

QUEEN
Q
180
.C2
N442
1995

IC

PHASE II

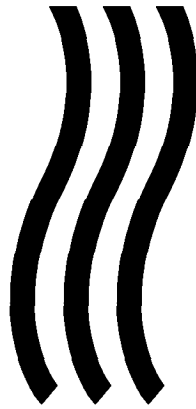
**Networks
of Centres
of Excellence**



**Réseaux
de centres
d'excellence**

**Report of
the Selection
Committee**

Canada



PHASE II

**Networks
of Centres
of Excellence**



**Réseaux
de centres
d'excellence**



Industry Canada
Library - Queen

JUL -7 1997

Industrie Canada
Bibliothèque - Queen

**Report of the
Selection Committee**

July 1995

Canada



Government
of Canada

Gouvernement
du Canada

Natural Sciences and Engineering
Research Council of Canada

Conseil de recherches en sciences
naturelles et en génie du Canada

Medical Research
Council of Canada

Conseil de recherches
médicales du Canada

Social Sciences and Humanities
Research Council of Canada

Conseil de recherches en
sciences humaines du Canada

Industry Canada

Industrie Canada

© Minister of Supply and Services Canada 1995
ISBN 0-662-61910-2
Cat. No. NS3-20/1995

Networks of Centres of Excellence
350 Albert Street
Ottawa, Ontario K1A 1H5
Telephone: (613) 995-6010
Facsimile: (613) 992-7356



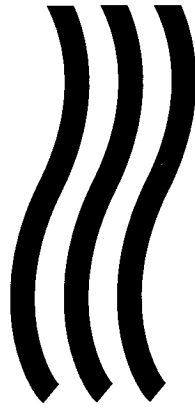


Table of Contents

| | |
|----|--|
| 1 | Remarks from the Chair |
| 2 | Background |
| 3 | Competition Process |
| 4 | Conclusions and Recommendations |
| 5 | Selection Committee's Evaluation: Networks Recommended for Funding |
| 11 | Selection Committee's Evaluation: Networks Not Recommended for Funding |
| 23 | Appendices |



Remarks from the Chair

The goal of the NCE Program is to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians. The Selection Committee was extremely impressed with the level of interaction developing between sectors and disciplines all across Canada. From the response of the community to the challenge presented by the current NCE Program competition, it is apparent that a new collaborative paradigm is emerging. This is evidenced by the wide range of private and public sector organizations that joined with their academic partners to respond to the call for proposals in a limited timeframe. This represents a major commitment of resources to foster exciting and innovative joint ventures.

In their feedback to the groups invited to submit full applications, the Selection Committee emphasized the importance of the participation of stakeholder organizations to focus the research program of the proposed networks from the outset with a clear delineation of objectives and strong well-structured collaborative relationships. The Committee believes that this early involvement will strengthen the commitment of these partners to ensure that Canada derives the maximum economic and social benefits from the network research. The positive reaction of the stakeholder community to active involvement in the strategic planning and development of the applications was also reflected in the level of projected support from outside sources. Although it is not possible to fund all fourteen of the prospective networks, the Committee would like to encourage every group to continue to build on the linkages between and within sectors established through the consultation and application submission process.

An important factor in the choice of target areas for this NCE competition was the potential for the research to benefit from a non-traditional approach that promotes collaboration among social, physical and medical scientists and engineers. This was an integral feature of the four networks that are recommended for funding.

The Committee felt that many of the other groups would have benefited from an increased integration of the social sciences in order to maximize the socio-economic impacts of the proposed network research effort.

The Selection Committee regrets that neither of the proposals submitted by distinguished Canadian scholars in Trade, Competitiveness and Sustainability met the quality threshold that permitted a recommendation for funding in the NCE Program in the context of the target area as defined, particularly with respect to the issue of sustainability. Nevertheless, the Committee considers this to be an important priority for this country which would benefit from an integrated research effort involving the community of researchers with international reputations from the academic, public and private sectors that are currently working in this area in Canada.

The Chair would like to acknowledge the commitment and major contributions of the members of the Selection Committee.



Dr. William Cochrane
Chair, NCE Selection Committee

Background

As part of Phase II of the Networks of Centres of Excellence (NCE) Program, the government identified \$48 million, from the \$197 million NCE Program budget, for the support of a limited number of networks in priority areas that are strategically important to Canada in terms of economic, social or environmental benefits. The NCE Steering Committee, which is comprised of the presidents of the three granting councils (NSERC, MRC and SSHRC) and the Deputy Minister of Industry Canada, appointed the Selection Committee to evaluate the letters of intent and applications according to the established selection criteria and relevance to the specified target areas (refer to Appendix I for descriptions of the Target Areas and Appendix II for the Selection Criteria as published in the NCE Competition Announcement). To be successful, a network had to excel in each of the selection criteria. One network was to be funded in each target area, if the budget permitted and the criteria were met. No more than one network was to be funded in each of the five target areas.

The first stage of the competition involved the submission of letters of intent that described the proposed networks and their relevance to the objectives of the NCE program and the designated target areas. The Selection Committee reviewed the letters of intent, and fifteen groups were invited to submit full proposals. These groups were deemed to best respond to the challenges of mobilizing a national research effort crossing traditional sectoral and disciplinary boundaries, and demonstrating the potential to provide benefits to Canada in the chosen target areas. Two of the invited groups decided to integrate their proposals, resulting in the submission of fourteen applications for review by the Selection Committee.

The mandate of the Selection Committee was to provide the NCE Steering Committee with a list of networks recommended for funding and the recommended level of award for each within the program allocation, for transmittal to the Minister of Industry (refer to Appendix III for the Terms of Reference of the Selection Committee). The rationale for the recommendations and a summary analysis of each application are provided in this *Report of the Selection Committee*, which will be made public.

The fourteen members of the Selection Committee were chosen for their balance of relevant expertise and cross-sectoral experience (refer to Appendix IV for the membership of the Selection Committee and Appendix V for their curricula vitae). To assist in the evaluation process, the Selection Committee was provided with reports from Expert Panels in each of the target areas that summarized the peer review of all applications, including meetings with representatives of each group of applicants (refer to Appendix VI for the Terms of Reference and Membership of the Expert Panels).

Competition Process

March 28, 1994

The federal government announced the renewal of 10 networks funded under the NCE program. In addition, \$48 million was identified to support a limited number of new networks in five priority areas that are strategically important to Canada in terms of economic, social or environmental benefits. (For descriptions of the Target Areas refer to Appendix I; for the Selection Criteria refer to Appendix II).

May 1994

The competition announcement was widely circulated to the academic, public and private sectors.

September 1, 1994

Sixty-five letters of intent in the five designated target areas were received: Advanced Technologies (Materials [9] and Software Engineering [2]); Environment [20]; Health Research [17]; Technology-based Learning [12]; and Trade, Competitiveness and Sustainability [5].

October 11-12, 1994

The NCE Selection Committee reviewed the letters of intent. (For the Terms of Reference of the Committee refer to Appendix III; for the membership of the Committee refer to Appendix IV). Fifteen groups were invited to submit full applications for the January 13, 1995 deadline. The letters of intent in the Advanced Technologies — Software Engineering Target Area were not of sufficient quality for the Committee to request full applications.

January 13, 1995

Fourteen applications were received. Two groups invited to submit proposals in Technology-based Learning merged their applications into one.

February 14 – March 2, 1995

The Expert Panels held evaluation meetings with representatives of applicant groups. (For the Terms of Reference and Membership of the Expert Panels refer to Appendix VI).

April 3-4, 1995

The NCE Selection Committee met to review the proposals and the reports of the Expert Panels.

Conclusions and Recommendations

As noted in the *NCE Competition Announcement*, one network was to be funded in each target area if the budget permitted and the criteria were met. The NCE Selection Committee recommends funding for the following four networks that were judged to be meritorious in their respective target areas and meet the criteria, with the level of the four-year award given in brackets:

Advanced Technologies — Materials:
Intelligent Systems for Innovative Structures
(\$9.5 M)

Environment:
Sustainable Forest Management
(\$10.8 M)

Health:
Information-Based Decision Tools in Health Care
(\$8.6 M)

Technology-Based Learning:
Telelearning Network of Centres of Excellence
(\$13.1 M)

The Committee judged that the applications received in the fifth target area did not meet the criteria and therefore made no recommendation for an award in Trade, Competitiveness and Sustainability.

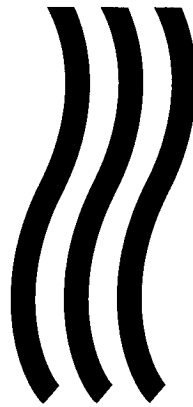
In addition, the NCE Selection Committee recognizes that the following networks have strong elements worthy of special mention:

Advanced Technologies — Materials:
Organic Materials for Information and Electronic Technology

Environment:
Network for Pollution Prevention and Waste Recycling

Health:
Health Network of Centres of Excellence

The following reports summarize the Selection Committee's evaluation of the fourteen proposals.



Selection Committee's Evaluation

Networks Recommended for Funding

- 7 Intelligent Systems for Innovative Structures
- 8 Sustainable Forest Management
- 9 Information-Based Decision Tools in Health Care
- 10 Telelearning Network of Centres of Excellence



Intelligent Systems for Innovative Structures (ISIS)

Dr. Sami Rizkalla

The ISIS network proposes to develop an innovative system that combines advanced composite materials and novel fibre-optic sensors for use in the design, reinforcement and repair of civil engineering structures. This presents a possible opportunity for Canadian leadership in a field that is becoming increasingly important internationally as infrastructure deteriorates. The Selection Committee noted that the proposed research program involves an integrated systems approach, with cross-linkages between theme areas playing an important role. They concluded that the research program would be strengthened by increased emphasis on the interface between the sensors and the composite materials.

The interdisciplinary nature of the proposed research program should be a major factor in retaining the highly qualified personnel trained in the network in Canada, to help expand our global position in the area of advanced construction engineering. The development of a Technical Resources Centre will provide students with opportunities to work closely with partners from industry and government on demonstration projects that will strengthen the technology base of the public and private sectors.

The ISIS team demonstrated its commitment to building strong interdisciplinary collaborations, which are crucial in a research program involving the development of intelligent sensors and advanced composite materials for structural engineering applications. The linkages to the private and public sectors will provide an interactive network environment, and will be essential to the network in achieving its objectives. The Committee noted the relatively low level of support from the private and public sectors, which the network should be able to increase given the magnitude of the infrastructure challenge in Canada.

The research program was judged to have a high probability of generating technology for commercial exploitation. The active participation of partners from industry and government will be an important factor in the effective exploitation and application of technology. Given the impact of severe climatic conditions on Canadian roads, bridges and buildings, the Selection Committee noted that this network also has the potential to generate considerable cost savings to the economy by strengthening the physical infrastructure of Canada.

The overall impression of the management team was very favourable. The proposed Program Leader displayed a high degree of leadership ability and has made a major time commitment to ensure the success of the network.

Recommended for funding.

ENVIRONMENT

Sustainable Forest Management

Dr. Ellie Prepas

The proposed network in the study of boreal forests ecosystems is led by a group of world-class researchers. The Selection Committee considered the proposed new model of forest management, using natural disturbances as a framework for evaluating the impact of harvesting methods, to be an innovative departure from traditional practices. The Committee felt that the proposed research would be of enormous benefit to Canada and in particular recognized the urgency of undertaking the research at this time. It was noted that the linkages with other international endeavours could be expanded and that the group could take advantage of knowledge and databases developed elsewhere.

The proposed training strategy will produce students with the multidisciplinary knowledge necessary for the future sustainability of forestry operations. The fact that students would spend time in industrial settings was also seen as a positive aspect of the training program.

Networking between universities, disciplines and sectors was judged to be strong. The Committee noted that the proposal represented a cross-disciplinary approach that integrated the social sciences into the research program. However, it was not clear to the Committee what mechanism will be used by the network to incorporate the input of all stakeholders into the formulation of research priorities (aboriginal people and the various industries involved, for example). This will be important for the network to pursue.

The Committee concluded that the proposed research program has very significant economic potential for Canada, as the model developed could be applied to other types of forests. The potential impact on policy-

making in Canada was also judged to be very important, particularly since many provinces have already expressed their support for the proposal. The Committee noted the importance of developing innovative approaches to knowledge and technology transfer.

The network is led by a dedicated Program Leader who has a good track record at directing major research programs. The proposed management structure was judged appropriate by the Committee to effectively administer a network of this size.

Recommended for funding.

Information-Based Decision Tools in Health Care

Dr. George Browman

This network was considered by the Selection Committee to be particularly relevant to the needs of Canada at the present time, providing a dynamic and responsive environment to address health care issues that will have a major impact on our future global competitiveness. The applicants propose to develop and market information-based tools to improve productivity in the workplace, the health of Canadian workers and the efficiency of the health care system.

The Committee concurred that the research program presented by the applicants is very innovative, well focused, and addresses relevant research questions that include public health and health care delivery perspectives. The broad spectrum of professional disciplines and variety of commercial partners needed to tackle this important research endeavour would only be possible with the network model. The quality of the research team with participants from the academic, private, public and labour sectors was considered excellent. Many of the primary researchers are recognized world leaders in their fields.

The applicants identified several very successful existing continuing education programs that would provide appropriate models for the training of highly qualified personnel. However, the Committee felt that more of the network's resources should be devoted towards graduate training with a clear statement of how those resources would be allocated to the various research themes.

This group brought together key individuals, groups and organizations across Canada and demonstrated an impressive ability to network and collaborate across disciplines. The Committee was impressed by the integration of partners from outside of the academic sector in the strategic planning of the network research program.

The Committee concluded that the potential for this group to produce products and services is very high. The number of corporate partners and their substantial involvement in the process are considered truly impressive. The support and commitment of these partners will be extremely important to the commercialization process. One of the major benefits to Canada of this group's research will be the provision of information tools that will enable policy makers and health care providers at the federal, provincial and regional levels to make more informed and more effective allocation of health care resources in a rapidly changing socio-economic environment.

The network management was considered by the Committee to be well developed and appropriate to foster a non-traditional, interdisciplinary research environment.

Recommended for funding.

Telelearning Network of Centres of Excellence (TL-NCE)

Dr. Linda Harasim and Dr. Tom Calvert

The Committee judged the proposal to be leading-edge on an international scale. The program is supported by a clearly stated conceptual framework which is based on the latest advancements in cognitive science. This takes into account the most up-to-date technological environments and links them to emerging and novel pedagogical concepts. Cognitive science, technology and pedagogy, within the theme of design, serve as the common foundation for the whole program and give it coherence, focus and direction. It was noted that the proposed socio-economic models could be strengthened and better integrated into the research plan.

The researchers were judged to be impressive world-class leaders in their respective fields. Clearly, a very strong team has been assembled especially in the fields of educational technology and pedagogy. The proposed training strategies were considered to be novel and likely to produce graduates with a truly multidisciplinary exposure to research.

It was evident that the linkages formed with the user sector are quite strong. The level of support from the founding and contributing members was indicative of substantial commitments to the network. However, the Committee believed that small and medium-size enterprises may find it difficult to become involved with the network because they lack the necessary financial resources to pay the membership fee. The network must consider a more flexible mechanism for including new partners.

The Committee had a strong sense that funding this network would facilitate the retention of highly qualified personnel in Canada as well as foster the commercialization of results by Canadian companies. It was noted

that many of the applicants' other research is being funded by foreign companies, leading to the exploitation of results outside of Canada. Clearly, the network must pay close attention to the issue of intellectual property as this could prove to be a stumbling block to commercialization by the user sector.

The network management structure was regarded as simple and effective. The co-leadership of Drs. Harasim and Calvert is considered a strength.

Recommended for funding.



Selection Committee's Evaluation

Networks Not Recommended for Funding



- 13 The Biomaterials Network
- 14 Organic Materials for Information and Electronic Technology
- 15 Environmental Applications Research Network for Operations in Extreme Environments
- 16 Network for Pollution Prevention and Waste Recycling
- 17 Canadian Maternal and Infant Health Network
- 18 Health Network of Centres of Excellence
- 19 The Canadian Network for Technology-Based Learning: Health
- 20 Technology-Based Learning Network Canada
- 21 Canadian Network on Trade, Innovation, Competitiveness and Sustainability
- 22 Consortium for Research on International Competitiveness, Trade and Sustainability

The Biomaterials Network

Dr. John Davies

This network has assembled a large number of well-respected researchers and small Canadian companies to work in the area of advanced biocompatible materials. The Selection Committee noted that this was not a well-integrated cohesive network research program, but a collection of individual projects loosely divided into three theme areas. The added value of a network approach was not clearly demonstrated; it was judged that the proposed projects could operate equally well outside of a network, either individually or in small groupings with the private sector partners. Although it was recognized that interdisciplinary interactions could be developed with time, this would require a very strong commitment on the part of the research management to focus the network research effort.

The training environment in this network is enhanced by interactions with the companies involved as industry partners. This would provide students with valuable experience for future employment, and an entrepreneurial environment that could foster the formation of spin-off companies. However, it was noted that the network would have to ensure that students are not isolated within individual projects with the exchange of information restricted because of confidentiality agreements with industry.

The networking among the theme areas and the various subprojects was considered to be rudimentary, with limited opportunities for interdisciplinary collaborative interactions. At the level of individual projects the links to industry are strong. This network has also attracted the participation of the financial community, including venture capitalists. The potential for increasing levels of contributions from the private sector was judged to be quite positive.

The Committee agreed with the targeting of small Canadian companies as the appropriate receptors for network research. The links to industry are clearly established, thereby providing good opportunities for technology exploitation. Nevertheless, this is a high-risk area with strong international competition and the possibility of existing proprietary positions. The network was judged to have a limited awareness of the impact of dominating patents or licenses on the network's future ability to commercialize research results.

The Committee noted that effective leadership and strong management would be particularly important in order to meet the challenges of focusing the research program, establishing priorities and reallocating resources. However, the proposed management structure was judged to have serious weaknesses. The time commitment of the proposed Program Leader was considered to be inadequate for this vital function.

Not recommended for funding.

Organic Materials for Information and Electronic Technology

Dr. Jaan Noolandi

The Xerox Research Centre of Canada identified an opportunity to “leapfrog Canada into the electronic display industry” through the development of new organic materials for electronic flat panel displays. Although this is an area that is intensely competitive internationally, this group believes that through a well-managed university-industry collaborative effort it is possible to develop core competencies that will help to establish a niche market for Canada.

The Committee viewed this as a highly focused research initiative, with two theme areas clearly linked to achieving this objective. However, the third theme involving the development and characterization of materials for smart sensors and actuators was less clearly linked, detracting from the cohesiveness of the overall research program.

This group could develop highly qualified personnel trained in an interactive environment, with benefits derived from working with industry partners at company locations. This would have a positive impact on their future employment prospects. The multidisciplinary nature in this network is judged to be relatively limited in the initial phase of the research program which is primarily focused on synthetic chemistry, although a broader materials science approach will be used for the characterization and testing of the new materials.

This network involves research partnerships that include universities, industry and government. The specific role of the non-university participants in the research projects was not clearly defined, apart from the fact that the private sector partners would be involved at the level of testing prototype devices, and pilot plant production of materials. The contributions from Xerox Canada represent a significant commitment relative to other industry partners, who are not involved to the same extent. While the proposed contribution from Xerox Canada is modest relative to that company's total expenditure on research, their level of support would certainly increase significantly at the commercialization stage.

The Committee noted that the potential for technology transfer and growth in the technology base of private sector partners is one of the strengths of this proposal. The active involvement of industry would ensure the relevance and market orientation of the research program. The private sector partners are already in place with the resources required to commercialize the results of the network research program. Nevertheless, given the involvement of companies with a multinational base of operations, this network would need to ensure that the research results would be exploited to the greatest extent possible in Canada.

Strong leadership would be provided by the proposed Program Leader from Xerox Research Centre of Canada, where the network administration would be located. However, it would be important to ensure that the management of the network included active participation from additional companies.

Not recommended for funding.

ENVIRONMENT

Environmental Applications Research Network (EARN) for Operations in Extreme Environments

Dr. Jack Clark

The Selection Committee recognized the high quality of the researchers involved in the EARN proposal who have an excellent track record in the development of technology in an area of strategic importance to Canada. The Committee noted that the proposed research program focused on the application of existing technologies rather than the generation of new approaches. It was also considered to lack focus. A serious weakness of the proposal was the fact that the socio-economic impacts of the technological changes were not addressed.

The training strategy of highly qualified personnel, as described in the EARN proposal, was considered excellent. In particular, the Committee was impressed by the requirements that graduate students take industrial internships and courses in social sciences, business and entrepreneurship. These students would have an edge in finding employment with the private sector.

The networking amongst universities and the private and public sectors appeared to be strong. The Selection Committee was impressed by the high private sector involvement in the proposal. The Committee noted that the EARN network is built on linkages established through C-CORE; however, the added value from the proposed network was not clearly demonstrated. The linkage with the social sciences was considered very weak. The Committee also deemed the relationship with aboriginal groups needed to be addressed, given that they are important stakeholders of the proposed research.

The research participants have an excellent record of technology development and transfer. The Committee had no doubt that this would continue in the future. It noted that the extent of international competition may have been somewhat underestimated by the applicants.

The Selection Committee expressed high regard for the Program Leader whose departure from this position after the first six months was a concern. Another concern was the fact that key research management positions, such as Theme Directors, have not yet been specifically identified. The Committee felt that leadership and commitment are essential in a network, given the complexity of managing a national program.

Not recommended for funding.

ENVIRONMENT

Network for Pollution Prevention and Waste Recycling

Dr. Christian Roy

The Selection Committee was impressed by the excellence of the researchers involved in the proposal. The group proposed to search, develop and transfer to Canadian industry novel technologies for source control of pollution, for the recycling of solid and hazardous wastes into useful or inert products, and for the clean-up of contaminated soils. The Committee considered the proposed research to be high risk but recognized it could result in a high pay-back if it were successful.

The Committee expressed concern that the proposal concentrated primarily on technologies that focus on pollution control with less emphasis on prevention. The research programs for the socio-economic and toxicology nodes were not considered clearly developed and well integrated with the rest of the research program. The Committee would like to have seen more evidence of the knowledge of the research done abroad with regard to the public perception of risk.

The proposed training plan for highly qualified personnel was considered to be very good, especially in providing training in real-world applications in an entrepreneurial setting. The Committee noted that the training curriculum would have benefited by the inclusion of the health and socio-economic aspects of pollution prevention.

The linkages between the three major groupings of universities were considered strong. As mentioned above, it was felt that the integration of the socio-economic and toxicology disciplines could be strengthened. In addition, the Committee thought that the multidisciplinary aspect of the proposal would have benefited from a stronger involvement of ecologists in the research program.

The Committee had no doubt about the great potential for transfer of technology of the proposed program, given the track record of the principal investigators. The Committee expressed concern that focusing on a particular technology could be high risk, given the high level of competition in this area. The Committee was very impressed by the strong support of the private sector, nationally and internationally. To facilitate the application of the resulting technologies, the Committee believed that policy makers should be more closely involved in the research program.

The leadership and entrepreneurial abilities of the Program Leader were considered strong points of the proposal. The Committee felt that the proposed network management structure was very appropriate.

Not recommended for funding.

HEALTH

Canadian Maternal and Infant Health Network (CMIHN)

Dr. Michael Kramer

The Canadian Maternal and Infant Health Network (CMIHN) addresses issues that are highly relevant to health services and population health research. The Selection Committee noted that important benefits are associated with the proposed area of research such as resource savings and productivity gains from improvements in the health and health care of mothers and infants.

However, the proposal presented multiple narrowly defined projects which were not well-integrated into a truly cohesive interdisciplinary program within an overall research framework. While the Committee recognized that most of the researchers are experts in their disciplines, it noted a lack of sociological expertise within the group.

The Committee judged that, although the research program would promote multidisciplinary research, the training approach did not take advantage of a network environment. The issue of developing and retaining highly qualified personnel in Canada was considered to be poorly addressed in the network proposal.

The Committee concurred that the CMIHN applicants have involved many Canadian academic institutions and developed good linkages at the federal government level with the National Perinatal Surveillance System (Health Canada).

The network's development of new products, processes or services for commercial exploitation were deemed likely to be modest. The links developed by the network with industry were considered to be rather limited. This is reflected by the low level of cash and in-kind contributions expected from the industrial sector.

Involvement with provincial health agencies, which deliver the health care programs in Canada, was also considered insufficient. This would limit the opportunities for the network research to have a major impact on policy-making and health care delivery.

The model of network management proposed by the applicants was considered to be weakened by its over-centralized leadership approach.

Not recommended for funding.

HEALTH

Health Network of Centres of Excellence (HENCE)

Dr. Judith Maxwell and Dr. Stuart MacLeod

The HENCE proposal aims at improving the ratio of health care costs to GNP. The NCE Selection Committee considered this to be very timely, particularly in view of the restructuring of health care systems currently underway in most provinces. The Committee considered the work proposed under some of the research themes addressed in the proposal to be knowledgeably designed and well presented. However, in several other research themes, it judged that the applicants failed to articulate a comprehensive research approach. The Committee felt that the research did not adequately address public health issues in the continuum of tertiary, regional and home care services.

The health services training program outlined in the HENCE proposal benefits from the involvement in the network of highly regarded educational institutions however, it was felt that more detail should have been provided for the non-traditional aspects of this training program.

The HENCE applicants have assembled an impressive group of highly-regarded university, industrial, professional and public sector partners to work on a socio-economically important research area. Their networking efforts include most of the key stakeholders, including the provinces. However, there were two major groups missing: health care providers and consumers. This was considered an important omission that would limit the acceptance of the proposed solutions.

The proposal appeared to have significant potential for technology transfer to public sector partners. A more active involvement of Canadian commercial partners would have provided the market and business experience to commercialize research outcomes. The major benefit to Canada arising from the HENCE proposal

would come from the development of cooperative links between provinces and the provision of information to help address the economic challenges to the Canadian health care system.

The program co-leaders demonstrated clear and effective leadership and expertise in the business management function. However, the highly centralized management model they proposed might not adequately respond to the changing needs of the Canadian health care system.

Not recommended for funding.

TECHNOLOGY-BASED LEARNING

The Canadian Network for Technology-Based Learning: Health (C-NET:TBL)

Dr. Penny Jennett

The development and implementation activities of the proposed research program were regarded as being at the leading edge of medical education and networking in that field. However, the proposal was seen to be very narrowly focused on aspects of health and would, therefore, have limited applications in the broader context of general education and learning.

The proposed research program was judged to be weak in several areas. The research pertaining to the current state of training and learning was not judged to be at the leading edge. In a significant number of proposed activities, there were no explicitly stated research questions.

The development of young professionals appeared to be limited to the medical and health communities and there was little evidence of the consideration of methods to transfer knowledge and expertise beyond these communities. This would limit the impact upon the broader education and training community.

The links to the private sector looked to be very strong. However, the approach to networking appeared to be focused on co-ordination of activities rather than collaboration of individuals.

Because of the strong industrial links, the potential for technology transfer was considered to be very promising and was regarded as a strength of the proposal. However, there was a concern raised that the dominant position of two large companies in the network structure might make it difficult for smaller firms to become involved.

While seen as rather complex, the management structure was regarded as one of the strengths of this proposal.

Not recommended for funding.

Technology-Based Learning Network Canada (TBL.CA)

Dr. Carl Cuneo and Dr. Brian Gaines

The Committee considered the concept of creating an open network environment serving as an interface for the collection and sharing of data to be an innovative approach to technology-based learning. The research program was judged by the Committee to be weak in terms of content with no over-arching conceptual framework. The research questions and issues to be pursued, while clearly stated, lacked detail on the implementation and the deliverables.

The Committee was also concerned with the quality of the evaluation framework component. The planned evaluation of learning and training software/systems did not reflect important developments in the field of evaluation in education and in the social sciences.

The network would foster the development of highly qualified personnel through exposure to a wide array of research projects and experiences. However, the Committee was not convinced that the actual mechanisms for the training strategies had been clearly identified.

The nature of knowledge-based networks and new models of network management presented were regarded as innovative. However, it was not clear whether all of the participants shared these views. The commitments and support from the user sector were seen as very impressive even if somewhat overstated.

Knowledge exchange and technology exploitation were regarded as notable strengths of this proposal. The network proposed a market-driven approach that would ensure the commercial exploitation by industrial partners. Intellectual property issues have been explicitly addressed. The methodology for transferring research results to affect policy development in government was not clearly defined.

The network leadership was clearly seen as being strong and effective, as evidenced by the bringing together of so many participants and users in so short a period of time. However, it was not clear to the Committee whether the proposed structure would serve to keep all of the participants working together with a common goal and focus.

Not recommended for funding.

Canadian Network on Trade, Innovation, Competitiveness and Sustainability (TICS)

Dr. Stan Shapiro

The TICS network is comprised of a group of internationally recognized scholars representing a wide range of disciplines and research areas. The focus of the network is on the role of technical and organizational innovation, government regulation and policy, and incentive structures in encouraging productivity in the target area.

However, the research plan presented did not assure the integration of individual theme areas and projects in the overall conceptual framework proposed by the network. In particular, the Committee noted that sustainability issues were not adequately dealt with or specified in the research program. Outcomes and implications for public policy and for potential stakeholders in the private and public sectors were unclear.

The Committee considered the proposed involvement of graduate students and postdoctoral fellows an important aspect of the proposal. The interdisciplinary approach, the internship model and the management co-operative program offered innovative approaches to training and human resource development.

TICS has assembled a large number of established research centres and institutes as members of the network. While the Committee commended the concept of building on the activities and experiences of existing centres, it concluded that team-building at the researcher level needed to be strengthened in order to benefit from the network approach.

The framework devised for knowledge exchange and technology exploitation was considered generally feasible and appropriate. However, a greater effort would be required to actively include the user sector partners in all phases of the research continuum, from defining research questions to the dissemination of results.

Although the network builds on the existing interactions with industries developed by the various centres, their role and contribution to TICS was not clear.

Given the complex nature of the "centre of centres" approach, effective leadership and strong management are essential to enable the network to come together and meet its overall objectives. However, the fact that the TICS group had no clearly designated Program Leader at the critical start-up phase was considered a serious flaw.

Not recommended for funding.

Consortium for Research on International Competitiveness, Trade and Sustainability (CRICTS)

Dr. Leonard Waverman

The objective of the CRICTS proposal is to create a forum for research that would lead to change in Canadian management practices, training strategies and public policy. The Selection Committee recognized that the CRICTS group brings together leading researchers with established international reputations. However, the research program proposed by CRICTS lacked an overall conceptual framework which would ensure that research supported by the network would advance and develop the three central themes of the proposal.

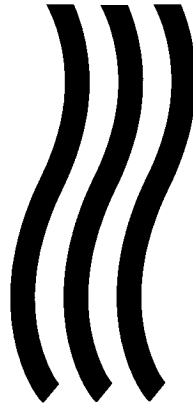
The Committee regretted that many of the research projects were not well articulated and few were multi-disciplinary or interdisciplinary in their approach. Sustainability issues were not dealt with in a coherent or in-depth manner. In particular, the international dimension and context was not well addressed in the proposed research.

The training component of the proposal was considered a strength. A large number of graduate students would be active in the network in a research capacity as well as through international student exchanges to be arranged by the Consortium. The development of placement programs with industry associations was also considered an important and innovative initiative.

The Committee noted the success of the group in attracting partners from the public and private sectors. In particular, the links established with the hydro and forestry industries showed good support, as did linkages with public sector departments concerned with energy and environmental regulation. However, a greater involvement of small and medium-sized enterprises in the research endeavour would have strengthened the competitiveness area.

While the approach to knowledge exchange and technology transfer was considered appropriate, a stronger involvement of the users of the research would make the dissemination plans more effective. CRICTS was designed with an administrative centre, three major nodes and three minor nodes. Although the leadership of the Program Leader was judged to be strong, there were concerns that the participation and input of the smaller nodes would be marginalized and that the proposed management structure would not facilitate a national network environment.

Not recommended for funding.



Appendices

- 25 Appendix I:
Target Area Descriptions
- 35 Appendix II:
Selection Criteria
- 36 Appendix III:
Terms of Reference of the
Selection Committee
- 37 Appendix IV:
Membership of the Selection
Committee
- 38 Appendix V:
Curricula Vitae of the Members
of the Selection Committee
- 42 Appendix VI:
Expert Panels: Terms of
Reference and Membership



APPENDIX I

Target Area Descriptions

Advanced Technologies — Materials

A Network of Centres of Excellence in Materials would undertake research in the design, development, evaluation and fabrication of new advanced materials for industrial and medical applications.

Rationale

To remain competitive in today's changing global economic environment, Canadian companies must be able to rapidly absorb and apply technological advances. This includes the ability to introduce, develop and commercialize new materials or adapt them to a manufacturing process.

Historically, many of the major innovations in materials technology have come from the novel synthesis of either totally new materials or of existing materials via simpler, lower cost, more environmentally friendly routes. Similarly, leading-edge knowledge in processing technology is essential for the conversion of new materials into marketable components, devices, structures and systems. Processing technologies are increasingly regarded as "technology enabling," hence critical in the development of new products.

A few examples are sufficient to indicate the significance of this research to Canada. Our traditional resource-based industries must keep pace with competing novel materials, including improved alloys and plastics, and improved recovery and refining techniques. Similarly, Canada's automotive and aerospace industries are under a dual pressure to remain competitive with offshore manufacturers and to develop more energy-efficient products that have a lower impact on the environment.

As miniature mechanical and electronic devices become value-added features of new industrial and medical applications, the worldwide interest in their design and fabrication is intensifying. Similarly, new bio-compatible materials are needed to maintain Canada's growing medical devices industry in a competitive position. Such materials must function successfully within the human body in roles as diverse as artificial membranes, sensors of body chemistry and replacements for tissue such as bone.

A Network of top researchers from university, industry and government laboratories would provide timely access to advanced materials research and draw together a wide spectrum of research resources. This concerted national R&D effort would increase traditional and emergent industries' capability to exploit new technical knowledge and advances in materials research.

Research in advanced materials requires highly complex interdisciplinary activities. A new Network would provide a cohesive structure to take advantage of Canadian expertise and coordinate the wide spectrum of applied and basic research activities needed to develop and exploit new advanced materials.

Issues

The development of new materials and cost-effective, environmentally friendly fabrication techniques will stimulate the design of innovative products and improve the competitiveness of Canadian industry.

A wide range of commercial applications are opening up for biomaterials, making it vital for Canadian companies to have access to the latest research techniques, for creating materials that are structurally and chemically compatible with living tissues.

Composites technology is another field of emerging importance. Polymer-metal composites are being introduced at a rapid rate by Canada's competitors. Significant discoveries, such as that of nanocrystalline structures, are creating other opportunities.

Research Themes

A new Network would focus on the development, synthesis, characterization, processing and fabrication of novel materials within a specific materials area. Potential areas of research could include medical devices, biomedical materials, microfabrication, soft materials and membranes, advanced polymers, molecules with functionality (e.g. photoactive pigments), improved alloys, ceramics, composites and thin films.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- Researchers working in advanced materials and novel material fabrication in university, industry and government laboratories;
- Canadian industry, from small- and medium-sized enterprises to large corporations; traditional and emergent firms involved in such fields as telecommunications, aerospace, energy, automotive systems, medical devices, specialty chemicals, manufacturing and biotechnology ventures; entrepreneurs at the frontier of innovative materials uses, conversion and design;
- Business and management professionals, economists, environmental experts, medical/pharmaceutical organizations and federal/provincial government departments and agencies.

Advanced Technologies — Software Engineering

A Network of Centres of Excellence in Software Engineering would undertake research on the principles, tools and methods needed for the timely development of reliable, efficient, easily upgradable, high quality software systems.

Rationale

The global demand for automated systems, products and services has exploded exponentially. The productivity of almost every economic sector, from financial services to aerospace, manufacturing, telecommunications, health, energy and automotive, now depends on software technologies and ultimately the engineering expertise that underlies them. Such expertise is also needed to develop the tiny microprocessors that are responsible for the so-called “smart” features of many new products.

Canada can derive major social and economic benefits from the development of its expertise in this field. The country already has major software strengths, and the markets for our products and services are growing rapidly around the world. More than 10,000 Canadian firms currently use, develop and produce sophisticated software and systems. All of these firms depend on advanced methodologies and tools for software development.

As the complexity of demands placed on software increase, quality and reliability become key issues. However systems must not only be efficient and highly accurate, they must also be flexible and easily upgradable. They must be able to evolve with changing user requirements, new hardware capabilities and the integration requirements of open systems technology. Developing software to satisfy these demands requires the rigorous application of software engineering principles and methods.

A Network in software engineering would provide the sustained thrust to advance the body of research knowledge required for this practice and encourage effective application of new research information and technology. The network would recognize the diversity of needs of large and small firms. It would capitalize on the expertise in the academic, industrial and government sectors, encourage the movement of concepts between sectors and build the intellectual infrastructure for progressive, experimental research. It would foster multidisciplinary efforts and provide the educational foundation to support software engineering as a discipline.

To create the bridge between academic research and industry, the network should focus on projects that clearly demonstrate the utility of proposed new software engineering principles and methods.

Issues

A central issue is that systems that must meet many needs or adapt to changing consumer requirements and hardware capabilities have a tendency to become unnecessarily complex. Poor design increases complexity, exposing suppliers to greater development costs, as well as delivery and quality problems. Faults in commercial software may have costly and severe consequences. A focus on design and analysis issues can reduce complexity and the many associated management problems. The new network will respond to this challenge by establishing more reliable techniques and methodologies for the entire software life cycle.

Research Themes

Research supported in this network must relate to one or more of the following core areas: software architectures; processes for the software life cycle; software evolution and retro-engineering; requirements analysis; design models; prototyping and evaluation; configuration management; risk assessment; verification and validation; quality assurance and assessment; performance prediction and evaluation; software development environments; integrated systems design; real-time and safety-critical applications; and standards.

Network researchers will need to demonstrate capabilities in the areas of: systems software operating systems, compilers, languages, databases and network software; real-time, distributed and large systems; user interface design; multimedia or mixed-media environments; telecommunications software; finance and manufacturing; mathematical models/structures underpinning software designs; neural networks and fuzzy logic; and simulation.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- Researchers working in software engineering in university, industry, and government laboratories; many of these centres are internationally recognized for their software engineering expertise, while others are still maturing;
- Canadian industry, from small- and medium-sized software development companies and suppliers, to major industrial players heavily reliant upon software engineering expertise. This could involve companies involved in areas such as information systems, computer graphics, user interface design, telecommunications, aerospace, energy, automotive systems, manufacturing process control, financial services, media industries and publishing;
- Business and management professionals, economists, psychologists, industrial and medical organizations and federal and provincial government departments and agencies.

Environment

A Network of Centres of Excellence in Environment would focus on the development of Canadian environmental technologies and know-how as well as stimulate the growth of a dynamic Canadian environmental industry by advancing the state of environmental science, technology, practices and processes.

The aim is to improve Canada's competitiveness in the growing environmental products and services markets while promoting sustainable development and a healthy living environment for Canadians. A Network would also need to address the challenge of effectively translating Canada's scientific and technical leadership into commercial success. A Network would integrate research from the social, human, health, natural sciences and engineering, as well as enhance understanding of the social, economic and political implications of applying the new knowledge. In order to achieve all of these goals it will be necessary for such a Network to promote the development of human resources.

Rationale

Canada is a leader in environmental research and in the development of environmental technologies in such areas as pollution prevention, water and wastewater treatment, solid and hazardous waste handling, toxicology, air pollution control and energy efficiency. However, this scientific and technical leadership has not been translated into commensurate commercial success. For example, Canada's annual environmental equipment trade deficit is about \$900 million. Canada also has expertise in the social, human, natural, and health sciences, and engineering, which can be applied to improving the information base for policy analysis and the timeliness and quality of decision-making on issues affecting the environment.

A network would advance environmental research and development, explore applications of new technologies and know-how in this field, and improve decision-making within the context of sustainable development. It would link university researchers in the social, human, health, natural sciences and engineering, government laboratories, manufacturers, financial institutions, service suppliers and ultimate industrial users.

Links could also be established with the new National Environmental Technology Advancement Centres, which provide technical and business services to Canadian firms for the commercialization of environmental technologies. A Network would train environmental scientists and technical experts required by universities, industry and government. Links could also be made with other Networks.

Through a cohesive effort and rapid exchange of knowledge and research results, industrial participants would be better equipped to compete in the domestic and world environmental products and services markets within a sound public policy framework. These are currently valued at U.S. \$11 billion and U.S. \$300 billion respectively, and are forecast to reach U.S. \$22 billion by the year 2000 and U.S. \$425 billion in 1997 respectively (Environmental Industry Strategy for Canada, Consultation Paper).

Issues

The main environmental issues for Canada have been identified by Environment Canada as climate change, ozone depletion/ultraviolet-B radiation, biodiversity, and toxic substances, particularly in air and inland water systems.

Environmental technologies developed in Canada can help to ensure the sustainability and economic viability of important sectors of the Canadian economy: traditional sectors such as fishing, mining, forestry, agriculture, energy, and manufacturing, as well as other industrial sectors that require new technologies for "greening" their processes in order to meet the highest policy and regulatory standards. A central environmental concern is the risk to human health.

Canada requires more trained engineers and other environmental scientists to discover, evaluate, disseminate, and market advanced technologies. Training in management, technical skills, management of industry change and development of linkages with public and private stakeholders are also required.

An environmental network would be expected to link the social, human, natural, and health sciences, and engineering, technology development, diffusion and commercialization. Particularly important is the issue of identifying the areas which are vital for the preservation of health and sustainable development, and which can most benefit from multidisciplinary research being carried out in Canada.

Research Themes

A Network of Centres of Excellence would address key research issues under the two following themes:

Environmental technology research

Research on aspects of environmental sciences, technologies, and practices. This includes technologies which aim to: monitor and assess the nature and pathways of pollutants and waste streams, and the associated impacts on the eco-system; prevent pollution by minimizing or eliminating solid, liquid and gaseous by-products and contaminants through process reengineering; control pollution through remedial action, restoration processes and other biological and technological processes; clean up and restore environments that have been degraded through neglect and misuse; and improve products, processes and technologies through biological and biotechnical engineering.

Management research

The socio-economic assessment of new technologies and the management of technological change. In assessing the social, health and environmental impacts of such change, a network will consider associated issues such as policy, economic, and market instruments that will promote the development of green technologies and industries, training, and legal issues related to the deployment of new technologies. A network will conduct research on marketing strategies, and examine new training programs and human resource development. A network will also address how environmental technology may be advanced or restricted by health, social, economic and scientific policies.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- University researchers in the areas of natural, social, human, and health sciences; engineering; environmental sciences; marketing and management;
- Industry including the manufacturers and users of environmental products and technologies, industrial associations, financial institutions, consulting and supplier groups, and various environmental organizations;
- National Environmental Technology Advancement Centres;
- Federal and provincial government departments and agencies.

Health Research

A Network of Centres of Excellence in Health Research would explore cost effective ways to maintain and improve the country's health system. Such a Network would examine how health is created and maintained and how effective health care is vital to Canadians' quality of life and can offer economic advantages to Canada. Research would focus on factors that impact on the health of Canadians and the efficiency of the country's health care system. These include social and economic factors, work and other environments, and the effectiveness of various health interventions such as technologies and health care delivery methods.

Rationale

Canada's health care system is respected internationally, and embodies values cherished by Canadians. Yet there remain inequities in the health status of our population and there has been growing attention paid to the cost effectiveness of the present health system. A Network in Health Research would address these concerns by drawing upon the country's widely recognized health research strengths and expertise. Such a Network would mobilize researchers and centres in Canada that have already achieved international recognition for their work and have developed extensive databases on our health care system. This approach has domestic and international attraction.

Canadians' health is central to the country's social well-being and economic competitiveness. Research in health can have a direct impact on the preservation and improvement of the country's social well-being. Health also has direct economic benefits. Canada spends \$70 billion per year on health; even modest increases in efficiency or decreases in costs will offer major economic advantages. Canada's ratio of health care costs to GNP is less than that in the United States, but more than that of other jurisdictions, giving us a competitive edge in the one case, and a disadvantage relative to others. Improving this ratio therefore directly affects our competitiveness. Furthermore, Canadian knowledge and expertise offers a potential industrial advantage: the exportation of our health care delivery systems and methodologies, especially in the context of significant change in the health system south of the border.

There are two promising areas of research in which a Network would make significant contributions. Both are vital to the future management of Canada's health care system and to international health. One is population health research, a study of the determinants of health, including social and economic factors, genetic heritage, and environment. The second is health services research, which examines the cost effectiveness and efficiency of various health interventions, such as new therapies or technologies, health care delivery methods, and clinical practices.

Issues

Society's concept of health has evolved rapidly in recent years and now places great importance on determinants of health. These determinants come from many sources, including social and economic factors, genetic heritage, nurturing *in utero* or in early life, and the environments at work and elsewhere. Health research is now increasingly directed at elucidating the determinants of health so that social and other systems can be modified to improve the health of the population.

Fiscal realities are forcing a change in Canadians' perceptions of the return on funds invested in health care delivery. There is increasing awareness that we cannot afford the past decade's rapid growth in health care costs. Patients and health care professionals are questioning the effectiveness and efficiency of health care interventions. An unacceptably high proportion of the preventive, diagnostic or treatment procedures now used in our health care system have never been rigorously demonstrated to be effective or efficient. The adoption of low cost but frequently used interventions that have proven their value offers the potential for enormous savings.

In Canada, the delivery of health care is the responsibility of the provinces. Taking into account that health status and health care can both consume and generate wealth, the issues addressed and knowledge generated by a new Network should be of substantial interest to the provinces early in its development stage.

Research Themes

Such a Network would address one or both of the following themes:

□ Health services research

A study of the effectiveness and value of health care interventions, including technology assessment, health care delivery methods and clinical practices. Part of the transfer and exploitation of this knowledge could include the development of mechanisms to analyze health risks, benefits and costs (associated with variations across populations in the delivery of specific treatments), new practice guidelines, the cost-effective rationalization of health care resources, and stimulation of industrial innovation.

□ Population health

A close examination of the diverse and complex determinants of health and their impact on the health status of Canadians. Such determinants include social and economic factors, genetic heritage, lifestyle choices and environment, including nurturing and work environments. Research can be expected to have major effects on individual as well as population health in the long term.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- Researchers in the areas of all health sciences, health policy, economics, and management and information sciences;
- Federal and Provincial Health Departments, government and voluntary research agencies, health professionals, and consumer representatives and associations;
- Hospitals and health care organizations;
- Workers' Compensation Boards and unions;
- Industry, including health management companies, insurance companies, drug manufacturers, biotechnology and diagnostics companies.

Technology-Based Learning

A Network of Centres of Excellence in Technology-Based Learning would focus on the application of new and emerging information and communications technologies to education, training and management/skills development. The Network would also research the social impact, effectiveness and economics of such applications and work with potential users to apply the results of this research.

Rationale

Learning opportunities in the home, the classroom and on the job are exploding as new technologies emerge. Educators and trainers are increasingly taking advantage of information and communications technologies for distance education, open learning and workplace training. This trend is being driven by two factors: the need for a more cost-effective and efficient learning system and the rapid development and convergence of information and communications technologies in networked systems.

Schools, homes, businesses, libraries, hospitals, universities, laboratories and government offices are gradually being linked by communication networks to the emerging electronic highway. Educational materials (courseware, electronic libraries) are being developed by local, regional and national interests. More and more interactive courseware is being produced, using integrated digital text, graphics, sound, animation and video (multimedia).

Canadians have much to gain socially and economically by applying this country's strength in communications, software development, educational broadcasting and multimedia technologies to enhance learning and capture market opportunities. As well as improving our skills and knowledge, we can take advantage of the potential for strong Canadian sales to domestic and international markets for technology-based educational and training products and services. The Canadian market for new media technologies is estimated to be \$500 million/year. We underinvest in workplace training, but public and private sector expenditures in this area may reach \$5 billion annually in the next few years, of which \$150 million/year will be for technology-based training.

The latter figure could translate into over 1,000 jobs in the advanced technology field, as well as into significant additional revenues from export sales. It is estimated that American companies supply up to 90 percent of the electronic course materials used in Canadian schools, while Canadian software, communications and multi-media companies export most of their products and services.

Issues and Research Themes

Canada's success in a knowledge-based economy depends on the knowledge and skills of its people, and therefore on training and education. Both employed and unemployed workers need training and retraining if they are to acquire and maintain the skills needed to function effectively in a highly competitive and rapidly changing global marketplace.

A new Network of Centres of Excellence would enhance and exploit the country's existing R&D in technology-based learning. Research should explore how people learn and how best to use new and emerging technologies to enhance the learning experience. Such a network would address key pedagogical and technological issues such as:

- perception, cognition, natural language processing, speech recognition and social psychology, to improve the design and application of hardware and software and facilitate learning;
- identification of categories or groups of learners, tasks, and situations that benefit most from (or are disadvantaged by) particular instructional methods or media;
- ways that technology can be used to integrate schools, offices and homes to encourage communication and cooperation among schools, teachers, and parents and the working world;
- design of systems to increase the efficiency of training;
- effect of technology on what is taught, and how it is taught;
- impact of automated teaching on learning and retention rates, motivation to learn and learner preferences in various learning situations;

- application of new technologies to demand-driven and learner-centred education and training;
- impact of communications and new media technologies on the teaching and learning process;
- economics of technology-based education and training.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- Researchers in the areas of education, educational psychology, training, management development, economics, computer science, engineering, social and health sciences, media and technology, information science, communications, industrial relations, sociology;
- Educators and educational organizations, including universities, teacher education institutions, hospitals, community colleges, and provincial departments of education, school boards, schools and teachers;
- Employers, trainers, business schools, industry and professional associations, and labour organizations;
- Federal government departments and agencies, including Industry Canada, Health Canada, Human Resources Development Canada, and Canadian Heritage;
- Industry, including training/educational service providers, related software and hardware suppliers, and telecommunications and new media companies and organizations.

Trade, Competitiveness and Sustainability

A Network of Centres of Excellence would examine key issues in trade, competitiveness and sustainability to help shape Canada's future well-being and competitiveness in a knowledge-based global economy. Such a Network would build an integrated and coordinated knowledge base to help diffuse this knowledge and find applications in business and management strategies, and other policy- and decision-making channels.

Rationale

Trade, competitiveness and sustainability will be among Canada's highest priorities in the decades ahead. This country must especially address a number of trends and challenges that have arisen largely through technological innovation, global economic restructuring and environmental degradation. A Network that pools the talents of the country's best researchers and partners from various disciplines and sectors would have the ability and capacity to study and tackle these challenges in a coherent and strategic manner.

A major challenge is the fact that Canada's future prosperity depends more and more upon its ability to develop an economy in which wealth is based on the production and application of new knowledge and technological innovation, while respecting the principles of sustainable development. A Network would embrace research in the natural, social and engineering sciences and humanities in the pursuit of national goals in trade, competitiveness and sustainable development.

A Network would serve as a focal point for building a national knowledge base on trade, competitiveness and sustainable development and would ensure that the knowledge is transferred between universities, industries and government. Furthermore, a Network would help to provide the most recent and reliable knowledge base from which economic and environmental factors would be integrated into the decision-making in both the private and public sectors. Policy makers and legislators who analyze and implement national options, as well as managers and business executives, would have the opportunity to gain fast and easy access to this leading-edge academic research on a number of matters, including incentives, regulations, and education.

A strong capability offered by such a Network in trade-related areas is necessary to support Canada's participation and leadership in international negotiations on multilateral trade and global environmental conventions. The Network's cohesive research would also contribute to a better understanding of the national and global environmental impact of trade liberalization and economic restructuring. It would assist in the development of business and management strategies to enable Canada to adjust to, and benefit from, the changing international trading environment and the latest technological and organizational innovations.

Issues

With an economy that is heavily dependent on trade, Canada has much to gain from recent developments to encourage trade liberalization. To benefit, however, Canada must provide greater focus to research development and capacity building in the area of trade, competitiveness and sustainable development.

A growing body of empirical evidence shows that lack of strategic management and a global mindset in Canadian firms is a key obstacle to accessing new markets and capital, and to increased technology diffusion, innovation and workforce skills development.

Environment and trade have become major issues in international forums. Agenda 21, the action program that emerged from the 1992 Earth Summit, placed considerable emphasis on promoting sustainable development through trade. The General Agreement on Tariffs and Trade (GATT) has also called for an open, equitable and predictable multilateral trading system that is consistent with the goals of sustainable development.

Canada's international leadership in trade and sustainable development would be enhanced through a Network of Centres of Excellence in this targeted area, to provide support for the next round of international negotiations on the GATT and discussions related to global environmental conventions. The action plan "Creating Opportunity" indicated that Canada will make sustainable development a fundamental goal of trade negotiations and that it will support a "green" round of GATT negotiations, in which trade and environment will be linked.

Research Themes

A Network of Centres of Excellence would examine key issues relating to trade, competitiveness and sustainability under four key themes:

□ **Regulation and long-term competitiveness**

Among the areas supported would be the study of technology and innovation and how they are advanced or restricted by trade, environmental and management policies. Michael Porter and other academics have argued that businesses that operate within a tough domestic regulatory environment are often the most able to compete internationally. Further research would identify trade-offs and complementarities between regulatory standards and the competitiveness of Canadian industry. Other important issues are the design of effective policy instruments to facilitate technological learning, help Canada to adjust to structural change in the economy, and promote sustainable development.

□ **Managing in a rapidly evolving world economy**

A Network of Centres of Excellence in this target area should make leading-edge academic research in management development more relevant to business, and diffuse and apply it more widely. For example, research would address how trade liberalization and regional integration of trading blocs affect firms' innovation, decision-making, marketing, location decisions and patterns of production. It would also assist in the task of greening management practice through the introduction of audits and monitoring mechanisms and the formulation of specific sustainable development policies and plans.

□ **International leadership**

Research can contribute to Canada's leadership in international trade negotiations, by addressing issues related to differences in environmental and labour standards, and a broad range of concerns related to testing, certification, economic incentives, and intellectual property rights. A better understanding of these issues can help create a consensus for cooperation on trade issues.

□ **Sustainability**

Research on government policies and decision-making related to the provision of subsidies, the use of economic incentives, and full cost pricing of resources can contribute to the government's goal of implementing the principles of sustainable development. Research would also contribute to debate and understanding on the role of trade in addressing global environmental issues, related to control of emissions of greenhouse gases, the conservation of biological diversity, and any future agreement in the area of forestry.

Stakeholders

A network would involve collaboration among organizations and individuals such as the following:

- Researchers in relevant areas of the natural and social sciences, engineering, and the humanities;
- Universities, regulatory agencies, policy-makers and decision-makers in provincial and federal governments;
- Federal government departments and agencies including Industry Canada, Environment Canada, Human Resources Development Canada and other science-based departments;
- Industrial executives and R&D managers; the banking and commercial sectors; trades unions and non-government organizations.

APPENDIX II

Selection Criteria

The following five, equally-weighted criteria will be used to evaluate the proposals. To ensure that the program objectives are met, successful networks will also be assessed on an ongoing basis during their tenure of an NCE grant. Networks must excel in each criterion as a condition of both initial and continued support.

Excellence of the Research Program

- The excellence, focus and coherence of the research program;
- Canada's ability to develop a lead position in areas of research with high economic and social impact;
- The quality of the researchers and their ability to contribute to the research thrust;
- An explanation of the relationship of the research program to similar scientific work conducted elsewhere in Canada and abroad;
- A description of how this research benefits or would benefit from a network approach.

Highly Qualified Personnel

- The ability to develop and retain outstanding scientists and engineers in research areas and technologies that are critical to Canadian productivity and economic growth;
- Evidence of non-traditional training strategies which promote multidisciplinary, multisectoral approaches to research and encourage trainees to consider the economic and social implications of their work.

Networking and Partnerships

- Effective research and technology development links among academic institutions and public and private sector participants, indicating the nature and extent of involvement of each participant in the research work planned;
- Demonstration of a multidisciplinary, multisectoral approach in the research program, to the extent feasible, and an explanation of why this is important to the Network's work plan;

- Evidence that an effort has been made to include all suitably qualified parties and relevant facilities in the network;
- The nature and extent of anticipated contributions from the private sector and federal and provincial agencies, and the prospects for these increasing as the work progresses.

Knowledge Exchange and Technology Exploitation

- The potential for the Network's research and technology to lead to new products, processes or services for commercial exploitation that will strengthen the Canadian industrial base, enhance productivity, and/or contribute to long-term economic growth;
- The extent to which a network creates an environment that encourages opportunities for collaboration with the private sector in the application of research to technology and/or in market development;
- The potential for technology transfer and growth in the technology base of private and public sector partners;
- Appropriate mechanisms and plans to:
 - protect the network's intellectual property;
 - ensure it is exploited to the greatest extent possible by firms operating in Canada; and
 - secure the support of investors.

Network Management

- Evidence of an organizational structure suitable for the management of the research and business functions of a complex multidisciplinary, multi-institutional program including:
 - presence of effective leadership and expertise in the business management function;
 - effective research planning and budgeting mechanisms; and
 - a management and board structure that will allow significant resource reallocation decisions to be made and implemented.

APPENDIX III

Terms of Reference of the Selection Committee

A Selection Committee will be appointed as part of the peer review process in the competition for new networks in Phase II of the Networks of Centres of Excellence program. The members of this Selection Committee will be selected and appointed by the NCE Steering Committee which is made up of the Presidents of the three granting councils and the Deputy Minister of Industry Canada or his delegate. The Selection Committee will review the letters of intent according to the selection criteria published in the *Phase II — Policies and Guidelines*, and the relevance of the proposed network to the specified target area. Applicants who have submitted letters of intent that pass this screening process will be invited to prepare full applications. Where appropriate, written advice will be provided to applicants to guide them in the preparation of the application.

The Committee will evaluate the applications according to the selection criteria outlined on the previous pages. To assist it in this evaluation process, the Committee will have reports from expert panels in each of the target areas that summarize the peer review of all applications, including meetings with representatives from each group of applicants. The chairperson for each of the expert panels will be requested to respond to questions and provide additional information during the Committee's deliberations. The Committee will rate all of the applications on each of the selection criteria. To be successful, a network must excel in every criterion.

The Selection Committee will provide the NCE Steering Committee with a list of networks recommended for funding and the recommended level of award for each within the program allocation of \$48 million. This list will be transmitted to the Minister of Industry. If the budget permits and the criteria are met, one network will be funded in each of the five target areas. The Selection Committee's report will provide the rationale for recommendations, with a summary analysis of each application, and may include a list of networks worthy of honorable mention that could be funded if additional resources were to be available. The report will be made public.

APPENDIX IV

Membership of the Selection Committee

Chair

Dr. William A. Cochrane
W.A. Cochrane and Associates Inc.
International Health Industry Consultants
Calgary, Alberta

Members

Dr. John Beck
Professor of Medicine
University of California
Los Angeles, California, USA

M. Aldée Cabana
Vice-président exécutif, Affaires corporatives
Les Industries C-MAC Inc.
Sherbrooke, Québec

Dr. Arthur J. Carty
President
National Research Council
Ottawa, Ontario

Dr. Michael Decter
Managing Director – Canada
APM Inc.
Toronto, Ontario

Ms. Maureen Farrow
Executive Vice-President
Loewen Ondaatje McCutcheon Ltd.
Toronto, Ontario

Dr. Michael Gibbons
Director, Science Policy Research
Sussex University
East Sussex, UK

Mr. J. Gerald Godsoe
Barrister
Stewart, McKelvey, Sterling, Scales
Halifax, Nova Scotia

M. Réal L'Archevêque
Private consultant
Montréal, Québec

Dr. Ronald W. Marx
School of Education
University of Michigan
Ann Arbor, Michigan, USA

Mr. G. David Nantes, P.Eng.
Vice-President, Operations
Jacques Whitford Group Ltd.
Dartmouth, Nova Scotia

Dr. Konrad von Moltke
Department of Environmental Studies
Dartmouth College
Hanover, New Hampshire, USA

Dr. Peter E. Wrist
Deputy Chairman of the Board
Pulp & Paper Research Institute of Canada
Pointe Claire, Québec

Dr. Hugh Wynne-Edwards
President and Chief Executive Officer
BC Research Inc
Vancouver, British Columbia

APPENDIX V

Curricula Vitae of the Members of the Selection Committee

William Cochrane is currently President of W.A. Cochrane and Associates Incorporated, a health products investment company.

A graduate in medicine from the University of Toronto, Dr. Cochrane moved from private practice to teaching at Dalhousie Medical School in 1958. In 1967 he moved to Calgary where he became the first Dean of Medicine of the new medical school of the University of Calgary. In 1973 he served as the Deputy Minister of Health Services for the Province of Alberta. In 1974 he was appointed President and Vice Chancellor of the University of Calgary. In 1978 he became Chairman, President and CEO of Connaught Laboratories Limited. In 1988 he became Deputy Chairman of Connaught BioSciences. In 1989 he resigned as CEO of Connaught Laboratories but remains a member of the Board.

Dr. Cochrane is a Fellow of the Royal College of Physicians and Surgeons of Canada, a Fellow of the American College of Physicians and a Diplomat on the American Board of Pediatrics. He was awarded the Borden Award of the Nutrition Society of Canada for his scientific research into metabolic diseases of children and was made an Honorary Medicine Chief of the Stony Indians of Alberta for his contribution to the health care of the native people. He has received numerous honorary degrees and in 1989 was made an Officer of the Order of Canada.

Dr. Cochrane is a Director of several companies and was a member of the National Advisory Board on Science and Technology.

John Beck is Professor Emeritus at the University of California, Los Angeles.

Dr. Beck received his medical training at McGill University and had extensive postgraduate training in Canada, the United States and Europe. He was Chairman of the Department of Medicine at McGill until he returned to the United States to become the first Director of the National Robert Wood Johnson Clinical Scholar Program and a Professor of Medicine at the University of California, San Francisco. He is a former member of the Council of the Royal College of Physicians and Surgeons of Canada, the Medical Research Council of Canada, a former Chairman of the American Board of Internal Medicine, and past President of the American Board of Medical Specialities.

Dr. Beck has received several honorary degrees and many awards for his long and outstanding career as a researcher including: a Mastership from the American College of Physicians, the Milo F. Leavitt Memorial Award, the Bruce Hall Memorial Lecture Award, the Duncan Graham Award, the Joseph T. Freeman award and the Irving S. Wright Award from the American Federation on Aging Research.

Dr. Beck has been a leader in the development of medical/education, research and service programs throughout the world, for the last 15 years focusing his efforts in the field of aging.

Aldée Cabana is currently Executive Vice-President, Corporate Affairs for Les Industries C-MAC Inc.

Dr. Cabana received his Ph.D. from the Université de Montréal in 1961 in chemical spectroscopy. He did his postdoctoral work at Princeton University before returning to Canada to take up a position as professor at the Université de Sherbrooke. He has served as Dean of the Faculty of Science and as Rector of the university before assuming his current position in private industry.

Dr. Cabana has served on grant selection committees for NSERC and FCAR, and has been a member of the Council of the National Research Council, and the Canadian Banker's Association.

Arthur Carty is President of the National Research Council of Canada.

Dr. Carty received his Ph.D. in inorganic chemistry from the University of Nottingham and then came to Canada to take up a position as an assistant professor at Memorial University of Newfoundland. Shortly thereafter, he moved to Waterloo to continue his academic career where he eventually became Dean of Research.

A Fellow of the Royal Society of Canada, Dr. Carty has received many prestigious awards such as the E.W.R. Steacie Award from the Canadian Society for Chemistry, the Alcan Award from the Chemical Institute of Canada and an honorary degree from the Université de Rennes. He has served on numerous Boards and Committees, as well as on peer review committees for NSERC.

Michael Decter is Managing Director, Canada for the management consultant company APM Incorporated.

Mr. Decter is a Harvard-trained economist with 20 years of experience in senior-level public and private sector positions. He served as Deputy Minister of Health in the Government of Ontario. He has been a partner in Peat Marwick Consulting Group, Chair of Shawinigan Energy and President of Vista Strategic Information Management. In 1994 he was Senior Research Scholar at the Centre for Bioethics, University of Toronto.

His consulting and public speaking engagements have taken him all over the world. He recently gave the prestigious 18th annual Garland Lecture at the Boston Medical Library. He has worked with many diverse groups, including CIDA on projects in Nairobi, Kenya and Shanghai, China.

Maureen Farrow is the Research Director and Executive Vice-President of Loewen Ondaatje McCutcheon Limited.

Ms. Farrow received her B.Sc. in 1966 from Hull University and did post-graduate work at York University. Shortly after graduating, she joined Ultra Electronics in London as the Marketing Research Manager. In 1974 she moved to the position of Vice President at J.J. Singer Consulting Economists Limited and in 1980 became Vice President of Singer Associates. From 1981 to 1992 she was a partner with The Coopers & Lybrand Consulting Group.

She is past President of the C.D. Howe Institute, a former member of the Council of the Social Sciences and Humanities Research Council and has served, or continues to serve, as a Director on numerous Boards. She is a Fellow of the Institute of Management Consultants of Ontario, and a member of the American Economists Association and the Canadian Association of Business Economists. She is a frequent speaker on global trends, demographics, the environment, innovation and technology issues.

Michael Gibbons is Director of the Science Policy Research Unit at the University of Sussex, Brighton, UK.

Dr. Gibbons was born and educated in Canada. In 1967, he obtained his Ph.D. in theoretical physics from Manchester University where he stayed to become Head of the department of Science and Technological Policy in 1975. In 1979 he founded PREST (Programme of Policy Research in Engineering Science & Technology). In 1988 he was appointed Manchester's Vice-Chancellor's Advisor on research development. In October 1992 he became Director of SPRU (Science Policy Research Unit) at the University of Sussex. In 1993 he was appointed Specialist Advisor to the House of Commons Science and Technology Committee. Dr. Gibbons has received many distinctions and awards throughout his career. He has served and is currently serving on numerous international committees.

His main areas of research interest lie in science and technology policy, economics of technical change, development and evolutionary models of technical innovation.

Gerald Godsoe is a partner in the law firm of Stewart, McKelvey, Stirling, Scales.

A former Rhodes Scholar, Mr. Godsoe was admitted to the Bar in 1968 and currently is a corporate and commercial lawyer with special interest in structuring business ventures, corporate private and public financings, petroleum and mining activities.

He is currently the Chair of the Oceans Institute of Canada and Director of the Canadian Institute of Resource Law. He has been the Chair of the Academic and Research Task Force, Dalhousie University, Chair of the Nova Scotia Barristers' Society Committee on Faculty of Law Review, Executive Director of the Royal Commission on the Economic Union and Development Prospects for Canada, Advisor and Counsel to the Federal Government on the constitution and offshore mineral rights as well as numerous other committees.

Réal L'Archevêque is the former Senior Executive Advisor at the Canadian Space Agency.

Dr. L'Archevêque received his Ph.D. in electrical and electronic engineering from Imperial College in London in 1965. From there, he returned to Canada where he spent 13 years as a researcher at Atomic Energy of Canada Limited. In 1977 he moved to Canatom Inc. where he became President in 1981. In 1983 he joined Société de Recherche SNC Inc. as President. Following that appointment he became Principal Vice-President and Director General of Technology at SNC-Lavalin Inc.

Dr. L'Archevêque's expertise lies in the fields of electrical engineering and electronics, especially applied to instrumentation and real-time systems. He has interests in industrial processes, waste management and environmental processes as well as biomass processing.

Ronald Marx is professor and Chair of the Educational Studies Program, School of Education, University of Michigan.

Dr. Marx received his Ph.D. in educational psychology and child development from Stanford University. Following that he spent 15 years at Simon Fraser University where he was a professor and Director of Graduate Programs. He was a visiting professor at the University of British Columbia and the University of Arizona. He served as Director of Research, Learner's Group, British Columbia Royal Commission on Education.

He is the author of over 150 articles, reports and presentations, and he has garnered over \$3 million in funding for research and development activities.

David Nantes is Vice President, Operations, and Discipline Vice President, Environmental Audit, at Jacques Whitford Group Limited.

Mr. Nantes received his Bachelor's degree in engineering from the Technical University of Nova Scotia in 1970. Shortly thereafter, he received his M.B.A. from Dalhousie University. From 1978 to 1993 he was a member of the Legislative Assembly of Nova Scotia. During that time he spent five years as President of the Tidal Power Corporation of Nova Scotia and seven years as a member of the Executive Council.

In 1990 he moved to his current position at Jacques Whitford, a consulting engineering and environmental science company.

Konrad von Moltke is a consultant on international environmental relations, a Senior Fellow of the World Wildlife Fund, Adjunct Professor at Dartmouth College and a Senior Fellow at the Institute for International Environmental Governance.

Dr. Moltke received his B.A. in mathematics from Dartmouth College in 1964 and his Ph.D. in medieval history from the University of Munich and the University of Göttingen in 1970. He taught at SUNY-Buffalo for six years before moving to Europe where he developed American Studies curriculum material and was active in the European Cultural Foundation. Between 1976 and 1984 he was the founding Director of the Institute for European Environmental Policy.

His interests lie in the areas of medieval history, comparative education and curriculum development, and international environmental policy.

Peter Wrist is a former Deputy Chairman of the Board of PAPRICAN.

Dr. Wrist received his B.A. and M.A. degrees in physics and mathematics from Cambridge University and an M.Sc. in crystallography from London University, Birkbeck College. He attended the Advanced Management Program of the Harvard Business School in 1967. For seven years he was a research physicist with the British Paper and Board Makers Research Association and the Quebec North Shore Paper Company. He then joined the Mead Corporation becoming the Manager of Corporate Research and Engineering, then Vice-President in 1968. In 1983 he moved to PAPRICAN as Executive Vice-President. He was elected President and CEO in 1986 and remained in that position until 1994.

Dr. Wrist is a member of the Technical Section, CPPA, a member and past President of TAPPI, a member of the New York Academy of Sciences, past Chairman of NCASI, and of the Institute of Paper Chemistry's Research Advisory Committee, and the Marcus Wallenberg Foundation Prize Selection Committee.

Hugh Wynne-Edwards is President and CEO of BC Research Inc. and President of Terracy Inc.

Dr. Wynne-Edwards holds a Ph.D. in geology from Queen's University (1959) and was awarded the Spendiarov Prize of the International Geological Congress in 1972. He also received an honorary D.Sc. from Memorial University and the R&D Management Award from the Canadian Research Management Association. He has been a Fellow of the Royal Society of Canada since 1969. In 1991 he was appointed an Officer of the Order of Canada and became a Fellow of the Canadian Academy of Engineering in 1993.

Dr. Wynne-Edwards was a professor at Queen's University and the University of British Columbia (1959-1977) before becoming Assistant Secretary for Universities in the Federal Ministry of State for Science and Technology (1977-1979). From there he moved to Alcan where he rose to the position of Vice President, Research and Development. In 1989 he served as CEO of Moli Energy Limited for one year. In 1989 he founded Terracy Inc., a company based on the principles of understanding the Earth involving sustainable development and environmental stewardship.

APPENDIX VI

Expert Panels

Terms of Reference

Expert peer review panels will be appointed in each of the target areas identified for the competition for new networks in Phase II of the Networks of Centres of Excellence program. There will be two panels in the advanced technologies target area: one for software engineering and one for materials. Each expert panel will review the applications submitted to it on the basis of Phase II selection criteria and the proposal's relevance to the target area. The expert panels will meet with each group of applicants. Members will be added to provide supplementary expertise if required for a given application.

The expert panel will prepare a written report on each application to the target area. The report will provide a detailed evaluation for each of the selection criteria and will identify any application that does not excel in all criteria. The expert panels will make recommendations on the appropriateness of the requested budget for each application. These reports, which will ultimately be provided to the applicants, will be transmitted to the Selection Committee. The chairperson of each expert panel will be requested to respond to questions and provide additional information during the deliberations of the Selection Committee.

Membership

Advanced Technologies — Materials

Chair:

Dr. Hutch Holton
Director, Research and Technology
Canadian Banknote Company
Ottawa, Ontario

Members:

Dr. Eric James
Chairman Emeritus
Cangene Corporation
Mississauga, Ontario

Mr. Franz Knoll
Partner
Nicolet, Chartrand and Knoll Limited
Montreal, Quebec

Dr. Bernie MacIsaac
President
GasTOPS Limited
Gloucester, Ontario

Dr. Grayson Marshall
Professor and Chair, Division of Biomaterials
University of California
San Francisco, California, USA

Dr. Jay Patel
Member of Technical Staff
Bellcore
Red Bank, New Jersey, USA

Dr. Wendell Williams
Professor, Materials Science and Engineering
Case Western Reserve University
Cleveland, Ohio, USA

NCE Staff:

Sue Milne
Jean Saint-Vil
Rick Schwartzburg

Environment

Chair:

Ms. Gail Gabel
President
Gabel Corporation
Victoria, British Columbia

Members:

Dr. Garry Brewer
Dean, School of Natural Resources and Environment
University of Michigan
Ann Harbor, Michigan, USA

Dr. Bruce P. Dunn
BC Cancer Agency
Vancouver, British Columbia

M. Louis LaPierre
Titulaire de la Chaire K.C. Irving en
développement durable
Université de Moncton
Moncton, Nouveau-Brunswick

Monsieur André Marsan
Président
André Marsan International Inc.
Montréal, Québec

Dr. Knute Nadelhoffer
Ecosystem Centre
Marine Biological Laboratory
Woods Hole, Massachusetts, USA

Dr. James Pojar
Prince Rupert Forest Region
B.C. Ministry of Forests
Smithers, British Columbia

Dr. Ferris Webster
College of Marine Studies
University of Delaware
Lewis, Delaware, USA

Dr. Roger Woodhead
Technical Services Manager
NODECO
Bull Arm, Newfoundland

NCE Staff:

Suzanne Duval
Patricia Dunne

Technology-Based Learning

Chair:

Mr. Grant Thomas
Vice President
The Halifax Group
Ottawa, Ontario

Members:

Dr. Michael Horner
Director, Management Systems Research
GBD
Switzerland

Mr. Gordon McKye
Principal
Etobicoke Collegiate Institute
Etobicoke, Ontario

Dr. Gavriel Salomon
Dean, School of Education
University of Haifa
Haifa, Israel

Dr. Luke Sato
Professor, Decision Systems Group
Harvard Medical School
Boston, Massachusetts, USA

Ms. Anna Stahmer
Principal
Stahmer and Associates
Toronto, Ontario

NCE Staff:

Suzanne Duval
Rick Schwartzburg

Health

Chair:

Dr. Alex McPherson
President and CEO
Biomira Inc.
Edmonton, Alberta

Members:

Dr. Ernest Jen-Hao Chang
President
AXIA International Inc.
Calgary, Alberta

Mr. Nigel Lilley
Acting Managing Partner
Health Industry Development Initiative
Manitoba Industry, Trade and Tourism
Winnipeg, Manitoba

Dr. Hardy Loe
Assistant Dean of Community Health
School of Public Health
University of Texas at Houston
Houston, Texas, USA

Dr. Garth McBride
Vice-President, Medical and Regulatory Affairs
Berlex Laboratories Inc.
Wayne, New Jersey, USA

Dr. John B. McKinlay
Senior Vice-President and Director
New England Research Institutes Inc.
Watertown, Massachusetts, USA

Dr. Leonard Schiffrin
Chancellor Professor, Department of Economics
College of William and Mary
Williamsburg, Virginia, USA

Dr. Margaret Stacey
Emeritus Professor, Department of Sociology
University of Warwick
Coventry, UK

Dr. Richard Stanwick
Medical Health Officer
City of Winnipeg Health Department
Winnipeg, Manitoba

Dr. Jeanne Stellman
Editor-in-Chief, ILO Encyclopedia of Occupational
Health and Safety, 4th Edition
Associate Professor of Clinical Public Health
School of Public Health
Columbia University
New York, New York, USA

NCE Staff:

Mary Ann Linseman
Sue Milne
Jean Saint-Vil

Trade, Competitiveness and Sustainability

Chair:

Dr. Elizabeth Parr-Johnston
President
Mount Saint Vincent University
Halifax, Nova Scotia

Members:

Dr. Clement Bowman
President
Clement W. Bowman Consulting Inc.
Punta Gorda, Florida, USA

Dr. James McConnell
Director, Canada-United States Trade Center
University of Buffalo
Buffalo, New York, USA

Dr. Norman McGuinness
Professor, School of Business Administration
Acadia University
Wolfville, Nova Scotia

Dr. John Ravenhill
Professor, Department of International Relations
Research School of Pacific and Asian Studies
Australian National University
Canberra, Australia

NCE Staff:

Patricia Dunne
Jean Saint-Vil
Janet Walden