TECHNOLOGY

ROADMAP

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1. INTRODUCTION

1.1 *Background*

The Technology Roadmap was developed as a result of challenges raised, issues identified and solutions proposed by technology stakeholders in the Atlantic region at the November 1996 Atlantic Technology Forum in Halifax, Nova Scotia. The event was co-sponsored by the Atlantic Canada Opportunities Agency (ACOA) and the National Research Council (NRC) and was guided by a Forum Steering Committee comprised of representatives of the private sector, universities, research agencies, financial institutions and government. The roadmap is intended to guide an Atlantic innovation approach whereby *research institutions, government, funding agencies, the financial community and the private and public sectors work synergistically to promote economic growth throughout Atlantic Canada"*.

1.2 *Why a Roadmap? Users and Uses*

The roadmap provides a framework or guide for action from 1997 to 2001, based on the areas of action and specific activities recommended at the Forum. The roadmap audience or intended users are the key technology players in the region (i.e., the private sector, educational facilities, research agencies, financial institutions and government). The "buy-in" and commitment of the key players to move forward the strategy and activities set out in the workplan is being sought.

It is intended that the roadmap will lead to specific initiatives and actions by each of the key technology players. The design of the roadmap also takes into account that some coordination mechanism with supporting resources is required to provide leadership and act as a catalyst for carrying forward agreed-to activities.

2.   THE ROADMAP VISION

2.1   *Goal*

To ensure that the Atlantic region is increasingly competitive in global markets by strengthening its capacity for the development and commercialization of technology.

2.2   *Its Dimensions*

This goal means that in the future:

- the benefits of research undertaken within the region are realized by Atlantic business;
- the region provides an environment which is attractive for investment;
- opportunities exist in the region to retain and attract highly qualified human resources;
- the private sector has better access to financing for R&D and technology commercialization; and
- stronger ties exist between the education and research communities, and business.

2.3   *Its Context*

The following characteristics of the regional context for innovation and technology are relevant to the roadmap's design:

- the region has a strong research infrastructure or knowledge base, founded on its mix of universities, community colleges and research facilities, as well as the advantage of relatively close proximity of these institutions;
- the region lacks a critical mass of companies in technology-based sectors;
- small firms in the region create eighty percent of new jobs but private sector R&D spending is lower than elsewhere;
- R&D intensive sectors are growing at more than twice the rate of other sectors in the region;
- the Atlantic region has fewer scientists and engineers as a proportion of the workforce compared to the rest of Canada and a significant proportion of graduating scientists, engineers and technologists leave the region; and
- the rapidly changing external factors influencing high-tech sectors create an imperative to which the education and research communities, and business, must respond.

3.   KEY CHALLENGES

The roadmap addresses three key challenges:

(i)   promoting increased communication and collaboration between research institutions and the private sector, thereby integrating research more effectively into economic development;
(ii)   strengthening the overall innovative capacity of firms in the region; and
(iii)   ensuring that industry is better able to access the human and financial resources needed for growth.

4.   Criteria

Major initiatives are already underway in each of the Atlantic provinces to encourage innovation, exploit strategic technologies and take advantage of growth opportunities. It is therefore essential that the technology roadmap serve to complement and add value to those initiatives.

Accordingly, three criteria or considerations were applied in selecting areas and activities to comprise the roadmap:

(i)   their significance to the region and the potential for effectively undertaking them on an Atlantic-wide basis;
(ii)   their potential for contributing to, not competing with, the considerable technology related efforts and activities underway in individual provinces; and
(iii)   their potential for concrete action that will produce a positive impact in the next three to five years.

It is intended, therefore, that the roadmap be flexible and used as a rolling plan, subject to periodic review, and to which additions or revisions can be readily made.

5. STRATEGY AND ACTIVITY AREAS

5.1 *Strategy Components*

The technology roadmap addresses five key areas, each of which is critical to ensure that the Atlantic region moves towards realizing the roadmap vision:

- **Coordination -** *finding the right arrangement to galvanize action around the roadmap.*
- **Awareness and Information-** *promoting Atlantic innovation and connecting the players.*

- **Linkages -** *forging partnerships for technology commercialization.*

- **Human Resources -** *tackling the human resource problem.*

- **Financing -** *assuring availability of financing for all stages of the innovation process.*

5.1.1 *Coordination*

The Technology Forum highlighted constraints and suggested directions to guide the roadmap's development. Emphasis was also placed on the coordination of technology initiatives on an Atlantic basis.

The benefits of coordination were seen as follows:

- creating a critical mass of technology stakeholders, thereby providing a forum for the exchange of ideas and models within the region;
- building a stronger voice for the Atlantic Region on the national and international scenes;
- yielding significant economies of scale and reducing costs by combining resources and expertise; and
- providing more opportunities for interface of the key players, thereby promoting more linkages for economic spinoff.

The Technology Forum recognized the need for a coordinating mechanism with supporting resources to initiate, catalyze and coordinate actions, as required.

It is intended that follow-up discussions on the roadmap will address the appropriate structure and roles of a coordinating mechanism, produce guidelines for its set-up and develop an action plan for the first year of implementation. Possible options include:

- an Atlantic Agreement with dedicated dollars and a Secretariat involving the provinces, ACOA, NRC and Industry Canada (the Agreement would include coordination and advisory representation from the education and research communities, the private sector and the financial community);

- an Action Plan to be carried forward by ACOA and NRC under the existing MOU between these two organizations (this structure and action plan would be guided by a Steering Committee comprised of stakeholder groups: government; the education and research communities; the private sector; and the financial community);

- a separate entity or technology partnership organization directed by an advisory board with members selected from government, the education and research communities and the private sector (members would be selected from the stakeholder groups on a rotational basis).

Any coordination mechanism will only be as effective as the support it has from innovative people in the region and elsewhere. The people contact will continue to be critical and should include both "thinkers and doers" for overseeing, initiating and actually carrying out actions in the roadmap.

5.1.2 *Awareness and Information*

Awareness and information act as catalysts for innovation, supporting the circulation of science and technology information and the building of connections among the key stakeholders. The vitality of education institutions and research facilities, the ability of firms to compete in global markets and the effectiveness of government depend upon the level of awareness and the timely exchange of information. Awareness and information approaches must go beyond an improved general understanding and must lead to actions by key players.

The following are suggested approaches and mechanisms:

- **Using an electronic fact sheet on technology business to circulate timely information.** This would provide, on a weekly basis and in bullet form, information on technology events in the region, success stories and specific alliance opportunities and contacts.

- **Producing a high quality quarterly technology business newsletter.** This newsletter would focus on providing information and critical analysis of current issues and also showcase success stories in particular areas of technology.

- **Organizing a technology lecture/seminar series.** This would address key technology topics and be delivered in each province.

- **Promoting public awareness through the media.** This would involve engaging the media in collaborating on increased communication of technology issues in the region and on coverage of local successes.

- **Utilizing the Internet as a mechanism to support research/private sector linkages.** Private sector needs in terms of specific technical problems would be posted and a register of current Atlantic research would also be established. Provided the information is comprehensive and updated, people will forge linkages and results can be followed up.

- **Conducting a series of dialogue fora between education and research institutions and the private sector.** These fora would focus on specific innovation and technology topics and provide a means for exchanging information and expanding research/private sector ties.

- **Using web technology to establish virtual networks around key issues:** This would allow for ongoing discussion of the key players around areas such as linkage models, human resources and financing strategies.

- **Organizing an annual technology forum with R&D partnership awards:** Such events would bring the key players together and provide a forum for presenting awards for research/business partnerships, leading contributors to innovation, individual achievement, etc.

5.1.3 *Linkages*

Partnerships within the private sector and business/research and education communities offer distinct advantages in terms of adding value to new ideas and opportunities. Linkages enable the private sector to take advantage of world-class research carried out by universities and government facilities, allow sharing of expertise and costs of research and development in complementary areas, and provide for the commercialization of research products. The forging of such partnerships to create economic activity, however, poses a significant challenge.

The following are suggested approaches and mechanisms:

- **Setting up a matchmaking service with the objective of matching business requirements with commercializable research**. This matchmaking service could draw upon an Internet-based information source to identify potential opportunities and would emphasize using proactive agents who would bring together the people involved and assist them in dealing with specific partnership issues. This service would also focus upon bringing companies in the region together in networks to take advantage of particular technology opportunities and would build upon existing networks and organizations in each province such as IRAP. The MettNet program, which has proved successful in Ontario and Quebec, is an example of such a service.

- **Examining the existing commercialization models in the region which link universities and the private sector with a view to expanding, adapting or replicating these models as appropriate.** Existing models to be considered are: Seabright, which is set up to commercialize technology from Memorial University and NUTech, with a similar mandate which includes Technical University of Nova Scotia (TUNS), Dalhousie University, University of Prince Edward Island, Nova Scotia Agricultural College and University College of Cape Breton.

- **Developing and carrying out special initiatives for building alliances and partnerships in particular science and technology areas.** These initiatives, for example, could invite and support proposals for technology commercialization in high-growth sectors, as well as promote international alliances between private sector firms in Atlantic Canada and other countries (such as the Canada-Israel Industrial Research and Development Foundation).

- **Setting up mechanisms to allow graduate students to carry out research applied to specific industrial projects**. Such a mechanism is being undertaken by TUNS, whereby the company and the university cost share; the research is tied to thesis requirements, and the company and graduate student work together on particular problems or opportunities.

- **Initiating and involving the major players in overseeing a study designed to provide a better understanding of how research/private sector linkages for commercialization generate economic benefits, with a view to actually identifying and piloting new models.** Such a study would explore models in other countries, examine the reasons for their success or lack thereof; engage international expertise in this area; and identify best options for maximizing economic spinoffs in the region.

5.1.4 *Human Resources*

The innovation process and the potential for commercialization of new technologies depends importantly upon the availability of human resources. The region lacks a pool of seasoned managerial, professional and technical expertise upon which companies can base expansion; in particular, because of the rapid growth in knowledge-based industries and the rapid technological change in these industries, the availability of human resources is a critical issue. Another related problem is that many small firms do not hire enough sufficiently qualified technical and business staff.

The following are suggested approaches and mechanisms:

- **Develop and carry out a program to assist emerging companies in recruiting experienced technology managers and technical expertise.** Such a program could be modelled after the Technical Persons in Industry Program in Nova Scotia.

- **Develop an approach to identifying and encouraging recruitment of skilled people, particularly Atlantic Canadians interested in returning to the region.**

- **Establish incentives for exchanges of expertise between the private sector and universities/community colleges.** This would involve: setting up structures and reward and evaluation systems so that researchers could move into industry to undertake assignments leading to potential commercialization; and setting up mechanisms whereby the private sector could spend time at the universities to work with researchers on specific technology opportunities or to lend specific areas of high-tech expertise to university/community college courses.

- **Identifying and projecting sector-specific requirements in terms of technology expertise to enable educational institutions to address these in their programming.** While it is acknowledged that this is a complex undertaking, it would be divided into manageable components by initially focussing on key sectors and particular areas of expertise and working closely with the private sector.

- **Building selected components of business training into science and engineering curricula and vice versa.** This approach, already under consideration by some educational institutions, would equip graduates with the complementary skills needed to develop and market research products and also equip business graduates with basic understanding of scientific processes.

- **Setting up a pool of expertise to act as mentors for technology-based companies.** This pool of expertise would be drawn locally, from both the private sector and universities, and focus upon strengthening management and business planning capabilities.

- **Examine mechanisms for updating training curriculum on a short-term time frame.** One possible mechanism to accomplish this would be to use distance education as a means of tapping into pools of expertise in specific technical areas (e.g., in order to meet the demands of short technology product life cycles).

5.1.5 *Financing*

A major challenge is the availability of start-up financing for potential entrepreneurs with innovative ideas but few assets. Financing for expansion by established companies with new products or processes and strong business planning capabilities, on the other hand, does not pose a major constraint. Although funding availability for high-tech firms has improved in recent years, there remains a significant gap at the start-up stage.

- **Setting up a mentorship forum to allow entrepreneurs to present their business plans to the business and financial communities.** This would provide for critique of, and improvements to, business plans. This mentorship forum would be carried out by an organization which would provide complementary services in areas such as actual business plan preparation and presentation and liaison support for securing venture capital.

- **Extending and expanding the incubator model to provide a low-cost environment, located in close proximity to a research facility, for start up.** This model not only reduces start-up costs but also increases the likelihood of success by building in support in areas such as management skills, access to R&D services and ties to educational institutions.

- **Developing financial initiatives for early stage financing.** Such initiatives would include the option of taking an equity position in start-up companies, address changing of entrepreneur attitudes towards sharing ownership and risk, and promote information regarding potential return on investment for investing in high-tech companies.

- **Carrying out a program to place potential entrepreneurs with established firms.** This model would identify firms in complementary business areas in which the entrepreneur would acquire business experience and with which potential existed for a future alliance for business start up.

- **Investigating and proposing specific taxation measures or adjustments to stimulate**

technology-based investments. Specific proposals would be made to Revenue Canada for measures to stimulate technology-based investment and possible provincial tax credit mechanisms would also be identified.

- **Accessing major international funding opportunities in other countries through the strength of an Atlantic entity.** This could involve setting up an accord or agreement between an Atlantic entity and an organization in the United States or in the European Economic Community (e.g., the Canada-Israel Industrial Research and Development Foundation model). These opportunities can be promoted through electronic fact sheets and other awareness mechanisms.

6.   NEXT STEPS

The roadmap provides the basis for follow-up discussions with the key stakeholders, including the four Atlantic provinces, the private sector, the education and research communities and the financial community. It is planned that this process will be carried out over the next three months, with the intended outcome of securing a buy-in from the stakeholders to proceed with a particular coordination approach and action. Funding requirements and how these should be met will be a part of the negotiations.