People and Excellence:
The Heart of Successful Commercialization

Volume I: Final Report of the Expert Panel on Commercialization

Canada

People and Excellence:
The Heart of Successful Commercialization

talent
research
capital

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Preface

The Minister of Industry appointed us to the non-partisan Expert Panel on Commercialization in May 2005. We were asked to identify how the Government of Canada could help ensure continuous improvement in Canada's commercialization performance.

Specifically, our task was to examine how to transform knowledge and technologies (whether developed in Canada or abroad) into new products, services and processes in response to market opportunities; how to ensure that new knowledge and technologies generated using public funds will lead to practical applications; and whether Canada has created the right business environment for commercialization.

Our various backgrounds and expertise in the private, public and academic sectors provided the opportunity to develop a cohesive, practical road map. We acted as individuals on the panel, not as representatives of our organizations, industries or communities.

We approached the task in a number of ways. We reviewed the evidence-based research available to help us in our deliberations, and sought the advice of those in the business, academic and public policy arenas. Eight experts from across the country and abroad then reviewed the report. We discussed these findings and recommendations among ourselves, and applied our own knowledge and experience to what became robust, lively debates.

Our discussions led us to focus on three areas – talent, research and capital. The recommendations we are submitting come with our unanimous approval, and reflect our principles and values and the criteria we used to assess new programs, as set out in Appendices B and C. The recommendations in this report are submitted recognizing that we are in a fierce global race, and that our commercialization system must be integrated and consistent, yet flexible and adaptable.

The report calls for a systemic approach and immediate action. Its underlying premise is that successful commercialization occurs when the supply of high-quality ideas and research is met by a demand from competitive businesses for innovation. People and excellence connect ideas to the marketplace.

We would like to thank Industry Canada for the services of the Expert Panel on Commercialization Secretariat, and would like to thank the Secretariat itself for its tremendous help in preparing this report. We deeply appreciate the contributions of the people who provided input, especially those who reviewed drafts of this report. We are grateful for the opportunity to make this contribution. It has been a privilege.

Joseph L. Rotman, Chair

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Mike Lazaridis

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Executive Summary

Canada at the Crossroads

The Challenge of a Competitive World

By any standard, Canada's economy is performing well. We are enjoying a period of growth not seen since World War II. Unemployment rates are at record lows, and our ratio of debt to gross domestic product (GDP) is steadily declining. But the past is not prologue, and we face significant challenges. Emerging economies such as China and India are industrializing at a rapid pace, creating exciting market opportunities but also putting strong pressure on our traditional manufacturers. Other countries are responding to these new realities by adding value through investments in innovation.

In such a world, Canada's weak productivity – particularly in relation to our largest trading partner, the United States – argues forcefully for a renewed commitment to bolstering commercialization.

Today, Canada has a unique opportunity – to build, from our current economic strength, an enduring national advantage, and to excel in expanding the critical capacity to translate the ideas in our heads into products, processes and services in the market. The latter is the key to success in a world where competition is global, change is rapid, and knowledge is a critical source of competitive advantage. But, first, we must act.

Reviewing Options, Making Choices

Documenting Canada's strengths and weaknesses in terms of commercialization is relatively straightforward. However, there is no consensus on **why** Canada's performance on this score lags behind those of its competitors – and there is even stronger disagreement on what our governments can do to improve the situation.

For our part, we decided to focus on issues where prompt action was possible. We saw our task as one of suggesting ways to improve, enhance and invigorate a commercialization system that works, but can work much better.

Indeed, many components of Canada's commercialization system are functioning well, and these should be reinforced. This is particularly true with respect to developing a talented workforce and supporting publicly funded research.

Canada does face a significant challenge, however, in the low level of commitment by many Canadian businesses toward research and the many other facets of innovation, especially in comparison to these levels of commitment among Canada's major competitors. These failings do much to explain Canada's relatively weak commercialization outcomes.

We have developed a comprehensive package of 11 recommendations to provide a strong starting point for Canada to achieve its full potential. At the core of these recommendations is the development of a new role for the private sector as a full partner in charting the course for, and developing policy related to, commercialization.

A New Model of Leadership – The Commercialization Partnership Board

Successful commercialization is market-driven, but, at the moment, there is a fundamental disconnect between the people who make commercialization happen and government efforts to encourage it. More must be done to ensure that the private sector has a strong voice in the design of public policies to improve commercialization in Canada.

The creation of a business-led Commercialization Partnership Board (CPB) would help change this dynamic. The CPB would be the lead advisory body to the Minister of Industry on commercialization issues. It would provide guidance on changes to existing government programs, the creation of new programs and the assessment of results. It would also commission policy-oriented research on key long-term challenges, including business framework issues such as taxation, regulation, intellectual property and competition.

The Government of Canada should act on the insights and expertise of the Board, which would provide advice on how to continually improve the policies and programs that support Canada's commercialization performance. Specifically, the CPB would:

- submit an annual report to the Minister of Industry, who would respond on behalf of the government; and
- identify strategic opportunities for Canada to build on its competitive advantages and exploit emerging opportunities.

Supply and Demand

There are two sides to successful commercialization – the supply of ideas and people, and the demand from the marketplace for new products and processes.

Canada has come a long way in addressing the supply side of the commercialization equation. It has increased funding for university research that produces both the knowledge and the talented people needed for commercialization, and it has employed tax measures to attract risk capital.

But there is a broad range of evidence that Canada is still struggling on the demand side – in the **pull** from the private sector. For example, Canadian businesses employ fewer researchers and university-educated business managers, perform less research, and win fewer and smaller risk capital deals than do their U.S. counterparts. The panel believes that while Canada needs to expand and renew its supply-side measures, it must now focus its efforts on the demand side, reducing the barriers and perceived risks that make businesses reluctant to engage in commercialization.

Three Themes for Action

Successful commercialization has many elements: critical management skills, vision and a highly qualified workforce are vital; scientific and technological discovery are important for all sectors of the economy; and access to capital at each stage of a company's life is essential.

To kick-start the process that would be sustained through the CPB, the panel has identified three specific areas that require early action by the federal government. These three areas – talent, research and capital – all share a common focus on people and excellence:

- People turn great ideas into new products and services, making the strategic business choices that result in commercial success.
- People engage in research, generating ideas that have commercial potential.
- People use capital to move through the many stages leading to successful commercialization.

Focusing on **people** and **excellence** in these three areas will make a difference for Canada in the global race to compete.

TALENT

Since it is people who develop ideas and move them to the marketplace, Canada needs to increase the presence of highly qualified workers and managers in Canadian businesses. Our recommendations on talent also reflect the need to raise the demand for highly qualified workers in business, while continuing to promote excellence in the skills needed for commercialization. Measures in these areas will also strengthen the demand for innovation and commercialization. We see particular benefit in programs that place skilled students and recent graduates in business settings. Such programs not only improve the ability of companies to commercialize, but help refine the skills that graduates need to make smooth transitions to the business sector.

To foster a supply of talented workers, we must maintain strong support for Canada's post-secondary education system, undertake greater efforts to attract more of the world's leading minds to this country, create employment opportunities, and encourage Canadians to gain exposure to other cultures and markets. Finally, Canada must bring about a long-term change in its culture to ensure business and technical achievement are valued more highly. To achieve this, attention should be focused on Canada's youth. We recommend initiatives that will:

- **increase business demand for talent, through the development of a new Canada Commercialization Fellowships Program;**
- **spur private sector hiring of highly qualified personnel with commercialization talents;**
- **encourage and celebrate young Canadians who aim for success in science, technology and business; and**
- **develop and retain talent for success in the global marketplace.**

RESEARCH

There is substantial research activity in Canada, but too little takes place within the private sector. The challenge for government is to increase – not merely maintain – its investments in publicly funded research, while encouraging private sector research and development (R&D). Business leaders, in collaboration with publicly funded research institutions, can identify areas for research and skills development that will position Canada for global leadership.

Small and medium-sized enterprises (SMEs) are pivotal players in business supply chains. With further support, they can build the bases needed to attract additional capital and employ more talent. In particular, seed and start-up firms can benefit from government support at the earliest and most risky stages of product and service development to help them overcome gaps in the financing marketplace. Experience from other countries points to approaches that can address government needs while encouraging research by SMEs.

We recommend initiatives that will:

- **create a Commercialization Superfund to address key commercialization challenges;**
- **expand federal programs that support seed and start-up firms in proving their business ideas; and**
- **increase the commercialization involvement of SMEs, through a Canadian SME Partnerships Initiative.**

CAPITAL

Finally, Canada must ensure that its capital markets are working effectively, getting funding and management expertise to promising commercial opportunities. One immediate goal should be to stimulate increased investment by angel investors, who provide firms with both financial capital and, in some cases, the benefit of their experience, contacts and mentorship.

The panel also proposes a series of tax measures to promote greater influxes of foreign capital and expertise. We also believe an in-depth analysis of how Canada can improve the climate for venture capital investment is also required, with the objective of strengthening the investor community and improving the quality of business opportunities.

We recommend initiatives to:

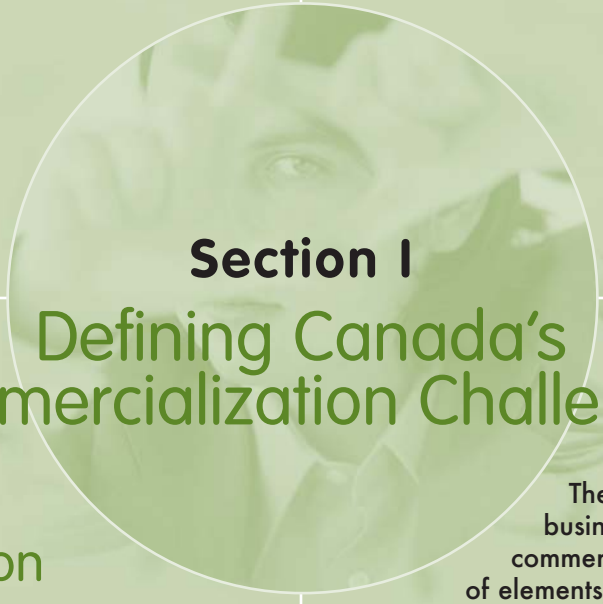
- **improve access to early-stage angel financing and expertise;**
- **review and identify improvements in Canada's expansion-stage venture capital market; and**
- **remove barriers to investment for foreign venture capital investors.**

Summing Up

Many others have reached the same conclusions and proposed similar recommendations as this Expert Panel on Commercialization. The key is execution. In this respect, our report and its recommendations are only a start. The panel believes that two key steps are required to position Canada as a recognized leader in the global marketplace:

- creating, through the CPB, stronger relationships among the business sector, the federal government and other key institutions such as universities; and
- acting immediately in the specific areas where needs exist, with these actions monitored by the CPB to ensure concrete results and enable further decisions.

Creating the CPB is a crucial first step in these processes.



Section I

Defining Canada's Commercialization Challenges

Understanding Commercialization

Commercialization includes everything a firm does that transforms knowledge and technology into new goods, processes or services to satisfy market demands. Commercialization is applicable across all economic sectors and is as relevant to Canada's natural resource industries, manufacturers and service providers as it is to its advanced technology companies.

Commercialization is anchored in the world of business and is affected by many factors, including:

- the pull of the marketplace;
- the flow of ideas through research efforts within the firm and from outside it;
- financial, operational and human resource strengths;
- the quality of the market information available for decision making; and
- whether the corporate culture values innovation and a focus on customers, and accepts that trial and error, risk, and failure are normal bumps on the path to success.

The broader culture within which businesses operate also influences commercialization through a number of elements, including:

- the public sector's framework of laws, policies, programs and supports, including those related to intellectual property, regulation and tax regimes;
- the degree to which competitive forces drive innovation throughout the economy;
- the role of publicly funded research and education in generating knowledge, and the roles of skilled people who know how to create, build on and apply this knowledge;
- the encouragement of alliances, networks and other forms of connections among businesses, governments, educational institutions and other partners; and
- whether society in general views personal achievement and business success as positive values.

Two elements are at the heart of commercialization — people and excellence. People identify market opportunities, carry out research, train others, make investment choices, build networks and create successful businesses. People, therefore, are the ultimate competitive advantage.

Excellence determines who wins in the face of emerging market opportunities, and can be seen in commitment to a talented, highly trained workforce; world-class research; and far-sighted investment.

The Case for Action

Why is it so essential to foster commercialization in our economy?

Despite the fact that Canada's economy is performing well, there are significant challenges on the horizon. First, today's economy demands that organizations in all sectors create value by adding knowledge. Second, our workforce is aging, threatening our ability to sustain strong economic growth unless workers are given the tools to add more value. Finally, Canadian businesses are facing increased competition from nations such as China and India, which are just beginning to realize their industrial potential.

Improving Canada's productivity growth will be crucial to meeting these challenges. Unfortunately, Canada does not have a strong recent track record in this area. Productivity growth in the Canadian business sector averaged only 0.7 percent per year from 2000 to 2005, a sharp slowdown compared with previous years, and a much poorer record than that of the U.S., our major trading partner.

An important element of Canada's productivity challenge is its inability to capitalize on innovation and discover new and better ways to add value to what it sells. The key to solving this is in commercializing knowledge — the surest path to enhancing productivity and sustaining economic prosperity. Enhancing productivity will also help to close the prosperity gap that has opened between Canada and the U.S. — a gap that now accounts for a difference of about US$8200 in average annual income between Canadians and Americans.[1]

Commercialization in Canada: How Are We Doing?

Commercialization does not lend itself easily to measurement, but a number of indicators suggest that Canada lags behind its major international competitors. European firms tend to derive a higher proportion of total sales from recent innovations than their Canadian competitors. Sales from new or improved products accounted for 35 percent of all sales by Canadian firms having Canada-first or world-first innovations. This figure is 54 percent in Germany.[2] Data for the U.S. is not available.

Ontario's Institute for Competitiveness and Prosperity found that Canadian firms lag well behind their U.S. counterparts in terms of patents granted per 10 000 employees, an important indirect measure of commercialization, even when firms in the same business sector are compared.[3] The use of information and communications technologies used to embed knowledge in services and products has risen in Canada, but at a slower pace than in countries such as the U.S. and Finland.

1. Organisation for Economic Co-operation and Development, *OECD in Figures* (Paris: Organisation for Economic Co-operation and Development, 2005).
2. Pierre Mohnen and Pierre Therrien, "How Innovative are Canadian Firms Compared to Some European Firms? A Comparative Look at Innovation Surveys," *MERIT-Infonomics Research Memorandum* series, 2001-033 (July 2001).
3. Roger L. Martin, *Realizing Canada's Prosperity Potential* (Toronto: Institute for Competitiveness and Prosperity, 2005).

This economic evidence of lagging Canadian commercialization is backed up by survey data showing that Canadian businesses prefer strategies based on cost containment rather than innovation. In 2001, fewer than 40 percent of businesses in Canada considered developing new products or production techniques as important to their business strategy. More than half, however, believed that reducing labour and other operating costs was important. The most recent *Global Competitiveness Report* ranked Canadian businesses 27th overall in their propensity to compete on the basis of unique products or processes rather than low-cost labour or raw materials.[4]

These findings suggest that changing Canada's prevailing business culture will be the country's main commercialization challenge. Corporate strategies must shift toward competing on the basis of excellence and innovation – including new, higher-value products, services and processes – through better commercialization of ideas across all sectors of Canada's economy. Implementing such a strategy will require firms to increase their capacities in talent, research and capital.

Our review of the evidence indicates that Canada has in place many of the investments needed to support innovation: public funding for R&D, a solid infrastructure of colleges and universities, and a business environment conducive to innovation. Canada's real opportunity for improvement is in increasing business demand in order to achieve a greater return on these investments.

DRAWING ON THE PANEL'S EXPERIENCE, EXPERTISE AND BEST JUDGMENT

The panel members have substantial experience as leaders of organizations in the private and academic sectors. We, therefore, not only assessed the evidence but also drew on our collective experience and applied our own judgment.

We vigorously debated what was practical and achievable. From these debates we developed a shared view on many issues, most importantly, striking the right balance between supply measures – those that improve the supply of talent, commercialization-directed research and capital – and demand measures that will encourage Canadian businesses to commercialize.

It is necessary to make informed choices about Canadian business framework policies such as taxation, regulation, competition and intellectual property protection. We are well aware of, and sympathetic with, recommendations in these areas from individuals and groups whose counsel we respect. However, given that the federal government has reviewed many of these issues in other forums, and that we have limited time and resources, we saw little value in duplicating this other work.[5] Further, our expertise and knowledge lay elsewhere.

Finally, we recognize that the relationship between successful commercialization and many broad framework policies is not always clear.[6] Section IV of this report sets out our views on the need to analyze these business framework issues in detail.

4. World Economic Forum.
5. For example, the federal government has received recommendations from the External Advisory Committee on Smart Regulation.
6. For example, the National Science Advisor has noted that there is no strong relationship between corporate tax rates and private sector R&D efforts. Countries that have low corporate taxes (e.g. Sweden and Finland) tend to be leaders in business R&D, but countries that have higher rates are not far behind (e.g. Japan, the U.S. and Germany).

Section II

Recommendations for Commercialization Success

From our review of the evidence and our own experience, we identified three core elements of the commercialization system in Canada in which change could have the biggest impact:

Talent – by ensuring that Canada creates, attracts, retains and employs the full range of talents needed for sustained commercialization and fosters a culture of internationally competitive excellence in all fields.

Research – by building on the existing Canadian bases of R&D in traditional science and technology disciplines and in fields such as design, market research and business management.

Capital – by increasing the capacity of smaller and younger firms and entrepreneurs to gain access to the capital needed at different stages of the commercialization process.

Within each of these elements, we combined the available evidence with our own experience to assess the situation facing Canada and develop recommendations. The result is a set of recommendations that form a comprehensive, practical and achievable package. We structured many of these recommendations so that they would begin as pilots and be scaled up or down based on new evidence, results and the best opportunities available to improve commercialization.[7]

We believe that the federal government's commercialization policies do not adequately address the demand side of the commercialization equation. For example, while Canada provides generous tax incentives for business R&D, it continues to underperform in this area. The reasons for this are complex, but this underperformance indicates that the current approach is not meeting private sector needs (since they have not changed their behaviour in response to these incentives). Correcting this will require more private sector input into the design of support programs. The Government of Canada has no formal body dedicated to engaging business people on these issues. However, demand considerations must be the cornerstone for decision making. Our recommendations begin by addressing this gap.

7. The appendices of this report (published in a separate volume) provide more detailed evidence and analysis of the issues that led the panel to its conclusions and recommendations. The recommendations have been designed so that existing institutions can take responsibility for implementing them, although other approaches have been proposed where the panel could not find an obvious choice among potential implementing organizations.

RECOMMENDATION

Create a Commercialization Partnership Board

PROPOSAL

We recommend that the Government of Canada create a Commercialization Partnership Board (CPB) reporting to the Minister of Industry as his or her lead advisory body on commercialization. Its mandate would be distinct from those of other advisory bodies. It would:

- make recommendations with respect to the major commercialization initiatives we are proposing, such as the Canada Commercialization Fellowships Program, the Commercialization Superfund, a new Angel Co-Investment Program and the Canadian SME Partnerships Initiative (described below);
- serve in an oversight role for federal commercialization policies, initiatives and investments, and provide an annual public report evaluating their effectiveness, integration and impacts;
- call on the Minister of Industry to respond publicly to the above-mentioned report;
- assess the implementation of the recommendations in this report, identify improvements, and advise on when it is appropriate to move from pilot to full-funding status for each recommendation;
- encourage linkages to, and coordination with, the many provincial/territorial government strategies and organizations working to support commercialization;
- build support in the private and public sectors for a sustained effort to improve Canada's commercialization outcomes; and
- provide policy-focused advice to the Minister on improving commercialization in Canada, including guidance on government–business framework issues such as the competitiveness of internal markets, regulation, intellectual property protection and taxation.

To do this, the CPB must be:

- rooted in the marketplace;
- focused and strategic in its advice;
- led by a respected commercialization expert from the private sector, with members who are knowledgeable, experienced and committed to getting results for Canada;
- driven by a culture of commerce and an awareness of the most current domestic and international commercialization realities; and
- focused on the need for better evidence on commercialization in Canada.

The Minister of Industry would appoint a full-time president who would devote his or her time and resources to ensure, through personal leadership and continual interaction with the community at large, that commercialization is kept at the forefront of public and economic thinking in Canada. Other CPB members should be drawn from the business community, academia and organizations focused on commercialization-related goals bringing partners together from all sectors (commonly known as fourth-pillar organizations).[8] These members should reflect the entire commercialization system but not be collectively or individually accountable or beholden to any other organization or mandate while exercising their responsibility. At least one member should be from outside Canada so that the CPB can draw on international best practices. Officials from key government research and commercialization organizations should be included as ex officio, non-voting members. Deputy ministers would be asked to attend when it is relevant to their departments.

The CPB would require the support of an independent, full-time secretariat, whose executive director would be selected by, and accountable to, the president of the CPB.

8. Fourth-pillar organizations are usually independent, non-profit entities funded jointly by government and the private sector to provide a catalytic role for the other three pillars: business, government and post-secondary education institutions. For example, Precarn Incorporated was created, and is funded, by partners from these three pillars to support the development of intelligent systems technologies.

To create the CPB, an interim board would be established with a one-year mandate to do the following:

- Develop an implementation plan for the recommendations of the panel, monitor the implementation of these initiatives, develop a plan for assessing their outcomes, and provide recommendations for improving, modifying or cancelling initiatives.
- Develop terms of reference, a budget, strategic plans and timelines for the creation of the CPB and ensure a clear mandate, as outlined, for the organization. This mandate will be distinct from those of other bodies with broad advisory mandates, such as the Prime Minister's Advisory Council on Science and Technology and the Council of Science and Technology Advisors, because it is focused strictly on commercialization. It will also differ from the proposed national advisory board of the pilot projects to commercialize university and federal laboratory research, in that the CPB will focus on private, rather than public, commercialization issues. The panel expects, however, that the CPB will work closely with the bodies mentioned in areas of common interest.
- Nurture collaboration between the private, public and other sectors, particularly in areas where Canada has, or could develop, a competitive advantage in commercialization, and where private sector commitment to commercialization can be increased.

The CPB itself should have an initial four-year mandate. After that, its effectiveness should be reviewed by an internationally recognized panel of experts on commercialization, to determine whether it should continue, be changed or be cancelled.

The interim board should be provided with an annual budget of $3 million. The board would, in turn, recommend a budget for the CPB. This budget would be reviewed periodically.

TALENT

Canada's competitiveness and capacity for commercialization depend on the talent and ingenuity of people who combine knowledge and resources in new ways. Canada needs a well-educated workforce whose skills, knowledge and creativity can compete with the best in the world — and it needs to put their skills and education to work in a way that spurs innovation and benefits businesses.

In many respects, Canada is doing well in the supply of talent. Among 15-year-olds, Canadians are exceeded in their math abilities only by students in Hong Kong and Finland.[9] Canada ranks first among Organisation for Economic Co-operation and Development (OECD) countries in terms of the share of its working-age population with post-secondary education. But this same OECD data reveals that we have proportionately fewer university graduates and — at the very high end — we are producing new PhD graduates at a much slower pace than major competitors such as the U.S.[10]

More fundamentally, there is concern about the extent to which Canada's universities have the capacity to significantly increase the number of graduate students. In particular, the Association of Universities and Colleges of Canada estimates that U.S. universities have 50 percent more funding per student for teaching and research.[11]

The Government of Canada has partly addressed these problems by establishing programs such as the Canada Millennium Scholarship Foundation and the Canada Graduate Scholarships to allow more Canadians to pursue a post-secondary education. Federal funding has also been increased for the granting councils and other funding organizations, in order to support Canada's research community. But these problems are a moving target, and Canada cannot afford to rest on its laurels.

As noted, a greater challenge for Canada's commercialization performance is inadequate demand for talent. In general, Canadian businesses have a weak record for hiring people with the skills needed for the full range of commercialization activities. For example, Canadian managers are only half as likely as American managers to be graduates of business programs. Among financial professionals, 18 percent in the U.S. have a master's degree or higher, compared with only 8 percent in Canada.[12] And, U.S., Japanese and German companies employ significantly more researchers per thousand employees than do Canadian firms.[13]

Most tellingly, the wage premium for highly qualified personnel is lower in Canada than in competitor countries, particularly the U.S. The wages for highly skilled workers have not risen relative to the Canadian average in recent years.[14]

Placing highly qualified personnel — from all education disciplines — in business environments will spur demand by influencing the way firms create opportunities, encourage greater involvement by firms in research, increase the flow of knowledge to businesses from academia, and broaden understanding of international markets.

9. Human Resources Development Canada; Council of Ministers of Education, Canada; and Statistics Canada. *Measuring Up: The Performance of Canada's Youth in Reading, Mathematics and Science. OECD PISA Study — First Results for Canadians Aged 15.* Catalogue No. 81-590-XPE. Ottawa: Statistics Canada, December 2004.
10. Organisation for Economic Co-operation and Development, *Education at a Glance 2005* (Paris: Organisation for Economic Co-operation and Development, September 2005). The comparison of PhD graduation rates was taken from the 2002 issue, given that recent data for Canada is not available.
11. Association of Universities and Colleges of Canada, *AUCC Backgrounder: Canada–U.S. Funding Comparisons* (Ottawa: Association of Universities and Colleges of Canada, 2005).
12. Based on census data from Statistics Canada and the U.S. Department of Commerce.
13. Organisation for Economic Co-operation and Development, *OECD Science, Technology and Industry Scoreboard 2005* (Paris: Organisation for Economic Co-operation and Development, October 2005).
14. See, for example, René Morissette, et al., *Relative Wage Patterns among the Highly Educated in a Knowledge-based Economy* (Ottawa: Statistics Canada, 2004).

RECOMMENDATION

Increase Business Demand for Talent Through Development of a New Canada Commercialization Fellowships Program

PROPOSAL

We recommend that the federal government create a new Canada Commercialization Fellowships Program. The program would support businesses in all sectors that are building or renewing a commitment to commercialization by supporting exchanges with post-secondary institutions. These fellowships would encompass the broad range of disciplines that support commercialization, such as management, marketing, market research and design, as well as the sciences, technology and engineering. These exchanges will happen throughout the career cycle:

- **Undergraduate Fellowships** will provide work experience and scholarships for Canadians entering a university in Canada. The winners of the regional and national science fairs and youth business competitions discussed later in this section should qualify automatically for these fellowships.
- **Graduate Fellowships** for master's and PhD students in Canadian universities will give participants work experience, training and research skills in both university and business settings in order to improve their ability to bring commercialization skills to Canadian workplaces.
- **Post-Doctoral Fellowships** will include support for specific efforts in order to bring ideas to market and provide funding for training and research that are relevant to commercialization.
- **Career Interchange Fellowships** will concentrate on two areas:
  - the temporary or part-time movement of post-secondary faculty into industry, and of people from industry into academic environments, creating a cycle for fellows to move ideas between both sectors; and
  - a mentoring and exchange program for a select group of mid-career professionals and next-generation angel investors and venture capitalists, who will work in, and learn from, successful venture capital firms in Canada and around the world, enabling the fellows to apply international best practices to commercialization in Canada.
- **Chairs of Research in Practice** will focus on people that have PhD degrees and substantial experience in industry and/or academia in Canada. The funding for these chairs will support multi-year projects that include the supervision of graduate students; direction of a research team in a business, not-for-profit organization or public research institution; and management of a project that will add to commercialization knowledge and its application.

The intentions of the Canada Commercialization Fellowships will be to encourage students not inclined to business to explore this option, and to encourage firms not currently employing high-end talent to do so. These intentions must be reflected in the program's design.

The dollar value of the fellowships must be irresistible in order to attract and retain the best and brightest from around the world. Funding decisions for all of these fellowships should be guided by how well proposals expand business demand for people with the skills needed for commercialization. After a reasonable tenure, the cost of continued employment with the firm would be borne by the company.

Program administration will involve two complementary parts. One part will assess fellowship candidates' qualifications in much the same way that applicants for scholarships and research grants are currently evaluated. The second part will assess how well proposals will improve the commercialization-relevant skills of the candidates and the commercialization capacity and outcomes of the host and/or home organization(s). Ensuring that a delivery organization has the ability to assess both the demand and supply elements of the program will be a key challenge for the CPB in its oversight function. The CPB will need to ensure that the fellowships add to any existing initiatives so that firms can gain new perspectives on commercial opportunities through the application of knowledge.

REASONS FOR ACTION

Canada is growing the supply of talent, and it must strengthen private sector demand for that talent. In our view, the way to do this is by reducing the initial costs. Once in place, the fellows will demonstrate their value, change the culture of their workplaces and make commercialization self-sustaining.

Funding Requirements and Expected Results

The panel estimates that funding for the Canada Commercialization Fellowships should begin at $65 million per year on a pilot basis, scaling up to $275 million per year once their effectiveness has been confirmed by a CPB-led review. This would provide funding for up to 5000 fellowships and associated research budgets in any one year. The panel expects that the fellowships will:

- increase the number of highly talented workers with commercialization-relevant experience in both academic and business settings;
- increase the capacity for, and commitment to, innovation and commercialization among Canadian companies; and
- improve the flow of knowledge from academia to business on recent scientific developments, and from business to academia on market needs.

RECOMMENDATION

Spur Employer Hiring of Recent Graduates with Commercialization Talents

PROPOSAL

We recommend that the federal government increase existing support to Canadian businesses to hire recent graduates on projects aimed at commercialization and innovation by:

- expanding the existing Canadian Institutes of Health Research (CIHR) programs that focus on industry–university partnerships;
- expanding the existing Natural Sciences and Engineering Research Council of Canada (NSERC) programs that provide research experience in industrial settings;
- creating a new Social Sciences and Humanities Research Council of Canada (SSHRC) commercialization and innovation fellowship program emphasizing disciplines such as business, design and human behaviour; and
- providing funds to these organizations based on a competition overseen by the CPB.

The federal government should support this recommendation by increasing funding for the granting councils involved, not by reducing funding for existing programs. What's more, this new money must be complemented by more aggressive campaigns aimed at Canadian employers to demonstrate the benefits of drawing on Canada's highly qualified graduates to spark innovation and commercialization.

REASONS FOR ACTION

The two organizations at the centre of this recommendation, NSERC and the CIHR, are already demonstrating their value in driving Canadian commercialization. They are improving the quality of the supply of talent and linking these people to demand opportunities. For example, the number of university–industry fellowships approved by the CIHR increased from 171 in 2000 to 324 in 2004 (in response to a near tripling in applications over this period). On average, more than 60 percent of people supported by NSERC's program are retained by the related firm, at the firm's expense. While the number of projects funded is not large, it shows growing interest in creating opportunities for talented people to make their mark in Canada's business sector.

While the CIHR and NSERC programs are valuable, they cover only part of Canada's commercialization needs. Adding a new program through SSHRC would incorporate other fields critical to commercialization.

We recognize that the programs of these three organizations will continue to be highly targeted and focused on opportunities for the most highly trained graduates. However, they fit with the larger need to create stronger bridges that enable highly qualified personnel to make the transition from Canada's universities to businesses and other applied settings.

Funding Requirements and Expected Results

The panel estimates that funding for the three programs mentioned should increase by $15 million per year, initially, scaling up to an additional $40 million per year following a CPB-led review of their effectiveness. This would roughly double the amount of funding now provided to these organizations for this purpose. The panel expects that this recommendation will:

- increase private sector demand for commercialization talent through higher overall employment and an increased number of hiring companies;
- lead to reduced emigration of highly skilled Canadians in fields that are the focus of fellowships, while enhancing the recruitment of Canadian students who have studied abroad; and
- improve the flow of knowledge crucial to commercialization from academia to Canadian businesses through increased hiring of recent graduates by industry.

RECOMMENDATION

Encourage and Celebrate Young Canadians Who Aim for Success in Business, Science and Technology

PROPOSAL

We recommend that the federal government provide substantial, guaranteed and long-term support for initiatives that promote and celebrate excellence in science, technology and business by young people. This will mean much more than incremental funding for science fairs, student business competitions and similar activities across the country. It must involve:

- granting Canada Commercialization Undergraduate Fellowships and other awards to high school students who win major academic and business skills competitions;
- creating the Prime Minister's Awards for Science, Technology and Entrepreneurship for Canada's Youth to send a powerful message to young people and their communities;
- launching an annual, national event involving the Prime Minister to honour the young achievers who will help to build our commercialization future;
- initiating new awards to honour leading-edge innovation by young people in new or non-traditional fields that encourage intellectual and commercial risk taking; and
- establishing new awards to celebrate the success of young people commercializing new products, services and processes.

We recommend that a competitive process be developed to provide sustained, long-term funding to local and national organizations that can demonstrate the ability to meet the goals of this recommendation.

REASONS FOR ACTION

If Canada is going to foster a culture that promotes intellectual achievement and business success, it must begin with its young people.

From our experience, interest in and an aptitude for science or business develop early in life. Activities for school-aged children that fuel curiosity and develop creativity build on that early childhood base — activities as pivotal in a student's life as winning the school science fair. The panel's recommendations, and other government actions, will encourage young people — including young women and members of other under-represented groups — to pursue careers in science, technology and business.

Of high school students attending Canada-Wide Science Fairs in 1995 and 1996, 57 percent expressed an interest in pursuing science-related careers, compared with only about 37 percent among those who did not attend. These fairs are where children can learn scientific and business skills and put them to work. Federal leadership will provide a great incentive for Canadian companies to expand their commitment to these activities and help foster a culture of excellence in Canada's classrooms and labs. Canada should prize excellence in these areas the same way it prizes excellence on the ice.

Funding Requirements and Expected Results

Funding requirements for this initiative are estimated to begin at $15 million per year, ramping up to $60 million per year once it has been demonstrated that this amount of funding can be absorbed in an effective manner. The panel expects that this recommendation will:

- accelerate the trend toward a Canadian culture that prizes excellence in the marketplace and the classroom;
- generate higher demand for enrolment in science, technology, engineering and business education programs; and
- induce more high-achieving students to stay in Canada to pursue their undergraduate degrees.

RECOMMENDATION

Develop and Retain Talent for Success in a Global Marketplace

PROPOSAL

We recommend that the federal government take action to attract skilled and talented individuals to Canada to support commercialization and to link Canadian students, businesses and researchers to global activity that is expanding knowledge.

Create a Talent and Research Fund for International Study

This fund will:

- create a set of Maple Leaf Graduate Scholarships to compete with the prestige of the Fulbright and Rhodes scholarships and attract more of the world's finest minds to this country's campuses;
- bring foreign research and teaching collaborators to Canada to serve as distinguished visiting chairs in disciplines that are strategic priorities for Canada and support its commercialization goals;
- provide matching grants for collaborative research projects with researchers in centres of excellence in other countries;
- support short-term exchanges of researchers between Canadian and foreign universities; and
- significantly increase the number of Canadian students conducting studies and research at foreign universities, thereby gaining exposure to other cultures and markets.

This fund should be administered by the Government of Canada's granting councils.

Encourage International Students to Stay in Canada

Like other countries, Canada should change its immigration policies to make it easier for international students, particularly those in advanced studies, to work while they are studying here and to remain in Canada after graduation. We are pleased to see that pilot projects to address this need have been announced, and look forward to their full availability across Canada. That said, we feel that more aggressive action is required to ensure that international students with advanced degrees from Canadian universities can stay and work in Canada.

REASONS FOR ACTION

As groups such as the Prime Minister's Advisory Council on Science and Technology have noted, Canada has to be open to international opportunities for knowledge creation, sharing and application. This is important across all disciplines relevant to commercialization, including those business-related fields critical to improved corporate management, stronger customer focus and support for innovation.

While we want to see Canada generate more knowledge to enhance commercialization results, Canadians also need to be alert to the knowledge being generated elsewhere. Indeed, some 96 percent of all new ideas and innovations are developed outside of Canada's borders.[15] Canada needs to welcome international partnerships – and the people who make them possible – as a key enabler in reaching its commercialization goals.

The panel believes that addressing the demographic challenges of a declining birth rate is necessary, in part by making Canada a more attractive place for immigrants. We support the government's commitment to bringing down the barriers that prevent skilled immigrants from using their talents fully. However, our commercialization goals for Canada would also benefit from a commitment to an even more open exchange of talent between Canada and other countries.

As part of this, Canada has to make it a priority to attract leading intellectual talent in all relevant areas from around the world. There must be a commitment to opening Canadians' eyes through international study opportunities, and to bringing this global perspective and experience to bear when these Canadians return to Canada. Canada should build on a solid foundation of exchanges and foreign student enrolment in implementing this strategy.

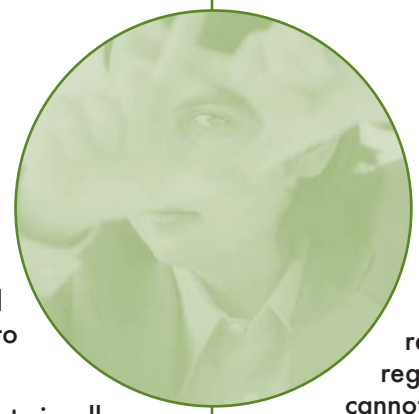
Funding Requirements and Expected Results

Initial funding requirements for this initiative are estimated to be $50 million per year. Pending review by the CPB, this amount could be increased to an estimated $190 million per year, which would provide enough funding to support 500 foreign research and teaching collaborators, 2000 short-term scholarships for Canadian students to study abroad, and more than 2500 scholarships for foreign students to study in Canada. The panel expects that this recommendation will:

- attract greater numbers of outstanding students and scholars to Canadian post-secondary institutions;
- develop more networks of individuals, both in Canada and internationally, who have gained experience through collaborations and exchanges; and
- encourage more international students to stay in Canada after graduation in order to meet demand in fields directly supporting commercialization.

15. This figure is based on Canada's share in the world's scientific publications, using Thomson Scientific's National Science Indicators database, 2005.

RESEARCH



Research, whether in the private, public or academic sectors, centres on people investigating questions, experimenting to find solutions and thinking about how to match ideas to opportunities.

The panel strongly supports investments in all forms of research. From a commercialization perspective, the biggest impact of publicly funded research lies in its role in developing talented workers who then apply their knowledge in business settings. This research can also generate ideas that have commercial potential. Indeed, breakthroughs by academic researchers can lead to the creation of whole new industries. For example, Watson and Crick's discovery of the structure of DNA gave birth to the biotechnology industry.

As noted, Canada is making progress on the supply side, particularly through increased support for research at Canadian universities. In fact, OECD data shows that Canada ranks first overall in the G7 in terms of the share of research performed in the academic sector. Most indicators – patenting, licensing income and spinoff companies – also point to improved commercialization outcomes from university research.[16] Budget 2004 provided funding to develop pilot programs aimed at improving commercialization in university and government labs.[17]

One of the major challenges for commercialization in Canada is its relatively low level of business investment in R&D. This lack of demand has been demonstrated in a number of ways, but most importantly in business sector R&D intensity (spending relative to output), in which Canada ranks 15th among OECD countries. Moreover, Canada's R&D-to-GDP ratio is 45 percent below that of the U.S. and 33 percent below the OECD average. Canadian research intensity in sectors commonly seen as high-technology (e.g. computing and telecommunications equipment, pharmaceuticals, etc.) compares favourably with that in the U.S., but these industries account for a smaller share of total economic activity in Canada. Low R&D intensity in other major sectors – including wholesale and retail trade, as well as motor vehicle manufacturing – has a significant impact on Canada's relative standing.

These overall weaknesses have particularly important consequences for the Canadian economy. The OECD estimates that a one-percentage-point rise in private sector R&D intensity could increase per-capita income by as much as 12 percent in the long run.[18]

We recognize there are many potential explanations for the relatively weak state of Canadian private sector investment in R&D, including a lack of competitive pressures, the effects of Canada's tax system on corporate decisions, and the effects of the country's regulatory and intellectual property regimes. We also note that economists cannot fully explain why Canadian businesses do not invest heavily in R&D, despite the generosity of Canada's R&D tax credit.[19]

The panel believes that federal support for key research challenges, matched by private sector funding, would boost private sector R&D activity. This approach would build on Canada's R&D strength in universities, while ensuring that supported R&D is driven by demand considerations. Canada would also draw on the successful experience of other countries in encouraging commercialization in SMEs, while addressing the R&D needs of government. On the supply side, targeted increases in funding for Canadian universities and government labs would promote stronger development of ideas within these settings.

> Added investments in research outside of universities must be complemented by continued increases in the public funding of research in Canada's universities and other academic and government research settings.[20]

16. For evidence in this regard, see, for example, Association of Universities and Colleges of Canada, *Momentum: The 2005 Report on University Research and Knowledge Transfer* (Ottawa: Association of Universities and Colleges of Canada, 2005) or Cathy Read, *Survey of Intellectual Property Commercialization in the Higher Education Sector, 2003* (Ottawa: Statistics Canada, November 2005).
17. A collaborative approach was taken to design, and a program proposal has since been developed.
18. Organisation for Economic Co-operation and Development, *The Sources of Economic Growth in OECD Countries* (Paris: Organisation for Economic Co-operation and Development, March 2003).
19. More comments on this are available in Section IV as issues for priority attention in the future, and in Appendix E – Historical Context for Innovation and Commercialization in Canada.
20. See Appendix F – Publicly Funded Research: The Essential Foundation for Excellence in Commercialization.

RECOMMENDATION

Create a Commercialization Superfund to Address Key Commercialization Challenges

PROPOSAL

We recommend that the federal government create a Commercialization Superfund to create commercialization opportunities in industries where Canada has potential competitive advantages. It will do this by:

- supporting large-scale private–public sector research and training partnerships; and
- expanding existing programs, and initiating new ones, to train highly qualified personnel.

The Superfund will:

- focus on fields where Canada is a market leader or can become one;
- address knowledge and/or skill gaps that have been identified by a sector or cluster of firms as critical to meeting future commercialization opportunities;
- attract commitments of private sector funding and engage multiple firms to ensure that skills development and research meet broad industry needs and opportunities;
- locate funded research and training in non-proprietary laboratories (e.g. in federal or provincial/territorial research facilities, universities or facilities jointly operated by different firms in an industry sector or cluster); and
- require collaboration among organizations in several sectors of the economy, including, for example:
  - private or public sector organizations;
  - participants in a supply chain; or
  - organizations in Canada and abroad.

During competitions for this funding, two criteria should be assessed: long-term commercial potential, and the scientific merit and feasibility of the proposals.

Assessment of the long-term commercial potential of proposals should be conducted by a private-sector-led group. Assessments of proposals' scientific merit should be carried out by existing organizations with relevant expertise and experience (e.g. granting councils). Once the organization overseeing this assessment process has determined which projects merit funding, these proposals should be forwarded to the CPB for approval and recommendation to the Minister of Industry, who would have final authority over funding decisions.

REASONS FOR ACTION

Canada's industrial future lies in focused efforts, not small-scale initiatives. However, where to focus has always been a critical challenge for public policy. Under the Superfund, firms and public sector research organizations would commit to medium-term, large-scale projects led by industry. Such a commitment would need to be made prior to any financing from the federal government. In this way, decisions on support would be firmly rooted in demand and be backed by a cross-section of firms and research organizations, significantly improving the chances of success.

Other countries are encouraging private–public research partnerships aimed at delivering results in the marketplace.[21, 22] Their programs often involve the flexibility and adaptability that the panel sees as key to a successful Commercialization Superfund. The fund should supplement existing programs and provide new support to take on emerging challenges. Funding commitments will need to span the 5 to 10 years necessary to develop new knowledge and highly qualified personnel.

Funding Requirements and Expected Results

A pilot program in this area would require funding of about $50 million per year. Pending CPB review of the program's effectiveness and potential demand, funding could rise to $250 million per year. When matched by private sector funding, this could support between 20 and 30 projects at any one time. The panel expects that this recommendation will:

- position Canada as a leading global competitor in selected sectors and economic niches;
- increase the demand for highly skilled people and research in Superfund sectors; and
- improve Canada's capacity to commercialize ideas developed in private sector, university and government research settings, and ensure highly qualified personnel to move them forward.

RECOMMENDATION

Expand Federal Programs that Support Seed and Start-Up Firms in Proving Their Business Ideas

PROPOSAL

We recommend that the federal government increase funding for granting council programs that support private sector research at the proof of concept or proof of principle (POP) stage of commercialization.

The proposed funding must, as a first step, consist of increases to successful programs such as:

- NSERC's Idea to Innovation program;
- the CIHR's Proof of Principle program, which provides grants to advance discoveries and inventions toward technologies that can be commercialized;
- the National Research Council Canada's Industrial Research Assistance Program, which supports projects at the pre-commercialization stage, including demonstration and pilot projects; and
- SSHRC, to establish a program similar to these three in order to encourage, where applicable, the commercialization of the research it funds.

Funding must grow based on additional evidence of success in terms of business outcomes and the relevant agency's responsiveness to the needs of these emerging businesses. The CPB should advise the Minister of Industry on funding under this recommendation, which should be based on a competitive process among the granting agencies, involving a strong, peer-reviewed process.

In time, the CPB should decide whether to recommend bringing the individual POP programs together into a single approach.

21. See Appendix I – Commercialization Strategies Being Used in Other Countries.
22. For example, see Organisation for Economic Co-operation and Development, *Public-Private Partnerships for Research and Innovation: An Evaluation of the Australian Experience* (Paris: Organisation for Economic Co-operation and Development, 2004).

REASONS FOR ACTION

Increased funding for research in Canadian universities has led to a growth in spinoff companies, greater licensing of innovations and other commercial benefits.[23]

One of the most critical points for this kind of government action is at the POP stage of commercialization. It is critical that the discoveries emerging from scientific research be brought to a stage where sources of private sector funding, such as angel investors and venture capitalists, can better appreciate their proposed value.

Existing programs provide both financial help and broader assistance to emerging entrepreneurs, thereby helping them develop their business talents. These programs are building track records by helping budding entrepreneurs make the leap to the culture and expectations of the business world. The risk capital community needs to link to these programs so that these projects can gradually progress from government support to support from the private sector at later development stages. Given evidence that start-up firms routinely succeed or fail on the strength of their business skills, Canada needs to do more at this stage.

Funding Requirements and Expected Results

The panel recommends injecting an additional $10 million per year into the programs mentioned, scaling up to $50 million per year following review by the CPB. This would lead to an approximate doubling of financial support in this area. The panel expects that this recommendation will:

- result in more successful commercialization initiatives;
- enhance investor interest in POP-supported initiatives; and
- expand awareness of business and commercialization demands among academic researchers with potential ideas for commercialization.

23. For evidence in this regard, see, for example, Association of Universities and Colleges of Canada, *Momentum*, or Cathy Read, *Survey of Intellectual Property Commercialization*.

RECOMMENDATION

Increase the Commercialization Involvement of Small and Medium-Sized Enterprises Through a Canadian SME Partnerships Initiative

PROPOSAL

We recommend that the federal government expand its existing and planned support to SMEs by creating a new Canadian SME Partnerships Initiative to help SMEs become more globally competitive. This support will come through two initiatives: research funding and program support.

Canadian SME Partnerships Initiative — Research Funding

Under this program, federal science-based departments and agencies will compete for five-year funding for research above and beyond their existing budgets.[24] In practice, these departments and agencies will identify topics representing scientific and technical problems requiring innovative solutions (including process innovations). Departmental proposals would be assessed on how well they address public policy priorities, and their potential for future commercial applications. As in other countries with similar initiatives, these programs will often be in fields such as resource management, agriculture, the environment and sustainable development, health, transportation and public security.

Once allocations have been determined through a competitive process, departments would use the incremental funding to support R&D projects carried out by small and medium-sized private sector firms (not academic or public sector research institutions). Funding decisions on individual projects will be left to the individual departments.

Funding for the SMEs will cover two stages:

- feasibility funding, with limited funds for short-term investigation of scientific merit and feasibility; and
- prototype funding, with more extensive funds for the further development of projects with strong scientific and commercial merit (both domestic and global).

After the prototype stage, firms will look to other sources of risk capital to develop their products, services or processes for commercialization.

Canadian SME Partnerships Initiative — Program Support

There is a real need for better support for SMEs engaged in the commercialization of new or substantially improved products, services and processes. This improved support should include efforts to help SMEs reach new international customers, both directly and through international alliances. Federal departments are in the process of examining their efforts in science and technology and in emerging markets. With this work in mind, consideration should be given to significantly expanding support for SMEs through measures such as support for technology acquisition and information gathering, and R&D partnerships with firms and research bodies in other countries. The focus should be on market research and marketing information, guidance and support.

REASONS FOR ACTION

Canada's leading-edge innovation and commercialization often start with small firms created to pursue a specific idea, technology or innovation. These firms could be our multinationals of the future.

Canadian public policy must demonstrate a commitment to helping these firms grow and thrive in the global marketplace. It must also help create linkages between domestic SMEs and larger firms, which often look to much smaller suppliers for specific innovations, thereby providing alliances. Canadian firms can win their share — and more — of these opportunities.

24. Such departments and agencies would include Agriculture and Agri-Food Canada, the Canadian Space Agency, Environment Canada, Fisheries and Oceans Canada, Health Canada, National Defence, the National Research Council Canada, Natural Resources Canada and Transport Canada.

The panel recognizes that SMEs often need different kinds of support for their R&D activities to achieve marketplace leadership than do their larger counterparts. With fewer resources to draw on, SMEs require a much broader range of assistance to help develop their business capacities, science, technology and other strengths, and in such critically specialized fields as product design. They need more dedicated access to opportunities in order to gain global knowledge and develop relationships that can lead to growth and further innovation.

To some extent, this is addressed under current programs. The new Canadian SME Partnerships Initiative we are recommending will accelerate the needed action.

The SME Partnerships' research funding program will be similar to what already takes place in very specific areas. A good example is the research on defence-related needs that Defence Research and Development Canada funds. We were also impressed with the experience of the Small Business Innovation Research program in the U.S., which has been very successful in boosting growth and employment in participating SMEs. This success has prompted countries such as the United Kingdom and France to develop similar programs. Another such program is now under development for the European Union.

The Canadian SME Partnerships Initiative will complement other actions recommended by the panel under the Talent and Capital parts of this section. For example, support through the Canada Commercialization Fellowships could help build the talent pool in firms that have received SME Partnerships program support funds as they've moved forward to implement their projects. Success in the SME Partnerships program could also enhance the technical credibility of firms in the eyes of angel and venture capital investors, as it has done in the other countries where similar programs are in place.[25]

For the SME Partnerships' program support funding, we expect program designs demanding the same standards of excellence that we want to see in all programming. The goal has to be working with those companies that are determined to succeed in the global marketplace and are willing to work and take risks to get there.

This focus on risk will mean that many initiatives would fail. However, the panel believes that those that succeed will contribute more than enough to the economy to yield a large net gain from this program.[26]

Funding Requirements and Expected Results

The panel recommends additional funding of $50 million per year for the Initiative, reflecting an increase of roughly 15 percent in the amount of R&D funding that the federal government contracts out to Canadian business. Following a review by the CPB, this funding could increase to an estimated $200 million per year. The panel expects that this recommendation would:

- encourage SMEs to engage in research with long-term commercial potential;
- develop new ideas and address gaps in early-stage funding for promising technologies;
- promote the development of products and services that could help achieve public policy priorities; and
- create stronger links between SMEs and larger businesses.

25. Charles W. Wessner, ed., *The Small Business Innovation Research Program: Challenges and Opportunities* (Washington DC: National Academy Press, 1999).

26. Ibid.

CAPITAL

Capital follows people with great ideas and sound business skills. However, issues of supply and demand are apparent here, as elsewhere in Canada's commercialization system. The consensus among industry experts is that there are financing challenges in two key areas: 1) the seed and start-up phase of a firm's operation; and 2) the expansion phase.

Given that much of the investment for early-stage firms is informal (personal savings, friends, family members and angel investors), there is no definitive evidence in this area. Still, many early-stage firms claim that they face supply gaps. They see a shortage of patient capital at all phases of their development. Current angel, seed and early-stage investors are often not able to provide adequate support, especially for companies that are beginning to grow. Indeed, anecdotal evidence suggests that the Canadian angel investor market is less developed than that in the U.S. and the U.K., with fewer networks and less wealth to reinvest.[27]

In terms of expansion-stage financing, we are concerned by data indicating that the average venture capital investment in a U.S. company is nearly four times that invested in a Canadian company.[28] This underinvestment in Canada may reflect a public policy approach that has focused too much on the quantity of venture capital rather than the quality. Canada needs a venture capital system that works harder at finding investments on which it can place bigger bets. In the panel's view, these smaller investments hamper Canadian firms' ability to expand their operations and compete with their better-funded U.S. competitors. As expansion-stage venture capital financings in Canada often involve syndications with foreign venture capitalists, the panel believes that efforts to promote the flow of foreign capital into Canada are necessary.

The Government of Canada is working to increase the supply of capital for early-stage businesses. For example, the Business Development Bank of Canada recently earmarked $100 million for investment in five new, independent seed and investment commercialization venture capital funds across Canada. Many provinces and territories now have initiatives to marshal venture capital for emerging companies, both directly, from provincial/territorial resources, and by building stronger connections between potential investors and potential investment opportunities.

While this will all certainly help, the key to long-term commercialization success will be in addressing the demand-side problems that investors have identified. These problems include the low returns on investments to date, and the shortage of good proposals backed by strong management teams with track records of success.

We have approached our work from a market-based perspective and believe that measures to improve the quality of demand will eventually earn greater investor activity, and, at the same time, improve capital supply.

Our recommendations on talent should help enhance management and business skills at the firm level. Beyond these, better networking and mentoring at the local level will link people leading seed and early-stage businesses with investors who can help them improve their management and open doors to other investors.

We are less certain of the appropriate role for government in expansion-stage financing. More work needs to be done to understand how government can help in ways that are effective and do not distort markets. Accordingly, we focused on three areas for immediate federal action: improving access to early-stage angel investing and expertise, reviewing expansion-stage venture capital, and removing barriers to foreign venture capital investment.

27. See, for example, evidence from Nathaly Riverin, et al., *Global Entrepreneurship Monitor: Canadian National Report 2003* (Montréal: Global Entrepreneurship Monitor Canada, 2005). Led by HEC Montréal and the Sauder School of Business, University of British Columbia.

28. Data for Canada is from Thomson Macdonald, while U.S. data is from Venture Economics.

RECOMMENDATION

Improve Access to Early-Stage Angel Financing and Expertise

PROPOSAL

We recommend that the federal government support early-stage business development by significantly improving Canada's angel investment environment.

To achieve this goal, we recommend two actions: funding excellence in building angel investor networks, and creating a new angel investor co-investment fund program. Both should be phased in, beginning with a pilot effort. The programs would earn more funding once they have proven their effectiveness.

Funding Excellence in Building Angel Investor Networks

It is necessary to ensure that start-up firms have access to the full range of business acumen necessary to attract early-stage investors.

To develop angel investor networks and enhance the managerial and financial support they provide to early-stage firms, we propose a competitive process to fund non-governmental organizations that mobilize the resources that already exist within communities. These organizations have the knowledge, experience and expertise to foster success. The goal of this initiative is to increase the number of investor-ready firms, improve the quality of the investment opportunities they present to investors, and match them with potential investors. The winning organizations will:

- mobilize people and resources within communities to work with entrepreneurs and emerging company managers to help them become more investor-ready by, for example, providing venues for companies to test their business proposals with informal groups of angel investors, in order to help the companies develop more compelling investment cases;
- match business opportunities with investors;
- strengthen networking activities within local clusters; and
- improve linkages to regional, national and international networks of expertise (i.e. technical, marketing, export and business-related expertise).

A New Angel Investor Co-Investment Fund Program

Early-stage investing is high-risk but essential to a dynamic and prosperous country. To ensure that the community of angel investors continues to grow, investment risk must be shared.

We are proposing the establishment of community-based funds, capitalized by the federal government, which will invest alongside angel investors in seed and start-up companies. Since angel investors will have their own money invested, they will have the incentive to perform all due diligence.

These funds will leverage private investments in start-up companies that are focused on growth through commercialization and will address the need for more funds. The funds will also create incentives for growth and enable angel investor expertise to reach more entrepreneurs and start-up businesses. The funding will expand the scale of angel funds.

The return of investment capital would be structured to reinforce the notion of shared risk but also to be consistent with the commitment to providing funding for early-stage support. Some companies will fail, but those that succeed should generate returns to the economy that exceed the cost of the program.

The interim CPB will need to work with its federal government partners to identify a private sector angel investor body to provide knowledgeable and objective peer review for this recommendation. The CPB should work with expert peer reviewers to identify the proposals from community organizations in both of the recommended action areas, and will recommend these to the Minister of Industry for funding.

REASONS FOR ACTION

Angel investment is about business, not philanthropy, and any advice that angel investors provide or any contributions they make – whether on corporate strategy, alliance and network-building or operational management – are meant to improve their own returns on investment, mitigate their risk and strengthen the companies they support. Their understanding of international markets and opportunities, and their ability to pave the way to later-stage funding, often makes a crucial difference in the progress of the firms in which they invest.

Angel investors are critical to the expansion of existing commercialization clusters and to helping to build local competitive advantages. In the U.S., their importance to start-ups has been demonstrated in many ways:

- Only 2 percent of *Inc.* magazine's 500 fastest growing companies received formal venture capital financing at the early seed stage.[29]
- Three million angel investors in the U.S. invest $50 billion annually in start-ups; their investments reach 30 to 40 times as many companies as formal venture capital investments and involve three to five times more money than comes from formal venture capitalists.
- The University of California at San Diego Connect Project has emphasized angel-type networks as part of a larger strategy that has been credited with helping to create 30 000 local biotechnology jobs and 24 000 jobs in telecommunications.

Information on Canadian angel investments is very limited. Some estimate that there are roughly 50 percent more informal investors per capita in the U.S. than in Canada.[30]

The panel believes that Canada needs to expand the number of people who can bring their money and experience to bear so that the country's commercialization results can be improved. This is a legitimate public policy goal, since angel investors help to shape community attitudes and awareness of the opportunities that come from being innovation- and commercialization-centred. They are a recognized strength of many of Canada's technology clusters, which are known for their innovative businesses. They also help foster the culture of commerce discussed throughout the panel's recommendations concerning talent and research.

Angel investor networks often connect entrepreneurs seeking capital with potential angel investors and can be vehicles for providing advice to entrepreneurs who want to do a better job of meeting investors' expectations. The networks are also important in overcoming two key challenges facing people who could be angel investors: the lack of information about specific investment opportunities and a lack of links to potential partners.

As in all of the panel's proposals, the use of a competitive process will be used, in this case to support angel networks that are strongly motivated to meet the needs of both potential investors and start-up companies that are ready to grow. The panel expects that any program design will draw on lessons learned through previous initiatives, such as the recent Canada Community Investment Plan pilot. We also want to see this program be subject to peer review under the auspices of the CPB.

Funding Requirements and Expected Results

Funding requirements to support a pilot program in this area are an estimated $20 million per year. Based on a review of the program's effectiveness, this could rise to annual funding of $40 million. The panel expects that this recommendation will lead to:

- a significant increase in the number of recognized angel networks in Canada;
- a substantial increase in Canadian angel investment;
- an increase in the number of seed and start-up companies that successfully expand their operations, due to improved business-management capacity and enhanced funding; and
- improved networking among potential partners in commercialization activities across all sectors.

29. Based on data from the Canadian Task Force on Early Stage Funding.
30. Nathaly Riverin, et al., *Global Entrepreneurship Monitor*.

RECOMMENDATION

Review the Expansion-Stage Venture Capital Market in Canada

PROPOSAL

We recommend that the federal government, possibly with provincial/territorial governments' involvement, launch a comprehensive review of policies, programs and other factors influencing the role of the venture capital markets on companies during their expansion stage. This review would involve the venture capital community and include assessing current initiatives and capital supply and demand considerations, including factors for firms seeking financing.

REASONS FOR ACTION

The panel devoted a substantial amount of time to discussing the role of venture capital investments in commercialization opportunities at later stages of business growth but before venture capitalists exit the business. The evidence suggests the following:

- Returns from venture capital in Canada are poor.
- The sector is less mature than its U.S. equivalent (e.g. younger, smaller, with fewer specialized funds).
- Pension funds and other institutional investors have been reluctant to commit capital in view of more profitable opportunities in other fields of private equity investment.

The panel heard from people who believe that high-potential firms will inevitably attract capital, whether Canadian or foreign-sourced. Others say that the likelihood of success increases with financing and the value added from domestic venture capital. The recent Government of Ontario decision to phase out tax credits for investments in labour-sponsored venture capital corporations has focused attention on how the current policy framework affects the Canadian private equity investment environment.

Given the international nature of capital flows today, Canada should ensure that its emerging businesses have access to foreign venture capital (see the next recommendation), and there should be a strong, viable Canadian venture capital industry. The latter was clearly identified as a federal objective in the 2004 federal budget.

The lack of clear information to support explicit recommendations on how best to improve the domestic venture capital environment was a challenge for the panel. Federal and provincial/territorial governments have policies that affect the operation of late-stage capital markets. We did not see the growth from small to medium-sized companies and from medium- to large-sized companies that we wanted. Therefore, a review of the policies and their implications for risk capital markets supporting commercialization is in order.

As well, many other countries face similar questions as Canada does on how best to improve the efficiency and effectiveness of their venture capital markets. These questions include whether to increase investments by pension funds and other institutional investors. A national conference designed to bring together experts who can comment on the experiences of other countries and who can provide information to guide policy choices for stronger venture capital markets will help policy-makers. Such a conference should be preceded by regional conferences that explore the local issues facing venture capitalists and firms seeking investment.

Funding Requirements and Expected Results

The review of expansion-stage financing is expected to cost $1 million (a one-time expense). This review should identify strategies to improve the operation of capital markets and will result in a more effective deployment of available capital. Increased venture capital investment in later-stage companies should also result.

RECOMMENDATION

Remove Barriers to Foreign Venture Capital Investment

PROPOSAL

In line with the conclusions of the Canadian Task Force on Early Stage Funding, we recommend that the federal government:

- eliminate the withholding tax on capital gains made by foreign investors in the equity of private Canadian companies;
- cover limited liability corporations that are venture capital funds or private investment funds under Canada's income tax treaties, and exclude them from withholding tax;
- extend rollover provisions to cross-border mergers, allowing companies to get access to strategic partnerships with foreign companies without triggering taxation; and
- eliminate the requirement that non-Canadian investors file a Canadian income tax return.

REASONS FOR ACTION

While the extensive review process of the previous recommendation would take some time, we believe immediate action can and must be taken to expand Canadian access to foreign venture capital. Foreign investors are increasingly present in the Canadian marketplace, seizing opportunities through syndications with Canadian venture capitalists and other investors. The growth of foreign venture capital financing is such that 27 percent of all venture capital financing in 2005 came from international sources.

To do more, Canada needs to address the barriers arising from current Canadian tax laws, regulations and policies. In this respect, we endorse the recommendations of the Canadian Task Force on Early Stage Funding aimed at improving the flow of foreign money into Canada.[31] This will not only increase the availability of funds for investment but will also increase Canadian talent in venture capital analysis and management that is essential to developing Canada's risk capital marketplace.

Moreover, Canadian companies themselves stand to benefit considerably from venture capital firms' direct links to key suppliers and customers, and from their specialized management and marketing expertise. These benefits will promote the growth of the innovative Canadian companies that Canada needs in order to reach its commercialization goals.

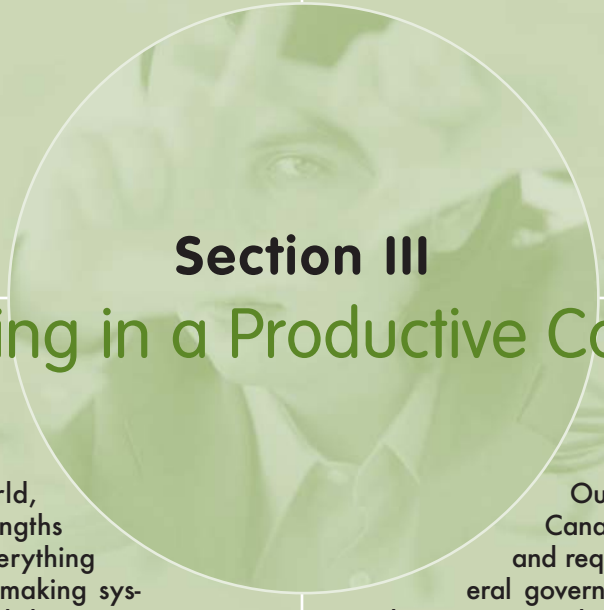
We understand the belief that emerging Canadian companies will be pushed by their foreign investors to move operations to the U.S., or that the investments will lead to foreign buyouts. Our belief, however, is that if the federal government moves promptly on our recommendations, Canada will strengthen its entire commercialization system. This will reduce the attractiveness of other countries to Canada's emerging companies. The real gains will, therefore, be far greater than any potential losses. Canada will be letting the free market work.

Expected Results

Implementation of this recommendation should:

- increase foreign investment in syndications and other funding pools supporting faster growth by Canadian early-stage companies; and
- improve the capacity for venture capital investment in Canada.

31. This task force, led by Daniel Muzyka, Dean of the University of British Columbia's Sauder School of Business, and co-sponsored by the National Research Council Canada, delivered its report in December 2004.



Section III
Investing in a Productive Canada

To succeed in today's world, nations must build on their strengths and embed knowledge into everything they do. Many countries are making systematic efforts in this regard by pursuing a focused, national, long-term approach to the commercialization of technology and know-how and to the large-scale investment essential to efforts to increase competitiveness. Canada must do the same.

Our 11 recommendations require Canada to focus its existing efforts, and require a commitment from the federal government to increase its investment by approximately $1.108 billion once the recommendations are fully implemented. Following is a list with each recommendation and a rough estimate of its cost to the federal government. These cost estimates are meant to illustrate the size of the program being recommended, and are not definitive. More definitive estimates will require further analysis.

Commercialization Proposals — Financial Summary (Cost Estimates Only)*

Recommendation	Estimates of Annual Funding (Pilot Scale)	Estimates of Annual Funding (Full Scale)
Create the Commercialization Partnership Board	$3M	$3M
Talent		
Create the Canada Commercialization Fellowships Program	$65M	$275M
Expand granting council programs to spur hiring of graduates with commercialization skills	$15M	$40M
Encourage and celebrate young Canadians who aim for success in business, science and technology	$15M	$60M
Develop and retain talent for success in a global marketplace	$50M	$190M
Research		
Create the Commercialization Superfund	$50M	$250M
Expand federal programs supporting firms in proof of concept/principle	$10M	$50M
Create the Canadian SME Partnerships Initiative	$50M	$200M
Capital		
Create the community angel networks and angel co-funding program to improve access to early-stage angel financing and expertise	$20M	$40M
Make tax changes to encourage foreign investment	n/a	n/a
Total Annual Funding Requirement	**$278M**	**$1.108B**

*These are investments that the panel believes would bring private sector returns through enhanced productivity but that would still need to be reviewed annually. In addition, approximately $1 million in one-time funding is required to review Canada's expansion-stage venture capital market. The CPB should regularly review the outcomes achieved through these initiatives to ensure that goals are being met. Based on these reviews, the CPB should make recommendations to expand, modify or cancel initiatives as appropriate.

The return on these new investments will include stronger economies at the community, regional and national levels; more demand for highly qualified personnel, especially young people; a more vibrant research climate; and a stronger risk capital community. These represent necessary investments in Canada's future in an extremely competitive world.

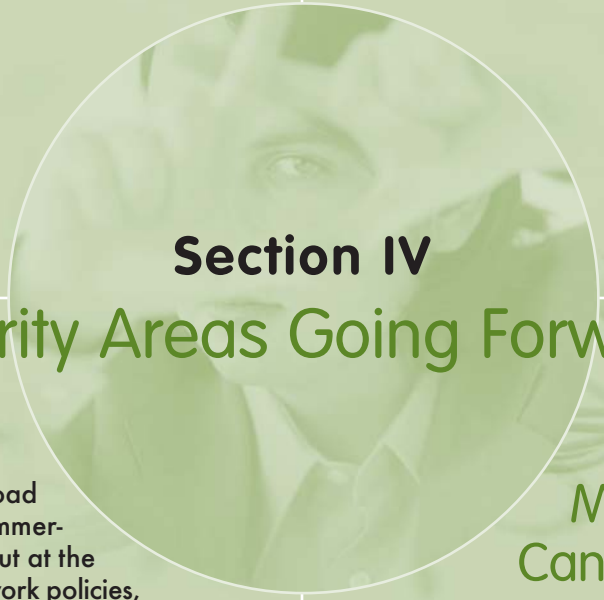
We believe that the steps we are recommending, reinforced by the measures discussed in the next section, will help improve the productivity vital to the quality of life of Canadians. They will help to reduce the standard of living divide between Canadians and Americans, estimated at US$8200 (GDP per capita at purchasing power parity).

Finland

The rapid growth of Finland's high-technology economy is often seen as a testament to long-term strategic planning, systematic investment and the ability to adopt innovative policies more quickly than other nations. In the 1970s, Finland's political leaders, research community and labour unions engaged in planning to focus R&D funding in electronics, biotechnology and material technology. Sustained government support paid off, as electronic-based exports grew from 4 percent of Finland's economy in 1980 to 33 percent of all its exports in 2003.[32] Today, Finland's private and public sectors invest 3.5 percent of Finland's GDP into R&D programs (the second-highest level in the world), and the proportion of the country's population working as research scientists is the highest in the world.[33]

32. Organisation for Economic Co-operation and Development, *Innovation Policy and Performance: A Cross-Country Comparison* (Paris: Organisation for Economic Co-operation and Development, June 2005).

33. Organisation for Economic Co-operation and Development, *Main Science and Technology Indicators: 2005/1 edition* (Paris: Organisation for Economic Co-operation and Development, 2005).



Section IV
Priority Areas Going Forward

This report has presented a road map for action to increase commercialization in Canada. As set out at the beginning of this report, framework policies, competition, taxation, intellectual property and regulation are all instruments that can have a significant impact on demand for commercialization, and further work in these areas is essential. In reviewing these programs, it is critical that Canada address domestic issues with a clear eye on global opportunities – and global competition.

Improvements to Canada's Regulatory System

The External Advisory Committee on Smart Regulation reported in September 2004 on how the federal government could redesign its regulatory system for the 21st century. This work on regulatory reform should help in identifying priorities for action on possible barriers to Canadian commercialization across all sectors of the economy. The CPB should review those recommendations and other regulatory issues that could influence achievement of Canada's commercialization objectives. Possible questions could include the following:

- What approaches to regulation work to maximize incentives to innovate?
- How can Canada's regulatory systems be better aligned with those of its major trading partners in order to open domestic and export doors for Canadian firms?
- Do Canada's financial sector regulatory approaches influence commercialization?

Modernization of Canada's Intellectual Property Laws

Many high-growth sectors rely heavily on intellectual property rights to secure financing and develop their products. This raises questions about the extent to which the *Patent Act* remains supportive of innovation and investment, especially in comparison with intellectual property legislation in other countries. While the federal government has minimal influence over intellectual property regimes in universities, these regimes are also seen as important in encouraging or discouraging commercialization-related research.

There exists a strong body of work on the role of intellectual property regimes on commercialization. In reviewing this field, possible questions could include the following:

- How can Canadian intellectual property protection ensure that firms reap the full benefit of their innovations?
- How can Canada get the most impact from the commercial potential of publicly financed research?
- With new technologies, such as biotechnology, posing challenges for Canada's existing patenting system, is Canada's intellectual property regime keeping pace with advances in technology?
- What steps will ensure competitive international protection for Canadian intellectual property?
- What approach to intellectual property protection for publicly funded research would ensure effective and efficient commercialization?

Improvements to Canada's Tax Regime

A culture of innovation must be supported by an internationally competitive taxation regime. We recognize the steps that the federal and provincial/territorial governments have taken to reduce corporate and personal income taxes. But, even with these reductions, we agree with the C.D. Howe Institute's recent statement that "Canada has the second-highest effective tax rate on capital (taking corporate income and other capital-related taxes into account) out of 36 developed and leading developing competitors."[34]

We also recognize the debate over the effectiveness and possible changes to the scientific research and experimental development (SR&ED) tax credit program.

Possible questions to consider regarding Canada's tax regime could include the following:

- What specific tax measures, such as changes to the SR&ED tax credit, or additional tax credits, would encourage greater investments in commercialization?
- What tax measures would expand access to angel and venture capital investment or stimulate greater protection of companies' intellectual property?
- What tax measures would increase the market research performed by firms?
- Would changes to the capital cost allowance for advanced machinery and equipment have a material impact on Canadian commercialization?
- What are the respective strengths and weaknesses of specific tax approaches in achieving policy goals, compared with using direct program spending?

Increasing Competitive Intensity within the Canadian Marketplace

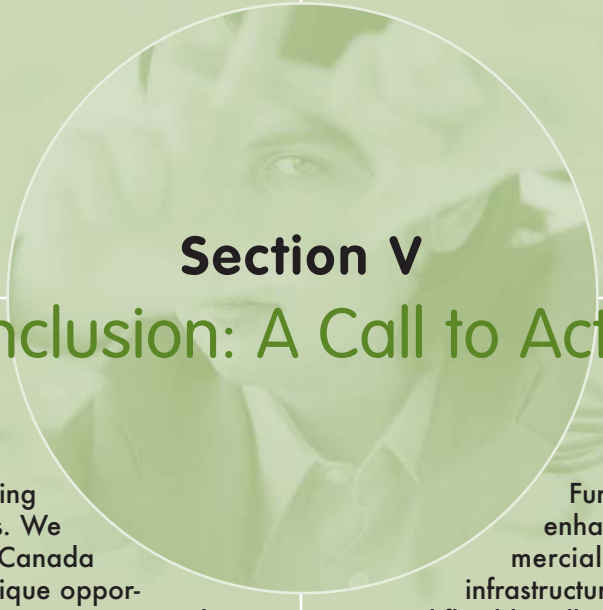
The panel strongly believes that competition is an important driver of commercialization. A competitive marketplace with capable rivals and sophisticated customers provides incentives for innovation. It encourages the kind of business discipline that leads to stronger Canadian companies that are ready to face international competition. While we have addressed some specific elements of competition in our other business framework comments, we believe the CPB should look at issues such as action under the Agreement on Internal Trade in order to reduce barriers to business activity among provinces/territories, and at measures to improve competition in areas exclusively under federal jurisdiction. Possible questions could include the following:

- What demonstrable effects does the current state of competition in Canada have on innovation and commercialization?
- What steps to improve the competitive environment for business, including steps that may require action by the provinces/territories, would generate the most results through commercialization?

Other Topics

During the course of its work, the panel has identified a number of other issues that also merit attention. These are described in Appendix H — Additional Issues for Longer-Term Consideration.

34. Jack M. Mintz, et al., "The 2005 Tax Competitiveness Report: Unleashing the Canadian Tiger," *C.D. Howe Institute Commentary*, No. 216, September 2005.



Section V
Conclusion: A Call to Action

We began this report by stating that Canada is at a crossroads. We conclude it by stating that Canada must take advantage of the unique opportunity presented by its current economic strength and invest in our ability to transform knowledge into market successes.

Canada needs an approach to policy in support of commercialization that is private-sector-focused and market-driven. This is what will deliver the best results for business while meeting the public interest demands of accountability and transparency. It will produce a more efficient, more integrated system – one that can meet immediate needs, while providing a clear road map for decision making and implementation in the future.

This means changing how we think and act, becoming global leaders and striving for continual improvement.

Canada must become more entrepreneurial. It must accelerate the ability of its innovative and creative thinkers to succeed and be rewarded. It must build on its competitive advantages. And it must do so by focusing on people and excellence.

Further, Canada must refine and enhance how it supports its commercialization and innovation infrastructure. Making it more adaptable and flexible will allow the private sector, governments, academic institutions and other groups to be better able to react to changing conditions, moving aggressively and seizing new opportunities.

It is in Canada's focus and execution that it will differentiate itself from its competitors around the globe.

Finally, Canada must nurture true networks among businesses, government and academia, as well as between the people and institutions that provide the money and expertise that accelerate commercialization: venture capital and institutional investors, pension funds, and angel investors in Canada. It must also nurture networks with the international marketplace in all its dimensions.

All of this will lead to an environment in which highly qualified personnel see and create opportunity and in which demand for innovation is increased. The result will be increased productivity.

To achieve all this, government, business and the education and research communities must work together as never before, united in a common cause to define Canada as an innovative country with products, services and processes that can compete and win in global markets.