POLICIES FOR TECHNOLOGY DEVELOPMENT IN CANADA: 1987–1993

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This is the third (and last) in a series of articles to appear in ***Prometheus*** *on federal policies for technology development in Canada during the two electoral mandates of Progressive Conservative prime minister Brian Mulroney. The first and second articles covered the period that began with the appearance in July 1984 of the policy-related report by Dr Douglas Wright and his colleagues and ended in the middle of 1987 as the Mulroney administration was well into its first mandate and was putting in place changes to federal technology policies and programs, some of which were Wright-related. This present article completes the story through to June 1993 when the prime minister resigned. The changes have continued under a variety of influences and have altered the ways in which technology development has been funded, organized and promoted by the federal government in Canada. They have generally been in line with the recommendations of the Wright report, making it a suitable framework against which to consider developments in this field during the six years covered by this present article.*

Key words: technology policy; Canada; Mulroney administration

INTRODUCTION

On 25 June 1993 Brian Mulroney resigned as leader of the Progressive Conservative Party and the federal government of Canada, having served as party leader for ten years and as prime minister for almost as long. The new incumbent — Kim Campbell — faced the prospect of an early general election and devoted most of her time and attention over the weeks that followed to the search for a mandate of her own. But this was not to be. On 25 October 1993 Campbell and her party went down to massive defeat at the hands of the Liberal Party and opposition parties with regional rather than national followings. Sandwiched as they have been between Liberal administrations, the two Mulroney mandates show quite distinctive characteristics and will be the subject of much comment and analysis in the years to come[1].

In September 1984, when Mulroney won a landslide election victory and took over the government of Canada, he inherited the recently-minted report of the task force led by Dr Douglas Wright which had been asked by the previous Liberal administration (in November 1983) to examine federal policies and programs for technology development and, in particular, to assess the effectiveness of: the government's industry support programs for science, technology and related activities; the government's procurement of technology-intensive products; the university-industry interface; and the government's intramural scientific and technical activities[2].

The first article that appeared in *Prometheus* included an extensive discussion of the Wright report[3]. The task force members considered their main emphasis and concern should be **technology** policy and not **science** policy, and that technology **development** should be aimed at producing something useful.

Dr Wright and his colleagues praised the Industrial Research Assistance Program (IRAP) and were reasonably happy with the Program for Industry/Laboratory Projects (PILP) — both of which were administered by the National Research Council (NRC). They had no strong views about the Defence Industry Productivity Program (DIPP) administered by the department of regional and industrial expansion (DRIE), but were critical of the effectiveness of the Industrial and Regional Development Program (IRDP), also administered by DRIE[4]. With regard to procurement, they concluded that the fostering of technology development through it could be much more widely and effectively pursued by federal departments and agencies.

The task force members saw basic research as one of the principal responsibilities of the universities. They praised the Natural Sciences and Engineering Research Council (NSERC) for providing effective programs that encouraged both basic and applied research, graduate training, and joint university-industry research projects. They also discussed ways in which the universities' anxieties about the funding of housekeeping items associated with research might be lessened[5].

Dr Wright and his colleagues had a lot to say about the federal laboratories, and about those of the NRC in particular[6]. While recognizing the excellence of much of the work done in them, the task force was critical of their management, the relevance of much of the work intended for industrial use, and the lack of involvement of potential client groups in the process of peer review. Areas for future research were suggested and the laboratories were encouraged to become more businesslike and responsive to the marketplace. It was suggested that the government-owned-contractor-operated (GOCO) model should be more widely used. But large increases in intramural R&D spending were not recommended. Indeed, the task force advised against paying too much attention to Canada's lowly international status as a spender on R&D since the deployment of funds was, in its view, more important than the aggregate amount.

The second *Prometheus* article examined the changes made by the Mulroney administration — under the influence of the Wright report and other inputs — up until the middle of 1987, which was almost three years into its first mandate[7]. This article discussed Mulroney's independently-made pre-election promise — with which the Wright task force would disagree — to double the federal government's own R&D spending and significantly increase the private sector's so that Canada's 'GERD percentage' would rise from 1.4 to 2.5 by 1988 or 1989. No progress had been made towards these objectives by mid-1987 [8].

The article also discussed the statement by the minister of finance in November 1984 that a more appropriate climate for increasing industrial R&D would require improved tax- and grant-based programs, and in this case Dr Wright's people would agree. The new administration acted immediately to scrap the abused, but still useful, Scientific Research Tax Credit (SRTC) and replaced it with improved invest-

ent and personal tax credits. Positive steps were also taken before the middle of 1987 to amalgamate PILP and parts of IRDP with the IRAP, and to improve DIPP. Client groups began to get a stronger voice in the peer review process for federal laboratories. Additional funding was allocated to NSERC and a program of matching grants for university-industry research was introduced.

But in view of the growing federal deficit and debt, the Mulroney administration began early in its first mandate to make a series of budget cuts in its own laboratories — and especially in NRC's — and to require them to develop cost-recovery and business plans. It halved the budget of the independent and advisory Science Council of Canada (SCC), but set up a National Advisory Board for Science and Technology (NABST) to provide advice directly to the prime minister, and with the prime minister himself as chairman. The House of Commons established its first standing committee for science and technology. But very little changed in the area of technology-intensive product procurement.

In March 1987 the 13 federal, provincial and territorial ministers with S&T responsibilities agreed on a formal national science and technology policy. Among its objectives, the following were particularly significant for technology development: encouragement for the commercialization of technology developed at home or abroad and the promotion of its diffusion; bolstering applied research and innovation through public and private mechanisms; development of technologies strategic to the growth of the manufacturing, service and natural resource sectors and to the broadening of those areas in which Canada could excel internationally. A Council of Science and Technology Ministers (CSTM) was set up to guide the implementation of this policy[9].

Shortly after the announcement of the national policy the Mulroney administration unveiled its own strategy — called 'InnovAction' — to achieve the policy's objectives. It was to be guided by four principles: greater support from industry for R&D; cooperation among all the science and technology players; encouragement of R&D activities for the public interest, and the commercialization of government-generated technology; and greater efforts to import foreign technology. The InnovAction statement also said that Canada could not remain competitive unless it acquired world-class technologies from wherever they were available and that the private sector and the universities should be encouraged to work with foreign partners on leading-edge projects which would otherwise be beyond reach[10].

During the period covered by the second *Prometheus* article the Mulroney administration laid the groundwork for later developments. But in the middle of 1987 the size of the federal budget deficit and the cost of servicing the rapidly growing debt load were of prime and continuing concern.

ECONOMICS AND POLITICS: 1987 to 1993

The Mulroney administration's preoccupation with the deficit and the debt continued throughout this entire period, in spite of the fact that 1987 and 1988 were boom years and 1989 a year of slower growth. The deficit/debt situation became even more serious as the recession into which Canada began to slide in 1990 took hold,

as the provincial governments' deficit and debt problems became increasingly more visible, and as the prime minister and his colleagues took steps to move Canadian industry away — economically and technologically — from the traditional hewers-of-wood-drawers-of-water dependence to one in which high value-added products and services were more prominent. By the middle of 1993 the country had not yet recovered from the recession or completed the restructuring, although inflation and interest rates had been brought down to their lowest levels in many years.

To these preoccupations several more should be added. The first was the constitutional problem involving the full adherence of the province of Quebec — something the new constitution of 1982 had not accomplished. By June 1987 the prime minister and the premiers had negotiated what became known as the Meech Lake Accord. But all the necessary legislative approvals were not in place by the deadline of June 1990 and this Accord died. Discussions re-opened in 1991, with much more public participation this time, and an agreement known as the Charlottetown Accord was reached by Canada's political leaders in August 1992. But this accord also failed ratification — in a national referendum held the following October.

The second was free trade — believed by the Mulroney administration to be an essential element in the achievement of prosperity, improved international competitiveness, and industrial restructuring. In 1987, after many months of negotiation, Canada and the United States concluded a Free Trade Agreement (FTA). In Canada it gave rise to vigorous political and public debate. However, it contributed only superficially to technology policies in either country. It was ratified in both countries in time for scheduled implementation on 1 January 1989 [11]. Beginning in 1991, and building on the FTA, Canada and the United States joined with Mexico to negotiate a Northern American Free Trade Agreement (NAFTA). Again there was a great deal of debate in Canada, but Parliament had passed NAFTA before the prime minister resigned in June 1993. In the other two countries, passage took until almost the end of the year.

The third preoccupation was comprehensive tax reform. Proposals were tabled by the minister of finance in June 1987. The majority of the ensuing, and again vigorous, political and public debate centred on the proposed VAT-type goods and services tax (GST). Industrial R&D expenditures were not at first to be seriously affected by reform since the minister believed the Canadian system to be among the most generous in the industrial world. However, in January 1988, his officials persuaded him to remove the provisions for limited R&D partnerships for passive investors — which had been working to the benefit of small companies in particular — because they could lead to abuses reminiscent of those that had plagued the SRTC. This change was incorporated in the legislation passed by Parliament in September 1988. The minister's budget in April 1989 included the GST, which took effect on 1 January 1991.

The fourth was the unpopularity of the prime minister himself, and of his administration, among the electorate. From a landslide victory in September 1984, the popularity of both fell dramatically over the next four years making re-election seem out of the question. However, by election day in November 1988, the appeal of the man and the Party had risen again and both received a second mandate — but

with a reduced majority in the House of Commons[12]. Unpopularity soon returned, fuelled by the prime minister's personal style, the tenor of — and the time consumed by — the constitutional, free trade, and tax reform debates, cuts to departmental and program budgets and personnel and cuts to programs themselves, and — from 1990 on — the apparent inability of the administration to deal speedily with the recession.

TECHNOLOGY POLICY DEVELOPMENT: 1987 to 1993

As noted earlier, a national science and technology policy and a federal strategy in support of it were in place in Canada in 1987. Also by 1987 the provincial and territorial governments — led by Ontario, Québec, and British Columbia — were putting in place policies and programs of their own. They were also involved in a continuing dialogue with the federal government at the minister, deputy minister, and expert official levels[13].

Since its founding meeting in February 1987 the work of NABST has been built around the work of the Wright task force, but the Board has gone considerably farther and deeper in its studies and recommendations[14]. The Board and its committees have prepared, and subsequently published, an impressive series of reports, and reference has been made to several of them later in this article[15]. Mr Mulroney was never hesitant to ask the members of NABST for their advice. Yet relatively few of their recommendations have so far been implemented. One stumbling block has most certainly been funding. At the Board meeting in January 1990, for example, the prime minister said that Ottawa was not then in a position to fund any new NABST-inspired S&T initiatives[16]. On the other hand, the Board has developed close links with the CSTM and with other S&T policy agencies in Canada and abroad. But its overall usefulness has been questioned, as has its role in providing confidential advice to the prime minister. In order to streamline its operations and accommodate some of its critics, the Board's membership was reduced from 41 to 24 members (including the prime minister) in September 1991.

In August 1987 the Mulroney administration announced that in order to provide leadership, enhance the role of science and technology in economic development, strengthen the industrial S&T base in Canada, and improve its competitiveness in international markets, the ministry of state for science and technology (MOSST) would be merged with the department of regional and industrial expansion (DRIE) to form the flagship department of industry, science and technology (originally called DIST — later Industry, Science and Technology Canada, or ISTC). It would have three ministers. The senior one would carry the title of the department but would have specific responsibility for manufacturing industry, industrial R&D support and technology diffusion, and support for CSTM. One of the juniors would be responsible for science and technology strategies, university research, public awareness, oversight of the NRC, NSERC, and the Science Council, and support for NABST. (The senior and this junior minister would also serve on this Board.) The other junior would have responsibility for small business. The regional programs for DRIE for the Atlantic and Western Provinces would become the responsibility of two new agencies, under their own ministers. Ministers in resource industry

portfolios would retain their S&T responsibilities. As it happened, the passage of the legislation for DIST/ISTC was delayed and did not take full effect until February 1990, but long before then the department was organizationally integrated. However, being a flagship department did not save DIST/ISTC from the kinds of cuts to its budgets, programs, or personnel that were applied to other federal departments and agencies between 1987 and 1993.

In January 1988 the federal government sponsored a National Confence on Technology and Innovation to which over 200 decision-makers from the private and public sectors were invited and in which the prime minister and his two science ministers took part. Among other things, this Conference expressed support for the new DIST/ISTC and, as the Wright report had done, emphasized the need for more risk-taking, the promotion of higher value-added Canadian products through the public procurement process, and increased cooperation between the universities and industry[17].

In May 1989 the House of Commons appointed a standing committee mandated to keep watch over industry, science and technology, and regional and northern development — effectively amalgamating the remits of two earlier committees[18].

In June 1989 the premier of Nova Scotia invited the members of all of the government-sponsored S&T policy advisory boards and councils in Canada to meet for the first time in Halifax to discuss matters of mutual concern. The result of this meeting was a document that became known as the Halifax Declaration[19]. The key issues in it on which there was general agreement included: the need to enhance science-based industrial innovation, especially in view of the growing knowledge-base of economic activity and global competition; the need to encourage and support the Canadian ownership of enterprises; the need to develop Canada's human resources to meet the requirements of the future; and the need for much improved national awareness of science and technology. On one further issue — the need for a national 'GERD percentage' target of 2.5 percent of GDP by the end of the century — the councils may have been in agreement, but the Mulroney administration was not. The prime minister's pre-1984-election promise had, by 1989, been set aside.

The CSTM met in September 1989 and agreed to establish a task force of experts to develop an action plan based on the national S&T policy, the Halifax Declaration, and other relevant reports. A draft of this plan was discussed by the ministers in April 1990, and the final text made public a year later. It was intended as a framework from which the individual jurisdictions would develop their own initiatives. However, it was endorsed by only eight provinces. Ontario declined to do so and, in view of the failure of the Meech Lake Accord, Québec had withdrawn from federal-provincial consultations. The framework included: the review by governments of their own R&D efforts in order to identify and improve future market opportunities; the identification of steps to be taken to strengthen innovation support efforts and to enhance the effectiveness of collaborative and strategic R&D; the implementation of initiatives to enhance Canada's international collaboration in technology transfer; and the matching of governments' procurement practices with support for regional technology development and supplier initiatives[20].

The National Forum met again in Edmonton in May 1990 at the invitation of the premier of Alberta. This time it authored the Edmonton Declaration, which reaffirmed the national expenditure target figure of 2.5 percent of GDP. This Forum also identified several more key issues, for example: the need for federal and provincial governments to enhance the environment in Canada for patient, long-term investments in science and technology; and the need for these governments to create initiatives to improve the management of companies.

The third meeting of the National Forum took place in Victoria in September 1991 at the invitation of the premier of British Columbia — and as the recession was in full swing. There was no Victoria Declaration. Instead, a series of messages was developed. Some expressed concern that governments in Canada were ignoring the conclusions reached in Halifax and Edmonton, and others that Canada was not yet competing effectively in world markets[21].

It was also around this time that competitiveness and the prosperity that could result from success in the global marketplace became constant themes when politicians spoke and when governments, advisory boards, committees, and business experts published their thoughts. In most cases, science and technology were credited with influencing both competitiveness and prosperity. Indeed, the steering group that led the federal government's own 'prosperity initiative' set up a task force to outline how Canada could best benefit from science, technology, and engineering[22].

Federal budgets contributed in varying degrees to the development of technology policies in Canada during the years under review. The February 1988 budget was a pre-election one and, consequently, made only minor changes. The budget of April 1989, on the other hand, included action to reduce the federal deficit and control the debt. Corporate and personal taxes were to be raised and, as noted above, the introduction of a GST was proposed. Department and agency expenditures, generally, were to be cut. However, Treasury Board figures tabled just after the budget showed that there would be a rise in overall federal spending associated with science and technology.

Deficit reduction was again a primary objective in the February 1990 budget. Controls on federal department and agency operating and maintenance expenditures would be kept in place. However, their programs would be dealt with individually. Some would be exempt, some frozen, some eliminated, and some — including certain ones in the S&T area — subject to a growth cap of 5 percent a year. In the case of grants to business, generally, a significant change was made. With few exceptions, grants would be eliminated and any financial assistance given (usually as interest-free loans) would be repayable on more rigorous terms than before. In practice, this change affected the larger contributions made for S&T purposes by ISTC, NRC's IRAP, and the regional development agencies. Small contributions, and those to non-profit corporations, would be exempt.

The budget of February 1991 reflected the increasingly difficult recessionary times. Expenditure controls were kept in place, some additional restraints introduced, and the ranks of management reduced. The growth cap allowed on certain

S&T programs would be 3 (and not 5) percent, beginning in fiscal 1992–93. Expenditures under the Green Plan — introduced in late 1990 to fund environmental S&T and other initiatives — would be spread over six years instead of five.

The February 1992 budget was, as a commentator noted, one that reaffirmed the Mulroney administration's conviction that any knowledge-based restructuring of the Canadian economy must be led by the private sector and not by government[23]. It included proposals to streamline the industrial R&D tax incentive program, introduce a multi-year tax expenditure commitment to private sector R&D in 1993, and modify the rules for certain risk capital funds[24]. However, the further cuts that were also proposed for department and agency spending might slow down the delivery of S&T programs administered by ISTC, National Defence, and the others involved. It was also proposed, as a cost-saving measure, to eliminate or consolidate some 46 federally-financed organizations — among them the Science Council of Canada. The rationale for killing the SCC included the fact that the Mulroney administration was getting S&T policy advice from NABST[25].

In response to the continuing recession and malaise in the economy, the minister for finance presented an economic statement in early December 1992 in which he proposed further measures to contain the deficit and, at the same time, to enhance economic recovery. Included in the latter were further improvements to federal R&D tax incentives.

The last of the Mulroney administration's budgets was brought down in late April 1993. On the one hand, it was obviously a pre-election budget in which any drastic measures would be left for the incoming administration to make. On the other, it included a number of the S&T-related proposals the minister had made in his December statement — as well as more restraints on federal spending.

WRIGHT REPORT REVIEW: 1987 to 1993

In spite of being less-well remembered by 1993, the Wright report still provides a framework in which to consider — very briefly — the application of the Mulroney administration's technology development policies during the six years under review. Also, the influence of Dr Wright and his colleagues on the Mulroney administration has been acknowledged by one of the ministers of science:

> Looking back, we can see that many of the changes made in government S&T policy since 1984 follow the Wright report recommendations, or are consistent with their intended goals. This is particularly true in terms of government support for technology development, university-industry collaboration, and the management of government laboratories[26].

IRAP has remained the federal flagship program for industrial S&T support — based as it now is on a nation-wide system of technology advisers with strong institutional connections and backed by the NRC's management system, staff, and laboratories. Between 1987 and 1993, IRAP — like any other federal program — was affected by the state of the deficit, and especially since the onset of the recession. Also, NRC was trying to improve the efficiency of the program's management and delivery, but there were problems in regard to the Council's motives for

this that prompted the House of Commons standing committee on industry, science, and technology to hold hearings and to issue a report[27].

The DIPP program, which has strong aerospace, space, and defence industry clients, has remained in place although it, too, has had budgetary problems. Also in the defence sector, the Mulroney administration in 1988 revived the modestly funded Defence Industrial Research program (DIRP), with the requirement that it be used to support R&D that also included industrial contributions.

DIST/ISTC set up the Technology Outreach Program (TOP) in 1987 to provide financial assistance to Canadian not-for-profit corporations wishing to establish specialized technology centres for national activities and services that would help accelerate the acquisition and use of technology and management skills by small and medium-sized enterprises (SMEs) in sectors such as advanced materials, biotechnology, plastics, and microelectronics. In 1988 DIST/ISTC introduced the Strategic Technologies Program (STP) to assist Canadian companies to establish alliances and pool resources with other Canadian firms, foreign firms, the universities, and research institutes in innovative projects in three specific areas: advanced industrial materials; biotechnology; and information technologies. In 1989 the department initiated a campaign to promote design, manufacture, and production control within the advanced materials technology (AMT) sector in collaboration with industry, labour, and the research community. It set up an AMT Application Program (AMTAP) to provide advice to SMEs on the use of facilities, microelectronics systems development and environmental technology commercialization programs, the Japan Science and Technology Fund (which encourages beneficial collaboration between Canada and Japan), and a variety of other programs related to specific industries, such as automotive, aerospace, forestry, and business services. ISTC has given financial support to two special private sector initiatives. One is PRECARN, an industrial consortium in the automation/robotics field which sponsors pre-competitive research on behalf of member firms. The other is the Canadian Institute for Advanced Research (CIAR) which sponsors networking and research in a wide variety of fields, principally in the universities.

The department of external affairs has responsibility for the world-wide trade commissioner service, for bilateral R&D and production agreements, the FTA, and NAFTA. For several years it operated the Technology Inflow Program (TIP) designed to help Canadian firms — and especially SMEs — acquire foreign technology. In spite of being successful, TIP became a budget casualty in 1991, but was partially revived by NRC in 1992 as part of IRAP.

The Mulroney administration has also supported the further development and application by industry of technology originating in its departments and agencies. On the legislative side, the Patent Act was amended twice (again, after vigorous public and political debate) to improve its international compatibility and protection for patent owners and as a lever to encourage more pharmaceutical research in Canada. The operations of the Patent Office have also been automated to improve its contribution to technology diffusion. And memoranda-of-understanding (MOUs), contracts, consortia arrangements, and other forms of agreement have been used to encourage the creation and diffusion of new technology involving governments,

industries, and private firms.

With regard to federal activities for the promotion of high-tech procurement, NABST published two reports — both of which encouraged the administration to follow the Wright report recommendations more energetically[28]. In the first of them the Board noted that there had been some remarkable successes in which procurement had resulted in industrial innovation, and that they were the result of collaboration between a few imaginative government managers and creative industry people. The second report was much more critical of the administration. It also noted that the successful Unsolicited Proposal Program (UPP) had become a budget casualty and that efforts to preserve the spirit of UPP through actions in individual departments had not been successful. (This program was recently reinstated, but in a less ambitious form.)

While the Mulroney administration has tried to encourage activities across the university-industry interface through as many of its departments and agencies as possible, the principal responsibility for this has remained with NSERC. This Council has continued to operate U-I programs which normally require industrial contributions, along with collaborative projects involving principally the universities. It has also maintained its strategic research and other programs which attempt to solve industrial problems. NSERC and its two sister Councils (for Medical and Social Sciences Research) organized a competition which led to the establishment in 1989, for an initial period of four years, of 15 Networks of Centres of Excellence (NCofE) covering a wide variety of subjects and linking the universities with government and industrial laboratories[29]. But no measures to relieve the universities of pressures from research overheads and other costs, as recommended in the Wright report, have been put in place. On the other hand, the universities have become the country's principal performers of basic research, as this report said they should.

Changes to the mandates, management, and funding of the federal laboratories that were initiated between 1984 and 1987 have been extended through to the 1990s, partly as a result of the budget pressures outlined above. In July 1987 the Mulroney administration announced that the largest of its laboratories (for example: parts of NRC; Energy, Mines and Resources; Agriculture) were to be included in a new management system under a Technology Centres Policy (TCP). The principal aim of TCP was to make the laboratories more relevant and responsive to clients' needs. Advisory boards of representatives of these groups were to be set up where they did not exist, and business plans were required. The participating laboratories also received a modest financial incentive (in the form of retained earnings) to stimulate cost recovery and joint projects with non-federal partners. As a result, agencies such as NRC began seriously to market their services.

In April 1991 the first (Wright recommended) GOCO was established for a 3-year trial period, when the management of the Wastewater Technology Centre — originally part of the department of the environment — was assigned to a private firm.

COMMENTARY

The Wright report's recommendations were based on the application of three prin-

ciples, which — it said — could be applied simultaneously by the public and private sectors.

One of them called for more intelligent risk-**taking**. The Mulroney administration's answer was more akin to risk-**spreading**. While there have been a fair number of new technology-support programs, these have been more concerned with wider technology diffusion than with restrictive research or development. Cost-sharing has become common, and stiffer conditions have been set for awards and repayments involving grants and loans made under the older programs. Consortia, alliances, and other partnership arrangements linking the government with industry or the universities have become more common, market research no longer ignored, and foreign as well as domestic sources of new technology have been sought out for potential application. The universities have been encouraged to share both research and risk with the industry sector.

The second principle called for more active enterprise. One can only assume that during the good years of the 1980s the private sector practised some of this since, with some exceptions in the high-tech field, enterprise has become a scarcer commodity everywhere since the recession began. For its part, the Mulroney administration tried to redefine the rules of the game for its departments and agencies to make them more entrepreneurial. It assigned a single department — ISTC — to lead the application of its technology policies. But the administration was thwarted in several ways from achieving significant results. For example, during the good years the departments and agencies were busy reorganizing, rebudgetting, and learning the new rules — about which their personnel were not always happy. During the recession years, federal public enterprise was limited by continuing budget and personnel shrinkages. The administration also appeared reluctant to increase the scope of venture capital incentives. Useful programs were terminated for budgetary reasons, useful R&D tax incentives were scrapped rather than modified, and the administration of the rules for R&D tax returns caused problems for companies. (The tax situation may, however, have begun to turn around with the 1993 federal budget.) Also, federal procurement was not used effectively to encourage innovation and, as has been pointed out by a leading Canadian entrepreneur, Canada's high-tech trade deficit continued to grow in spite of the measures put in place by the Mulroney administration[30].

The third principle — the need for better overall management — was applied by the Mulroney administration to the implementation of its technology policies and programs by its own departments and agencies. ISTC was part of its management plan, as was the Technology Centres Policy. But changes in the rules also affected management, and these caused difficulties. Most federal departments and agencies — unlike many private sector companies — were not closed down and their entire staffs laid off in response to the recession, but they were still affected by personnel and budget cuts which, in turn, influenced their ability to do all of the jobs assigned to them. The federal laboratories became increasingly subject to the kinds of micromanagement which the Wright report wanted to avoid and which structural changes did not always eliminate. Those private companies that were surviving the recession were obviously having to make management adjustments involving budg-

ets, products, personnel, markets and other factors.

On the wider canvas, technology development policies received more attention from the Mulroney administration — and from the prime minister himself — than was the case in earlier administrations. These policies were also different and more focused on eventual applications than on the creation of new information. The prime minister's association with NABST served to ensure that he was at least briefed on the issues and problems involved in these policies and could debate them directly and regularly with members of the S&T community. His administration initiated the discussions that led to the articulation of the first national science and technology policy, as well as putting in place right away a strategy of its own in support of it. The administration also helped establish and maintain the CSTM, which brought jurisdictional representatives together for policy consultations. And while the prime minister and his colleagues may not have agreed with all of the conclusions and recommendations of the National Forums — or with all the elements in the CSTM's action plan — its technology policies followed their general thrust.

Just as Dr Wright and his colleagues were criticized a decade ago for their views and recommendations, so was the Mulroney administration for inadequacies in its technology policies. Perhaps the most persistent critics were those who disliked the heavy emphasis on technology and application and the relative neglect of science and creation, who believed the administration did not understand the differences between science and technology or between basic and applied research, who were concerned that — budget considerations notwithstanding — too little was being spent by the federal government on everything connected with science, technology, research, and development, and who felt the administration was placing too much emphasis on the private sector's role in the restructuring of industry. The national policy also had its critics. It was far too general, and the subsequent discussions by CSTM, the National Forums, and others, were seen as time-consuming, inconclusive, and even sterile. The proposal to close down the independent, advisory, and remarkably successful Science Council of Canada provoked angry reactions from the science, S&T, and R&D communities, but to no avail. The disappearance of MOSST into the bowels of ISTC was mourned. The administration's treatment of its own laboratories, and especially those of the NRC, attracted much adverse comment. And both government and university laboratories were seen as becoming, unjustly, the 'hand maidens' of the private sector[31].

For the record, Canada's GERD percentage remained around 1.4 percent of GDP throughout the two Mulroney mandates. In regard to the aggregates for the main R&D funding and performing sectors, there have been a number of small shifts over the years. For example, on average, for the period between 1981 and 1985, the federal government provided 34 percent of all funding, the business enterprise sector 38 percent, the higher education sector 12 percent, and all other sources 16 percent (including foreign, provincial, and private-non-profit). The preliminary figures for 1991–92 show that these figures changed to 30, 41, 10, and 19 percent respectively. In regard to performance, the average figures for the period 1981 to 1985 were 20 percent for the federal government, 50 percent for business, 26 per-

cent for higher education, and 4 percent for the others (provincial and PNP). The 1991–92 figures show that higher education and the others remained the same, while the federal government and business shares fell and increased by 3 percent respectively, not perhaps very significant but — along with the similar-sized shift in spending — the kind of change the administration had been trying to effect[32].

In the last analysis, the Mulroney administration's technology policies for 1987 and 1993 must stand on their own feet and not those of Dr Wright and his colleagues. In this regard, two factors must be taken into account. The first is that there were two distinct periods involved, one being the three good years from 1987, and other the three bad years of the recession. And since the bad followed the good the overall results at the end of the period were undoubtedly less favourable. The second is the persistence of the deficit and the debt problems, and the fact that they strongly influenced the policy and program options open to the administration.

One can say that the Mulroney administration's technology policies were novel and, significantly, directed towards technology diffusion and economic action as well as to having the industry-technology lead taken by the private sector. The changes to the federal laboratories and in its use of grant and other programs were perhaps more radical than novel, and it can be said in connection with the laboratories at least that the government used a hammer instead of a shoehorn to achieve its objectives. Yet the administration was undoubtedly headed in the right direction — getting a bigger 'bang' for its S&T 'buck' — making more use of technology for the benefit of more Canadians.

NOTES AND REFERENCES

1 During the four months in which she was prime minister, Ms Campbell made only a few changes to the federal technology system. Of significance was the expansion of the mandate of ISTC to include responsibility for corporate and consumer affairs, intellectual property, telecommunications, and investment monitoring. ISTC, in the process, was to change its name to Industry and Science Canada (ISC) and become a super ministry instead of simply a flagship one. Ms Campbell also named the deputy prime minister, Jean Charest, to head it, with the assistance of one junior minister, for science and small business.

2 *Report of the Task Force on Federal Policies and Programs for Technology Development*, Ministry of State for Science and Technology, Ottawa, July 1984.

3 Andrew H. Wilson, 'Technology development: A Canadian priority', *Prometheus*, 3, 1, June 1985, pp 86-109.

4 See reference 3, page 108, for short notes on the IRDP, DIPP, IRAP, and PILP programs. Short descriptions of the later programs included in this present article may be found in *ISTC Programs and Services*, revised edition 1992, published by the Services to Business Branch of Industry, Trade and Commerce Canada, 235 Sparks Street, Ottawa, Canada K1A 0H5, or in the *1993 Guide to Federal Programs and Services*, published by the Canada Communication Group, Ottawa, Canada K1A 0S5. Information on the Scientific Research and Experimental Development (SR&ED) program — the federal R&D tax incentive — is available from the Department of Finance, Ottawa, Canada K1A 0G5.

5 Education in Canada is a provincial responsibility and, in this context, the provinces normally deal with housekeeping items such as overheads for research. The federal government does, however, transfer negotiated funding to the provinces to help pay for education.

6 The 1970 report by a working group headed by Dr Pierre Gendron included recommendations on the future organization of federal scientific activities. Those made in regard to the National Research

Council (NRC) were remarkably similar to those of the Wright task force. A discussion of this report appears in: Andrew H. Wilson, 'The Gendron Report: Another view of Canadian science policy', *Science and Public Policy*, 16, 5, October 1989, pp 269-281.

7 Andrew H. Wilson, 'Technology development: The continuing story in Canada', *Prometheus*, 5, 2, December 1987, pp 338-358. One of the other inputs was the report of the task force chaired by deputy prime minister Erik Nielsen, whose mandate included policies of all kinds, and whose main recommendations were published in *New Management Initiatives*, which was part of the Budget Papers of the Department of Finance, Ottawa, May 1985.

8 Science and technology, and research and development, will be referred to in this article as S&T and R&D. The difference between them will be related scientific activities (such as data acquisition and diffusion), or RSA. The equation, S&T = R&D + RSA, applies.

9 The news release package from the Ministry of State for Science and Technology (MOSST) on the National Science and Technology Policy was issued in Ottawa on 12 March 1987. This package included a background paper.

10 The news release package from MOSST on the federal InnovAction Strategy was issued in Ottawa on 24 March 1987. This package included a background paper.

11 A discussion of the 1987 Canada-U.S. Free Trade Agreement appears in Andrew H. Wilson, 'Canadian and U.S. science and technology policy under free trade', *Science and Public Policy*, Vol. 16, No. 2, April 1989, pp 119-125.

12 The Senate in Canada is appointive, not elective.

13 This article cannot deal with the policies and programs developed by the provincial or territorial governments for their own jurisdictions. However, a recent discussion of them appears in: Andrew H. Wilson, 'Canada: federal and provincial issues, policies and programs', *National Purposes, Federal Government*, ASTEC, Canberra, November 1990.

14 The NABST-Wright connection was made in a private communication to the author from the Chief of Staff to the Prime Minister of Canada on 20 May 1993.

15 The full list of the publications of the National Advisory Board on Science and Technology (NABST) is too long to be included in this article. The list (including NABST's current mandate), and copies, can be obtained from the Board at 240 Sparks Street, Ottawa, Canada K1A 0H5.

16 The statement was made on 30 January 1990 and reported in *Re$earch Money* (Evert Communications, PO Box 3158, Ottawa, Canada K1Y 4J4), on 7 February 1990.

17 The *Proceedings* of the National Conference on Technology and Innovation, held in Toronto in January 1988, and the accompanying discussion papers can be obtained form ISTC, Communications Branch, 240 Sparks Street, Ottawa, Canada K1A 1A1.

18 The Minutes of Proceedings of the House of Commons Standing Committee on Industry, Science and Technology, Regional and Northern Development can be obtained from the Canada Communication Group, Supply and Services Canada, Ottawa, Canada K1A 0S9, as can copies of the Committee's reports. Three of these reports have been cited in this article and are listed below.

19 Copies of the Halifax Declaration — and the later Edmonton Declaration and Victoria Report — can be obtained from NABST (see 15 above).

20 The Action Plan developed by the Council of Science and Technology Ministers (CSTM) was released at Saskatoon, Saskatchewan on 9 May 1991, under the title — *National Science and Technology Framework for Action*. Copies can be obtained from CSTM at 235 Queen Street, Ottawa, Canada K1A 0H5.

21 One of the keynote speakers at the Victoria Forum was the Hon. Barry Jones, the former Australian Minister of Science.

22 The following were among the competitivenesses/prosperity studies released in Canada around 1991:
Canada Must Compete, report by the House of Commons Standing Committee on Science etc., December 1990 (see n.18 above).
Statement on Competitiveness, by NABST, presented to the Prime Minister in November 1990 and published in March 1991 (see n.15 above).
Inventing our future: An Action Plan for Canada's Prosperity, report of the Steering Group on the Prosperity Initiative, 1992. Copies can be obtained from ISTC Communications Branch (see n.17 above).
Prosperity through Innovation, summary report of the Task Force of the above Steering Group, 1992. Copies can be obtained from the Conference Board of Canada, 255 Smyth Road, Ottawa, Canada K1H 8M7, or from the ISTC Communications Branch.

23 Vincent Wright, Editor, *Re$earch Money*, 4 March 1992 (see n.16 above).
24 This measure was influenced in part by the final report of the NABST Committee on the Financing of Industrial Innovation, published in March 1991.
25 The Science Council of Canada closed its doors in June 1992 after almost 26 years of service, many publications, and a great deal of open advice to both the public and the private sectors — in particular, to the federal government.
26 This statement was made in a private communication to the author from the Hon. Tom Hockin, then the Minister for Science, on 28 April 1993.
27 *IRAP: An Inquiry into the Industrial Research Assistance Program,* report of the House of Commons Standing Committee on Science etc., December 1991 (see n.18 above).
28 *Government Procurement Committee Report*, NABST, February 1988 (see n.15 above).
Report of the Committee on Federal Government Procurement, NABST, March 1992 (see n.15 above).
29 An analysis of the performance of the federal Centres of Excellence, *Beyond Excellence: The Future of Canada's Networks of Centres of Excellence*, was published by the House of Commons Standing Committee for Science etc. in May 1993 (see n.18 above).
30 A discussion of Canada's annual trade deficit in the high-technology sectors and in the context of risk capital, 'Canada throwing away high-tech jobs', by Denzil Doyle, appeared in the *Ottawa Citizen* on 7 March 1993.
31 The critics of the Mulroney administration's technology policies include two Nobel Prize winners, Drs Gerhard Herzberg and John Polanyi, one of Canada's astronauts, Dr Roberta Bondar, as well as the Academy of Science of the Royal Society of Canada.
32 Source of the R&D statistics: *Statistics Canada*.