FEDERAL SCIENCE AND TECHNOLOGY REVIEW

IC mmunity Workshop Highlights

PETERBOROUGH

JULY 12, 1994

Chairperson: Dr. Colin Taylor, Associate Dean, Research and Graduate Studies, Trent University (Phone: 705-748-1478)

Sponsors: Trent University; Peterborough Chamber of Commerce; Sir Sandford Fleming College; Greater Peterborough Economic Council

Participants: 90: 36 academic; 44 business; 10 government.

Federal management of S&T investments

Research could be better targeted to enhance Canada's strengths and address the challenges.

Simplify and coordinate government science and technology programs by creating a one-stop service with effective delivery systems to the communities.

Increase the used tax incentives; establish joint funding initiatives to enhance cooperation and partnerships among industry, academic and government sectors.

Focus on Peterborough

Cooperative arrangements between institutions, such as the one between Trent University and Sir Sandford Fleming College, whereby students can move flexibly back and forth, transferring credits and receiving a degree using courses taken at both institutions, was identified as exemplary.

Hire experienced policy makers with a science and technology background. Involve provinces more in setting science and technology policy.

At the international level, increase support to allow our trainees and scientists to go abroad. Import innovative technology is systematically and develop better legal means to protect our investment in science and technology.

Setting Priorities

We need to improve the appreciation and knowledge base of S&T through education and skills training/retraining.

S&T research efforts could be more focused on those sectors in which Canada is a recognized leader, such as natural resources and telecommunications and targeted to address critical issues such as services for the aged, green technologies, mass transit and agricultural competitiveness.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

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Suggestions for improving the transfer of science and technology included: increased cooperative exchanges among industry, government and academia; better use of the information highway; and a stronger link between research and its applications.

Common Views

Science policy should be viewed as an instrument of national policy.

Canada needs to be better at training or teaching people how to apply science to the practical world.

Improve linkages between applications and research.

Increase numbers of women in science, particularly in earth sciences, chemistry and physics.

Thoughts on the process

As most of the attendees were "producers" of science and technology, it was felt that more "users" should participate in the consultations.

A half-day session was considered by some to be too short.

Prepared by the Science and Technology Review Secretariat
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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

PINAWA

JULY 14, 1994

Chairperson: Dr. Colin Allan, Vice President, Physical and Environmental Sciences, AECL Research (contact: Dave Studham, phone: 204-753-2311). Mr. Mike Owens and Ms. Laurie Courchesne were co-facilitators.

Sponsor: Atomic Energy of Canada Limited (AECL) Research Whiteshell Laboratories

Participants: 83: 13 academic; 5 business; 25 government; 38 AECL; 2 private individuals.

Federal management of S&T investments

Government research and development policy should not be bogged down by political or bureaucratic decisions.

Develop a long-term science and technology strategy, unaffected by political or bureaucratic considerations.

Government should create more tax incentives for private industry involvement; more support should go to small and medium-sized companies to initiate or increase their research and development activities.

Increase funding for basic research and high-risk research; Natural Science and Research Council (NSERC) and Career Oriented Summer Employment Program (COSEP) programs should continue.

Focus on Pinawa

Investment in nuclear research and spin-off industries should increase.

Nuclear waste disposal knowledge should be transferred to help create environmental waste disposal businesses.

"We have the infrastructure. We have a strong information-technology industry. We have a strong medical research industry. We have a nuclear research laboratory whose potential is not being tapped." (Dr. Albert Lee of AECL as quoted by the Winnipeg Free Press, July 14, 1994.)

Setting Priorities

Remove barriers between science and business through education, ie. co-op student programs at colleges and universities; a national science curriculum for the Canadian school system; science as a mandatory subject.

Improved communication and understanding between science and industry must take place to ensure commercial viability of scientific developments, and the creation of new jobs.

Research is important to the development of value-added products. The role of research in this area needs to be better understood and appreciated.

The ongoing development of the Electronic Highway is a major priority.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Common Views

Canada's education system is key in raising the profile of science and technology, and in increasing participation in the sector by young Canadians.

Communication between scientists and the public could improve, to strengthen understanding of the cause and effect between research and job creation/quality of life.

The science community should be working together, whether it be with universities, colleges, schools, or laboratories in private industry or government.

Promoting and establishing global partnerships in science and research will bring universal benefits.

Thoughts on the process

Over 118 invitations were extended for the event. The invitation list included private sector (39), federal and provincial labs (21), municipal representatives (13), universities (14), Aboriginal peoples (4) and others. For a variety of reasons namely, the summer vacation period and the short time-frame for organizing the event, many were unable to attend.

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Community Workshop Highlights

EDMONTON

JULY 19, 1994

Chairperson: Dr. Martha Piper, Vice-President (Research), University of Alberta, (Phone: 403-492-5353). (Contact person: Katharine Moore, Office of the VP (Research), phone 403-492-0868)

Sponsor: University of Alberta

Participants: 51: 16 academic; 10 business; 16 government: 9 others.

Federal management of S&T investments

Government programs are not well integrated; some programs are not well marketed and hence not well known to business.

A re-examination of both current regulations and process was recommended. The regulatory environment must not be capricious and the regulatory process should not be burdensome. The regulatory environment in telecommunications, for example, is felt to be too restrictive, leaving little room for experimenting.

Focus on Edmonton

Science and technology policy needs to be more prominent and high profile in the national scene; it also needs to be understandable for Canadians. The national science strategy, once developed, must be promoted and communicated so that all Canadians are aware of the importance of science and innovation.

It is difficult to do applied research in some areas without leaving Canada.

A full-inventory of regulations currently in place should be done.

Financing is a barrier; Canada needs to alter the tax credit system; must assist more broadly to help companies to survive transition when funds are scarce.

The federal government was seen to have a role in gathering information on commercial opportunities and re identifying emerging technologies.

Any S&T research policy must emphasize the social and cultural impacts of technological change. All regulations should be assessed regarding their impact on the national well-being.

Setting Priorities

Specific and major goals for S&T need to be set and clearly articulated. Goals should be achievable, measurable, and include: job creation (youth employment), education, wealth creation, and innovation.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

A national S&T strategy should capitalize on Canada's natural advantages (eg. natural resources, geography) and acquired advantages (eg. basic research infrastructure, excellence of medical and social support systems, inventiveness of people and telecommunications expertise).

Social science has a key role to play in researching and the links between technological change.

This S&T Review process must explore the question of the federal role in promoting outcomes/commercial applications of S&T research. Scientists need to recognize market opportunities arising from their research and business must be made aware of research results; seed money would help scientists and small business; university student/staff exchange programs with business can also be helpful.

In order to assess science priorities and spending we need more thought and better measures of the impact of various policy options and likely return on investment; we also need to evaluate frequently.

To capitalize on S&T, Canada needs: an effective S&T strategic plan, with identified goals; management to carry high tech inventions through to international markets; capital investment and identification of demand (industry) and supply (technology) issues to facilitate exchanges between S&T researchers and industry partners.

It often makes sense to bring in technology from abroad; here Canadian embassies could play an important role; small businesses need ready access to existing technologies.

Government funding does not match priorities.

Common Views

S&T policy in Canada must be seen as senior policy and not subservient to economic or other policies.

Canada falls down in technology transfer/diffusion/commercialization; technology is not getting to the market place; there is a need to connect science and industry.

The national science strategy, once developed, must be promoted and communicated so that all Canadians are aware of the importance of science and innovation.

In whatever we do, we need to search for excellence.

We need to broaden our definition of a scientist. We need to train scientists to look beyond the lab.

Seamless fabric analogy, a continuum must exist from the research lab to the store shelf; S&T should be viewed as a process and the customer should be involved early.

Thoughts on the process

It was felt that more government guidance concerning S&T goals could have improved this consultation process. It was stressed that the Minister should report to the participants at the conclusion of the local consultations process.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

CALGARY

JULY 20, 1994

Chairperson: Dr. Cooper Langford, Vice President (Research), University of Calgary
(Phone: 403-220-5465)

Sponsor: University of Calgary

Participants: 54: 20 academic; 21 business; 9 government; 4 other.

Federal management of S&T investments

Science and Technology Policy lacks coordination between Federal, Provincial and University laboratories. The NRC was suggested as a possible coordinating agency at the federal level. Central bodies in the provinces should be made responsible for facilitating technology transfer, and strategic alliance development, for supplying information on research undertaken in Canada and abroad, and for providing funds to venture capitalists.

Focus on Calgary

Calgary serves as the headquarters of a number of significant university/industry collaborative programs and institutes. An integrated and co-operative approach to S&T is needed in order to bring experts together to meet community needs and identify commercial opportunities. The Calgary approach has been identified as a useful model for the scientific community to adopt in other parts of the country.

Federal policy must recognize the resource-based nature of the Canadian economy, and encourage technological development by SME's to service these resource industries and to create wealth through export.

Government should be a source of direct or indirect funding for long term research that is in the *public* interest -- not just the interest of a single firm or multi-national corporation.

Successful programs such as (IRAP) the Industrial Research Assistance Program, (NSERC-IRF) National Science and Engineering Research Council - Industrial Research Fellowships should be expanded, and tax incentives and the regulatory environment modified to encourage technological *success*, and not merely technological *activity*.

Incentives should be established to stimulate private sector investment in R&D; funding to promote technology transfer could be diverted from the large government labs to the private sector or IRAP.

Canada needs a more comprehensive approach to S&T -- one which encourages the participation of women, integrates international scientific developments, and better evaluates the economic impact of technology.

Government's role should be to educate people on the importance of S&T and to facilitate scientific exchanges and cooperation.

Technological advances must be delivered to the public in order that quality of life be improved or maintained.

Setting Priorities

We need to improve science literacy through public education and the promotion of Canadian innovation; high profile S&T spokespersons should be utilized for media and public relations purposes.

Canada must train its young people to adapt scientific knowledge to the realities of a turbulent world.

A Federal S&T Strategy should place greater emphasis on encouraging small and medium size enterprises to become involved in research and development, and to utilize emerging technologies. One way to promote the technological innovation of SME's would be through the establishment of flexible assistance programs, similar to IRAP. SMEs should cooperate through consortia because they cannot on their own invest very much in R&D but could have a very significant combined effort.

Science and technology must be more responsive to market forces and consumer demand; medium and short term S&T research by government and the private sector must become customer-driven.

Government, the universities and industry must strive for a greater integration of R&D projects and resources. It is necessary that representatives from these sectors work cooperatively to establish scientific priorities and planning.

Common Views

Basic science must be part of a life-long learning culture and must be understood as an important economic strength.

All stakeholders must create an awareness of the importance of science and technology by reporting on the achievements in the area, developing a system for the recognition of those achievement and individuals working in S&T fields, and educating the general public on the value of research and its job creation potential.

Canada must use its S&T resources efficiently by investing in areas which have an already proven track record, by utilizing inherent technological and research strengths; and by developing new strengths. Understanding and accurately assessing the risks associated with technological and scientific development is also crucial to the judicious use of Canadian scientific resources.

In order to best use the knowledge generated by S&T to enhance quality of life, short term scientific activities should be market driven. While the government may play an important role in bringing the scientific community together, innovation and R&D must be facilitated by the private sector so as to assure and strengthen industry input.

Thoughts on the process

Several participants expressed the concern that the questions asked in the S&T Review documents and at the workshops were too superficial, and subsequently suggested that the issue of S&T in Canada deserved a more comprehensive discussion than could be achieved at the workshops.

The hope was expressed that the public consultations serve as the beginning of ongoing dialogue among government, academia, scientists and industry.

The active involvement of Minister Gerrard was welcomed and very much appreciated.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

KELOWNA

JULY 21, 1994

Chairperson: Dr. Bill Bowering, President, Okanagan University College (Phone: 604-470-6026)

Sponsor: Okanagan University College

Participants: 116: 50 academic; 60 business; 6 government

Federal management of S&T investments

Federal S&T policy and program delivery must become more efficient and more responsive to the competitive nature of technological development and scientific discovery.

There should be a "one stop shop" for researchers, including a grants clearing house, and marketing assistance.

The government must assume greater responsibility for encouraging co-operation among all sectors involved in S&T through the establishment of formal exchanges, the promotion of student co-op programs, and by opening federal labs to industry.

Focus on Kelowna

This session consisted primarily of industry participants and the message was loud and clear: Industry was not looking for handouts and 50 cent dollars, but rather, a reactive partner who could assist in responding to rapidly developing market opportunities in innovative and creative ways.

We need to improve the culture of science and technology through education at the primary and secondary school levels.

The funding of capital assets must be increased, as banks are often reluctant to become involved in knowledge-intensive industries.

Greater emphasis should be placed on market-driven research. However, commercialization cannot be undertaken to the detriment of basic research, which remains crucial to maintaining our science base and the generation of new technologies.

Industrial Research and Assistance Program (IRAP) is an excellent program.

R&D needs to be regionalized so as to assure community participation and investment. Subsequently, S&T must be "demystified."

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

Government needs to clarify and expedite intellectual property regulations, so as to allow innovators to take advantage of narrow windows of opportunity.

Scientific and technological advancements must become more market-driven and linked much more closely to industry.

The serious shortage of risk capital must be addressed. Insufficient funds are of major concern to SME's – especially those in knowledge-based industries – and a more positive climate for investment must be established.

Twinning remote communities with centres of scientific excellence through electronic media would promote greater scientific exploration and discussion.

The establishment of ethical reviews for all areas of research is necessary to foster greater integration and cooperation within Canada's scientific community.

Common Views

Industry would like to see government energies directed toward the "development" side of the R&D equation, emphasizing getting the product to market, once it has been produced.

Increased linkages and collaboration among industry, academia and government is crucial, and an objective to which industry is willing to commit considerable time and resources.

In the area of S&T, the government needs to "spend better, not more."

Waste disposal, environmental management and forestry were identified as priority sectors for S&T research and development.

More attention must be focused on maintaining Quality of Life. The development of *sustainable* technologies is integral to the well-being of future generations, and will influence impending scientific priorities and decision-making.

Thoughts on the process

There was great energy and enthusiasm for the process, and the group was highly motivated and eager to contribute their ideas.

The format (a plenary discussion followed by ten breakout groups) proved effective, and events proceeded smoothly. Welcoming remarks were followed by two local success stories – brief presentations by Sun Rype Products Ltd. and Total Care Technologies – which were useful in initiating discussion and setting an appropriate tone for the consultation.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

VICTORIA

JULY 22, 1994

Chairpersons: Dr. David Strong, President, University of Victoria (Tel: 604-721-7002)
Dr. Michael Corcoran, Research Administration (Tel: 604-721-7971)

Sponsor: University of Victoria

Participants: 70: 35 academic; 14 business; 21 government.

Federal management of S&T investments

The government must assume greater responsibility for encouraging co-operation among all sectors involved in S&T through the establishment of formal exchanges, and by opening federal laboratories to industry.

Canada needs to establish a **National Academy of Sciences**, which could operate under the auspices of the Royal Society. As the Academy would assume the NABST role in performing studies, it is essential that such an organization operate at arm's length from government so as to ensure credibility.

Government needs to balance short-term and long-term goals.

Focus on Victoria

One of the most significant issues to emerge from the Victoria session was marine conservation and the need for improved ocean technology. Depleting fish stocks, waste disposal, aquaculture, marine transportation and tourism were identified as priority areas for technical innovation and science funding. Participants supported the termination of the B.C. moratorium on exploration, which they believed would provide the stimulus for significant growth in marine and marine-related sectors.

There needs to be *continuity* and *consistency* in federal government S&T policy.

The responsibility of R&D performance must be shifted from government to the private sector.

Government needs to provide industry with incentives for undertaking research activities -- IRAP is identified as a good program because it encourages technical risk taking.

There needs to be a national effort to enhance technology-based learning, and to increase the number of scientists graduating from Canadian universities.

The role of television should be exploited to create a science culture in our youth.Government should purchase and utilize private sector products, as this practice lends credibility to private sector enterprise, and provides private firms the opportunity to partner with a client to develop product innovation and improvement.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

Canadian investment in S&T must focus on areas of inherent strength and national importance.

Government should look at SPARK Ocean report.

Government needs to assume an active role in filling the gap between innovation and commercialization.

The establishment of better lines of communication among all S&T stakeholders is critical.

We need to strive for a greater than "50% competency" target in our education systems.

It must be determined whether legislation is required to delineate federal marine responsibilities.

Common Views

Industry would like to see taxes reduced so that Canadian private sector enterprises may become more competitive on international markets. Growing companies which are reinvesting their profits in research and expansion should be accorded a lower tax rate.

Increased linkages and collaboration among industry, academia and government is crucial.

Federal labs should be more closely connected to their communities – providing information to schools and private companies.

Applications for government assistance should be evaluated on their probable return on investment.

University scientists should be rewarded for undertaking serious scientific research, not victimized by the syndrome of "publish or perish."

Industry wants co-operation, not competition, from government.

Federal S&T strategy must be developed in the context of debt/deficit management.

Thoughts on the process

After an introduction, and comments by representatives of two local "success stories," the plenary broke into 8 working groups, each tasked with discussing five topics outlined in the first session (Federal Tax Structure, Role of Federal Government in Encouraging Technology Transfer, Incubator Companies, Areas of National Importance, and Interaction with Federal Labs). After a break, this process was repeated with another five discussion topics (Research in Government Labs, Role of Federal Research Councils, Labs and Outside Groups, Science Training, and S&T in the Community). This format could have been improved by having each group discuss a single topic, allowing greater depth of discussion and input.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

HALIFAX

JULY 26, 1994

Chairperson: Dr. Robert Fournier, Associate VP Research, Dalhousie University (Phone: 902-494-6513).

Sponsors: Dalhousie University

Participants: 43: 18 business; 11 public sector; 12 academic; 2 other (community).

Federal management of S&T investments

Canada needs a cohesive federal S&T policy.

Federal S&T spending should emphasize wealth creation, not data collection.

The Centres of Excellence concept needs to be re-examined. We need regional centres of excellence -- connected by an information "freeway."

A portion of NSERC funding should be re-allocated for collaborative projects with industry.

The federal government's role is to fertilize and facilitate participation in a knowledge-based economy.

Focus on Halifax

If we're going to create wealth, we have to offer something of value to the rest of the world. We have to take advantage of the positioning we have -- as the No. 1 location for quality of life, according to the United Nations -- and sell this by showcasing our example of quality of life and public/private models. This should be a strategy for development at next year's G-7 Economic Summit meeting in Halifax.

Government must assume a vital role in fostering co-operation between the private sector, universities and federal laboratories. Government-sponsored industry/university partnerships, student co-op programs and industry sabbaticals for university researchers are options which may encourage greater S&T collaboration between private and public sectors.

Federal support for R&D should be allocated to the private sector, or to co-operative government/industry ventures.

Canada needs to create and foster a culture of entrepreneurship.

Competition between industry and government must be eliminated; industry does not do as much as it should because government does too much.

Industrial Research Assistance Program (IRAP) projects must be more rigorously evaluated.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

We need to devise strategies for using key resources more creatively; e.g., universities and oceans.

Federal S&T spending must encourage investment, innovation and entrepreneurship.

Government needs to assist in the creation of an environment which challenges companies to excel internationally.

We need to recognize that existing technology is not generally accessible beyond the elites; clusters of computers networked to the information highway should be available to young people.

The information "freeway" must be fully utilized for disparate groups to realize disbursed expertise.

Financing for investments must be increased.

Common Views

Appropriate incentive systems must be established to encourage broad public investment in knowledge industries and to encourage research scientists in universities and research organizations to work with the private sector.

The information highway is a critical tool for knowledge enhancement and business development, and access must be broadly based.

The federal government should analyze the short and long-term impacts of its policies and programs as they relate to the development of the private sector.

Export innovation and entrepreneurship are key to building value and generating wealth.

Voluntarism is very strong in Atlantic Canada and should be utilized as an important resource.

Our future science and technology development should be seen as a community/societal opportunity.

Thoughts on the process

The general awareness level of the federal government's role and investment in science and technology was high, and the tone of the discussion was positive.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

FREDERICTON

JULY 27, 1994

Chairperson: Dr. Frank Wilson, Vice-President, Research, University of New Brunswick (Phone: 506-453-5189).

Sponsors: University of New Brunswick

Participants: 88: 30 academic; 15 government; 43 business.

Federal management of S&T investments

We need to develop a science and technology culture through education and skills training/retraining.

Government bureaucracy needs to be reduced, and federal S&T information simplified.

Canada must become better at entrepreneurship and risk-taking.

Focus on Fredericton

We have not encouraged risk taking in the broadest sense including risk taking for universities to develop new programs... The percentage of science technology funding to job creating enterprises needs to be increased.

Government needs to encourage university and private sector collaboration and to make funds available for R&D projects where both private sector and university funding is present.

Atlantic Canada Opportunity Agency (ACOA) has successfully provided much needed short-term funding and filled the gap existing in the banking system to allow for research and development financing.

National Science and Engineering Research Council (NSERC) has done a good job, particularly recently with the development of Industrial Chairs at universities which focus on particular areas such as Pulp and Paper or Nuclear Engineering. This initiative brings industry and universities together to work on research issues affecting the Canadian economy.

Industrial Research Assistance Program (IRAP) should be maintained and strengthened.

Laboratories and other federal S&T resources should be made available to the private sector; federal labs should be removed from university campuses.

The R&D tax credit system already in place must be maintained and improved to encourage research by SMEs.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

Banks must be encouraged to provide greater financial support for research and development initiatives.

Industry and the universities should co-operate to develop mentoring programs in industry for university graduates.

Government needs to develop a long-term plan for the use of natural resources -- including the utilization of recycling material.

Any future science and technology policy must allow for regional priorities and administration.

We must maintain a balance between pure and applied science.

It is vital to maintain and accelerate investment in proven Canadian technologies (nuclear power reactors, space, e.g.)

Research opportunities in Canada must be made more attractive so as to prevent Canadian scientists from emigrating elsewhere.

Common Views

There is a strong need to improve communication among sectors of the scientific community (e.g. industry, government and the universities) and the general public.

There needs to be a stronger differentiation between basic, applied research and technology transfer. There should be more incentives for research and development and patent development in universities.

Government programs such as IRAP and NSERC need to be continued and enhanced. These programs should also focus on more universal opportunities.

R&D benefits need to be maximized through cost-sharing, client driven regional programs.

Thoughts on the process

Workshop participants were very supportive of review process and impressed with the active role played by Minister Gerrard. The questions, however, were felt to be too broad.

The most common concern was that the process be maintained for participants to have further input into the review.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

CHARLOTTETOWN

JULY 28, 1994

Chairperson: Dr. Geoff Ralling, Director, Research, University of Prince Edward Island (Phone: 902-566-0561)

Sponsors: University of Prince Edward Island

Participants: 36: 11 academic; 7 government; 18 business.

Federal management of S&T investments

Government must encourage coordination, communication and cooperation among S&T stakeholders.

Canada needs a coherent S&T policy – with clearly defined programs which are readily accessible to individuals seeking information or financial support.

Government support should be given to projects that involve university and private sector collaboration on R&D.

Focus on Charlottetown

Our continued prosperity and quality of life is threatened by the failure of industry to adopt S&T and by the Canadian failure to take commercial advantage of new knowledge... Our ability to generate new knowledge is good but our ability to commercialize knowledge is poor. This inability to commercialize new knowledge must be addressed.

Research results and activities within university and government labs must be better communicated to the private sector in order to take commercial advantage of R&D.

Government agencies must coordinate their activities to avoid duplication and conflict.

University and government researchers and research planners must be more attentive to industry's needs and problems.

Programs which encourage or require that industry identify problems and opportunities for research should be continued (e.g. the National Research Council (NRC) and Industrial Research Assistance Program (IRAP), which has proven especially effective because of its focus on problems of interest to industry and it decentralized decision-making process).

It is imperative to develop a means for ensuring that the various government laboratories are aware of each other's activities so that they avoid duplication and can better coordinate their efforts.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

There is a need to have applied research recognized as advancement of knowledge and the need to have basic researchers working more closely with industry to address the poor record of technology transfer and commercialization of research in Canada.

Canada needs a national S&T vision and mission-driven science. Some participants thought that the Networks of Centres of Excellence were a step in this direction.

The information highway must be developed as mission-driven technology.

Common Views

S&T will be responsible for the creation of wealth and jobs in the coming years.

Educational activities, and in particular, public knowledge of S&T is important to achieve quality of life benefits. Only a well educated, knowledgeable population can make informed decisions about science and technology issues.

It is very difficult for an individual to navigate or find the way between agencies or departments and this prevents individuals from developing a coherent picture of the research support available.

S&T within the federal government is characterized by insufficient program planning and vague research objectives.

There is insufficient communication and cooperation amongst S&T players. There does not appear to be any central vision or coordination to achieve commonly shared goals.

Thoughts on the process

The tone of the workshop was supportive and concerned. Participants seemed genuinely interested in the exercise and approached the discussion with a positive attitude.

However, there was general consensus that the wording of question three is very poor. Rather than "How can science and technology contribute to the advancement of knowledge," this might better read, "How can federal support of science and technology contribute to the advancement of knowledge?"

Many of those who attended expressed the desire to see that Industry Canada develops a clear idea of how the local consultations will feed into the regional conferences. The need for a mechanism to select and brief participants who will go on to attend the regional conferences was clearly articulated.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

ST. JOHN'S

JULY 29, 1994

Chairperson: Dr. Kevin Keough, VP Research, Memorial University of Newfoundland (Phone: 709-737-8000)

Sponsors: Memorial University of Newfoundland

Participants: 68: 31 academic; 21 business; 15 government; 1 other.

Federal management of S&T investments

The education system needs to be improved to provide a stronger base for the building of a science and technology culture where the general population has well-developed, critical thinking skills.

Government should consider directing more of its funds to collaborative efforts between industry, government and academia than it does now.

Programs such as IRAP and the NSERC Operating Grants are particularly successful because they are very flexible.

Focus on St. John's

A clear understanding of issues such as environment and health require a greater understanding of Science and Technology concepts among the general public. Before we can get to this level of understanding, we need to improve the education system so that people can have an active and educated role in the public debates on science and technology issues.

There is a need for a mechanism to fund large long-term projects of a strategic regional or national significance.

Government needs to direct policies and monies to creating and sustaining links between knowledge *creators* and knowledge *users*.

There is a need for better and increased accountability. Are we doing appropriate research and development? Are we measuring this R&D output?

There should be greater organization of the knowledge pool to facilitate access to existing documented knowledge.

Government should contract out more research and development from its labs to encourage greater private sector and academia involvement and buy-in.

Peer review by experts external to the government – industry/academia/other agencies -- is desirable in determining which specific projects and longer-term strategic thrusts should receive funding.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

University research should be focused on inherent strengths and make improvements in Science and Technology which have significant local reference.

We need to establish a culture for risk-taking in the management of Science and Technology.

Some research priorities should be established on a regional basis, focusing on local needs.

Common Views

Government funding should be used as an incentive to foster collaboration between private and public S&T sectors.

We need to establish national standards for science education.

It is important to follow the success of funding models such as NSERC and IRAP.

Our strength is in basic research, but as a nation, we are poor in applied research.

Too many well-educated graduates are leaving Newfoundland. We need to have students consider entrepreneurial enterprises, with multi-disciplinary support within the university.

Science and Technology contributes to our sense of national identity.

Thoughts on the process

The general awareness level of the federal government's role and investment in science and technology was high, and there was much support of the consultation process, with people adopting a constructive approach to the issues being faced.

Many participants expressed the desire for further input into the policy process, and suggested that a local mechanism to continue dialogue be established.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

SHERBROOKE

AUGUST 2, 1994

Chairperson: Alain Caillé, Vice-Rector, Research, Université de Sherbrooke (Phone: 819-821-7700)

Sponsors: Université de Sherbrooke

Participants: 63: 40 academic, 20 industry, 3 government.

Federal management of S&T investments

Focus on Sherbrooke

Long-term training and labour force strategies are essential, as is co-operation among all stakeholders (governments, private sector, universities).

There are not enough links between universities and businesses. Mechanisms must be found to promote the creation of such links. Both groups would benefit, and Quebec's and Canada's competitiveness would be strengthened. Some participants proposed brief get-acquainted sessions (15-minute interviews) between businesses in a given sector and university researchers. It was also noted that events such as technology fairs help researchers and businesses to understand one another better. Universities should also make businesses more aware of the services they can provide. Technology fairs should increase researchers' visibility.

Ways must be found to enable university professors and graduate students to work in businesses in general, and small businesses in particular. One participant mentioned the case of a doctoral student who did research work in a small business, and whose research expenses were covered by a grant from the Natural Sciences and Engineering Research Council (NSERC). This experience was useful for everyone, and would be worth repeating.

Setting Priorities

Businesses do not do enough R&D. They could be encouraged to do so by automatically deducting a certain amount of money from them. Bill C-91 could serve as a model; it requires pharmaceutical firms to devote 10% of their sales to R&D activities.

Quebec small businesses do not employ enough engineers. There is a provincial program that facilitates the hiring of engineers in small businesses. The federal government is also studying a similar initiative, but its efforts are inadequate.

Businesses need technical specialists, but these persons must have some general knowledge as well (in management, for example).

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

It was recommended that students be able to complete business internships to prepare themselves for the labour market. Former students should also be able to benefit from coaching for a certain time after completing their studies.

Common Views

One representative from the private sector stated that tax credit application procedures are too long and that filling out forms is tedious. Rather than looking for money (through tax credits) to conduct research activities, he prefers to devote his time to making sales.

Training must be better linked to market demand. There are too many trained researchers in fields that have no openings, while in other fields there are not enough researchers.

Public research centres should bill businesses more for the services they provide. This would force businesses better to structure their projects and would create an additional source of funding for the centres.

Grants and contracts are spread too thinly throughout the country. In addition, some participants felt that some projects are receiving government funding that do not deserve it. Rather than providing financial assistance to marginal projects, the government should properly finance valid and formative projects.

Attitudes must be changed, starting with students who want to work in large firms because they are afraid that in small businesses they will have to be jacks-of-all-trades.

Improving the quality of life will be achieved in two areas: labour force training and liaison mechanisms with small businesses.

Linkage between universities and businesses must be made easier. How can this be achieved?

R&D tax credits are not always used for research. They are sometimes used to boost businesses' profits, rather than to finance research.

Canada must identify niches of excellence.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

ST-HYACINTHE

AUGUST 3, 1994

Chairperson: Réal Lallier, Associate Dean, Research, Faculty of Veterinary Medicine (Phone: 514-773-8521)

Sponsors: University of Montreal, Faculty of Veterinary Medicine

Participants: 40: 25 academic, 10 industry, 5 government.

Focus on St-Hyacinthe

The importance of science is recognized for both advancement of knowledge and economic development. All proposals must be rigorously reviewed to ensure that the benefits are substantial and that the proposals are in accordance with national objectives.

Federal management of S&T investments

Federal S&T spending often serves as a "bridge" between the academic and industrial communities, making it possible to close the gap between these two economic agents and produce products for which a market exists.

The federal government must stop acting as a philanthropist. It must explicitly take into account the following elements when choosing projects:

- The short and long-term return on investment.
- The researcher's qualifications. For example, has he or she already done basic research?
- The linkage involved in carrying out the project. It was suggested that a project be funded only if private companies assume part of the financing. The federal government should demand a royalty on revenues resulting from the marketing of a product for which it financed the development.

Setting Priorities

It was suggested that the federal government finance applied research in universities and that industry finance those aspects of the research that are more geared toward meeting a market requirement.

Federal action would be more effective if the following objectives were kept in mind:

- Avoid multiplying programs.
- Strengthen links between university researchers and businesses. To this end, it was suggested that researchers spend a sabbatical year in the private sector.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

- Avoid being obsessed with short-term profitability when choosing projects. Unfortunately, it seems to be difficult for researchers to find funding for projects of which the benefits will be known only in the long term.

- Encourage projects in sectors where there is a critical mass of knowledge and where industry can become involved.

Common Views

With regard to technology transfer, it was noted that industries do not have qualified personnel to receive new technologies. Moreover, universities state that they are training qualified people, but graduates often cannot find work. There is thus a need to facilitate the entry of graduates into industry, and to foster a sense of entrepreneurship among graduates.

Basic research must continue to exist and to be encouraged. It was recognized that it is difficult to assess the usefulness of long-term basic research projects. Researchers must be required to assess the usefulness of their research.

Canada does not allocate enough of its resources to R&D. Its current R&D/GDP ratio is woefully inadequate (1.4% compared with 2.5% for most major industrialized countries). Moreover, Canadian society does not value researchers.

With regard to technology transfer, it was noted that industries do not have qualified personnel to receive new technologies. Moreover, universities state that they are training qualified people, but graduates often cannot find work. There is thus a need to facilitate the entry of graduates into industry, and to foster a sense of entrepreneurship among graduates.

Tax credits are good tools for financing R&D, but the application procedures are very complicated. The procedures should be streamlined, and eligibility for tax credits should be extended to the pre-marketing phase.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

QUEBEC CITY

AUGUST 4, 1994

Chairperson: Jacques Desmeules, President, Quebec City/Chaudière/Appalachians Techno-Région (GATIQ)
Jean-Eudes Bouchard, CEO (Phone: 418-692-2470)

Sponsors: GATIQ

Participants: 101: 34 academic, 33 business, 33 government (research centre) and 1 MP.

Focus on Quebec City

Science and technology jobs are created by increasing "spinoff effects" that build bridges between the academic and business communities. To promote these types of effects, it was recommended that institutions explicitly adopt spinoff and incubation policies.

Federal management of S&T investments

Existing links among stakeholders in the science and technology field must be strengthened. To do so, the federal government might base its efforts on a number of existing models in Quebec, as follows:

- Increase links among the three levels of education (secondary, CEGEP and university).
- Increase links among universities, businesses and governments through linking organizations such as the Centre de recherche industriel du Québec (CRIQ), the National Optics Institute (NOI), and the Centre francophone de recherche en informatisation des organisations (CEFRIO).
- Adjust or modify the federal infrastructure program to increase economic spin-offs.

Setting Priorities

- Promote entrepreneurship among young scientists, and develop support mechanisms for them when they leave universities or research centres, such as training by experienced businesspeople.
- Professors must inform graduate students of the patent and commercial aspects of their research work.
- High-technology companies must be able to depend on high-quality input from suppliers to be competitive internationally.
- It was hoped that links can be forged between venture capital corporations and researchers to stimulate investment.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

- More statistical studies by the federal government on job creation in R&D-intensive fields would be appreciated.

- It was suggested that management students receive science training and that science students receive management training. Governments must pursue their efforts to expand the public's science culture.

- More information must be provided to small businesses, especially with regard to technology monitoring activities.

The establishment of science and technology priorities must sometimes be based on regional comparative advantages, and at other times on market opportunities. Moreover, regional priorities must be respected; we should not attempt to impose other priorities on the regions.

Common Views

Increase budgets allocated to S&T activities or make government spending more effective:

- by reducing the number of programs and the complexity of the procedures connected with them;

- by assigning more work currently conducted in government laboratories to the private sector.

Integrate S&T policies into employment policies.

Competition must give way to co-operation at all levels.

Science and technology development must be seen as an economic engine, because S&T activities make it possible to develop value-added products, thus creating high-quality jobs.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

MONT-JOLI/RIMOUSKI

AUGUST 5, 1994

Chairperson: Jean Boulva, Director of the Maurice Lamontagne Institute (Phone: 418-775-0500)

Sponsors: Maurice Lamontagne Institute, Department of Fisheries & Oceans

Participants: 36: 12 academic, 11 business; 13 government.

Federal management of S&T investments

The following measures must be taken to promote business development and competitiveness:

- Promoting partnership among the three stakeholders (businesses, universities and governments) in the S&T field.
- Basing applied research on industry's needs.
- Concentrating on competitive strategic sectors at the international level.
- Strengthening Centres of Excellence and establishing satellite centres in the regions.

Focus on Mont Joli/Rimouski

A balance must be maintained between basic research and applied research, and between scientific megaprojects ("big science") and small projects ("small science"). Science-related leisure activities and international exchanges should be encouraged.

To enable Canada to catch up to other countries with regard to S&T, industry members must be urged to participate in scientific missions and not be reluctant to look for better ideas in other countries.

It was suggested that measures be used to expand the public's science culture such as competitions, science tourism, school programs, debates between scientists, and awards of excellence.

Because there are few links between those who produce research and those who use it, particularly industry, new mechanisms should be used to establish links between these two stakeholders.

It was felt that the government allocates enough money to S&T activities, but that one third of these expenditures are poorly targeted, meaning that we need to focus on the quality of the research being conducted.

Setting Priorities

Workshop participants first identified sectors of strategic interest in which science and technology activities can improve the quality of life: human health, the environment, marine resource management, job creation, tourism development, visibility of science initiatives, and mineral resource management.

To enable Canada to catch up to other countries with regard to S&T, industry members must be urged to participate in scientific missions and not be reluctant to look for better ideas in other countries.

To remedy the shortage of scientists in the labour force, it was suggested that a program be established similar to the former Scholarships Program, but adapted so as to promote the transition of researchers to businesses and universities. This would make it possible to increase the number of scientists in small businesses and would help remedy the problem of the aging of researchers in educational institutions.

Common Views

Scientific investments must be made in the following sectors to improve the quality of life:

- Environmental technologies, including waste management, water purification and soil decontamination.
- Programs to raise young people's awareness of science.
- Marine, mining and secondary and tertiary processing industries.
- Knowledge of species.

Regulation plays a role in improving the quality of life. To make it more influential and less costly, it was proposed:

- that scientists' opinions be taken into consideration when preparing regulations;
- that all stakeholders be involved in developing standards.

All stakeholders in the S&T field should be involved in decisions that direct government action. In addition, the federal government was urged to take real consideration of the opinions formulated during the consultation sessions, and to apply them.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

HULL

AUGUST 8, 1994

Chairperson: Gilles Quesnel, Director of the Centre de la PME-UQAH (Phone: 819-773-1806)

Sponsors: Université du Québec in Hull

Participants: 70: 40 academic, 10 industry, 20 government.

Focus on Hull

When measuring the impact of S&T on economic growth and quality of life, it must be recognized that the effects of R&D are often indirect, and that assessments must take into account the full R&D cycle, up to and including the marketing phase, fully to appreciate the role of S&T.

Federal management of S&T investments

- Government must act as a "sponsor", by providing funds to create permanent jobs that make it possible to manage and direct regional establishments and organizations responsible for encouraging innovation within the local community.
- Government must develop a more flexible method with regard to its programming and institutions, to meet the real needs of industry and society. This applies especially to providing information through new technical means.
- The government must play a more affirmative role in supporting the marketing of R&D results. The research side is receiving too much attention; we must focus more on strategic fields of interest to Canada.

Setting Priorities

- Help university and government laboratories to develop an approach of co-operation with industry. Expand the co-operative system for students (interns) so that they acquire experience in industry.
- Improve science training for managers and management training for scientists.
- It is important to see R&D as an investment, rather than an expense.
- Canada must develop niches of excellence better to position its technological assets on world markets.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Common Views

- Government plays an important role in supporting marketing (tax credits, international market). It must focus on strengthening international links for small business, co-operation with Europe and North America at international fairs, and marketing technologies.

- It is essential to create single windows for laboratories' R&D services and R&D programming.

A number of common ideas were expressed in the four sessions: defining the appropriate and changing role of the federal government regarding promotion of the following elements: entrepreneurship, science culture, innovation, strong decentralization, links with regional authorities, and services to small businesses with regard to capital, international marketing and access to programs and information through new technologies.

It must also be ensured that the federal government's role involves facilitating activities (in addition to providing funds, an infrastructure, qualified personnel and public property). It plays an important role as an agent of social change by effecting desired adjustments to technological change in the work environment and in society as a whole. When measuring the impact of S&T on economic growth and quality of life, it must be recognized that the effects of R&D are often indirect, and that assessments must take into account the full R&D cycle, up to and including the marketing phase, fully to appreciate the role of S&T.

Thoughts on the process

A number of well expressed messages were formulated as a result of the workshop: technological change can destabilize the work environment and society; and government plays an important role by providing analyses of these changes and demonstrating ways of adjusting to them.

The problem must be re-evaluated of an archaic education system that requires substantial changes to address real issues of training, transition to employment, and learning techniques.

Some participants called for increased participation by regional stakeholders and constituents in activities of federal agencies and departments that control R&D expenditures.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

HAMILTON

August 9, 1994

Chairperson: Dr. Martin Taylor, Acting Vice President Research, McMaster University (Phone: 905-525-9140)

Sponsors: McMaster University

Participants: 116: 61 academic; 48 business; 7 government.

Federal management of S&T investments

Government needs to develop a stronger science culture through the allocation of more funds to Science Culture Canada and to other related programs.

It is necessary to fully integrate federal and provincial S&T initiatives.

The tax system must be restructured so that risk-taking is rewarded.

Canada needs a long-term S&T policy.

Focus on Hamilton

Make S&T success measurable by analyzing the relations between inputs and outputs and then create a set of fundamental guidelines for testing... we need to be able to measure innovation and R&D in this country.

Government should link job creation with science and technology.

Investment tax credits should be increased – they prevent migration of domestic R&D.

We need to establish criteria for measuring the rate of return on investing in S&T.

It is critical to stimulate "partnering"to strengthen innovation.

The development of national educational standards is central to the development and understanding of a science culture in Canada.

Government partnerships with banks would create a better support system for Canadian entrepreneurs.

There have to be "research bridges" with the education system.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

Setting Priorities

We need to create jobs and wealth within the context of sustainable development.

More resources must be devoted to the commercialization of emerging technology.

Encourage more engineers to be directly involved in the application and commercialization of technology.

Common Views

There must be better communication among academia, industry, business and government to ensure meaningful collaboration and a more comprehensive approach to S&T policy.

Education must be improved.

S&T policy must represent a coordinated effort across all levels of government.

Training and experience is the essence to education and the advancement of knowledge.

Thoughts on the process

The general awareness level of the federal government's role and investment in science and technology was good, however the perception was mixed.

The tone of the discussion was supportive.

The mix of participation from academia (actively involved in R&D); colleges; industry at all levels and across several sectors, and both levels of government provided balanced discussions of the issues raised.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

WINDSOR, ONTARIO

August 11, 1994

Chairperson: Dr. William E. Jones, Vice-President Academic, University of Windsor (Phone: 519-253-4232)

Sponsors: University of Windsor

Participants: 61: 38 academic (R&D); 3 MPs; 18 private sector; 2 public sector

Federal management of S&T investments

Government has a role to play in helping to bridge the gaps between research, development and marketing: i.e. overhaul tax credit structure, provide venture capital.

There are many regulations (red tape) surrounding the commercialization of technology, including regulations on banks and financial institutions. The overall process should be streamlined.

Focus on Windsor

A new paradigm is emerging: the closer integration of physical sciences and social sciences. Science and technology should not be viewed as only involving the traditional fields of engineering, medical, etc.. This paradigm should be reflected in the policies of federal advisory bodies, such as the Canadian National Academy and the granting councils.

There should be a strong emphasis on human resources, particularly education and training. The education system in Canada must be reformed, from the way we teach children in elementary school, to the way we upgrade the skills of those already employed so that our skill base remains flexible and current.

Setting Priorities

- S&T has to be market-oriented and industry-customer focused;
- Government should view S&T research and product development as "works in progress." Government should help to coordinate S&T knowledge and solutions with market-driven mechanisms such as loan guarantees, and a formal process to introduce the product into appropriate markets.
- Government needs well-trained individuals to put industry in touch with the appropriate S&T funding programs.
- Government should provide support and assistance to industry but let industry lead in S&T/R&D.
- There should be recognition by government of the significance of developing new products that expand on old technologies, which in turn, result in new technologies.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

- In many cases R&D is being performed, but is not recognized as R&D by those performing it. Government should help business identify their R&D needs and opportunities.

Common Views

The government must build on Canada's existing resources and strengths (i.e. areas where we have a competitive advantage).

Natural resources continue to be one of Canada's main strengths and generator of wealth. This is a strength that should not be neglected. Thus, we should develop our leadership in this area via knowledge-based industries and technology to reduce the exploitation of natural resources, and use this technology to spin-off other industry advances.

Encourage the development and use of clean technologies and the preservation of the environment.

Investment in any area will be lost without adequate investment in human resources. The continued development of people is the key to the future.

The role of government is to act as a *facilitator* for promising industries. It should not try to direct the private sector to get into specific industries.

Federal Government needs more *leaders* who are willing to take risks in supporting S&T activities, as opposed to *managers*, who are not encouraged to take risks.

Canadian society must work to instill excellence and pride in all jobs, in all sectors of the economy. The S&T we perform must be the best we are capable of performing.

Smart technologies will lead to new products and sales. New products resulting from application of S&T have to meet market needs.

Academia, industry and government need to find innovative ways of promoting a science culture in Canada, especially among youth.

Thoughts on the process

The CAW Centre at the University of Windsor was an excellent venue, as it provided ample space for both the plenary session and the breakout groups. The workshop was well-organized.

The majority of participants were members of academia. Although a significant percentage of those invited were from industry, industry representation was lower than expected.

Local media coverage was positive. Dr. Gerrard was interviewed by The Windsor Star, CBC Radio (English and French) and BBS (Television affiliate).

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

SAULT STE. MARIE

August 12, 1994

Chairperson: Dr. Gerry McGuire, President, Sault College (Phone: 705-759-2554)

Sponsor: Sault College of Applied Arts and Technology

Participants: 25: 9 private companies; 10 academic (R&D); and 6 public sector.

Federal management of S&T investments

Poor commercialization of research;
Poor definition/regulation of incentives;
Poor communication of science and technology;
Onerous paperwork for government funding;
No incentive for investment in development of existing research;
Little promotion of successes;
Have not done a good job of teaching entrepreneurship and risk taking;
Poor recognition of importance of transferring science to application;
Poor communication of science to public.

Focus on Sault Ste. Marie

In future, the need is to:

- Increase and improve S&T information to general public
- Promote careers in S&T to men and women equally
- Publicize successful people in science as mentors, role models
- Improve and increase S&T training and education at post secondary and university levels

On the positive side, the Sault benefits from: the National Research Council's Industrial Research Assistance Program (IRAP); establishment of the regional forestry centre in Sault Ste. Marie as well as the international scale forest institute (FPMI); development of centres of excellence and the BRIDGE (integration of educational institutions in Sault Ste. Marie, Ontario and Michigan) project.

Setting Priorities

Shift to sustainable development;
Balanced pollution regulations;
Long-term impacts evaluation of environmental and social legislation;
Facilitate access to information highway (data/information/design/problem solving);
Use technology to reduce distances through videoconferences, distance medicare
- reduce scare factor in science and technology, e.g. jobs of the future, new opportunities;
Educate people in small communities, access to and use of communications facilities, libraries.

Common Views

Encourage entrepreneurship programs;
Tie R & D funding to successful commercialization and facilitate the process;
Give incentives to researchers to commercialize their ideas;
Simplify interfacing with government;
Increase networking and exchanges among colleges, universities, government and business;
Recognize that everything is customer/end-market driven;
Entire infrastructure must encourage value-added entrepreneurship;
Encourage small businesses;
Encourage venture capitalism;
Commit to environmental protection/sustainable development;
More attention to health care system;

Thoughts on the process

The discussion was supportive and concerned. Cross-sectoral linkages, decentralization and social issues were the main concerns.

Session format was good. A small number of the participants felt an hour or so should have been allocated at the beginning of the workshop to decide on what topics should be discussed in addition to, or instead of, the pre-formatted topics.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

WHITEHORSE, YUKON

AUGUST 16, 1994

Chairperson: Mr. Larry Bagnell, Executive Director, Association of Yukon Communities, (403) 667-3925

Sponsor: Yukon College, Ms. Sally Ross (President)

Participants: 60: 8 academic; 8 business; 29 government (largely Yukon and local); 15 other

Federal management of S&T investments

There is a critical need for the expansion of the information highway in Yukon, and Dr. Gerrard challenged the group to develop a plan for this, emphasizing that it was not the role of the government to supply the pipeline, but rather this is the challenge facing industry and the other community stakeholders. It will require partnering and cooperation in order to develop and implement a community based strategy.

The issue of equal access was raised repeatedly. With a small population base there is a concern about the prohibitive costs of "plugging in" to the electronic highway.

Focus on Yukon

Cold weather technology is a key priority sector for Yukon, and is an area where there is excellent export potential. Yukon has developed unique technologies in the process of solving its own cold weather challenges, particularly in the areas of house and road construction, alternate power sources, and sewage treatment. These can be successfully marketed to other northern nations. As well, tourism is the lifeblood of the Yukon, and must be more closely linked with S&T.

There should be Yukon representation on the national Information Highway Advisory Committee and NABST, in order to ensure that the needs of the North are heard.

First Nation's traditional scientific knowledge dates back thousands of years, and there is an urgent need to integrate and link this knowledge into the "modern" scientific knowledge base before it is lost. It is largely an oral tradition and is currently housed in the heads of the community's elders. The use of CD-Rom technology may be one method of recording this information, ensuring access to a wider scientific and educational audience.

Setting Priorities

The largest challenges to successful commercialization are a lack of marketing skills and the presence of transnorthern trade barriers. The removal of trade barriers between Yukon, NWT, B.C., and Alaska in terms of discriminatory building standards and government procurement is critical to the commercial success of this industry.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

The industry is currently fragmented, and the federal government should assist by facilitating collaboration between the players, as well as identifying international marketing opportunities.

A database of cold weather research and expertise should be assembled to establish an industry baseline and facilitate network development. This database could be marketed internationally.

The centenary of the RCMP, the discovery of gold in the Yukon, and the 50th anniversary of the Alaska Highway mark a special opportunity for tourism.

Mentorship programs would be an effective way for SME's to help learn form each other.

Common Views

Yukon College and the Northern Research Institute should focus on areas of northern relevance, and not duplicate programs readily available elsewhere. They should build on their unique strengths and develop an internationally recognized specialization in cold weather research\technologies.

The eligibility requirements for sponsorship by the National Science and Engineering Research Council (NSERC) must be examined, so that research originating from colleges would also be eligible for funding. The existence of research grants would help the colleges attract and retain high calibre faculty.

The development of partnerships and improved communication links between all stakeholders is critical, particularly where the industry is composed of many small players. The government could help by facilitating these initial linkages. (Business networks\association building etc.)

Collaborative research between industry and the research institutes must be encouraged. This should be broadened to include transnorthern cooperation, with each region contributing its unique strengths to the overall project.

Thoughts on the process

The session was extremely well attended with 60 participants, 40% of whom were women. There were representatives from the First Nations communities, Yukon Territorial Government, Council for Yukon Indians, federal government departments, Canadian Polar Commission, Yukon College and the Northern Research Institute, and 14 private sector participants. Both the Yukon News and the CBC interviewed Dr. Gerrard, and some freelance journalists were in attendance.

Prepared by the Science and Technology Review Secretariat
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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlight

ELIE

August 20, 1994

Chairperson: Sheila Champagne (Phone: 204-857-3900)

Sponsor: Whitehorse Plains School Division

Participants: 41: 27 academic; 2 business; 5 government; 7 others.

Federal management of S&T investments

Government and business can make hardware and software more readily available to schools through subsidization and donation of old equipment.

Must communicate S&T priorities and issues better.

Make it possible for someone with a "good idea" to cut through the layers of administrators and present ideas directly to government.

Need some sort of Research Council.

Need more forums like this.

S&T department can be the "treasury board" of technology.

Ensure S&T focus of the education and training components of the Canadian Armed Forces.

Accountability from top down. TQM.

Need for concerted planning and effort - education, business, industry, and government.

Focus on Elie

The main issues and themes expressed concerned:

- the need for communication, coordination, planning, sharing and;

- the over-riding importance of education.

Setting Priorities

Partner government with business and education in the development of learning resources through a "School Net".

More obligation rests on shoulders of business.

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Common Views

Coordinate efforts at different levels (government) and across different sectors (academic, business, industry).

Work at making S&T more easily accessible for educators and for schools.

Stress the positive contribution S&T can achieve in enhancing quality of life.

Thoughts on the process

Less supportive and appreciative of the opportunity for input.

Suggestions were made to change the format of the session.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

FORT FRANCES

August 22, 1994

Chairperson: Tony Beyak, President of the Fort Frances Chamber of Commerce (Phone: 807-274-5773)

Sponsor: Fort Frances Chamber of Commerce

Participants: 25: 4 academic; 5 business; 15 government; 1 other.

Federal management of S&T investments

The federal representative for forestry and reforestation products lives in Calgary; we need local representation and information.

Forestry Canada does not cooperate. Locally we decided to approach Finland and for 2 years have been doing work in the peat business, couldn't get the information in Canada - we don't even try anymore because it is too much trouble and we get no information or help.

Focus on Fort Frances

Put dollars into forestry and agriculture infrastructure nationally but especially locally so that infrastructure can create the environment for research to flourish, instead of the current process of continually funding something that doesn't work.

Forestry should work more like the good cooperation which exists between the federal and provincial agricultural research extension efforts. Federal forestry presence is very poor.

Government and industry are working together.

Decisions made will not be valid if the people making them are not knowledgeable and don't understand the value of Science & Technology, we need a common thread in Canada.

In France S&T continual upgrading and training is the responsibility of the large corporations for which they receive tax benefits. If they decide not to participate the government provides a program and charges the company for it with no tax benefit. We need a similar program here.

In Germany, industry, government and unions cooperate on research, training and export.

A local councillor is following up with the Sault Ste. Marie Industry Canada representative to visit the Sault Ste. Marie municipal hatchery and pursue the possibility of having one in Fort Frances.

Setting Priorities

Must be a balance between environmental concerns and industry.

More funding needed in Canada and Ontario for medical research.

More local involvement with government and business to foster S&T development and training.

Common Views

The lack of communication of the science and tech resources available locally, eg. Experimental Lakes Research Centre-Kenora.
The lack of marketing of these resources.
The need of deregulation and fed/prov/municipal/business cooperation in using these resources more efficiently.
The need to make a career in science a viable economic option for Canada's top students rather than just for summer employment opportunities.
A need to tap into the tourism potential of S&T.
The need for a well thought out plan, for science and tech and a leader who will stick by it.

Thoughts on the process

All participants had comments to make and the input was supportive. However near the end of the day some of the frustrations of local business and municipal government became apparent; ie. that big government whether provincial or federal by nature of its big bureaucracy is insensitive to the issues and incapable of meeting the needs of the region. Yet big government is not willing to delegate the delivery or decision making to the local level.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

KITCHENER-WATERLOO

August 23, 1994

Chairperson: Dr. Bruce Hutchinson, Chair, Dept. of Civil Engineering (Phone: 519-885-1211 ext. 2620)

Sponsors: University of Waterloo, William G. Davis, Computer Research Centre.

Participants: 125: 63 academic; 26 business; 36 government (including provincial and local).

Federal management of S&T investments

The government needs a science strategy, which includes: a review of where it currently spends science dollars; balanced spending between basic vs. applied research and short-term vs. long-term investment.

There must be greater collaboration between industry, academia and government.

Focus on Kitchener-Waterloo

Information technology and the information highway is clearly where opportunities for the future lie. The strategic question is what can government do to ensure that small, bright companies are part of the world-wide move to information technology.

The government spends too much federal money internally. For example, the system of funding for government labs must be changed.

The way government provides funding to industry needs improvement. For example, a combination of tax incentives and strategic grants is needed.

The government should help companies get their first, critical sale, not through "soft" efforts (such as providing market lists), but through "hard" support, similar to the U.S.'s efforts in targeting specific countries and developing strategies.

Overseas science and technology counsellors are employees of trade commissions. Industry people should be seconded to these positions and/or should have more input into international marketing efforts.

Government policy for S&T should involve a wide range of people, not only traditional representation from the research community.

Setting Priorities

Social programs are very important, but expensive. Expenditures on social programs should be redirected towards building long-term wealth and growth.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

The education system in Canada needs to be enhanced to return maximum benefits to society and to allow Canadians to maintain their present standard of living.

Promote an innovation-oriented economy.

Improve funding and incentives to promote S&T.

Common Views

Improve the education system to maintain quality of life in future.

Improve partnerships.

There is a need for greater links between government spending on S&T and social spending (in areas directly related to Quality of Life) and areas related to economic growth.

The government should focus on long-term job creation strategies (i.e. brain-drain will affect future wealth and quality of life in Canada.

Eliminate red tape and reduce bureaucracy.

Need better university-industry collaboration.

Promote a science culture.

Improve university research funding and reduce "brain-drain".

Exploit advances of knowledge from around the world.

Thoughts on the process

Approximately 125 people participated. Participants included representatives from the University of Waterloo, Sir Wilfred Laurier University, the University of Western Ontario, the University of Guelph, industry and government. Representatives from Industry Canada and Natural Resources Canada were also in attendance as group reporters.

Local media coverage was positive. Dr. Gerrard was interviewed by Mike Strathdee of the Kitchener-Waterloo Record, David Crane of the Toronto Star, Mariam Tehouse of Chyme/Country Radio and Brent Hansen of CKCO T.V.

There was a relatively good awareness of government spending and present role in S&T among participants, particularly of the National Science and Engineering Research Council (NSERC), Industrial Research Assistance Program (IRAP) and other government agencies related to R&D funding.

The general tone of the discussions was positive and supportive, although there was some scepticism regarding what the government would actually do to improve overall S&T in Canada.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

WINNIPEG

August 25, 1994

Chairperson: Dr. Terrence Hogan, VP Research, University of Manitoba (Phone: 204-474-9404)

Sponsor: University of Manitoba

Participants: 64: 30 academic; 17 business; 17 government

Federal management of S&T investments

Information access should be made more available.

Need for science and technology/ industrial vision/strategy for future.

More accountable regional development agencies rather than vertically integrated federal departments.

Government Minister(s) involved in science decisions should have scientific background.

The methodology of science and technology should be used in the advancement of knowledge.

Focus on Winnipeg

Encourage/implement entrepreneurship initiatives such as co-op programs in graduate education.

Meld social science with natural and engineering sciences.

Exploit innovations in biotechnology relating to:
- reducing environment contaminants
- genetic engineering

Setting Priorities

Encourage contact between education and industry, i.e. requirement for business education in science education.

More integration of researchers between/among business, industry, universities, federal government labs, etc.

Build models of partnerships and a positive public disposition towards R & D.

Link universities to technical colleges and promote shared visions between faculty and students.

Provide support to scientists for commercialization.

Enhance Industry/University programs. Make funding linked to technology transfer.

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Create export opportunities by :
- emphasizing manufacturing
- value-added to natural resources
- emphasize what we do well, i.e.: information technology

Language and culture training must be encouraged in the early years to prepare people for global business.

Long term policy framework with focus.

A Telecom infrastructure is a must. S&T expenditure must support this.

Common Views

Emphasis on long term research.

Develop a timely environmental impact process.

Assess future needs and focus training /retraining on jobs that have a future.

More support for social science research in addressing quality of life issues.

Thoughts on the process

The participants were very much aware of what the S&T Review meant to them. There seemed to be a few messages that had an underlying cynicism, however, overall, the majority were very appreciative of being able to participate in the review.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

REGINA

August 27, 1994

Chairperson: Robert Dalziel, Executive Director for the Regina Economic Development Authority (Phone: 306-522-0227)

Sponsors: University of Regina, Dr. Nicholas Cercone and the Regina Economic Development Authority, Robert Dalziel.

Participants: 73: 18 academic; 43 business; 10 government and 2 others

Federal management of S&T investments

The federal government needs a science strategy, which includes a review of where it currently spends science dollars. There is a balance needed in the spending between basic and applied research.

There is a strong need to build greater collaboration between industry, academia and government.

The federal role should be to create a favourable climate by creating a realistic regulatory and taxation environment.

Focus on Regina

The focus of the discussions centred on the need to examine human capital and financial capital for a healthy Science and Technology environment. This consultation was unique as it involved participants from the total province, not just Regina.

The government should not try to direct research too specifically. Research should be market driven and flexible depending upon national and regional natural advantages. The federal government should attempt to improve the regulatory system and the bureaucracy which serves the S&T environment.

The federal government also needs to lead the way in changing the educational system in Canada and its current approaches in delivering and promoting science and technology subjects.

The federal government needs to continue its role as a mentor of science successes in Canada.

Setting Priorities

There must be a clear and focused science policy for Canada which truly represents the priorities for science and technology as found in these consultations.

Government needs to promote an innovation orientated economy which is reflected not only in enhancement of the quality of life for Canadians but also as to the economic competitiveness of the nation.

Our mission is to identify principles that can guide the federal government in setting priorities for investment in science and technology.

There is a need to improve funding and incentive to promote science and technology. There is also a strong need to improve the educational system and increase public support for science and technology activities.

There must be a better coordination between federal and provincial government in the areas of S&T spending and public promotion of science.

Common Views

There must be a bridging mechanism between university and industry.

Industry must contribute to the educational process to stimulate young people's interest in science and technology.

Teachers must be retrained to actively promote and teach the benefits of science and technology and to stimulate young peoples' interest in careers in these areas.

There needs to be more investments by both provincial and federal governments as well as industry in funding researchers, equipment and graduate students' work.

There needs to be a program which reduces the risk for venture capital investments in R&D projects.

There needs to be a program which supports business mentorship of science students and provides scholarships for co-op work situations for science and technology students.

There needs to be a regional or local focus on expertise and technology in those industrial areas of strength which can be competitive in the international marketplace.

There needs to be a new focus placed on enabling technology and the strength they provide to Canadian businesses.

Thoughts on the process

The science and technology review has been generally received as a positive exercise. Participants feel that the process is being given a high priority in the federal government's agenda.

This has been supported by participation in local consultations by key cabinet ministers which have given the opportunity for local participants to express their views directly. Many of the participants are looking forward to participating in the next round of consultations at the regional level and to seeing a federal policy which reflects a consensus of views which have been articulated in this process.

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FEDERAL SCIENCE AND TECHNOLOGY REVIEW

Community Workshop Highlights

OTTAWA

August 29, 1994

Chairperson: Dr. John ApSimon, Associate VP Research and Dean of Graduates Studies, Carleton University, (Phone: (613-788-2518)

Sponsors: Carleton University, University of Ottawa and Algonquin College.

Participants: 90: 26 academic; 35 business; 23 government; 6 others.

Federal management of S&T investments

Canada needs an industrial strategy which relies heavily on R&D to drive industry;

Traditional industries such as forestry and agriculture should not be forgotten in our infatuation with high tech industries as these are still the source of employment for much of our workforce - in fact changes such as the elimination of chlorine bleaching in the paper industry should be seen as an opportunity to promote industrial development;

The regulatory environment in Canada must support and encourage the use of technology - Canadian firms should actively participate in international fora involved in the setting of standards;

Focus on Ottawa

This region has utilized the very high concentration of federal research facilities to fuel its efforts to diversify the regions economy away from its traditional base in government. The relationship between the science community and industry has flourished in this region due to the efforts of groups such as the Ottawa - Carleton Research Institute and the strong interest in the private sector in the development of knowledge based industry.

Application oriented research and development is best done in industry or federal labs - investigator initiated research best done in universities;

Need for an independent body to evaluate and direct expenditures in R&D was strongly expressed - no consensus that the proposed national academy could meet this role.

Setting Priorities

The role of science and technology in creation of the wealth and jobs was generally accepted by those attending the meeting. Steps were needed to maximize the benefit to the Canadian economy of the investments we now make in the area of S&T. A clear consensus was not evident on the role of sustainable development in the definition of S&T priorities.

- the role of financing in bringing S&T to usable products was discussed at length with the general consensus

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that the financing mechanisms available to companies were inadequate for the needs of the knowledge based economy;
- the need for improved mechanisms to transfer technology from the sources of knowledge to the users was noted;
- university community must be close to the community - Univ of Waterloo is an example of a highly effective university due to its close ties to the community;
- present research lack market focus;
- roles of the federal and provincial governments needed to be clarified;
- need to encourage scientists to think as entrepreneurs to speed the transfer of technology and to sharpen the market focus of research;
- tax incentives were sited as a very positive example of haw a government expenditure could effectively encourage the use of S&T - more firms should be taking advantage of this incentive;
- science needs a broader focus to ensure all interests are taken into account in developing science policy,
- key sectors such as environmental industries should be used to drive expenditures and to sharpen the focus on sustainable development;
- Canada needs to set priorities for its S&T expenditures - cannot continue to be all things to all people;
- Canada's long-term science in relatively good shape.
- a national policy is necessary for Canada federal labs and universities;

ADVANCEMENT OF KNOWLEDGE

- the value of investigator initiated research must not be lost in the move to establish the importance of applied market driven research;
- Canada has a strong base of world class research which should be expanded;
- product of research is both the knowledge and the need for highly qualified personnel;
- Canadian R&D should be highly focused and aim to dominate the world in a few selected areas.

Common Views

The main themes arising from this meeting were:

- need for integration of broader scope of knowledge into science and technology;
- need to balance Canada's expenditures on R&D in areas of basic and applied research;
- need for national S&T culture;
- need for financing mechanisms which foster the development of companies based on knowledge;
- Canada needs to make better use of science to build national wealth.

Thoughts on the process

The tone of the consultations in Ottawa was very supportive of the need to undertake a review.

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LOCAL COMMUNITY CONSULTATIONS

Summary Report by Dr. Jon Gerrard, Secretary of State (Science, Research and Development)

A number of themes have emerged from the community consultations held to date that are worth setting down to provide a perspective on the discussion and debate that has occurred.

THE VISION

Science policy is an instrument of national policy. In setting science and technology policy, the government will make critical decisions about the future of Canada. In the past, Canadians have done very well in basic science, but poorly in applying that science to improve our economy and government programs. Statistics presented in Edmonton showed that Canadians do about one-third better than the US in producing good new ideas and discoveries, but we do only 50% as well as the US in commercializing them. As one participant expressed it "Government needs to create policies which will focus on breaking the bottleneck between a good idea and a functioning industry."

Canada has also done poorly in communicating the achievements of Canadian scientists to Canadians. The result has been an extraordinary ignorance of the role, influence, power and return on investments from government expenditures on science and technology. This situation has resulted in part from a practicality, relevance, application, commercialization gap.

We need a science strategy that will give opportunities and challenges to all who are involved whether employed in federal departments, in universities or in the private sector. The strategy should create new visions and new roles and provide mechanisms for people to fulfil the new roles. We need to harness the benefits of science and technology for all Canadians.

It is probably not an accident that the two G-7 countries who have spent least in proportion to GDP on research and development (Canada and Italy) are the two which have the highest relative debt. It is similarly no accident that two high tech sectors where we have had clear and long-term government support in applied research and development (nuclear and aerospace) are the only two high technology sectors in which Canada has a balance of payments surplus. Within Canada, companies which invest in research and in up to date technology are doing better than their counterparts who have not. In today's world, it is the efforts in research and development and the best use of science and technology which are most critical in ensuring a solid national industry. This perspective also applies to the jobs of the future, for jobs will go increasingly to more highly trained people; in the next few years 50% of jobs will need 17 or more years of school. We need to understand this and to use this knowledge to build an effective national strategy which will provide a brighter future for Canadians.

PRINCIPLES

All government policy must adhere to coherent principles, e.g. innovation is important. Programs should have demonstrable cost-efficiency and a significant return on investment. There should be clear accountability in all government funding.

Science policy must preserve and build on strengths, seek excellence, seek areas of international strength, international opportunity, areas of need and be consistent with the increasingly cross-disciplinary basis of present research.

OVERVIEW OF THE ROLE OF GOVERNMENT, UNIVERSITIES AND BUSINESS

We were presented with a useful concept of the relative roles of governments and various size businesses in supporting research in Pinawa—given in graphic form. (Figure 1—Copy sent by FAX) In essence, this figure suggests that small business should be primarily responsible for the shortest term lowest risk research. Medium sized business should be primarily responsible for the medium term and medium risk. Large business and government should be primarily responsible for the longest term and highest risk research and development. Government should also provide some underpinning of support for shorter term and lower risk research. Whether or not this view is correct, it represents in concise form the relative roles of different players in Canada, and is an important starting point for discussion.

In the past, priorities have been set in terms of budgets instead of needs. Major needs (goals) should be defined and then choices made based on those needs. Part of the gap (commercialization, application) problem is from not critically incorporating strategies to assess return on investment and relevance at all levels. Many of those directly involved in science and technology fail to accurately estimate or even to realize the major returns which the investments are or should produce.

A Changing World. Science often gives greatest returns on investment when it is collaborative, cross-disciplinary, is "incremental," is critically tied in to success or failure of communities to adapt to the new economy, and incorporates the concept that young people are agents of innovation and change.

We are in the knowledge age, and strategies to disseminate information and to use the information highway to re-engineer our current programs and to ensure that we are planning for the future are critically important in providing businesses with opportunities and advantages.

Federal Laboratories. Federal laboratories have two major roles: to provide long term planning and research underpinning for the sector of the economy to which they are linked, and to work at the interface between the federal government research effort and the rest of society—in particular the industry in the sector of interest, but also with people in universities and community colleges and with the general public. In the context of these roles federal laboratories should be strongly rooted in and supported by their local communities, but should have a clear national mandate with high quality scientific and business leadership.

There is a natural progression of research and development from the basic understanding of biological, physical or chemical processes underlying the relevant industry to the production of commercially relevant ideas, prototypes, etc. Federal laboratories need to have not only the ability to produce the underpinning of research needed for the sector (i.e. studies on soils and soil replenishment for the forest industry), they also must have in place an efficient hand-off mechanism to the private sector when a commercializable idea or prototype has been developed. Too often we have had laboratories which have done the former well and the latter poorly, to the extent that instead of handing off to the private sector and returning to the critical research needs for the future, some federal laboratories are producing products and even competing with the private sector. When a technology is mature, it should be transferred to Canadian companies. We will not develop world class exporting companies if we do not ensure the transfer of technologies to private enterprise. Government should be a client not a competitor for technology.

Although each federal laboratory is different, and the particularities of each laboratory should be recognized, a knowledgeable participant in Victoria suggested that space at federal laboratories might be divided up with about 50% of the space allocated to efforts to provide the basic long-term research and development needed in the industry sector, 30-50% of the space to be used as "incubator" space which would be for starting up companies or for people from industry working within the federal laboratories and together with federal laboratory staff. 10% of the space in federal laboratories should be used for communication, education of the general public, tourist facilities to promote science tourism, etc. Whether or not these numbers are correct, they represent a starting point for discussion. In general, the views presented at the community conferences suggested that in Canada we do too much science intramurally within government compared to other developed nations. This view if supported in regional conferences will lead to a decrease in traditional support for federal laboratories. Participants suggested federal laboratories should have increased flexibility to generate income in new ways and for personnel within federal laboratories to act in new ways. For example, many within the federal laboratory system suggested that we should facilitate entrepreneurship on the part of staff.

In order for the federal laboratories to work more closely with industry and the community, laboratories should have advisory committees or boards which have industry and community representation. Some laboratories are doing this well.

There was clear recognition of the importance of federal laboratories putting an emphasis on the use of new communications technology and informatics to help their industry sector. This includes being the hub of a national network as well as the hub of a local community network, and developing real expertise in the diffusion of information technology expertise to the industry sector.

Federal laboratories which are based in primary industries (agriculture, forestry, fisheries) should increasingly be emphasizing value added products, and strategies to help the industry develop and market such products. We have lost out on major opportunities in the past in this area, and it is imperative that there be a substantial effort to improve.

Institutions for post-secondary education. In the knowledge age the mandate of Universities and colleges is changing from being primarily centres of higher learning to being in addition the economic engine for communities. This new role has resulted from the fact that universities are the major centre of intellectual capital for communities and in a knowledge-based economy it is the universities and colleges with their knowledge-base which must play a critical role in the transformation of the community from the old economy to the new.

The role of the universities is complicated by the fact that there are not new resources from traditional sources to help. Indeed, like many other large organizations in the knowledge-based economy, many universities need to go through a period of "re-engineering" in order to be able to fulfil their new role. Many believe the delivery or transfer of knowledge to students can be done much more cost-efficiently than it is being done at present.

There are fundamental changes in the way information can be delivered today which also lead to the conclusion that there are new efficiencies in the way education can be provided. The University of Winnipeg, for example, is delivering courses on the local cable network and so reaching students without having the traditional limits of the number of seats in a classroom. The use of interactive CD-ROMs for self-learning is another example of how technology is changing delivery of education. Queen's University will this fall deliver education through a distance network spread out across the country. At the same time as there are new ways of delivering didactic teaching, the practical experience in the laboratory which used to be a major feature of university teaching, is now increasingly changing to emphasize practical experience in cooperative education using industry, federal laboratories or university research laboratories. At the University of Waterloo, which has been a leader in this respect, a high proportion of the students now have a cooperative training experience before they graduate. While there are new expenses in administering cooperative education programs and distance education programs which are "independent of place and time" there are also considerable savings from "re-engineering" to change the traditional way of doing things. Universities will increasingly have to make considerable changes to achieve these goals. Students, beginning in the primary grades, must increasingly become knowledge builders instead of knowledge assimilators.

The role of the universities and colleges in teaching entrepreneurship was emphasized in many community consultations. Training in sciences should increasingly require training in entrepreneurship. Indeed, the Community College of the Mirimachi is a leader in this respect requiring that graduating science students must have started a company and developed a product before graduating. It was also suggested that Universities could help this adaptation by converting 10% of their laboratory space into incubator space for small business. The traditional reaction of a university administrator faced with such a proposal will be "I don't have such space." In fact, changing the attitudes and procedures for incubating businesses in university space is likely to overnight convert space used in a traditional fashion to use in incubating small businesses. It is already happening in some universities. But the "incubation" of small businesses in University space needs also to consider the provision of guidance to scientists in start-up of companies, (using the expertise in the community and in other parts of the university).

Many commented that the primary role of the federal government in supporting universities is to provide the support for basic and fundamental research through the granting councils. In an era when there is an increase appreciation of and need for commercialization of products coming from universities, one option is a switch in support towards funding more applied research with less for basic research. The view was widespread that support for basic research which is excellent in Canada should not be sacrificed but should be maintained. This means that we must develop other effective mechanisms for commercialization than driving this process by an influx of federal funding.

The view was presented that Science and technology + commercialization = wealth and jobs. We must organize a national effort to mix ingredients to achieve commercialization. It was suggested that this should be largely the responsibility of the local university or community college working in conjunction with the local business community. It was even suggested that Universities which do not have an effective commercialization strategy to identify all new potentially commercializable ideas and products and which do not put in place a strategy for commercialization as soon as potential opportunities are identified should not receive MRC/NSERC/SSHRC funding, or EPF financing. This step seems drastic and unlikely, but emphasizes the strong feeling that we can not permit in Canada to have institutions supported in basic science which are not also critically effective in the transfer of technology to Canadian companies (Canadian companies being those which are Canadian owned or with a significant research presence in Canada) and commercialization using laboratory space as incubator space or working with local businesses or institutes such as TRLabs. Universities have varied expertise in marketing/business/management training and can bring this all to bear.

Industry. From the point of view of funding, there is a need for a very different approach to the funding of or support of research and development in different sized businesses. There is also a need to recognize critical differences between industries where we have businesses which are ready and capable of partnering and industries where we need to grow new crops of businesses.

The overall sense from the community consultations is that businesses want more say in the direction of research efforts supported by the federal government. At the same time there is a growing realization of the critical importance of research and development to the survival of many industries in Canada—certainly to their performance at a level which will improve our sectorial balance of payments, and of the need for industry to spend more on research efforts.

While the research activity of small businesses may be enhanced by the presence of research parks and incubators and by the activities of federal laboratories, it is clear that this question also needs to be approached from a sectoral point of view. There are a number of industry sectors in Canada where small business support of research is low and these include tourism, construction, transport, and fisheries. The comment was made in Sherbrooke that small businesses should be legislated "forced" to invest in research using the model of bill C-91 which set guidelines for the pharmaceutical industry. This option is not applicable in the same way to other industry sectors, but it does make sense to have discussions with industry or small business associations on a sector by sector basis to develop a strategic plan for research and development in each sector to which the industry has input.

Strengths on Which Canada can Build

1. Support of basic science—NSERC, MRC, SSHRC excellent (NABST report and from community consultations)

2. Support of small business—IRAP—excellent program, many reports and examples of critical role and return on investment. S, R and ED tax credits—good program

3. Support of large business and industries:
   a. Direct cooperative research and development funding programs. Many excellent examples of critical role in saving employment in communities and providing very high returns on investment in economic payoffs, jobs and in positioning the industry for the future.
   b. Federal laboratories are critical components of infrastructure for support of industries.
   c. Cooperative University/federal government/provincial government/industry institutes/labs, research funding initiatives such as TRLabs, WESTAIM, Precarn, CIAR, Institut National d'optique, Institut de la Technologie du Magnesium in Quebec City, the International Institute for Sustainable Development in Winnipeg.
   d. Networks of Centres of Excellence—provides very useful links between teams of university researchers and industries generally at a precompetitive level.

4. Data banks to serve all communities.

Major Needs in Canada Which Must be Addressed

1. *Technology transfer/diffusion/application/commercialization gap.* This needs to be understood as a major need, and a nationally coordinated effort to evaluate and optimize funding/programs, etc., directed towards this goal.

2. *The maximization of government return on investment.* There is inconsistent understanding of the critical importance of science and technology in federal departments and in many Canadian businesses including a critical inability to assess the probable returns on investments from different science and non-science expenditures, and to use science to help make decisions about expenditures based on return on investment and environmental sustainability. In an era of great fiscal constraint maximizing return on government investments in all areas is critical.

3. *Science and technology as critical underpinnings for communities.* There is a lack of community support for and understanding of science. Science needs to move from the "rusty halls of academia" out into the real world of building communities. We understand far too little how to do this. It needs a major rethinking of how we support/operate/fund science, engineering, research and technology so that there is a customer/client focus in which communities and individual Canadians are the beneficiaries.

4. *The development of value-added industries.* This needs multi-departmental coordination/assessment/ programming/funding to move this forward.

5. *The development of a culture of innovation in Canada.* Government and universities need to be leaders. The federal government has not internalized the importance of innovation by incorporating into all aspects of its programming to show leadership and to lead by example. One area where government will have to be innovative is in cross-sector or cross-disciplinary research. Federal procedures have difficulty dealing with cross-disciplinary research of some types. Increasingly as research is interdisciplinary and as highest returns on investment are interdisciplinary there is a critical need for excellent collaborative, networked and interdisciplinary mechanisms—this means some revisions to our present framework.

6. *The enhancement of research and development and technology usage activities in small businesses in Canada to achieve a growing economy.* Small businesses are the critical economic engine for the economy and yet Canadian small businesses generally underinvest in research and development activities. Some sectors (information technology, for example) are much better than most others (agriculture, fisheries, forestry, tourism). A concerted strategy is essential to address this shortcoming in the Canadian economy.

7. *Research, development and economic growth as critical underpinnings to all sectors of the Canadian economy.* A clear sector by sector economic, research and development strategy is critical. This program needs to consider the variety of potential instruments for improving research and development in each sector in order to promote growth, including research consortia and partnerships, centres of excellence, the involvement of key NRC labs, technology outreach programs, other types of networks, etc.

a. *Role of Federal Laboratories.* Many federal laboratories need a clarified mandate, community and industry orientation, and more flexible operating procedures.

b. *Support for large businesses.* Not enough certainty in the long term planning given major funding for much of this soon will fall off the table—need to look at all current approaches and redefine.

8. *Sustainable development/waste management/environmental technologies as critical industries for the future.* The industries of the future will depend on critical environmental technologies. We need a major effort to ensure we are preparing for the future by building these industries.

9. *Science education/learning.* There is a problem with access to high quality education/learning all across Canada in which students are knowledge builders rather than knowledge assimilators. We need a vision for the future in which we can deliver access to education/learning/ apprenticeship/co-op education which can be more broadly provided with some elements provided independent of time and place, consistent with the new technology of the information highway. This effort needs a broad multi-departmental, multi-governmental, multi-industry vision.

10. *Safety nets to trampolines.* The conversion of social programs from safety nets to trampolines is a major current objective. Our current profile of social research is overly biased to the view of social scientist as observer and recorder, and insufficiently emphasizes the role of the scientist as doer, planner, initiator, and critical tester of alternative approaches (action research). There are tremendous benefits to individual Canadians to be obtained by achieving a better system as well as tremendous long-run cost savings by ensuring we have Canadians working. Research is needed in the optimal design testing and implementation of effective goal oriented programs.

11. *A just society/a peaceful world.* Canadians want a just society, as clearly emphasized in the time spent in attention to this issue. Research, in particular in relation to the needs and effectiveness of alternative justice programs (outcomes, best practices), is critical. Research is also important to understand and better develop the support for early childhood learning and development—devising, testing, implementing programs. There remain difficulties in achieving equity of opportunity for Canadians. Better research in relation to justice can have significant long-term cost savings by having a society with improved incentives, rewards, penalties, prevention, and rehabilitation.

12. *Basic investigator initiated research.* The origin of the next major advance is not precisely predictable. Strong support for investigator initiated research is essential. NSERC, MRC and SSHRC are regarded world-wide as excellent mechanisms for this, were highly rated by NABST for emphasizing both a knowledge-thirsty society and market-oriented technology development, but, as with other areas, we must continually look for improvement.

13. *Science as critical to the development and enhancement of Canadian culture.* Many aspects of science are critical to Canadian culture from the use of technology to disseminate culture, and to the development of an understanding of our history. If we truly want to create a science culture in Canada we need to build on science interest and awareness and market science for its role in science tourism, its contribution to museums, etc.

14. *International Marketing.* The recent NABST report and comments at many community meetings have highlighted the importance of international marketing, and the importance of science and technology both as vehicles for marketing for Canadian firms and as components of Canadian technology which we want to market.

15. *A National Academy of Science or a National Academy of Science and Technology.* Canada is one of the few if not the only developed nation without a national academy of sciences. There is strong support to develop one in Canada, but there is a need to have a clear decision as to whether this should be an Academy of Science or an Academy of Science and Technology, and what is the role of existing organizations which are pre-eminent in Canada such as the Royal Society.

AREAS WHERE THE FEDERAL GOVERNMENT CAN SPEND LESS ON SCIENCE AND TECHNOLOGY, CAN REDIRECT EXISTING EXPENDITURES, OR CAN FIND SOURCES FOR INCREASED SPENDING IN THE CANADIAN ECONOMY OTHER THAN THE FEDERAL GOVERNMENT.
[Various ideas from community workshops—not all may be workable or appropriate.]

1. Compared to other nations, Canada spends a higher proportion of federal spending intramurally. In the community consultations there was a general sense that we should spend less intramurally and more extramurally. We must transfer mature technology has been developed with laboratories and services are now being provided by federal science and technology institutions, to the Canadian private sector. This will allow the private sector to market the technology or the services around the world, and federal institutions to refocus on the research and development needed for the coming decades. Federal laboratories should work in cooperation with Canadian businesses, not compete with them. In instances where there is not a Canadian company eager to commercialize the newly developed technology, individuals who are publicly funded in universities or in federal laboratories should be given the opportunity and encouragement to privatize commercially viable research results and to move to the private sector.

2. Administration of research and research funding should be as efficient as possible and cost as little as possible.

3. Restructuring libraries in Canada to give a national electronic library system.

4. De-emphasize data collection, which can be done commercially, and look at all options or find more efficient ways to spend less in these areas and more in wealth creation areas.

5. Provide every possible incentive to reduce waste and pollution. Reduction in these areas will create lower later costs to government to clean up. This should include tax reform to realign the tax system to lean more heavily on the very things holding back economic recovery including waste, pollution and inefficient energy and resource use.

6. Where possible programs should be consolidated or be delivered through existing mechanisms in ways that programs are as efficient and flexible as possible.

7. Effective one-stop shopping for federal government support is necessary.

8. Approval of pharmaceuticals must be done differently to save money as we are now doing it and to use the funds better.

9. Evidence-based health care can give large savings.

10. Improved health care practices employing the best technology from around the world will save money.

11. Apply information technology to health care services to improve the quality of service and to reduce costs.

12. Apply, to the maximum extent, all current scientific and practical knowledge to give social programs which are effective trampolines and are at the same time cost-effective.

13. Savings from better scientifically based and environmentally friendly transportation policies.

14. Savings in the construction industry from energy efficiency.

15. Savings from re-engineering education.

16. Cutback in subsidies to businesses in areas which are non-sustainable (environmentally unfriendly).

17. Encourage increased R&D efforts by Canadian businesses. At the same time, increase input from Canadian businesses into federal science and technology programs.

18. In view of the importance of science and technology to the future of communities, provinces and regions, there will need to be greater involvement at all levels of government in promoting the new economy.

AREAS WHERE NEW SPENDING IS NEEDED

A. New expenditures needed to address the needs outlined in the section, "Major Needs in Canada which must be Addressed."

B. Possible major new cross-disciplinary initiatives:

i. *ACCESS 2000—Education/learning for the future.* Fulfilling the dream—Canadians as knowledge builders—with all Canadians having access at an affordable cost to the best learning and training available to anyone, anywhere, anytime.

ii. *Socio-technology for the future.* Instead of focusing on strong sectors, we should focus on critical, often enabling, technology where we want to be strong in the future and which will offer the most possibilities in the future.

iii. *Bringing our resource sectors into the twenty-first century.* Emphasize the use of information technology, the production of value added goods in Canada and sustainable resource management.

iv. *Scientific explorations of the new frontiers*

- Space
- Astronomy/Particle physics
- Polar Science
- Ocean Science
- Science of the inner selves of people (Neuro/Cognitive/emotional/decision making/social programming science

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SUMMARY TABLE OF WORKSHOP PARTICIPATION

WORKSHOPS	DATE	ACADEMIC	BUSINESS	GOVERNMENT	OTHER	TOTAL
Peterborough	July 12	36	44	10		90
Pinawa	July 14	13	5	25	40 (38 AECL)	83
Edmonton	July 19	16	10	16	9	51
Calgary	July 20	20	21	9	4	54
Kelowna	July 21	50	60	6		116
Victoria	July 22	35	14	21		70
Halifax	July 26	12	18	11	2	43
Fredericton	July 27	30	43	15		88
Charlottetown	July 28	11	18	7		36
St. John's	July 29	31	21	15	1	68
Sherbrooke	August 2	40	20	3		63
Ste. Hyacinthe	August 3	25	10	5		40
Québec City	August 4	34	33	33	1 (MP)	101
Rimouski	August 5	12	11	13		36
Hull	August 8	40	10	20		70
Hamilton	August 9	61	48	7		116
Windsor	August 11	38	18	2	3 (MP)	61
Sault Ste. Marie	August 12	10	9	6		25
Whitehorse	August 16	8	8	29	15	60
Elie	August 20	27	2	5	7	41
Fort Frances	August 22	4	5	15	1	25
Waterloo	August 23	63	26	36		125
Winnipeg	August 25	30	17	17		64
Regina	August 27	18	43	10	2	73
Ottawa	August 29	26	35	23	6	90
TOTAL		690	549	359	91	1689