CANADA

Report of the
National Advisory Board
on Science and Technology

ECONOMIC SUMMIT PROPOSAL COMMITTEE

Presented to the
Prime Minister of Canada

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Economic Summit Proposal Committee Report

February 1988

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

Committee Members

Hugh R. Wynne-Edwards (Chairman)
Vice-President
Research and Development and
Chief Scientific Officer
Alcan International
Montreal

Stephen D. Acres
President
Biostar (and)
Director
Veterinary Infectious
Disease Organization
University of Saskatchewan
Saskatoon

Patricia Baird
Professor of Medical Genetics
University of British Columbia
Vancouver

Pierre Bois
President
Medical Research Council of Canada
Ottawa

Larkin Kerwin
President
National Research Council Canada
Ottawa

A.W. May
President
Natural Sciences and Engineering
Research Council of Canada
Ottawa

William E. Taylor
President
Social Sciences and Humanities
Research Council of Canada
Ottawa

Douglas T. Wright
President
University of Waterloo

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1.0 OVERVIEW

1.1 Introduction

On June 1, 1987, the Prime Minister presided over a discussion with NABST concerning the Japanese request to support their initiation of an international research program on 'human frontiers' (proposed later at the Venice Economic Summit). The Board concluded that Canada should support the proposal even though the main political and economic benefits would fall to Japan.

Because the 1988 Summit will be hosted by Canada in Toronto, it would provide a good opportunity to seek Japanese and other support for a comparable Canadian initiative.

NABST was asked to identify options for a Canadian proposal. The Economic Summit Proposal Committee was asked to address this issue.

1.2 Criteria

The committee suggested 10 criteria for the proposal:

- Tightly defined
- Specific objectives (deliverable within 10 years)
- Wide public appeal
- Directly beneficial to people
- Multi-disciplinary
- Multi-sectorial (in a business sense)
- Built on Canadian strengths, expertise and competitive advantage
- Useful to the private and public sectors
- Externally competitive (provides opportunities for international leadership and dominant market share)
- Financially beneficial

1.3 Proposals

The following proposals comply were submitted for review:

- Understanding and managing the 'global commons' - the resources held in common by all the nations of the world;
- 'Successful aging' (ensuring that our aging population is healthy, independent and socially fulfilled);
- Reducing the cost of transportation;
- Improving our communications infrastructure;
- Computer translation; and
- Hydrogen research.

1.4 Evaluation

The committee's first concern was to combine, where possible, the objectives of these proposals. For example, the computer translation objectives could support the improvement of our communications infrastructures; the hydrogen research objectives could support the need to reduce the cost of transportation. This resulted in four substantive proposals:

- Understanding and managing the global commons;
- Successful aging;
- Reducing the cost of transportation; and
- Improving our communications infrastructures.

Additional criteria were applied to the evaluation:

a) **Necessity** - Can Canada tackle the problem by itself or must it collaborate with other nations?

Canada alone cannot find a solution to a global problem such as the pollution and depletion of the environment. It can, however, undertake significant projects on its own concerning its aged population and its transportation and communications infrastructures.

b) **Desirability** - Are there considerations that would affect sharing our research results with others?

Because international collaboration would be essential in tackling the global commons proposal, any research results would be shared for the benefit of the countries involved. Canada would gain respectability if it shared its research results on the aged with others; it could also exploit lucrative foreign markets with the resulting technology. However, because transportation and communications are so strategic to Canada's economic wellbeing, it would not make sense to mount a major research effort in these areas and share the results with our competitors - except for joint ventures.

c) **Interest** - our national interest versus the interest of our economic partners.

Although all proposed areas of research are of interest to developed nations, protection of the environment is the most crucial to our future prosperity. Among those proposals that could be of special interest to Canada, the transportation and communications proposals could bring immediate benefit.

Many other considerations were discussed. The committee unanimously agreed to support the global commons proposal. Because of the value of the other proposals, members discussed ways to provide government support to them as well.

1.5 Conclusions and Recommendations

The committee recommends that Canada prepare a major R&D initiative on understanding and managing the global commons and ask for international collaboration on this proposal at the 1988 economic summit.

Before it is presented, the summit will require the support of the science advisors and senior scientists of the summit countries. NABST should retain this initiative and develop a more comprehensive proposal until this support has been obtained. The Royal Society of Canada, which is preparing a similar initiative, should be awarded a contract to prepare the proposal for NABST in consultation with the four research councils. Through them, the medical, social science, and science and engineering experts can provide advice.

The committee recommends that the three other initiatives - on successful aging, transportation and communications - be considered by the research councils as national programs unrelated to the summit.

The successful aging proposal is an ideal candidate for a national undertaking and would find wide support throughout Canada. The management of such a national initiative would be a good model for other countries and the results could be used by them as well. The transportation and communications proposals are strategically important to Canada. A major effort in these areas would be entirely appropriate.

The committee received preliminary descriptions of the opportunities in each of the proposed areas. These texts are not intended to be exhaustive. The description relating to understanding and managing the global commons follows. The other descriptions are available if needed.

2.0 UNDERSTANDING AND MANAGING THE GLOBAL COMMONS

2.1 Introduction

> We are witnessing the birth of a sweeping new science. From it will come a powerful new understanding of the planet's structure and metabolism that could vastly improve the chances of sustaining billions more people. Its subject is nothing less than the composition, behaviour, and interactions of the planet's non-living realms of phases - the atmosphere, geosphere, and hydrosphere - and its living realm the biosphere, which encompasses parts of each of the others.
>
> - *World Resources 1987*. International Institute for the Environment and Development and the World Resources Institute.

When there was surplus, the commons - the grazing lands of medieval England - could be freely exploited. Common management was neither necessary nor desirable. But as the resources were used up, the lack of management became disastrous.

Today's 'global commons' are now near the point of disaster for this same reason - lack of proper management. There is an urgent need to understand the political will, the tolerance and cooperation, and the technologies to manage human activity within these global systems.

Human activity has risen in this century to become the dominant force shaping the future of Earth and compete with the natural cycles that renew the global commons. Humans move more mineral material than all natural processes and contribute significantly to changes in the atmosphere and waters. The world's population is increasing by 83 million per year; projections show that, barring a catastrophe, there will be almost 10 billion people at the start of the next century. Today, there are gross inequalities of opportunity; this problem will worsen as the population grows, threatening global stability and our future.

Advances in space technology have led to a revolution in our ability to observe the Earth and monitor change. We can see what is happening to our planet everywhere, and on all scales. However, we don't have the means to integrate and fully interpret this knowledge, and we lack a deep understanding of the dynamics of human interaction with the changing global environment.

2.2 Rate of Annual Change

Over the past two decades there has been a growing concern that human-induced and human-accelerated change may lead to environmental catastrophe. Change, in itself, is not bad; change is part of all natural systems. It is the *rate* of change that is alarming enough to warrant immediate action.

Recent observations (accepted by established scientists) illustrate some dramatic rates of change:

a) In the quarter century since 1960, the amount of atmospheric carbon dioxide has increased by 13 per cent.

b) Atmospheric methane has more than doubled, increasing by at least 1 per cent per year.

c) Atmospheric carbon monoxide has increased by 20 per cent in the past decade.

d) The amount of polar ozone is rapidly diminishing - more than 1 per cent per year.

e) Topsoil is being lost at 0.7 per cent per year.

f) Genetic diversity is being reduced at a rate of nearly 1 per cent per year.

All current models show that global temperature should rise, especially near the poles, where ice is stored. Satellite measurements now show that the amount of solar energy received by Earth is decreasing. The sea level is rising, and there is evidence that the Arctic is warming faster than the global average (4°C in the

last 100 years). Through the consumption of fossil fuels, humans are exacerbating the Earth's natural greenhouse effect and are changing the planet's natural radiation balance.

Scientist Wallace Broecker of Columbia University recently wrote:

> We play Russian roulette with climate and no one knows what lies in the active chamber of the gun. There is now clear evidence that changes in the Earth's climate may be sudden rather than gradual.
>
> Not only do our current managers lack a proper intellectual grasp of the problem, but they are obsessed with legislatively imposed 'five-year reports', and give little attention to developing a long-term strategy to build the needed base of knowledge.

If the present rates of change continue, the future warmer planet will be bathed in ultraviolet radiation and fit only for microorganisms (its only major life form for more than 3 billion years of its 4.5-billion-year history).

2.3 New Strategies

We are no longer simple modifiers of materials. Our species solves problems at the atomic-molecular level, whether it's a new antiviral agent or a new material for supersonic aircraft. At the heart of many of our great advances lie the great chemical and energy industries.

Our present systems must change; they are failing now. Our present behaviour must change. We must better understand and better manage our global commons, which are now being exploited by each country for its direct benefit. Common interests must be assessed and safeguarded. What is held in common must be managed in common, but this requires concerted international action and an agency with teeth.

There is an urgent need to begin reshaping and modifying many of our major systems now, if we seriously wish to improve them in the future.

2.4 International Initiatives

These concerns have led to many new initiatives, including the International Geosphere Biosphere Project launched in 1986 by the International Council of Scientific Unions. Its goal is "to advance our ability to predict change in the global environment." Its theme is:

> To describe and understand the interactive physical, chemical, and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human action.

There is a growing interest and commitment to this initiative from the U.S., U.S.S.R., India, Africa, China, Japan, Europe, the South Pacific and Canada.

Other international activities are gaining momentum. The release of the 1987 Brundtland Report to the United Nations: *Our Common Future*, has heightened awareness of the need to tackle the technological, environmental, economic and social dimensions of a planet under stress. These activities include:

a) Studies of Sustainable Development of the Biosphere, organized by the International Institute of Applied Systems Analysis which emphasizes:

   i) policy implications of linkage between ecological and industrial systems, and

   ii) the effect of global change on socio-economic development;

b) Man and the Biosphere (run by UNESCO), which stresses:

   i) human activities and renewable resources, and

   ii) the effect humans have on the ecosystem;

c) Global Environment Monitoring System, operated by UNEP;

d) emerging social programs being organized by the International Federation of Institutes for Advanced Study with several international agencies, emphasizing:

   i) human response to global change, and

   ii) environment and society; and

e) space-based observational programs for global data acquisition (e.g., LANDSAT, ATMOS, RADARSAT).

2.5 Canada: Challenge and Opportunity

The environmental problems we are currently facing include acid rain, holes in the ozone layer, endangered species and visible pollution. These daily reminders have kept environmental quality one of the top priorities for Canadians.

Canada has a unique opportunity to assume international leadership in activities that involve understanding and managing our global commons. A vigorous national program combined with an international consensus (led by Canada) to coordinate and integrate the work of the separate initiatives could give Canada a position of primacy in the scientific, technological, social and policy issues that will increasingly dominate our lives.

Why Canada? This is the ideal country in which to conduct this initiative. We offer excellence in the earth and social sciences, remote sensing, satellite technology and engineering mega-projects and hold the following trump cards:

a) **Geographic** - Canada has the second largest continental land mass, the longest coast line and a large arctic domain and offers a rich knowledge of these resources. This means Canada is a natural 'laboratory' for monitoring global environmental change. (The Arctic's fragile ecology provides an excellent early warning system of change.) By allowing scientists from around the world access to these natural laboratories, Canada would automatically become the international leadership in this field.

b) **Scientific** - Canada has a history of strong research in the disciplines central to understanding and managing Earth, e.g.:

   i) remote sensing (including satellite observation);

   ii) atmospheric sciences (chemistry, modelling);

   iii) ecological studies (wetlands, peat bogs, etc.); and

   iv) managing natural resources (fisheries, forests, etc.).

   Before standards can be set, the previous record of change must be measured. This involves an exact monitoring of Canada's physical and biological systems. Our knowledge of satellite and ground-based sciences gives Canada the unique opportunity to lead and train other nations in remote sensing. We also have a vast amount of knowledge about our land mass and ecology, and are experts on our own climate and atmospheric conditions.

c) Technological - Much world technology must change to create sustainable development and future economic opportunity. Countries actively seeking technological 'niches' and a capability to manage their resources will prosper. The consequences of scientific and technological advances could be dramatic: better long-range climate predictions, for example, would greatly benefit Canada's agricultural, forestry, tourist and transport industries.

   Better understanding of the environmental impact of present technology will almost certainly change or enhance many other technologies.

d) **Human** - Effective adaptation to, and management of, global change will involve a new order of cooperation between the physical, biological, medical and social sciences. This is an immense social challenge, but Canada, viewed throughout the world as a symbol of openness and tolerance, would be the ideal candidate to assume the role of international leader.

2.6. Specific Roles for Canada

To support this initiative and promote its position as international leader for this proposal, Canada should undertake:

a) **A national program** in which the federal government should:

   i) determine public attitudes an identify what individuals can do;

   ii) begin programs of public information and awareness; and

   iii) find incentives to attract the participation of the public, especially school children and northern agricultural and forest communities.

b) **An international leadership role** - There must be international cooperation to provide the hard data needed for investigating global processes and change, and a strong voice for integrating the various disciplines, especially the social sciences. Therefore, Canada should:

   i) open up its lands, waters and coastlines, including the Arctic, to international research; and

   ii) promote graduate fellowships and international scientific exchanges on a large scale.

c) **Assume primacy in technological advances** - Our technology must anticipate new demands. Not only are there new environmental conditions for creating wealth and jobs through resource-based industries, but there also will be intense demands on new information systems. Advances will be required in S&T to determine what data are collected and how they are made available. The problem will be to integrate, analyse and use for practical predictive purposes an enormous mass of global data. To achieve primacy in this area, Canada should:

   i) construct and operate remote sensing satellites to gather necessary data and supply ground stations and all relevant software and systems to participating countries.;

   ii) monitor as much as possible by remote sensing;

   iii) measure the rates of global change affecting the global commons (ozone layer, acid rain, carbon dioxide content, etc.);

   iv) set standards of desirable environmental quality;

   v) set targets toward meeting such standards in set time periods;

   vi) evolve models and systems that identify the interaction and interdependence of natural cycles and the impact of various kinds of human activity;

vii) propose and test organizational and socio-economic models of systems management; and

viii) determine the costs of inaction, i.e., of further environmental degradation and also the costs of environmental enhancement and their social consequences.

The goal must be to lead, not to follow. Those who consider the current 'early warnings' as alarmist will fall behind. As stated by W.E. Gordon, Foreign Secretary of the U.S. Academy of Sciences, "the International Geosphere Biosphere Program is the most important thing scientists will do this century."

2.6.1 Implementation of the Proposal

The proposed program will challenge social physical, biological, engineering and medical sciences and draw them together on common objectives. It will meet the committee's criteria by generating new understanding, new technologies and new enterprises; it will capture the public imagination.

The program would last at least five years. Its focus would be on evolving models and methods that measure the effect of human activity on the interacting and interdependent natural cycles and on proposing and testing organizational and socio-economic models of systems management.

If accepted, preparations must begin at once. Responsibility for the initial definition of the proposal could remain with NABST, which would cooperate with government and other agencies. Once accepted in this form, the program should be transferred to government for proposal and implementation.