

Q127
.C2
N234

c. 1 aa



CANADA

Report of the
National Advisory Board
on Science and Technology

HUMAN RESOURCE DEVELOPMENT COMMITTEE

Presented to the
Prime Minister of Canada



National Advisory Board on
Science and Technology

Conseil consultatif national
des sciences et de la technologie

The Right Honourable Brian Mulroney
Prime Minister of Canada
House of Commons
Room 1142
Ottawa, Ontario
K1A 0A5

Learning to Win: Education, Training and National Prosperity

Report of
The Human Resource Development Committee
National Advisory Board on Science and Technology

INDUSTRY, SCIENCE AND
TECHNOLOGY CANADA
LIBRARY

JUN 20 1991

BDOH
BIBLIOTHÈQUE
INDUSTRIE, SCIENCES ET
TECHNOLOGIE CANADA

APRIL 1991



*Printed on
recycled paper*



*Imprimé sur du
papier recyclé*



National Advisory Board on
Science and Technology

Conseil consultatif national
des sciences et de la technologie

The Right Honourable Brian Mulroney
Prime Minister of Canada
House of Commons
Room 309-S
Ottawa, Ontario
K1A 0A6

Dear Prime Minister,

I submit to you herewith the report of the Human Resource Development Committee which was accepted by NABST at its plenary session on November 28, 1990, in Ottawa.

As you know, NABST is convinced that Canada's national prosperity is at stake and that we face a crisis. To remain a Summit Nation, Canada needs to focus intently on adding value and knowledge to its exportable goods and services, building on existing strengths.

The key to remaining prosperous is mastery of continuous innovation (the process of relentless improvement and creativity). Furthermore, the attitudes to work and the quality and excellence built into continuous innovation must extend beyond exports to make the whole economy competitive including the non-market services of government, education and health care. Not to do so is to accept further decline and the erosion of the tolerance, equity, education, and caring which are the hallmarks of Canada.

Our report entitled ***Learning to Win: Education, Training and National Prosperity*** identifies Canada's highly educated population as the huge untapped resource in the country. Continuous innovation depends not just on technology, but paramountly on people, on teamwork, and on team management. Canada invests proportionately more in education than almost any country in the world and already has over twice the participation rate in post-secondary education of all countries except the United States. To tap this potential, a huge gap between these high inputs and the present low outputs in terms of productivity and international competitiveness must be quickly closed, as a matter of national priority.

The enemy is complacency among Canadians who have yet to realize or admit that their heritage of natural resources is no longer of itself paying their way. One result is a national debt whose mere maintenance already consumes 35 cents of every Canadian tax dollar.

Although there have been many welcome initiatives, the process of restructuring to an innovative economy has not seriously begun. Nothing less than a deliberate change of course will do. Marginal adjustments, although more comfortable, will not suffice.

We propose the concept of Continuous Learning to close the competitive gap and unleash Canada's real potential. We pull no punches, in order to foster understanding and debate. Continuous Learning involves pre-school orientation, formal education, and adult training in a continuous process that lasts a lifetime to provide people with flexibility and self-confidence in the face of continuous challenge and change.

At the core of continuous learning is Adult Training. The average Canadian worker now receives annually only 7 hours of training, against 17 in Australia, 170 hours in Sweden, and 200 hours in Japan.

The report calls on you, Prime Minister, to set a national target for workforce training of 5% of working time by the year 2000, about 90 hours a year for each person in the workforce. This is more than a 10-fold increase, realistic, but still not enough to make us competitive by then. It is also an input target, when the country needs to learn to measure itself by its competitive output, and must develop and implement the standards and targets to do so. It is, however, an excellent first step.

Learning to Win also recommends an initial focus on retraining managers and teachers. This is because managers, public and private, by their myriad decisions create the climate for change, and teachers in their classrooms have large influence on the orientation and attitude of students.

In formal education, the report calls for more local relevance to lower the 30% high-school dropout rate by involving industry and business in the classroom and students early in work experience. It wants national standards for the school system and locally chosen targets for achievements against them. It recommends the reorienting and clustering of the best and brightest through the differentiation and specialization of universities. It recognizes the special role of science and technology in an innovation-driven economy and that careers in these fields must be made more attractive and challenging to attract the talent required, particularly from among women. It sees

investments in computer assisted learning as a means of increasing the productivity of both formal education and adult training by large factors.

The overall goal of Continuous Learning is public awareness and the widest possible active participation in the economy. Needed are higher levels of literacy and numeracy, and much more generally shared scientific and technical understanding.

The report contains 14 recommendations to initiate these changes and establish a structure for action. They are merely to point the way. It is not realistic to write a prescription or propose a detailed plan because so much must depend on local initiatives and on professional, business and individual action. In the traditional pattern of "top down, bottom-up" management, we are asking you to lead in order to generate a wide response, the precise outcome of which cannot fully be foreseen.

The Committee and NABST are sensitive to the massive problems of jurisdiction and entrenched self-interest that must be overcome to succeed. We therefore advocate extensive reallocation of existing expenditures before any new money is directed to Continuous Learning, first because deficit reduction must remain the overall first priority, and second to ensure that all non-essential diseconomies leading to the gap between expenditure inputs and competitive outputs in education and training have been routed out to free up funds for new initiatives. We are aware that most such expenditures are not in your control. We are not advocating federal control of education, but instead the country developing *courage to manage* on a wide front. We are asking you to wake up Canada to the opportunities and advantages inherent in its population, by appealing directly to its people to act in their own communities to bring about a change of Canada's course into the future.

The other members of the Committee and I are fully prepared to assist you in launching this challenge, in amplifying our recommendations, and in carrying them out.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'H.W. Edwards', with a long, sweeping flourish extending to the right.

Hugh Wynne-Edwards
Chairman
Human Resource
Development Committee

HWE:JL
Att.

The views expressed in this paper are those of the authors and do not necessarily correspond to the views or policies of the Government of Canada.

Members of the Human Resource Development Committee

Dr. Hugh Wynne-Edwards, Chairman

President, Terracy Inc. and
Science Advisor, Teck Corporation

Dr. Stephen D. Acres

President, Biostar and
Director, Veterinary Infectious
Disease Organization
University of Saskatoon

Dr. Pierre Bois

President
Conseil de recherches médicales du Canada

Madame Jeannine David-McNeil

Professeur titulaire
L'Institut d'économie appliquée
Ecole des hautes études commerciales

Monsieur Yvon C. Dupuis

President
Consultants Dutech Inc.

Madame Paule Leduc

Présidente
Conseil de recherches en
science humaines

Professor Marion Vaisey-Genser

Associate Vice-President (Research)
University of Manitoba

Dr. Norman E. Wagner

Chairman of the Board and
Chief Executive Officer
Alberta Natural Gas Company Ltd.

Dr. Douglas Wright

President
University of Waterloo

Table of Contents

	Page
Preface	i
 I. Continuous Learning for Global Competitiveness	 1
1. Background	1
2. Continuous Learning	3
 II. Canada's human Resource Development System	 9
1. The Policy Context	9
2. International Comparisons in Formal Education	10
3. International Comparisons in Adult Training	12
 III. Adult Training	 15
1. Training the Managers	15
2. Training the Teachers	17
3. Training the Adult Workforce	19
 IV. Formal Education	 21
1. Economic Relevance: Industry-School Interaction	21
2. Excellence at the Top: The Best and Brightest	22
3. Excellence Throughout: The Need for Educational Standards	24
4. Science, Engineering, and Technology	25
5. Women in Science, Engineering, and Technology	26
6. Attracting Students to Science and Technology	26
 V. A Structure for Action	 29
1. The Continuous Learning Board	29
2. The Reallocation and Investment: Who Pays?	30
 VI. Recommendations from the Text	 33

Preface

Education and training affect nearly everyone, so that most people have strong views about them based on personal experience and perspective. Formal education and adult training are two key facets of human resource development, involving respective annual expenditures of about \$45 billion and \$5 billion. Human resource development is a complex area of politics and policy, with jealously guarded jurisdictions and funding from three levels of government.

Forty reports over the last ten years have produced 600 recommendations about education and training in Canada. They had only minor discernible effects.

Their recommendations resolved into five themes, all of which are again covered in this report. These are recommendations for the government to promote:

- public awareness of the competitive economic challenge;
- a national strategy for human resource development;
- new partnerships between education, business and labour;
- performance standards and curricula for basic literacy, numeracy and technological skills; and
- lifelong or continuous learning.

Why has the response to these recommendations been so weak in the past? Part of the answer must be that most Canadians, although uneasy about the quality and relevance of education, are reasonably satisfied with the status quo. Yet the Canadian economy has not paid its way since the mid-1970s, and among those who know or will admit this, education and training are identified as the principal tools with which to redress the situation.

The only conclusion is that the message of economic crisis has not got out. Not nearly enough people understand (or want to understand) its long-term implications. For years we have allowed constitutional, legal and political wrangling to dominate the news and absorb political energy, leaving the economy and the environment mostly to fend for themselves.

Canada's economic dilemma is that the growth in world trade is two to five times faster in the knowledge-intensive goods we buy (for a trade deficit) than in the resource-intensive commodities we sell (for a trade surplus). With brisk demand for finished goods, and low demand for commodities, prices and profits are higher on Canada's trade deficit side. Since Canada's domestic market is so small, the country is highly dependent on international trade for its standard of living. **Continuing to exchange low-value productivity for high value-added goods under these conditions requires us either to reduce our standard of living, or to work much harder for less money than our trading partners, or to do both at once.**

In *The Borderless World*, (Harper, 1990), Kenichi Ohmae contrasts two attitudes to international trade. Resource-poor nations (e.g. Japan, Switzerland, Hong Kong), must purchase many necessities of life abroad. Exportable goods and services of higher value must be created within the national economy to pay for these necessities. In resource-rich countries (Canada, Argentina, Brazil) the traditional attitude is protectionist, defending

“a pot of gold.” The necessities of life are indigenous, but manufactured goods and luxuries are purchased from abroad by reluctantly selling some of the national resource endowment.

Today, with resource commodities in chronic surplus and commodity profit margins highly cyclical and declining, the sale of bulk raw materials can no longer support a high standard of living. Natural resources are an economic mainstay for Canada, but we must not earn our living from them by exploiting the environment in a way that is unacceptable to the public and which conspicuously mortgages the future. Therefore, more knowledge must be added to the goods and services we export through creativity, innovation and lean management practices.

The main forces behind global competition and economic restructuring are the rise of **continuous innovation** and of **environmental conservation** which can be seen as the parallel expressions of competitiveness and caring. These forces, through technological substitution, recycling, conservation, and downsizing, have accounted for the disappearance of Canada’s “pot of gold” of natural resources. They created commodity surpluses, which caused a sharp decline of commodity prices and growth rates relative to world GNP since the oil-shock of 1973, when the world learned to do more with fewer resources. Whereas competitiveness is at the core of economic strategy and is the focus of this report, it should be matched by caring in a careful balance – caring for the poor, the minorities, the unfortunate, and caring for the Earth itself. This balance is already visible in the expansion of minority and women’s rights and in the economic shifts to more efficient uses of resources.

Goods must not only be made better, cheaper, and faster simultaneously by continuous innovation, but they must also be made greener. Here Canada could develop a major competitive advantage. Public concerns about the environment run high in Canada, making it an ideal and challenging first market for environmentally efficient products. A healthy environment should not conflict with a healthy economy, since both can be achieved through the activities of economic renewal.

Much more time and energy needs to be spent in raising concern about the competitiveness of the Canadian economy, to widen the debate and to make Canadians aware of the necessity of economic restructuring on a large scale. Only when a majority of people have understood the problem can action follow, and can solutions be implemented with relative ease.

Looking at Human Resource Development in its narrow context or in a piecemeal fashion will do nothing. Any changes need to be part of a systematic and orchestrated process of economic restructuring and the accompanying adjustments to social change. “I think that the schools by and large turn out quite good people, but you have to have an environment which can absorb them, and we do not have that right now. There is a lot of criticism of education – that we should go back to education and spend more money on it. I think that is a waste of money, quite frankly, until you create an environment which can absorb these people. Otherwise we are just educating them in order to export them”. (Ian Sharp¹, quoted in *Canada’s Technology Industries in the 1990s*, Ernst and Young, 1990.)

Without a concerted attack on restructuring towards an innovative economy, more money for education and training and more money for research and development will be wasting scarce resources on luxuries we can no longer afford. Worse, they will raise unrealistic expectations and false hopes which can only add to social discord.

¹ Founder of I.P. Sharp Associates, Toronto, which launched APL, the first language behind the commercial computer networks to enable the globalization of trade.

Much of the drive and initiative for economic restructuring will come from individuals acting locally once the problems are widely understood and the goals are identified and shared. The balance of this report is presented assuming that its recommendations will be implemented within this context of action on a wide front.

I. CONTINUOUS LEARNING FOR GLOBAL COMPETITIVENESS

1. Background

Education and training comprise a \$50 billion enterprise in Canada, larger than the forest industry, or mining, or agriculture, or the automobile industry. We invest proportionately more in education than almost any other country in the world. Internationally the skills of a nation's people have suddenly been recognized as the most important factor in its economic performance, and as perhaps the only real competitive advantage a country has. Canada should be at the top because of this investment in its people. Instead we have the lowest productivity growth of the G-7 countries, and a miserable score in the key factors in international competitiveness. We have an annual deficit that adds over \$1,100 per capita to the national debt, two thirds of the amount spent on the whole of education. Natural resources are no longer of themselves paying our way, and with a backlog of national debt amounting to \$365 billion, have not done so since the mid-seventies.

Relentless, continuous innovation is the tool that can enable Canada to develop new products for new export markets, streamline its public and other service sectors, and retain the competitiveness of its natural resources by raising quality, lowering cost, and adding value by further processing. The driving force will be managers who understand the need for innovation and have the ability to combine the interpersonal, technical and marketing skills that support innovation. *Business Week* of September 3, 1990 reported that 91% of Japanese executives in a recent poll cited innovation as the key to growth in the 1990s. What would the corresponding percentage be in Canada?

Continuous innovation is intently focused on identifying and satisfying customer needs. It involves simultaneous development in marketing, manufacturing, product engineering, and technology on parallel and interrelated development paths. Its foundations are leadership, teamwork, communication, and motivation. The innovation leader's task is to create collective genius in teams of ordinary people who have these different skills. Technological understanding and interpersonal skills are of equal importance in this management arena.

The importance of education, science and technology as competitive factors in the global economy was highlighted by the Government in the Throne Speech of 1986. It has been repeatedly re-emphasized by the Prime Minister since then, together with the need for Canada to focus on human resource development rather than natural resource development to remain a leading economic nation. One outcome was the formation of the National Advisory Board on Science and Technology (NABST), chaired by the Prime Minister himself.

In 1989, NABST was asked to review and report on the adequacy of the Canadian human resource system to meet the needs of a competitive economy. This report is the response. It was prepared by a Committee on Human Resource Development of NABST formed in August 1989, and approved by the Board on November 28, 1990.

The urgency of the issue and its prominence in the political agenda has prompted numerous parallel studies and initiatives, many of which are still continuing. Among the most significant are reports of the Science Council of Canada (1986), the de Grandpré Commission (1989), the Economic Council of Canada (1990), and the Canadian Labour and Management Productivity Council (CLMPC), also in 1990. Related government initiatives in the same period include a literacy program in the Secretary of State of Canada, the Canada Scholarships and Centres of Excellence programs of Industry, Science and Technology Canada, and the reallocation of \$800 million from passive support of the unemployed to active retraining programs within Employment and Immigration Canada, together with the formation of a management-labour National Training Board to oversee the programs in co-operation with CLMPC. Similar initiatives

have occurred in several provinces, with the lead being taken by the Premier's Council of Ontario report *People and Skills in the New Global Economy* (1990), and the parallel creation of a management-labour training board to plan and fund training programs on a sectoral basis. These are welcome initiatives, but the necessary restructuring has scarcely begun.

Other countries have been similarly exercised. In 1989, President Bush met with state governors to set goals for the revitalization of schools in the United States. In Europe, Germany has led for several decades in emphasizing the importance of a highly skilled workforce, with visible competitive success. Other countries are scrambling to develop comparable training cultures through vocational training and business-labour partnerships. Britain has the greatest catching up to do to retain competitiveness in Europe after 1992, with only 15% of high-school students going on to universities, ineffective and inadequate job training programs, and low manufacturing productivity. The new Prime Minister, John Major, has identified education as his most important challenge. This follows efforts to revitalize and privatize training programs for the British workforce which have led to the creation of 82 employer-led Training and Enterprise Councils, each responsible for a population of at least 100,000. Japan leads the world in its focus on workplace training, with an average involvement per employee of 200 hours per year.

What emerges from this report and companion studies by NABST, on competitiveness and the financing of innovation, is extremely serious. **NABST has become convinced that only a step-change in Canadian attitudes to work, to management, and to learning can maintain Canada's traditional position as an economic summit nation, and with it maintain the most cherished values embodied in the Canadian way of life. Canada is in economic crisis, and the time remaining to change course is being steadily reduced by the burden of the national debt which already consumes 35 cents of every tax dollar in interest payments alone.**

The new competitive determinant in the global economy is the management know-how and the diverse skills necessary to apply new technology in the shortest possible time through the process of continuous innovation. To regain competitiveness, Canada must master these skills and use them to build on existing strengths. With one of the largest public investments in education in the world, this should be easy for Canada, but this is not the case. The committee has focused on the huge gap between the high inputs to Canadian education in terms of participation and cost, and the very low outputs in terms of productivity growth and the key factors in international competitiveness. **Canada's highly educated population represents the largest untapped resource in the country.**

Closing the input-output gap in education will create the climate for continuous innovation everywhere in the economy. It is a national priority that will involve almost everyone acting locally on a common front. This report focuses on the concept of Continuous Learning as the best lever to initiate change on the scale required. With Continuous Learning as its context, the report examines the competitive crisis, and the requirements for mastering continuous innovation and the work attitudes, quality and excellence that continuous innovation brings with it. After analyzing Canada's current efforts in education and training (Part II), it moves through the new needs for Adult Training, for managers, teachers and the workforce (Part III), and then to a new agenda for the Formal Education system (Part IV). It concludes with a proposed structure for action dealing with organization and finance (Part V). Key suggestions and recommendations appear in bold type throughout the text, and the recommendations are collected and repeated under sub-headings in Part VI.

2. Continuous Learning

Continuous learning embraces preschool orientation, formal education, and adult training in a compatible system that involves most people, at least part-time, through their lives. Its task is to prepare people for a world of continuous and unpredictable surprises by instilling flexibility and self-confidence at the beginning and providing repeated opportunities for renewal, reskilling, and upgrading thereafter.

The overall goal of continuous learning is public awareness and the highest possible level of active participation in the national economy.

Formal education and adult training are the two major components of what should evolve into continuous learning. The first is almost entirely publicly funded at about \$45 billion a year at present from a combination of federal, provincial and municipal levels of taxation. The second, partly sponsored by employers, amounts to \$5 billion a year.

Already, the boundaries are becoming blurred. Preschool exposure to reading and learning has been shown to be a critical influence on later learning abilities and attitudes, and even on subsequent physical and mental well-being. Students, full-time and part-time, now come from all ages and walks of life, and return repeatedly to update themselves. Relevant and concurrent work experience through co-op programs has a positive effect on college and university education. The transition from school to work is often difficult. It may involve apprenticeship, in many cases in programs seen as antiquated and irrelevant and driven more by the protectionist objectives of trades and professions than by the needs of the student. Continuing education programs at colleges and universities are a growth industry.

What must be added is much more training in the workplace. With the passage through schooling of the baby boomers, new young entrants to the labour force will fall by over a million by the end of the century. Immigration cannot fill the gap, especially as the competition for the key innovation skills is increasing in every country at once. A majority of Canadian women has already joined the workforce. **Adult training is the major underdeveloped opportunity to regain competitiveness through economic restructuring. By involving nearly everyone in some fashion, adult training can foster a different attitude to working and living in Canada.** Part of it will be at work, and part of it work-related but separate, in many cases provided within the institutions on the formal side of education, helping further to integrate learning into a continuous system. People need to be in a position to acquire new skills and knowledge as part of their work, while firms learn to master new technology and the management of innovation in order to change their products. **In the business environment, investments in training must be carried to the bottom line in the form of better, cheaper products made faster, and made more attractive to the customer.**

That training is both essential and profitable is better understood outside than in North America. In a letter instructing national managers to cut back in response to the signals of recession, the Chief Executive Officer of a major European multinational has recently written, "Unfortunately I see in some places a tendency to focus on cost-cutting in the wrong areas. We must keep up worthwhile investments in R&D, in training and development of people, in cycle-time and quality management investments etc... We must be able to manage both the business cycle and restructuring without cutting into our investments for the future... you need (such programs) even more to safeguard the future of (the Company)... So please make sure you attack the right things and do not choose the easy way out to live up to some nominal employee-number by reducing worthwhile investments".

Continuous learning is *the means* by which Canadians can create an environment and a culture able to maintain prosperity in a highly competitive world of continuous change. This is an environment wherein continuous innovation, quality, and excellence are routine matters for the workforce and where welcoming change with cheerful flexibility becomes a way of life. **Social activism should refocus on behalf of the rights of Canadians as producers rather than on their role as consumers, which is mainly what we hear about at present.** Only by remaining competitive in terms of productivity can the Canadian economy accommodate the other values of Canadian society.

Already the demands of most rewarding jobs are rapidly rising, so that basic literacy is a moving target. It now requires an ability to read, question, and respond to printed instructions from a computer, a far cry from instructions communicated orally from a supervisor and repeated as often as necessary. Projections in Canada are that 64% of all new jobs created between 1986 and 2000 will require a minimum of 12 years education. Half will require 17 years. Job functions are becoming more autonomous, less routine, less repetitive and less predictable. Technology is also providing people with opportunities for creativity, decision-making, and increased responsibility. Many Japanese companies annually receive from employees an average of 20 suggestions for improvements per person. These are prized sources of new ideas and savings. People now operating well in an undemanding work environment will need assistance to upgrade their skills in communication, teamwork and technology to take part in the world of technology and knowledge-based competition.

To match these demands for productivity with action, the diseconomies that lie between the high investment in education and the dismal results in terms of competitiveness need to be exposed, understood, and removed where they are unessential. The inputs and outputs are discussed in Part II. What are the diseconomies?

First, there are three obvious factors which cost money, but money well spent. These are (1) the high participation rates created by universal access to schooling and post-secondary education; (2) the large number of young people in our population, compared with other countries; and (3) the extra demands on many schools, particularly in cities. These extra demands, or diseconomies, include education in a second language, the accommodation of multiple cultures, and much of the responsibility for the social adjustments and orientation of adolescents coming from two-wage families or single-parent families where there is little energy left over for such tasks at the end of a busy day.

Second, other diseconomies flow from the fact that education must do more than teach the skills required for successful employment. It must also include social development, cultural activities, special attention to minorities, to the handicapped, and to slow learners. As the population becomes more diverse, its demands multiply, making objective evaluation of the success or failure of a learning program more difficult.

Accounting for these legitimate extra demands on education, however, still leaves huge diseconomies unexplained. In brief, they can be thought of in three categories: (1) the failure to dispel the complacency of a significant proportion of the middle majority who see high school and college chiefly as a social experience or as activities which interfere with their lives; (2) the squandering of the abilities of those at the bottom who either drop out of high-school and/or fail to retain the basic skills of literacy; and (3) the squandering of the talents of the best and brightest at the top on underachievement, on a steady brain drain, or on an overcrowding of the high-paying but peripheral professions in terms of national wealth creation. Together, these three groups of students waste the bulk of public expenditures on education today.

We shall deal with the last group first, (they are also discussed in Part IV). Allan Bromley, a Canadian, and the Science Advisor to President Bush, commented that 50% of the directors of major U.S. research laboratories were Canadians. To compound such losses, the Premier's Council of Ontario in comparing the province with Japan found that, out of every 10,000 workers, Japan had 400 engineers to 112 in Ontario, 3 accountants to 43 in Ontario, and 1 lawyer to 39 in Ontario. To blame these economic losses on the Canadian education system is clearly not correct, especially since Canadian scientists and others have proved themselves highly competitive elsewhere. The problem lies in the low challenge and reward of many technical jobs in Canada, and their overall scarcity in industry. It will be overcome only when managers become persuaded that continuous innovation is the way forward, and begin demanding a different mix of skills.

Turning to the second group, it is deeply disturbing that a significant part of the Canadian workforce lacks important basic skills in literacy, numeracy, and technological understanding. Thirty percent of young people drop out before completing high school. Statistics Canada reports that 38% of Canadian adults cannot meet most everyday reading demands and the same percentage do not have numeracy skills adequate to deal with printed material requiring a simple sequence of numerical operations. According to a Southam Press survey 1987, this would include an astonishing 8% of university graduates, 32% of professionals, 24% of executives/owners/managers and 20% of skilled labour. These statistics reflect terrible wastage of scarce resources.

One could argue that the low achievers in the first, middle majority group are simply too lazy and complacent to care. Perhaps they would rather watch television and work routinely than find a demanding job. Some of their children would rather work after school hours to support their social life than work on their cognitive development and a future career, and their parents are content with this. These Canadians would seem to prefer to blame their economic plight on someone else: on the Free Trade Agreement, on the government, on the GST, on high interest rates, or on the exchange rate, as if these things somehow existed independent of themselves. They would continue to demand services but do not want to pay for them.

There is some justice in this view of Canadians, but also significant error. Firstly, the complacent attitude does not extend to many Canadians, and it is apparently less common in immigrant families, and in Quebec. In the opening statements of the new Commission on the Future of Quebec, Michel Belanger, as quoted in *La Presse* (November 7, 1990), said "The economic frontiers are falling one after another. It is the phenomenon of the globalization of markets. To deny the existence and the magnitude of this phenomenon or to think that recourse to isolationist measures can protect our standard of living would be a grave mistake. It will be neither adherence to the federal regime nor the attainment of sovereignty which will defend it".

Born believing they are rich with the "pot of gold" of Canadian natural resources at their disposal, and with new immigrants to do the hard or unpleasant work, Canadians may have simply not wanted to hear of the changing world economy and the new world realities. Getting the message out that there is a real crisis, and that the means to avert it are in their hands, should help develop their courage to manage and to get involved.

The additional factor in shaping their attitudes is that school is no longer the most exciting part of childhood, as it used to be. The excitement of the world outside the classrooms has made school seem dull and irrelevant in a voluntary and involuntary environment of TV, video, computers, Nintendo, organized sport, sex and violence, rock and rap, fad and fashion.

To compete, teaching needs to become more technology-intensive and innovative, and focused as much on flexibility for an unpredictable future as on the lessons of the past. “Right answers” need to be replaced by right attitudes and skills, in an on-line, real-time, participatory way. Learning has to be made worthwhile, and it should be at least partly fun. **The formal education system has been among the slowest parts of the economy to embrace computers and what they can do to raise productivity. To the Committee, it seems shocking that a student can graduate from high school today without basic computer skills and experience.**

As far back as 1967, Marshall McLuhan, the prophet of the information age, wrote “The classroom is now in a vital struggle for survival with the immensely persuasive ‘outside’ world created by new information media. Education must shift from instruction, from improving of stencils, to discovery – the probing and exploration and the recognition of the languages of forms.” (The Medium is the Message, Bantam, 1967).

That the classroom has not moved far in this direction is not the fault of the teachers, but of their institutions and the people who support them. In the United States, where the schools are acknowledgedly much worse, and more poorly funded on a per-capita basis, action is underway, accompanied by the refreshing frankness that we find so difficult in Canada. The following quotes are extracted from a special supplement in *Business Week* of December 10, 1990 from an article by Lewis J. Perelman of the Hudson Institute:

“Because knowledge is the steel of the post-industrial economy – the essential commodity all else depends on – learning has become the strategically central enterprise for national competitiveness that steel was in the Industrial Age. As a result the first nation not to ‘reform’ its education and training institutions but to *replace* them with a brand-new, high-tech electronic schools learning system will be the dominant world economic leader in the 21st century... the key economic challenge facing America and other nations is to liberate the power of this new wave of technology from the hands of monopoly and bureaucracy... 45 million people who learned how to use personal computers... learned from vendors, books, other users, and the computers themselves, not from schools... Nintendo and other games are doing more to cultivate the skills needed in the Information Age workplace than are most schools and colleges... We have the technology today to enable virtually anyone who is not severely handicapped to learn anything at a Grade A level, anywhere, anytime”.

“Blocking... progress is an education establishment that, as an economic sector, had the worst productivity record of any major U.S. industry... Education is our most labour-intensive industry, (with labour costs) at 93% of output... Total capital investment – what buys technology – is only about \$100 per worker in schools compared with \$50,000 per employee in the average U.S. business... 20 years of research shows that computer-based instruction produces at least 30% more learning in 40% less time at 30% less cost”.

Later in the same section, another author comments that many parents value the baby-sitting aspects of schooling to free them for employment: “Perhaps that explains why the same parents who get cash from automatic teller machines, their news from TV, and their employment from data terminals fail to demand that public schools be anything more than chalk and talk”.

The large computer manufacturers, with Apple Corporation in the lead, are aggressively marketing software aimed at the schools. These include “electronic field trips” and video encounters with people in other countries. Just as corporations are restructuring to adjust to a different environment, so must the schools.

The U.S. Senate has passed the Excellence in Mathematics, Science and Engineering Education Act 1990, to establish a *National Institute of Technology and Learning* at the Smithsonian Institution with a mandate to explore the application of technology in the classroom.

It would be wrong to believe that computers and electronic networks are the “silver bullets” that will suddenly resolve problems in the classroom, but they clearly have a large role to play in increasing productivity and motivation.

This is particularly true in persuading drop-outs to drop in again, and to help adults acquire new skills and confidence, particularly women already in careers who want to enter technical fields.

In a world of continuous learning, learning modules would be highly accessible in places such as libraries and community centres as well as in schools. They would be as self-directed as possible, so that, largely through computer-aided learning, people could study at their own pace and avoid competitive pressure, yet end up with an ‘A’ when they have mastered the work. Experiments with such systems have been highly successful.

As continuous learning for the workforce spreads, it will be largely led and financed by employers. New kinds of teachers will be needed with both relevant work experience and teaching skills. Many will come from within large firms on a part-time basis, but community programs to meet the needs of small businesses will also emerge. The present training in word processing and information systems is an example of the services required. As already noted, properly managed training programs in industry will be repaid by the higher productivity and competitiveness of the firm. If the spread of continuous learning is very uneven, however, some firms may find themselves subsidizing their whole industry, as other companies hire away their experienced people. Northern Telecom, a giant among small electronics firms, has found itself in this situation. One remedy, used in France, is a ‘use it or lose it’ payroll tax of, say, 2%. This tax is waived if a firm uses the amount for its own training purposes, but otherwise is used to provide generally available learning programs.

Moving to universally accessible continuous learning will eventually make education and training into a continuous and integrated system. The first priority, as already noted, is to increase greatly the emphasis on Adult Training, the subject of Part III of this report. At different levels, this is already happening. Governments will need to facilitate action with new structures, financial assistance, incentives, and access to teaching and training facilities, and to help and inform. To encourage these complex steps and to ensure public debate and a sense of urgency, the Committee recommends that:

RECOMMENDATION 1

The Prime Minister should announce a National Continuous Learning Target of FIVE PER CENT BY 2000, representing a goal of five per cent of adult working time to be spent on teaching and learning by the turn of the century, to raise the international competitiveness of business and labour throughout Canada.

Five per cent of average working time is about 90 hours or 12 days per year, less than the usual holiday entitlement. Holidays are for “recreation,” but spending equivalent time on *real* recreation in terms of reskilling and learning has now become essential.

As explained later, this is more than a 10-fold increase over the present level of effort, but is still not fully competitive by international comparison. It is, however, within our grasp and is an excellent beginning. As Canada learns to measure its performance by outputs rather than inputs such as this, standards and targets for competitive output can replace this goal.

II. CANADA'S HUMAN RESOURCE DEVELOPMENT SYSTEM

1. The Policy Context

Where people are the most important resource, education and training require national attention. The national dimensions to education and training need not imply that the solution is federal control or co-ordination. Provincial and municipal jurisdiction over the nature and content of education enable it to be adapted to the local environment and responsive to the priorities of the community.

The proposals and recommendations in this report are made with the political realities of Canada firmly in mind. However, to renew and restructure the economy, education and training must be more firmly linked to both economic and social priorities. First Ministers, Ministers of Education and Ministers of Science and Technology have expressed clear willingness to develop co-operative approaches, essential to gain public support and co-operation from unions and the private sector. Canada must take advantage of this co-operation to build a human resource development system within the mosaic of jurisdictions which can ready Canadians for the global economy.

In this report, there are many references to Formal Education and Adult Training. **Formal education** refers to primary and secondary schools and post-secondary education in schools, colleges, CEGEPs and universities. All education delivered to those who have formally left institutions, either through graduation or dropping out is **Adult Training**, regardless of the age of the student or the level or location of the training. With these definitions, it should be noted that much adult training occurs within institutions whose primary function is formal education.

In renewing economic competitiveness, we face other countries that:

- in many cases have a population already skilled in several languages;
- have focused on education and training at the highest levels and made this an active priority;
- have elite technical academic institutions that produce role models and networks of talent and excellence that draw the quality of the whole education system upward. Examples include M.I.T. (U.S.A.), the Grandes Écoles and Institutes (France), the Technische Hochschulen and Institutes (Germany, Switzerland, Italy) and the University of Tokyo (Japan);
- have a larger pool of scientific and technical skills to draw on and a greater propensity to use these skills in industry;
- have mastered the new soft technologies in the organization of work, including self-managed work teams, quality-of-working-life programs, quality circles, and other techniques that increase worker participation and responsibility; and
- are vastly increasing their investment in private sector training. Germany has increased its expenditure on workforce training by 45% in the last 3 years, and Japanese companies are still increasing the time devoted to training.

2. International Comparisons in Formal Education

How well positioned is the Canadian Human Resource Development System to respond to the priorities of international competitiveness? Probably everyone has a different opinion. Discussion is hampered by a lack of valid output data on the *results* of education and training. We have lots of input data, on budgets, overall numbers, school sizes, participation rates, and graduations, but comparing expenditures with those in other countries in this way merely reveals the priorities given by different nations to different kinds of education. Even large expenditures, however, do not guarantee excellence. Measuring the satisfaction resulting from the investment in education and the efficiency of its processes is still largely beyond us.

International comparisons have a direct relationship to economic competitiveness in world markets. They are also the best output measures we have to evaluate the results of formal education and training. They are often dependent on “soft” data involving comparisons between different cultures and organizational structures, and even opinion polls as sources. Looking behind the numbers to see their significance is critical.

For example, the age distribution of the Canadian population contains proportionately more young people than most OECD countries. This raises overall scores in per capita or GNP-based expenditure comparisons, but lowers it on a per student basis. Further, countries such as Germany and Japan have virtual monocultures – populations with shared language and values. In Canada, in its cities in particular, many schools have large numbers of immigrants or first-generation children from many cultures who are learning in a second language. The responsibilities which schools in Canada bear include helping the socialization and adjustment of Canadian children in this and other ways. They are essential parts of education here, but less so elsewhere.

Canada is ranked against 23 other countries in the 1990 annual survey of the World Economic Forum (Figure 1). On the input side, Canada ranks 4th in overall public expenditure on education per capita. Ahead are Denmark, Sweden, and Switzerland. In previous surveys Canada ranked 2nd or 3rd in terms of the percentage of Gross Domestic Product (GDP) spent on education. Inside Canada, however, these expenditures, now amounting to more than \$45 billion annually, have declined as a proportion of all government expenditure by 40% since 1970, reflecting the burdens on governments of deficit financing and other priorities.

In 1989, Statistics Canada estimates, expenditures in round figures for schools were \$28 billion, for universities \$9 billion, for colleges \$3.6 billion and for vocational training \$3.6 billion. In total they amounted to 7.7% of GDP, and \$1,685 per capita.

The focus of education policy has been on access to education. Canadian secondary school enrolment as a percentage of the relevant age group ranks 3rd internationally. Post-secondary enrolment in colleges and universities ranks 2nd (after the United States) in terms of the percentage of 20 to 24-year-olds so occupied, and is nearly double the average of all other OECD countries except the United States, reflecting the importance to North Americans of accessibility and equity in education. The effect of large post-secondary enrolments, where costs per student are highest, is to drag down the score in the schools. Figure 2, from a UNESCO survey and different data, shows Canada falling to 8th and the United States to 15th in terms of expenditures per pupil from Kindergarten to Grade 12, measured as a percentage of national per capita income. The scores reflect the greater size of the school population in North America, and for Canada are despite a real increase in expenditures in the schools of 27% between 1976 and 1990.

Figure 1

**World Competitiveness
Canada's Rank out of 23 Countries**

Inputs		Output in Competitive Factors	
Public Expenditure per		Industrial Efficiency	10
Capita on Education	4	Financial Dynamism	10
Higher Education		Quality of Skilled Labour	11
Enrolment	2	Worker Motivation	13
Secondary School		Employee Turnover	14
Enrolment	3	International Orientation	15
		Managerial Initiative	15
		Quantity of Skilled Labour	15
		Future Orientation	16
Source:	World Competitive	Vocational Education	16
	Report, IMEDE and	R&D Expenditures	17
	Forum, 1990	Exploiting New Technologies	18

Figure 2

**Comparison of Industrialized Country Grade K-12 Expenditures
per pupil as a percentage of per capita income, 1985**

Country	Percent	Rank
Sweden	35.3	1
Austria	29.7	2
Switzerland	29.6	3
Norway	27.1	4
Belgium	25.0	5
Denmark	24.5	6
Japan	24.7	7
Canada	24.0	8
West Germany	23.5	9
France	23.2	10
Netherlands	23.0	11
United Kingdom	22.8	12
Italy	21.1	13
United States	20.8	14
Australia	19.5	15
Ireland	19.4	16

Sources: UNESCO Statistical Yearbook, 1988
National Centre for Education Statistics, U.S.
Department of Education: *Digest of Education*
Statistics, 1988.

Full-time enrolment in Canada's colleges and universities increased from 602,700 to 829,050 over the same period, while overall post-secondary expenditures fell by 6%. A simultaneous increase in part-time students has further diluted funding. By comparison with the 1970s, the universities are seriously underfunded on a per-student basis.

In formal education, therefore, Canada appears to occupy the high to middle ground in expenditure terms. The comparisons generally indicate that we are investing enough to remain competitive with other countries, provided the skills resulting from formal education are relevant and well applied. Here the output indicators are startling. The output side of Figure 1 shows that we rank well below the middle among the countries surveyed in many indicators related to competitiveness. Canada's labour productivity rate in manufacturing grew by an average annual rate of only 2.2% in the decade from 1979 to 1988, the lowest among the economic summit countries. The implication is that the investments in education are not well reflected in Canada's management and labour force, even while Canada, still buoyed by its resource sector, ranks high overall as a competitive economy (5th in 1990).

The output part of the World Economic Forum survey of competitiveness depends heavily on opinion rather than data, and the causes behind these rankings are manifold. What they indicate, however, is that there should be a large potential in the Canadian population which is not being tapped for economic performance.

3. International Comparisons in Adult Training

A further clue is provided by the score in Vocational Education (Figure 1), the "extent to which ongoing job training meets the requirements of a competitive economy". Canada's rank is 16th out of 23. In workforce training, where the current commitment of the country to continuous learning is most clearly reflected, Canada's public sector expenditures total approximately \$4 billion, less than 10% of the public investment in formal education. Whereas change in the formal education system is not felt in the workforce for up to a decade, adult training has an immediate impact on its quality and skills.

In employer-sponsored adult training, expenditures are estimated at \$1.3 billion per year. With the public sector expenditures above, the total is about \$5.3 billion, roughly one-eighth of the amount invested in formal education. Since 1970, public sector expenditures for training have declined from 19% of total government expenditures to 11%.

Canada lags far behind many other countries. The average Canadian worker participated in 6.7 hours of formal training in 1988. By contrast an Australian worker received 17 hours, a Swede 170 hours, and a Japanese 200 hours. Only one third of Canadian companies provide any training to employees at all. In a 1990 Conference Board survey, 75% of companies reported problems with basic employee literacy, but only 24% had systematic policies or training programs to address the issue.

As a percentage of gross wages, employer-sponsored training in Canada is extremely low (Figure 3). Real training expenditures are undoubtedly higher, because accurate statistics are difficult to obtain and much goes unreported.

The shortfall in adult training is so large that it is clearly unacceptable in competitive terms. On the positive side, however, it means that there is again a means to release the stored potential in the Canadian labour force.

Figure 3

**Employer Sponsored Training
as a % of Gross Wages and Salaries**

Country	Expenditures as % of payroll	Year
France	2.3	1986
Australia	2.2	1987
United States	1.0	1987
Canada	0.5	1987

Source: (Morrison and Rubensen, 1990)

Countries with a highly educated population have a significant advantage in attracting knowledge and innovation-intensive industries. In return, the best companies in these industries invest significantly in training to stay at the leading edge. IBM, McDonnell Douglas and Bell Northern Research are each leading knowledge-intensive companies in different business sectors and are among the largest industrial investors in training in Canada.

Perhaps the outstanding familiar symbol of the competitive advantage of an investment in worker training was the opening of a McDonald's on Gorky Street in Moscow in 1990 after 14 years of patient preparation and negotiation. Led by the President of McDonald's in Canada and triggered by a chance meeting at the 1976 Olympics in Montreal, the venture required the international transfer of technology *by means of Adult Training* in beef raising, potato growing, baking and market gardening, as well as the recruitment and training of the warehouse and retail outlet employees. The latter extended to politeness and attention to the customer that stunned the Soviet clientele.

When it opened, it was a McDonald's from the golden arches to the salt and pepper. McDonald's routinely requires all employees to spend up to 15% of working time in teaching or learning activities. Senior managers may spend most of this time teaching others, but even the CEO systematically takes time out to learn in order to keep up with the best. Three thousand five hundred people graduate from their management training programs per year.

III. ADULT TRAINING

With profound changes so essential in Canada's competitive posture, and with so many traditional attitudes and practises to be adapted, where and how can the process begin? The answer, of course, is at the top. Without consistent leadership and direction, change cannot begin. Once the new directions are clear and welcome, however, the action will flow from the grass roots: from the bottom up. It was Mr. Gorbachev who launched Perestroika, but it is the people of the eastern block countries who are now forcing it to happen on an overwhelming scale.

1. Training the Managers

Under the Prime Minister's leadership, continuous learning should have managers in the public and private sectors as its primary initial target. The slow rate of technology diffusion, the low level of research and development investments, the hostile financial environment for new technology venture companies, the paucity of adult workforce training, and Canada's continued reliance on imported technology-intensive goods all stem from management and investment decisions, and testify to the work to be done to change current priorities and perspectives.

In a companion NABST report on the Financing of Industrial Innovation, it is noted that access to capital is the primary issue for new or emerging technology-intensive firms. Highlighting the cultural gap between investor and inventor it states: "Those managing technology-intensive enterprises and their potential investors share a significant attribute: meagre knowledge of each other... most financiers and potential investors... do not share a common background of training and interests with their prospective clients and... do not have access to the technical expertise needed to assess the practicality and potential of an industrial innovation project. This lack of understanding and expertise, on both sides, creates a self-perpetuating cycle of failure, twin vicious circles of undercapitalization." For investors, poor judgements lead to poor performance and subsequent lack of investment in innovation. Starved for funds, innovation companies lack management strength and infrastructure, leading to poor performance on their part, which then appears to justify the lack of investment that creates the vicious circles in the first place.

Two groups must join forces to create successful technological innovation: scientists, engineers, and technicians, who have specialized skills and full careers in a relatively narrow field, and management people with broad general skills but little technical depth or self-confidence. The most critical decisions in innovation have both technical and management content. If either group decides alone, the decision is likely to be wrong, but effective communication between them is very difficult in the absence of a common vocabulary. Interpersonal skills and sensitivity are essential to manage the disparate expertise needed for successful innovation.

Until the gap can be bridged routinely, Canada will endure many vicious and wasteful circles of underinvestment and weak management, squandering money and opportunities on research which fails to reach the marketplace in Canadian hands.

The starting point for continuous learning is therefore the managers who create these vicious circles both in the investment community and in innovation management. Both need new skills to develop the creative environments in which continuous innovation can flourish. Operating at higher levels of innovation puts new demands on the management of companies. Some require different capabilities and others a change in corporate culture, to substitute flexibility for rigid controls, and to flatten the organization so that interactive teamwork supersedes structured authority. Among the challenges are:

- financing new ventures and innovations with a full understanding of their needs and problems, so that more money is available for investment to create new sources of wealth;
- ensuring that such investments are understood to be investments in the management of the enterprise, rather than the management of money;
- creating career opportunities, especially in industrial technology and research, which will attract more of the best and brightest students into such careers;
- matching market needs and new technologies to create new product opportunities;
- creating and leading teams of diverse people;
- delegating authority so creativity can flourish;
- choosing technologies for investment and development;
- training for and executing technology transfer;
- managing R&D; and
- negotiating licences, patents, technology deals and partnerships.

The most important first step of the continuous learning initiative is to deliver to managers concerned with innovation the technological confidence and depth, and the necessary breadth of financial and interpersonal management skills to orchestrate this wide span of activities. Much of it will be learned by doing the job under the right guidance. The successful outcome will be a new generation of *Technically Confident Managers* in Canada.

Technically confident managers can arise from either of the existing technical and management solitudes. Training for experienced managers should focus on building their technical confidence and providing them with the new skills of continuous innovation. Comprehensive strategies to reach both managers already at work and those in educational programs leading to management positions should be a top priority. Training experienced technical people in personal and management skills is the complementary task. At present many young people combine a science or engineering background with management training, but then leave the technical arena before acquiring enough technical judgement or experience to give them sufficient technical confidence later on.

The management training process therefore needs careful rethinking for the world of continuous innovation. **Continuous learning for managers could include activities such as:**

- **industry-to-industry exchange programs;**
- **business mentoring and advisory services;**
- **training modules for competitive skills for different levels of management expertise;**
- **business schools more actively reaching out to working managers with special programs, as well as revising their university courses;**

- service and engineering curricula with basic marketing and management included; and
- a second focus on public sector managers who establish the fiscal, regulatory and social environment in which the private sector must operate and develop competitive advantage.

RECOMMENDATION 2

The Private Sector Challenge Group should lead Canadian businesses to establish management training programs in individual firms aimed at developing managers with the confidence, knowledge and skills to manage continuous innovation.

The group should bring together representatives of business associations, the leading business and engineering schools in universities and individual firms to develop a concerted approach to training technically confident management to function in a competitive global environment focused on competing through technology and innovation.

RECOMMENDATION 3

Industry, Science and Technology Canada should develop and implement a program to support industry-to-industry management exchanges and mentoring activities to be funded primarily by private sector participants.

Business learns from business on many fronts. Strategic alliances between large and small firms for innovation training may accelerate progress. Large firms have management experience, resources, and perhaps operational needs that could assist small firms with innovation and product trials. Technical personnel from large firms could rapidly widen their management experience by a period in innovative small business, and gain access to new technology in the process.

RECOMMENDATION 4

The federal government should assess the impact of the changing world economy on the future skill requirements of public service managers and employees, and develop and implement appropriate continuous learning programs.

As already stated, the new attitudes and skills for innovation are needed throughout the economy, not just in export businesses. Global competition will quickly identify structural inefficiencies of any kind. The ability of the different levels of government to keep pace with external changes, in regulating and establishing the climate for continuous innovation, will be very important. Further, the introduction in parallel with industry of new information technology and other advanced technology, to improve productivity in the public service and non-market service sectors, should be a key objective in deficit reduction.

2. Training the Teachers

Teachers are the heart and soul of education and training. Their skills and motivation determine quality, provided they are adequately prepared and supported. Almost everyone remembers one (or more) particular teacher who helped them find their way.

Teachers will be in the front line as Canada prepares for the global economy, and they need time and help to get ready. A 1982 survey by the Science Council of Canada found that more than half of all early-year primary school teachers and one third of middle-year teachers had never taken a university level science or mathematics course. At the secondary school level, nearly all Canadian science teachers had at least an undergraduate degree, and many had graduate degrees. Over half, however, indicated that it was six or more years and often more than ten years since their last college-level refresher course.

Keeping science and mathematics teaching revitalized is an important challenge, especially with the declining university enrolments in science and engineering discussed earlier. **Teachers have a profound influence in shaping attitudes towards science and technology. Outstanding students in education should be encouraged to specialize in science and mathematics, current teachers must be encouraged and supported to upgrade and update their expertise, and public recognition should be given to excellence in science and mathematics teaching.**

Provincial departments provide training to back up curriculum changes, teachers' associations provide workshops, and Boards of Education assist teachers through consultants with specific issues. **What seems to be missing is a focus of responsibility for overall career planning for teachers or for systematic development and renewal.** Strongly unionized, and in a flat organization with few promotion levels, teachers must sacrifice advancement if they remain in the classroom. The career path of the ambitious is into administration, which removes many talented people from the teaching process. Both the teachers' associations and the teaching administrations must be involved in deciding what to do.

The invasion of the classroom by information technology is something teachers should actively welcome and encourage. As it takes place, teachers will need the training to match, and they should see it both as a right and a duty. There is an additional special need for a cadre of excellent, experienced, and dedicated teachers from Grades 6 to 12 with an understanding of science, technology, innovation and economic competitiveness, who can help others.

In the article by Lewis Perelman quoted in Part I, he says that the technological revolution has made "the traditional classroom teacher almost as obsolete as the blacksmith shop." While an overstatement, it does emphasize that continuous technological innovation has a real place in education and the service sector in preparing for renewed competitiveness, and that it is urgent that we begin with teaching as a high priority.

One approach would be the introduction of a Master Teacher program in which "Master" teachers act as mentors and trainers for beginning teachers. Becoming a Master Teacher would be a prestigious, financially rewarding, and rigorous process involving an individually tailored study plan, and frequent exchanges with industry and the research environment. Such a program would fundamentally change the nature of the teaching profession and of the classroom environment, making both more integral to the economic fabric of the country. It would also combat teacher "burn-out" in the classroom, and keep teachers strongly motivated and updated.

Among the activities might be:

- **regular in-service modules for teachers with less than three years' experience, delivered by Master Teachers and required for permanent certification;**
- **an education-industry/government exchange program to expand the knowledge of all participants of the needs and problems facing other sectors;**

- a specific program of university study, work assignments in different school levels and areas, and exchange programs with other sectors leading to the certification of Master Teacher;
- development of specific training modules relating economic competitiveness to classroom activities; and
- summer scholarships for teachers to participate in research at universities.

RECOMMENDATION 5

A National Task Force – including representatives of provincial and federal governments, teachers' associations, teachers and parents, and industry and universities – should be convened to develop and implement a comprehensive plan to support excellence in teaching through training and professional development. It should report its findings to the Prime Minister and the Provincial Premiers and include recommendations on the resources required.

RECOMMENDATION 6

The three federal Granting Councils should develop co-ordinated programs of summer scholarships for science teachers to work in research at universities, to provide direct experience with up-to-date science and technology.

RECOMMENDATION 7

The Prime Minister should establish a program of Awards for Excellence in Science Teaching to recognize 50 outstanding science teachers across the country each year. It should also identify and publicize innovative ways of teaching science and technology in primary and secondary schools.

RECOMMENDATION 8

In conjunction with this program, a fund should be established to encourage the development of innovative science teaching methods and to foster the development of advanced-technology-based curriculum materials across Canada.

3. Training the Adult Workforce

The broad scope and goals involved in training the adult workforce were described in Part I within the context of continuous learning. Adult workforce training must proceed through a broad-based partnership. The aim is to launch a widely supported private-sector initiative in which both management and labour participate. Initiatives by Employment and Immigration Canada and by the Premier's Council of Ontario have each led to management-labour boards being created, after a time-consuming and delicate effort in both cases. The objective, similar to that in other countries, is to transfer to such broadly representative groups the responsibilities for allocating funds, formulating programs, and setting program standards.

As these important initiatives gain strength, the mandate of such bodies may extend to those issues in formal education where the role of the private sector has a critical bearing, as with the school drop-out rate, as described in the next section.

As these important initiatives gain strength, the mandate of such bodies may extend to those issues in formal education where the role of the private sector has a critical bearing, as with the school drop-out rate, as described in the next section.

The announcement of a National Target for Adult Training should help accelerate co-operation and the involvement of social action groups in the management of the training process.

In part V of this report, the Committee recommends the creation of a Continuous Learning Board with a broad mandate to set national standards and monitor results. We recognize that such a board will take some time to evolve out of the existing initiatives, and others that we have recommended. Although we think it essential for this board to be largely independent of government, and certainly not to be seen as a federal agency, it could grow from the National Training Board being launched by Employment and Immigration Canada.

IV. FORMAL EDUCATION

Much of the initiative to adapt schools to the new global environment will be through teacher incentives and training, as just described. In this section, the Committee focuses on the economic relevance and the quality and excellence of formal education, and the position within it of science, engineering, and technology.

1. Economic Relevance: Industry-School Interaction

The contact between teachers and the rest of the working world seems to be fragmentary and sporadic. In the Science Council of Canada study referred to earlier, many secondary school science teachers surveyed had some other work experience in research or analytical laboratories or in the resource industries. At the elementary school level, however, few teachers had any other work experience.

Only 39% of secondary teachers felt they were able to convey the nature and process of engineering and technological activities effectively. At middle school levels the proportion dropped to 26.5% and at the elementary level to only 14.1%. Less than half of the secondary school teachers had visited an industrial plant, and only 21% had received classroom visits from industrial personnel. Sixty percent of elementary teachers and a third of all teachers claimed no contact with or knowledge of industry. It is no surprise that the challenges and changes occurring in technology and industry are not reaching the upcoming generation through the classroom, unless industry has taken the initiative.

Some large companies have taken the lead on a wide front across the country. Others are operating at the local level where they have branches or headquarters. As noted earlier, Northern Telecom and Bell Northern Research are particularly active, both in adult training and in interactions with schools and universities.

In the United States, notably around Rochester, New York, and to a lesser extent in Canada, local action groups have formed. The best-known Canadian initiative is in the Hamilton-Wentworth area of Ontario where an Industry-Education Council involving major companies is providing career information and counselling, workshops, work experience and direct interaction with both teachers and students. **Industry and school community action is reducing the dropout rate and motivating students to strive for excellence in each case, providing important models for other Canadian municipalities to study and emulate.**

Several Canadian municipalities are also discussing their "technology engines," with the help of the Science Council of Canada and the Canadian Advanced Technology Association. These technology engines represent an effort to link businesses, colleges and universities at a local level to help bring in enabling technologies and the skills to apply them. They could also help in the schools.

The Committee believes that Canada will visibly have begun to move forward on its competitive agenda, when action at the community level on these issues becomes widespread. The Committee encourages all communities to take careful note.

RECOMMENDATION 9

The Conference Board of Canada, other business organizations, and local levels of government should foster local initiatives to help reduce dropout rates. Industry-school partnerships could work to motivate students to continue in school and to strive for excellence.

2. Excellence at the Top: The Best and Brightest

Excellence can only be measured in comparative terms, against the past or against the current competition. The result of striving upward, excellence can exist at all levels in society. Two of the most remarkable symbols of excellence in Canada are Terry Fox and Rick Hansen, whose triumphs over handicaps captured the hearts of the nation. Excellence has two facets, the overall level that the very best have reached, and the degree to which ordinary people have approached this limit by realizing their own potential. Without the best to set records and limits, it is difficult to inspire people or to set high standards for everyone. Michael Porter's exhaustive **The Competitive Advantage of Nations** (1990) includes the following comment: **"A nation's success largely depends on the types of education its talented people choose, where they choose to work, and their commitment and effort... Nations tend to be competitive in activities that people admire or depend on, the activities from which the nation's heroes emerge"**.

In Switzerland these activities include banking, pharmaceuticals, chocolate and watches; in the Netherlands tulips, in Israel agriculture and defence, in Germany high performance, and in Italy design. In Canada our historic heroes have been in fur trading, forestry, mining, dams, and railroads. Who are they today? Who will they be in the future?

In today's world of global competitiveness, the careers and professions chosen by the best and brightest should be biased towards those most directly concerned with wealth creation (science, engineering, design, marketing, entrepreneurship), rather than wealth administration (accounting, finance, law), or wealth reallocation (politics, public service, education, social services). "Wealth" here refers to the assets underlying the national economy, not to personal gain. The Committee suspects that Canada is heavily biased away from the areas of wealth creation. If so, the balance can only be redressed by making entrepreneurial careers more attractive. This will depend largely on the initiative of managers, as already noted.

A new emphasis on identifying, clustering and rewarding the best and brightest people should also greatly expand their number in the overall population. Again, without data to prove it, we suspect that many such people never surface within the groups described in Part I as the complacent middle and the bottom. We anticipate that, if challenged early and often, and with more demands for their talents, their numbers will grow steadily. Once national standards have been set for scholastic achievement, the expansion of this group can be monitored. Canada should aim to develop 20% to 25% of its population in this conspicuously talented category by the next century, measured by people who are able to maintain a consistent "A" standing in anything they tackle.

Graduates from elite universities and technical institutes are leading industrial innovation in Japan, Switzerland, Germany, France, Italy, and Sweden. They have spent their lives in friendly competition with the best and brightest, and learned as much from each other as from their instructors.

Canada is alone among the summit countries in having no such elite centres of learning. We have no equivalent to MIT, Princeton, Oxford, the University of Tokyo, or various European institutes. Concentrating on access and equity, and maintaining jurisdiction over university education at the provincial level, we have avoided this path.

Many of our best students travel abroad to take advantage of what other countries have to offer, and many do not return. While international experiences are productive and to be encouraged, **Canada should offer world-class opportunities to the best and brightest to train in superior institutions within Canada. It must also offer challenging careers and work environments sufficiently exciting to retain them or attract them back from abroad.**

With over 60 degree-granting institutions across the country, it is not realistic to recommend new ones, unless they are to be largely funded by private endowments. Instead, colleges and universities should be encouraged to diversify and compete, each concentrating on specific disciplines and subject areas. In this way they can build critical masses of talent in particular fields, able to attract the best students to work in environments as challenging as those of the best foreign universities. This follows the example of the University of Waterloo, which has focused on mathematics, engineering and computer science since its foundation, and has cornered much of the talent in these areas as a result.

University faculty may rightly protest that numerous centres of excellence already exist. The Canadian Institute for Advanced Research was set up to link some of the best Canadian research people with each other and with the best elsewhere. Recent initiatives of the federal government and some provinces are building networks of excellence. These are sound beginnings. **There is no substitute for daily contact and proximity in the growth of excellence. As often stated, Nobel prize winners beget Nobel prize winners. Excellence breeds excellence, but in a hothouse atmosphere.**

Elitist arguments do not do well in Canada, and it can be said that the best and brightest people will find their way without institutional help. But that ignores the fact that the right environment encourages such people to emerge and grow together. They are valuable as role models to encouraging others to strive for excellence.

The Committee investigated a variety of options for encouraging competition and differentiation between universities using market-based funding mechanisms, such as student vouchers. It has concluded that the administration of such schemes is cumbersome, expensive, and could lead to uniformity rather than diversity. Instead, it recommends using the federal financing of university research as a tool to build pools of new talent in specific areas at different universities.

RECOMMENDATION 10

Funding for the three federal Granting Councils should be doubled in order to expand the Canadian stock of competitive, talented, and renowned graduates. The increased funding would build concentrations of world-class research capability in key subject areas, enabling certain Canadian universities to attain world status through differentiation and specialization. Most of the increase in funding should be devoted to the development and implementation of strategic plans proposed by universities to develop their chosen priorities in research and research training.

3. Excellence Throughout: The Need for Educational Standards

Even with the best and brightest setting upper limits to challenge and inspire others, national levels of competitiveness and excellence will rise only to the extent that the whole population moves towards excellence in each of its activities. Quality is defined as a desired state of excellence. What quality do Canadians desire? How hard will they work through formal education and adult training to achieve it?

As noted earlier, Canadians share a general unease about quality in the schools, and have a tendency to explain this through personal anecdotes. The problem lies in the lack of good output indicators and in the multiple, varied roles that schools play in Canadian society. There are probably no dominant views of what schools should do or how they should be evaluated.

The OECD has pointed out the difficulty of developing broadly accepted standards in education because of the diversity of the values and attitudes that underlie the concept of quality. As the diversity of the population increases, the difficulty of reaching a consensus also grows. International comparisons are even more difficult. Canadians are culturally and linguistically diverse and unlikely to concur with countries such as Japan or Germany on the overall objectives of education.

Some experts argue that national testing imposes a uniform curriculum, reducing the flexibility of teachers to respond to students' interests, needs and abilities, and that it conflicts with local autonomy. Despite these problems many countries have successfully instituted some form of standardized national testing. Students in England write common O and A level exams. American students undergo various regular tests including the Scholastic Aptitude Testing (SAT). The competitiveness of the Canadian system is difficult to assess in the absence of comparable data.

Other experts argue that the lack of broadly accepted standards in schools, colleges and apprenticeship programs makes it difficult for students to move around the country, for universities to assess students for admission, for industry to evaluate applicants and for the public to feel confident that the investment in education is well used. It may be that national exams would be less acceptable than provincial or municipal exams. Still, the usefulness of the results as an indication of competitiveness falls with the size of the sampled population. It would be best to face up to this to create a country-wide system. Quebec has excited public interest and action in raising school standards by revealing the aggregate scores of schools in province-wide exams, but is so far the only part of the country doing so.

In the face of the competitive challenge, failing to confront the issue of national or at least regional standards would be a grave mistake. It will take much time and effort to reach consensus on what to do. Meanwhile, the Council of Ministers of Education is studying the quality of performance indicators in co-operation with Statistics Canada and the OECD, which will provide useful background.

RECOMMENDATION 11

The National Task Force proposed in recommendation 5 should develop a consensus on appropriate educational output performance standards for the Canadian system, and on how these standards can be broadly monitored and tested.

With such standards in place, reliable output measures will be available. Literacy, numeracy, and scientific, technical, and environmental understanding can be assessed, and progress measured. It would be reasonable to anticipate a large shrinkage of the drop-out and illiterate bottom group, and an up-scaling of the standards of the middle majority. With national standards, communities can choose their own targets of achievement and campaign for them in their local schools and colleges.

RECOMMENDATION 12

To motivate students and stimulate competitiveness and excellence in schools, the Private Sector Challenge Group and the federal government should encourage the media to produce television quiz competitions, national essay competitions and national awards programs in key areas, and to publicize the results widely.

4. Science, Engineering, and Technology

Canada has 4.4 engineers and scientists per thousand people in the workforce. Japan has 8.4, the United States 6.6, and West Germany 5.2.

A 1985 survey in Ontario showed that fewer than 25% of the firms surveyed, which included a wide range of sizes, sectors and levels of technical sophistication, employed an engineer in design or manufacturing.

Statistics Canada reported in 1989 that less than half of all manufacturing firms in Canada used any form of advanced manufacturing technology. Canada's overall R&D expenditures rank 17th out of 23 countries (Figure 1). Within these general expenditures on R&D (GERD), Canadian industry spends 56%, in comparison with 70% in the U.S., 66% in Japan and 60% in France, all countries with much higher levels of GERD. The ratio of exports to imports of high technology products in Canada is 0.46, and Canada's world market share of production of high technology products is 2.2%, both ranking in 10th place among OECD countries.

Enrolment in science and engineering in Canadian universities has declined by 5.3% over the last five years while overall university enrolment rose by 8.2%. Full-time registration in mathematics and physical sciences has declined from a peak of 31,800 in 1984 to 25,000 in 1989.

The drop in enrolment in engineering, technician and technologist programs at colleges and institutes of technology has been even more dramatic. Since 1983, the peak year for enrolment, participation has dropped by 25%. This presents a critical problem for the future since technicians and technologists are a vital part of smooth-running innovation and manufacturing processes. A shortage of any of these professional groups will have a detrimental impact on Canada's technology-intensive industries.

There have been few comments on the role of colleges in Canada so far in this report, because the focus has been on training, schools, and universities. This is not to imply that colleges are less important. **Colleges are the source of many existing adult training programs, and the most important environment for developing the essential technical and administrative skills of a modern economy. The fall in the numbers of entrants to technical programs in colleges is a major concern.**

Both present and forecast demand for science and engineering skills is high, but the right people are already hard to find. As the switch to continuous innovation gathers strength in Canada, many

agencies believe the shortages will become acute. Their surveys include scientists, engineers, designers and others with a graduate degree, under the category of Highly Qualified Personnel (HQP). The Canadian Council of Professional Engineers projects a shortage of 30,000 engineers by the year 2000, and is working to make the basic training of engineers more relevant to innovation.

The Conference Board has noted that 40% of responding companies were experiencing difficulty in finding highly qualified R&D personnel in 1989. Due to rapid hiring in the 1960s, 35% of full-time university faculty are reaching retirement age and will need to be replaced in the late 1990s. These are distressing indicators for skills which require many years to produce.

International competition for highly qualified personnel is rising as technological innovation becomes a widespread industrial priority. Although at present some needs are filled by immigrants, their numbers are dwindling. Of the 34,000 immigrant PhDs in Canada, 40% arrived between 1967 and 1976, but less than 20% arrived from 1977 to 1986. To make matters worse, temporary residents of Canada made up 43% of those who received PhDs in engineering or applied science in 1986, and 75% of these said they planned to leave Canada.

Our own post-graduates will be increasingly tempted to take advantage of superior opportunities elsewhere. Nineteen percent of Canadians who received PhDs in 1986 also indicated an intention to leave Canada because of a lack of opportunities here or better employment elsewhere.

5. Women in Science, Engineering, and Technology

The participation rate of women in science, engineering, and technical positions is approaching that of men, but is heavily skewed in favour of the biological and health sciences and non-market services such as health care and education. Women currently make up only 17% of students enrolled at the college level in technician and technologist programs. **Women still find entry into engineering, mathematics and the physical sciences daunting because they face various forms of discrimination in roles so traditionally male. If women could be further encouraged to move into these fields and then into industry, they would unlock fresh potential when it is sorely needed.**

For this to happen, corporate management must help smooth the way by eliminating discrimination and pay inequity and providing accelerated promotion for the most promising women. **Women will need access to training programs to fill gaps in their previous education which are barriers to entering technical fields. Continuous learning will need to take place during working hours, when schools and daycare centres are open, to harmonize with family obligations.** The federal government has reserved half of the new Canada Scholarships for women in science and engineering, an excellent beginning, but these follow-through steps still need close attention.

6. Attracting Students to Science and Technology

The overall picture in science, engineering and technology is bleak given the future Canada faces. If we are to catch up and remain competitive, consistent policies and programs in immigration, education, training and job creation are needed to encourage many more people and many more of the best and brightest, especially among women, to pursue careers in science, engineering, and technology.

At the present time, it appears that the declining enrolment of both sexes in science and technical programs is a function of a drop in the school age population, falling interest in science and

mathematics, lack of awareness of careers in science and technology, and a poor public image associated with the prestige, financial rewards and career opportunities in these areas. The current attractions for those seeking high qualifications to enter the business world are degrees in law, commerce, accounting and business administration, which are perceived to offer more rapid advancement.

The science and technology skills of teachers at all levels assume critical importance in changing to an innovation-driven economy. At present many school students see science and mathematics as hard and unrewarding subjects reserved for the few. In some classrooms extra mathematics is even administered as a punishment for misbehaviour! **Faculties of education will need programs to attract more science and technology graduates into careers in teaching at primary and secondary levels. As they are successful, they will increase both the immediate demand and the eventual supply of science, engineering and technology graduates.**

Most students up to Grade 6 are excited and strongly motivated by science, but a majority forsake it soon after, for reasons still being debated. **At present the decision whether or not to continue the study of science is made by students at about the Grade 9 level. Arguments are being expressed to make science and mathematics compulsory through Grade 10. Provided attention is given to technical proficiency (including computer literacy) as well as to pure science, the Committee strongly supports this view.**

The Committee recommends that:

RECOMMENDATION 13

The Department of Industry, Science and Technology should determine from direct consultation with students in Grades 8 to 12 their attitudes and interests in pursuing careers in science, engineering and technology and the factors dissuading them from entering these fields. Special attention should be paid to the concerns of women students. The results should be publicized and form the basis of consistent programs in immigration, education, training and job creation to raise both the overall number and the proportion of the best and brightest entering these fields.

V. A STRUCTURE FOR ACTION

As discussed earlier, a significant part perhaps a majority of the Canadian population, does not seem to want to hear the extent to which the world has changed and our standard of living jeopardized. Under these circumstances, politicians bearing this news may become quickly unpopular. Only consistent leadership from the top, by the Prime Minister personally, can bridge the painful transition to getting Canada started on a learning agenda already dangerously overdue, and to developing the *courage to manage* on a wide front.

The transition will need time, and much room for discussion among people who have a common stake in the future, but who rarely, perhaps, would otherwise meet. The transition is not simply a task for the elite, but needs to involve almost everyone. For this reason, the Committee strongly recommends that the National Task Force referred to in Recommendations 5 and 11, and the Private Sector Challenge Group of Recommendations 2 and 12, converge and join as rapidly as possible to evolve into a broadly representative Continuous Learning Board on which all such stakeholders can be adequately represented.

1. The Continuous Learning Board

RECOMMENDATION 14

The Prime Minister should charge the National Task Force and the Private Sector Challenge Group to work with the new National Training Board to develop membership criteria and broad terms of reference for a Continuous Learning Board, which they would then form to supersede themselves. This Board would include a wide range of stakeholders in learning, drawn from parents, students, government, education, management, labour, technology and training. It would focus on means to develop excellence at all levels in the workforce through continuous learning programs, to develop skills appropriate to competitiveness in the global economy.

The Continuous Learning Board would then develop strategies in response to the recommendations of this report and those following from the National Task Force. It would define its mission to embrace the following priorities:

1. retraining and renewing the confidence of managers and teachers in dealing with science and technology issues, and greatly expanding training programs for the workforce to ready them for a world of continuous innovation;
2. focusing and reorienting the best and brightest;
3. setting and maintaining national standards in education in terms of output measures;
4. promoting careers in science, engineering and technology, ensuring that the educational programs in these fields are consistent with the need for competitiveness;
5. gaining maximum competitive advantage from the awareness, participation and initiative of the whole population of Canada;
6. creating a climate for excellence in the financing and management of innovation; and

7. balancing this thrust towards world competitiveness by continuous learning programs related to caring for people and for the environment through the process of economic renewal.

A new institution helps focus effort on long-term issues and promotes action. A national agency, which this Board should become, can develop and oversee the implementation of the recommendations of this report and others developed by the Task Force subsequently. The agency should be independent of government and only partly funded by the government, to ensure flexibility and autonomy. It should work through existing channels as far as possible, and fulfil primarily an analytical and advisory role comparable to that played by the Economic Council of Canada or the OECD on an international scale, but devoted entirely to continuous learning issues. A strong secretariat funded by the federal government would be required.

Representation on the Board should be broad, to reflect diverse stakeholder groups. At some level, on sub-committees or on the Board itself, teachers, teachers' associations, pre-school educators, parents, labour, industry management, school board, provincial and federal representatives, and students from both formal education and adult training and their counsellors should be involved and consulted in building programs and maintaining consensus.

The Committee envisages an annual budget not to exceed \$5 million for the Board and Secretariat with a sunset clause to provide a ten-year life for the agency, and with a mid-term re-evaluation and zero-base review in 1996.

It foresees operational programs developed by the Board or approved by it being funded by the appropriate mix of governments and users in each case as a firm policy, and delegated to an appropriate agency for implementation and management, with the Board retaining a watch-dog function.

The Continuous Learning Board should have the authority to monitor the quality of education and training by every means available, including cross-correlation through common questions in provincial or municipal tests and arranging participation in international comparative examinations. Its findings should be reported promptly and publicly by region and institution.

It would report annually to the Prime Minister and provincial Premiers on the state and needs of the Canadian human resource development system in relation to international competitiveness.

2. The Reallocation and Investment: Who Pays?

To this point the report has been silent on the costs and sources of funds required for the move to continuous learning. The focus of this report has been on the restructuring of the economy for competitiveness, so that the means must be reallocation of existing government expenditures and priorities accompanied by major investments in workforce training and outreach programs by the private sector. The committee is not advocating large new expenditures that would increase the deficit, seeing deficit reduction as the overriding priority. Yet the future will be bleak for Canada if the necessary investments are not made. The following comments are meant as illustrations of what is possible, referring to the principal headings and recommendations of the report:

Training the Managers (Part II.1) Training programs for managers and executives would be financed out of existing revenues in the private and public sectors, to be recouped from increased productivity. Similarly, exchange programs should be financed by the parties involved, for mutual gain.

Training the Teachers (Part II.2) To stimulate the investments by employers to meet the National Learning target of recommendation 1, the federal government may need to provide some mix of incentives or penalties. Tax-related credits or a version of the payroll tax in use in France could be considered. Beyond these provisions, the programs should be largely financed by employers, again to be recovered by increased productivity and performance, and supplemented by reallocations within employment and immigration programs.

Economic Relevance (Part IV.1) Linking businesses, colleges, universities, and schools for mutual benefit has so many rewards that it should become a self-financed competitive activity in its own right, linked to the efforts of regions and communities to attract new investments in their area.

Excellence at the Top (Part IV.2) Doubling the budgets of the Granting Councils to develop a pattern of differentiated universities focused on special areas of excellence will result in reallocations of effort and budgets among existing, already funded institutions. Significant disruption and early retirement or other incentive programs will be inevitable, but should be accommodated within existing provincial budgets. Expanding the quantity of research to raise quality, however, involves both new money for the direct costs of increased research, and adequate support for the expanded infrastructure required to make this research possible and efficient.

To date, the Granting Councils have confined themselves to direct research costs, leaving infrastructure to be furnished from university operating budgets and capital campaigns. The councils, the universities, and their governments should decide whether new infrastructure costs should be borne federally, through the councils, or provincially, through the universities. “Doubling” the councils’ budgets can properly be subject to different interpretations, depending on how infrastructure costs are viewed and sourced.

In either case, the necessary funds for infrastructure can be found within the Established Program Financing (EPF) of the existing federal-provincial fiscal arrangements. In 1990 the amount involved for health care and post-secondary education (at the discretion of the provinces at present) is \$20 billion. The direct research costs should be reallocated from the federal science and technology envelope as part of the restructuring of government R&D and S&T activities, as these are largely unrelated to the training of highly qualified personnel, which emerges as a new priority.

Both forms of reallocation require considerable courage to manage, and consensus on the goals among the parties concerned. Only a vigilant and informed public committed to the changes can create the pressure to ensure that they are carried out quickly. Both will require belt-tightening by a move to leaner management and higher productivity, but, as already noted, the public sector cannot in any case escape the winds of change forcing economic restructuring. This issue seems to be the right place to begin.

Excellence Throughout (Part IV.3) Developing and implementing standards involves the collaboration of volunteers whose expenses must be met, and the adjustment of priorities among the others composing the task force and involved in the consultation process. The Task Force budget must be adequate for this. Encouraging the media to take a lively interest and to foster excellence through competitions should be easy once public interest has been engaged and sponsors have come forward. **Awakening public interest on the issues of excellence will depend largely on creating newsworthy discussions. With all of the stakeholders involved, many of whom will be making painful adjustments in their own areas of responsibility, the level of tension and stimulus should ensure the creation of newsworthy debate.**

The Continuous Learning Board (Part V.1) will take time, perhaps a year or two, to evolve and define. Its budget should not be allowed to grow large.

Continuous Learning (Part I.2) The umbrella concept of continuous learning will grow by the fusion of the different categories of education and training discussed above. The major additional costs identified in the section describing continuous learning will be investments in computers, software, and other electronic forms of imagery and network communication. As these are real investments in productivity in a badly undercapitalized industry, they should be recoverable from the savings they generate over a period of time, and should therefore be seen as high priority items within existing expenditure provisions.

VI. RECOMMENDATIONS FROM THE TEXT

TRAINING THE WORKFORCE

RECOMMENDATION 1

The Prime Minister should announce a National Continuous Learning Target of FIVE PER CENT BY 2000, representing a goal of five percent of adult working time to be spent on teaching and learning by the turn of the century, to raise the international competitiveness of business and labour throughout Canada.

TRAINING THE MANAGERS

RECOMMENDATION 2

The Private Sector Challenge Group should lead Canadian businesses to establish management training programs in individual firms aimed at developing managers with the confidence, knowledge and skills to manage continuous innovation.

RECOMMENDATION 3

Industry, Science and Technology Canada should develop and implement a program to support industry-to-industry management exchanges and mentoring activities to be funded primarily by private sector participants.

RECOMMENDATION 4

The federal government should assess the impact of the changing world economy on the future skill requirements of public service managers and employees, and develop and implement appropriate continuous learning programs.

TRAINING THE TEACHERS

RECOMMENDATION 5

A National Task Force – including representatives of provincial and federal governments, teachers' associations, teachers and parents, and industry and universities – should be convened to develop and implement a comprehensive plan to support excellence in teaching through training and professional development. It should report its findings to the Prime Minister and the Provincial Premiers and include recommendations on the resources required.

RECOMMENDATION 6

The three federal Granting Councils should develop co-ordinated programs of summer scholarships for science teachers to work in research at universities, to provide direct experience with up-to-date science and technology.

RECOMMENDATION 7

The Prime Minister should establish a program of Awards for Excellence in Science Teaching to recognize 50 outstanding science teachers across the country each year, and to identify and publicize innovative ways of teaching science and technology in primary and secondary schools.

RECOMMENDATION 8

In conjunction with this program, a fund should be established to encourage the development of innovative science teaching methods and to foster the development of advanced technology-based curriculum materials across Canada.

ECONOMIC RELEVANCE

RECOMMENDATION 9

The Conference Board of Canada, other business organizations and local levels of government should foster local initiatives through industry-school partnerships to reduce dropout rates by motivating students to continue school and to strive for excellence.

EXCELLENCE AT THE TOP

RECOMMENDATION 10

Funding for the three federal Granting Councils should be doubled in order to expand the Canadian stock of competitive, talented, and renowned graduates. The increased funding would build concentrations of world-class research capability in key subject areas, enabling certain Canadian universities to attain world status through differentiation and specialization. Most of the increase in funding should be devoted to the development and implementation of strategic plans proposed by universities to develop their chosen priorities in research and research training.

EXCELLENCE THROUGHOUT

RECOMMENDATION 11

The National Task Force proposed in recommendation 5 should develop a consensus on appropriate educational output performance standards for the Canadian system, and on how they can be broadly monitored and tested.

RECOMMENDATION 12

To motivate students and stimulate competitiveness and excellence in schools, the Private Sector Challenge Group and the federal government should encourage the media to produce television quiz competitions, national essay competitions and national awards programs in key areas, and to publicize the results widely.

ATTRACTING STUDENTS TO SCIENCE AND TECHNOLOGY

RECOMMENDATION 13

The Department of Industry, Science and Technology should determine from direct consultation with students in Grades 8 to 12 their attitudes and interests in pursuing careers in science, engineering and technology, and the factors dissuading them from entering these fields. Special attention should be paid to the concerns of women students. The results should be publicized and should form the basis of consistent programs in immigration, education, training and job creation to raise both the overall number and the proportion of the best and brightest people entering these fields.

A STRUCTURE FOR ACTION

RECOMMENDATION 14

The Prime Minister should charge the National Task Force and the Private Sector Challenge Group to work with the new National Training Board to develop membership criteria and broad terms of reference for a Continuous Learning Board, which they would then form to supersede themselves. This Board would include a wide range of stakeholders in learning, drawn from parents, students, government, education, management, labour, technology and training. It would focus on means to develop excellence at all levels in the workforce through continuous learning programs, to develop skills appropriate to competitiveness in the global economy.

