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CULTURE AND COMMUNICATIONS

Key elements of Canada's economic future

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Canada

CULTURE AND COMMUNICATIONS:

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Brief submitted by
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The terms of reference establishing the Royal Commission on the Economic Union and Development Prospects for Canada speak of 'realizing Canada's potential and securing sustained economic and social progress'. This brief starts from the assumption that economic and social progress cannot be realized independently of each other and that any successful economic strategy must be developed in the context of the culture of the country as a whole. Indeed, it suggests very strongly that cultural issues are in many ways central to future growth, not simply in the area of communications but with respect to the performance of the economy as a whole. In this sense the brief argues that we must approach culture and technology together, since both are critical components of future industrial success.

1. Introduction

More specifically, the terms of reference lay particular stress on examining, among other things:

- trends in labour market developments and conditions;

- capital requirements and the cost structure in a highly competitive, technologically sophisticated and interdependent world environment; and

- trends in productivity, standards of living and social progress.

Recently a major debate has begun both internationally and domestically about the nature of the relationship among these issues, with particular attention to the impact of information technology on employment and productivity.[1] Beginning in the late 1970s, a number of official and academic reports began to appear suggesting that the new information technologies would result in profound improvements in the productivity of all sectors of the economy. Many commentators felt that they represented the key to future industrial growth, since they represented the new 'heartland' technology. As a distinguished British economist put it, heartland technologies are:

> ... those which can give leverage over the system as a whole and raise its level of performance. Steam power and electric power were such key technologies in their time. Today electronic information technology represents this "heartland" technology... . The capacity to handle, process, store and transmit information is now the critical technology for advanced industrial countries both for industry and for service.[2]

Certainly a number of Organization for Economic Cooperation and Development (OECD) countries are sufficiently convinced of the importance of these technologies that they have invested large sums in their development and dissemination. The Japanese, for example, have focussed on computers and manufacturing automation technologies as two of their highest priorities for the 1980s. Similarly the French Eighth Economic Plan for the period 1980-84 makes the improvement of their domestic manufacturing capacity through the application of information technology its highest priority. The Minister of Research and Technology plans to spend no less then $555 million on electronic components alone by 1984 and the equivalent of $5.7 billion on telecommunications.[3] These developments are not, however, unique. Parallel expenditures are being made in many West European countries, including the United Kingdom, Germany, Holland and Sweden.

At the same time, concerns have been expressed that the productivity gains associated with these technologies may prove so great that they will result in unacceptably high levels of unemployment and profound changes in skill requirements. Warnings about the potential job consequences have been issued by a variety of organizations, ranging from the (OECD) on the one hand through offical government commissions, independent research institutes, trade unions and academics. In fact the literature on this issue has become so voluminous over the last few years as to constitute practically a sub-discipline in its own right.[4]

In Canada, although the debate has begun, it has been neither as sustained nor as wide ranging as the discussion in Europe. Perhaps the most active student of the subject outside the Department of Communications has been the Science Council. In their most recent report on the issue, Planning Now for an Information Society: Tomorrow is Too Late they make the same general points: that information technology is a 'transformative technology, a technology which gives impetus to fundamental changes in human thought and action'. They suggest that its impact on industrial performance and subsequently on employment will be equally dramatic. For these reasons the council urged a major public review and discussion of the technologies which will 'radically transform Canadian and world society'.[5]

This brief seeks to examine the implications of these technologies from two fairly distinct perspectives:

- their relationship to Canada's communications services and equipment industries; and

- their relationship to the development of arts and culture.

The reasons for this are partly a function of departmental concerns, but derive more fundamentally from a growing conviction that it is important not to set economic questions within too narrow a focus. Increasingly we are coming to understand that any policy which fails to take adequate account of the cultural dimension will result in a weakening of our capacity to respond to the changing circumstances of international industrial competition. In this sense, the brief attempts to look at the role of communications and culture in economic development more generally.

2. The Technology

The basis of information technology is the integration of two earlier technologies into a single, unified technology. These two earlier technologies are: telecommunications and computers.

To take telecommunications first, it is important to note that this is a relatively old industry, which predates the invention of the internal combustion engine. It is also an industry in which Canada has historically been a world leader. This is true of all aspects of the industry, including telephony, data transmission, cable, switching, microwave, satellites and broadcasting. As a result, Canada has a very strong tradition of excellence in the area, which constitutes a major national asset and one which increasingly represents a significant international trading advantage.

The other major industry is computers. This is a relatively new technology, whose first commercial products did not appear until the early 1950s. It is not an area where Canada has been as strong as it has in telecommunications. Rather the industry has been dominated both in Canada and abroad by the giant U.S. corporation, IBM. There is no reason to suppose this will change significantly in the future, although it is likely the Japanese will become increasingly important players as a result of the national commitment they have made to the development of a Fifth Generation Computer.

In a scientific sense the integration of these technologies results from a pair of related developments. First, telecommunications and computers are beginning to speak the same language: digital. Digital is a simple binary language measured in 'bits' (a term that originated in telecommunications, not computer science). Every kind of information, no matter what its source or nature, can be encoded in digital form. This means that in principle all information can be transformed into machine language, transmitted over long distances without loss of fidelity, processed into new forms and translated back into pictures, text or numbers for human use.

Second, the physical integration of telecommunications and computers has been facilitated by the development of integrated circuits, the famous micro-chips. These permit computer power to be distributed throughout telecommunications networks. Beyond this, micro-chip technology is extremely inexpensive, very small, highly reliable and extraordinarily powerful. The net effect is to make information technology portable and nearly invisible, allowing it to be applied in an extraordinarily wide variety of situations. This is the key to its pervasiveness.

The extent to which telecommunications and computing have effectively merged into a single technology is reflected in the difficulties that have been confronting regulators over the last few years. In the United States, for example, telephone companies were traditionally restricted from engaging in data processing - which they still are in Canada - and computer companies were not allowed into telecommunications. As a result of the Second Computer Inquiry, however, the U.S. Federal Communications Commission effectively abandoned the distinction. In the words of its chairman, Charles D. Ferris:

> In that world (1966), a line between communications and data processing was defensible. The advent of distributed data processing made these rules obsolete. The new "smart" terminals are both data processors and communications devices... . The realities of the marketplace and the likely evolution of technology simply do not support such a distinction.[6]

At a more conceptual level, the important thing about information technology is not so much that it uses and processes information, - which it does in abundance - but that it is fundamentally a control technology. This has led to a confusion about the importance of the technology and the nature of its impact, with much effort focussed on the emergence of 'information economies', 'information societies', and such like. But in fact information stands in relation to the real agent of technological change in much the same way as smoke to fire or dust to a sandstorm: it is an index, or superficial manifestation, of a deeper phenomenon. If we are to understand the nature of the new information technologies it is necessary to focus less on their content and more on their function (i.e. the regulation - in the cybernetic sense of the term - of systems, or in other words control).

Once information technology is understood in this way, the nature of its impact on productivity becomes much clearer. As well, its potential consequences for employment can be appreciated, since it becomes apparent that its function is precisely to substitute machines for human intelligence and judgement in limited domains of industrial activity where control takes an essentially repetitive character.

During the last decade these effects have become particularly clear in a new generation of equipment that has come on to the market and which is based on the complete integration of computers and communications. Broadly speaking, this equipment falls into two general categories:

- office equipment, including wordprocessors, which are rapidly evolving into network ports that will allow full access to all textual tranformations, including electronic mail, electronic filing, access to data-bases, and so on. This equipment is central to the automation of the office and particularly important to Canada since it is largely a service economy (i.e. 62% of GDP); and

- robots and distributed process controls. These are the key to the automation of traditional manufacturing and industrial processes. One of the clear consequences of their adoption will not only be to reduce the requirements for labour, but also to permit manufacturers to move away from mass production to more specialized and made-to-measure production.

It is these systems and products that constitute the primary technological basis for improved industrial performance.

The extent to which Canada will be able to profit from these technologies will in large measure be a function of the speed with which industry can adopt them. This is a particularly important issue for Canada. As the Economic Council's recent report on Technology, Trade and Income Growth (The Bottom Line) put it:

> "Our general finding is that new technology [generally, not just information technology] diffuses slowly into Canada from other countries. It also diffuses slowly from firm to firm and region to region within the country... . Although there are some exceptions, case studies show that often the process of diffusion of technical change into and throughout Canada occurs more slowly than in other western developed nations, and not only in the manufacturing sector but in the service sector as well."[7]

As far as information technology in particular is concerned, there appear to be a number of key factors affecting its development and diffusion. These include:

- the R&D effort invested in developing new technologies and opportunities;

- the quality of the telecommunications infrastructure and its equipment, which is a necessary pre-condition for the utilization of the new technologies;

- the accessibility of Canadian industry to advanced information technology equipment, including advice as to its application, and the strength of the domestic manufacturers in the area;

- the availability of the right kinds of skilled manpower; and

- the character of the economic and artistic culture and the extent to which it supports innovation.

These issues are dealt with in some detail in the rest of the brief, along with the more general impact of information technology on Canadian social and industrial life.

3. Telecommunications

Terms such as 'automation' and 'robotics' tend to evoke images of automobile factories, usually associated with recent developments in Japan. In fact, the telecommunication services industry was the first industry anywhere to be extensively automated. Control functions which were originally performed by human operators were taken over by generations of successively more sophisticated switching machines. The modern telecommunications system has machine intelligence built into it at many levels; without integrated micro-processor logic circuits, nothing like the high levels of performance and reliability that we are accustomed to could be achieved. Throughout this process, the industry achieved an unparalled degree of 'user-friendliness'. Today an ordinary telephone set will open the doors to the largest, most complex system ever designed - the global telephone network - and a simple set of instructions will guide the user, often without any human intervention at all, anywhere on the face of the earth.

At the same time, the telecommunications industry is very large. When one includes telephones, data transmission, satellites, cable and mobile radio, the industry generates operating revenues of $7.8 billion per year and employs more than 125,000 people. This represents about 3% of GDP and makes it far and away the largest high technology employer.

It is also an area of significant capital investment and growth. In 1982, for example, Bell Canada, representing about two thirds of the Canadian system (6 million subscribers and 9 million phones), invested $1.4 billion in its network. North American investment totaled about $27 billion US and estimated world construction was $77 billion. In addition, telecommunications shares with data processing equipment the distinction of being the fastest growing sector of the world market for finished products. Projections indicate that output will continue to grow, doubling by the year 2000.[8] By any standards, telecommunications is a very big business.

Beyond its sheer size, however, it is also a critically important industry for the Canadian economy. This is true in a number of respects.

- It provides the central nervous system of the country, which is the key piece of infrastructure for future business development. The quality of the networks is a pre-condition for the development of advanced information technologies and their application in other areas of the economy, and it is beginning to become clear that information based firms will not locate in areas where the networks are not first class.

- The telecommunications equipment industry is also one of the few non-resource based industries where Canada has a strong and successful export orientation. Northern Telecom, for example, now has sales of over $3 billion worldwide and can be said to rival all but the giants in the field (notably ITT, Western Electric and Siemens).

- It is also the most innovative industry in the country and the key to Canada's overall performance in information technology. Bell Northern Research is by far the largest single research complex in the country. Taken together with Microtel Pacific, the Department of Communications Research Centre, plus the many smaller establishments, it accounts for more than 30% of all the manufacturing related R&D in the country.

Apart from these features, it is worth noting that the telecommunications industry is one of the most productive in the country. Examination of its performance over the last decade shows that the output per employee has increased steadily on a year by year basis. It is probably not going too far to say that telecommunications is the best available example of the productivity gains associated with the use of information technology.

The reasons for the success of the telecommunications industry are worth looking at in some detail, both for their own sake but also to gain some insight into the problems that could arise in the future. The first point to note is that Northern Telecom only exists as a major Canadian company because of decisions taken by the American government. In 1956 a consent decree between AT&T and the U.S. Department of Justice forced Western Electric, the principal manufacturer of telecommunications equipment in the United States to divest itself of its Canadian subsidiary, Northern Electric. By 1970 the separation was complete with the termination of the technology agreement with Western Electrics resulting in a potentially important Canadian presence in the field, since Northern Telecom inherited the very considerable technological knowledge of its parent.

The second key point is that in 1971 Northern Telecom decided to establish a separate R&D organization to develop new products, Bell Northern Research. At the same time, it decided to make a major resource commitment to the new organization. This was only possible, however, because of the third major factor underlying Bell/Northern Telecom's success: the fact that they enjoyed unrestricted access to a captive monopoly market.

The monopoly in telecommunications derives from the earliest days of telephony when it was realized that a host of competing companies made little economic or practical sense. But as a result of the monopoly, it became possible for Northern Telecom to amortize its R&D costs over a secure base. The development of the digital switch since 1976, for example, will cost $270 million. With its assured Canadian market, it was possible to sustain these costs and bring the switch into operation very quickly. This in turn paved the way for penetration of the switch into the United States, to the point where Northern is now the world's largest producer of fully digital switching systems.

Recently pressures have begun to develop both domestically and internationally to increase the overall level of competition in the industry and open up the Bell/Northern monopoly. These pressures derive from a couple of general sources.

- As we noted earlier, the technology has been evolving in such a way that it is increasingly difficult for regulators to distinguish various types of activities. The problem of separating telecommunications and data processing is only the first of these issues. With the emergence of teletext and videotex, the distinction between common carriers and broadcasters becomes blurred. Similarly alternative transmission technologies of fibre optics and switched cable call into question distinctions among different services. Collectively these changes, among others, are creating a situation where it is harder and harder to draw the line between competitive and monopoly operations.

- At the same time the de-regulation of AT&T in the United States is creating pressures for Canada to move in the same direction. In essence, what has happened is that the Americans have opened up long distance and business services to competition. Inevitably this will reduce costs in these areas because rates for them were traditionally kept high to subsidize domestic subscribers. When this happens, it will provide American firms - particularly those heavily dependent on telecommunications - with a significant cost advantage and tempt Canadian business to route its traffic through the United States.

For these reasons the question of competition will inevitably come to dominate the policy agenda in the area of telecommunications over the next few years.

The issue of competition is not, however, entirely new in Canada. Over the last five or six years, the government and the CRTC have increased competition in the area of terminals, allowed CNCP to interconnect its long haul data services with Bell's local switches and are in the process of creating a duopoly in cellular mobile radio. But these changes amount to little more than nibbling at the margins of the telephone companies' monopolies. Where the real challenges will come is in determining a policy for long distance voice traffic and business services.

These issues go to the very heart of the structure of the industry and raise some extremely difficult political and economic questions. Among other things, a policy of increased competition would inevitably have to take into account the following considerations:

- The pattern of cross subsidies between local and long distance rates and residential and business rates in Canada is - like those in the United States - extremely skewed in favour of local residential service. This means that if competition is encouraged in long distance and business services, the costs of residential telephone services will certainly rise and would, if all services were put on a full cost basis, rise significantly. This is an issue which will affect everyone in the country, on which everyone will have a view and which involves the reallocation of billions of dollars within the system.

- The Canadian telecommunications system does not fall within a single jurisdiction. Although the majority of the system, in terms of revenues, is under federal regulation, significant parts of it are provincially regulated, and in some cases, provincially owned. The major telephone companies in all provinces except Ontario, Quebec and British Columbia are provincially regulated, and in the case of Alberta, Saskatchewan and Manitoba are provincially owned. Unless we are careful, the danger arises that if one province is more restrictive than another with respect to competition issues, it could adversely affect firms - and particularly information technology firms - with respect to their location decisions. This would be unfortunate because one of the great potentials of telecommunications is that it can reduce the importance of distance and makes it possible for companies to locate anywhere and still be plugged into the most advanced networks, thereby eliminating one of the key disadvantages traditionally experienced by the poorer regions in attempting to attract industry.

- Finally, it is worth noting that the players involved in this issue are all enormous. Bell Canada has assets of $12 billion making it the second largest company in Canada; Alberta Government Telephone controls over $2 billion which makes it as large as Ford Canada Ltd., MacMillan Bloedel or Cominco; and even a relatively small company by industry standards like New Brunswick Telephone and Telegraph is still worth $422 million, making it larger than Westinghouse Canada and almost as big as Hawker Siddeley.

There is little doubt that competition policy will be one of the major topics facing the government in this area over the next few years. Given the size and complexity of the issues, the potential for federal-provincial tension and the raw politics involved, the resolution of this question will probably be as difficult in its own way as the debate over the Crow.

4. Information Technology Equipment

When one moves to a consideration of the equipment that attaches to the telecommunications infrastructure - telephones, computers, word processors and distributed process controls - the issues change dramatically. Unlike the telecommunications industry, Canadian equipment manufacturers do not enjoy a protected domestic market. To the contrary, the market for these products is international in scope and subject to the most intense competition.

Unfortunately, with the exception of telephones, Canada has not done as well in producing terminals and other equipment as it has in telecommunications. Our trade deficit in the area is large and has been increasing steadily over the last ten years. At the present time it stands at $1.6 billion, the greatest part of which is made up of trade in computers.

There is no simple solution to these problems. Even if tariffs were possible they would be undesirable, since it is essential that Canadian companies have access to the most advanced equipment in the world if they are to compete successfully. As well, it is exceptionally difficult to build domestic industries in many of these areas because the entry costs are so high. To take computers as an example, the next generation of technology - the so-called Fifth Generation - is currently consuming enormous resources in R&D alone. For their part the Japanese are investing $500 million, while it appears the U.S. government alone will be putting up $137 million this year.[9] There is no way Canada can compete in this game.

Some Canadian companies have, however, succeeded both domestically and internationally in producing advanced equipment. Among others, Mitel has produced an excellent line of switches, AES is doing very well in word processing equipment, as is Micom, and firms like Norpak are world leaders in Telidon technology. There appear to be four key reasons for their success:

- they all made significant investments in R&D, resulting in highly innovative products that incorporated features not available anywhere else;
- their strategies were market driven and emphasized the exploitation of 'niches', rather than attempting to take on whole ranges of products or the basic lines of the giants;
- they made link-ups with world-wide distribution facilities to ensure their products were readily available; and
- their management was very aggressive, export oriented and prepared to take risks.

The issue for the government is how best to encourage these characteristics in firms. For its part, the Department of Communications has tried to assist by creating seedbeds where companies can develop new approaches through its Office Communications Systems program; it has transferred technology from its laboratories - most notably Telidon - to industry; it is now in the process of determining whether the Communications Research Centre can be made more sensitive and relevant to the needs of industry by transforming it into a not-for-profit research corporation; and has recently announced the establishment of a new research centre in Montreal for the study of office automation.

More generally, it will be important for the government to re-think its approach to industrial support in this area. Traditionally decisions on government assistance for the manufacturing sector have involved the provision of financial aid based on the number of jobs created and the region involved. However, it is questionable whether this approach will work for technology based industries. Issues about the number of jobs created may be less relevant, and it may be important to look not only at financial support, but also the creation of seedbeds, the use of procurement, the sharing of human resources and the development of joint government-industry partnerships for marketing purposes (as DOC has done with SPAR). In other words, the development of a strong and vigorous domestic information industry may require a new definition of the role of the government and the nature of its partnership with the private sector.

But beyond these specific issues, it is essential that the government develop and maintain a climate that encourages risk taking and innovation. This topic is discussed briefly at the end of this paper, but it is obviously an issue which goes well beyond the scope of the Communications portfolio and includes considerations about the macro-economic and industrial environment. In fact the whole subject of how the government should approach its role vis-à-vis small, innovative companies - particularly in the area of information technology - is a matter to which the Royal Commission on the Economic Union may want to pay special attention.

5. Culture

Although not generally recognized, arts and cultural activities may have as much to contribute to economic performance as information technology. The reasons for this have been addressed by John Kenneth Galbraith, who has suggested that:

> ... we must cease to suppose that science and resulting technological achievement are the only edge of industrial advance. Beyond science and engineering is the artist; willingly or unwillingly, he or she is vital for industrial progress in the modern industrial world.

> The basic point is a simple one, and it applies to the widest range of industrial products: after things work well, people want them to look well. After utility comes design. And design depends not alone on the availability of artists; it invokes depth and quality of the whole artistic tradition. It is on this that industrial success comes to depend.
>
> Proof is wonderfully evident once we learn to look for it. One of the miracles of modern industrial achievement has been Italy. Since the war Italy has gone from one public disaster to another with one of the highest rates of economic growth of any country in the western industrial world. No one has cited in explanation the superiority of Italian engineering or science. Or of industrial management. Or the precision of Italian government policy and administration. Or the discipline and cooperativeness of the Italian unions and labour force.
>
> ... The Italian case is only the most vivid. The industries of Paris, New York and London - textile and furniture design, building construction, dress manufacture, advertising, film-making and theatre - all survive in these otherwise economically inhospitable surroundings because of their juxtaposition to the arts. And there is ample indication that they survive better in consequence - are less vulnerable both to the competition of the new lands and the devastation of modern economic policy - than the solid industrial establishments of traditional economic achievement: the steel mills, automobile factories and coal mines. It has been little noticed that in the older industrial countries those industries and cities that best survive are those that co-exist with a strong artistic tradition..."[10]

In the Canadian context this seems to have been recognized at least indirectly by many employers. Statistics from the 1971 and 1981 Census show that in the previous ten-year period the number of people working in cultural occupations (i.e. painters, designers, photographers, decorators, writers, etc.) doubled, not only in the cultural industries per se, but also in all other industrial sectors. This compares with a growth rate of 30% for all occupations over the same period and suggests that arts related activities are seen as increasingly important to overall economic performance.

These figures also reflect the growth that has taken place in the cultural industries themselves. During the same ten-year period between 1971 and 1981, the operating revenues of the firms in publishing, film, videotape production and broadcasting, grew significantly faster than Gross Domestic Product. According to Statistics Canada data, the total contribution to GDP in 1981 of the cultural sector, as defined here, exceeded $2.7 billion, almost 1% of GDP. This means effectively that the cultural sector contributed just a little less to the economy than did the textiles, aircraft and chemicals industries combined.

At the same time, the cultural sector runs a serious balance of payments deficit. Canada imports almost seven times as many books as it exports, four times as many TV programs and four times as many periodicals and newspapers. This trade deficit has been deteriorating over the past decade and is primarily incurred with the United States. We are a country which has been, and remains, awash in American cultural products.

This situation is not, however, likely to improve significantly in the near future. It may, in fact, get worse as a result of the very developments we have been describing in the area of information technology. More specifically the following factors are likely to aggravate the situation:

- the number of producers is increasing internationally, particularly in the United States. This is true for all manner of cultural products including books, TV programs, films, etc. These producers will be actively pursuing export sales and looking particularly at Canada as a potential market.

- the number of distributors is increasing. It is now the case that cultural products are being moved through a number of different media. So, for example, films can be seen not only in movie houses, but on pay-TV, conventional TV and through videocassettes. Inevitably this increases their accessibility to all parts of the populace.

- the distribution media are expanding. With the emergence of satellites, fibre optics and coaxial cable, there is no longer any shortage of 'bandwidth' or distribution capacity. It is now possible to deploy more channels than there is content to fill them.

- most cultural products can in principle be digitized. As we noted earlier, all information can be translated into the binary language spoken by computers and telecommunications systems. This means that most cultural products can be moved electronically.

The upshot of this state of affairs is there will be more products available internationally via more channels. Inevitably they will enter the Canadian marketplace and compete with domestic products for the pocket books of consumers. At the same time, the decline of the traditional distributors, many of which are foreign owned and controlled, creates a series of important opportunities for increasing Canadian sales at home and abroad. If Canada does not want to create an electronic curtain, but prefers to compete vigorously in the international marketplace, we must ensure that our own industry is strong and can compete against the best in the world. In essence this is the approach the government pursued in the recent announcement of the broadcasting strategy, where it moved to strengthen the domestic industry to ensure its long term competitiveness.

The issue of how best to develop and maintain a strong domestic industry without resorting to artificial barriers of one variety or another raises some difficult questions of public policy. In particular it is essential to address the question of how extensively the government should intervene to support the cultural industries and ensure their strength. Perhaps the easiest way of addressing this is by distinguishing two broad categories of cultural industry:

- those that are essentially non-commercial in character and which can probably never be financially self-supporting. These include such activities as ballet, poetry, theatre, symphony orchestras, some films, etc. Typically these are supported by arms-length granting councils and other public institutions (i.e. the Canada Council, the NFB, etc.);

- those that are essentially commercial in character and constitute business ventures like any others. These activities embrace popular music, private television and radio, newspapers, most periodicals, and so on. In the case of these activities, the government may in some cases provide indirect support (i.e. the Broadcast Program Development Fund, etc.) to reduce the burden of risk imposed on Canadian producers by the size of our domestic market. But the primary test of their success is found in the balance sheet.

Although this distinction is not a hard and fast one, since some essentially non-commercial undertakings may become commercially successful, it is useful for thinking about the nature of the policies required.

As far as the non-commercial sector is concerned, it is essential to begin by understanding its importance. The elite and experimental arts are the seed-beds and standard bearers of all the other arts. They are - metaphorically speaking - the basic research component of the R&D in the arts community. In this sense, they create the new ideas, preserve the essential traditions and create the most central images of a society. Without an innovative artistic tradition, a vibrant commercial cultural sector is impossible.

While it is difficult to say precisely how much support the government should provide, one standard of adequacy may be to compare Canadian support with that of other countries. On this basis, Canada does reasonably well. According to the best statistics available[11] - and these are notoriously difficult to develop - we appear to spend about the same per capita as the major West European countries and somewhat more than the United States. This is a tradition of which we can be justifiably proud, but one which we must also sustain and expand.

When we come to consider the commercial sector, however, the issues are somewhat different. Although there is clearly room for some government support - and this has notably increased over the last few years, particularly for television programming, despite the recession - the issue is much more one of whether the cultural industries are to be placed on the same footing as other industries and treated with the same seriousness - in an industrial sense - as steel, automobiles or telecommunications. In addition to the programs already available to support the cultural industries (i.e. the Capital Cost Allowance, the postal subsidy, the book publishing program), it is important to consider whether cultural industries should continue to be considered under a different regime from other manufacturers when it comes to such things as eligibility for industrial support programs and fiscal incentives (i.e. should development work on a film be considered R&D for tax purposes?).

Beyond this most producers of cultural products have trouble raising financing from the banks or government agencies. The reason for this derives in part from the intangibility of the assets in question. To rectify the problem, it is essential that cultural property be given the same protection in law as any other type of asset. And this will require a major overhaul of the Copyright Act.

This is not to say, of course, that the cultural industries should be treated identically for all purposes to automobile manufacturers, but that they should not be penalized because of the nature of their assets. This would seem to be particularly shortsighted at a time when the cultural industries are widely regarded as being one of the major growth sectors for the next decade.

6. Socio-economic Impact

As we noted at the very outset of the brief, the key characteristic of information technology is that it is essentially a control technology. It is this feature that accounts for the pervasiveness of its application and the fact that it has the potential to improve performance in all sectors of the economy.

In the primary sector, information technology is being applied to a host of activities ranging from 'sizing' logs to obtain the best cut, through feeding livestock via computer monitored silos, to the creation of continuous flow refining processes that are in effect completely automated procedures for producing pulp from wood or gasoline from crude oil. For example, the MacMillan Bloedel computerized sawmill at Port Alberni obtains 10% more lumber from its logs and uses 40 fewer people than the mill it replaces. Information technology is also being used in prospecting (particulary in geological exploration), cutting furrows with a tractor and managing mining operations.

The secondary sector is, if anything, even more susceptible to automation. It has by now become commonplace that robots are reducing the demand for labour in the manufacturing process, while automated materials handling is abolishing jobs in warehousing. General Electric has recently announced an accelerated program of robotization of its major appliance manufacturing operations (1,000 over the next 10 years) to improve product quality, plant efficiency and labour productivity. The company expects to replace half its 37,000 assembly workers with robots.[12] By way of an example of how profound these effects can be in the very industry that creates them, it is interesting to note that between 1972 and 1982 the shipments of the Canadian telecommunications equipment industry increased from nearly $756 million to $3000 million and during this same period, employment in the industry fell from 40,148 to 39,820. But this experience is not at all unique. Similar examples could be cited in almost every major industry.

Finally the tertiary sector, the so-called 'services' sector that embraces everything from banking through communications, administration and retail trade will also be profoundly affected. Developments include improvements in inventory controls, billing and financial systems, point of sale terminals and office automation equipment (word processors, electronic mail, electronic filing, etc.). In describing the automation of the Citibank letter of credit department, Richard Matteis, a Citibank vice-president stated "Where it once took days, 30 odd separate processing steps, 14 people and a variety of forms, tickets, and file folders to process a single letter of credit, it now takes one individual less than a day to receive, issue, and mail out a letter of credit."[13] Again it is important to note that this is a particularly important area for Canada, since 62% of our GDP is in the services sector.

To move beyond anecdotal evidence to estimating the overall impact of information technology is not simple. Only a limited number of macro-economic studies have been done and the results have been quite variable. In one study of the U.S. economy conducted at the Science Policy Research Unit at Sussex University, the researchers looked at the U.S. economy in terms of broad occupational groupings rather than industrial sectors (i.e. information handlers, industrial workers, service industry workers, and agricultural workers). The report then graded these into high, medium, low and zero risk with respect to job loss over the next 15 years. Basing their prognosis on this, the analysis found a potential job loss of 18.2%.

Following a roughly similar procedure, the Association for Scientific Technical and Managerial Staff in Britain came up with a significantly higher figure for the U.K. They suggest that "...high risk occupational areas account for 55% of the existing working population."[14] This compares with an OECD finding that anywhere from 20 to 25% of the work forces of the OECD countries were engaged in "routine information handling activities" that could be eliminated through automation. In Canada research conducted by the Department of Communications shows that approximately 40% of all jobs may be affected (20% in offices alone).[15] But regardless of the particular numbers, what is interesting to note is that all of the studies agree that a <u>significant</u> proportion of present jobs could be affected by the new technologies.

As a result of these developments, a number of commentators have become very pessimistic about the future prospects for employment. Some have gone so far as to suggest that the impact of information technology will be so extensive as to result in a period of jobless growth that will create large pools of chronically unemployed people. They suggest that we may be witnessing a 'collapse of work', with the attendant prospects of a new utopia or massive social disorganization.

Less alarmist students of the subject point out that the trends are not all in one direction. They note that historically periods of productivity growth are accompanied by rising employment, and that what will determine overall levels of employment is aggregate demand. They note as well that the application of information technology can, in some cases, create new jobs. To return to telecommunications, on the services side - as opposed to manufacturing - the sector also experienced a dramatic increase in revenues between 1972 and 1982 - from $1.9 billion to $7.0 billion. During the same period employment grew by more than 50% from 72,671 to 111,648. While it is difficult to say precisely why this occurred, it appears that much of the growth was accounted for by the automation of the network, in particular by the shift to digital switching and transmission. Instead of having the bulk of its human resources devoted to maintaining and operating the network, functions which are being progressively taken over by machines, the industry has found new employment in such areas as business development, marketing, sales and R&D. In terms of this new employment growth, however, it is important to note that it is occurring largely in highly skilled and people oriented occupations, rather than in more traditional jobs.

Beyond this, information technology also involves the creation of completely new products and the transformation of old products into 'intelligent' versions of their earlier forms. Indeed, it is precisely in the creation of such intelligent products - products that simulate intelligent human responses in a number of situations - that we can expect to see significant growth. It may well be as one scholar has put it that 'the meaning of information technology is that we are passing from the era of intelligent design of machines to that of design of intelligent machines'.

This transformation also has important implications for the kinds of skills required. It would be a mistake to think that it means we only need more skilled software specialists or programmers, although we are chronically short of these. That is only part of the problem. To succeed at the creation of intelligent machines requires a major investment in design skills that extends far beyond the sectoral interests of computer programming into the broad field of industrial design and infrastructure renewal. It also requires that a taste for innovation became part of our industrial culture at all levels, and that it be promoted with enthusiasm by governments and educational institutions alike.

These areas of new employment may or may not outweigh the losses that will inevitably occur in other sectors as the productivity improvements associated with information technology are realized. It is clearly too early to come down with certainty on one side of the argument. What can be said with some confidence, however, is that information technology is not part of the solution to the current high levels of unemployment. At the very least, it will cause significant shifts in the types of jobs that will become available, with attendant changes in the demand for particular types of skills and education. Some people will no doubt do very well out of these adjustments, while others will suffer major losses of income and damage to their careers.

As we noted earlier these changing occupational requirements will alter the kinds of graduates that are required from universities and community colleges. Certainly it appears we will need more computer programmers, systems engineers and industrial design specialists. Over time, however, the requirement to produce more individuals with particular skills may prove less important than producing individuals who are capable of working in environments that are experiencing rapid change and responding in innovative ways. The premium will be less on specific abilities than the capacity to adapt and solve problems in imaginative ways. As Marshall McLuhan put it 'the future of work will consist of learning a living'.

7. Conclusion

Information technology is at the heart of many of the developments that will confront us as a country over the next few years. It is clear that it promises to significantly improve productivity and increase the aggregate wealth of the country over the long term. At the same time, it is far from certain that it will result in any corresponding growth in employment. To the contrary, we may discover that information technology will result in a new era of essentially jobless growth.

This may occur not simply because manufacturing is moving to the newly industrialized countries (NICs) with their large pools of disciplined inexpensive labour. It will occur because information technology's key function is - as we noted earlier - to substitute machines for human intelligence and judgement. Indeed, so far reaching are its substitution properties that we may be seeing the beginnings of a shift back to the OECD countries from the NICs. The reason for this is precisely that the new technology requires so little labour that the NICs lose their principal advantage.

But regardless of whether one approves or disapproves of these developments, it is clear that Canada has no option but to vigorously embrace the development and dissemination of these technologies. The alternative would be to delay their introduction and find ourselves falling farther and farther behind in the international race to improve the productivity of all sectors of the economy. If this happened, it would make our goods less competitive, resulting in a loss of trade and eventually reducing our standard of living.

Given the scale and intensity of international competition in the area, it is important to be clear where our competitive advantage lies. Before doing so, however, we need to recall that the information industry is, as the name suggests, primarily an intellectual and conceptual industry, one that consumes brainpower as its key resource. In this sense, the industry will develop and prosper to the extent that sufficient skilled personnel are available and to the extent that they are effectively managed.

From this perspective, our principal advantage lies in the quality of Canada's human resources. Here we are in good shape from two points of view. First and foremost we already have a highly educated, well trained population. While there may be room for improvement, this constitutes an extremely valuable national asset. Second, we have demonstrated that Canadians have the capacity to manage high creativity industries. This is no small consideration since effective management of innovative industries is the very antithesis of managing the old mass production ones. For them, standardization and regulation is everything. Information technology emphasizes the exact opposites: flexibility and imagination.

The critical character of the skill base of the population raises the issue of how the institutions of higher learning can most effectively contribute to meeting the economic challenges that face the country. Perhaps it is not going too far to suggest that the Commission may want to consider the effectiveness of the current jurisdictional arrangements in the area of post-secondary education and how they can be made more responsive to the demands of the evolving labour market. While this may appear a radical notion, it is not too far fetched to suggest that the principal economic and trading advantage we have is the quality and vitality of our intellectual life.

More generally the major theme that runs through this brief is that the most important condition of success in developing and using information technology will be the character of Canadian culture and the extent to which it encourages innovation. If we have learned nothing else from recent experience in the field of telecommunications and computers, it is that those firms perform best that make the greatest commitment to research and the development of new products.[16] By the same token, it is also clear that those individuals who can adapt most easily to changing circumstances and occupations are the ones who will prosper over the coming years. Although somewhat intangible, the capacity to adapt and the ability to encourage change may in the long run prove more important than whatever specific adjustments are made to particular tariffs or taxes. Put bluntly, unless we can be flexible at both an institutional and personal level, we may have trouble making the necessary transition.

Underlying the requirement of flexibility is the issue of self-confidence. Without a sense of confidence and the willingness to take risks, all of the flexibility and imagination in the world will be of little use. It is only when firms and individuals believe in their ability to compete and to

succeed that they will commit the necessary resources to the development of new products. In this sense confidence lies at the very heart of the capacity to innovate.

To a large extent confidence is clearly a function of how people believe the economy will perform. If they can anticipate stable prices, manageable interest rates and relatively constant growth they are likely to invest. On the other hand, if there is little certainty that the economy is likely to perform well, the propensity to develop new products will decline accordingly. All of this has become very clear over the course of the recent recession.

At the same time, confidence is very much a function of the culture as a whole. As we noted earlier, the arts - both popular and élite - provide the defining images of our system and our sense of ourselves as a people. In this way, they create the context within which Canadians see themselves and establish the standards of excellence for other sectors of our national life. To the degree that the arts provide objects and ideas of beauty and significance, to that extent will Canadians be proud of their heritage and confident of their strength as a nation.

Encouraging a climate that supports innovation and risk taking is something that must pervade all of the government's activities. While the cultural programs of the Department of Communications are clearly central, given the pervasive character of information technology, these concerns must be taken into account in almost every sphere of public activity. It may well be that the key challenge facing the government and the Royal Commission is to determine with some degree of precision how to encourage innovation and make it a central priority of our economic strategy.

Prepared by

Strategy and Plans
Department of Communications

FOOTNOTES

1. See for example, Organization for Economic Co-operation and Development, Information Activities, Electronics and Telecommunications Technologies, Vol. 1, Study No. 6 of the Working Party on Information, Computer, Communications Policy (Paris, 1981).

2. Chris Freeman, "Government Policies for Industrial Innovation", the Ninth J.D. Bernal Lecture delivered at Birkbeck College, (London, May 23, 1978), p. 12.

3. Dirk de Vos, Government and Microelectronics, Science Council of Canada Background Study No. 49, (Ottawa, March 1983), p. 13. This report presents brief case studies of the approach taken by five European countries to promote the growth of their microelectronics based industries.

4. Z.P. Zeman, on The Impacts of Computer/Communications on Employment in Canada: An Overview of Current OECD Debates, Institute for Research on Public Policy, (Montreal, 1979), which is an extensive literature review of European, American and Canadian studies in this area.

5. Science Council of Canada, Planning Now for an Information Society: Tomorrow is Too Late, (Ottawa, March 1982). This report is an assessment of some of the possible effects of technology on the economy, society and employment. p. 14.

6. Cited in FCC Docket No. 20828, "In the Matter of Amendment of Section 64-702 of the Commission Rules and Regulations (Second Computer Inquiry), Chairman's Remarks, Final Decision 77FCC 2d 384,461 (1980).

7. Economic Council of Canada, The Bottom Line: Technology, Trade and Income Growth, (Ottawa, 1983), p. 61.

8. A.D. Little Inc., World Telecommunications Survey II, 1980.

9. The Defense Advanced Research Projects Agency which manages the U.S. Department of Defense basic and applied research program requested approval for a new supercomputer program which would cost $50 million in FY1984 and $95 million in FY1985. See Science, 6 May 1983, "Supercompeting over Supercomputers", p. 582.

10. John Kenneth Galbraith, quoted in The Times Higher Education Supplement, February 18, 1983. The article is based on his W.E. Williams Memorial Lecture given before the Arts Council of Great Britain in January 1983.

11. For example, the UNESCO series of Studies and Documents on Cultural Policies. These country studies deal with administrative structures, planning and financing, legislation, budgeting and related subjects. A complete listing of titles in this series is found in the Study of Cultural Policy in Australia, Jean Battersby (UNESCO, Paris, 1980).

12. Business Week, "America Rushes to High Tech for Growth", p. 84-98, March 28, 1983.

13. Quoted in the Futurist (February 1981) article "The New Industrial Revolution" by Colin Norman.

14. Association of Scientific Technical and Managerial Staff (ASTMS), Technological Change and Collective Bargaining (London, 1978), p. 27.

15. Canadian Economic Services Ltd., Issues in the Analysis of the Information Sector of the Canadian Economy, Report for DOC, 1977; Yves Rabeau, GAMMA Inc., Tele-informatics, Productivity and Employment: An Economic Interpretation, April 1980; S.G. Peitchinis, University of Calgary, The Employment Implications of Computers and Telecommunication Technology, April 1981.

16. The employment records of a group of companies in the U.S. over the 1945-1974 period were examined in The Role of New Technical Enterprises in the U.S. Economy a report of the Commerce Technical Advisory Board to the Secretary of Commerce, U.S. Department of Commerce, (Washington 1976). The data contained in this report reveal that innovative companies taken as a group recorded substantially higher rate of increase in employment than companies using mature technology. See also the Massachusetts Institute of Technology study, "Who Creates Jobs?" The Public Interest, Spring 1980. Among the findings - 70% of new jobs created during the 1970s were created in newly developing industries in small companies, the birth and death rates of companies within developing industries were very high, with a half-life of 3 years; manufacturing contributed 4% of new jobs.

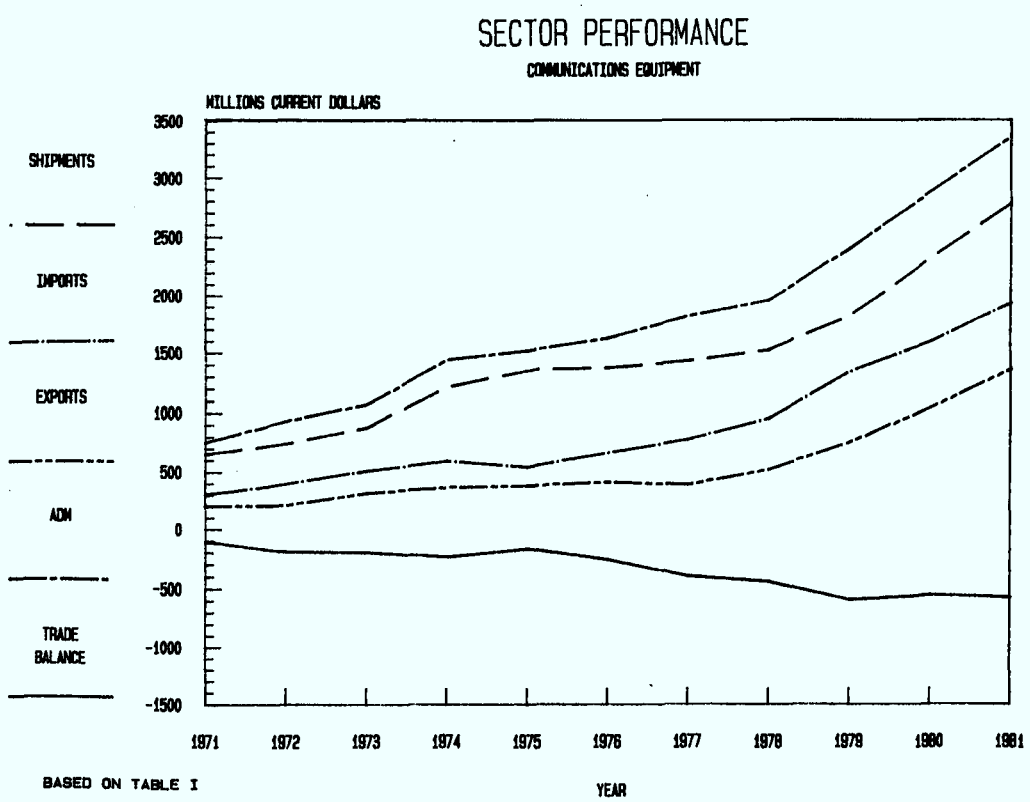
APPENDIX

SELECTED STATISTICS

LIST OF TABLES

LIST OF CHARTS

CHART 1



SECTOR PERFORMANCE **TABLE I**

(Current $Millions)

Communications Equipment*

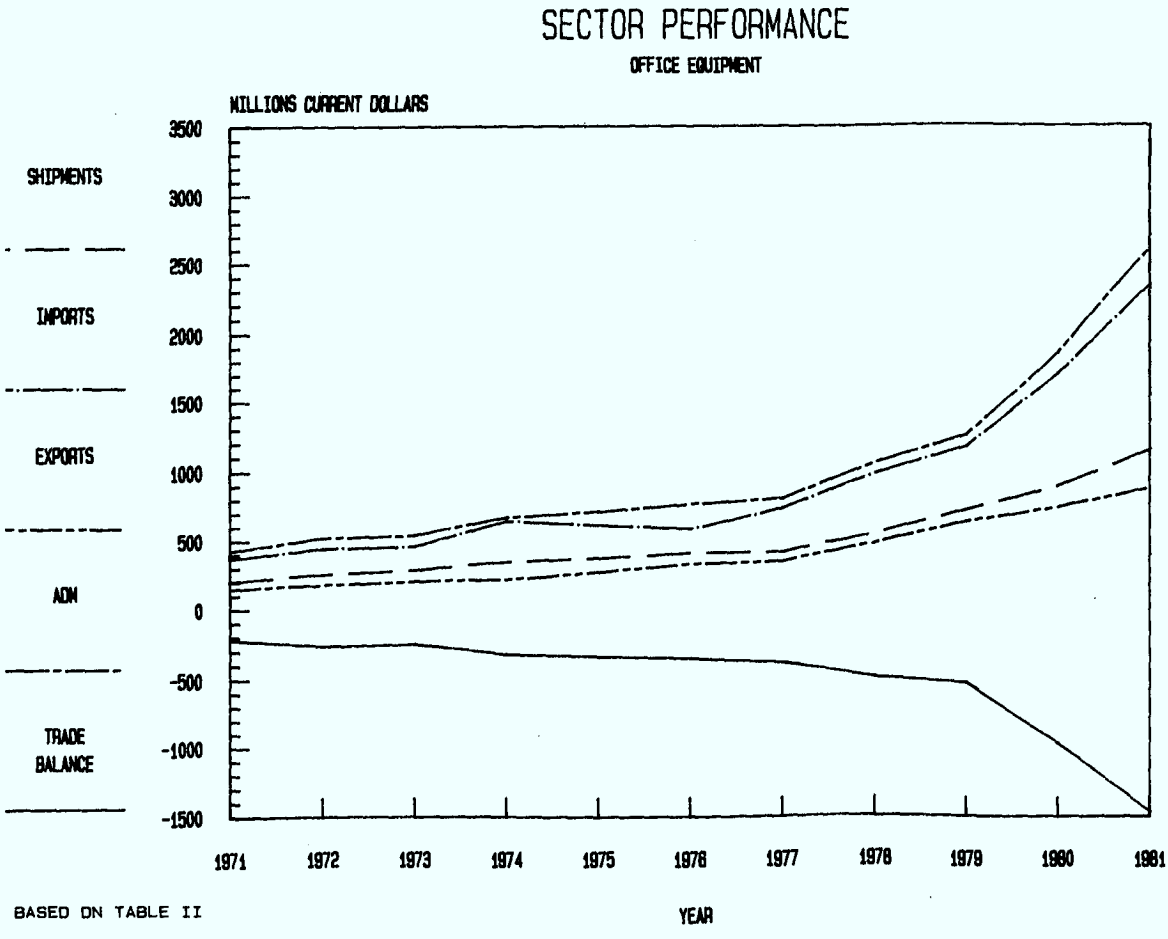
	1971	1973	1975	1977	1979	1981
Shipment	660	889	1,368	1,441	1,814	2,786
Imports	313	517	551	785	1,340	1,939
Exports	212	324	389	397	750	1,368
Apparent Domestic Mkt.	761	1,082	1,530	1,829	2,404	3,357
Trade Balance	-101	-193	-162	-388	-590	-571

Source: Statistics Canada, Census of Manufacturers

Note: Apparent Domestic Market = Shipments and Imports-Exports

* Includes telephones, telegraph equipment, radio communications equipment, transmission and switching equipment, broadcasting equipment: SIC335

CHART 2



BASED ON TABLE II

SECTOR PERFORMANCE **TABLE II**

(Current $Millions)

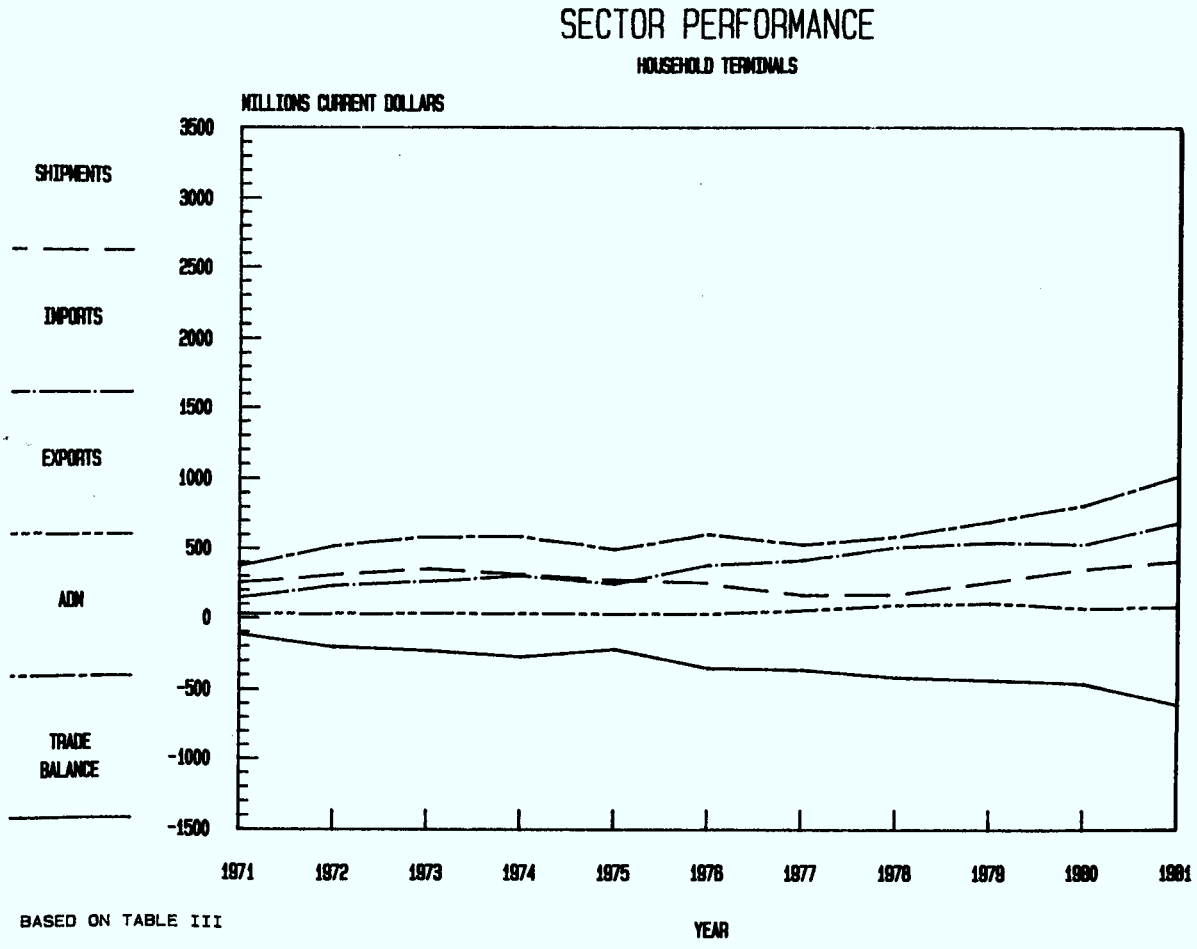
Office Equipment*

	1971	1973	1975	1977	1979	1981
Shipment	203	287	373	417	725	1,147
Imports	368	458	615	737	1,175	2,346
Exports	147	205	272	347	642	874
Apparent Domestic Mkt.	424	540	715	807	1,258	2,619
Trade Balance	-221	-253	-342	-390	-533	-1,472

Source: Statistics Canada, Census of Manufacturers
Approximately 90% of imports in 1978-1981 period were computers

* Includes calculators, wordprocessors, typewriters, dictating machines; SIC318

CHART 3



BASED ON TABLE III

SECTOR PERFORMANCE **TABLE III**

(Current $Millions)

Household Terminals*

	1971	1973	1975	1977	1979	1981
Shipment	256	352	274	166	257	416
Imports	146	263	247	419	541	694
Exports	29	32	27	55	104	86
Apparent Domestic Mkt.	373	583	494	530	694	1,024
Trade Balance	-117	-231	-220	-364	-437	-608

Source: Statistics Canada, Census of Manufacturers

* Includes: stereos, televison receivers, radio receiving sets, antennas; SIC334

COMMUNICATION/CULTURE **TABLE IV**

Sector Contribution to GDP

($ billion's constant 1971)

	1971	1973	1975	1977	1979	1981
TOTAL GDP	205.1	237.7	252.4	271.5	295.4	301.9
Telephone Systems	2.0	2.5	2.9	3.5	4.0	4.6
Telegraph & Cable	.2	.2	.3	.3	.3	.4
SUB-TOTAL	2.2	2.7	3.2	3.8	4.3	5.0
Communication Equipment	1.0	1.1	1.3	1.1	1.3	1.5
Office Equipment	.3	.4	.4	.5	.9	1.4
Household Terminals	.3	.5	.4	.3	.3	.4
SUB-TOTAL	1.6	2.0	2.1	1.9	2.6	3.3
Sector SUB-TOTAL	3.8	4.7	5.3	5.7	6.9	8.3
Broadcasting	.6	.7	.8	.9	1.0	1.0
Film & Video	.1	.1	.2	.2	.2	.3
Publishing	.8	1.0	1.1	1.2	1.4	1.4
Audio Recordings	N/A	N/A	N/A	N/A	N/A	N/A
SUB-TOTAL	1.5	1.8	2.1	2.3	2.6	2.7
GRAND TOTAL	5.3	6.5	7.4	8.0	9.5	11.0

Source: Statistics Canada, Census of Manufacturers

Note: Gross domestic product is a measure of industrial output at factor cost (wages, purchase of materials, etc.) GDP has been deflated to account for inflation. Constant GDP person employed is an accepted measure of productivity.

PERCENTAGE CONTRIBUTION TO GDP **TABLE V**

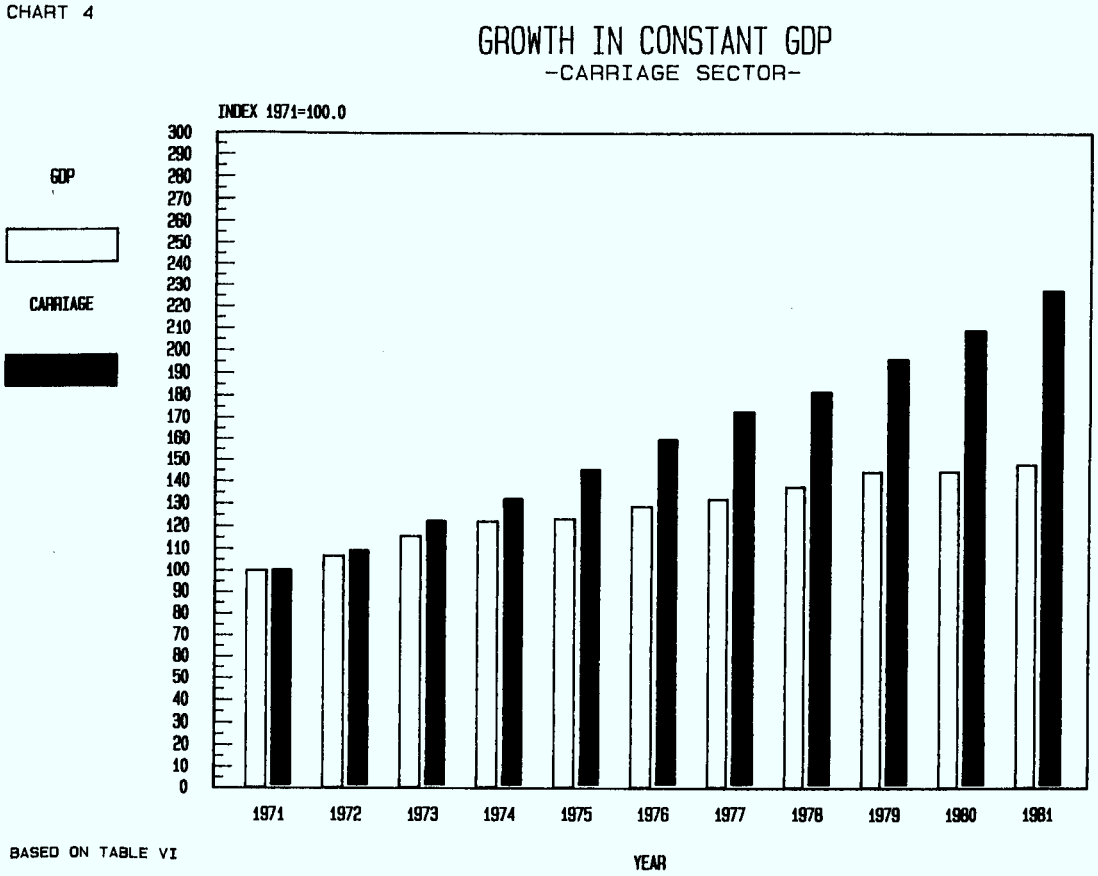
(Constant 1971 dollars)

(Percentage)

	1971	1973	1975	1977	1979	1981
TOTAL GDP	100.0	100.0	100.0	100.0	100.0	100.0
Telephone Systems	1.0	1.0	1.1	1.3	1.4	1.5
Telegraph & Cable	.1	.1	.1	.1	.1	.1
SUB-TOTAL	1.1	1.1	1.2	1.4	1.5	1.6
Communication Equipment	.5	.5	.5	.4	.4	.5
Office Equipment	.1	.2	.2	.2	.3	.5
Household Terminals	.1	.2	.2	.1	.1	.1
SUB-TOTAL	.7	.9	.9	.7	.8	1.1
Sector SUB-TOTAL	1.8	2.0	2.0	2.1	2.3	2.7
Broadcasting	.3	.3	.3	.3	.4	.3
Film & Video	.1	.1	.1	.1	.1	.1
Publishing	.4	.4	.4	.4	.5	.5
SUB-TOTAL	.8	.8	.8	.8	.9	.9
GRAND TOTAL	2.6	2.8	2.8	2.9	3.2	3.6

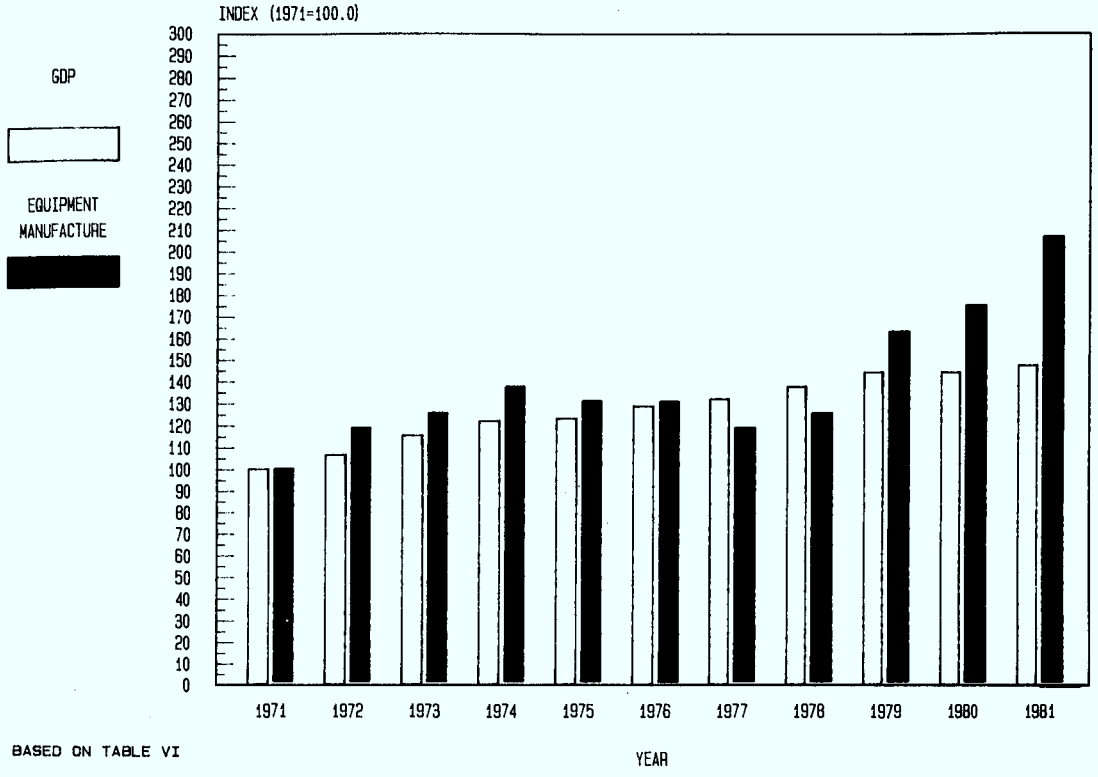
Source: Statistics Canada

CHART 4



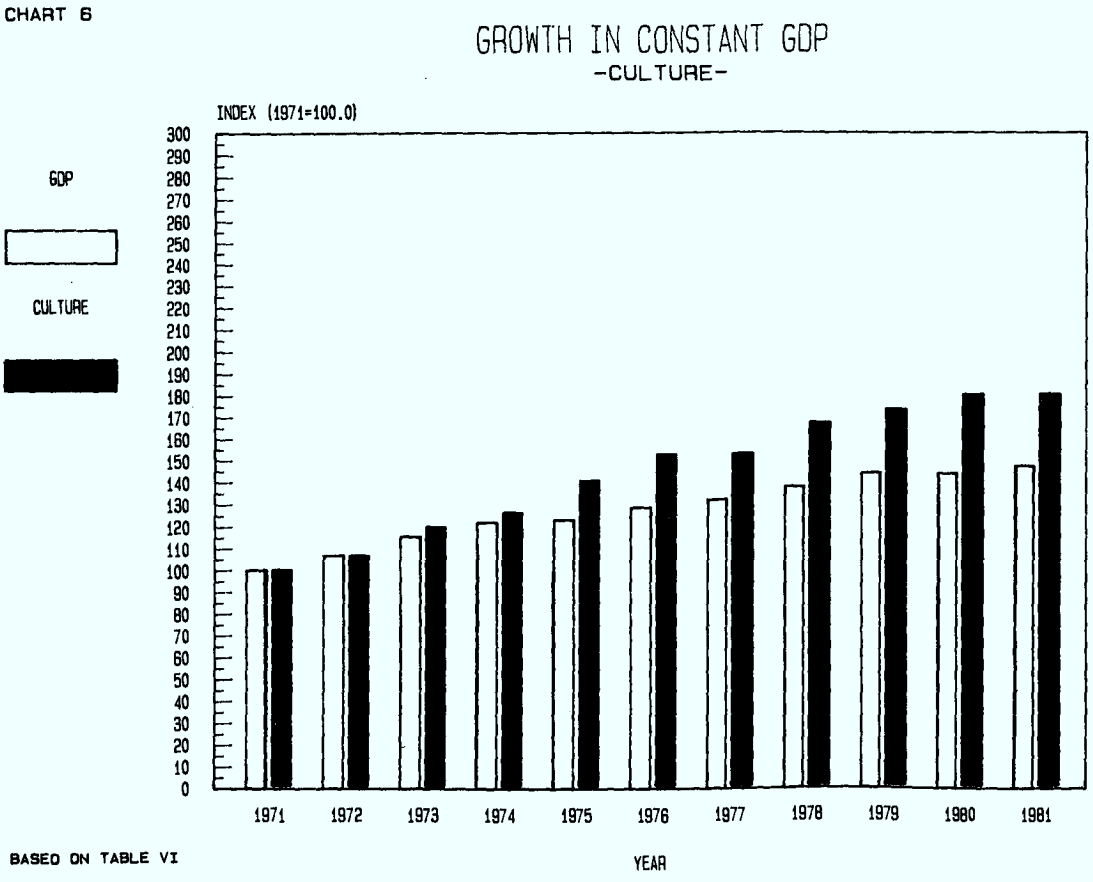
BASED ON TABLE VI

CHART 5



BASED ON TABLE VI

CHART 6



BASED ON TABLE VI

INDICES OF CONSTANT GDP **TABLE VI**

(1971 dollars, 1971 = 100.0)

	1971	1973	1975	1977	1979	1981
TOTAL GDP	100.0	115.9	123.1	132.4	144.0	147.2
Telephone Systems	100.0	121.7	145.6	171.6	196.1	230.0
Telegraph & Cable	100.0	115.1	139.4	149.8	168.8	194.5
SUB-TOTAL	100.0	122.7	145.5	172.7	195.5	227.3
Communication Equipment	100.0	116.5	129.2	114.9	132.7	149.5
Office Equipment	100.0	122.3	145.4	173.0	302.7	451.5
Household Terminals	100.0	146.0	118.7	89.1	88.8	116.6
SUB-TOTAL	100.0	125.0	131.3	118.8	162.5	206.3
Sector TOTAL	100.0	123.7	139.5	150.0	181.5	218.4
Broadcasting	100.0	126.4	140.4	160.4	199.6	193.8
Film & Video	100.0	104.7	134.0	140.1	182.8	202.3
Publishing	100.0	121.9	131.3	145.0	160.4	171.1
Audio Recordings	100.0	N/A	N/A	N/A	N/A	N/A
SUB-TOTAL	100.0	120.0	140.4	153.3	173.3	180.0
GRAND TOTAL	100.0	122.6	139.6	150.9	179.2	207.5

Source: Statistics Canada

Note: These indices use a base year (1971 in this case) to measure relative changes of GDP. They are a measure of percentage growth or decline year to year from the starting point of the series.

EMPLOYMENT IN COMMUNICATIONS/CULTURE SECTOR **TABLE VII**

1971-1981
(units)

	1971	1973	1975	1977	1979	1981
Telephone Systems	69,995	75,407	82,866	96,268	104,800	111,648
Telegraph & Cable	9,733	10,145	11,246	11,701	12,816	13,049
SUB-TOTAL	79,728	85,552	94,112	107,969	117,616	124,697
Communication Equipment	44,582	43,719	42,041	36,676	39,326	46,330
Office Equipment	8,696	10,866	9,613	10,169	11,791	16,161
Household Terminals	7,737	8,748	7,036	3,382	2,946	3,327
SUB-TOTAL	61,015	63,333	58,680	46,845	53,563	65,818
Sector SUB-TOTAL	140,743	148,885	152,792	154,814	171,179	190,515
Broadcasting	19,789	21,172	23,497	25,651	27,675	28,792
Film & Video*	-	-	1,757	1,666	1,469	1,532
Publishing*	37,887	41,178	42,744	42,541	46,478	45,443
Audio Recordings*	1,752	1,844	2,337	2,501	2,713	2,559
SUB-TOTAL	-	-	70,335	72,359	78,335	78,326
GRAND TOTAL	-	-	223,129	227,173	249,514	268,841
TOTAL LABOUR FORCE (millions)	8,639	9,276	9,974	10,498	11,207	11,830

Source: Statistics Canada
Note: * These data considerably underestimate the employment generated in these industries. For example, in film industry these data omit free lancers and shell corporations formed to produce feature films (these are transitory, may have been all freelancers or had no employees at all). The importance of free lance labour is shown when examining salaries and wages, and fees for free-lancers. In 1975 salaries and wages totaled $19.569 millions and free lance fees $5.825 millions. In 1981, salaries and wages were $24.470 millions while freelancers fees were $31.191 millions.

EMPLOYMENT AS PERCENTAGE OF LABOUR FORCE **TABLE VIII**

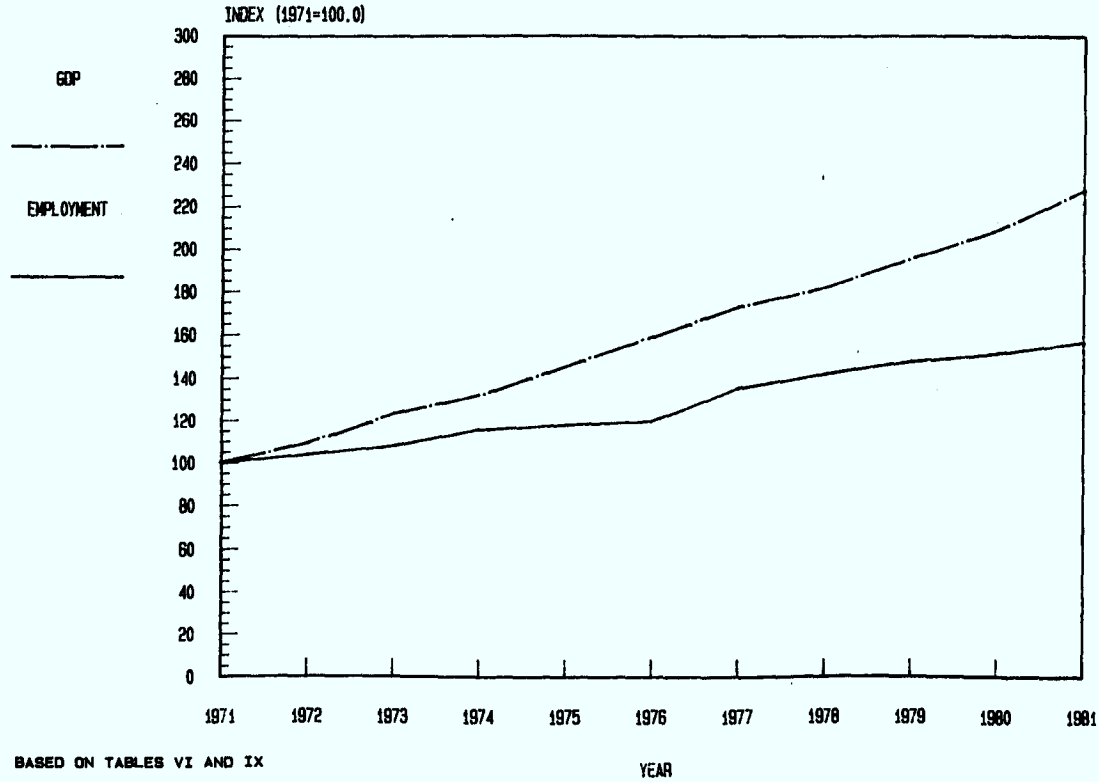
	1971	1973	1975	1977	1979	1981
Telephone Systems	.8	.8	.8	.9	.9	.9
Telegraph & Cable	.1	.1	.1	.1	.1	.1
SUB-TOTAL	.9	.9	.9	1.0	1.0	1.0
Communication Equipment	.5	.5	.4	.4	.3	.4
Office Equipment	.1	.1	.1	.1	.1	.1
Household Terminals	.1	.1	.1	-	-	-
SUB-TOTAL	.7	.7	.6	.5	.4	.5
Sector TOTAL	1.6	1.6	1.5	1.5	1.4	1.5
Broadcasting	.2	.2	.2	.2	.2	.2
Film & Video	-	-	<.1	<.1	<.1	<.1
Publishing	.4	.4	.4	.4	.4	.4
Audio Recordings	<.1	<.1	<.1	<.1	<.1	<.1
SUB-TOTAL	.6	.6	.6	.6	.6	.6
GRAND TOTAL	2.2	2.2	2.1	2.1	2.0	2.1
TOTAL LABOUR FORCE	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada

CHART 7

COMPARISON OF EMPLOYMENT AND CONSTANT GDP GROWTH

-CARRIAGE SECTOR-

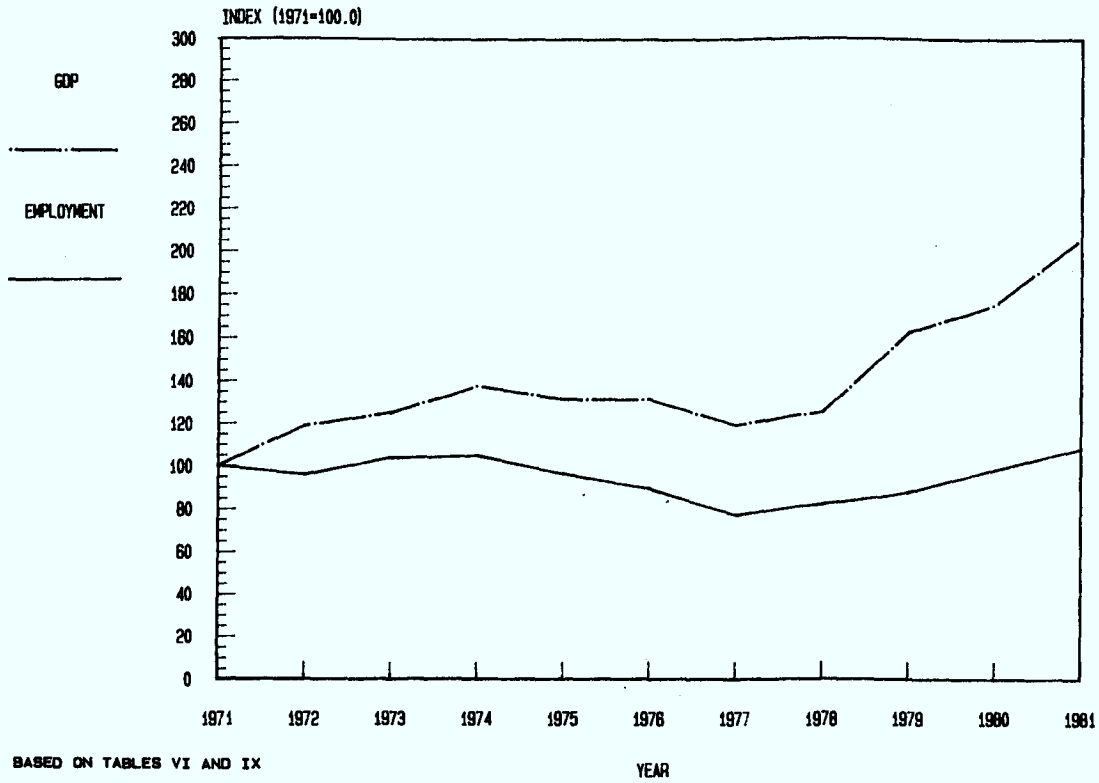


BASED ON TABLES VI AND IX

CHART 8

COMPARISON OF EMPLOYMENT AND CONSTANT GDP GROWTH

-EQUIPMENT MANUFACTURING SECTOR-



BASED ON TABLES VI AND IX

INDICES OF EMPLOYMENT GROWTH

TABLE IX

	1971	1973	1975	1977	1979	1981
Telephone Systems	100.0	107.7	118.4	137.5	149.7	159.5
Telegraph & Cable	100.0	104.2	115.5	120.2	131.7	134.1
SUB-TOTAL	100.0	107.3	118.0	135.4	147.5	156.4
Communication Equipment	100.0	98.1	94.3	82.3	88.2	103.9
Office Equipment	100.0	125.0	110.5	116.9	135.6	185.8
Household Terminals	100.0	113.0	90.9	43.7	38.1	43.0
SUB-TOTAL	100.0	103.8	96.2	76.8	87.8	107.9
Sector SUB-TOTAL	100.0	105.8	108.6	110.0	121.6	135.4
Broadcasting	100.0	107.0	118.7	129.6	139.9	145.5
Film & Video	100.0	-	-	-	-	-
Publishing	100.0	108.7	112.8	112.3	122.7	119.9
Audio Recordings	100.0	105.3	133.3	142.8	154.9	146.0
SUB-TOTAL *	100.0	-	-	-	-	-
TOTAL LABOUR FORCE	100.0	107.4	115.5	121.5	129.7	136.9

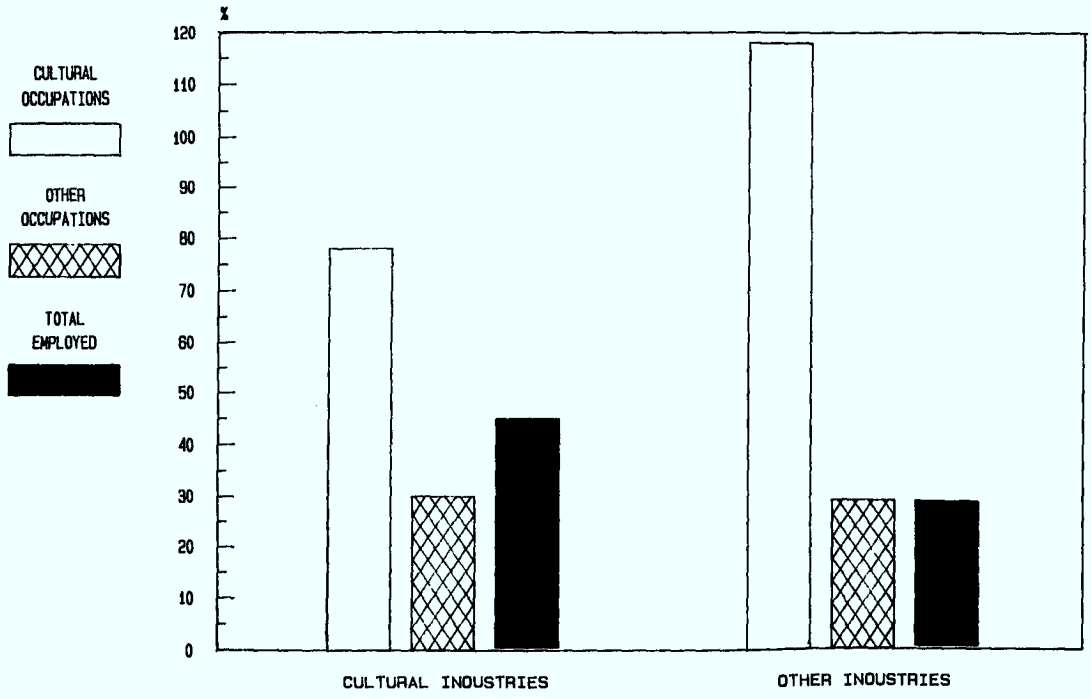
Source: Statistics Canada

Note: * These data considerably underestimate the employment generated in these industries. For example, in film industry these data omit free lancers and shell corporations formed to produce feature films (these are transitory may have been all freelancers or had no employees at all). The importance of free lance labour is shown when examining salaries and wages, and fees for freelancers. In 1975 salaries and wages totaled $19.569 millions and free lance fees $5.825 millions. In 1981, salaries and wages were $24.470 millions while freelancers fees were $31.191 millions.

CHART 9

CHANGE IN EMPLOYMENT

CULTURAL AND NON-CULTURAL
OCCUPATIONS BY INDUSTRY 1971 AND 1981

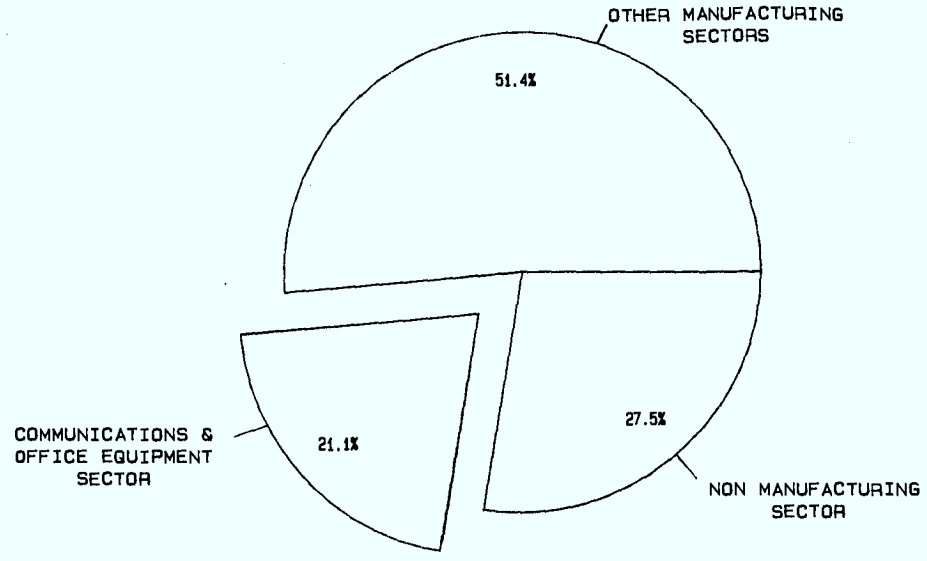


BASED ON TABLES X AND XI

CHART 10

PERCENTAGE DISTRIBUTION OF TOTAL INDUSTRIAL R&D EXPENDITURES

SELECTED INDUSTRIES 1981



BASED ON TABLE XI

TOTAL R&D EXPENDITURES BY SELECTED INDUSTRIES

TABLE X

($000,000'S Current)

	1973	1975	1977	1979	1981	1983
Mines and Wells	28	47	50	118	205	470
Manufacturing						
- Business Machines	19	12	14	27	55	80
- Communications Equipment	96	127	145	210	365	614
- Aircraft and Parts	62	57	95	153	247	282
- Petroleum Products	20	46	72	116	208	321
- Chemical Products	34	44	48	66	102	126
- Other Manufacturing Sectors	191	275	294	412	579	685
Services						
- Transportation and other Utilities	10	25	52	41	61	72
- Electrical Power	23	42	44	69	92	152
- Engineering and Scientific Services	11	20	32	43	57	67
- Other Services	3	5	11	14	33	38
Total - All Industries	497	700	857	1,269	2,004	2,907

Source: Statistics Canada

Note: Includes both capital and operating expenditures performed by companies in most industry sectors. They do not include government expenditures nor industries such as agriculture, forestry, fishing, trade, finance, insurance and personal services where there is little or no R&D done.

PERCENTAGE R&D EXPENDITURES SELECTED INDUSTRIES, SELECTED YEARS

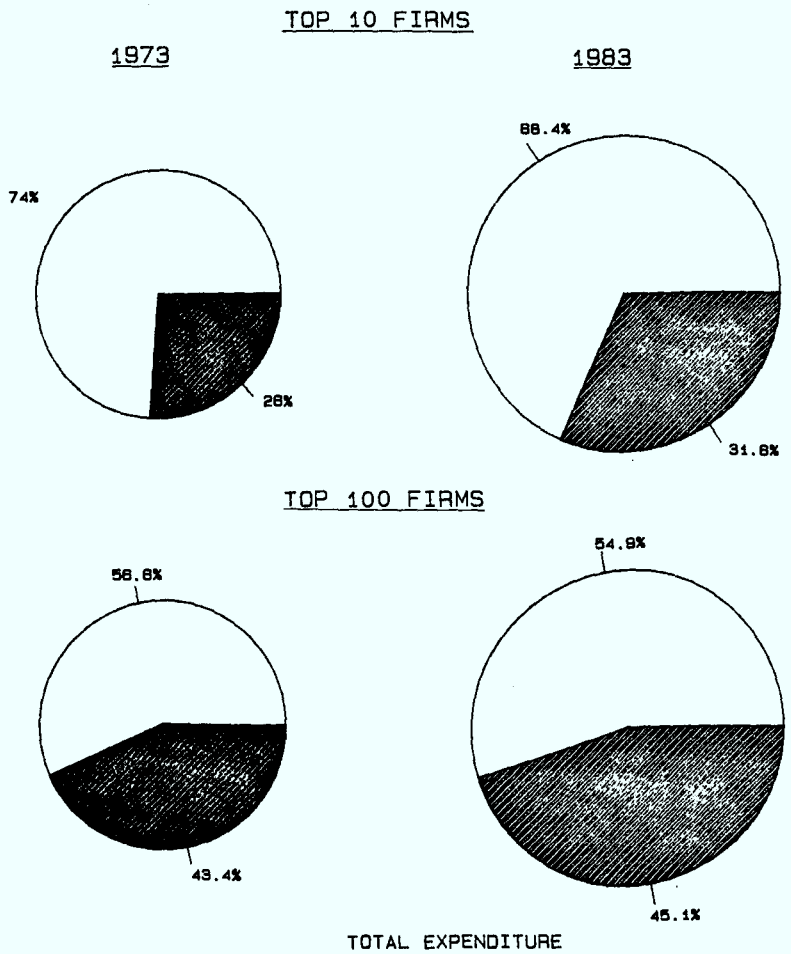
TABLE X1

	1973	1975	1977	1979	1981	1983
Mines and Wells	5.6	6.7	5.8	9.3	10.2	16.2
Manufacturing						
- Business Machines	3.8	1.7	1.6	2.1	2.7	2.8
- Communications Equipment	19.3	18.1	16.9	16.5	18.2	21.1
- Aircraft and Parts	12.5	8.1	11.1	12.1	12.3	9.7
- Petroleum Products	4.0	6.6	8.4	9.1	10.4	I1.0
- Chemical Products	6.8	6.3	5.6	5.2	5.1	4.3
- Other Manufacturing Sectors	38.6	39.3	34.3	32.5	28.9	23.6
Services						
- Transportation/ Communications	2.0	3.6	6.1	3.2	3.0	2.5
- Electrical Power	4.6	6.0	5.1	5.4	4.6	5.2
- Engineering Services	2.2	2.9	3.7	3.4	2.8	2.3
- Other Services	.7	.7	1.4	1.2	1.8	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada

CHART 11

TOTAL R&D EXPENDITURES OF TOP INDUSTRIAL R&D PERFORMERS, 1973 AND 1983



TOTAL EXPENDITURE

1973

$503 million

1983

$2,907 million

TABLE XII

Telecommunications Systems Market Forecasts, by Major Geographical Region
(in $ million US)

Region	Telephone		Telegraph Telex and Data		Satellite Communications		Mobile Radio and Radio Telephone		Radio Paging		Cable Television		Total	
US $ (000,000)	$	%	$	%	$	%	$	$	$	%	$	%	$	%
North America														
1980	12,638.2	74.3	2,481.4	14.6	122.9	0.7	1,496.2	8.8	33.4	0.2	228.7	1.3	17,000.8	100%
1985	18,714.3	74.9	3,823.9	15.3	290.4	1.1	1,779.2	7.1	44.4	0.2	318.9	1.3	24,971.1	100%
1990	26,504.6	74.2	6,000.5	16.8	463.7	1.3	2,299.4	6.4	55.8	0.2	391.5	1.1	35,715.5	100%
Asia (incl. USSR)														
1980	8,687.5	86.7	636.5	6.3	122.5	1.2	560.8	5.6	14.5	0.1	0.5	-	10,022.3	100%
1985	14,338.4	85.7	1,157.0	6.9	237.6	1.4	985.7	5.9	19.5	0.1	1.1	-	16,739.3	100%
1990	23,069.1	85.9	1,934.2	7.2	374.2	1.4	1,434.6	5.3	23.1	-	1.6	-	26,836.8	100%
Europe														
1980	9,465.7	87.3	739.9	6.8	59.0	0.5	539.5	5.0	28.7	0.2	15.2	0.1	10,848.0	100%
1985	13,243.9	84.7	1,322.3	8.5	111.4	0.7	854.7	5.5	63.9	0.4	29.5	0.2	15,626.7	100%
1990	17,117.1	82.1	2,015.6	9.7	189.4	0.9	1,297.9	6.2	106.5	0.5	123.1	0.6	20,849.6	100%
Latin America														
1980	978.0	83.4	104.9	9.0	14.2	1.2	70.4	6.0	3.5	0.3	1.7	0.1	1,172.7	100%
1985	1,524.1	84.5	144.3	8.0	14.6	0.8	111.9	6.2	6.8	0.4	2.6	0.1	1,804.3	100%
1990	2,010.4	84.1	186.4	7.8	34.0	1.4	145.3	6.1	10.6	0.4	4.0	0.2	2,390.7	100%
Oceania														
1980	654.2	86.8	33.3	4.4	43.1	5.7	23.0	3.0	0.1	-	-	-	753.7	100%
1985	913.6	87.8	46.6	4.5	48.1	4.6	32.4	3.1	0.1	-	-	-	1,040.9	100%
1990	1,270.3	87.9	79.2	5.5	51.5	3.5	44.4	3.0	0.2	-	-	-	1,445.6	100%
Africa														
1980	313.5	81.4	48.3	12.6	3.2	0.8	20.0	5.2	-	-	-	-	385.0	100%
1985	457.4	82.3	66.7	12.0	5.6	1.0	25.7	4.6	0.1	-	-	-	555.5	100%
1990	689.6	82.1	97.0	11.6	10.5	1.3	42.3	5.0	0.2	-	-	-	839.6	100%
World ($ billion)														
1980	32.7	81.7	4.0	10.0	0.4	1.0	2.7	6.7	0.1	0.2	0.3	0.7	40.2	100%
1985	49.2	81.0	6.6	10.9	0.7	1.1	3.8	6.3	0.1	0.2	0.3	0.5	60.7	100%
1990	70.6	80.3	10.3	11.7	1.1	1.2	5.2	5.9	0.2	0.2	0.5	0.6	87.9	100%

Source: Arthur D. Little Inc., World Telecommunications Survey II, 1980.