TURNING RESEARCH INTO COMMERCE

Private Sector Advisory Board Report on Activities and Impacts of the Centres of Excellence for Commercialization and Research

November 2011

Government of Canada
Networks of Centres of Excellence

Gouvernement du Canada
Réseaux de centres d'excellence

Canada

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FOREWORD FROM THE CHAIR

I am pleased to present the Private Sector Advisory Board's report on the progress to date of the Centres of Excellence for Research and Commercialization (CECR) program.

Launched by the Government of Canada in 2007, this bold and innovative experiment has rapidly evolved into one of the country's most dynamic commercialization engines. In its first three years, the program has leveraged the financial, scientific and business resources of both the private and public sectors to deliver tangible results:

- 55 new companies
- 1186 new jobs created by the organizations served by the CECRs
- $138 million in partner contributions
- $103.7 million in follow-on investments in the companies served by the CECRs
- $206 million in foreign investment in the companies served by the CECRs

The Private Sector Advisory Board (PSAB) was established by the Networks of Centres of Excellence Secretariat at the request of the federal government in 2007 to provide expert advice and recommendations concerning the CECR program as well as the Business-Led Networks of Centres of Excellence (BL-NCE) program.

As the first round CECRs have been operating for at least three years, the PSAB decided to focus its discussion and recommendations on that program. The Board has also included some preliminary observations on the progress of the four BL-NCEs, and is encouraged by the outcomes to date. (See Appendix C for details on the BL-NCEs.)

In reviewing the CECR program, the PSAB was impressed with the breadth of partnerships, commercialization models and best practices that are helping academia and companies transform this country's most promising research into economic prosperity, improved health outcomes, safer communities and a cleaner environment. These new business opportunities are creating high-paying jobs and generating revenue for homegrown companies selling homegrown products and services.

I would like to thank the CECRs for taking the time to meet with the PSAB over the past year in Vancouver and Toronto, as well as the NCE Secretariat for its ongoing support.

My gratitude and respect also goes out to my fellow Board members who have volunteered hundreds of hours reviewing applications and attending meetings. Your rigorous due diligence – grounded in years of experience in bringing technology to market – have brought the business realities of commercialization to the forefront of these strategically important programs.

Honourable Perrin Beatty

Chair, Private Sector Advisory Board

GLOSSARY OF ACRONYMS

BL-NCE	Business-Led Networks of Centres of Excellence
CECR	Centres of Excellence for Commercialization and Research
CIHR	Canadian Institutes of Health Research
IP	Intellectual Property
LOI	Letters of Intent
NCE	Networks of Centres of Excellence
NSERC	Natural Sciences and Engineering Research Council of Canada
PSAB	Private Sector Advisory Board
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
S&T	Science and Technology
SME	Small- and medium-sized enterprise
SSHRC	Social Sciences & Humanities Research Council

Overview of the Private Sector Advisory Board

The Private Sector Advisory Board (PSAB) is a body of trusted, seasoned, strategic industry advisors comprised of respected Canadian industry leaders. The PSAB was established by the Networks of Centres of Excellence secretariat at the request of the Government of Canada in 2007. The PSAB provides the NCE Steering Committee with expert advice and recommendations during the Centres of Excellence for Commercialization and Research (CECR) and Business-Led Networks of Centres of Excellence (BL-NCE) competition processes. PSAB evaluates proposals based on their ability to create a strategic, long-term economic advantage for Canada.

The mandate of the Board is to:

- Provide advice to the NCE Steering Committee, as appropriate, on the implementation, delivery, and performance measures of the BL-NCE and CECR programs;
- Make recommendations to the NCE Steering Committee on which letters of intent (LOIs) to retain for consideration, followed by funding recommendations for the invited full proposals for the CECR and BL-NCE programs;
- Review the progress and impact of funding of these programs and provide additional guidance and advice to the NCE Steering Committee; and
- Provide advice to the NCE Steering Committee on other industry-related initiatives, as required.

PSAB MEMBERS:

(Chair) The Honourable Perrin Beatty
President and Chief Executive Officer
Canadian Chamber of Commerce

(Vice-Chair) Nancy Hughes Anthony
(Former) President and
Chief Executive Officer
Canadian Bankers Association

Sue Abu-Hakima
Co-founder and President/CEO
Amika Mobile Corporation

Cédric Bisson
Venture Partner
Teralys Capital Inc.

Alan Burgess
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BelAir Networks & Tundra
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Paul Dottori
Vice-President, Energy,
Environment and Technology
Tembec Enterprises, Inc.

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Dawson College

Raymond Leduc
Director, Bromont Manufacturing
IBM Canada Ltd.

Donald Lush
President
Environmental Bio-detection
Products Inc.

Kevin O'Brien Fehr
Pharmacologist
(Formerly with GlaxoSmithKline)

David Ross
President
Langara College

Keith Stoodley
Senior Vice-President of Marketing
Provincial Aerospace Ltd.
St. John's International Airport

EXECUTIVE SUMMARY

WHAT IS A CENTRE OF EXCELLENCE FOR COMMERCIALIZATION AND RESEARCH?

A CECR is a not-for-profit corporation created by a university, college, not-for-profit research organization, firm or other interested non-government party that matches clusters of research expertise with the business community, and shares knowledge, expertise and resources, to bring new technologies to market faster. The goal is to stimulate new commercialization activities that would likely have never taken place without the CECR program.

CREATING VALUE FROM UNIVERSITY RESEARCH

Canada, like other Organisation for Economic Co-operation and Development (OECD) countries, has spent billions of dollars in public funds to strengthen the research capacity of its universities, and to train the next generation of highly skilled professionals. That investment is paying off. Today, Canada is home to many of the world's top scientists and internationally recognized research programs. Where this country and many others have lagged, however, is in translating that research into products, services and solutions.

The federal government's 2011 budget emphasized the importance of innovation to Canada's competitiveness and committed to continue to make targeted investments to promote and encourage R&D in the private sector and post-secondary institutions, and to support greater collaboration between these sectors.

At the same time, the recent recession and ongoing austerity measures mean governments must act responsibly to ensure that commercialization efforts are well directed and are generating sustainable economic benefits. The June 3, 2011 Speech from the Throne stated that Canada "will look for ways to support innovation while ensuring that federal investment in research and development is effective and maximizes results for Canadians."

TACKLING THE INNOVATION GAP

There is no shortage in Canada of innovative ideas and excellent research. Scan any newspaper and you will find articles on a breakthrough discovery that "may one day" increase an industry's productivity, reduce wait times for medical tests, improve environmental monitoring or increase energy efficiency. Such discovery-based research is essential and should continue to be supported. At the same time, it is important to understand that most of this research it is still a long way from becoming a validated technology that people need, want and will buy. Therein lays the gap.

Many countries have learned the hard lessons of spinning off technology too soon. For a large company that licenses the technology, it may decide to cancel development of a new product or service if the time-to-market becomes too long. For start-ups and small- and medium-sized enterprises (SMEs), the risks are even greater: burning through their limited amount of working capital before a product or service is generating revenue. The challenge is particularly acute in the health sector, where moving from a small molecule or protein in a university lab to a regulatory-approved drug can take over a decade and involve hundreds of millions of dollars.

These challenges are exacerbated by the virtual disappearance of venture capital in Canada. Impatient funders are demanding a faster return on investment, which is resulting in the majority of venture capital funding favouring later stage ventures, leaving angels and governments to fill a critical financing gap. Too many early-stage companies that license university technology are unable to raise the capital necessary to carry out the development, testing and validation needed before a product or service can be brought to market. As a consequence, many of these companies either fail or are sold to foreign buyers. Of the 137 venture-backed Canadian start-ups whose ownership changed hands between 2006 and 2010, nearly 60% were sold to non-Canadian companies, including some 200 patents.[1]

HOW CECRS ACCELERATE COMMERCIALIZATION & ECONOMIC ACTIVITY

- Facilitate university-industry collaborations
- Provide access to centres of research excellence (people and equipment)
- Match entrepreneurs with potential partners, investors and customers
- Partner with academic researchers with a commercialization track record
- Mentor new start-ups
- Build regional clusters of technological excellence
- Advance research to a technology-readiness level
- Add value to technology to attract venture capital
- Provide entrepreneurial training and mentorship
- Educate investors
- Provide access to commercialization services (e.g. intellectual property management, business plan development, market assessments, partnership development)
- Accelerate timelines for funding projects

[1] Canadian International Council, Rights and Rents: Why Canada must harness its intellectual property resources, October, 2011.

The success of small companies also has a direct impact on many larger corporations, particularly those in mature sectors. Increasingly, the capacity of larger firms to grow and compete internationally depends on incremental innovations that diversify their product offerings, open new markets, reduce costs or increase their productivity. In many cases, the ideas they are looking for can be found within small companies and universities. The Centres of Excellence for Commercialization and Research program creates opportunities and mechanisms for these various groups to come together to transform these ideas into solutions.

As a result, the whole research enterprise is shifting away from a technology push model—where the focus is on the research institution—to commercialization models that directly respond to the needs of industry and society. CECRs have worked closely with industry to develop commercialization models, including new business models for start-ups that are addressing these very real business challenges.

The results from the program so far have been impressive. In just three years, the Canadian government's commitment of $287 million has already leveraged more than $138 million from provincial governments, the private sector, universities, municipalities and others, with partners on track to match the federal government's investment by 2014. In light of the fiscal pressures facing both the public and private sectors, these investments provide a very tangible vote of confidence in a program that has become a key plank in Canada's Science and Technology Strategy.

This collaborative approach to commercialization is having an impact. As a result of the CECR program, Canada has built a nationwide network of commercialization factories that are producing innovative solutions to many of Canada's—and the world's—most pressing needs.

WHY THE CECR PROGRAM WORKS

One of the overriding goals of the CECR program is to strengthen the Canadian economy through the growth of early-stage companies and the expansion of existing companies. In the PSAB's view, the results to date have been positive.

Several centres have adopted partnership approaches, business models and best practices that are steering early-stage companies toward success, and resulting in new collaborations

with larger firms with staying power. These models and practices are building the foundations for economic growth in several industry sectors. Below are some trends the PSAB has identified, as well as recommendations for strengthening the program in future competitions.

Strong partnerships: The PSAB found that industry partners and other receptors are involved in varying degrees with all 22 Centres—on boards of directors, advisory committees and research review panels. They provide advice on the Centre's strategic direction, which projects go forward, partnership opportunities, new company creation, seed funds, royalty structures, contract research agreements and other commercialization activities. Larger companies may contribute money for research or as seed funding to help start-ups grow to the next level. CECRs act as facilitators, administrators and funding partners to create and nurture these partnerships.

RECOMMENDATION: That CECRs be encouraged to have substantive and early involvement from all participants in the value chain (e.g. large companies, SMEs, suppliers, distributors, customers, users and investors) at the advisory, research, technology demonstration and investment stages.

RECOMMENDATION: That CECRs be encouraged, where appropriate, to collaborate and leverage each other's areas of expertise to accelerate commercialization.

Financial support for small firms: One of the biggest challenges for early stage technology companies is a lack of access to seed funds and venture capital to sustain and grow their operations. Several CECRs have pooled public funds with private funds to produce a comprehensive suite of funding programs for projects and companies at different stages of development. Funding applications are subject to rigorous review, in most cases by a panel that includes representatives from the CECR, industry and other receptor communities who may receive first rights to any technology developed.

Flexible business models: There is no one size fits all model when it comes to commercialization, nor should there be. Different industry sectors have different technology development cycles, business risks and market considerations that require a flexible approach specific to each sector's needs. Developing a new smart phone application, for example, may take just a few weeks. Bringing a new green chemical to

market may take three to five years, while clinical trials and regulatory approvals can push the commercialization of a new drug to anywhere from 10 to 15 years.

Most innovation will build on existing products, supply chains and customers. More radical, and albeit riskier, innovation will result in the emergence of new business sectors and markets. Many CECRs have business models that address both, creating a pipeline that delivers short-term successes as well as longer term prospects for "home runs" with a higher pay-off.

The CECR program was designed to allow for that flexibility. Working closely with industry, CECRs have developed innovative models for collaboration and commercialization that respond to the specific needs of different industry sectors and companies of varying sizes. These models also create flexible opportunities for the SMEs, large companies and other external organizations to engage with universities.

RECOMMENDATION: That the CECR program remain flexible with the types of business models adopted by individual Centres, recognizing there is no one-size-fits-all model for commercialization.

EXAMPLES OF EMERGING BEST PRACTICES AMONG CECRS

- Micro-loans
- Flexible repayment options
- Investment funds that are co-managed and co-funded with industry
- Projects led by a SME or other proponent
- Projects that link large companies with SMEs
- Funding applications vetted by expert review panels that include industry/receptor participation
- Standardized intellectual property policies

Best practices: Several Centres have adopted best practices and approaches that reduce the amount of time it takes to ramp-up operations, advance research to a technology- and investment-ready stage, build sustainable partnerships and grow SMEs. One example is standardized intellectual property policies that make it easier for industry to license

technologies. Another common practice is to have project applications vetted by expert review panels that include participation from industry or other receptors. This helps to ensure that research remains focused on the needs of end users and on the commercial realities involved in bringing a new technology to market.

RECOMMENDATION: That CECRs be encouraged, from their inception, to share best practices between Centres.

HOW THE CECR PROGRAM CAN WORK BETTER

The CECR program is one of the largest commercialization investments in Canada's Science and Technology Strategy. It represents a bold and innovative approach to accelerate the translation of world-class academic research into a stronger economy, sustainable environment, more jobs and improved health outcomes.

The program has many strengths, but as with any new initiative, there is always room for improvement. The PSAB makes the following recommendations for maximizing the program's impacts, strengthening its governance and operations and improving future competitions.

Maximizing program impacts:

RECOMMENDATION: That the NCE Steering Committee and federal government review the mandate of the CECR program, and its funding levels, with a view to maximizing its impact within Canada's larger innovation system.

Governance and operations:

RECOMMENDATION: That Centres regularly update their business plans, including pro-forma financial projections and technology-readiness level assessments of their portfolios.

RECOMMENDATION: That new applicants and existing Centres establish baseline data and relevant performance indicators for measuring impacts and outcomes that are a direct result of the CECR program. This should include traditional quantitative metrics (e.g. patents, licensing and spin-offs) as well as qualitative societal impact metrics (e.g. reduced health care costs, environmental benefits and enhanced public policy).

RECOMMENDATION: That financial sustainability continue to be a long-term goal of Centres, while recognizing that the first priority should be on the economic sustainability of the mix of business enterprises they support.

Future competitions

RECOMMENDATION: That applicants, in partnership with stakeholders, submit more highly developed business plans with clearly defined commercialization goals, including detailed work plan, resource costing and approach to intellectual property. Other criteria may include:

- Ability to leverage funding from provincial and regional partners
- Demonstrating expected value for the Canadian economy and how Centre will deliver that value
- Creating a critical mass of technology expertise in a region
- A stronger focus on short-term R&D cycles and projects that are at a later stage of technology readiness
- Capacity to ramp up operations quickly
- Commercialization experience
- Expertise in intellectual property management

RECOMMENDATION: That existing Centres that can provide evidence of economic impact be permitted to apply for an extension or renewal. Renewal criteria should include: a business plan with financial projections and performance metrics showing the incremental value generated by the CECR investments, and how this builds on the investments of other funders.

RECOMMENDATION: To improve quality of applications and accelerate ramp up of operations, NCE Secretariat should provide applicants with additional guidance and assistance (e.g. sharing best practices from existing Centres and lessons learned from PSAB reviews.)

RECOMMENDATION: As CECRs are expected to demonstrate broad benefits to Canada and economic impacts, their business models should support activities that will both further these societal benefits in addition to specific commercial impacts/benefits for partners and the sector served by the CECR. CECRs should ensure that they have clear metrics demonstrating progress toward each of their expected societal and economic impacts and the linkages that they have developed between these.

CONCLUSION

The CECR program is doing many things right. The PSAB is impressed with the diversity and the creativity demonstrated by Centres in overcoming many of the practical challenges facing Canada's innovation system. The program has done a remarkable job in leveraging the expertise and resources of the public and private sectors, and engaging partners with proven experience in translating promising research into tangible benefits for Canada.

The PSAB is encouraged by the results to date, and optimistic from the evidence it has seen that the benefits from the CECR program will continue to accrue for many years to come.

BACKGROUND

As part of its Science and Technology (S&T) Strategy, the Government of Canada has invested in two innovative, industry-focused programs that are translating world-class research into a stronger economy, more jobs and improved health outcomes.

The $287-million CECR program matches clusters of research expertise with the business community, and shares knowledge, expertise and resources, to bring new technologies to market faster. Led by a not-for-profit corporation created by a university, college, not-for-profit research organization, company or other non-government party, Centres stimulate new commercialization activities that would likely have never taken place without the CECR program.

The federal government is also investing $46 million in Business-Led Networks of Centres of Excellence—not-for-profit corporations led by industrial consortia to solve specific challenges. These large-scale collaborative networks help to increase private sector investments in Canadian research, support industry training of young researchers, and accelerate the timeline involved in translating ideas from the laboratory into products and services in the marketplace.

To date, the NCE Steering Committee and the PSAB have approved 22 CECRs and four BL-NCEs within the four areas identified in the federal S&T Strategy: Environment; Natural Resources and Energy; Health and Life Sciences; and Information and Communications Technologies.

22 CECRs have been approved to date: 11 in 2008, six in 2009 and five in 2010. Each project was screened against rigorous scientific and business criteria for clear development path and marketability.

This report is primarily focused on the CECR program, which is now four years into a five-year mandate. Many CECRs have been operating long enough for the PSAB to conclude, with confidence, that the program is filling a critical niche in Canada's innovation agenda.

The PSAB also conducted a preliminary review of the BL-NCE program to date. The four Networks are nearing the mid-point of their four-year funding mandate and the results so far, while still somewhat early, are encouraging. The program has developed strong partnerships with industry, including SMEs, and has leveraged the federal government's investment nearly two-fold through contributions from partners. The PSAB's observations on the BL-NCE program can be found in Appendix C.

Like all federal grants and contribution programs, the CECR program is subject to formal program evaluations conducted by a third party to assess the extent to which the program is meeting its objectives and delivering value for money. The PSAB report will complement the formal evaluation and will provide analytical support to the NCE Secretariat and the government when considering possible changes to the terms and conditions of the CECR program.

The PSAB report will also complement the Review of Federal Support to R&D, which will recommend to government how it can maximize the impact of the $7 billion dollars it spends annually in support of business-led and commercially oriented R&D. The panel is expected to release its report by October 2011

HOW A CECR DIFFERS FROM AN NCE

CECRs build on the success of the original NCE program, which funds large-scale, university-led collaborative research networks involving academia, industry, government and not-for-profit organizations. In comparison, CECRs support the commercialization of such research by matching clusters of academic research expertise with the needs of business, health practitioners and other end users. It is an innovative model for collaboration in which public and private sector partners share knowledge, expertise and resources to bridge the technology and funding gaps that exist between a promising discovery and a commercial technology.

The CECR program was launched as a response by the federal government to help fill this gap in Canada's innovation system. At the front end of this system are the federal granting councils, the Canadian Foundation for Innovation, the Canada Research Chairs and related programs supporting academic research whose primary goal is to create knowledge and understanding, and to train the next-generation of highly qualified workers. At the other end of the innovation continuum are programs such as the Industrial Research Assistance Program and the Business Development Bank of Canada which focus on technologies that are much closer to market.

CECRs work in the middle – as research centres and innovation intermediaries[2] – to mine commercially promising research and then to bring together the human, physical and financial resources needed to nurture research to a technology-readiness level, and start-up companies to an investment-readiness stage. CECRs facilitate new collaborations between research institutions at a regional, provincial and national level and then link

[2] "Innovation intermediaries are organizations or groups within organizations that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing national, regional, or sectoral innovative capacity (Dalziel 2010; Howells 2006). Such organizations include industry associations, economic development agencies, chambers of commerce, science, technology or business parks, business incubators, research consortia and networks, research institutes, and university technology transfer offices."; Measuring the Impact of Innovation, Margaret Dalziel, University of Ottawa, Telfer School of Management, 2010.

those institutions to private sector partners, including suppliers, distributors, customers, users and investors, as well as other end users such as hospitals.

Many of the first round CECRs have been operational now for three years, providing the PSAB with a long enough window to identify models, practices and impacts that show the greatest promise for long-term economic success. While it is still early days for many Centres, the PSAB finds that the program is generating value by building the commercialization infrastructure and technology opportunities that are:

- strengthening and diversifying regional economies;
- increasing the international competitiveness of Canadian companies;
- transforming research into new products and services with the help of entrepreneurs;
- creating internationally recognized centres of commercialization and research; and
- increasing private sector investments in research in Canada.

WHY THE CECR PROGRAM WORKS

CECRS ARE GROUNDED IN PARTNERSHIPS

Commercialization does not happen in isolation. One of the strengths of the CECR program has been its ability to act as a magnet for collaboration between universities, the private sector, all levels of government and other stakeholders. Centres with meaningful partner participation are better equipped to decide which technologies have the greatest prospect of success, and what resources are needed to move their development forward.

Partners provide much more than money. Universities, research hospitals and other public research institutes—about 40 in all—have done what few of their counterparts internationally have been able to achieve: a new level of partnership that sees academia collaborating not only in areas of basic research, but at the intersection with industry to bring solutions to Canadians. Today, more than 290 partners—the Canadian government, provincial governments, municipalities, companies and universities—are sharing in this investment.

The private sector also plays a pivotal role in the success of these Centres. Entrepreneurs share business advice, research expertise and resources to develop technologies that can be put into practice. The PSAB found that industry partners and other receptors are involved in varying degrees with all 22 Centres. They participate on boards of directors, advisory committees and research review panels. They provide advice on the Centres' strategic direction, which projects go forward, partnership opportunities, new company creation, seed funds, royalty structures, contract research agreements and other commercialization activities.

Entrepreneurs and industry scientists and engineers also act as mentors to smaller companies, and provide technical support and access to facilities to accelerate development, testing and validation of new technologies. Larger companies may contribute money for research or as seed funding to help start-ups grow to the next level. CECRs act as facilitators, administrators and funding partners to create and nurture these partnerships.

The Wavefront CECR in Vancouver has partnered with Sierra Wireless, Ericsson, Nokia, Orange and others to offer SMEs access to resources normally beyond their research: testing and validation services, business and technical training, advisory services and global market linkages. For example, its Machine to Machine (M2M) Development Lab/Market Development Program enables universities, start-ups and solution providers to rapidly prototype and commercialize new ideas.

In addition to time and resources, the private sector is also a major financial contributor to CECRs. It is the largest external contributor. Since the program's launch, the private sector has contributed in cash and in kind contributions of more than $45 million and its contributions have been rising each year.

Increasingly, these partnerships are extending between CECRs as a way of leveraging each other's areas of expertise to accelerate commercialization. For example, the Vancouver-based Centre for Drug Research and Development (CDRD) expanded its national commercialization capabilities by partnering with MaRS Innovation, which represents 14 health research institutions in the Toronto region. MaRS Innovation (MI) has also teamed with GreenCentre Canada (GCC) to co-identify and co-develop green chemistry related intellectual property (IP) generated by the MaRS Innovation members. Likewise, GCC has partnered with the Bioindustrial Innovation Centre in southern Ontario to push green, sustainable technologies to market.

GreenCentre Canada has joined forces with the Bioindustrial Innovation Centre to create a development pipeline that takes projects from the lab bench to pilot scale testing. Under the agreement, GCC will further develop green innovations created at BIC's Modeland Road Research Park in Sarnia. The projects will then move back to BIC's pilot facility where they can be ramped up to a demonstration scale before being transferred to industry.

CECRS OFFER FLEXIBLE AND SUSTAINABLE BUSINESS MODELS

There is no one size fits all model when it comes to commercialization, nor should there be. Different industry sectors have different technology development cycles, business risks and market considerations that require a flexible approach specific to each sector's needs. Developing a new smart phone application, for example, may take just a few weeks. Bringing a new green chemical to market may take three to five years, while clinical trials and regulatory approvals can push the commercialization of a new drug to anywhere from 10 to 15 years.

The CECR program was designed to allow for that flexibility. Working closely with industry, CECRs have developed new models for collaboration and commercialization that respond to the specific needs of different industry sectors, and create flexible opportunities for the SMEs, large companies and other external organizations to engage with universities. Centres often fall under more than one model.

1. INVESTMENT MODELS

One of the biggest challenges for SMEs is a lack of access to seed funds and venture capital to sustain and grow their operations. Centres are working on two fronts to address this issue:

a) Direct access to capital: Several Centres have pooled public funds with private funds to produce a comprehensive suite of shared risk funding programs to help advance technology and grow early-stage companies. These funds are not designed to displace private capital, but rather to mitigate risk in order to accelerate a technology's development to the point where it can attract private investment.

Funding applications are subject to rigorous review, in most cases by a panel that includes representatives from the CECR, industry and other receptor communities who may receive first rights to any technology developed. Small firms and spin-offs compete for funds to support technology development projects, often in partnership with a larger company and/or academia. The investments may be in the form of a grant, or in return for equity, or licensing/royalty revenues. Examples include:

- **Micro-loans:** CECRs may partner with an angel investor and/or industry receptor to provide small companies and start-ups with smaller investments, averaging $50,000 or less, for technology/product development, commercial demonstrations and initial operations. Follow-on funding may be available.
- **Innovation Funds:** CECRs, in partnership with larger companies and other public funders, provide money for technology development, and access to expertise, facilities and equipment. Under this model, industry investors often have first rights to technology that is developed.
- **Investment Funds:** These investments tend to be larger that those from innovation funds, and almost always require participation of a SME. The investment may be converted into equity, royalties or in the case of one CECR, carbon credits.

Emerging Trend: Microfunding

A June 2011 report on Canadian innovation by the Institute for Competitiveness & Prosperity says new approaches to financing are needed and points to positive emerging trends with microfunding—pre-seed financing that acts as a bridge between bootstrapping and angel and venture capital funding. [3] For example, the average micro-loan awarded by the **Centre for Commercialization of Research** is $50,000.

[3] Institute for Competitiveness & Prosperity, Canada's Innovation Imperative, June, 2010. b) Contract research

b) Contract research

Several CECRs have developed fee-for-service models in which private sector partners or government users of technology contract with a university, research hospital or commercialization centre to address specific technology challenges. This practice reflects a growing trend in Canada by both governments and the private sector to extract greater value from academic collaborations ("technology pull") than traditional licensing and royalty models ("technology push").

Two clear models within the CECR program have emerged:

- Companies or other partners contract a Centre for a scientific expertise. This model often results in the receptor having first rights to the technology, and a say in how the research is directed. This also provides the Centre with a source of revenue.
- Through a CECR, large companies contract a SME to undertake the R&D. In addition to benefiting the large company, the model provides SMEs with a revenue stream and a potential new customer.

Prostate Centre's Translational Research Initiative for Accelerated Discovery and Development: PC-TRIADD works with industry partners to leverage the scientific excellence, platform technologies and specialized facilities of the Vancouver Prostate Centre. To date, it has negotiated eight contract research agreements with pharmaceutical and biotechnology companies, including Pfizer ($3 million per year), Takeda ($1 million per year) and AstraZeneca ($500,000 per year).

The Impact Group concludes that contract research has a far greater economic impact than traditional technology transfer activities of licensing and royalties. [4]

2. ACCELERATION MODELS

Providing investment capital on its own does not guarantee that a technology will be successfully commercialized or that the company selling it will be profitable. Some CECRs provide additional support by pre-screening technologies, facilitating access to scientific expertise or testing facilities, adding value as well as providing assistance with regulatory approvals, entrepreneurial training and IP management. Such support significantly increases the chances of a company starting on a sound technology and business footing.

[4] The Impact Group, Knowledge Transfer Through Research Contracting, June, 2010.

Within the CECR program, acceleration models are often driven through regional or provincial centres, research consortia, innovation centres or business parks which aim to bolster job creation, company creation and competitiveness through more productive university-industry linkages.

Without access to CECR funding, these organizations would face a more difficult task in providing the services needed to accelerate commercialization.

Traditional "incubation" centres, which tend to offer physical space and shared business services, are morphing into "acceleration" centres that offer a one-stop shop for entrepreneurial support for early-stage companies. For example, Conquer Mobile, a leading Vancouver-based developer of mobile search applications, saw its revenues grow 10 times with the release of more than 20 apps during its 21 months at **Wavefront**'s 14,000 sq ft acceleration centre. Conquer used Wavefront's business advisory services to help with go-to-market strategies and managing growth as well as its state-of-the-art boardroom for client meetings. The 400-plus handsets in Wavefront's library allowed Conquer Mobile to quickly and cost-effectively develop cross-platform solutions for iPhone, BlackBerry, Android and more. Wavefront also connected them with a seasoned wireless technology executive through its executive-in-residence program. Perhaps the largest benefit Conquer Mobile received was the casual connections with potential customers made possible in the unique Wavefront setting. It was through such a connection that Conquer Mobile was ultimately chosen to develop McDonald's Canada's restaurant locator iPhone app.

Other CECR acceleration centres include **MaRS Innovation** and the **Canadian Digital Media Centre**.

3. SECTOR STRENGTHENING MODELS

In addition to advancing a particular technology or supporting a start-up, some CECRs also focus on strengthening an industry sector. They build on existing regional expertise in a particular technology area or link regional clusters to create a critical mass of national capabilities. Others work with public and private sector partners to develop platform technologies and other broad solutions that can be used by multiple companies for mutual economic benefit. Other services include: networking, standards development and work with regulatory and policy bodies.

Each sector comes with its own technology challenges, product development timelines, regulatory requirements and markets. CECRs have responded with flexible approaches that meet the needs of each industry sector.

Université de Montreal's (U de M) Institute for Research in Immunology and Cancer (IRIC) as well as its affiliated Center of Excellence in Commercialisation and Research (**IRICoR**), and Bristol-Myers Squibb (BMS), a major multinational pharmaceutical company, are in the midst of a multi-year collaboration. U de M/IRIC's expertise in medicinal chemistry and target biology is being accessed by BMS whereby U de M/IRIC will optimize compounds of interest to the company. In addition to payments received for its target biology and medicinal chemistry work and expertise, U de M/IRIC and IRICoR will share milestone payments from BMS which are linked to the successful development of the compounds.

4. MARKET PULL MODELS

Technology is more likely to be adopted if there is a user that needs it and is willing to pay for it. This basic premise of "technology pull" is what drives successful commercialization, and it can be found throughout the commercialization models noted above. A company, industry, hospital or other organization may have a challenge that it can leverage university capacity to solve, or there may be a university-developed technology that can provide the institution with a new revenue stream.

Market pull models facilitate collaborative technology development, contract research agreements, mentorships and internships between academia and industry to ensure the research agenda meets the needs of the private sector.

Centre for Drug Research and Development: CDRD responds to the pharmaceutical industry's need to reduce risk by licensing drug candidates from a university or start-up at a later stage of development. By offering access to facilities, equipment, expertise, education and administration services, academics and companies can develop drugs from the discovery to the pre-clinical stage, and source additional capital and expertise to support further development. CDRD's not-for-profit arm, CDRD Ventures Inc., drives drug development and technology commercialization further by creating companies or licensing to an existing company.

5. TECHNOLOGY PUSH MODELS

Technology pull is mainly driven by external market forces, as opposed to technology push which is mainly driven by internal R&D activities. This more traditional approach to R&D and commercialization has had sporadic success in stimulating economic activity. Some CECRs are demonstrating that a push model can work when Centres are able to mine the most promising technologies from research institutions, and then add value to accelerate their path to technology- and investment-readiness.

Advanced Applied Physics Solutions Inc.: AAPS identifies and adds value to the most promising technologies under development at TRIUMF, Canada's national laboratory for nuclear and particle physics in Vancouver. It then spins off these technologies into new companies, or licenses them to established firms.

MEASURING SUCCESS

The dramatic increase in public research funding among developed countries over the past decade has been accompanied by a growing requirement for greater accountability and more accurate and meaningful metrics that demonstrate value for money.

Governments face two challenges. First, there is no single set of key performance indicators to assess research outcomes and impacts—and it is questionable if there should be as what is measured will vary depending on the type and size of the receptor and the sector. Secondly, a paradigm shift is occurring in how countries view and measure innovation outcomes. Traditional quantitative metrics, including patents and licensing, do not always capture the full impact of research and commercialization activities. Many organizations, including the OECD and the National Science Foundation, are calling for more qualitative metrics, which are often medium- and longer-term.

All Centres and Networks are required to provide the NCE Secretariat with performance indicators as part of their annual reporting requirements. Summaries of some of those metrics are provided in the following pages.

The NCE Secretariat is working to improve this process. Since 2008, the NCE has been a member of the Consortia Advancing Standards in Research Administration Information (CASRAI), which is helping researchers, their institutions and their funders collect and exchange data through the life cycle of research activity. Membership in CASRAI is growing and includes NSERC, SSHRC, the Canada Foundation for Innovation, the Ministry of Research and Innovation (Ontario), Fonds de la recherche santé (Quebec), and Alberta Innovates-Health Solutions. Several NCE grantees joined CASRAI through the NCE Associate Cluster.

Some CECRs have become very proactive in how they collect impact data. For example, the Ontario Centres of Excellence's Centre for the Commercialization of Research (CCR) and the Canadian Digital Media Network have both contracted a third party to provide independent impact assessments.

Commercialization impact of a CECR:

Quantitative Metrics	**Qualitative Metrics**
# of patent applications filed/issued	List of patent names
# of licences under negotiation	Other intellectual property
# of licences granted to industry	Workshops and conferences
# of new products/services brought to market	Names of new start-up companies
# of start-ups	List of projects funded
Leveraged funds raised	Regional growth
# and value of contract research agreements	

Impacts of organizations served by a CECR:

Quantitative	Qualitative
# of jobs created/maintained	Shared infrastructure/resources
Patent applications filed	Mitigating technology risk
Patents issued	New linkages between large firms and SMEs
Licenses under negotiation	New national and international linkages
Licences granted to industry	Increased productivity
Number of copyrights	Environmental benefits
Number of new products or services to market	Savings/improvements to health care and patient outcomes
% of increase in exports	Building management capacity
Amount of additional investments accessed	Improved standards and regulations
Amount of foreign investment received	New clinical trials initiated (medical)
Revenue generated	Networking opportunities

IMPACTS AND OUTCOMES

Moving from discovery to commercialization is a complex process involving participation from academia, the private sector and all levels of government. As such, measuring the incremental impact of CECR funding will always be a challenge, given that awards typically build on existing public-private partnerships and are led by entrepreneurial researchers.

Comparing outcomes and impacts of CECRs in different sectors is made more difficult by the range of business models described earlier. For example, the timelines for a path to market for health and life sciences innovation are significantly longer than those in sectors such as information and communications technology (ICT), and as such, an advancement in the technology readiness level for a product in one sector may be a comparable success to product sales in another sector.

Many Centres are overcoming these challenges by establishing baseline data and relevant performance indicators for measuring impact and outcomes. Some Centres have enlisted outside companies to conduct third party assessments on their progress to date.

The PSAB is encouraged by this progress and confident that the commercialization models and best practices adopted are building the foundations for economic growth in several industry sectors. Below are some trends the PSAB has identified, as well as examples of notable impacts to date from individual CECRs.

Increased industry investment in R&D

Increasing industry investment in R&D is a priority of the Government of Canada. The CECRs are creating incentives for companies to invest more in R&D and commercialization through a variety of mechanisms:

- Direct partnership support (in return for first rights on technologies)
- Contract research agreements with the CECR, a start-up or SME
- As co-investors in pre-seed and seed funds
- Fee-for service (e.g. access to testing, validation, specialized equipment and facilities)

Partner contributions

The CECR program has leveraged significant cash and in-kind contributions since its launch in November 2008, with the largest contributions coming from the provinces, academia and industry. Since the program's launch, the private sector has contributed more than $45 million in cash and in-kind contributions, and these contributions have been rising each year, from $4.2 million in 2008-09 to $5.8 million in 2009-10 and $35 million in 2010-11.

CECRs facilitate contract research agreements: Contract research agreements are a measurable source of industry engagement with Centres. For example, PC-TRIADD has negotiated eight contract research agreements with pharmaceutical and biotechnology companies, including Pfizer ($3 million per year), Takeda ($1 million per year) and AstraZeneca ($500,000 per year). Pfizer also contributed $3.4 million to the Pfizer-CDRD Innovation fund to accelerate commercialization of promising academic research.

Partner Contributions: FY 2008-09 to FY 2010-11

Source	Cash	In-Kind	Total
CECR	$255,685,135	$0	$255,685,135
University	$8,871,630	$12,075,341	$20,946,971
Industry	$31,858,243	$13,147,459	$45,005,702
Federal	$9,389,068	$726,710	$10,115,778
Provincial	$33,391,825	$2,248,533	$35,640,358
Other	$16,902,026	$9,476,952	$26,378,978
Partners Total	$100,412,792	$37,674,995	$138,087,788
Grand Total	$356,097,927	$37,674,995	$393,772,923

New start-ups

The CECR program has resulted in the creation of more than 50 start-up companies. In addition to providing funding support for technology development, some Centres also offer commercialization services such as mentoring, entrepreneurship training, executives-in-residence and linkages with potential partners, customers and investors.

MaRS Innovation launches seven companies: MI has helped launch seven companies so far, including VitalHub, an iPhone-based system that gives physicians secure, remote access to patient records and test results from a hospital's internal data network. The Mount Sinai Hospital spin-off has raised $1 million in financing to date and is expanding its customer base and hiring employees.

MI has also negotiated seven licensing agreements to date on behalf of its member institutions, including one between Sanofi-aventis and Sunnybrook Health Sciences Centre to commercialize a new compound to treat diabetic foot ulcers.

Knowledge Translation Activities: FY 2008-09 to FY 2010-11

	2008-09	2009-10	2010-11	Total
# of start-ups	21	17	17	55
# of patent applications filed	29	117	186	332
# of patents issued	11	31	65	107
# of licences under negotiation	6	23	72	101
Licences granted	0	2	32	34
# of copyrights	0	1	7	8
Interactions with industry	304	635	N/A	939
# of organizations served	N/A	N/A	230	230
International collaborations	45	80	N/A	125
Other knowledge translation activities	85	85	261	431

Job Creation

Growing companies is one of the primary goals of the CECR program. During the past year, companies served by the Centres reported adding 1186 new jobs. A large portion of those jobs (509) were associated with industry partners of the Ontario Centre of Excellence's Centre for Commercialization of Research (CCR).

Jobs Created by Companies Served by Centres: FY 2010-11

BIC	26
C3E	12
CCR-OCE	509
CDMN	24
CDRD	380
CEPMED	5
MI	22
PC-TRIADD	75
PREVENT	11
PROOF	49
Tecterra	16
Wavefront	57
Total	**1186**

REGEN Energy creating clean tech jobs: CCR connected Toronto-based REGEN Energy Inc. with a new CEO, Tim Angus, through its Embedded Executive program. Angus has a proven track record of leveraging private and public equity markets for growth stage companies. CCR also participated in the equity financing round, investing additional funds in REGEN and, through its participation, helped to attract other investors. The company recently closed a $5.5 million equity investment from clean tech investors, has increased sales 15 times over the previous fiscal year, has opened an office in California and expects to create 15-30 new jobs in Ontario over the next three years.

Licensing

CECRs have already licensed 34 technologies to the private sector. In most cases, the company will continue to work with the Centre and its SME and academic partners to develop, test and validate the technology.

Blood test moves closer to regulatory approval: Luminex Corp., a multinational corporation with operations in Toronto, is on track to seek regulatory approval in 2011 from Health Canada and the U.S. Food and Drug Administration for a simple blood test that eliminates the need for invasive and expensive biopsies. The Biomarkers in Transplantation initiative, primarily funded by the PROOF Centre of Excellence and Genome British Columbia, teamed with Luminex to further develop and clinically validate the biomarker tests. The tests will help reduce the need for expensive, invasive and fear-evoking post-surgery biopsies. They can also save the Canadian health care system tens of millions of dollars annually.

Export sales

Some Centres have begun collecting data on the export sales of companies they support. In 2010-11, 10 CECR partners reported an increase in exports, with international sales doubling for five companies, and rising over 50 percent for three others.

Ocean observing technology lands first international export: In 2010, OceanWorks International Inc. delivered the core infrastructure for a Tsunami Warning and Early Response system for Cyprus. OceanWorks, which has design and manufacturing operations in Burnaby, British Columbia and Houston, Texas, developed this node and junction box infrastructure for the VENUS and NEPTUNE Canada fibre optic cabled observatories in British Columbia. Commercialized with the assistance of Ocean Networks Canada Centre for Enterprise and Engagement, the system is being marketed globally to other ocean observatories, offshore petroleum production facilities and port security systems. The company has added several new jobs to its Burnaby operations this year.

Participating Companies and Organizations

The number of CECR partners has grown significantly since the program's launch in 2008-09. Over the last two years, the number of participating organizations has increased nearly 60%, primarily as a result of 148 new industry members partnering with Centres.

Organization	2008-09	2009-10	2010-11
University	23	39	39
Host organization	7	12	13
Support from other sources	15	35	45
Centres that generated revenue	0	6	7
Company/Industry	16	68	164
Federal (non-CECR)	0	9	12
Provincial	10	13	20
Municipal	0	2	4
Total	**71**	**184**	**304**

Life sciences companies partner with Cepmed: Laval, Quebec-based Warnex Inc. is collaborating with the Centre of Excellence in Personalized Medicine and the Montreal Heart Institute to develop a new diagnostic test for cadiovascular and metabolic diseases. Another major pharmaceutical company, Merck, is donating $4 million to CEPMed to support translational projects and knowledge translation activities.

CONCLUSIONS AND RECOMMENDATIONS

The CECR program was launched as a bold initiative by the federal government in 2007 to stimulate Canada's economy through the commercialization of academic research. Four years later, the PSAB finds that the program is producing strong partnerships, business models and best practices that are bringing together researchers, entrepreneurs, investors and communities to translate promising research into products, service and solutions for Canada and the world.

One of the strengths of the program is its flexibility. When it comes to research and commercialization, there is no one-size-fits-all model. Working closely with industry, CECRs have developed innovative models for collaboration and commercialization that respond to the specific needs of different industry sectors, and companies of varying sizes. These models create flexible opportunities for early-stage companies, large companies and other external organizations to engage with universities.

While it is still early days for many of these Centres, there has been enough progress to date for the PSAB to conclude, with confidence, that the program is fulfilling its mandate. Several Centres are showing early success in:

- strengthening and diversifying regional economies;
- increasing the international competitiveness of Canadian companies;
- transforming research into new products and services with the help of entrepreneurs;
- creating internationally recognized centres of commercialization and research; and
- increasing private sector investments in research in Canada.

More than $138 million from companies, investors, provincial governments and other partners has been leveraged, technologies are moving closer to market-readiness and 55 start-up companies have been launched. Both the buyers and sellers of technology are helping to decide which technologies are chosen, how they can be de-risked and value-added, and how commercialization can be achieved in the shortest possible time, with the greatest opportunity for success. Having industry and other receptors at the table minimizes the risk that a technology will be pushed out before it is investor and market ready.

Another important issue the PSAB considered is whether Centres should be required to become sustainable and whether existing Centres should be permitted to apply for funding extensions or renewals. The PSAB believes sustainability should continue to be a goal of the CECR program, although it recognizes that this may not be possible within a five-year funding cycle. Certain

industry sectors, particularly drug discovery, require much longer development cycles. The dearth of venture capital also means that research must be developed to a more mature stage before it can be spun out. How long it takes a Centre to become operational can also effect its timeline to sustainability.

The PSAB has identified several business models and best practices for engaging partners, accelerating technology development and growing companies—all of which will contribute to the long-term financial sustainability of CECRs and the industry sectors they serve. The PSAB encourages existing centres and future applicants to incorporate relevant practices into their business models. (See Appendix B for examples of models and practices.)

Similarly, the PSAB makes the following recommendations on the direction of the CECR program, the operation of Centres and future competitions.

RECOMMENDATIONS

MAXIMIZING PROGRAM IMPACTS:

- That the NCE Steering Committee and federal government review the mandate of the CECR program, and its funding levels, with a view to maximizing its impact in Canada's larger innovation system.
- That the CECR program remain flexible with the types of business models adopted by individual Centres, recognizing there is no one-size-fits-all model for commercialization.
- That CECRs be encouraged, from their inception, to share best practices with other Centres.

GOVERNANCE AND OPERATIONS:

- That CECRs be encouraged to have substantive and early involvement from all participants in the value chain (e.g. large companies, SMEs, suppliers, distributors, customers, users and investors) at the advisory, research, technology demonstration and investment stages.
- That CECRs be encouraged, where appropriate, to collaborate and leverage each other's areas of expertise to accelerate commercialization.
- That Centres regularly update their business plans, including pro-forma financial projections and technology-readiness level assessments of their portfolios.

- That new applicants and existing Centres establish baseline data and relevant performance indicators for measuring impacts and outcomes that are a direct result of the CECR program. This should include traditional quantitative metrics (e.g. patents, licensing and spin-offs) as well as qualitative societal impact metrics (e.g. reduced health care costs, environmental benefits and enhanced public policy).
- That financial sustainability continue to be a long-term goal of Centres, while recognizing that the first priority should be on the economic sustainability of the mix of business enterprises they support.

FUTURE COMPETITIONS

- That applicants, in partnership with stakeholders, submit more highly developed business plans with clearly defined commercialization goals, including detailed work plan, resource costing and approach to intellectual property. Other criteria may include:
    - *An ability to leverage funding from provincial and regional partners*
    - *Demonstrating expected value for the Canadian economy and how Centre will deliver that value*
    - *Creating a critical mass of technology expertise in a region*
    - *A stronger focus on short-term R&D cycles and projects that are at a later stage of technology readiness*
    - *Capacity to ramp up operations quickly*
    - *Commercialization experience*
    - *Expertise in IP management*
- That existing Centres that can provide evidence of economic impact be permitted to apply for an extension or renewal. Renewal criteria should include: a business plan with financial projections and performance metrics showing the incremental value generated by the CECR investments, and how this builds on the investments of other funders.
- To improve quality of applications and accelerate ramp up of operations, NCE should provide applicants with additional guidance and assistance (e.g. sharing best practices from existing Centres and lessons learned from PSAB reviews.)
- **Recommendation:** As CECRs are expected to demonstrate broad benefits to Canada and economic impacts, their business models should support activities that will both further these societal benefits in addition to specific commercial impacts/benefits for partners and the sector served by the CECR. CECRs should ensure that they have clear metrics demonstrating progress toward each of their expected societal and economic impacts and the linkages that they have developed between these.

APPENDIX A: INVESTMENT MODELS

Two key criteria in the CECR program are to create, grow and retain companies and to attract investment, including foreign direct investment and venture capital. Centres have developed several innovative business and investment models to address these criteria:

Centre for Commercialization of Research: CCR has partnered with angel investors to provide micro-loans (average $50,000) for technology/product development, commercial demonstrations and initial operations. Larger, follow-on loans have attracted co-investments from venture capitalists. Loans are in the form of debentures that can be converted into equity.

- # of companies supported through micro-loans: 67
  Co-investment ratio: 5:1
- Follow-on investments: $42 million
  Leverage ratio: 15:1

Centre for Drug Research and Development: CDRD has created three innovation funds with industry and public sector partners.

- Pfizer-CDRD Innovation Fund: $3.4 million from Pfizer Canada and $1 million from the NCE program to accelerate the commercialization of promising academic research.
- Genome BC-CDRD Development Fund: $1 million from Genome BC and $1 million from CDRD in expertise, facilities and equipment time.
- Western Canada Innovation Fund: $1.1 million from CDRD, the Province of British Columbia, the Province of Alberta, and Johnson & Johnson COSAT to support innovative health research programs in the life sciences sector.

TECTERRA: TECTERRA has designed a suite of investment programs through partnerships with the Canadian geomatics industry, Alberta university research groups, and the Canadian resource sector.

- Industry Investment Programs provide $100,000 to $500,000 per project, with each project led by a SME.
- University R&D Investment Programs provide $100,000 to $500,000 for projects led by an Alberta university research group in partnership with a geomatics company or end-user government agency.

Institute for Research in Immunology and Cancer: IRICor provides initial seed investments averaging $50,000 and follow-on funding averaging $150,000 in return for revenue sharing. Some co-funding is provided by companies, government agencies or venture capitalists. IRICor's business model is based on revenue sharing. It licenses mature technologies to biopharmaceutical companies in return for licensing fees and royalties and takes an equity position in new spin-offs.

Centre of Excellence in Energy Efficiency: C3E is one of several investors in the $150-million Cycle-C3E pre-seed fund, designed to help early-stage clean tech companies close the gap between technology demonstration and commercialization. Other sponsors include the Quebec government, Rio Tinto Alcan, Lonza, Gas Métro and Systemex.

- Average award: between $350,000 and $400,000
- Un-secured convertible debenture can be converted into 15 percent equity and/or carbon credits or royalties flowing back to the CECR

Centre for Probe Development and Commercialization: CPDC has become a one stop shop for developing and manufacturing an alternative supply of medical isotopes. A new research, manufacturing and distribution centre for medical isotopes opened in Toronto in June, 2011, as a result of a joint partnership between the CPDC and the University Health Network. The Centre has already become the leading supplier of molecular probes for clinical trials and diagnosis in Ontario, with plans to open satellite manufacturing sites across Canada. Major pharmaceutical and probe development companies have contracted with CPDC for manufacturing, laboratory services and clinical trials. CPDC views this revenue-generating service model as key to its ongoing sustainability.

Prostate Centre's Translational Research Initiative for Accelerated Discovery and Development: PC-TRIADD has negotiated eight contract research agreements with pharmaceutical and biotech companies, and has had 11 patents granted. A notable success has been Vancouver-based OncoGenex Pharmaceuticals Inc., one of two companies spun-off from PC-TRIADD. More than 300 patients have been treated in seven clinical trials with a new drug for prostate cancer that was initially developed at the Vancouver Prostate Centre and is being commercialized by OncoGenex. A phase three trial is planned in 2011 with Israeli-based Teva Pharmaceutical Industries Ltd., which will provided OncoGenex $60 million in upfront payments.

MaRS Innovation: MI offers a one stop-shop for 14 universities, research hospitals, health centres and small companies in the fields of therapeutics, medical devices, diagnostic imaging, ICT, advanced manufacturing and clean technologies. MI provides funding and resources to qualify and advance technologies, file patents, develop business and marketing plans and secure investments. In partnership with the Ontario Institute for Cancer Research, MI launched a private company—Triphase—that provides proof-of-concept funding, start-up company space, industry advisory and other resources to help companies get from late pre-clinical to clinical proof of concept in oncology.

Canadian Digital Media Network: CDMN is comprised of acceleration centres, commercialization hubs and development centres across Canada. Services include physical space, programs, tools, technology and applications, financing and connectivity. CDMN also offers mentoring and advice on a range of topics, including intellectual property, marketing and strategy.

Bioindustrial Innovation Centre: BIC is creating North America's first biotechnology laboratories and shared pilot plant facilities for gasification, pyrolysis, fermentation and bio-conversion—key technologies involved in converting agricultural and forestry by-products into fuels, chemicals, products and materials.

GreenCentre Canada: GreenCentre's 10,000 sq. ft. laboratory, funded by the Ontario government and private sector, is able to offer a suite of commercialization services as a result of its CECR funding. Services include: technology assessment, product and application development, IP management, business development, scale up manufacturing; licensing and new company creation.

Pan-Provincial Vaccine Enterprise Inc.: Canada has capacity within its academic institutions to conduct pre-clinical, Phase 1 and early Phase 2 animal studies but the resources are spread across the country. PREVENT is leveraging this dispersed infrastructure and expertise to develop vaccine candidates to the stage where they can be licensed to an industry partner for late-stage clinical trials and commercialization.

Centre for Commercialization and Regenerative Medicine: CCRM is building and supporting three translational platforms—using exiting infrastructure and expertise—that address the key bottlenecks in regenerative medicine commercialization: reprogramming; cell manufacturing; and biomaterials and tissue mimetics.

APPENDIX B: SUSTAINABLE MODELS

SUSTAINABILITY PRACTICES EMERGING AMONG CECRS

- CECR is part of an established regional or provincial innovation centre/intermediary
- Fast ramp up of operations
- Multiple sources of public and private funding
- Participation of industry and other partners on boards of directors and scientific review committees
- Having an experienced entrepreneur leading start-up company
- Commercialization of "low-hanging fruit" to generate early revenues and attract capital
- Service model that meets an industry need and generates revenue for CECR or SME
- Manageable royalty/licensing structures
- Fast turnaround between application and project funding
- Process to quickly terminate projects that are not advancing

The PSAB reviewed two issues related to sustainability: the sustainability of CECRs after their five-year funding ends, and how CECRs contribute to a sustainable economic impact in society. Sometimes the two are interconnected, particularly if industry and other receptors derive value from their partnership with a CECR. Companies and other receptors that see bottom line improvements in terms of revenues, cost savings or increased productivity as a result of their collaboration with a CECR are able to strengthen their business case for maintaining or increasing that funding.

One of the greatest challenges, however, is timing. The majority of companies works on much shorter development timelines than universities and need to see incremental benefits occurring throughout the R&D project. Likewise, many CECRs are seeking ways to monetize and generate revenue from their research, expertise and investments before their mandates end so that operations can continue.

The PSAB identified several models and practices that show promise for delivering sustainable economic impact. CECRs often mix and match many of these practices into their business models.

1. **Governance**

   While not a revenue generating activity, effective execution of a research and commercialization program often begins with good governance. Large companies and SMEs—including suppliers, distributors, customers, users and funders—participate on several CECR boards of directors, as well as on scientific review committees, advisory boards and in research activities. Their participation helps to ensure their long-term commitment to the Centre.

2. **Fee for Service/Contract Research Agreements**

   CECRs engage with large and small firms in contract research agreements in very different ways. Some Centres facilitate contract research agreements between large companies and SMEs and start-ups as part of a research program, which provides the early-stage company with revenues to grow operations.

   Other Centres establish service agreements with large firms to conduct research and product development. For example, the Centre for Probe Development and Commercialization has agreements with major multinational companies to develop and manufacture molecular imaging probes for clinical trials. These agreements support the operations of the Centre over the long-term and ensure that research priorities respond to market needs.

3. **Product Sales**

   Some Centres plan to sell products and other technologies that can generate revenue in the short-term for itself and for start-ups. For example, the Centre for Surgical Invention and Innovation is setting its sights on a system for early detection and treatment of breast cancer that would be commercialized by a new spin-off. CSII would own an equity stake in the company, generate royalties from the IP and sell disposable tools associated with the system. The Centre would also generate service revenue from testing, validating and training. Another CECR, the Centre for Probe Development and Commercialization, expects to generate revenue from the manufacture and sale of molecular imaging probes, in addition to contracted services.

4. **Royalties and Licensing**

   CECRs commonly in-license IP from a university or research hospital and then out-license to receptors, including spin-offs. A royalty stream on future revenues may also be

negotiated. Sometimes royalties go directly to the university or principal investigator with the CECR taking a minority of their share. Whether royalties or licensing, it can take several years before a start-up is able to deliver a return on investment.

Royalty agreements vary between CECRs. MaRS Innovation, for example, takes 25% of all IP royalty streams: 20 percent is kept for operations and 5 percent is reinvested. In comparison, the Institute for Research in Immunology and Cancer—Commercialization of Research (IRICor) has upfront and milestone payments built into its royalty agreement with Bristol Myers Squibb.

5. **Equity in Newco**

   CECRs often take an equity position in a start-up. For example, GreenCentre Canada has a significant equity position and licensing agreements in Queen's University spin-off, Switchable Solutions, which is commercializing an efficient, economical and environmentally friendly approach to plastic recycling and oil sands processing.

6. **Loan Repayments**

   Several CECRs have programs that provide seed funds to start-ups and SMEs to assist in their commercialization of a new technology. How that financing is repaid varies between Centres. The Centre of Excellence in Energy Efficiency provides an un-secured convertible debenture that can be converted into 15percent equity, or royalties or carbon credits—or a mix of all three. If a project looks like it will not succeed, C3E can release the debt and licence to the technology to another company.

   Advanced Applied Physics Solutions Inc. takes a similar flexible approach. Recognizing that start-ups have little operating capital, AAPS provides a service contract or a loan that can be converted later to equity or a royalty stream.

7. **Membership Fees**

   Some CECRs charge their partners an annual fee to be members. In return, they may receive access to research services, facilities and first rights to any technology developed. Both GreenCentre Canada and the MiQro Innovation Collaborative Centre are among the Centres that have adopted this model.

APPENDIX C: BUSINESS-LED NETWORKS OF CENTRES OF EXCELLENCE

BL-NCES: PUTTING INDUSTRY IN THE DRIVER'S SEAT

- BL-NCEs receive approximately half of their funding through the NCE, with the rest coming from other public and private sector sources. This gives an added incentive to the networks to fund research which will lead directly and quickly to products and services which generate revenue, and lead to the creation of jobs.
- In order to encourage and promote partnerships with SMEs, $2.8 million of BL-NCE funding money has been specifically allocated for these organizations.
- The BL-NCE introduces a unique and innovative partnership model, where academic and private sector partners are on an equal level. This new type of relationship is now being considered or used in countries such as France, Spain and some Nordic nations.
- The BL-NCE is the only program of the three funding agencies (NSERC, SSHRC and CIHR) to allow networks to fund private sector partners directly, so that they may do research within their own facilities.

As announced in Budget 2007, the Government of Canada invested $46 million over four years for the creation of the Business-Led Networks of Centres of Excellence program. The program funds large-scale collaborative business-led networks to enhance private sector innovation in order to deliver economic, social, and environmental benefits to Canadians and to promote an entrepreneurial advantage as described in the federal government's S&T Strategy "Mobilizing Science the Technology to Canada's Advantage."

These networks are an amalgamation of the original NCE program's academic perspectives and the eagerness of the private sector to solve specific problems. They are headed by industrial consortia and help to increase private sector investments in Canadian research, support training of skilled researchers, and accelerate the timeline involved in transferring ideas from the laboratory into products and services in the marketplace.

"The Business-Led model encourages industry to seek help from universities and research organizations to solve their problems, rather than universities seeking help from industry to commercialize their inventions."

Source: ArboraNano

Guided by the recommendations of the PSAB, the NCE Steering Committee approved four BL-NCEs in 2009 in the areas of drug discovery, value-added forestry products, next-generation aviation technologies and sustainability challenges related to hydrocarbon production. One of the main goals of the program is to improve the global competitiveness of Canadian companies working in these sectors.

Although it is still early days for the program, the PSAB has noted some positive trends and outcomes to date. One of the most impressive has been the growing commitment of industry, provincial and other partners. Despite the recession and challenges by some industry collaborators to meet initial financial commitments, partners still contributed nearly $38.3 million in cash and in-kind support to the BL-NCE program between 2009 and 2011, exceeding the federal government's investment of $31 million during that period.

In 2010-11, contributions from the private and public sector partners reached $19.7 million. The largest increase from the previous year was from industry, which contributed $11.6 million in cash and in-kind in 2010-11, compared to $6.1 million the year before. Industry now represents the single largest funder to the program after the federal government.

The fact that most Networks have met and even surpassed their required matching contributions—so soon after their launch and during a tough fiscal climate—reflects a strong commitment on the part of industry and other partners to the Network's commercialization successes.

THE VALUE OF IN-KIND CONTRIBUTIONS

Industry partners contribute time, resources and access to specialized equipment and facilities—in addition to direct financial contributions. For example, Bell Helicopter in Mirabel, Quebec, is providing **ArboraNano** access to its specialized testing facilities for polymer composites. Another ArboraNano partner, Montreal-based Nanoledge, is sharing its expertise in integrating nanoparticles with other materials.

Partner Contributions: 2009-2011

Source	Cash	In-Kind	Total
BL-NCE	$31,013,375	$0	$31,013,375
University	$0	$59,960	$59,960
Industry	$8,823,304	$8,926,123	$17,749,427
Federal	$550,000	$4,720	$554,720
Provincial	$13,502,645	$535,155	$14,037,800
Other	$1,298,145	$4,553,400	$5,851,545
Partners Total	$24,174,094	$14,079,358	$38,253,452
Grand Total	$55,187,469	$14,079,358	$69,266,827

Flexible business models

Like the CECR program, there is no one-size-fits-all model for BL-NCEs when it comes to partner engagement and commercialization. Networks need to retain a certain level of flexibility to respond to partner demands and changing market conditions.

For example, ArboraNano had to delay the full launch of its R&D program in its first fiscal year because of the financial constraints of partners impacted by the economic downturn. The Network, its researchers and industry partners responded with a revised collaboration model that sees members providing matching funding or in-kind support for specific projects, as opposed to non-targeted R&D funding.

Industry members also asked for stronger measures to protect their IP and for greater flexibility to exploit their IP in the ordinary course of their business. ArboraNano reported that the changes resulted in a "strong increase in support" from industry partners. "Program funding was seen as arms-length participation with very uncertain outcomes. Project funding helps to integrate the work more easily into the corporate research strategy," the Network noted.

In comparison, the CQDM has adopted an open innovation model that sees six large drug competitors working together to develop pre-competitive research tools and platforms that accelerate the drug discovery process in a wide variety of therapeutic areas. Companies

have a say in which research areas will be pursued, which projects get funded and a first option to license any new technologies. A mentor from each company also works with researchers to ensure projects continue to be aligned with industry needs.

SHARING KNOWLEDGE TO IMPROVE OIL RECOVERY

Sustainable Technologies for Energy Production Systems (STEPS) is supporting research to develop simple, reliable methods for identifying basic properties of oil reservoirs—with minimal sampling—to help companies identify the most promising methods to increase overall recovery in a given oil field. Towards this end, in 2010 STEPS launched a "Super Database" that provides detailed information on increased recovery options for petroleum reservoirs. One industry sponsor is already using the database to refine design parameters for several major field commercial products. The tool will also prove useful for smaller reservoirs, which are generally owned by SMEs.

Strong partnerships

Since BL-NCEs are led by the private sector, companies need to play a hands-on role in the direction of the Network and in the design and execution of projects. Each Network includes strong industry participation on the board of directors and scientific committees, as well as direct participation by private sector research staff in BL-NCE research programs. As one Network noted: "Knowledge and technology transfer ceases to be an issue when knowledge is exchanged and shared rather than transferred."For example, industry members have majority representation on GARDN's board of directors and its scientific committee. The Network's three scientific directors are also from the private sector.

The number of organizations participating in the Networks increased in the period 2009-10 to 2010-11 from 68 partners to 85, with the largest increase in Quebec (29 to 47 participating organizations). The number of industry partners also grew, from 33 in 2009-10 to 47 in 2010-11. Part of this increase can be attributed to a $2.8-million fund that was intended to make it easier for SMEs to partner with BL-NCEs.

LINKING SMES WITH LARGE COMPANIES

CQDM was awarded $751,242 from the NCE in 2010 to stimulate the involvement of two SMEs (Caprion Proteomics and Biospectives) into new international partnerships. CQDM is also helping Caprion develop a more sustainable business model, by expanding beyond a fee-for-service company through the development of proprietary technologies that generate ongoing licensing fees.

Market pull

All four networks are driven by research that responds to the needs of various industry sectors to reduce costs, increase efficiencies, reduce environmental impacts and improve international competitiveness.

For example, Canada's major aerospace companies are collaborating with university and government researchers as part of GARDN to develop new materials, alternative fuels and quieter engines for a new generation of greener airplanes. These innovations are being driven by changing market conditions: new carbon taxes in Europe, new rules in Europe requiring airplanes to produce less noise and emissions, and plans by the United Stations to increase the throughput of its airports three-fold by 2025, without generating more noise or greenhouse gases.

INNOVATIONS IN "GREEN" AEROSPACE

CMC Electronics, Montreal, credits the **GARDN** program in assisting with its ongoing green aerospace initiatives, including the development of vertical navigation capability for its flight management system, and enabling the company to start new initiatives earlier that it would have otherwise.

Job creation

The following chart shows the number of highly qualified people (e.g. graduate students and post-doctoral fellows) who found employment, and in which sectors, after they participated in BL-NCE activities, since the program's launch two years ago.

Industry Sector	HQP Hired
Government, Canadian	5
Industry, Canadian	10
Other Canadian	1
University, Canadian	35
University, Foreign	18
Total	**69**

Strengths of BL-NCE program to date:

- Strong industry leadership on boards of directors and scientific review committees
- Growing financial contributions from partners. Since the program's launch two years ago, the federal government's investment of $31 million has leveraged nearly $38.3 million from partners.

Challenges:

- Some industry partners were not able to meet initial funding commitments as a result of the recession, delaying the launch of some R&D activities.
- Negotiating research agreements (particularly IP management) with some universities took longer than anticipated, delaying the launch of some Network research projects.
- Engaging SMEs at the onset was difficult for some Networks. The NCE responded with the creation of dedicated funding to encourage SME participation. It has helped to attract more SME partners although Networks acknowledge more work is needed in this area.
- At least one Network expressed concern about producing results from research within the four-year mandate, partly as a result of delays in establishing field trials with industry.

CURRENTLY FUNDED BL-NCES

Canadian Forest NanoProducts Network – ArboraNano

Pointe-Claire, Quebec ($8,991,000 for 2009-13)

Founding industry partners: FPInnovations, NanoQuebec and Kruger Inc.

ArboraNano brings an unlikely mix of partners from industries that have not historically collaborated—including medical, aerospace, automotive and chemical—to work with the forest sector on a multi-disciplinary research and development team. Their goal to revitalize Canada's forest sector by transforming plant-derived nanocrystalline cellulose and other biomass materials into new high-value forest products.

Green Aviation Research and Development Network – GARDN

Ottawa, Ontario ($12,486,133 for 2009-13)

Founding industry partners: Bombardier, Pratt & Whitney Canada and CMC Electronics

GARDN is a national consortium of 23 public and private sector partners that identifies

promising research that industry can take to the development, testing and prototype stages. GARDN is targeting what it refers to as the "valley of death in the innovation supply chain" which includes prototype, testing and demonstration of early-stage research conducted by universities or research institutes. The Network funds the development of technologies that will reduce the environmental impact of the next generation of aircraft, engines and systems that will enter into service in 2015-2025.

Québec Consortium for Drug Discovery – CQDM

Nuns Island, Quebec ($8,751,242 for 2009-13)

Founding industry partners: Merck, AstraZeneca, Pfizer

CQDM is a meeting ground for all stakeholders in biopharmaceutical research whose principal mission is to fund research projects carried out in partnership between the academic and hospital milieus in the public sector and the pharmaceutical and biotechnology industries in the private sector. CQDM has a twofold goal: to accelerate the drug discovery process and to develop safer and more effective drugs.

Sustainable Technologies for Energy Production Systems – STEPS

Regina, Saskatchewan ($10,500,000 for 2009-13)

Founding industry partners: Natural Resources Canada, Saskatchewan Industry and Resources, Saskatchewan Research Council and the University of Regina

STEPS conducts advanced research, development and deployment of new enhanced oil recovery technologies in Canada. The majority of STEPS' budget focuses on developing and field testing practical technologies or systems that can increase production of heavy oil and bitumen resources in the oil sands and other reserves—while at the same time leaving the smallest environmental footprint. Other projects are related to enhancing the recovery of light and medium oil and developing enabling technologies.

APPENDIX D: LIST OF CENTRES OF EXCELLENCE FOR COMMERCIALIZATION AND RESEARCH

FIRST ROUND CECRS: 2008-2013

Advanced Applied Physics Solutions Inc. – AAPS

Vancouver, British Columbia ($14,955,575)

AAPS is building on the strong foundation of TRIUMF's internationally recognized expertise in particle accelerators and advanced radiation detection systems to establish an applied research facility that develops and commercializes technologies emerging from worldwide subatomic research. AAPS's ultimate vision is to help position Canada at the forefront of knowledge and application in 21st century technologies.

Bioindustrial Innovation Centre – BIC

Sarnia, Ontario ($14,955,575)

The focus of BIC is to help Canada become a globally recognized leader in taking sustainable feedstock, such as agricultural and forestry by-products and wastes, and turning these renewable resources into energy and value-added chemicals for use in applications ranging from construction materials to automotive parts.

Centre for Drug Research and Development – CDRD

Vancouver, British Columbia ($14,955,575)

CDRD provides drug development expertise and infrastructure to enable researchers from leading academic and health research institutions to advance promising, early-stage drug candidates. The Centre has supported close to 100 research projects generated from its network of 20+ affiliated research institutions across Canada.

Centre for Probe Development and Commercialization – CPDC

Hamilton, Ontario ($14,955,575)

CPDC discovers, develops and distributes molecular imaging probes to hospitals across the province for the early diagnosis of diseases and the assessment of the effectiveness of treatments. CPDC also works collaboratively with industry and academic partners, offering the research, manufacturing and regulatory expertise needed to move innovative probe technology and new therapeutic drugs from R&D labs to clinical use.

Centre for the Commercialization of Research – CCR

Ottawa, Ontario ($14,955,575)

CCR acts as a catalyst which allows innovative businesses to grow and achieve sustainable, commercial success and global competitiveness. CCR complements and extends the

Ontario Centre of Excellence's existing research, talent and commercialization programs to cover the innovation continuum from initial research idea to market success.

Centre of Excellence for the Prevention of Organ Failure – PROOF Centre

Vancouver, British Columbia ($14,955,575)

The PROOF Centre develops and implements blood-based biomarker tests to better manage patients with heart, lung and kidney failure and prevent disease progression. By embracing a cross-disciplinary team of people and uniting organizations including commercial partners, PROOF aims to speed up the development of these tests, applying them sooner to improve and save lives.

Centre of Excellence in Personalized Medicine – Cepmed

Montreal, Quebec ($13,805,000)

Cepmed is dedicated to promoting the science and practice of personalized medicine through research, commercialization and education. It currently participates in several multi-million dollar public-private partnerships in translational medicine that incorporate pharmacogenetic testing into Phase III clinical trials and studies of marketed products.

Institute for Research in Immunology and Cancer – Commercialization of Research – IRICoR

Montreal, Quebec ($14,955,575)

IRICoR's focus is to contribute significantly to the advancement of health research by shedding light on the workings of the immune system and the causes of cancer, to provide exceptional training to investigators in the making, and to develop therapies to stop the suffering and premature death caused by cancer.

MaRS Innovation – MI

Toronto, Ontario ($14,955,575)

MaRS Innovation's aim is to put Canada on the global innovation stage, by better connecting research with industry and strengthening Canada's competitive capacity in knowledge-based businesses—in short, to launch a new generation of robust, high-growth Canadian companies that will become global market leaders.

Pan-Provincial Vaccine Enterprise – PREVENT

Saskatoon, Saskatchewan ($14,955,575)

Pooling the knowledge and resources of experts in public health, academic organizations

and research institutes, the vaccine industry, and the investment community, PREVENT identifies promising vaccine candidates targeting Canada's public health priorities. PREVENT then works with industry partners to develop these vaccine candidates for the marketplace.

The Prostate Centre's Translational Research Initiative for Accelerated Discovery and Development – PC-TRIADD

Vancouver, British Columbia ($14,955,575)

PC-TRIADD's goal is to foster the paradigm of team-driven translational health research to discover molecular mechanisms of cancer progression and therapeutic resistance and to use this information to develop new services and products that reduce suffering, improve survival for patients with cancer and promote regional growth of biotechnology.

SECOND ROUND CECRS: 2009-2014

Canadian Digital Media Network – CDMN

Waterloo, Ontario ($10,721,000)

CDMN uses digital media tools, technology and applications to advance multiple industries—entertainment, health care, education, financial services, and advanced manufacturing. CDMN is comprised of acceleration centres, commercialization hubs and development centres across Canada.

Centre for Surgical Invention and Innovation – CSII

Hamilton, Ontario ($14,805,000)

CSII's focus is to develop and commercialize a new class of robotic platforms for targeted, less invasive surgical and medical interventions. These innovations seek to dramatically improve patient outcomes, reduce the length of hospital stays and recovery periods, and allow patients to return to full activity following major procedures far more quickly than conventional procedures.

Centre of Excellence in Energy Efficiency – C3E

Shawinigan, Quebec ($9,623,000)

Working with its founding partners, Rio Tinto Alcan and Hydro-Québec, C3E supports commercialization of technologies related to energy efficiency and renewable energy in buildings, industrial processes, communications and information technology, bio-industries and transportation.

GreenCentre Canada

Kingston, Ontario ($9,100,000)

GreenCentre focuses on commercializing early-stage green chemistry discoveries generated by academic researchers and industry. It is dedicated to developing environmentally friendly alternatives to traditional chemical and manufacturing products and practices.

Oceans Networks Canada Centre for Enterprise and Engagement – ONCCEE

Victoria, British Columbia ($6,576,760)

ONCCEE is positioning Canada as an international leader in the science and technology of ocean observation systems and is maximizing the associated economic and social benefits through innovative commercialization and outreach programs.

Tecterra

Calgary, Alberta ($11,685,000)

Tecterra invests in and supports the development and commercialization of intelligent, integrated resource management tools to observe, monitor, forecast and manage Alberta's land and natural resources.

THIRD ROUND CECRS: 2010-2016

Centre for Commercialization of Regenerative Medicine – CCRM

Toronto, Ontario ($15,000,000)

CCRM seeks to allow its members to address the barriers faced by the Canadian regenerative medicine (RM) industry, such as the licensing of early-stage RM technologies to companies outside of Canada before their market value is realized.

Centre for Imaging Technology Commercialization – CImTeC

London, Ontario ($13,310,785)

CImTeC tackles the obstacles faced by Canadian medical imaging companies, such as limited access to medical imaging equipment, that prevent the rapid commercialization of diagnostic imaging technologies emerging from Canadian universities and research centres.

Leading Operational Observations and Knowledge for the North – LOOKNorth

St. John's, Newfoundland and Labrador ($7,107,000)

LOOKNorth is enabling its network of industry and research partners to build on Canada's monitoring technologies industry, helping to ensure safe and sustainable resource development in remote, challenging and environmentally sensitive northern regions.

MiQro Innovation Collaborative Centre – MIC2

Bromont, Quebec ($14,078,965)

MIC2 carries out industrial R&D in Bromont on the packaging of microsystems and electronic microchips. Its goal is to become an international pioneer in packaging the next generation of microchips.

Wavefront Wireless Commercialization Centre

Vancouver, British Columbia ($11,593,000 million)

Wavefront provides SMEs with access to resources normally beyond their reach and helps connect researchers from Canadian academic institutions with commercially viable innovation to suitable industry partners.

TURNING RESEARCH INTO COMMERCE

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the Centres of Excellence for
Research and Commercialization

November 2011

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