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TOWARDS AN INFORMATION TECHNOLOGY AGENDA

INFORMATION TECHNOLOGIES INDUSTRY BRANCH

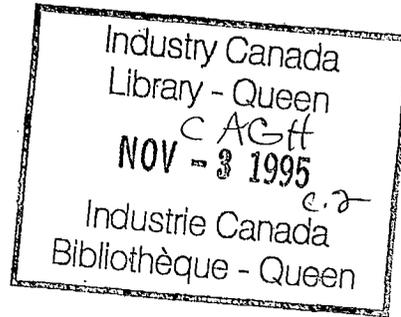
April 1, 1992

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PREFACE

"Towards An Information Technology Agenda" is a background paper on the information technology (IT) industry in Canada and the application of IT for economy-wide competitiveness in the context of global change. It was intended to provide the basis for critical discussion on the IT industry and the application of IT across such issue areas as markets and trade, science and technology, human resources, and finance and investment.

This paper is a synthesis of the work undertaken by our Branch during the fall of 1991 to develop an agenda that would help us set priorities and define our changing role. The paper was prepared for a series of consultation workshops sponsored by the Information Technologies Industry Branch in February of this year. These workshops, which attracted over fifty participants from within our Department, External Affairs and International Trade Canada, and Investment Canada, were part of our ongoing process of consultation with other government stakeholders.

As we incorporate the views of our government colleagues, expand our consultations to include industry, and as the results of the Prosperity Initiative unfold, a more evolved synthesis view on IT in Canada will emerge.

1. THE COMPETITIVE LANDSCAPE

1.1 Overview of Global Changes

- The starting point for global changes has been the rapid growth of international trade and investment in the post-War period, the emergence of a liberalized multilateral trading regime, and improvements in communications and transportation.
- More recently, the application of information technology (IT) has acted as a catalyst for these changes by automating business operations and vastly improving communications capabilities. This is driving profound changes within firms and industries to take advantage of the power of IT. Information technology has become a key factor in defining the competitive landscape.
- At the present time, the world IT industry is undergoing rapid transformation due to changes occurring throughout the world in terms of markets, regulation, technology advances and government intervention. The clearest manifestation of these changes are that private and public sector organizations are no longer treating trade, investment, and technology as separate strategies but, rather, as an integrated whole.

1.2 Market Trends

- Deregulation is opening new markets, liberalizing existing markets to greater competition and, thereby, fostering a borderless and interdependent world economic system in which the notion of the "national" firm is fading.
- Concurrently, intra- and inter-firm trade is expanding driven by the globalization and rationalization of corporate operations. These types of trade account for more than sixty percent of total transactions in the world IT sector and contribute to the increased interdependence of firms and nations.
- Among the OECD countries, the value of trade in services is rapidly approaching that of trade in goods as international transactions more closely reflect the evolution of domestic economic structures.
- Barriers are falling and, trade or not, IT firms are being exposed to higher levels of competition from foreign producers. Therefore, whether they supply domestic or world markets firms must possess, or have access to, a range of world-class corporate capabilities. Increasingly, firms are using various partnering arrangements such as consortia and strategic alliances to lever capabilities and resources.

- Liberalization is causing market shifts that open up new niche opportunities that can be exploited by adroit IT firms able to commercialize new and unique products, processes and services. Similarly, the emergence and adoption of new technical standards (eg. ISO 9000 and Open Systems) are creating new business opportunities.
- Since the early 1980s, power has been shifting from producers to buyers due to the expansion of choice in a more open marketplace. Meeting the rising expectations of sophisticated and demanding customers persists as a major challenge for the industry.
- Not only the IT Industry in Canada, but the entire economy's competitiveness is closely tied to its ability to purchase high-quality, competitively-priced, IT inputs. Therefore, open access to international markets, investment, and technology is vital.
- IT remains one of the fastest growing sectors in the world. According to the consulting firm of Arthur D. Little, Inc., the world IT market is projected to grow at a rate of 7.6% and is forecast to exceed \$2.2 trillion by the year 2000.

1.3 Technology Trends

- The sector has become synonymous with extremely rapid technological change drastically shrinking product life cycles, increased performance capabilities at reduced cost, and shifts in value-added as a result of standardization and the emergence of commodity-like IT products.
- A shift towards the use of digital technology is driving the convergence of a wide range of technologies and industries including micro-electronics, software, telecommunications, consumer electronics, broadcasting and information services.
- These technological trends are having a profound impact on both the IT industry (opening new markets, driving trade as a means to recoup increasing R&D costs, altering firm and industry organization, etc.) and the entire world economy through the application of IT (enhanced productivity, flexibility, and responsiveness to clients, better quality and delivery, improved efficiency of supplier linkages, etc.).

1.4 Implications for Government

- Globalization has changed the way businesses operate. Global corporations, with their web of subsidiaries, joint ventures and strategic business partners, are extremely mobile and quick to react to changes in their environments.
- As a result, most governments are applying more generic incentives through such measures as advanced R&D, post-secondary education and job-training programs, and tax and regulatory changes. These measures are directed towards the development of highly-qualified human resources and improvements in the business environment in order to attract value-added activities.
- The drive to attract global corporations is also spurring some governments (national, provincial/state, municipal) to compete among themselves for international investment by offering lucrative incentive packages. For many governments, a global company's "home-base" remains an important consideration for the location of such key business functions as R&D and for the decision-making process itself.
- Some governments continue to intervene directly by providing support to "national champions". Such measures can result in competitive advantages for these firms, both domestically and in foreign markets.
- Tendencies toward direct intervention in trade, investment and technology are being restrained through multilateral discussions which seek to increase transparency, set rules and guidelines and, ultimately, limit intervention which distorts competition.
- National trade and regulatory regimes are being superseded by those at the international level. Not only is the role of government being re-defined, but so is the concept of sovereignty.
- The ability of governments, particularly those with complex federal structures such as Canada, to react to rapid global change in a timely, coordinated and effective manner is becoming more difficult.

1.5 Emerging Global Trading Rules

- If and when concluded, the Uruguay Round of the GATT will create new rules, expand existing ones, and permit the further growth of IT trade among all countries. Specifically:
 - The MTN Services Code is expected to liberalize trade in professional IT services and value-added networks.
 - New investment rules are intended to prevent restrictions or distortion of trade.
 - The Subsidies Code may impose restrictions that limit industry support at local and provincial levels, and to disadvantaged regions, that could impact on IT firms in specific areas.
 - Agreement on intellectual property rights (IPRs) will mean a more effective rules framework, dispute resolution function and enforcement provisions.
 - The Procurement Code is being extended to cover all government-run utilities. This is vital for telecommunications equipment manufacturers and could reduce the effectiveness of current preferential procurement practices.
 - The "Electronics Zero-Zero Initiative" is a proposal by the US and Japan to eliminate most tariff and non-tariff barriers (NTBs) on office equipment, semiconductors and telecommunications equipment.
- It is expected that a successful conclusion to the Uruguay Round will reduce the pressure for the formation of inward-looking trading blocs. In general, both regional (FTA/NAFTA, EC & Asia-Pacific) and global trade frameworks are assuming greater importance and, thereby, diminishing national economic sovereignty.

1.6 Firms Responding to Global Change

- The evidence of firms and clients responding to the changing landscape are pervasive. In particular, we are witnessing:
 - Growing world IT trade, investment and technology transfer;
 - Industrial and corporate restructuring (Fujitsu buying ICL, the re-organization of Bull and Thomson, Northern Telecom's purchase of STC, and the re-organization of IBM into smaller functional units acting as profit centres);
 - Refocusing on the core business (Philips selling its computer division to Digital) and streamlining of supplier relationships (Xerox);
 - Growth of alliances (Sematech, Apple-IBM) and increased inter-firm networking - particularly links to suppliers;

- Focus on quality, portability and the movement toward "open systems", in response to customer demands;
 - The success of firms outside of the IT industry realized through the application of IT to gain a competitive advantage (Japanese automobile manufacturers, Royal Bank of Canada, Swedish pulp and paper mills).
- Many of the above changes are not unique to the global IT sector, and certainly not to Canada's IT sector, but reflect a profound shift impacting the manufacturing and high-technology sectors. A shift which, to a large extent, is a result of the application of IT and its capacity to change the way business is done.

1.7 The Uneven Impact of Global Changes on the IT Industry

- The various sectors which make-up the industry have different industrial structures, historical development experiences and relationships to customers, suppliers and governments. Consequently the impact of global change has not been evenly felt across all sectors.
- The computer, office equipment, instrumentation, software and services sectors are ones in which artificial barriers to trade, investment and technology flows have been relatively modest. In these areas, tariff and NTBs have tended to be less intrusive, although there has been concern with mobility and rights of establishment in foreign countries. Firms in these sectors are particularly concerned with IPRs. A lack of adequate protection for technology in some foreign markets has hindered the expansion of exports.
- The telecommunications sector is characterized by extensive government intervention and less reliance on free market principles. Frequently, a local manufacturing presence or licensing arrangement has been a prerequisite for selling equipment to the national telecommunications carrier. Further movement in dealing with NTBs such as standards, product registration and approval, and government procurement are required before the full impact of global economic changes on firm and client behaviour can be felt.
- Within the global semiconductor industry, trade, investment and technology flows have become constrained through unilateral trade actions, managed trading arrangements such as the recent agreement between the United States and Japan, and the shift of chip production from the U.S. to East Asia.

2. THE INFORMATION TECHNOLOGY INDUSTRY IN CANADA

2.1 Industry Overview

- Companies in Canada are responsible for approximately three percent (or \$40.2 billion) of worldwide IT production and services. IT manufacturing contributes 7% of manufacturing GDP, while the services segment of the IT sector is responsible for 5% of services GDP.
- Canada's \$24 billion domestic market for IT goods is the 7th largest, ranked in order behind the U.S., Japan, Germany, France, U.K., and Italy.
- Canadian IT firms export three-quarters of their production and are extremely dependent on the import of intermediate inputs. As a sophisticated IT market, Canadians are heavy importers of finished products such as computers, office machines and consumer electronics. (In 1990, IT imports were equivalent to 70% of the apparent domestic market.)
- Over the past decade, export growth has not paralleled the growth in IT imports. Consequently, Canada has an IT merchandise trade deficit (1990 - \$7.2 billion) that has been growing at about 10% each year through the 1980s.
- The industry in Canada, when judged against its foreign competition, has been less successful in adapting to changing demand patterns, improving productivity and, thereby, raising its share of growing foreign markets.
- The IT industry in Canada is predominately composed of small and medium-sized enterprises (SMEs), Northern Telecom and approximately 30 subsidiaries of foreign MNEs. A significant portion of Canada's IT trade is between the subsidiaries of these global corporations.
- Over 75% of the sector is concentrated in Ontario and Quebec with pockets of expertise across the country, most notably in British Columbia, Alberta, and Nova Scotia. The sector employs close to 300,000 people.
- Thirty-five percent of all Canada's industrial R&D is performed by the IT sector. On average, IT companies spend about 12% of their revenues on R&D. The high rate of industrial R&D in this sector is not, however, proportionally matched by public sector spending on IT R&D.
- Bell-Northern Research is Canada's unchallenged single-largest private sector R&D performer, spending more than AECL, Pratt & Whitney Canada, IBM Canada, and Alcan Aluminum combined. These companies are, in rank order, the top five R&D spenders in Canada. Although only two are IT firms, all five are heavily involved in IT R&D.

2.2 Sectoral Assessment

- Canada does not have competitive strengths in all IT sectors and, even within the various sectors, strengths tend to be niche-oriented - residing mainly in areas such as telecommunications and data communications, micro-electronics design, instrumentation and process control products, software products, and systems integration services.
- Unlike other G-7 countries, Canada does not have a fully-integrated computer industry. Many of the world's leading computer companies have a presence in Canada - assembly operations, software R&D laboratories. But, with a few notable exceptions like Philips, Hewlett-Packard, and NCR, these global companies have not located much value-added manufacturing in Canada. There are, however, about 160 speciality suppliers that are primarily small electronics equipment and microelectronics companies.
- **(a) Telecommunications Equipment & Services:** In terms of tradeable goods, this industry includes the manufacture and assembly of terminal equipment, mobile equipment, public and private switching equipment, data network equipment, transmission products, cable, satellite systems and broadcast systems.
- In Canada, the telecommunications equipment industry is dominated by one firm, Northern Telecom, which accounts for 50% of the sector's exports. There are also some twenty medium-sized firms and over 275 smaller companies. Notably, 90% of these businesses have revenues under \$5 million.
- Northern Telecom and Bell-Northern Research are tremendous assets. They have served as an incubator for the industry, fostering a number of excellent spin-off companies as well as the geographic clustering of corporate capabilities.
- A main area of concern in this sector is keeping Northern Telecom a Canadian-based company, that is, retaining and expanding its value-added activities in Canada. Another consideration which is important to the economic health of this sector is improving the profitability and growth prospects of our middle-tier niche companies. Finally, there is the issue of access to adequate financing for start-ups and early ventures which cuts across all of IT.
- The current world market for telecommunications equipments is \$130 billion with a projected annual growth rate of about 6.2% to the year 2000.
- In 1990, Canadian production was valued at \$6.4 billion and the sector employed 48,000 people. Between 1986 and 1990, industry revenues maintained a 9.5% annual growth rate.

- The industry in Canada has moved from a strong trade surplus position to a modest surplus, largely resulting from strong import growth and increased investment by Canadian companies in production outside of Canada.
- On the services side, the communications industry includes local and long distance telephone services, data communications, paging, resale, cable and cellular services. The convergence of broadcasting and telecommunications, computer and communications technologies, and the emergence of personal communications and new network services, are expected to have dramatic effects on the nature and structure of the worldwide services industry.
- Issues of concern for Canada include taking advantage of emerging trade opportunities in services, as well as the implications arising from the implementation of broad-band switch services to the home.
- Worldwide, the communications services market is estimated at approximately \$540 billion with a projected annual growth rate of 7.1% to the year 2000.
- In Canada, industry revenues were about \$16.8 billion in 1990 and had experienced a 9.5% growth rate for the 1986-1990 period. The sector employed 134,000 in 1990.
- **(b) Microelectronics:** This industry comprises the design, development, and production of semiconductor devices such as integrated circuits (ICs). These devices are used ever more pervasively and intensively in a wide range of economic activities - from military and industrial applications to toys and video games. In short, microelectronics represents a strategic set of technologies that are vital to the competitiveness of an increasing number of industries.
- Canada's microelectronics industry has developed and grown primarily due to the vertical integration of Canadian telecommunications companies. Northern Telecom designs and develops microelectronic devices for in-house needs, and Mitel's production is for both internal and commercial markets.
- In addition to these dominant players in telecommunications, IBM Canada has a world-class facility for packaging ICs, and Gennum Corporation has the only bipolar silicon fabrication facility in the country. The remainder of the industry is composed of 30 small companies involved in the design of customized chips for speciality markets. Most of their products are for export.
- Canada's strengths lie in design capabilities and in specialized niche areas. The industry does not have the large scale, high volume fabrication facilities generally associated with the sector worldwide.

- Canadian microelectronics companies are faced with a number of challenges. There are the escalating costs associated with rapid technological change and facilities upgrading. There is the issue of timely access to foreign foundries which is of crucial importance to most companies. Also, there is concern about how these companies position themselves to take advantage of the high-growth potential of specialized markets.
- The current world market in microelectronics is \$62 billion. Canada's market for these devices is estimated at close to \$3 billion and the output of the Canadian industry is estimated at \$500 million.
- **(c) Instrumentation and Process Control Products:** This sector designs, develops and produces devices that measure, record, or control machine-based processes. The various kinds of instrumentation run the spectrum of industrial activities. They include photonics, building control and supervisory systems, industrial process controls, environmental monitoring and control devices, geophysical and geological measurement and recording devices, security and alarm systems, testing and measuring equipment, and medical and navigational instrumentation.
- In Canada, there are some 450 predominately small firms with a focus on instrumentation. These firms have total shipments of \$2.3 billion of which 40% is exported.
- The industry is galvanized around industrial process control and building control which together account for 80% of production. The niche areas of photonics, and environmental monitoring and control, are expected to be high growth areas in the future.
- Globally, the market for instrumentation is \$90 billion. In comparison, Canada's market is \$3.2 billion. Canada has a growing trade deficit in instrumentation which in 1990 was close to \$1.4 billion.
- **(d) Software Products:** The software products industry is comprised of firms engaged in the development of systems software, user tools, and applications.
- There are an estimated 3,600 companies, the vast majority of which have annual revenues of less than \$250,000. The largest Canadian company, Cognos, has sales of about \$150 million, and there are another 200 companies with revenues of \$1.5 million to about \$50 million.
- The revenues of this sector are growing at a rate of 13% which is on par with world market trends. Software companies are highly export-oriented, earning over 60% of their sales outside of Canada. Market penetration into the United States, which represents 50% of the worldwide market, is a minimum requirement for the success of most of these firms.

- Successful Canadian software product companies have typically gained their competitive edge by offering unique, technologically sophisticated, and niche-oriented products in such areas as fourth generation languages, geographical information systems, seismic interpretation and oil and gas applications. Canada has gained world recognition for quality in software development.
- For software products firms, marketing and distribution, and the issue of overall business management, are critical factors for growth. Many companies are extremely dependent on sales outside of Canada and face stiff competition primarily from U.S. firms. Like many other IT companies, software developers are also faced with difficulties accessing adequate financing.
- The world market for software products is about \$52 billion and the Canadian market is estimated at over \$1 billion. Trade figures for this sector are not available. However, it is estimated that Canada is in a deficit position as a result of the heavy importation of popular American application packages such as Wordperfect, Lotus 1-2-3, and dBase.
- **(e) Systems Integration and Professional Services:** This sector includes such services as value-added resellers, turnkey systems, systems analysis, systems design, custom software, systems and technical consulting, and training and education.
- Systems integration is the fastest growing component of IT. Strong growth is driven by the standardization of IT components and PCs that has resulted in a situation in which value-added is derived from devising business solutions through the linking of hardware and software systems.
- SHL Systemhouse and DMR Group, and possibly CGI and the LGS Group, are Canadian systems integrators of sufficient size to be capable of improving their positions in international markets. Canada also has a large number of smaller systems integration and professional service companies most of which service local or regional markets in Canada.
- In the integration business, competition is growing spurred by strong demand. Large computer companies like IBM and Digital are moving into the field, and market trends, such as "outsourcing", are creating new business opportunities. In Canada, these trends are resulting in increased competition from large foreign integrators for what has traditionally been a domestic market serviced solely by domestic suppliers.
- Unlike other IT sectors, the success of Canadian systems integrators in international markets does not necessarily result in the undertaking of new valued-added activity in Canada. Indeed, greater benefits may accrue to Canadian customers and Canadian IT suppliers through the influx of foreign systems integration firms (eg. Andersen Consulting and EDS) into Canada.

For example, these foreign companies have significant project management expertise that can be filtered down to Canadian IT companies through project partnering.

- The world systems integration and professional services market is estimated at \$89 billion and is growing extremely rapidly (19% for systems integration and 15% for professional services). In Canada, this market is \$1.8 billion with an annual growth rate of 14% (15% for systems integration).

2.3 The Application of IT for Competitiveness

- Information technology is a set of enabling technologies whose application cuts across all industrial sectors. Its benefits are increasingly vital to the domestic and international competitiveness of Canadian manufacturing and services firms alike - be they a large automotive company (General Motors of Canada), a leading forest products company (MacMillan Bloedel), a small construction company (computerized estimating and cost controls), a leading passenger airline carrier (computerized seat booking and seat sales controls), or a fast food chain (McDonald's Canada).
- Information technology means faster communications with suppliers and customers (fibre optics, networking services), improved management and control over inventories (speciality application software), improved quality control of products and production processes (CAD/CAM, CIM), more accurate tracking of shipments and deliveries (computerized tracking systems), improved and up-to-date accounts managements, and more accurate and current market intelligence (database and demographic services).
- In addition to having a tremendous impact on basic business functions such as financial control or plant floor management, IT is also being embedded in a diverse range of end-products and services - from toys to the computerization of stock exchanges. As in the case of today's automobile, it is the embedded technologies that frequently differentiate the product from that of its competitors, and is touted as the source of the product's superiority.
- In short, there are cost reduction, productivity gains, and product/service differentiation benefits attainable through the adoption of IT which, given today's business climate, Canadian firms can ill afford to ignore.
- However, the successful exploitation of IT in any business can also require substantial mind-set and organizational change, as well as workforce adjustment. There are many cases of both small and larger companies that have made relatively substantial investments in IT with little positive effect on productivity and the business' bottom line. There are more considerations than just the technology in making a company more competitive through IT.

There is the question of effectively managing technology, an area in which both business and government, need to gain a better understanding.

- It is also important to emphasize that there are linkages between the successful adoption of IT in the Canadian economy and a strong Canadian IT industry.

2.4 A Need for More Analysis

- Although each IT sector is faced with its own specific set of concerns and constraints, there are similarities (these will be explored further in the Horizontal Issues section of the paper). For all firms, the cost of doing business is being driven higher and higher by the need to keep pace with competition, to keep on top of customer needs, to maintain and expand market share, and to keep pace with new products and technologies. As a consequence, all IT firms need:
 - to have open access to international markets, investment and technology in order to grow;
 - to maintain a strong commitment to R&D;
 - to have an adequate supply of highly qualified people;
 - to have ready access to adequate financing/investment.
- Although we have a good knowledge of the IT industry and its relative strengths at the present time, this may not be adequate in an industry undergoing rapid change. We need to gain a greater appreciation not only of the current picture, but perhaps more importantly, of the future technology, investment, and market trends. We also need to focus attention on the longer-term so as to be better placed to anticipate change.
- Moreover, we need to gain a greater appreciation of the nature and rate of the application of IT across the Canadian economy. We need to know more about how successful Canadian resource, manufacturing and services companies have been in adopting IT. We need a greater appreciation of the gains, in terms of productivity and cost and time savings of IT implementation. We also need to know how firms are adjusting the way they do business in order to take full advantage of the benefits of IT.

3. HORIZONTAL ISSUES/CHALLENGES

3.1 Markets & Trade

- a) The Canadian IT sector, and the entire economy (in terms of the application of IT), is highly trade dependent.
 - Rapid change in technology is driving trade.
 - Access to export markets and imports is critical.
- b) Canada has many promising SMEs with strong niche capabilities. There is a need to adopt strategies for "growing" firms that can compete internationally.
 - Build on internationally-competitive niche strengths in areas such as telecom equipment, data communications, instrumentation and process control products, software products, systems integration, and micro-electronics design.
 - Disseminate international market, investment and technology intelligence.
 - Improve the export awareness and readiness of IT firms.
- c) MNEs/global firms are an important part of Canada's IT industry.
 - A need for global firms to source intermediate inputs in Canada (supplier development).
 - Having these firms exercise full production mandates (rather than simple assembly) in Canada and, by so doing, actively compete in world markets.
 - A need to maintain the beneficial role of MNEs in sourcing components from IT SMEs to foster an internationally competitive Canadian components industry.
 - Setting the "right" environment to attract, retain and grow these firms value-added operations in Canada.
- d) Partnerships are increasingly being used by firms of all sizes to access markets, investment and technology.
 - Building partnerships - identifying partners, negotiating agreements and maintaining effective corporate relationships.
 - Ensuring the integrity of core technology.

- e) There is inter-departmental (fed-fed and fed-prov) overlap in the area of international IT business development assistance (intelligence, support services, program funding).
- A need to maximize the return on government support expenditures.
 - A need to collaborate in setting strategic priorities.
 - Approaches for dealing with support to Canada-based global IT firms.
- f) Canada needs to remain mindful of its international obligations and the benefits and opportunities associated with an open world trade, investment and technology environment.
- Ensure programs and policies are harmonized with our multilateral and bilateral obligations.
 - Recognize that emerging trade regimes (GATT & NAFTA) require governments to examine current preferential procurement practices.
 - Develop and promote alternative strategies for using government purchasing power for industry development (eg. outsourcing) that is consistent with our international obligations.

3.2 Science & Technology

- a) Overall, Canada originates a very small proportion of its technology requirements. These technologies are the basis for the international competitiveness of the IT industry and the entire economy.
- Access to technology - wherever it may reside - is critical.
 - A pressing need for improved awareness of domestic and foreign sources of technology (eg. use of Patent Office and other technology review services).
- b) Rapid technological change and the competitive challenge necessitate industry-university/government R&D linkages.
- Linking into domestic cooperative R&D programs (local, regional, national), consortia and networks.
 - Tapping into foreign R&D - corporate partnerships, government programs (US, EC, Japan), consortia and networks.
 - A requirement for adequate support vehicles that allow for effective industry participation in strategic linkages.

- c) The setting and implementation of new IT standards and regulations is an on-going process, not only by governments and international organizations, but also by large corporations through their purchasing activities.
- Engendering firm awareness of the implications of standards as a technical and market access issue. (Standards are often a two-edge sword. They can be an effective way of restricting market access and, conversely, for the companies that adopt new standards quickly, they can be a competitive advantage.)
 - Ensuring that Canadian organizations adjust to and implement new IT standards (eg. Standards Council of Canada).
 - Promoting the concerns of the Canadian IT industry and IT users in Canada through participation in international standards-making and regulatory bodies (eg. ISO, ITU, GATT and OECD).
 - Canadian government's establishment of a regulatory/standards environment that will positively influence the process of innovation leading to the introduction of new products and services by Canada-based IT firms.
- d) Technology is a key force driving the re-organization of the industry and the emergence of new market opportunities.
- A need to examine government support mechanism and focus on those technologies in which Canada possesses or has the potential to possess a competitive advantage.
 - A need to assess existing strengths, capabilities and improve intelligence on future technology trends.
 - A need to foster the development of leading-edge technologies as well as the growth of firms.
 - A need to understand emerging technology trends and their impact on companies and the organization of industries.
- e) A strong S&T environment encourages and sustains economic competitiveness and growth.
- A need to sustain the ability of our existing S&T infrastructure (R&D tax credit, university/government lab/industry R&D linkages, investment, ITIB effectiveness) to enable:
 - start-ups
 - the growth of existing firms to become internationally competitive
 - the retention and attraction MNEs/global IT firms to locate in Canada.

- f) Information technology is an important set of enabling technologies that underlie long-term economic competitiveness.
- A need to foster economy-wide awareness of the benefits of IT application.
 - Cost-effective adoption of technology by Canadian industry accompanied by organizational change to ensure maximum productivity gains.

3.3 Human Resources/Learning

- a) As a result of technology convergence, the emergence of new information technologies, and the standardization of some hardware and components, utility or value increasingly resides in the ability of individuals to develop new applications and improve productivity.
- Requires an adequate and timely supply of people with the right skill sets for the IT industry and the application of IT.
 - Attracting and retaining human resources (eg. dealing with migration and reduced enrolment in technical fields).
 - IT application as a possible remedy for personnel skill shortage and productivity gains.
- b) Science, engineering, business and other technical skills need to be encouraged to prevent projected skills shortages in the future.
- Strengthening technical education at the secondary and post-secondary levels.
 - A stronger commitment to continuous corporate training to adopt to new technological realities that permits upward movement along the value-chain and a sustained high-standard of living.
- c) Alone, technical skills are not sufficient to allow for the growth of an IT firm.
- Fostering an entrepreneurial and risk-taking mentality combined with improved business management skills.
 - A need to develop business management capabilities beyond technology development in the IT industry and improve the management of technology in SMEs throughout the Canadian economy.

3.4 Financing/Investment

- a) Capital requirements are escalating because of high R&D and product commercialization costs. The IT industry in Canada faces a severe access to capital problem.
 - Access to capital - both domestic and foreign - is insufficient.
 - Start-up firms lack adequate venture capital to permit effective product commercialization.
 - Growing firms can not get funding to initiate and advance foreign market penetration.
 - Large firms need "patient" funding to globalize.
- b) Many prominent Canadian IT firms have been targets for foreign acquisition which results in a shift in the home-base of the corporation.
 - A need to assess the pros and cons of the acquisition of successful Canadian IT firms by foreign interests.
 - Retain integrity of core technology in Canada.
 - Partnerships as a source of capital.
- c) The financing challenge is intertwined with the management challenge. Many SMEs lack the ability to develop and sell a business plan to potential lenders and the lenders lack an appreciation of high-technology business.
- d) Considerations related to overall corporate profitability are an important determinant of location decision-making by global firms.
 - Ensure a degree of consistency of profitability potential (tax regime, employee compensation and productivity, regulations) for IT firms in Canada (domestic and foreign-owned) versus other OECD countries to attract value-adding investment in Canada.
- e) Canadian financial institutions are risk averse and certain aspects of our tax law (capital gains) inhibit business start-up and expansion.
 - Investigating the impacts of the Canadian Tax Act to the extent that it inhibits the formation of new IT ventures while promoting investment in "hard" as opposed to knowledge-based assets.

EPILOGUE

As we strive toward a vision of *information-based prosperity* we endeavour to support an environment that will:

- Build on existing strengths to grow Canadian firms into internationally competitive players.
- Attract and retain the value-added activities of MNEs/global firms.
- Push effective economy-wide adoption of IT and the realization of its full productivity enhancing potential.
- Pursue telecom world leadership as both an industry and an infrastructure.

APPENDIX I THE INFORMATION TECHNOLOGIES INDUSTRY BRANCH

Our Mission

To enhance the international competitiveness of Canada's Information Technology industry and, through the application of appropriate information technologies, the competitiveness of other sectors of the economy.

Our Goals

- To assist the Canadian information technology industry **double** its share of the world market by the year 2000, by focusing on opportunities matched to Canada's strengths.
- To assist 5,000 SMEs become internationally competitive by the year 2000, by focusing on management improvement and the application of information technologies.

Our Approach

- **Strategic Intelligence** - Earn national recognition as the source of strategic intelligence on the industry, the technologies and products, their application and management, and the markets.
- **Cooperative Relationships** - Build cooperative and productive relationships with other parts of ISTC and with leaders in industry, universities, research establishments and governments.
- **Industry Representation and Challenge** - Present an industry perspective in government policy formation and develop programs and initiatives which will encourage and challenge industry clients to improve competitiveness.
- **Professional Team** - Develop Branch staff as a team of dedicated, competent professionals noted for the timeliness and quality of their contributions and respected by their industry clients and government partners.
- **Quality Work Environment** - Develop an environment for Branch staff to promote and reward innovation, effectiveness and excellence.

APPENDIX I THE INFORMATION TECHNOLOGIES INDUSTRY BRANCH

Our Programs and Services

- Sector Campaigns: Microelectronics, Software, Photonics
- Advanced Manufacturing Technology Application Program (AMTAP)
- Manufacturing Visit Program (MVP)
- Strategic Technologies Program (STP) - PRECARN, IRIS
- Federal Artificial Intelligence Research Fund
- Microelectronics and Systems Development Program (MSDP)
- Canadian Network for the Advancement of Research, Industry and Education (CANARIE)
- Workshops on Informatics for Senior Executives (WISE)
- Manufacturing Assessment Services (MAS)

Our Initiatives

- Mandate for Export and Research and Development in Information Technology (MERIT)
- Canadian Telecommunications Action Committee (CTAC)
- Canadian Microelectronics Action Committee (CMAC)
- Information Technology (IT) Round Table
- National Software Working Committee (NSWC)
- Software Industry Liaison Committee (SILC)

