after the post terminal attachment legislation in 1979 and in this, it worked closely with the Department of Communications[33]. Each piece of certified telecom equipment carries a Department of Communications decal which verifies its quality.

The government's Export Aid programmes also provide direct incentives for firms to export.

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[31]. Statistics Canada (TIERS).

[32]. Interviews with executives of a telecom carrier firm.

[33]. Interviews with industry personnel.

The establishment of a fibre optics network which will allow equipment manufacturers to test equipment and communications software under the CANARIE programme seems to have been a very useful initiative and used by equipment manufacturers. The Sector Competitiveness Framework studies, however, does not seem to have been used to improve the competitive position in the equipment industry between 1981 and 1991.

It is in the area of human resources that the factor conditions in Canada seem to be the weakest, especially in high technology industries like the telecom industry. Government policies to secure a steady stream of graduates in high technology fields have failed to attract young students. Executives interviewed by us were uniformly concerned about the quality of the graduates and the extent of on site training required to be given for new employees before they could perform on the job.

The labour productivity in the Canadian telecom equipment industry is quite high relative to other manufacturing in Canada. Its average growth rate of 5.7 per cent has outpaced the productivity rate of growth of 4.9 per cent in total manufacturing. But while labour productivity registered a continuous growth till 1991, it seems to have been steadily declining, with manufacturing value added per worker falling from 135 in 1991 to 125 in 1993[34]. See Exhibit 7 for trends in labour productivity and total factor productivity in telecom industry between 1981 and 1991..

The nature of province-federal relations in Canada make it difficult to upgrade factor conditions in the entire country in a synergistic manner through well orchestrated programmes. One crucial area, mainly the weakness in human resources, is especially difficult to tackle.

Related and Supporting Industries. The carrier and equipment industries, as noted above, are mutually supporting and are well developed. The electronics industry as a whole, the computer and peripheral equipments, and software industry are other related industries to communication industry. All these are fairly well developed, with close ties to the U.S. which make them all well exposed to international competition. "Other communications and the electronics equipment" industry (SIC 3359), which include various radio and microwave communication equipment television broadcast equipment, antenna etc. has a turn over of $ 3.1 billion with an export orientation of 34 per cent (in 1992). Electronic parts and components industry (SIC 3352), which includes a wide variety of electronic parts has a turnover of C$ 1.25 billion, with high export orientation[35]. Many of these industries themselves are highly competitive internationally.

Firms' Strategy, Structure and Rivalry. In the carrier segment, we noted that in most areas, the companies were given monopoly status till 1992. Despite this, however, Bell Canada and other

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[34]. From a study furnished to us by the Department of Communications, Industry Canada. The source of data for this study is Statistics Canada.

[35]. The export orientation, as given in the Statistical Review is 255 per cent. This, of course, takes into account an import of 151 per cent. It is difficult to calculate the exact export orientation in these circumstances.

telephone companies have been able to provide Canada with one of the most sophisticated, reliable and affordable communication systems in the world. Canada has also been the pioneers in many areas in telecommunications, as we have seen earlier. Thus the monopoly itself does not seem to have led to a firms' strategy of exploitation of monopoly status and consequent inefficiency.

This was because of the government's control. On the one hand, it laid down broad parameters of efficiency, service levels and reach; on the other hand, it laid down highly sophisticated standards which were necessitated not only for interconnections among Canada's carriers, but also to the U.S. carriers.

The tax credit policy and the "ROI cap" policy also perhaps gave a strong incentive for firms to invest in R&D, although verifying this through a rigorous analysis is beyond the scope of this study. A study based on a sample of 45 firms[36] shows that it is the small size firms which are devoting the highest percentage of their revenues to R&D as may be seen from the following table:

Table 1

R&D Intensity and Firm Size

Firm Size (Sales) C$ million	R&D as per cent of Sales
>1000	11.5
100-1000	12.8
10-100	12.9
<10	20.5
Overall	11.5

R&D expenditure, of course, is decided not merely by the tax incentives. But it does seem to affect the decisions considerably, as we gathered from our interviews, and as may broadly from the above table.

It is also not clear that with the introduction of competition after 1992, the playing field is level. For the competitors to Bell Canada can use the exchange and circuit facilities of Bell Canada, which Bell executives felt have been set up by Bell after considerable effort. They seem to feel that the carriers are taking undue advantage of Bell's past achievements and the returns obtained by way of leasing/ usage changes are not adequate to cover the expenses incurred. What is more, they fear this policy

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[36]. From a study furnished to us by Department of Communications, Industry Canada. The data for this study are from Evert Database.

may encourage other carriers not to develop their own facilities, but instead rely on Bell's development. Consequently, Bell's own incentive to invest in sophisticated improvements may reduce[37].

The ROI cap policy applies to overall profits including profits from overseas operations. In one case, Bell Canada had high foreign earnings and this led to "excess profitability". Bell was asked by CRTC to distribute the "excess" to its subscribers. After this experience, Bell Canada formed a separate subsidiary to carry out its international operations, a move which added no value to anyone.

In the equipment industry, the government has avoided direct interference. The decision to allow terminal equipment of any make to Bell's system, as we have seen, spurred vigorous competition among manufactures and brought down the prices. This also seems to have led to shifting by Northern Telecom of its lower technology manufacture (like basic telephones) to offshore, taking advantage of cheaper labour, and concentrating on higher technology equipments including digital switching and fibre optics.

It is not, however, clear that this will necessarily lead to cheaper equipments for consumers. While the tariffs for telecommunications equipments in U.S. is 4.7 to 8.5 per cent, Canadian tariffs are higher, 10.3 to 17.8 per cent[38]. Hence equipments manufactured abroad may turn out to be costlier to Canadian consumers than if they were made indigenously. After NAFTA, these tariffs may, however come down.

Despite the very favourable tax treatment of R&D expenditure, the response of firms to the R&D credit incentive seems to have been lukewarm. While it is true that the Canadian R&D incentive programme is among the best in the world, and the firms in the telecom industry do spend a relatively high proportion of their revenues on R&D, R&D investment after 1986 seems to have flattened out [see Exhibits 8, 8(a), 9 and 9(a)]. Between 1978 and 1988, the rate of growth of R&D expenditures on a compounded basis was 21.1 per cent per annum, much above the rate of growth of revenue. This slowed down to 3.2 per cent between 1988 and 1993, much below the rate of growth of revenue. These trends are true even after correcting for inflation.

This slowdown after 1988 was despite the fact that the new scheme of R&D tax credits was introduced in 1986. It was only in 1990-91 that we see a spurt in R&D activity in the firms, but this was followed by a dip in the following year.

The level of capital investment in the telecommunications equipment, and electronic parts and components (SIC 335) industries is quite modest relative to the R&D expenditures in this area.

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[37]. Interviews with executives of a telecom carrier firm.

[38]. ISTC 1993 information.

Moreover, according to a study[39], the contribution of capital input to total factor productivity in this sector is nominal relative to the role of new materials. Despite this, between 1978 and 1987, new capital investment in the telecom equipment industry experienced a tremendous growth of 26.2 per cent per annum. This trend, however, reversed to an annual decline of 7.8 per cent during the 1988 to 1992 period, as may be seen from Exhibits 10 and 11 which give the trends in capital investments and total investments between 1976 and 1992.. This might suggest that (i) either some overcapacity built earlier was shed (Mitel and NT both shed some of their capacity) and/or (ii) the industry was no longer modernizing its assets at a sufficiently fast rate.

Successful Canadian equipment firms (other than NT) have generally followed a niche market strategy. They develop high skills in particular areas and compete globally. All these firms depend on exports to a great extent.

Due to the "hand off" policy of the government in this area, the relevant capabilities developed by firms have been disjointed. This is of no great consequence so long as global trade follows such trends. But as more and more global purchases, especially from the large markets of Newly Industrialising Countries are on a turn key basis, knowledge in limited areas proves to be a handicap, and consortium formation is more the exception than the rule[40].

Telecommunications Industry and Government Policies: A Critical Appreciation

The government of Canada has played a direct role as a regulator and an indirect role as a catalyst with respect to the telecommunications industry. It has defined the rules of the competition from time to time, set the rates, sought to improve infrastructural facilities and encourage R&D through its taxation policies.

Looking at Exhibits 2, 3 and 3(a), we note that in terms of access lines, the industry seems to be encountering saturation. Though this is understandable in the case of residential access lines (with already 98 percent of the households covered), it is not clear that the number of business access lines is not growing due to saturation effect. In fact, the demand for value added telecommunication services is experiencing a steep growth in the whole world, and the fact that this is not getting reflected in the number of business lines is a matter for concern.

The number of toll calls has been increasing steadily. But the main growth took place in 1985 when the annual increase jumped to around 10 percent (see Exhibit 3(a)). The major event prior to this was the interconnection of other carrier networks in 1984. This seems to have stimulated the traffic in the industry.

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[39]. Furnished to us by the Department of Communications, Industry Canada.

[40]. Interviews with industry personnel..

Starting from 1990, this growth tapered off. The new Telecom Policy of 1987 does not seem to have contributed much to the growth of telecom traffic as such. We were unable to assess the impact of the 1992 Telecommunications Act since the statistics were not yet available, but we gathered that there has been a great increase in the number of toll calls in 1993 and 1994.

Despite the increase in the number of calls, however, the revenues experienced stagnation. This is because of the rates per call coming down steadily. This is seen more clearly from Exhibits 12 and 13. The call rates have been coming down steadily over the years, both in nominal and real terms. Till 1987, there has been no reduction in nominal terms but in real terms, rates declined by 4.2 percent during the period 1982 - 1986. From 1987 onwards, there has been a steep reduction, with two sudden drops in 1988 and 1991. Between 1986 and 1992, the rates have declined by 27 percent in nominal terms and 33 percent in real terms[41].

Thus there seems to be little doubt that introduction of competition has led to reduction rates for the consumer. But this does not necessarily seem to be an unmixed blessing. The profitability of the corporations, notably Bell Canada and NT seem to be getting eroded, with the result that investment in R&D and investment in new capital assets have been going down. Looking at Exhibits 8, 8(a), 9 and 9(a), it is clear that the efforts of the government to encourage R&D through tax incentives are having only a limited impact. The squeeze on margins resulting from competition seems to have led to a slowdown in R&D in the industry, and this has not been compensated by the tax incentives.

This does not mean that the tax incentives are not serving any purpose. In fact one of the executives from the telecom industry interviewed by us stated that in his opinion, but for the sizeable incentives for R&D, the companies would have been unable to do any R&D of much consequence with the margins under squeeze.

Capital investments are also slowing down (Exhibits 10 and 11). This again may be indicative of a mixed impact due to government policies.

While the emergence of competition has undoubtedly contributed to reduction of rates in the long distance segment, it is not certain that the playing field is level. CRTC is cautious about increasing the local rates. It is estimated that while the costs of a household connection and local service are in the range of $ 32 per month, only about $8 to 9 are recovered[42]. CRTC has permitted Bell to increase local rates over three years to cover the cost, but this has been effectively blocked by lobbies and its competitors. These companies do not provide local services, with the result that in their case the relevant costs are the costs of the long distance alone. This is estimated to be about 31 to 32 cents, with the result that they are able to offer much lower rates than Bell's, while Bell has to bear

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[41]. We were not able to get the advertised base rate per minute call over the years. We have therefore used the average revenue per toll call as a surrogate. Unless the average duration of a call has changed over the years, this may not be a bad surrogate measure.

[42]. Interviews with industry executives.

the burden of subsidizing local services. A more sophisticated system for fixing the rates seems to be called for.

In the equipment sector, Canada's international competitiveness in excellent in wireline equipment and moderate in customer premises equipment. In the U.S. import market for telecom equipment which was C$ 9574.4 million in 1993, Canada had an important presence, with a share of 14.17 per cent[43]. Its presence is very strong in public network equipment (62.48 per cent of the U.S. imports) and parts (79.11 per cent). In customer premises equipment, Japan was the leader with 34 per cent share, and Canada was sixth with 5.28 per cent. In customer premises equipment parts, however, its share of 24.69 per cent was second only to Japan which had a share of 43.93 per cent. In wireless equipment, even though Canada was second with a share of 9.44 per cent, it was well behind the leader, Japan (share 29.2 per cent). An examination of Canada's share in U.S. market for public network equipment shows that it improved its position steeply, from 16.74 per cent in 1989 to 62.48 per cent in 1993. The main losers in this share were Japan and Hong Kong. In public network equipment parts also, Canada's share went up from 52.59 per cent to 79.11 per cent over the same interval, mainly at the expense of Sweden and Japan. In customer premise equipment and parts, the market share distribution seems to have been stable, with no major changes in the relative shares of the countries, and the same was the case with wireless systems equipment.

In other countries which are major producers of equipment, in no country has Canada a major presence, except perhaps in U.K., where with a share of 9.99 per cent, it has the fourth largest share. In Germany, Canada has a good share of 13.5 per cent in wireline equipment parts, but this has now become 1.94 per cent. Thus, Canada seems to have been unable to penetrate markets in equipment producing countries other than the U.S.

In non-equipment producing countries, Canada has a presence in wireline equipment in Australia (share: 9.86 per cent) and Korea (22.3 per cent). Besides these, its presence in other countries has been negligible.

These data would indicate that while Canadian equipment, especially public wireline equipments are competitive, as seen by their ability to penetrate the U.S. market, this competitiveness has not been translated to sales in other major equipment producing (MEP) or in non-major equipment producing countries (NMEP). A study of the determinants of export performance done by the Department of Communications, Canada shows that the most consistently appearing determinant is the R&D expenditure, followed by capital formation, annual wages and exchange rates (for NMEP countries)[44]. Since the telecom equipment sold in MEP markets by the MEP countries tends to be associated with sophisticated technology, the level of technical expertise is the most apparent determinant of export performance.

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[43]. "Foreign Market Penetration", a study by Felix Berezovsky (1995) for Industry Canada.

[44]. Felix Berezovsky, Op. Cit.

With AT&T buying interests in Unitel, the trend is towards a more integrated market with the U.S. It is reported that already cross country calls are getting routed through U.S. due to the difference in rates between U.S. and Canada (Despite the reduction in long distance call rates in Canada, the U.S. rates continue to be lower). If this trend increases considerably, Canadian companies may become unviable.

Government initiatives and interventions like research conducted by government laboratories and universities to help the industry seems to have had mixed and on the whole, limited success. There seem to be serious problems of industry - laboratory linkage and usage of these programmes and facilities by the industry.

Many areas of dissynergies also come to light. One is the complexity of regulation and fragmentation of decision among provinces and between the federal government and provinces. Though the Telecom Act 1993 does remove a great of these difficulties, considerable powers still rest on the provinces.

Second is the fragmentation of decision making in the government itself. Telecommunication "policies" are framed in different agencies like the Department of Communications, other units of Industry Canada, the Department of Finance, etc.[45] No mechanism for coordination seems to exist among these different agencies. The recent Telecommunications Act seeks to get over the problem of multiple regulations from different Acts, but the decision making itself is still fragmented. Industry members seem to feel confused and apathetic towards government control and initiatives. There seems to be a need for greater coordination in decision making in this area.

The R&D tax credit system needs to be made more visible and easier to operate. These programmes seem to involve a great deal of paper work which deter many firms, especially the smaller ones, from using these incentives. So is the case with the export aid programmes. There is an urgent need for export aid to be administered and delivered by one government body.

The factor conditions in the telecom industry in the area of human resources needs to be tackled, aiming at ensuring long term output of qualified personnel for the telecom industry.

It is also to be recognized that despite its obvious strengths and world class capabilities, Canada in general, and Northern Telecom in particular, have not been able to, or not felt compelled to penetrate markets other than the U.S. A large export base does not seem to be a part of the strategy of Canadian firms. This may prove to be a major weakness, when vast markets are emerging in many countries like China and India.

Thus even in a free market economy like Canada, in sectors like telecommunications, the government still plays an important role. While many of these roles are indirect and supportive, some are industry

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[45]. Interviews with the DOC personnel.

specific and these seem to be quite effective. But some areas of dissynergies discussed above reduce the effectiveness of these policies.

THE CANADIAN SOFTWARE INDUSTRY

An Overview of the Industry

The computer services and software industry is one of the fastest growing sectors in the Canadian economy. It has three subsectors: professional services, data processing services and software products development. The professional services includes consulting services like systems advice and technical consulting, contract systems analysis and programming, applications management, project or facilities management, training and education. It also includes development of custom made software to meet individual needs. This accounts for 35 per cent of industry's revenues[46]. Data processing services consists of establishments that provide computer processing and related products and services like gateway and network services, data base access, shared processing and data entry services. These account for 22 per cent of revenues. Software product development involves development and sale of packaged software. Packaged software may be systems software packages (operating systems), user tools (systems development and maintenance packages) and applications (ready to use packages). The packages may be vertical (specific to particular industries like hospital systems) or horizontal (generic packages like accounting, pay roll, etc.). The software products development account for 15 per cent of revenues. The remaining 28 per cent of the industry's revenues were made of other activities like hardware sales, leasing and rentals, hardware repair and maintenance.

Of these, data processing services do not strictly come under software, but often the line separating it from software is thin and most of the statistics (including those of Statistics Canada) include these services.

The Canadian software industry registered steep growth with the introduction of mini and micro processors in the 1970s. Growth rates of 15 to 20 per cent were not uncommon in computer hardware in the late 1970s[47]. The vast growth of personal computers (PCs) shifted the marketing emphasis from hardware to software, and this expansion took place to a very large extent in U.S. Canada also witnessed a high expansion. In the period 1986 - 1991, the Canadian software industry witnessed a growth of 15.5 per cent per annum as compared to the overall growth of 1.9 per cent of the Canadian economy[48]. By 1992 the Canadian software industry consisted of 12,000 firms and

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[46]. Industry Science and Technology Canada (1993), Insight (Diskette).

[47]. Industry Science and Technology Canada (1993), Information Technologies Statistical Review.

[48]. Ibid.

employed over 70,000 people. The projected worth of the Canadian software industry for 1995 is C$ 7.2 billion[49].

It must also be noted that in the official statistics, only the establishments whose primary output is computer services or software are captured. There is a lot of activity by numerous firms in developing software, notably in telecommunications. It is estimated that the telecom equipment and computer manufacturers were responsible for 38 per cent and 19 per cent respectively, of the software R&D performed in Canada, whereas the computer services and software industry performs only 17 per cent of the software R&D[50]. Hence the official estimates of the output substantially understate the industry's true output. Exhibits 14 and 15 show the output of the computer and services industry and the software products development industry[51].

Despite a large number of firms in this industry, most of these firms are small, and the Canadian software industry is dominated by its major players. In 1989, 78 firms with revenues of more than C$ 10 million earned 48 per cent of revenue. The next 90 firms, with revenues of C$ 5 to 10 million accounted for another 11 percent of the revenues. The three largest Canadian software firms are: Cognos, a product firm, Corel, a product firm and Systems House, a consulting service and systems integrater firm.

Large and medium sized software companies necessarily have to play in the global market due to the small demand base of Canada and the need to recover the large R&D expenditures. This may be seen from the following table:

Table 2

Domestic Revenues and Foreign Shares of Domestic Revenues (As on 1990)

Company	Domestic Revenues (C$ million)	Foreign share %
Cognos	14.6	85.4
Corel	5.0	95.0
System House	73.4	26.6

[49]. Ibid.

[50]. Industry Science and Technology Canada (1993), Insight (Diskette).

[51]. We have not been able to get the output of the software industry as such.

Source: Industry Science and Technology Canada (1993), Insight (Diskette).

In the global scene, however, Canada is a small player. It accounts for only 1 per cent of global sales in software products, although the exported software services accounted for 5.6 per cent of global revenue in 1992[52]. But it must be noted that this may also be an understatement since software sales to U.S. are valued only at the cost of the medium that holds the software (i.e., the floppy disc, tape etc.) rather than the value of the programme itself.

The Software Industry "Diamond".

Demand. Canadian domestic demand base for software is small. The total industry revenues earned in Canada by all firms (Canadian and foreign) were C$ 6.6 billion in 1990[53]. But in this industry, this does not seem to have affected the Canadian industry much, for the vast U.S. market next door, with free facilities for transmigration between the two countries and the low tariff barriers between the two countries (in any case the tariffs are on the medium, and not on the software itself) served as an effective domestic market. Thus the "double diamond" of Rugman and D'Cruz seems to describe the demand in this industry accurately[54].

Indeed, far from starting from the domestic market and expanding into overseas markets, the Canadian software industry uses the U.S. market as a testing ground for new software[55].

The direct influence of government policies on software demand seems to have been negligible. Like in U.S., the software industry is unregulated. There has been no policy to stimulate domestic demand as such, and the share of government buying in software has been small. The user industries in software, with exception of utility industries like telecommunications and services like airlines are also unregulated.

But there have been policies with an indirect effect. The policy of open borders with U.S. has helped in using the U.S. as a base for developing and selling software. Earlier there was a difference of 3 to 5 per cent between tariffs for software between U.S. and Canada, but with the Free Trade Agreement in 1989, this has been eliminated. At least till 1990, there seems to have been no effect of the FTA on Canadian software exports, as may be seen from Exhibit 14.

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[52]. Industry Science and Technology Canada (1993), Information and Technology Review.

[53]. Industry Science and Technology Canada (1993), Insight (Diskette).

[54]. Alan M. Rugman and Joseph R. D'Cruz, "The Double Diamond Model of International Competitiveness: The Canadian Experience", Management International Review, 33(2), pp.17-39.

[55]. Interviews with executives in software industry.

FTA extends national treatment to Canadian and U.S. suppliers of computer services and software without requiring them to establish facilities within each other's borders. FTA increased the amount of procurement open for competition between Canadian and U.S. firms by lowering the threshold for restricted access procurement to US $ 25,000[56]. U.S. national security exemptions still remain, and most Canadian firms, save the largest ones, still find the U.S. government procurement market difficult to penetrate[57].

As a component of the free trade negotiations, Canada and U.S. have agreed to work together in establishing international standards for software addressing quality, international tax standards and intellectual property protection, although little concrete seems to have been accomplished till now.

Intellectual property legislation has a vital bearing on the development of the software industry, by virtue of the ease with which the programmes can be copied. Thus a great percentage of "demand" can be satisfied in this way, affecting the sales and consequently the incentive for firms to invest. As Porter has pointed out, Canada's Intellectual Property Rights (IPR) legislation is weaker than many other countries, notably the U.S., which may impede development of software, especially of the generic variety, although our interviews with executives in the software industry indicate that this may not be posing a real problem in Canada.

Factor Conditions. The two crucial factors in software industry are human resources and finance. The governments role in both has been small. In an effort to improve the technological knowhow of software employees, the government has instituted such programmes as the Software Human Resource Council and Saskatchewan Software Engineering Centre. But this does not seem to have been well received by the industry and almost unanimously the industry representatives interviewed felt that the quality of graduates from universities is poor, that there is a great need for training before they could be actually utilized, and this training has to be done by the industry itself.

The Diagnostic Review Service (DRS) is a sector specific initiative attempting to deal directly with industry problems through improving the level of management and marketing skills in the software industry. This service is a two stage grant contribution process designed to cover the consulting costs for improvements to management and marketing skills. The respondents interviewed, however, saw the utility of this service to be low.

The general state of university education in Canada has been commented upon by Porter in his study of Canadian competitiveness[58]. This seems to be affecting the software industry particularly. In fields associated with computer science, enrolment in post secondary education had declined by 30 percent

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[56]. Industry Science and Technology Canada (1993), Insight (Diskette).

[57]. Interviews with industry executives.

[58]. Porter, Op.Cit.

between 1984 and 1990[59]. Although interviewed software firms did not report shortages in post secondary graduates (largely due to the domestic recession), it is likely to affect the industry once the recession gets over. An even larger problem is likely to be the migration of the highest talent to U.S. where the opportunities and salary levels are much higher.[60] To compete with firms like Microsoft in attracting and retaining talent, some firms like Corel are taking measures such as offering stock options to its personnel[61].

In the area of finance, software firms present a peculiar problem in that they need finance for their development and marketing but have little tangible collateral to offer. Hence obtaining finance from banks is always a problem. What is needed is some sort of venture capital funding which again is difficult due to the very high degree of risk in this business. The government now assists software firms in negotiating with Banks to secure financing from financial institutions. But this programme is neither well coordinated nor well known, and neither government officials, industry association representatives nor firms representatives that we interviewed could provide documentation concerning venture capital assistance. It appears that government assistance is administered on a case by case basis.

Related and Supporting Industries. Computer industry is the most important related industry for the software industry. Successful software development requires knowledge of the technology embodied in the newest computer hardware and its systems software. But most of these hardware companies are located in U.S. and this is a handicap for Canadian software firms. Especially with the development of fourth and fifth generation languages, expert systems, artificial intelligence and voice recognition systems, close interaction with hardware manufacturers is vital.

Another important related industry is the telecommunications industry. This segment, however, is well developed, with the carriers providing a good and sophisticated demand base.

The fragmented policy making prevents a coherent set of policy initiatives towards an entire industry cluster. The Diagnostic Review Service, for example, addresses only to the software sector itself, whereas such services could be made available to related industries.

Firms' Strategy, Structure and Rivalry. The domestic rivalry in Canada has been intense. Most of the firms adopt niche strategies. There is no firm which deals with standard software packages, like the U.S. firms Ashton-Tate, Microsoft, Oracle and Novell.

The success of software firms depends, to a great extent, on its R&D investments and their effectiveness. Here the Scientific Tax Credit Scheme (20 per cent for large firms and 35 per cent for

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[59]. Industry Science and Technology Canada (1993), Information Technologies Statistical Review.

[60]. Interviews with executives in the software industry.

[61]. "Stock Options Plan Being Offered to Attract Talent", The Ottawa Citizen, 13 April, 1995.

small) plays an important role. In the software industry, since a large number of firms are small, they are able to make use of the credits to a high extent. For the software firms, all R&D upto and including the documentation phase for the software can be considered R&D expense[62]. Hence the vast majority of R&D software expense qualifies for tax savings, and this facility is seen by respondents as a source of competitive advantage over software firms from other nations[63].

Government Policies in Software Industry: A Critical Appreciation

Government has, by conscious choice, refrained from influencing the software industry. It has tried to upgrade general factor conditions and offer across the board incentives to industries, which are made use of by the software industry also. Especially its higher concern for IPR is likely to influence the software industry to a greater extent than most other industries, and so are the R&D incentives.

Treating all R&D expenses upto the documentation stage as qualifying for tax rebate has helped the software industry gain in competitiveness. But R&D tax credits are not being fully utilized due to lack of awareness and the negative perceptions about dealing with the government. Clearly the government must continue to actively promote R&D tax credits in order to stimulate usage. Periodic seminars by Revenue Canada to explain the various tax incentive schemes available seem to have been very useful in enhancing the awareness among software firms, especially smaller firms, about these schemes.

The Diagnostic Review Service seems to be a somewhat more effective government initiative, which provides consulting help to improve management and marketing skills. But this perhaps fails to develop skills in the related and supporting industries.

The government has done little to promote the quantum or sophistication of domestic demand, but so far it does not seem to have led to any major problem, thanks to the U.S. market which, for most purposes, constitutes a "domestic" market.

But there seems to be a lack of awareness among software users of the software products and services produced by domestic firms, and to this extent quality buyer information could be useful.

An initiative launched recently to match policies with industry needs is the Business Impact Test (BIT), a software tool created at Industry Canada to assess the impact of regulation on industry, in order to create future policies to improve the competitive positions of industries. The refreshing approach of BIT is to create policies based on industry needs. But its success is yet to be seen.

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[62]. Interviews with Industry Canada.

[63]. Interviews with software industry executives.

An important area which is likely to affect the software industry is the development and training of software personnel. The efforts made so far seem to have touched only the fringe of the problem.

Lastly, the nondevelopment of a strong computer industry in Canada is likely to affect the Canadian industry, especially in the coming years. The domestic firms of U.S. are not likely to be of great help in this regard.

Conclusion

(i) Role of the Government. The government has played the role of a stimulator, a catalyst and a regulator in the telecommunications industry. An important role for the government has been as a demanding setter of standards and forcing high levels of customer coverage at a reasonable price for all regions of Canada. Another role is that of a sophisticated regulator which kept track of efficiencies of the firms and developed methods to measure the efficiency. Through its public hearings which have become increasingly sophisticated, the government has succeeded in bringing multiple inputs into the process of laying down of tariff. In software, there is no role of a regulator for the government.

In both the industries, the government also adopted measures like R&D tax credits and tax savings to stimulate R&D effort, with special measures for the software industry. Setting up government funded research institutions and infrastructure and giving access to firms to these technologies and facilities has resulted in the ability of firms to be on the forefront of technologies. Certain other attempts like upgradation of the quality of manpower through training programmes, however, seem to have met with only limited success.

(ii) Role of Home Demand. The sophistication of the home demand, rather than its size seems to have been the major factor in enhancing the competitiveness of the industries. But the "home" for the demand for both the industries studied seems to be the combined markets of U.S. and Canada, and the government regulations and customer needs of both the countries need to be taken into account. A "double diamond" model may be more appropriate for some of the Canadian industries than Porter's model.

(iii) Bundles of Policies vs. Incremental Policies. Though the evidence from our study is not strong, there seems to be a case for looking at all the points of the "diamond" of an industry and its related and supporting industries, for the government policies, whenever formulated. Clearly, the attempts of the government to intervene have been half-hearted and fragmented. They also have been rather ineffective, except perhaps in the area of regulation. Fragmentation of policies is much too easy with multiple government agencies and with multiple regulations from Federal and Provincial agencies. The case for bringing a highly integrated industry like the Telecom industry under a Common Federal agency which not only carries out regulatory functions but also is involved in promotional functions seems to be strong.

Exhibit 1

Major Telephone Companies in Canada and their Regulators

Company	Total Operating Revenues ($m)	Territory	Regulatory Agency
Alberta Government Telephones (AGT)	1189.3	Alberta	CRTC *
B.C. Tel	1852.6	British Columbia	CRTC
Bell	7654.7	Ontario, Quebec	CRTC
Island Telephone Co. (Island Tel)	51.2	Prince Edward Island	CRTC *
Manitoba Telephone System (MTS)	541.7	Manitoba	Province
Maritime Telegraph & Telephone (MT&T)	442.6	Nova Scotia	CRTC *
New Brunswick Telephone (NB Tel)	324.1	New Brunswick	CRTC *
Newfoundland Telephone (Newfoundland Tel)	256.9	Newfound Land	CRTC *
Saskatchewan Telecommn. (Sask Tel)	576.5	Saskatchewan	Province
Telesat	177.8	Canada	CRTC
Subtotal Telecom Canada	13065.4		
Edmonton Telephones	261.2	Edmonton	Municipality
Northern Telephones	35.2	Ontario	Province
Northwest Tel.	84.1	Yukon, NWT, Northwin B.C.	CRTC
Quebec Telephone	223.5	Quebec	Province
Telebec	159.8	Quebec	Province
Teleglobe	234.0	International	CRTC
Other independents	140.0	-	-
Unitel	362.2	Canada	CRTC
Subtotal	1500.0		
Total	14565.4		

Source: Communications Canada (1990), Telecommunications in Canada: An Overview of the Carriage Industry. (Ottawa: Industry Canada), pp. 14,27.

Notes: 1. Cantel and BCE Mobile not included. Their combined income is about $ 650 million.
2. Radio Common Carriers not included.
3. Items marked with an asterisk were under provincial jurisdiction till 1989.

Exhibit 2

Telecommunications Carrier Industry:

Industry Revenues, Access Lines and Toll Calls

Year	Local Service Revenue (C$ bn.)	Toll Revenue (C$ bn.)	Total Revenue (C$ bn.)	# Business Access Lines	# Residential Access Lines	Total # Access Lines	No. of Toll Calls
1981	2.98	3.70	6.99	5193	11751	16943	1452979
1982	3.40	4.14	9.29	5043	11758	16801	1475376
1983	3.56	4.50	8.53	4885	11745	16630	1541277
1984	3.71	4.94	7.86	4735	11745	16480	1640932
1985	3.88	5.41	6.99	4636	11338	15974	1792434
1986	3.94	5.89	10.60	3247	9701	12948	1959151
1987	4.07	6.12	11.09	3492	9952	13444	2207429
1988	4.30	6.44	11.88	3748	10228	13976	2533738
1989	4.64	6.87	12.64	4070	10578	14648	2846597
1990	5.04	7.47	13.74	4430	10866	15296	3094080
1991	5.19	7.13	13.50	4706	11109	15815	3264383
1992	5.33	7.34	13.88	4839	11424	16263	3354092

Source: Industry Science Technology Canada, Information Technologies Statistical Review, 1993,. 1991.

Exhibit 3

Telecommunications Carrier Industry

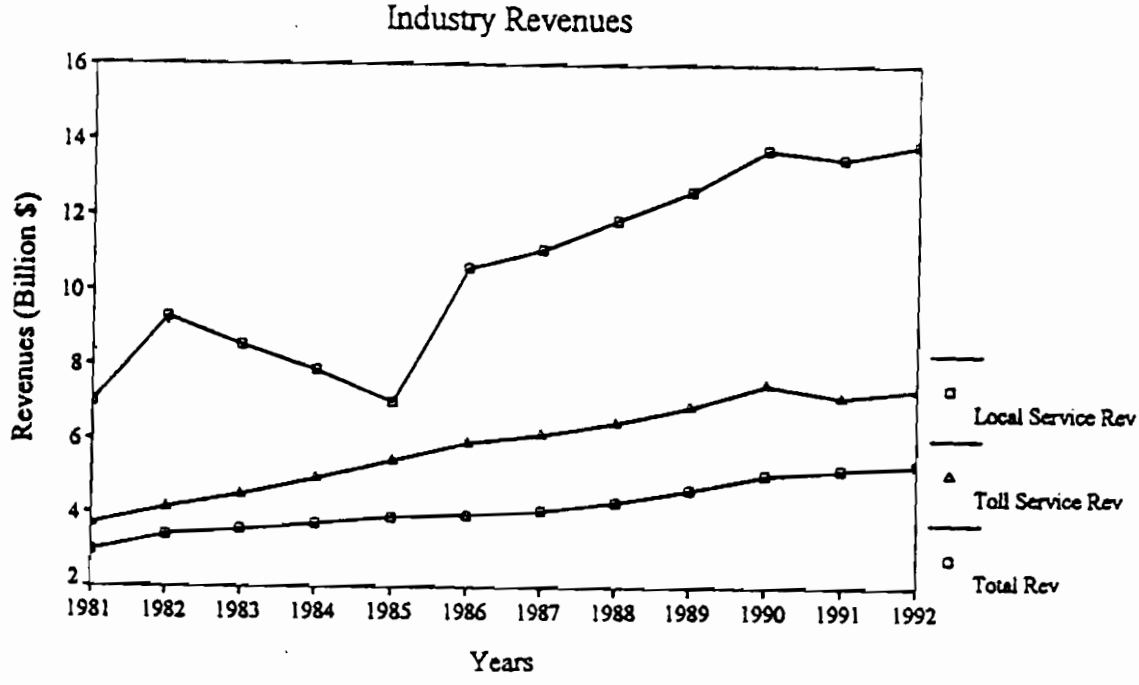


Exhibit 3(a)

Telecommunications Carrier Industry

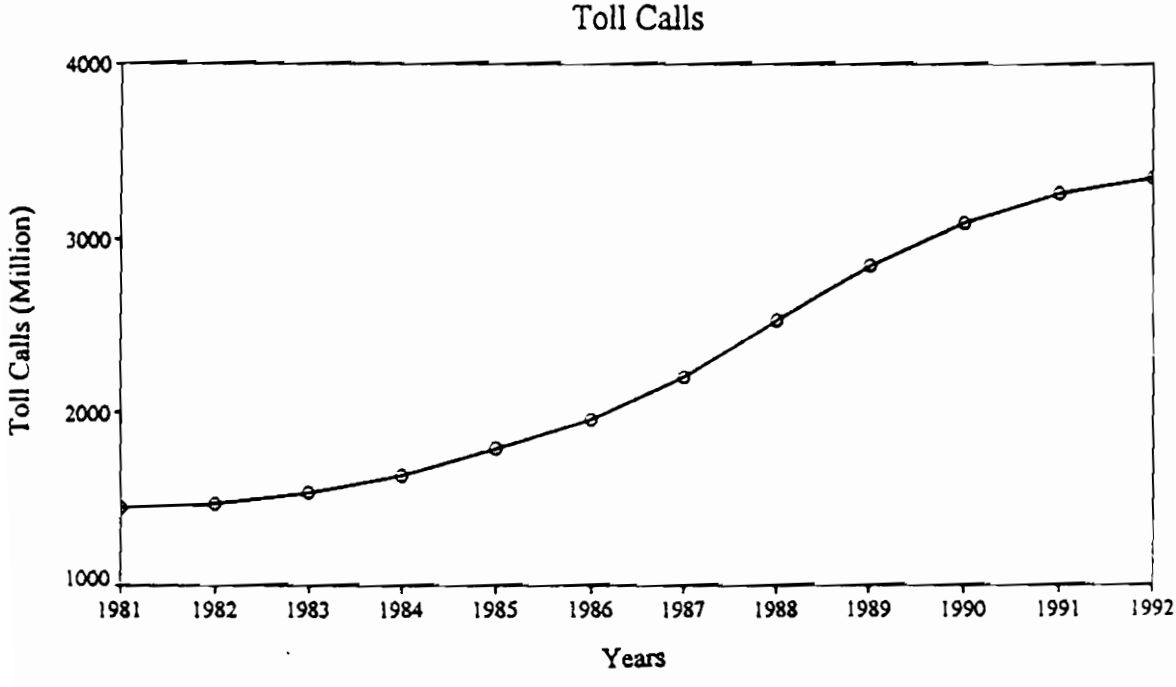


Exhibit 4

Telecommunications Equipment Industry:

Manufacturing Shipments and Exports

(For SIC 3351 only)

Year	Mfg. Ship-ments (C$ bn.)	Domestic Exports (C$ bn.)	Col(2) as % of Col(3)
1983	1.54		
1984	1.82	1.08	59.34
1985	2.02	1.29	63.86
1986	2.21	0.75	37.91
1987	2.21	0.75	34.05
1988	2.41	0.75	31.16
1989	2.66	0.79	29.87
1990	3.01	1.06	35.26
1991	3.19	1.03	32.33
1992	3.37	1.4	41.48
1993	3.81		

Source: Same as Exhibit 2 above.

Exhibit 5

Telecommunications Equipment Industry

Manufacturing Shipments and Exports

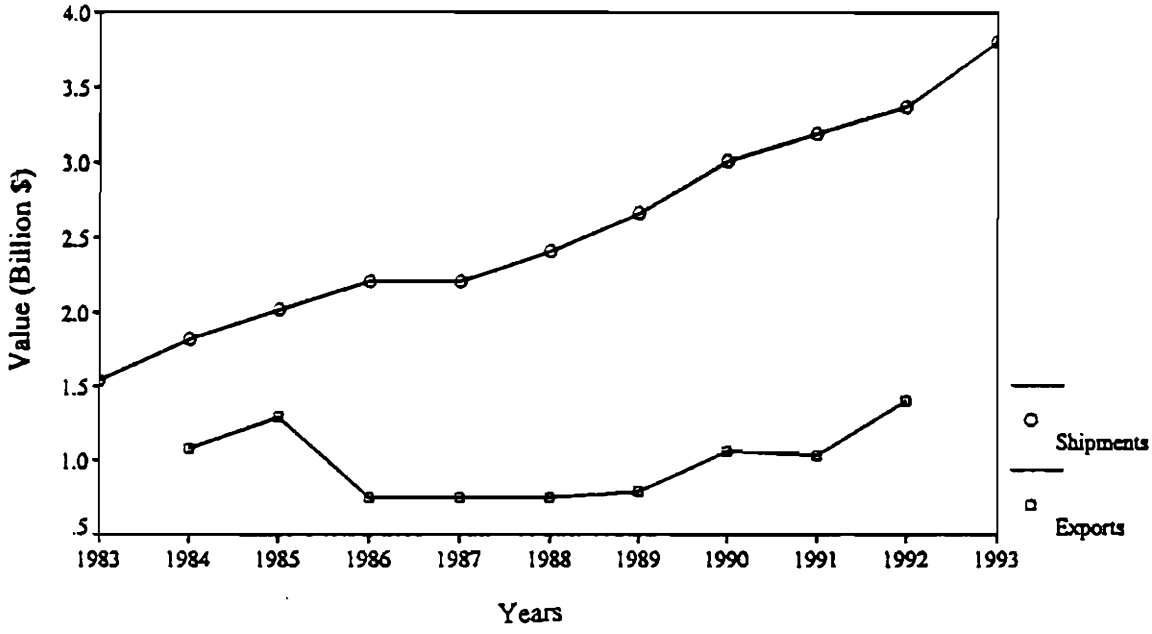


Exhibit 5(a)

Telecommunications Equipment Industry

Exports as Percentage of Shipments

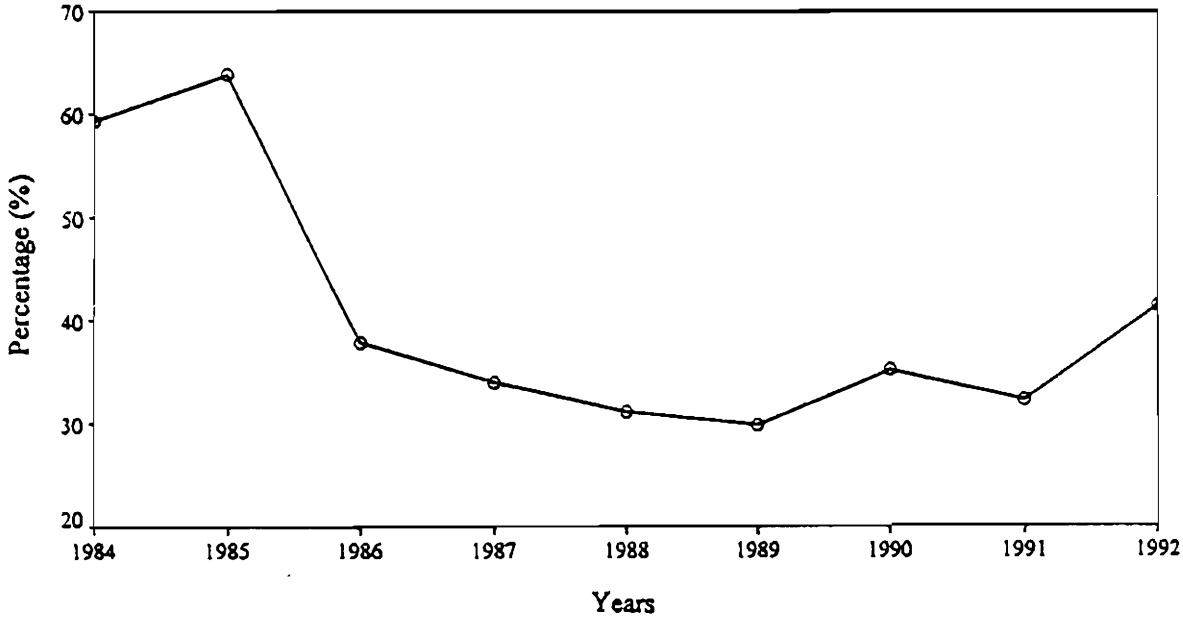


Exhibit 6

Canadian Policies at a Glance

Year	Major Policy Changes/Initiatives
1976	• CRTC formed and made the body to regulate all telephone companies under federal jurisdiction
1977	• R&D tax credits of 5 per cent
1978	• Detachment of science and engineering research from NRC and creation of Natural Sciences and Engineering Research Council (NSERC) • R&D tax credit of 5 per cent enhanced to 10 per cent; 25 per cent for small businesses; an additional 50 per cent deduction for incremental expenditures
1979	• CRTC permitted Unitel to connect to Bell system
1980	• Terminal Attachment Legislation • Establishment of Microelectronics centres in different provinces
1981	• CRTC permitted Unitel to connect to BC Tel
1983	• Additional to 50 per cent deduction for incremental expenditure removed; tax credit rates enhanced by 10 per cent to make it 20 per cent for large and 35 per cent for small firms • Partial refundability of unused credits • Carry forward period of 7 years
1984	• Reselling of services permitted • Tax credit limited to $2 million for small businesses
1985	• 100 per cent refundability of tax credit for current expenditure introduced (for small firms)
1987	• New Telecom Policy introduced • Establishment of Type I and II carriers; unregulated competition in the Type II segment • Carry forward period for tax credits increased to 10 years, but R&D expenditure base for deduction reduced by R&D tax credit; refundability for large corporations eliminated; buildings made ineligible for R&D tax credit
1989	• Supreme Court ruling brings all phone companies under Federal jurisdiction
1992	• CRTC permitted competition in long distance carrier market
1993	• Passing of Telecom Act integrating all previous related Acts and establishing Federal jurisdiction

Exhibit 7
Trends in Productivity Indices in Telecommunications Industry
(1981=100)

Year	Total Factor Productivity	Labour Productivity
1981	100.0	100.0
1982	96.6	98.0
1983	99.3	105.0
1984	104.4	112.5
1985	107.7	117.5
1986	111.7	124.9
1987	116.9	132.8
1988	118.0	135.3
1989	123.9	147.9
1990	126.7	160.1
1991	127.8	168.9

Source: Statistics Canada, Aggregate Productivity Measures, 1993 (Cat. No. 15-204E).

Exhibit 8

Trends in R&D Expenditure in the Telecommunications Equipment Industry

(For SIC 3351 & 3359)

Year	R&D Expenditure (C$ bn.)		R&D Expenditure as % of Manufacturing Shipments
	Current Prices	Constant Prices (1981=100)	
1963	0.02	0.08	
1966	0.05	0.15	
1969	0.07	0.16	
1972	0.08	0.16	
1975	0.11	0.19	
1978	0.15	0.23	
1981	0.35	0.35	
1982	0.45	0.42	
1983	0.60	0.54	22.4
1984	0.70	0.61	21.8
1985	0.85	0.72	23.7
1986	0.90	0.75	22.5
1987	0.95	0.77	20.1
1988	1.02	0.80	19.8
1989	1.08	0.82	19.0
1990	1.12	0.85	19.4
1991	1.18	0.91	20.5
1992	1.19	0.91	19.8

Exhibit 8 (a)

Trends in R&D Expenditure in the Telecommunications Equipment Industry

(For SIC 3351 only)

Year	R&D Expenditure (C$ bn.)		R&D Expenditure as % of Manufacturing Shipments
	Current Prices	Constant Prices (1981=100)	
1984	0.53	0.46	29.1
1985	0.61	0.51	30.2
1986	0.62	0.52	31.3
1987	0.69	0.56	31.2
1988	0.72	0.56	29.9
1989	0.71	0.54	26.7
1990	0.71	0.54	23.6
1991	0.82	0.63	25.7
1992	0.76	0.58	22.6

Sources: 1) Statistics Canada.
2) Information Technologies Statistical Reviews for different years for SIC 3351 data.

Exhibit 9

Telecommunications Equipment Industry

Trends in R&D Expenditure (SIC 3351 & 3359)

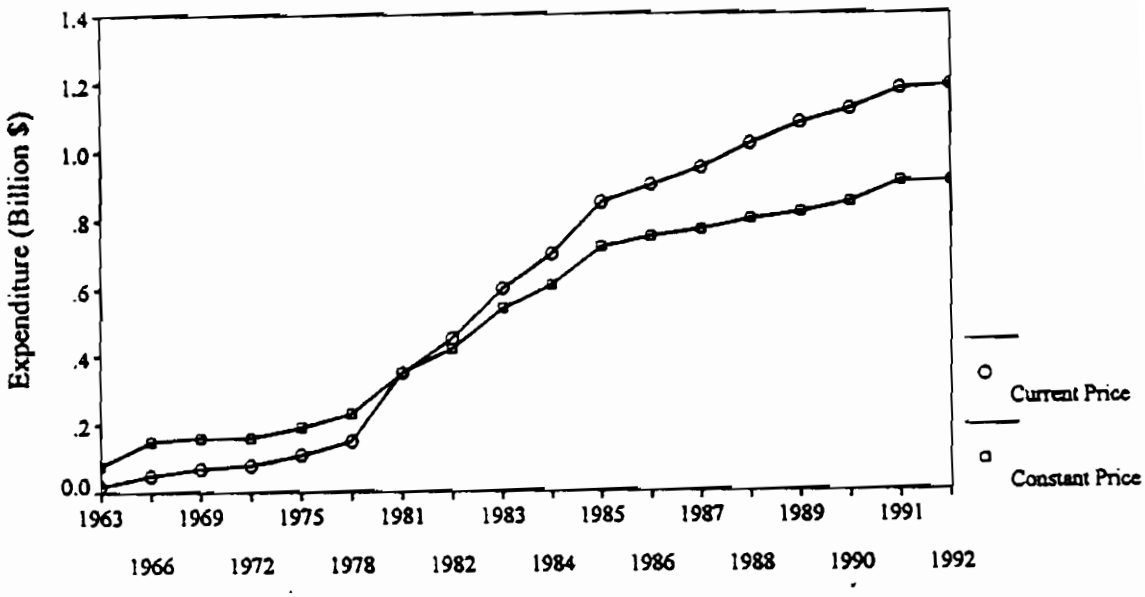


Exhibit 9(a)

Telecommunications Equipment Industry

Trends in R&D Expenditure (SIC 3351)

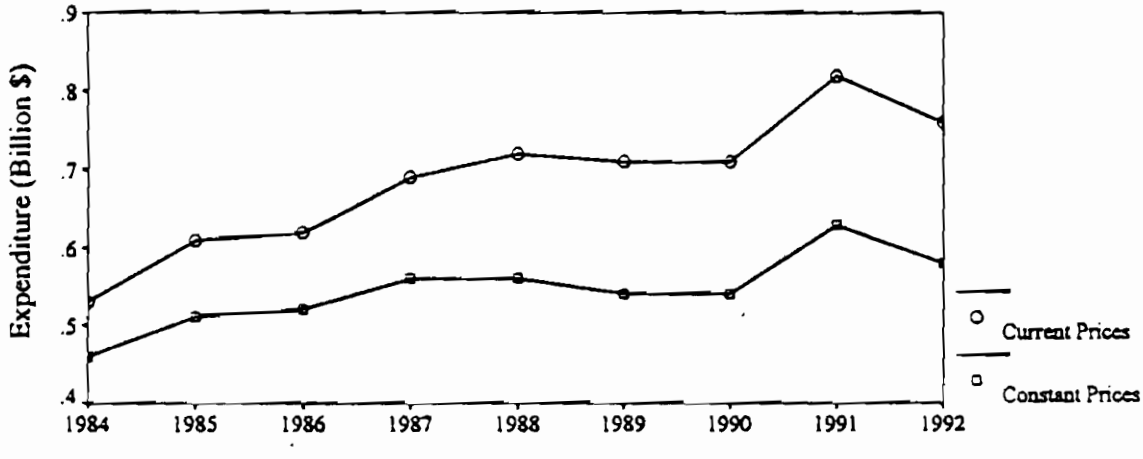


Exhibit 10

Trend in Investment in Telecommunication Industry

(For SIC 335 only)

Year	Capital Expenditure (C$ bn.)		Total Investment (C$ bn.)	
	Current Prices	Constant Prices (1981=100)	Current Prices	Constant Prices (1981=100)
1976	50	86	65	112
1978	45	69	60	92
1981	190	190	210	210
1982	170	159	205	192
1983	210	190	250	226
1984	310	269	350	303
1985	300	253	400	337
1986	310	259	360	301
1987	340	277	400	326
1988	370	289	430	336
1989	300	229	360	275
1990	260	198	330	252
1991	320	246	400	308
1992	240	184	350	268

Source: A study furnished by the Department of Communications, Industry Canada. The source for the figures in this study is Statistics Canada.

Exhibit 11

Telecommunications Industry

Trends in Investment (Current Prices)

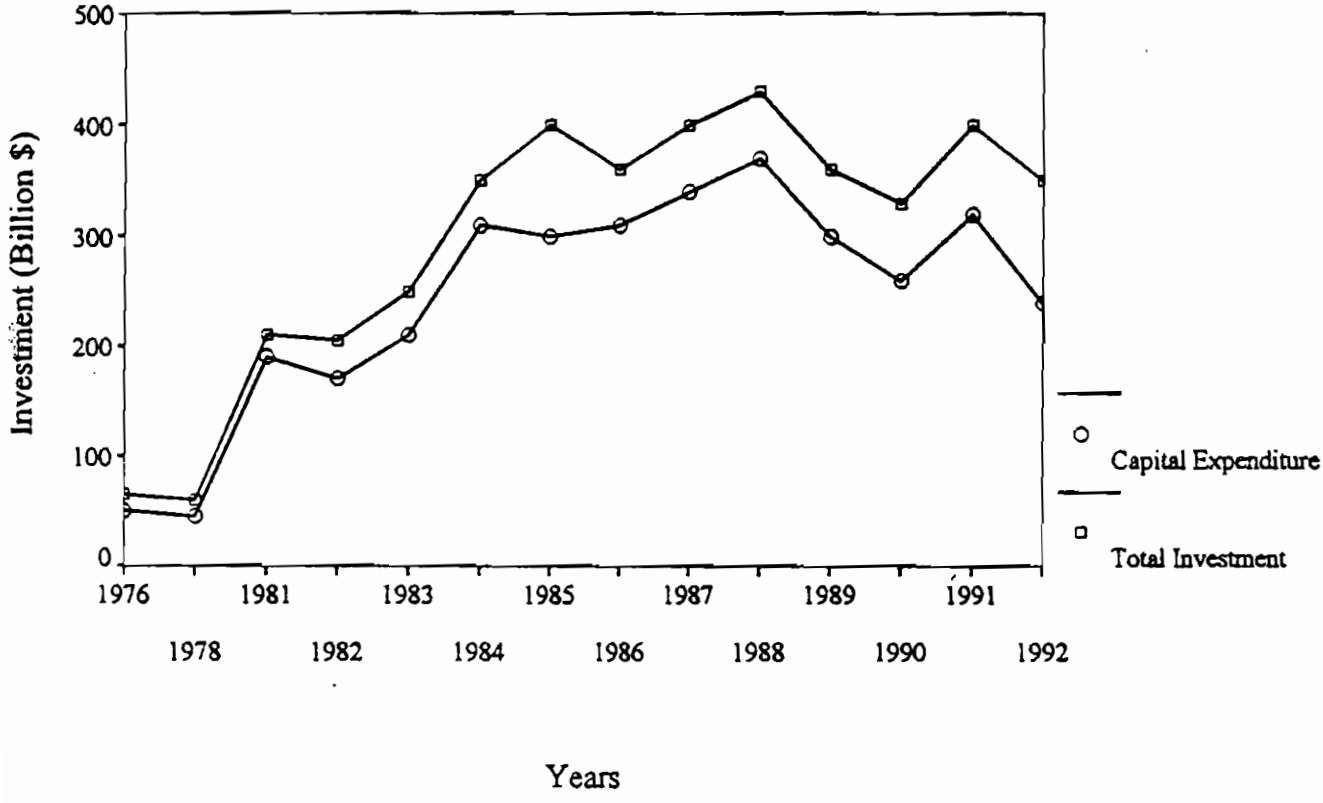


Exhibit 12

Trends in Average Cost for Long Distance Calls
(Current Prices)

Year	No. of Calls	Toll Revenue C$ Million	Cost/Call ($)	Constant Prices 1981=100
1982	1475.38	4140	2.81	2.63
1983	1541.28	4500	2.92	2.64
1984	1640.93	4940	3.01	2.61
1985	1792.43	5410	3.02	2.55
1986	1959.15	5890	3.01	2.52
1987	2207.43	6120	2.77	2.26
1988	2533.74	6440	2.54	1.99
1989	2846.60	6870	2.41	1.84
1990	3094.08	5470	2.41	1.84
1991	3264.38	7130	2.18	1.68
1992	3354.09	7340	2.19	1.68

Source: 1) Statistics Canada, Telephone Statistics (cat. no. 56-203) over the years for number of toll calls.

2) Toll Revenues are the same as those shown in Exhibit 2, with the same sources for data.

3) For conversion into constant prices, price indices from Statistics Canada have been used. The index used is that for "All Manufacturing Industries".

Exhibit 13

Trends in Average Cost per Long Distance Call

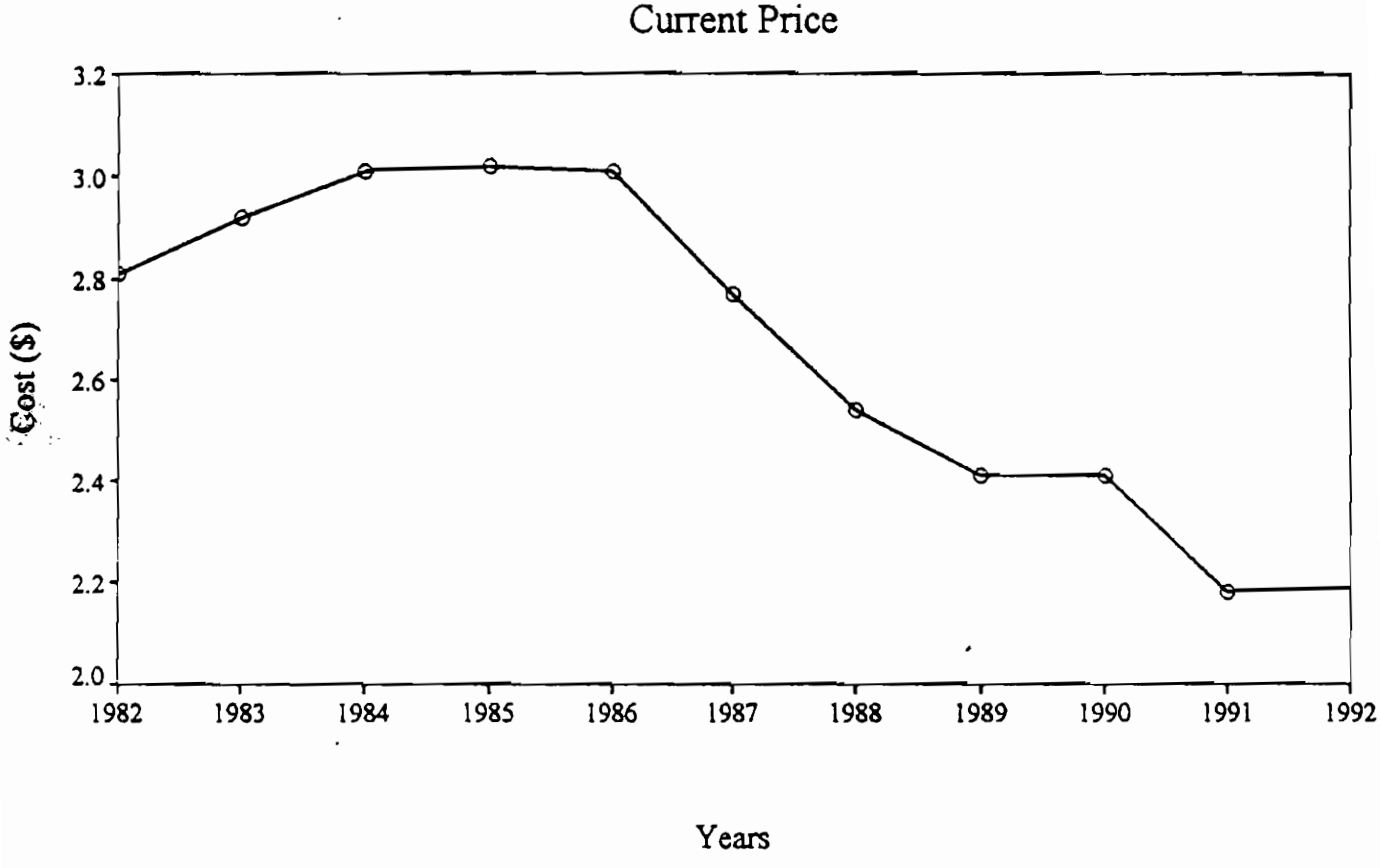


Exhibit 14

Software Industry: Output and Foreign Revenues

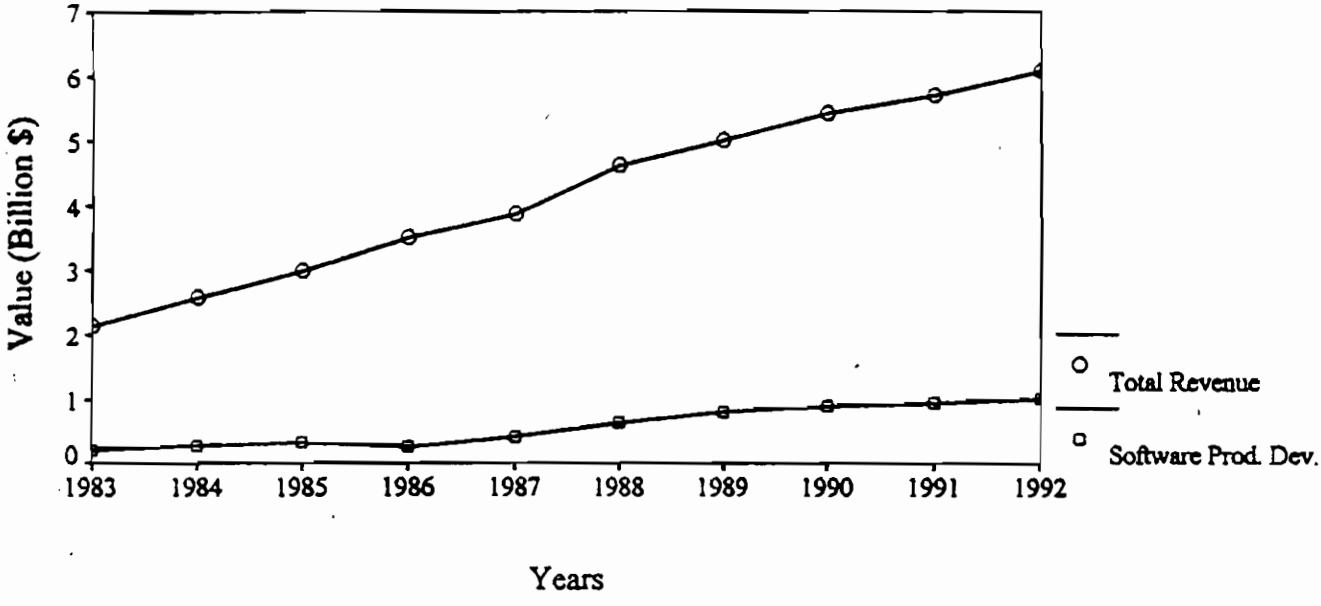
Year	Total Revenues (Computer & Related Services) (C$ bn.)	Software Products Development (C$ bn.)	Foreign Revenues (Computer & Related Services) (C$ bn.)	Col. (4) as % of (2)
1983	2.13	0.21	0.13	6.10
1984	2.57	0.28	0.19	7.39
1985	2.99	0.33	0.22	7.36
1986	3.51	0.26	0.30	8.65
1987	3.87	0.42	0.32	8.39
1988	4.62	0.64	0.41	8.99
1989	5.00	0.81	0.44	8.99
1990	5.42	0.89	0.52	9.00
1991	5.70	0.94	0.57	9.30
1992	6.08	1.07	0.76	11.8

Source: Statistics Canada, Catalogue No. 63-222 for different years.

Exhibit 15

Computer and Related Services

Revenues



Years