Review of Relevance and Effectiveness of the Networks of Centres of Excellence (NCE) Program

- Final Report -

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Introduction and Methodology

The Networks of Centres of Excellence (NCE) program was launched in 1989 with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians.

This report presents the findings from the review of the relevance and effectiveness of the Networks of Centres of Excellence (NCE) program. The current review is intended to meet the coverage requirements of Treasury Board's *Policy on Evaluation* and the requirements of Section 42.1 of the *Financial Administration Act*. In planning and calibrating the review of the NCE program, a number of factors were taken into consideration in determining the approach, including: the longevity of the program, program theory, context and risk, performance measurement data, quality of the existing evaluations, and information needs of management.

The review of the NCE program covered the five-year period from fiscal year 2007-2008 to the end of fiscal year 2011-2012. The review examines the relevance and performance of the NCE program including 15 of the 20 networks funded during the study period.

The review involved a review of documents relevant to the program, a file review of expert panel reports for 12 networks that received funding during the time period under review, administrative data analysis, interviews with 13 individuals representing the three networks funded in 2009, the granting agencies, Industry Canada and the NCE Secretariat. The review also included surveys of network researchers (n=21) and partners (n=56) from the three networks not covered by the file review as well as partners (n=80) and researchers (n=207) involved in comparable networks (i.e., Business-Led Networks of Centres of Excellence program [BL-NCE]) as well as comparable networks.

Key Findings

Relevance

The need for a network approach to funding research, development or innovation has been well documented in previous evaluations of the NCE program and, more recently, in evaluations of other programs. The network approach offers an effective mechanism for multidisciplinary and multisectoral collaboration; brings together a critical mass of people and resources to achieve results that cannot be achieved separately; offers an opportunity for parties to share risks; increases the visibility and credibility of the research; and allows the research to expand in scope, both in terms of the research area covered and the geographical scope of the research and those participating. The review of expert panel reports confirmed that funded networks had realized benefits in these areas and that the funded networks addressed highly relevant research problems. Interviewees also confirmed the need for the NCE program's network approach.

The NCE program is designed with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and

improving the quality of life of Canadians. This goal aligns with the guiding framework for Canada's 2007 Science and Technology (S&T) Strategy, *Mobilizing Science and Technology to Canada's Advantage*. Interviewees noted that there is a necessary role for the federal government support the NCE program and that the federal government's role in the program is needed to help identify and address challenges in a way that could not be achieved without multidisciplinary, multisectoral network research.

The NCE program's five objectives are also aligned with the strategic outcomes in the Program Alignment Architecture (PAA) of all three granting agencies. The rationale for the program remains current and there is a continued need for the NCE program.

Effectiveness of Network Approach to Research, Development and Innovation

The evidence gathered for this review shows that the NCE program's investments in a networking approach to research have enhanced research, development and innovation in areas targeted by the funded networks. Over the five-year period for this review, the program has successfully involved thousands of researchers and thousands of partner organizations in Canada and around the world representing a range of disciplines and sectors. Universities, companies, hospitals, federal and provincial governments and other organizations from all provinces and territories are involved in the networks. These organizations are truly engaged in these networks, as evidenced by their significant cash and in-kind contributions which almost doubled the NCE program's grant expenditures over the five-year period within the scope of this review ($378 million in partner contributions to NCE grants of $383 million).

The program has facilitated multisectoral and international collaboration to help address research challenges, as evidenced by the involvement of a wide range of researchers and partner organizations from Canada and around the world. There is also evidence of the program's contribution to multidisciplinary research from the surveys and expert panel reports, where there is indication that the networks involved partners and researchers from several disciplines.

Available evidence from the review indicates that there have been network activities, such as international collaborations, hosting or participation in international conferences and the participation of international experts on network boards, which may have contributed to the visibility and reputation of Canadian researchers. The review did not assess in-depth the program's effectiveness in increasing the visibility and reputation of Canadian researchers or the ability of the networks to attract and/or retain research personnel in Canada. The evidence pertaining to these outcomes is therefore limited and non-conclusive.

The review found that the research undertaken by the networks appears to meet the research needs of partner organizations. In general, interviewed network representatives, surveyed partners and researchers, and expert panel reviews showed some positive results related to the ability of the networks to meet the needs of partner organizations. Network representatives also noted that there were mechanisms in place to help identify what partners' research needs were, such as conferences and outreach activities.

Effectiveness of the Program in the Transfer and Use of Network Research

NCE networks have a range of mechanisms in place to promote knowledge transfer and the use of research results. Over the five years covered by this review of relevance and effectiveness, networks have successfully created, extended or applied knowledge or technology. In fact, between 2007-2008 and 2011-2012, 244 products and innovations have been developed by the NCE networks. Networks have adopted a range of mechanisms to help ensure that research results are shared and can be used. Results are shared with members of the networks through discussions, meetings, conferences, reports, presentations and other mechanisms; these mechanisms were also generally assessed to be effective by expert panels. Knowledge and/or technology have been transferred through tens of thousands of publications. Other means used to protect, transfer or promote the use of research results and manage network-supported intellectual property (NSIP), include: filing of hundreds of patents with more than 100 patents issued; more than 75 licenses granted with many under negotiation; and many other mechanisms.

The survey results suggest that about two-thirds of partner organizations increased their knowledge base as a result of their participation. The network research had also been used by and benefited many partner organizations despite the fact that the survey was conducted in the second year of funding. Specifically, at the time of the surveys, there was evidence of major benefits related to increased knowledge. About half of partners and researchers reported that partners had experienced impacts in at least one area (other than increased knowledge base) as a result of their participation. These benefits included, in order of frequency of mention, impacts on: research and development (R&D); processes and/or practices; products and/or services; productivity; and competitiveness. It is noteworthy that there were significantly fewer NCE partners than BL-NCE partners reporting at least one of these other benefits. In addition, based on the NCE annual reports, the networks have resulted in a number of spin-off companies.

A joint summative evaluation of NCE and Business-Led NCE (including NSERC's SNG as well as CIHR and SSHRC networks as comparators) planned in 2013-2014, should provide the basis to demonstrate more substantive intermediate and long-term outcomes, particularly in light of the evidence of broader impacts already demonstrated by some of the more mature networks.

Effectiveness of the Program in the Training of Highly Qualified Personnel

The review found that the NCE program has been effective in providing extensive opportunities for the training of highly qualified personnel (HQP) by involving thousands of PhD and master's students in network-funded research projects. While female HQP are under-represented when compared to actual gender enrolment in all graduate programs, the data available did not allow for a more in-depth analysis by degree and discipline.

Multiple lines of evidence indicated that the networks have enhanced the training of HQP by creating multidisciplinary and multisectoral training environments which have facilitated the acquisition of a wide range of both technical and general knowledge and skills.

HQP participating in the funded networks are highly likely to find employment after their involvement in network research. Administrative program data shows that a large number of

students involved in network projects find employment. Only 2% were reportedly unemployed. Even though the three networks were in their early implementation stage, 47% of partners and 45% of researchers surveyed indicated that HQP had been hired by network organizations.

NCE researchers were more likely than BL-NCE researchers to indicate that the network contributed to training of HQP and research personnel. According to researchers, NCE HQP were also more likely to have an opportunity to interact with other HQP, but less likely to be given an opportunity to conduct research relevant to the private sector and acquire technical skills. NCE partners were more likely than BL-NCE partners to report that research personnel had been hired by network organizations.

Demonstration of Efficiency and Economy

The review found that the NCE program has demonstrated operational efficiency during the period from 2007-2008 to 2011-2012, both at the program level and at the network level.

For every $1 of grants awarded, only 3.3 cents have been used to cover administrative costs at the program level. This administrative cost for delivering the NCE program is low and similar to the administrative cost for other comparable programs delivered by the NCE Secretariat. The low administrative costs of the NCE program are likely the result of operational efficiencies given the program's maturity and large critical mass.

Between 2009-2010 and 2011-2012, the networks funded in 2009 expended 16.7% of their grants fund in the operation of their administrative centre. This overall administrative operating cost is close to the program's maximum of 15% of the total grant awarded (over the five years) for support network administrative costs; however, the percentage of funds spent on the operation of the administrative centre during the first three years varied across the networks from a minimum of 10.2% to a maximum of 31.8%. The high administrative costs for some networks did not raise significant concerns, as start-up costs can be significant in the beginning of a grant relative to other grant expenditures. Still, the administrative costs on the network level are something that the program should continue to monitor closely for the remainder of the funding period, as overruns cannot be corrected once the funding period has ended. Administrative costs are reviewed annually by the NCE Monitoring Committee and Secretariat.

Conclusions and Recommendations

Conclusions

The review used a calibrated evaluation approach, focusing on outcomes achieved by networks that received funding from fiscal year 2007-2008 to the end of fiscal year 2011-2012. Notwithstanding limitations associated with the scope of the study, overall, the methodology provided sufficient evidence for reaching conclusions for all core evaluation issues and questions using multiple lines of evidence.

Relevance

The NCE program was launched in 1989 with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians. The NCE program is well aligned with current government priorities and there is thus an ongoing role for the federal government to be involved in the program. The rationale for the program remains current, and there is a continued need for the program.

Performance (Effectiveness)

Overall, the evidence looked at for this review suggests that the NCE program has been successful in achieving its intended outcomes. In particular, the evidence presented in this report shows that the NCE program has:

- Supported a networked approach to research which has enhanced research, development and innovation in the areas of funded networks, as demonstrated by the networks' successful involvement of a large number of researchers and partner organizations in Canada and around the world from a range of disciplines and sectors. In doing so, the program has facilitated multisectoral and international collaborations to address research challenges. The networks also appear to be meeting the needs of their partners.

- Resulted in the creation, extension or application of knowledge and technology and put in place the necessary mechanisms to transfer and use these research results and thus reach network researchers, partners and a broader audience, as appropriate. Consequently, the program has benefited participating partner organizations, in particular, by increasing their knowledge in the areas of relevance to the networks. BL-NCE partners were significantly more likely than NCE partners to report that their organization had benefited in other ways than increased knowledge.

- Been effective in providing extensive opportunities for the training of HQP by involving thousands of graduate students on network-funded research projects; many of these individuals have found employment but it is not possible to conclude on the effectiveness of the program in helping find employment in areas of relevance to the networks. There were significant differences between NCE and BL-NCE partners and researchers regarding benefits to HQP and research personnel related to training, employment and other benefits. Equal gender representation among HQP may be an issue but additional data collection and analysis would be needed before conclusions can be drawn.

Performance (Efficiency and Economy)

Efficient and effective means are being used to deliver the NCE program, as evidenced by its relatively low program administrative costs. Given the maturity of the program, large critical mass and lack of start-up costs, it is unlikely that the delivery on the program level can be more efficient and effective. Also, while some networks had high start-up costs, no major issues related to the efficiency of individual networks were identified by this review.

Availability of Performance Information to Support the Review

Although there was sufficient performance information available to support this review, some smaller concerns were highlighted in the expert panel reports and some were observed during the course of this review. In particular, performance information related to: the multidisciplinary nature of networks; the attraction and retention of research personnel to Canada; and the effects of networks on HQP (outcomes of HQP training, employment and career outcomes of former HQP, and eventual career paths of network HQP) was either unavailable or less robust.

Recommendations

Given the positive nature of the conclusions and the scope of this review, the recommendations presented below relate to the possibility of program renewal as well as to specific considerations for the joint summative evaluation:

1. **The NCE program is a relevant, effective and efficient model to fund network research and should therefore be considered for continued support at the federal level.** The NCE program is addressing a continued need for a network approach to funding research, development and innovation, and knowledge transfer, and is making progress towards the achievement of expected outcomes. The findings of the review support the validity and further funding of the program model. The findings also support the involvement of the federal government in funding of the program model as such funding enhances the scope and nature of the funded networks.

2. **The joint summative evaluation of the NCE and BL-NCE programs, planned for the 2013-2014 fiscal year, should further explore the differences between the partnerships formed under the programs and possibly whether there is a gender imbalance among HQP in funded networks.** This review found differences in the results of the NCE program versus the BL-NCE and other networks (including comparable NSERC and CIHR networks) pertaining to partners; however, the evidence was limited to survey results involving participants from networks at an early stage of maturity. Further evidence is required to truly assess the unique aspects of each program in terms of the partnerships formed and their resulting benefits. While the review noted that women appear to be under-represented among HQP at the graduate level in funded networks, further data collection and analysis would be required to gain a more complete understanding of the extent (e.g., variations by degree, discipline) and the reasons behind this issue.

3. **Ensure that reliable contact information for researchers, partners and HQP who will be surveyed as part of the joint summative evaluation is available.** There were some performance measurement concerns identified during this review. It is not expected that existing performance measurement systems can be modified to address concerns identified prior to the summative evaluation. To mitigate gaps in performance information, it will be critical to ensure that reliable contact information for partners, researchers and HQP be available in order to gather missing information through primary

data collection techniques. While it may not be feasible to expect the networks to gather this information on an ongoing basis, mechanisms are required to ensure that the information can be obtained.

1.0 Introduction

This report presents the findings from the review of relevance and effectiveness of the Networks of Centres of Excellence (NCE) program. The current review is intended to meet the coverage requirements of Treasury Board's *Policy on Evaluation* and the requirements of Section 42.1 of the *Financial Administration Act*.

The starting point for the planning, scoping and calibration of the review of the NCE program was the risk rating for the program outlined in the NSERC-SSHRC Long-term Risk-based Evaluation Plan. The NCE program has a medium risk rating based on following factors: materiality, timing for decision-making, delivery complexity, visibility/sensitivity and past performance. In addition to these factors, the planning and calibrating of the review of the NCE program considered a number of factors in determining the approach, scope and data collection methods, including:

- **The longevity of the program**: Established in 1989, the NCE program is a long-standing program.

- **Program theory, context and risk**: The NCE program is based on a sound program theory. It has evolved to address a unique need for a network approach to creation, transfer and use of research results. The program has been proven effective in addressing complex challenges that extend beyond the context of a single federal granting agency (see discussion on quality of existing evaluations below).

- **Performance measurement data**: The NCE program has an established monitoring and performance measurement system (including annual reporting and mid-term reviews of networks), and a demonstrated track record of performance.

- **Quality of the existing evaluations**: The program has an excellent evaluative record, having been evaluated four times since its inception in 1989 (1993, 1997, 2002, 2007), with clear and consistent findings regarding the ongoing relevance and effectiveness of the program. Ten of the 15 funded networks were included in the last evaluation of the program. In addition, several recent evaluations of other complementary programs have incorporated findings related to the NCE program; the findings from these evaluations are still current and can be used to support the program theory (e.g., the 2012 evaluation of the Business-Led Networks of Centres of Excellence Program [BL-NCE] and the 2012 evaluation of the Centres of Excellence for Commercialization and Research Program [CECR]).

- **Information needs of management**: The timing of this study was designed to be compliant with the Section 42.1 of the *Financial Administration Act* and to feed into the extension of the program's Terms and Conditions, which are set to expire in September 2013. In addition to this review, a joint summative evaluation is scheduled to commence in the 2013-2014 fiscal year, which will examine the issues identified in the joint evaluation framework (prepared in 2010) for the NCE and BL-NCE programs. The evaluation will include CIHR and SSHRC networks as well as networks from NSERC

Strategic Network Grants (SNG) program as comparators. The rationale for timing of the joint summative evaluation (so soon after the review) is threefold. First, fiscal year 2013-14 was the optimum year to collect data from participants in NCE and BL-NCE networks; for example from:

- Networks that are reaching the end of their NCE funding eligibility (i.e., that will have been funded for the 14-year maximum);
- Networks that have reached the end of their first 7-year funding cycle or are in their second 7-year funding cycle;
- Networks that are reaching the end of their first 5-year funding cycle, a change implemented to the program in 2009.

Second, the information collected at this time will provide additional data/findings regarding partnerships to inform decision-making regarding the third "partner-led" funding cycle; and third, the joint evaluation will be completed late in 2013-2014, which will better align the timing of future evaluations of NCE Secretariat programs.

In light of the risk rating and the additional factors, the approach for and methods of the review of the NCE have been chosen and calibrated to: focus and align the selection and assessment of expected outcomes by the period of the grants in the funding cycle; make use of available secondary and comparative data; be strategic in the conduct and use of primary data collection; and integrate existing performance measurement data.

As outlined in Section 3.0 of the report, the review addresses issues related to program relevance and effectiveness (i.e., the extent to which the program is achieving its expected outcomes). The evaluation collected data from NCE networks, BL-NCE networks and, where possible, recently funded networks by comparable agency programs as a means of comparison. This data will also serve as baseline for the summative evaluation. The review of the NCE program covers the time period from fiscal year 2007-2008 to the end of fiscal year 2011-2012.

This report is structured as follows:

- Section 2.0 provides a brief profile of the NCE program;
- Section 3.0 provides an overview of the methodology used to complete this evaluation, how the different lines of evidence address the evaluation issues and questions, and discusses the study limitations;
- Sections 4.0 to 8.0 present the key evaluation findings and conclusions; and
- Section 9.0 summarizes the conclusions and discusses the ensuing recommendations.

2.0 Networks of Centres of Excellence (NCE) Program

2.1 Program Rationale and Objectives

The Networks of Centres of Excellence (NCE) program was launched in 1989 with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians.[1] This goal aligns with the guiding framework for Canada's science and technology policy, *Mobilizing Science and Technology to Canada's Advantage*. The overall NCE program goal is accomplished by investing in national research networks that meet the following objectives[2]:

- Stimulate internationally competitive, leading-edge, multidisciplinary research in areas critical to Canadian economic and social development;
- Develop and retain world-class researchers and research mobilization capabilities in areas essential to Canada's productivity and economic growth;
- Create nation-wide and international research partnerships that bring together the key individuals and organizations needed to generate and implement multifaceted solutions to complex Canadian challenges;
- Accelerate the exchange of research results within the network and the use of this knowledge by organizations within Canada to produce economic and social benefits; and
- Increase Canada's international visibility and reputation as a leader by attracting world-class collaborations and developing partnerships with international organization counterparts when applicable.

The program's logic model is included in Annex B.

2.2 Target Population and Stakeholders

The NCE program is directed at researchers in universities, affiliated hospitals and research institutes, as well as industry consortia. Because NCE is a tri-agency program, researchers and organizations that wish to receive funding must meet the eligibility criteria of one of the three granting agencies. Networks funded by the NCE program are comprised of the following: members of the Board of Directors; members of the research management committee; academic partners and researchers; and public and private sector partners as well as non-government organizations which have provided a letter of support and/or contribution (cash or in-kind) to the network.[3]

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1 Joint Results-based Management and Accountability Framework and Risk-based Audit Framework for the Class Grant Networks of Centres of Excellence (NCE) Program (2007).

2 2012 Networks of Centres of Excellence Program Guide, p. 2.

3 Ibid. p. 6.

Stakeholders of the program include the three federal granting agencies, Industry Canada, Health Canada as well as organizations from the private, public and not-for-profit sectors within the areas covered by the networks. With respect to the NCE's mandate to improve Canada's productivity, economic and social growth, and international visibility, the Canadian public is also considered a stakeholder of the program. Other program stakeholders include collaborators, consultants, clients, suppliers and various levels of government.[4]

Since its inception, a total of 45 research networks have received funding through the NCE program. A total of 20 networks received NCE funding in 2007-2008 to 2011-2012. The 15 networks looked at as part of the review of relevance and effectiveness are listed in Table 2-1.[5]

Table 2-1: Networks Reviewed (funded in 2007-2008 to 2011-2012)

Network Name	Funding Period
GEOmatics for Informed DEcisions Network – GEOIDE	1999-2013
Canadian Photonic Industry Consortium – CPIC (previously called CIPI)	1999-2013
Canadian Arthritis Network – CAN	1999-2014
Mprime Network Inc. (previously called MITACS)	1999-2014
Canadian Stroke Network – CSN	2000-2015
Canadian Water Network – CWN	2001-2015
Stem Cell Network – SCN	2001-2015
AUTO21 Network of Centres of Excellence	2001-2015
Advanced Foods and Materials Network – AFMNet	2003-2011
ArcticNet	2003-2018
Allergy, Genes and Environment Network – AllerGen	2004-2019
PrioNet Canada	2005-2012
NeuroDevNet	2009-2014
Carbon Management Canada – CMC-NCE	2009-2013
Graphics, Animation and New Media Canada – GRAND	2009-2014

Source: Program Data.

In addition to the NCE networks, the NCE Knowledge Mobilization (NCE-KM) initiative, launched as a pilot in 2005 and made permanent in 2010, supports networking and collaboration among well-established research teams and receptor communities to further the application and mobilization of knowledge.[6]

[4] Joint Results-based Management and Accountability Framework and Risk-based Audit Framework for the Class Grant Networks of Centres of Excellence (NCE) Program.

[5] Previously funded networks are listed at http://www.nce-rce.gc.ca/Networks-Reseaux/PreviouslyFunded-FinancesAnterieurement_eng.asp.

[6] For more information on KM-NCE-funded networks, see: http://www.nce-rce.gc.ca/Programs-Programmes/NCEKM-RCEMC/Index_eng.asp.

2.3 Governance and Administration

The NCE program is administered jointly by the three federal granting agencies (Natural Sciences and Engineering Research Council [NSERC], Social Sciences and Humanities Research Council [SSHRC] and Canadian Institutes of Health Research [CIHR]) in partnership with Industry Canada.

The two bodies governing the NCE program are:

- The NCE Steering Committee, composed of the Presidents of the three granting agencies, the Deputy Ministers of Industry Canada and Health Canada (or delegate), and the President of the Canada Foundation for Innovation (observer); and

- The NCE Management Committee, composed of the Directors-General and/or Vice-Presidents from the three granting agencies, Industry Canada and Health Canada, the Associate Vice-President, Corporate Planning and Policy Division (NSERC), and the Associate Vice-President of the NCE program.

The NCE Steering Committee is responsible for final funding decisions. The granting agencies are accountable for all reporting obligations to Treasury Board and Parliament with respect to the funding they have received for the NCE program. The day-to-day administration of the program is provided by the NCE Secretariat, which is made up of staff from the three granting agencies and housed at NSERC.

2.4 Funding Levels and Program Expenditures

The NCE program was initially announced in 1988. In February of 1997, it was made permanent, with a commitment of $47.4 million in annual funding starting in 1999-2000. The 1999 and 2004 federal budgets provided an additional $30 million and $5 million of new funding, increasing the NCE budget to $82.4 million annually. The NCE program allocation is detailed in Table 2-2.

In 1997, following two initial four-year pilot phases, networks could compete to receive funding for up to two seven-year cycles. Following the last evaluation of the program in 2007, it was determined that new networks would be funded for a five-year cycle, with the possibility of renewing for up to two further cycles of five years. Funding amounts for successful networks are determined based on the overall funding available. Networks funded by the NCE program could receive funding for up to 15 years. Networks can use funds to support research, knowledge and technology exchange and exploitation, development of highly qualified personnel (HQP) as well as networking activities and the operations of the administrative centre.

Table 2-2: NCE Program Allocation (2008-2009 to 2012-2013)
(millions of dollars)

	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Total
Grants Vote	79.5	79.5	79.5	79.5	79.5	397.5
Full-Time Equivalents (FTE)	18	18	18	18	18	N/A
Salary	1.1	1.1	1.1	1.1	1.1	5.5
Employee Benefits	0.22	0.22	0.22	0.22	0.22	1.1
Non-salary	1.437	1.437	1.437	1.437	1.437	7.185
Subtotal Vote 70 (Operating)	2.757	2.757	2.757	2.757	2.757	13.785
Accommodation	0.143	0.143	0.143	0.143	0.143	0.715
Total NCE	82.4	82.4	82.4	82.4	82.4	412

Source: Joint Results-based Management and Accountability Framework and Risk-based Audit Framework for the Class Grant Networks of Centres of Excellence (NCE) Program (2007).

3.0 Methodology

As noted previously, the approach for and methods of the review of the NCE program have been chosen and calibrated to: focus and align the selection and assessment of expected outcomes by grants' point in the funding cycle; make use of available secondary and comparative data; be strategic in the conduct and use of primary data collection; and integrate existing performance measurement data.

3.1 Evaluation Issues

Table 3-1 outlines the evaluation issues and questions. The issues and questions presented in the table were developed in consultation with, and were approved by, the NCE Management and Steering Committees.

Table 3-1: Evaluation Issues and Questions

Relevance
1. To what extent is there a continued need for a network approach to funding of research, development and innovation?
2. Is there a necessary role for the federal government in providing the program?
3. To what extent is the program aligned with federal government priorities?
Performance (Effectiveness): Achievement of Expected Outcomes
Network approach to research, development and innovation
4. How and to what extent has the program enhanced research, development and innovation in the areas of funded networks?
4.1 To what extent has the program facilitated multidisciplinary, multisectoral and international collaborations between the research community and partner organizations to address research challenges?
4.2 To what extent does the research undertaken by the networks meet the needs of partner organizations?
Transfer and use of network research
5. What impact has the program had on partner organizations (in particular industry partners)?
Training of highly qualified personnel
6. What impact has the program had on training of highly qualified personnel (HQP)?
Performance (Efficiency and Economy): Demonstration of Efficiency and Economy
7. To what extent are efficient and effective means being used to deliver the program?

3.2 Evaluation Scope

The review of the NCE program covers 15 of the networks funded during the time period from fiscal year 2007-2008 to the end of fiscal year 2011-2012. As explained in Section 1.0, the optimal time to collect data from network participants is 2013-14; however, an evaluation was required to inform the renewal of the program's Terms and Conditions, which expire in 2013. As a result, primary data was collected only for the first three networks supported under the new funding model which was implemented in 2009:

- Carbon Management Canada (CMC-NCE)
- Graphics, Animation and New Media Canada (GRAND)
- NeuroDevNet

A purposeful sample of 12 other networks was assessed based on existing performance information. The seven networks funded under the NCE-KM initiative are not included in this evaluation given it is early in the funding cycle of the networks supported by this initiative (the first competition was held in 2011) and the pilot initiative, originally called the NCE New Initiatives (NCE-NI), was evaluated in 2009.

It was determined that the review would address core issue 5, as laid out in Treasury Board's *Directive on the Evaluation Function* (2009), by analyzing the administrative costs of the program in relation to the grant funds awarded. This perspective of operational efficiency was determined to best meet senior management information needs at it allows for meaningful comparisons with other programs. An assessment of economy was not deemed worthwhile, practical or feasible, partly because of the program's central, simple delivery mechanism[7] and partly because the assessment of operational efficiency did not highlight concerns related to the program's optimization of inputs. On the contrary, the operational efficiency was very high (see Section 8).

3.3 Evaluation Approach, Design and Methodology

While the review used a calibrated evaluation approach, it drew on multiple lines of inquiry and integrated elements of quasi-experimental design (comparisons with other networks). Comprehensive expert assessments (representing a non-stakeholder perspective) were complemented with interviews and surveys of a range of stakeholders as well as with data from administrative records and documents.

The data sources and methods are summarized in Table 3-2. A detailed description of the methodology is included in Annex C.

[7] The NCE program's overall risk rating for delivery complexity in the NSERC-SSHRC Long-term Risk-based Evaluation Plan is "medium", but the program inputs and activities managed by the NCE Secretariat can be characterised as simple. According to the Treasury Board Secretariat's guidance document *Assessing Program Resource Utilization When Evaluating Federal Programs* (2012), it may not be feasible to assess economy in cases where programs have simple delivery mechanisms.

Table 3-2: Summary of Evaluation Methodology

Method	Description
Document review	This involved a review of government-wide, NSERC/CIHR/SSHRC, NCE Secretariat, NCE program and network-specific documents to help address program relevance.
File review	The file review was comprised of a review of the most recent expert panel reports (i.e., mid-term or renewal reports) for a sample of 12 networks that received funding from the NCE program during the period under review (2007-2008 to 2011-2012).
Administrative data analysis	This involved analysis of financial and other data on the NCE program as a whole, on individual NCE networks and on comparable networks. The data was analyzed to help address the program's relevance, effectiveness, efficiency and economy.
Interviews	In total, 10 telephone or in-person interviews with 13 individuals from NSERC/CIHR/SSHRC/IC, NCE Secretariat and the three networks (CMC-NCE, GRAND and NeuroDevNet) funded in 2009 were completed.
Surveys	The surveys were comprised of NCE network partners (n=21) and researchers (n=56) from three networks (CMC-NCE, GRAND and NeuroDevNet) as well as partners (n=80) and researchers (n=207) involved in comparable networks (i.e., NCE-BL as well as comparable NSERC and CIHR networks).

3.4 Limitations and Mitigating Strategies

The limitations associated with the study scope will be taken into account in the design of the joint summative evaluation of the NCE and BL-NCE and SNG programs. Some of the key limitations associated with this review included:

- **Limited opportunities to examine the NCE program's longer-term outcomes in the review:** While the review examines the relevance and performance of 15 networks funded during the study period, primary data was only collected for the three networks funded in 2009. This has meant that there were limited opportunities to examine the NCE program's longer-term outcomes because the three networks were in their infancy (particularly as the surveys were conducted when these networks were only in their second year of operations). Although shorter-term outcomes have been assessed in the review, the joint summative evaluation will provide an opportunity to explore longer-term outcomes.

- **Limited consultations with external stakeholders and unfunded networks**: This review included internal (program documentation, administrative data) and external (expert panel reports) sources. In addition, the review included surveys of program participants as well as participants in other network programs. However, interviewees were limited to program managers and a smaller number of funded network representatives who have a clear stake in the program. There were no interviews with external stakeholders or consultations with representatives of unfunded networks. This limitation was mitigated with the use of the expert panel reports, surveys with participants of comparable networks and comparable data related to non-NCE networks.

- **Limited measures to ensure data quality**: This review included analysis of existing, self-reported data. While there were no mechanisms in place to further objectively

validate the data through broader consultations with the networks, data quality was not a major concern, partly because the program has been in existence for a long time and data reporting issues have been addressed over time and partly because the data presented was reasonably consistent from year to year.

Notwithstanding limitations associated with the scope of the study, overall, the methodology provides the basis for reaching conclusions for all core evaluation issues and questions using multiple lines of evidence.

4.0 Relevance

Summary

The need for a network approach to funding research, development or innovation has been well documented in previous evaluations of the NCE program and, more recently, in evaluations of other programs. The network approach offers an effective mechanism for multidisciplinary and multisectoral collaboration; brings together a critical mass of people and resources to achieve results that cannot be achieved separately; offers an opportunity for parties to share risks; increases the visibility and credibility of the research; and allows the research to expand in scope, both in terms of the research area covered and the geographical scope of the research and those participating. The review of expert panel reports confirmed that funded networks had realized benefits in these areas and that the funded networks addressed highly relevant research problems. Interviewees also confirmed the need for the NCE program's network approach.

The NCE program is designed with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians. This goal aligns with the guiding framework for Canada's 2007 Science and Technology (S&T) Strategy, *Mobilizing Science and Technology to Canada's Advantage*. Interviewees noted that there is a necessary role for the federal government support the NCE program and that the federal government's role in the program is needed to help identify and address challenges in a way that could not be achieved without multidisciplinary, multisectoral network research.

The NCE program's five objectives are also aligned with the strategic outcomes in the Program Alignment Architecture (PAA) of all three granting agencies. The rationale for the program remains current and there is a continued need for the NCE program.

4.1 To what extent is there a continued need for a network approach to funding of research, development and innovation?

Advantages of network approach to research, innovation and training

One of the key elements of the NCE program, in comparison to other research, innovation and training programs funded through the granting agencies or other federal organizations, is its focus on a network approach. It is thus important to examine the advantages of such an approach.

Recent evaluations of the BL-NCE and CECR programs clearly demonstrated the advantages of a network approach to funding research, development and innovation which are of direct relevance to the NCE program. In fact, these programs were based on the design of the NCE program and were created partly because the NCE program had demonstrated success. These include:

- **Opportunities and mechanisms for collaboration**: Networks bring together universities and research institutions and link them to private sector partners. (CECR evaluation)

- **Critical mass**: The ability of networks to develop a critical mass of people and resources able to produce together what they could not produce separately. They bring together the best expertise nationally and internationally. They also help stimulate critical mass in terms of infrastructure and expertise. (BL-NCE evaluation, CECR evaluation)

- **Shared risks**: The involvement of the federal government, provincial governments and other public sector organizations and the private sector allows for shared or distributed risk. (BL-NCE evaluation)

- **Credibility**: Networks add to the credibility of the research, development and innovation activities undertaken through those networks and, consequently, to the credibility of network researchers. Networks create synergy and visibility within targeted sectors which enables them to bring national and international partners together and to attract funding from a variety of sources. (BL-NCE evaluation, CECR evaluation)

- **Geographic scope**: Federal government funding helps ensure that the networks include partners and researchers from across Canada involved in research, development and innovation activities of relevance to those networks. (BL-NCE evaluation)

- **Research scope**: Networks provide the tools and resources required to broaden the scope of research programs. (BL-NCE evaluation)

The review of expert panel reports confirms that key advantages of the network approach are the integration of network researchers, research institutions, partners and stakeholders and increased research capacity through the creation of new research opportunities, cutting-edge research projects, and large and integrated research coalitions, instead of traditional smaller research groups. This collaboration across a community of researchers and partners is supported and stimulated by the network funding strategy, which builds on the NCE grant funding to access and leverage network partner contributions and resources (financial and in-kind). In addition, the network approach improves the transfer and use of knowledge and development of HQP through the development and implementation of programs and initiatives focused on the transfer of knowledge and technology and training of students. For example, the expert panel reports identify the following achievements of networks: a changed research culture to large research coalitions and collaborative team-based models that fostered greater synergies among groups of researchers; the opportunity for important research to be developed and undertaken that would not have happened otherwise; the creation of a unique international consortium of leading researchers and partners that does not exist in the United States or Europe; added value to Canada far beyond what would be the sum of the separate contributions; and a catalyst for enabling the research translation process to occur.

Specific needs addressed by the program

At the program level, the 2007 evaluation of the NCE program found that the NCE program addresses unique needs because it assembles at least three characteristics that other granting council programs do not share or bring together to the same degree: the multidisciplinary nature

of networks; the strong emphasis placed on the training of highly qualified personnel (HQP) in a multidisciplinary, multisectoral, networked environment; and the objective of solving real-world problems via research and knowledge transfer.[8]

Interviewees confirmed that the NCE program is still unique and continues to address the need for a network approach to funding research, development and innovation that is not addressed through other granting agencies programs. Interviewees noted that, while the granting agencies have programs that encourage networks, their nature and scope are different from the NCE program. Rather than duplicating or overlapping, these programs complement the NCE program in helping address needs.

Findings from the review of expert panel reports indicate that funded networks address unique needs (e.g., needs of researchers, partner organizations and receptor community) by conducting collaborative research in high-profile areas where a strong stakeholder demand exists.

Evidence in the expert panel reports that the NCE networks conduct unique, high-profile and relevant research is revealed by the most common types of needs the networks address:

1) needs in areas of urgent public interest;
2) needs that address urgent information requirements;
3) needs that benefit underserved populations of the Canadian public; and
4) various unique (differentiated) needs specific to the fields of interest.

Ultimately, the expert panel reports noted that the network research emphasizes research that focuses on areas that are desirable to both the research community and to the end users (partner organizations, the public, etc.). The expert panel reports noted that partner collaborations were a focal point in addressing the unique needs of all relevant stakeholders.

Overall, eight out of twelve NCE expert panels did not report any weaknesses in the network approach to addressing the needs of researchers, partner organizations and the receptor community; this is a positive sign for the strength of the NCE networks. The review of expert panel reports also revealed that only four of twelve of the NCE networks reported weaknesses in the networks approach to address the needs of researchers, partner organizations, and the receptor community. Of these, it was noted that involvement of key minority communities in the research remained underdeveloped. The expert panel report for one network noted the educational activities and publications had not always led to public policy outcomes that would be of ultimate benefit to Canadians. The expert panel report for another network noted the limited engagement in network research projects of relevant partners from small and medium-sized enterprises (SMEs) that deal with technologies applicable to the network's sector.

Evidence that the program is responding to the need for multidisciplinary and multisectoral networks

[8] Circum Network Inc. and R.A. Malatest and Associates Ltd. Evaluation of the Networks of Centres of Excellence Program - Evaluation Report. 2007. http://www.nce-rce.gc.ca/_docs/reports/NCEEvaluationReport2007-eng.pdf

Findings from the review of expert panel reports indicate that funded networks are responding to the need for multidiciplinary and multisectoral networks by providing and facilitating opportunities for researchers, stakeholders, organizations and end-users to plan, conduct and access research. Numerous types of collaborations demonstrated an integrated and multidisciplinary approach, and research collaborations were reflected in relevant global relationships, participation in regulatory processes, and clinical trials. According to the expert panel, this demonstrated a multifaceted approach to integration and emphasis on multidisciplinary research projects to address needs. The networks have also facilitated the creation of multidisciplinary and multisectoral teams and approaches to research topics that have broadened and enhanced the scope and approach of, and expertise brought to bear on, research projects. Notably, the networks provide a focal point for the integration and incorporation of knowledge and needs of researchers and end-users from a wide variety of sectors, including government (federal, provincial, municipal), industry, not-for-profit and university. The advantage of such a multidisciplinary network approach is that such a holistic viewpoint of research benefits the wider public interests by surpassing the limitations of a researcher's specific field of research. These communities of multidisciplinary researchers now take interest in understanding the broader implications of their research impacting society (e.g., quality of life, inclusiveness of more stakeholder and end-user needs), often from a broader socio-economic, political, systemic and environmental perspectives. Multidisciplinary training seems to be exemplary, with training provided to clinicians as well as professionals in clinical epidemiology, environmental professionals, housing, transportation, nutrition, biostatistics and other areas. Findings from the review of expert panel reports indicate that networks are:

- providing an opportunity for multi-stakeholder interactions;
- creating communities of multidisciplinary researchers that have increased collaborations across traditional silos of researcher activities and collective actions that would not have been possible otherwise; and
- consolidating broad academic, clinical and healthcare interests around multidisciplinary approaches to research.

4.2 Is there a necessary role for the federal government in providing the program?

The *Review of Federal Support to Research and Development* notes that one of the key roles of the federal government in fostering innovation is providing appropriate support for business and commercially oriented R&D, whether it be through indirect tax measures, direct assistance to businesses, or funding for public sector or non-profit bodies conducting research of relevance to the private sector.[9] The last role listed is directly aligned with that of the NCE program.

All network and program-level interviewees agreed that there is a necessary role for the federal government to support the NCE program. In fact, interviewees noted that federal involvement has, through the funded networks:

[9] Public Works and Government Services Canada, Review of Federal Support to Research and Development: Expert Panel Consultation Paper, 2011, page 14.

- addressed innovation needs in areas that are significant contributors to the economy;
- allowed for the focus of research in those areas to go beyond a regional focus, beyond a single sector and/or beyond a single discipline;
- supported strategic sectors; and
- supported sectors that compete internationally.

4.3 To what extent is the program aligned with federal government priorities?

As noted in the Government of Canada's science and technology (S&T) Strategy, *Mobilizing Science and Technology to Canada's Advantage*, "scientific and technological innovations enable modern economies to improve competitiveness and productivity, giving us the means to achieve an even higher standard of living and better quality of life".[10] The S&T Strategy explicitly mentions the NCE program as a means to implement the strategy's priorities. In addition, the NCE program objectives are of direct relevance to the priorities set out in the S&T Strategy, namely:

- fostering a Knowledge Advantage to ensure Canadian universities and colleges sustain their world-class research excellence;
- encouraging a People Advantage so that Canada has access to the highly skilled researchers and innovators it needs; and
- to some extent, encouraging an Entrepreneurial Advantage to strengthen private-sector commitment to R&D and innovation vital to productivity and competitiveness.

The 2013 federal budget renews the Government of Canada's commitment to invest in world-class research and innovation. The Economic Action Plan notes that the Government of Canada needs to support advanced research and technology.[11] This is of direct relevance to the objectives of the NCE program.

Collectively, the research areas of funded networks align with the federal priority areas: environmental science and technologies, natural resources and energy, health and related life sciences and technology, and information and communication technologies. [12]

Additionally, as identified in Table 4-1, each granting council has at least one strategic outcome in its Program Alignment Architecture (PAA) that is directly linked to the intended outcomes of the NCE program.

[10] Government of Canada. Mobilizing Science and Technology to Canada's Advantage. 2007.
[11] Government of Canada. Jobs Growth and Long-Term Prosperity: Economic Action Plan 2013. March 21, 2013.
[12] Networks of Centres of Excellence. 2009 Networks of Centres of Excellence (NCE) Competition for New Networks: Competition FAQ.

Table 4-1: Alignment of NCE Program with Granting Council PAAs[13]

Granting Council	Strategic Outcome	Programs
NSERC	Canada is a world leader in advancing, connecting and applying new knowledge in the natural sciences and engineering	People: Research Talent Discovery: Advancement of Knowledge Innovation: Research Partnerships
CIHR	A world-class health research enterprise that creates, disseminates and applies new knowledge across all areas of health research	Health Knowledge Health Researchers Health Research Commercialization Health and Health Services Advances
SSHRC	Canada is a world leader in social science and humanities research and research training	Talent: attraction, retention and development of students and researchers in the social sciences and humanities Insight: new knowledge in the social sciences and humanities Connection: mobilization of social sciences and humanities knowledge

Those interviewees who commented agreed that the NCE Program is aligned with the federal priorities as identified in the S&T Strategy.

[13] Source: 2013-14 Reports on Plans and Priorities of each granting council.

5.0 Network approach to research, development and innovation

Summary

The evidence gathered for this review shows that the NCE program's investments in a networking approach to research have enhanced research, development and innovation in areas targeted by the funded networks. Over the five-year period for this review, the program has successfully involved thousands of researchers and thousands of partner organizations in Canada and around the world representing a range of disciplines and sectors. Universities, companies, hospitals, federal and provincial governments and other organizations from all provinces and territories are involved in the networks. These organizations are truly engaged in these networks, as evidenced by their significant cash and in-kind contributions which almost doubled the NCE program's grant expenditures over the five-year period within the scope of this review ($378 million in partner contributions to NCE grants of $383 million).

The program has facilitated multisectoral and international collaboration to help address research challenges, as evidenced by the involvement of a wide range of researchers and partner organizations from Canada and around the world. There is also evidence on the program's contribution to multidisciplinary research from the surveys and expert panel reports, where there is indication that the networks involved partners and researchers from several disciplines.

Available evidence from the review indicates that there have been network activities, such as international collaborations, hosting or participation in international conference and the participation of international experts on network boards, which may have contributed to the visibility and reputation of Canadian researchers. The review did not assess in-depth the program's effectiveness in increasing the visibility and reputation of Canadian researchers or the ability of the networks to attract and/or retain research personnel in Canada. The evidence pertaining to these outcomes is therefore limited and non-conclusive.

The review found that the research undertaken by the networks appears to meet the research needs of partner organizations. In general, interviewed network representatives, surveyed partners and researchers, and expert panel reviews showed some positive results related to the ability of the networks to meet the needs of partner organizations. Network representatives also noted that there were mechanisms in place to help identify what partners' research needs were, such as conferences and outreach activities.

5.1 How and to what extent has the program enhanced research, development and innovation in the areas of funded networks?

Number of researchers participating in the program

Based on program data, the total number of researchers funded by the NCE program is as follows:[14]

- 1,282 in 2007-2008
- 1,388 in 2008-2009
- 1,325 in 2009-2010
- 1,303 in 2010-2011
- 1,465 in 2011-2012

The program also tracks the number of person years (PY) on an annual basis for both researchers and HQP involved in research projects. The data shows that the number of researcher PYs between 2007-2008 and 2011-2012 has varied from a low of 1,131 in 2009-2010 to a high of 1,462 in 2008-2009. The number of HQP PYs has varied from a low of 3,416 in 2009-2010 to a high of 4,742 in 2007-2008.

Number of partner organizations participating in the program

According to program data (see Table 5-1), more than 2,000 unique organizations were involved in the funded networks in 2011-2012.[15] The number of organizations involved in any given network ranges from 40 to 308. It should be noted that, in general, the three less mature networks have relatively fewer partners than the more mature networks. Nevertheless, it is also important to note that the number of partners depends on the nature of the network, and therefore a smaller number of partners is not necessarily indicative of less success related to enhanced research, development and innovation.

[14] Researchers are counted in each year they are funded.

[15] It should be noted that the last fiscal year within the scope of this evaluation is used because it reflects the most current reality for the program. The number of participating organizations cannot be added across years as many of the same organizations are involved from year to year. Nevertheless, duplicate organizations across networks within a fiscal year have been removed.

Table 5-1: NCE Program Participating Organizations (2011-2012 fiscal year)

Province/ Territory	University/ College	Company/ Industry	Hospital	Federal	Provincial	Other	Total
NWT, Nunavut, Yukon	2	5	0	6	6	40	**59**
British Columbia	15	69	5	8	22	83	**202**
Alberta	8	111	2	8	28	87	**244**
Saskatchewan	2	8	1	2	5	14	**32**
Manitoba	4	14	2	3	11	24	**58**
Ontario	26	302	24	76	25	230	**683**
Quebec	24	116	23	14	29	95	**301**
New Brunswick	4	8	0	1	4	4	**21**
Nova Scotia	8	15	2	5	5	36	**71**
Newfoundland and Labrador	1	5	0	4	3	3	**16**
Prince Edward Island	1	2	0	0	1	0	**4**
Total Canadian	**95**	**655**	**59**	**127**	**139**	**616**	**1,691**
Total International	**152**	**117**	**9**	**32**	**1**	**75**	**386**
Grand Total	**247**	**772**	**68**	**159**	**140**	**691**	**2,077**

Note: The numbers in the table include partner organizations associated with NCE-NI and NCE-KM. However, excluding those organizations would not have had a significant impact on the overall numbers as each organization is only counted once and a large majority of partners involved in NCE-NI and NCE-KM networks were also involved in NCE networks.

There are several observations that can be made regarding Table 5-1 including:

- From a geographic standpoint, all provinces and territories are involved in the programs, with Ontario representing the largest proportion of participating organizations (33% of grand total; 40% of total Canadian) followed by Quebec (14% and 18%, respectively), Alberta (12% and 14%) and British Columbia (10% and 12%).

- Collectively, the networks have been successful in engaging the participation of a range of international organizations; close to one in five (19%) of all organizations involved in the program are international.

- The public, private and non-government sectors are well represented in the program. More than one in three organizations (37%) participating in the program represent a company or industry.

- According to the Association of Universities and Colleges of Canada (AUCC), there are 98 universities in Canada; with 95 participating in the program, this means that almost all (97%) universities are involved in the program.

Total program funding and partner organization contributions

An indicator of the program's enhancement of research, development and innovation in the areas of funded networks is to assess the financial contribution of partner organizations. Table F-1 (in Annex F) shows the cash and in-kind contributions of partner organizations by sector and year.

Over the same timeframe, NCE grants totalled more than $380 million. With partner contributions, the program has therefore contributed to more than $760 million in research, development and innovation activities in the areas of funded networks, close to double the amount of NCE grants (see Table F-2 in Annex F).

The expert panel reports were critical of the ability of the networks to secure contributions from partners for only two out of twelve networks. Specifically, the panels perceived that the networks had not maximized the potential for partnership contributions, by relying too heavily on NCE funding and partner in-kind contributions, rather than partner cash contributions.

The NCE Secretariat directs grantees to NSERC and CIHR guidance on how to calculate in-kind contributions, but some network interviewees still noted that reporting on in-kind contributions was difficult because the value of in-kind contributions is not always readily available or easy to track.

Assessment of the effectiveness of the program's network approach to enhance research, development and innovation in the research areas

Findings from the expert panel review suggest that the network approach has been effective in enhancing research, development and innovation in the network research areas. In half (6/12) of the network reports, the panels commended networks for the high quality of research they had produced through network partnerships that had played a key role in focusing research efforts, making them more responsive to end-user needs. The financial contributions of partner organizations were reported to have improved network infrastructure and enhanced research productivity. In addition, partnerships facilitated through the network were considered to have played a key role in the transfer and use of knowledge by identifying research outcomes and facilitating the adoption and/or application of research findings. However, expert panel reports for half of the networks noted either a lack of or a need to improve the metrics used by the network to assess research performed and its impact.

In general, interviewees from the three networks funded in 2009 believed that their networks were effective in enhancing research, development and innovation projects as a result of the projects funded and the degree of collaboration on those projects. Interviewees also generally believed that their networks contributed to better focused research in the area of relevance to the networks. However, the interviewees believed it was still early to truly assess the impacts of their networks on the nature of research, development and innovation. Nevertheless, they

believed that there were some positive results so far which demonstrated progress towards expected outcomes, for example:

- One network interviewee noted that the biggest impact in this regard so far was that researchers were collaborating across university boundaries and disciplines to a degree that was not evident before.

- Another interviewee noted that the network was funding research projects in specific research fields that were not funded previously. The network was also collaborating on research projects with partner organizations; the interviewee believed that these collaborations could not exist without the NCE network.

- Another interviewee noted that the network had funded a large number of projects, involving an even larger number of researchers. This interviewee noted that the biggest impact of the network so far on enhanced research, development and innovation was that the network had been able to bring in a range of smaller organizations who had never worked in the field before.

In addition, the surveys asked researchers to identify the extent to which their network was addressing their research needs. In total, 70% responded to a good or great extent. This is similar to the responses provided by researchers of comparable networks (76%).

Assessment of the extent to which the networks have increased visibility and reputation of Canadian researchers

Network interviewees noted that they believed that their network had increased the visibility and reputation of Canadian researchers to some extent. One interviewee noted that researchers involved in the networks have already usually built an international reputation. However, interviewees believed that their networks had been effective in increasing visibility and reputation through international collaborations, hosting of or participation in international conferences, and the participation of international experts on their boards.

Number of research personnel attracted to and/or retained in Canada due to the networks

Information on the number of research personnel attracted to and/or retained in Canada due to the networks is not available in the data, and network interviewees had mixed opinions about the ability of the networks to attract and/or retain research personnel in Canada. One interviewee noted that the network had not been in place long enough to have achieved this; another noted that it was hard to determine as the network is only one of several elements in the decision of research personnel to stay in or come to Canada. One interviewee indicated that the network had attracted several individuals but that the challenge was keeping them in the research network rather than going to work for large companies.

5.1.1 To what extent has the program facilitated multidisciplinary, multisectoral and international collaborations to address research challenges?

Extent to which networks have established the necessary research collaboration with relevant researchers, partner organizations, disciplines, institutions, sectors and countries

Network interviewees believed that they had established the necessary research collaborations with relevant researchers, partner organizations, disciplines, institutions (including other NCE networks), sectors and countries. They pointed to specific evidence included in the program data; for example, thousands of researchers involved in network research, thousands of partner organizations, the multidisciplinary nature of their network which involved researchers and organizations from several disciplines (although no specific data is available in this regard), the involvement of a range of institutions and sectors as well as progress in involving organizations and researcher from other countries.

Specific data supports the evidence provided by interviewees. As previously noted in Section 5.1, the funded networks have involved a wide number of researchers. In addition, the NCE network organizations represent a wide range of organizations representing various institutions, sectors and countries. The organizations represent the private, public and not-for-profit sectors; participating Canadian and foreign organizations in the funded networks included, in 2011-2012:

- 247 universities;
- 772 industry/companies;
- 68 hospitals;
- 159 federal government organizations;
- 140 provincial government organizations;
- 691 other types of organizations;
- for a total of 2,077 different organizations.

These network organizations are located in Canada and around the world. While the specific countries reached are not available in the data provided, as per Table 5-1, participating organizations in the funded networks included:

- 152 foreign universities;
- 117 foreign industry/companies;
- 9 foreign hospitals;
- 32 foreign federal government organizations;
- 1 foreign provincial government organization;
- 75 other types of foreign organizations;
- for a total of 386 different foreign organizations.

In addition, those organizations located in Canada may be part of a larger international organization. For example, based on the partner and research survey, 67% of the private sector organizations participating in the surveys were foreign-owned with Canadian operations.

There are also examples of specific foreign partnerships reported by different networks noted in the NCE Annual Reports. These include, for example:

- In 2007-2008, AllerGen partnered with the Global Allergy and Asthma European Network (GA^2LEN), the Karolinska Institute (Sweden), the World Health Organization, the International Union Against Tuberculosis and Lung Disease and the Institute of Population Health and Clinical Research at St. John's Research Institute (India).

- Also in 2007-2008, ArcticNet forged strong international partnerships with Arctic research organizations in Russia, Denmark, Norway, France and the United States.

- In 2008-2009, GEOIDE created a draft charter of global network for networks, engaging partnerships with Australia, South Korea, Mexico and others.

- Also in 2008-2009, MITACS partnered with several international organizations to hold the second Canada-France Congress in Montreal; held a workshop in Botswana to train African and Canadian graduate students in latest mathematical tools and techniques to help control the spread of diseases; and created Globalink, a program designed to facilitate collaboration between Canadian and Indian researchers.

- In 2010-2011, PrioNet established dozens of partnerships with research organizations from around the world and held valuable knowledge exchanges with several countries including China, the United States, Mexico, Spain, Scotland and Austria.

The findings of the expert panel make it difficult to assess if the networks had established the necessary research collaborations with relevant organizations. Although the strength and/or diversity of participating organizations were praised in reports for three of the twelve networks, the panel reports do not provide an assessment of the nature of the collaborations with relevant organizations. The findings of the expert panel suggest that the networks are establishing the necessary research collaboration with the relevant sectors, with the engagement of key industry or government partners. Engagement of key partners was described as a strength for seven of the twelve networks.

The survey data provides some evidence of the multidisciplinary nature of the three networks funded in 2009. As outlined in Table 5-2, partners and researchers represent several disciplines for all networks.

Table 5-2: Disciplines of Research Interest

Discipline	Partners			Researchers		
	CMC	GRAND	NeuroDevNet	CMC	GRAND	NeuroDevNet
Natural sciences and engineering	50%	n.a.	41%	100%	70%	8%
Health sciences	25%	n.a.	94%	10%	15%	100%
Social sciences and humanities	0%	n.a.	35%	10%	49%	23%
Other	25%	n.a.	0%	0%	9%	0%
Base (number of respondents)	**4**	**0**	**17**	**10**	**33**	**13**

Note: There were no GRAND partners that participated in the survey. Respondents were able to select more than one discipline when answering the question.

Survey respondents were also asked to indicate the extent to which the network has resulted in multidisciplinary research collaborations; 71% of surveyed NCE partners and 80% of surveyed NCE researchers indicated that it had.

Assessment of the effectiveness of established and/or strengthened research collaborations to address research challenges

The expert panel reports provide evidence that collaborations with relevant countries are being established within at least for four of the twelve networks. The extent of collaborations with relevant countries was found to vary from active participation of international collaborators and partners to the more passive sponsorship of international conferences.

Only one of the twelve was found to have a weakness in the establishment of the necessary research collaborations to address research challenges. For this network, the expert panel found there to be a lack of an integrated approach for management of the network's focus areas.

The researcher survey also examined the nature of the research collaborations in order to help determine the effectiveness of the networks in establishing or strengthening research collaborations. Table 5-3 shows that the research projects are resulting in multisectoral collaborations. NCE networks were more likely than BL-NCE networks to have established collaborations with universities and health providers, but less likely to have established collaborations with the private sector.

Table 5-3: Sector Collaborations on Network Projects

Sector	NCE	BL-NCE	Others
University	100%	93%	99%
Private sector	56%	91%	62%
Canadian government (federal, provincial, municipal)	20%	23%	53%
Foreign government	4%	0%	2%
Hospital or other health provider	33%	9%	17%
Not-for-profit organization	29%	9%	21%
Other	0%	2%	4%
Average number of different sectors on research projects	2.5	2.3	2.6
Maximum number of different sectors on research projects (possible maximum is 7)	6	4	5
Base (number of respondents)	**55**	**43**	**160**

Note: Cells highlighted in yellow indicate statistically significant differences across sub-groups ($p<0.05$).
Source: Surveys of researchers

5.1.2 To what extent does the research undertaken by the networks meet the needs of partner organizations?

The surveys of partners and researchers examined the extent to which the research undertaken by the networks meet the needs of partner organizations. Partners and researchers were asked if the networks/research projects had resulted in the research collaborations required to address the needs of network organizations. At the time of the surveys, 52% of partners and 46% of researchers indicated that this had occurred.

Network interviewees also believed that their network was meeting the needs of partner organizations. One interviewee noted that the network had annual conferences to identify needs or priorities, one-on-one outreach activities and a Board of Directors with representation from a diverse range of partners and thus, several mechanisms in place to ensure needs were identified and addressed appropriately.

The expert panel review revealed that partner participation was a noted strength for four of the twelve networks. However, the evidence given of partner engagement was limited to anecdotes of maintained or increased partner organization memberships or investments. Some mention is given to the strength of the research-partner collaborations as beneficial to the overall research program. The review of the expert panels' assessment of networks identified only a few weaknesses in how networks engage partners, which also suggests that the networks generally are meeting the needs of their partners. In the case of one network, there were concerns that key industry sectors were missing from the network and that the nature and level of participation of industry and government were not clear and may not be the most effective. In the case of another network, it was noted that the network relationship with industry has been one-sided, with more of the focus on the value that the network can bring to industry and less focus on the value that industry can bring to the network (e.g., market awareness, trends, consumer expertise).

6.0 Transfer and use of network research

Summary

NCE networks have a range of mechanisms in place to promote knowledge transfer and the use of research results. Over the five years covered by this review of relevance and effectiveness, networks have successfully created, extended or applied knowledge or technology. In fact, between 2007-2008 and 2011-2012, 244 products and innovations have been developed by the NCE networks. Networks have adopted a range of mechanisms to help ensure that research results are shared and can be used. Results are shared with members of the networks through discussions, meetings, conferences, reports, presentations and other mechanisms; these mechanisms were also generally assessed to be effective by expert panels. Knowledge and/or technology have been transferred through tens of thousands of publications. Other means used to protect, transfer or promote the use of research results and manage network-supported intellectual property (NSIP), include: filing of hundreds of patents with more than 100 patents issued; more than 75 licenses granted with many under negotiation; and many other mechanisms.

The survey results suggest that about two-thirds of partner organizations increased their knowledge base as a result of their participation. The network research had also been used by and benefited many partner organizations despite the fact that the survey was conducted in the second year of funding. Specifically, at the time of the surveys, there was evidence of major benefits related to increased knowledge. About half of partners and researchers reported that partners had experienced impacts in at least one area (other than increased knowledge base) as a result of their participation. These benefits included, in order of frequency of mention, impacts on: R&D; processes and/or practices; products and/or services; productivity; and competitiveness. It is noteworthy that there were significantly fewer NCE partners than BL-NCE partners reporting at least one of these other benefits. In addition, based on the NCE annual reports, the networks have resulted in a number of spin-off companies.

The planned joint summative evaluation should provide the basis to demonstrate more substantive intermediate and long-term outcomes, particularly in light of the evidence of broader impacts already demonstrated by some of the more mature networks.

6.1 What impact has the program had on partner organizations (in particular industry partners)?

The review of expert panel reports highlighted specific processes or models used to promote transfer and use of knowledge and technology, including the selection of partners with capacity for influence and/or action, the development of tools that allow for knowledge transfer (e.g., reporting tools, databases), and the use of workshops, conferences and other events or forums to bring researchers and partners together. The use of media to communicate research results and build awareness of the problems targeted by the networks as well as the use of student-interns as knowledge brokers for industry partners were as also cited as ways in which the networks have transferred and used knowledge. However, one-quarter (3/12) of the networks were criticized

for not fully synthesizing results, not explicitly identifying the targets of knowledge transfer and use activities, or not appropriately measuring impacts.

Findings from the survey confirm that networks have been successful in transferring and using the knowledge and technology produced even though the networks were surveyed early in their life-cycle. Based on the surveys of partners and researchers, the majority of respondents believed that the networks or network research had resulted in:

- the creation of new knowledge (62% of partners; 76% of researchers);
- the creation of new technology (10% of partners; 47% of researchers);
- the extension or application of existing knowledge (57% of partners; 82% of researchers);
- the extension or application of existing technology (48% of partners; 67% of researchers); and
- at least one of the above (67% of partners; 88% of researchers).

Based on the surveys, mechanisms used for sharing these research results included: informal discussions or correspondence (79% of partners; 93% of researchers); meetings (79% of partners; 87% of researchers); annual conferences or general meetings (79% of partners; 86% of researchers); reports or presentations (74% of partners; 76% of researchers); direct involvement of personnel from network's partner organizations in projects (53% of partners; 40% of researchers); formal correspondence (58% of partners; 40% of researchers); and shared drives or electronic space (32% of partners; 49% of researchers).

The NCE annual reports provide evidence of knowledge transfer and use. This has been achieved through publications, filing of patent and licensing applications, patents and licenses issued, and other means. Table 6-1 provides an overview of the extent to which different mechanisms have been used since 2007-2008.

Table 6-1: Transfer and Use of Research Results

Mechanism	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Total
Refereed contributions	4,322	4,384	3,672	4,340	3,693	20,411
Non-refereed contributions	948	1,875	1,096	1,819	1,453	7,191
Specialized publications	2,016	1,006	1,516	1,015	907	6,460
Total publications	**7,286**	**7,265**	**6,284**	**7,174**	**6,053**	**34,062**
Products and innovations	20	27	2	11	184	244
Patent applications filed	88	104	85	89	1	367
Patents issued	27	42	32	6	0	107
Copyrights	15	8	2	8	6	39
Licensing under negotiation	13	13	26	25	6	83
Licenses granted to industry	17	22	8	16	1	64
Number of active networks	**15**	**14**	**17**	**15**	**16**	

Source: Program data

The surveys also probed the mechanisms used to promote transfer and use of research results. These results are presented in detail in Table F-3 in Annex F. The table shows that, for the three NCE networks funded in 2009, the most frequently noted mechanism was referreed publications (65% of partners; 62% of researchers). The table also shows that NCE network partners were significantly less likely than the partners from BL-NCE and other networks to indicate that they had network agreements regarding intellectual property or commercialization (21% versus 65% and 44%, respectively) and to have execution on non-disclosure or confidentiality agreements (0% versus 57% and 16%, respectively).

The expert panels offered a positive assessment of the networks' knowledge and technology transfer and use activities overall. Their observations included the following:

- Seven of the networks were deemed effective in generating publications; these networks had either produced a large number of publications or had increased the amount of publications produced since the previous review. The panels felt that two networks had underperformed in terms of the number of publications produced.

- The traditional types of academic publications (e.g., peer-reviewed articles, conference presentations, invited talks) were typically mentioned when discussing network strengths. Other types of publications, such as network-produced reports and newsletters which communicated program findings and publications in popular media, including newspapers articles and interviews, were mentioned less often as network strengths.

- Expert panel reports for a majority of networks (7/12) identified strengths related to improved transfer and use of network knowledge or technology by partner organizations. For four networks, public awareness of the research problem was increased through the use of websites, popular media (e.g., print, electronic, interviews), partnerships with stakeholders, or a promotional video. In addition, workshops, conferences and other (e.g., industry conventions) were also identified for three networks as a means through which to transfer knowledge.

- The number of patents was listed as strength for four of the networks; the number of reported patents ranged from 10 to 120 across these networks. At the time of the expert panel report, one network had filed 120 patents, of which 37 patents and 21 licenses had been issued. However, for two networks, the expert panel noted missed opportunities for patenting or exploitation of network technologies as a weakness.

The surveys probed extensively into the impacts of the network research on partner organizations. Not surprisingly given the relative infancy of those three networks at the time of the surveys, the most prominent impact of the networks on partner organizations was increased knowledge (68% of partners and 64% of researchers). More than half (52%) of partners and (53%) of researchers reported that they had experienced impacts in at least one of the other areas listed in Table 6-2 as a result of their participation (excluding increased knowledge base). More specifically, impacts were reported by partners in the following areas: 53% on R&D; 42% on processes/practices; 37% on products/services; 37% on productivity; 37% on competitiveness; 30% on economic, social, health and/or environment benefits; and 16% on public policy. Some

(5%) partners reported that a spin-off company had been created (Table 6-2). There had been at least 11 spin-off companies created between 2007-2008 and 2011-2012 according to the NCE annual reports.[16] The results summarized in Table 6-2 show that the results achieved by the three NCE networks funded in 2009 are similar to those of comparable networks. However, significantly fewer NCE partners than BL-NCE partners reported at least one other benefit (excluding increased knowledge).

Table 6-2: Program Impacts on Partner Organizations

Feature	Partners			Researchers		
	NCE	BL-NCE	Others	NCE	BL-NCE	Others
Increased knowledge base	68%	74%	66%	64%	47%	61%
Impact on R&D	53%	74%	53%	36%	40%	38%
Impact on processes and/or practices	42%	44%	23%	16%	19%	20%
Impact on products and/or services	37%	22%	23%	18%	16%	12%
Impact on productivity	37%	35%	17%	18%	19%	22%
Impact on competitiveness	37%	39%	6%	18%	14%	18%
Economic, social, health and/or environment benefits	21%	9%	6%	11%	5%	13%
Impact on public policy	16%	17%	2%	2%	0%	5%
Creation of a spin-off or start-up company	5%	0%	0%	2%	0%	1%
% reporting at least one of the benefits noted above (excluding increased knowledge base)	52%	83%	54%	53%	43%	49%
Base (number of respondents)	**19**	**23**	**53**	**55**	**43**	**160**

Note: Cells highlighted in yellow indicate statistically significant differences across sub-groups ($p<0.05$).
Source: Surveys of partners and researchers

The joint summative evaluation will provide an opportunity to further examine the impacts of funded networks on partner organizations, since the evaluation will include more mature networks as well as two to three more years of results for the networks funded in 2009. It is expected that reported impacts will be more prevalent, particularly based on the results reported by more mature networks. The examples provided below illustrate how more mature networks can result in a wide range of impacts on partner organizations and society at large.

[16] Note: information not included in the 2008-2009 Annual Report; therefore, the number could be higher. In addition, this information is not available for 2011-2012.

The **Canadian Photonic Industry Consortium** (CPIC), previously **The Canadian Institute for Photonic Innovations (CIPI)** active between 1999 and 2013, was intended to bring university researchers together with public sector and industrial partners in a network in order to stimulate innovations in phonics – the technology of light – and promote its exploitation to generate wealth and enhance the quality of life for Canadians. During the last seven years of funding from the NCE program, the network increased its focus on transfer of technology and know-how to Canadian Industry.

The network engaged an average of 71 industry partners per year in 2009-2012. A total of fourteen new companies were created as a result of the network, and eight of those were still active in 2012. In 2012, an independent firm was hired to assess the funded projects' impact on companies. Surveyed companies reported that their participation had at least some impact on their firms' degree of innovation (88%), time to market (77%), the number of employees (72%), research investment (71%), annual revenues (62%), number of new customers (62%) and research investments (50%). The network's final report to the NCE program provides examples of impacts on the photonic industry that occurred after the summative evaluation of the NCE program in 2007. For example, a CPIC-funded researcher at the University of Toronto explored optic techniques and the impact of light energy on water. It resulted in a laser device that was 10 times more powerful than the existing technology and could be applied in several industries including manufacturing, energy, ICT and medicine. A spin-off company was created which is now selling the laser systems around the world. As of 2012, the company had hired seven employees.

The CIPC entity that supports networking and collaboration between researchers, industry and government organizations, which was created by CIPI, continued to exist beyond 2013 through a merger with the Canadian Photonics Consortium. The CPIC will assist companies to identify financing opportunities, new technologies and talent. The non-profit will also help connect companies with prospective customers in six key industry sectors.

According to CIPC, the photonics industry contributed $4.4 billion to the Canadian economy in 2008, employing more than 20,000 people in 450 different companies.

The **Canadian Stroke Network** (CSN) works towards decreasing the physical, social and economic consequences of stroke on the individual and on society since it first received funding from NCE in 1999. The network has carried out many different activities to reach this goal. The Registry of the Canadian Stroke Network is one of CSN's key accomplishments.

In 2001, the CSN launched what has become the world's largest clinical stroke database. The Registry includes data from more than 130,000 patients and monitors stroke care in Canada on a continuous basis. In 2007, when the summative evaluation of the NCE was conducted, the Registry had helped generate some new information about the state of stroke care in Canada, but it was not until 2011 that the network released the report *Quality of Stroke Care in Canada*, the first national study that closely examined stroke care in Canada. The report identified ways in which stroke care could be improved across the country and provided recommendations for patients, the public, care providers and policy makers. CSN visited all regions in Canada to discuss the findings and next steps. The 2011-2012 CSN annual report highlighted that the dissemination of findings so far has resulted in the establishment of four new stroke units, implementation of stronger approaches to prevention and increased awareness of issues related to inadequate access to stroke care by all provinces. Improvements in stroke care can ultimately help reduce the costs to the Canadian economy which currently is estimated at $2.7 billion a year.

The CSN also reported to have shared experiences related to the Registry with other countries, including China and Sweden. As of 2011-2012, the Registry had contributed to a total of 59 peer-reviewed publications, more than 110 abstracts, 13 technical and research reports, and five graduate theses. The ownership of the Registry was transferred to the Institute for Clinical Evaluative Sciences in 2012 to ensure that the monitoring capacity that had been built would be sustained beyond 2015 when the network sunsets.

7.0 Training of Highly Qualified Personnel

Summary

The review found that the NCE program has been effective in providing extensive opportunities for the training of highly qualified personnel (HQP) by involving thousands of PhD and master's students in network-funded research projects. While female HQP are underrepresented when compared to actual gender enrolment in all graduate programs, the data available did not allow for a more in-depth analysis by degree and discipline.

Multiple lines of evidence indicated that the networks have enhanced the training of HQP by creating multidisciplinary and multisectoral training environments which have facilitated the acquisition of a wide range of both technical and general knowledge and skills.

HQP participating in the funded networks are highly likely to find employment after their involvement in network research. Administrative program data shows that a large number of students involved in network projects find employment. Only 2% were reportedly unemployed. Even though the three networks were in their early implementation stage, 47% of partners and 45% of researchers surveyed indicated that HQP had been hired by network organizations.

NCE researchers were more likely than BL-NCE researchers to indicate that the network contributed to training of HQP and research personnel. According to researchers, NCE HQP were also more likely to have an opportunity to interact with other HQP, but less likely to report that HQP were given an opportunity to conduct research relevant to the private sector and acquire technical skills. NCE partners were also more likely than BL-NCE partners to report that research personnel had been hired by network organizations.

7.1 What impact has the program had on training of highly qualified personnel?

Over the five-year scope of this review, the NCE program has provided training opportunities to thousands of HQP working on research projects funded through the NCE networks. For the purpose of this review, HQP include undergraduate, master's and doctoral students, and postdoctoral fellows; whereas, research personnel include research associates, technicians, research staff, engineers, and professors. [17] Table 7-1 summarizes the program's HQP reach.

[17] These definitions were used in the surveys and based on those used by the NCE Secretariat. .

Table 7-1: HQP Trained and Supported by NCE Program

Type	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Level					
PhD	1,691	1,537	1,198	1,441	1,595
Master's	1,706	1,404	1,128	1,364	1,401
Gender					
Male	1,982	1,804	1,425	1,642	1,765
Female	1,415	1,137	901	1,163	1,231
Canadian vs. Foreign					
Canadian	2,539	2,150	1,676	2,051	2,158
Foreign	858	791	650	754	838
Total	3,397	2,941	2,326	2,805	2,996

Source: Program data

Table 7-1 shows that, over the five years, the networks have supported:

- slightly more PhD students than master's students, although they are close to equal (average over five years of 52% PhD students vs. 48% master's students);
- a majority of Canadian HQP (average over five years of 73% Canadian vs. 27% foreign); and
- more male than female HQP (average over five years of 60% male vs. 40% female) even though, according to Statistics Canada data[18], women accounted for 56% of enrolment in master's programs and 47% of enrolment in PhD programs in 2008-2009.

While female HQP appear to be underrepresented when compared to actual gender enrolment in all graduate programs, the data available did not allow for a more in-depth analysis by discipline or degree. Such an analysis could help determine if the proportion of women participating in funded networks in a particular discipline, or enrolled in a particular degree, is lower than the proportion of female students enrolled in graduate programs within the same discipline or degree.

Findings from the review of expert panel reports confirm that all networks have enhanced the training of HQP in network research areas by creating training environments that support HQP from a variety of disciplines, provide opportunities for multidisciplinary training with other HQP and researchers, facilitate the acquisition of specialized knowledge and skills (e.g., intellectual property management) and core competencies, involve graduate students and postdoctoral fellows to multidisciplinary and multisectoral approaches to research, and expose HQP to professional development and employment opportunities. In addition to the funding support for the training of HQP, networks have developed or facilitated a number of mechanisms and processes to enhance training, including: inter-laboratory exchanges or rotations between researchers and trainees from different institutions and disciplines; establishing committees and sub-committees to direct and oversee network training activities; involving HQP in leadership

[18] Statistics Canada. Education Indicators in Canada: Fact Sheets. February 2011.

positions and/or decision-making bodies of the network (e.g., Board of Directors, Research Management Committee); fostering the development of student and professional networks and associates that provide networking, support and development opportunities; and, in the case of one network, influencing the development of educational programs and the training and certification of professionals in the field.

Despite the positive achievements of networks in the training of HQP, the expert panels noted the following weaknesses and areas of improvement: the need for additional activities/outreach to attract and involve underrepresented trainees and professionals; and better leveraging of funding of network partners for network training programs.

The survey of partners and researchers explored the effects of the NCE (and other) networks on HQP and research personnel. Table 7-2 shows that the great majority of NCE network partners (89%) and researchers (98%) indicated that the network/research project had resulted in the training of HQP while 84% of partners and 50% of researchers reported that it had resulted in training of research personnel. In addition, even though the three networks were in their early implementation stage, 47% of partners and 45% of researchers indicated that HQP had been hired by network organizations, and 58% of partners and 33% of researchers reported that research personnel had been hired by network organizations.

Table 7-2: HQP and Research Personnel Outcomes

Feature	Partners			Researchers		
	NCE	BL-NCE	Others	NCE	BL-NCE	Others
Training of HQP	89%	73%	72%	98%	62%	86%
Training of research personnel	84%	82%	64%	80%	55%	71%
HQP hired by network organizations	47%	55%	34%	45%	29%	31%
Research personnel hired by network organizations	58%	41%	25%	33%	21%	26%
Base (number of respondents)	**19**	**22**	**53**	**55**	**42**	**129**

Note: Highlighted cells indicate statistically significant differences across sub-groups ($p<0.05$).
Source: Surveys of partners and researchers

The table highlights that researchers associated with NCE networks are more likely than those from comparable networks (in particular BL-NCE networks) to report training results, both with HQP and research personnel, and that partners of NCE networks are more likely than comparable networks (in particular other academic networks) to report that research personnel were hired by network organizations.

Researchers surveyed were also asked to compare the impacts on HQP of their NCE research projects to other research projects in which they had been involved. These results are summarized in Table 7-3.

Table 7-3: Proportion of Researchers Indicating that Network Research Projects were Better/Much Better than Other Research Projects

Feature	NCE	BL-NCE	Others
Conduct multidisciplinary, multisectoral research	70%	50%	65%
Interact with other HQP	72%	42%	66%
Interact with university researchers	60%	46%	65%
Interact with private sector researchers	60%	58%	57%
Participate in exchanges/internships	57%	42%	58%
Acquire professional skills	49%	65%	44%
Conduct research relevant to the private sector	43%	77%	62%
Opportunities to contribute to economic growth for Canada	43%	54%	51%
Acquire technical skills	43%	65%	38%
Access to cutting edge technology and research facilities	43%	58%	46%
Exposure to industry/hospital/not-for-profit organization practices	42%	46%	45%
Acquire research skills	40%	46%	40%
Consider the social, economic or ethical implications of research	38%	35%	40%
Acquire business/entrepreneurial skills	34%	39%	30%
Base (number of respondents)	**53**	**26**	**136**

Note: Highlighted cells indicate statistically significant differences across sub-groups ($p<0.05$).
Source: Surveys of researchers

The table shows that NCE network researchers are most likely to indicate that NCE research projects were better/much better than their other research projects in providing opportunities to interact with other HQP and conduct multidisciplinary, multisectoral research. When compared to the responses of researchers from other networks, the results are similar with three exceptions:[19]

- NCE network researchers are more likely than other researchers (in particular BL-NCE researchers) to indicate that NCE network research projects provide opportunities for HQP to interact with other HQP;

- NCE network researchers are less likely than other researchers (in particular BL-NCE researchers) to report that NCE network research projects provide opportunities for HQP to conduct research relevant to the private sector; and

- NCE network researchers are less likely than BL-NCE researchers to report that NCE network research project provide opportunities for HQP to acquire technical skills (but more likely than researchers of other academic networks).

[19] Statistically significant differences ($p<0.05$).

Administrative program data shows that a large number of students involved in network projects find employment. There was, however, no data available on the relevance of the employment to the skills acquired through the networks. Tables F-4 to F-6 in Annex F provides details on the employment of HQP. These tables show that participating students have been successful in acquiring employment after their involvement in network research, in particular:

- Only 2% were reportedly unemployed (however, the employment status of 28% was unknown);
- The higher the degree completed, the less likely a student is to be unemployed after his/her involvement with the program (known unemployment rate of 1% for post-doctoral fellows (PDF); 2% for PhDs; and 3% for master's);
- 46% of foreign students found employment in Canada whereas only 10% of Canadian students left Canada;
- However, the higher the degree completed, the more likely a student is to have found employment outside of Canada, regardless of country of origin (29% of PDFs are employed outside Canada vs. 18% of PhDs and 9% of master's);
- A large proportion (41%) is employed by a university with only 20% employed by industry, 5% by government and 5% by other;
- However, the higher the degree completed, the more likely a student is to have found employment in a university (53% of PDFs are employed by a university vs. 43% of PhDs and 34% of master's) and the less likely the student is to have found employment in industry (11% of PDFs are employed in industry vs. 16% of PhDs and 26% of master's).

The panel reports also concluded that networks are contributing to HQP employment post-network, with one-third of network reports (4/12) citing statistics on HQP employment after participation in the network. For example, one report indicates that 90% of network trainees are employed and approximately 30% have pursued careers in the field of the network. In addition, findings indicate that networks are undertaking a wide variety of network activities and initiatives that contribute to the employment of HQP, such as workshops, professional development activities, mentorships, internships and network/association activities. These provide opportunities for HQP to: interact with researchers, industry and professionals in the field; improve career development and leadership skills; improve employability; and develop entrepreneurial and commercialization skills. For example, the expert panel review reports from two networks note that network HQP have participated in internships offered by another program delivered by a former NCE (Mitacs_Accelerate); this provided a means to interact with industry and appreciate the translational aspects of current and future research.

The information available through administrative data and the expert panel reviews was sufficient to support the requirements of this review. However, the expert panel reports for four networks noted a need for additional or more robust metrics to: better track and quantify the outcomes of HQP training and the employment and career outcomes of former HQP; and track

the eventual career paths of network HQP in order to better assess network impact on the attraction, retention and employment of HQP in Canadian industry. In the case of networks, the privacy concerns were noted as precluding the networks from gathering more robust data on HQP outcomes.

8.0 Performance (Efficiency and Economy)

Summary

The review found that the NCE program has demonstrated operational efficiency during the period from 2007-2008 to 2011-2012, both at the program level and at the network level.

For every $1 of grants awarded, only 3.3 cents have been used to cover administrative costs at the program level. This administrative cost for delivering the NCE program is low and similar to the administrative cost for other comparable programs delivered by the NCE Secretariat. The low administrative costs of the NCE program are likely the result of operational efficiencies given the program's maturity and large critical mass.

Between 2009-2010 and 2011-2012, the networks funded in 2009 expended 16.7% of their grants fund in the operation of their administrative centre. This overall administrative operating cost is close to the program's maximum of 15% of the total grant awarded (over the five years) for support network administrative costs; however, the percentage of funds spent on the operation of the administrative centre during the first three years varied across the networks from a minimum of 10.2% to a maximum of 31.8%. The high administrative costs for some networks did not raise significant concerns, as start-up costs can be significant in the beginning of a grant relative to other grant expenditures. Still, the administrative costs on the network level is something that the program should continue to monitor closely for the remainder of the funding period as overruns cannot be corrected once the funding period has ended. Administrative costs are reviewed annually by the NCE Monitoring Committee and Secretariat.

8.1 To what extent are efficient and effective means being used to deliver the program?

Program Efficiency

A common measure of operational efficiency of grant programs is to assess the ratio of operating expenditures to the total amount of grant funds awarded. This ratio represents the cost of administering $1 of grant funds awarded. The granting agencies also commonly report operating expenditures as a percentage of total program expenditures.

Table 8-1 presents an estimate of the operating expenditures for the NCE program over the period from 2007-2008 to 2011-2012. The actual operating expenditures for the NCE program are not available because some expenditures are only captured at the level of the NCE Secretariat, which manages four programs. As a result, the proportion of NCE Secretariat operating expenditures that correspond to the NCE program were estimated using the percentage of total NCE program grant funds to total NCE Secretariat grant funds. The operating expenditures for the program include both the direct and indirect costs of administering the program: direct costs are comprised of salary and non-salary costs, which are related primarily to the adjudication of the program grant; and non-salary costs also include a share of the costs related to corporate representation and general administration for the NCE Secretariat. Other direct costs associated with administering the program, such as post-award management and

indirect costs, such as common administrative services provided by NSERC (e.g., finance, human resources and information technology) are not available at the program level. These other direct and indirect costs have also been included in the total calculation of costs and were estimated using the ratio of total NCE grant funds to total NSERC grant funds. It should be noted that the estimation of operating expenditures only accounts for cost incurred by the NCE Secretariat and therefore does not account for services provided without charge (e.g., time volunteered by selection panel members, audit services provided by the Office of the Auditor General).

Table 8-1: Estimation of NCE Program Operating Expenditures

Operating Expenditures	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Total
Direct Salary	$500,979	$681,032	$970,738	$909,883	$900,502	$3,963,134
Direct Non-Salary	$633,192	$591,903	$772,625	$582,040	$925,940	$3,505,700
Total Direct	$1,134,172	$1,272,935	$1,743,363	$1,491,923	$1,826,443	$7,468,836
Indirect and Direct Non-Attributable	$1,015,112	$854,113	$1,024,858	$983,965	$903,367	$4,781,415
Total	$2,149,284	$2,127,048	$2,768,221	$2,475,888	$2,729,809	$12,250,250
Grant Funds Awarded	$79,500,000	$68,909,490	$79,500,000	$78,171,500	$77,059,000	$382,729,990
Operating Ratio (¢:$1) (Expenditures to Grant Funds Awarded)	2.7¢	3.1¢	3.5¢	3.2¢	3.5¢	3.2¢
Operating Expenditure as a Percentage of Total Program Expenditures	2.6%	3.0%	3.4%	3.1%	3.4%	3.1%

At 3.3 cents for every $1 of grants awarded for the period from 2007-2008 to 2001-2012, the administrative cost is very low for the NCE program and comparable to other programs administered by the NCE Secretariat. For example, over the same period the operating ratios for the CECR program and BL-NCE program were 2.8 cents and 5.7 cents for every $1 of grants awarded, respectively, and the operating ratio for NSERC's SNG program was 5.8 cents over a similar period (2008-2009 to 2011-2012).

According to interviews with program management, the lower administrative costs of the NCE program were the result of operational efficiencies given the program's maturity and large critical mass. The increased operating ratio in 2009-2010 was due to the combined selection committee and expert panel costs in that year. The operating ratio decreased somewhat in 2010-2011 as there were only two selection committee meetings held and no expert panels. In 2011-2012, the operating ratio increased somewhat again. There were two selection committee meetings and expert panels held that year and costs for monitoring committees were also introduced.

Efficient use of network resources

Table 8-2 presents the use of resources by the networks funded in 2009 over the three-year period from fiscal year 2009-2010 to 2011-2012. As outlined in the NCE Program Guide, NCE networks can use grant funds for the following two types of eligible expenditures:[20]

1) General Eligible Expenditures, which apply to NCE Networks, NCE Knowledge Mobilization (KM) Networks and NCE-Networks Management Funds (MF), including: Operating Costs for the Network's Administrative Centre, Costs Related to Networking; Costs Related to Communication Activities; and Costs Related to Knowledge Mobilization and/or Technology Exchange and Exploitation.

2) Specific Eligible Expenditures, which apply only to NCE Networks, including: Direct Costs of Research and Facility Access, Administrative Operating Costs, Costs Related to Networking, and Other Costs Related to Student and Postdoctoral Fellows.

Over this period, the networks expended $22,485,923 (or 65.2%) of the $34,475,865 in grant funds awarded. Of this, $3,753,682 (or 16.7%) was expended by networks in the operation of their administrative centre. As expected, these operating expenditures as a percentage of network expenditures decreased over the three-year period (from 50.7% in the first year to 13.2% in the third year) as the networks established their structure, expanded their operations and implemented their research program. For the first three years of operation, the overall administrative operating cost for the 2009 cohort of 16.7% is close to the program's maximum of 15% of the total grant awarded (over the five years) for support network administrative costs; however, the percentage of funds spent on the operation of the administrative centre during the first three years varied across the networks from a minimum of 10.2% to a maximum of 31.8%. Start-up costs appeared to have been the main reason for high administrative costs during the period under review.

[20] See 2012 Networks of Centres of Excellence Program Guide for a detailed description of eligible expenditures. Available online: http://www.nce-rce.gc.ca/_docs/reports/NCEProgramGuide-GuideProgrammeRCE_eng.pdf

Table 8-2: Use of Resources by the Networks Funded in 2009

2009 Network Cohort	2009-2010	2010-2011	2011-2012	Total
Grant Funds Awarded	$6,538,865	$14,088,000	$13,849,000	$34,475,865
Balance of Grant at End of Previous Year	$0	$6,190,740	$11,982,634	N/A
Total Grant Funds Available for Current Year	$6,538,865	$20,278,740	$25,831,634	N/A
Network Expenditures	$348,125	$8,296,105	$13,841,692	$22,485,923
Percentage of Network Expenditures to Grant Funds Awarded	5.3%	58.9%	99.9%	65.2%
Percentage of Network Expenditures to Grant Funds Available for Current Year	5.3%	40.9%	53.6%	N/A
Operational Expenditures of Network Administrative Centre	$176,636	$1,750,340	$1,826,707	$3,753,682
Percentage of Operational Expenditures to Network Expenditures	50.7%	21.1%	13.2%	16.7%

Source: NCE Program Annual Reporting Data

9.0 Conclusions and Recommendations

9.1 Conclusions

The review used a calibrated evaluation approach, focusing on outcomes achieved by networks that received funding from fiscal year 2007-2008 to the end of fiscal year 2011-2012. Notwithstanding limitations associated with the scope of the study, overall, the methodology provided sufficient evidence for reaching conclusions for all core evaluation issues and questions using multiple lines of evidence.

Relevance

The NCE program was launched in 1989 with the goal to mobilize Canada's research talent in the academic, private and public sectors and apply it to the task of developing the economy and improving the quality of life of Canadians. The NCE program is well aligned with current government priorities and there is thus an ongoing role for the federal government to be involved in the program. The rationale for the program remains current and there is a continued need for the program.

Performance (Effectiveness)

Overall, the evidence looked at for this review suggests that the NCE program has been successful in achieving its intended outcomes. In particular, the evidence presented in this report shows that the NCE program has:

- Supported a networked approach to research which has enhanced research, development and innovation in the areas of funded networks, as demonstrated by the networks' successful involvement of a large number of researchers and partner organizations in Canada and around the world from a range of disciplines and sectors. In doing so, the program has facilitated multisectoral and international collaborations to address research challenges. The networks also appear to be meeting the needs of their partners.

- Resulted in the creation, extension or application of knowledge and technology and put in place the necessary mechanisms to transfer and use these research results and thus reach network researchers, partners and a broader audience, as appropriate. Consequently, the program has benefited participating partner organizations, in particular, by increasing their knowledge in the areas of relevance to the networks. BL-NCE partners were significantly more likely than NCE partners to report that their organization had benefited in other ways than increased knowledge.

- Been effective in providing extensive opportunities for the training of HQP by involving thousands of graduate students on network-funded research projects; many of these individuals have found employment, but it is not possible to conclude on the effectiveness of the program in helping find employment in areas of relevance to the networks. There were significant differences between NCE and BL-NCE partners and researchers regarding benefits to HQP and research personnel related to training,

employment and other benefits. Equal gender representation among HQP may be an issue but additional data collection and analysis would be needed before conclusions can be drawn.

Performance (Efficiency and Economy)

Efficient and effective means are being used to deliver the NCE program, as evidenced by its relatively low program administrative costs. Given the maturity of the program, large critical mass and lack of start-up costs, it is unlikely that the delivery on the program level can be more efficient and effective. Also, while some networks had high start-up costs, no major issues related to the efficiency of individual networks were identified by this review.

Availability of Performance Information to Support the Review

Although there was sufficient performance information available to support this review, some smaller concerns were highlighted in the expert panel reports and some were observed during the course of this review. In particular, performance information related to: the multidisciplinary nature of networks; the attraction and retention of research personnel to Canada; and the effects of networks on HQP (outcomes of HQP training, employment and career outcomes of former HQP, and eventual career paths of network HQP) was either unavailable or less robust.

9.2 Recommendations

Given the positive nature of the conclusions and the scope of this review, the recommendations presented below relate to the possibility of program renewal as well as to specific considerations for the joint summative evaluation:

1. **The NCE program is a relevant, effective and efficient model to fund network research and should therefore be considered for continued support at the federal level.** The NCE program is addressing a continued need for a network approach to funding research, development and innovation, and knowledge transfer, and is making progress towards the achievement of expected outcomes. The findings of the review support the validity and further funding of the program model. The findings also support the involvement of the federal government in funding of the program model, as such funding enhances the scope and nature of the funded networks.

2. **The joint summative evaluation of the NCE and BL-NCE programs, planned for the 2013-14 fiscal year, should further explore the differences between the partnerships formed under the programs and possibly whether or not there is a gender imbalance among HQP in funded networks.** This review found differences in the results of the NCE program versus the BL-NCE and other networks (including comparable NSERC and CIHR networks) pertaining to partners; however, the evidence was limited to survey results involving participants from and networks at an early stage of maturity. Further evidence is required to truly assess the unique aspects of each program in terms of the partnerships formed and their resulting benefits. While the review noted that women appear to be underrepresented among HQP at the graduate level

in funded networks, further data collection and analysis would be required to gain a more complete understanding of the extent (e.g., variations by degree, discipline) and the reasons behind this issue.

3. **Ensure that reliable contact information for researchers, partners and HQP who will be surveyed as part of the joint summative evaluation is available.** There were some performance measurement concerns identified during this review. It is not expected that existing performance measurement systems can be modified to address concerns identified prior to the summative evaluation. To mitigate gaps in performance information, it will be critical to ensure that reliable contact information for partners, researchers and HQP be available in order to gather missing information through primary data collection techniques. While it may not be feasible to expect the networks to gather this information on an ongoing basis, mechanisms are required to ensure that the information can be obtained.

Annex A – Glossary of Acronyms

AUCC	Association of Universities and Colleges of Canada
BL-NCE	Business-Led Networks of Centres of Excellence
CECR	Centres of Excellence for Commercialization and Research
CIHR	Canadian Institutes of Health Research
CMC-NCE	Carbon Management Canada
GRAND	Graphics, Animation and New Media Canada
HQP	Highly qualified personnel
NCE	Networks of Centres of Excellence
NSERC	Natural Sciences and Engineering Research Council
PAA	Program Alignment Architecture
PDF	Post-doctoral fellow
PY	Person year
R&D	Research and development
S&T	Science and technology
SME	Small and medium-sized enterprises
SNG	Strategic Network Grants
SSHRC	Social Sciences and Humanities Research Council

Annex B – Logic Model

The logic model of the NCE program is presented in Figure B-1. The following narrative provides a description of, and explains the linkages between, the activities, outputs and outcomes presented in the logic model.

Activities[21]: The key activities for the NCE program include the selection of networks, program management and monitoring and evaluation activities. Competitions are held regularly for renewal of existing networks and for new networks to be funded. All funding decisions are based on an arm's length and peer-reviewed assessment of applications by expert panels and selection committees. The NCE Secretariat is responsible for the day-to-day management of the NCE program and receives administrative support from NSERC. The monitoring of awards is an ongoing function of the NCE Secretariat that consists of ensuring that NCE funds are used effectively to attain the expected results. These monitoring activities are linked to ongoing performance measurement, and the data collected in this context can also be used for the purpose of periodic evaluations.

Outputs: Four key outputs result from the activities listed above: funded networks, agreements with networks, advice and direction to networks, and reports on monitoring, peer reviews and evaluation. As a result of the peer-reviewed competitions, applications to the program are selected and funded to establish or renew a network. The Selection Committee recommends the annual grant amounts to be allocated to the networks funded, and the Steering Committee makes the final decision on the funding. The NCE Secretariat informs the applicants of the competition results. Prior to the release of the first installment of the award to the network, a Funding Agreement that outlines the terms and conditions for funding under the NCE program, and the governance structure of the network's Board of Directors, must be signed by designated representatives. Networks receive advice and direction from the NCE Secretariat on various aspects related to the networks' development, ongoing activities and termination. They also receive advice on requirements and procedures for negotiation of internal agreements (e.g., memoranda of understanding, affiliate agreements). Networks provide annual statistical and financial tables and annual corporative reports. Progress reports are provided either annually or at mid-term as well as for the renewal of networks. These reports constitute an important information and data input for the performance measurement system.

Outcomes: The outcomes for the NCE program are expected to occur at a variety of levels and points in time. It is important to note that the achievement of program outcomes rely on activities of grantees, researchers, highly qualified personnel (HQP), and private sector, government and not-for-profit partner organizations involved in the NCE program grant, which are not all under the direct control of the NCE Secretariat. The immediate outcomes are expected to take place during the grant period, although it is likely that some outcomes will be ongoing and continue beyond the grant period. The intermediate outcomes are expected to occur after the grant period. The final outcomes are expected to occur over the longer term (i.e., several years after grant award).

[21] Descriptions adapted from Joint Results-based Management and Accountability Framework and Risk-based Audit Framework for the Class Grant Networks of Centres of Excellence (NCE) Program (2007).

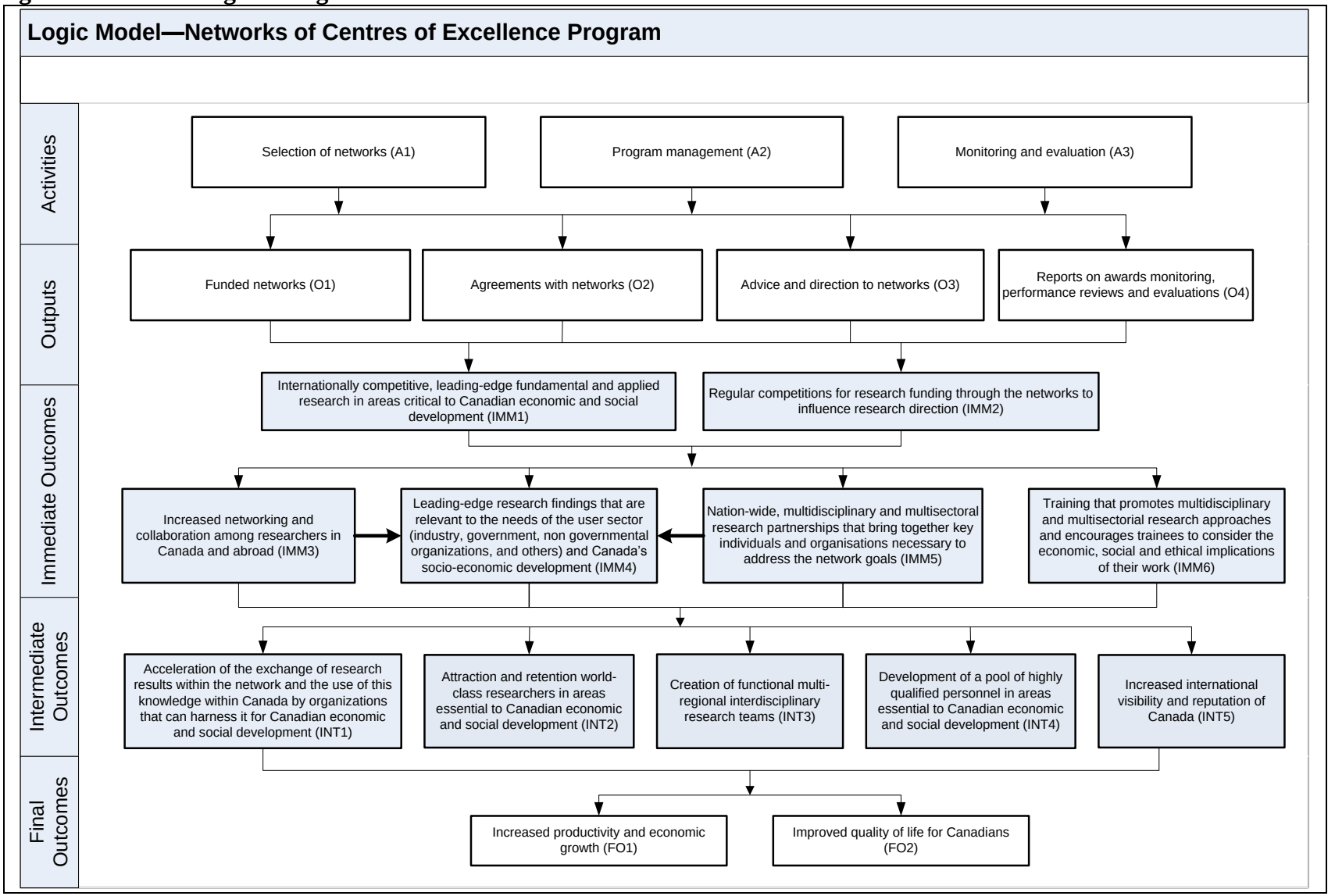
Immediate outcomes: The networks are expected to direct leading-edge research that is relevant to Canada's socio-economic goals. In addition, the research should be carried out in a way that involves a high degree of networking and collaboration among researchers.

The NCE program was designed to overcome the traditional barriers between academic research, industrial exploitation and public use of research results and stimulating collaboration. In this context, networks are expected to build strong partnerships across all sectors in the first years of their existence. The networks are also expected to build international collaborations and partnerships where applicable to increase Canada's international visibility and reputation.

Intermediate outcomes: An important intermediate outcome is the transfer of findings and knowledge including trained graduates and HQP to the private, public and not-for-profit sectors. This will be achieved by generating high-quality research that meets the needs of government, industry and other user groups and that is relevant to Canada's socio-economic development. In addition, the program should contribute to strengthening Canada's research base, through the training of new researchers in a multidisciplinary and multisectoral setting and attraction and retention of experienced researchers.

Final outcomes: Final outcomes represent the broader societal impacts that the NCE program contributes to along with other programs and initiatives, as well as environmental factors. It is expected that the program will contribute to final outcomes at the national level; however, the degree to which the program can influence the achievement of these longer-term outcomes is considered to be even less than for previous levels of outcomes. These are usually not measured at the program level due to problems with attribution. Ultimately, the NCE program should contribute to the government's overall objectives of improved quality of life and a stronger economy.

Figure B-1: NCE Program Logic Model



Source: Joint Results-based Management and Accountability Framework and Risk-based Audit Framework for the Class Grant Networks of Centres of Excellence (NCE) Program

Annex C – Detailed Methodology

Document review

The document review involved a review of documents on the NCE program as a whole, government-wide documents, individual NCE network documents, and literature in general. Documents were reviewed and assessed for their contributions to specific evaluation issues and questions. Key findings from the document review have been incorporated as appropriate throughout this report. A list of the documents reviewed is included as Annex D.

File review

The file review was comprised of a review of the most recent expert panel reports (i.e., mid-term or renewal reports) for a purposeful sample of 12 out of 20 networks that received funding from the NCE program during the period under review (2007-2008 to 2011-2012). The sample included networks that were first funded in 1998, 1999, 2000, 2003, 2004 and 2005 and included both networks that had completed seven-year funding cycles and networks that had completed 14-year funding cycles during the period under review. Networks that had not gone through a mid-term review during the time period were not included in the file review, as no expert panel reports were available for these networks. A document review template was created based on the relevant review questions and indicators to facilitate the review, collection, aggregation and reporting of information from the expert panel reports on contribution of networks to the achievement of program outcomes.

Administrative data analysis

Data analysis involved analysis of financial and other data on the NCE program as a whole, on individual NCE networks and on comparable networks. The data was analyzed to help address the program's relevance, effectiveness, efficiency and economy. Key findings from the document review have been incorporated as appropriate throughout this report.

Interviews

A total of 10 interviews were completed with 13 individuals. Interviews were scheduled at a time that was convenient for the interviewees, in their official language of choice and in person or by telephone, as per their choice. As interviews were scheduled, individuals were forwarded a copy of the interview guide to help them prepare. A list of the individuals interviewed is provided in Table C-1 below.

Table C-1: List of Individuals Interviewed

Name	Title	Affiliation
Janet Walden	Chief Operating Officer	NSERC
Jane Aubin	Chief Scientific Officer/Vice-President, Research	CIHR
Brent Herbert-Copley	Vice-President, Research Capacity	SSHRC
Alison McDermott	A/Director General, Program Coordination Branch	Industry Canada
Melanie Vanstone	Director, NSERC Liaison	Industry Canada
André Isabelle	Associate Vice-President	NCE Secretariat
Stéphanie Michaud	Program Deputy Director	NCE Secretariat
Gordon Lambert	Chair of the Board of Directors	CMC-NCE
Steve Larter	Scientific Director	CMC-NCE
C. Ian Kyer	Chair of the Board of Directors	GRAND
Kellogg Booth	Scientific Director	GRAND
Daniel Goldowitz	Scientific Director	NeuroDevNet
Henri Rothschild	Chair of the Board of Director	NeuroDevNet

Web-based surveys

Four web-based surveys, each using a census approach, were administered to four groups: NCE network partners; NCE network researchers; partners of BL-NCE and comparable NSERC and CIHR networks; and researchers of BL-NCE and comparable NSERC and CIHR networks. For the purpose of the surveys:

- partners were defined as representatives of organizations who were affiliated with the network as funding partners and/or members of one of the network's committees and/or member of the network;
- researchers were defined as individuals involved in projects funded by the networks either as the lead researcher or as a member of the project research team; and
- comparative networks were defined as research networks in similar broad research domains, with comparable funding levels, that had been in existence for a similar length of time (i.e., less than five years).

The list of partners and researchers of NCE and BL-NCE networks was compiled from the progress reports submitted by networks to the NCE Secretariat. For the BL-NCEs, it was validated and updated by the individual networks. The partner population identified for the BL-NCEs was small for two reasons: first, most networks had a small number of partners involved in their network; and, second, some of the partners were removed from the survey population because they had either been interviewed or eliminated during the interview scheduling process (i.e., refusals, not sufficiently involved in/ aware of the networks to respond to participate in an interview).

The lists of partners and researchers of comparable networks were provided by NSERC and CIHR based on information available in program databases. For all surveys, individuals were sent an original email invitation and a follow-up reminder. Table C-1 outlines the final sample disposition for each survey.

Table C-1: Survey Disposition

Network	Initial sample	Removed for interviews	No / invalid emails	No longer there	Not associated with network	Valid / effective sample	Completed / total responses	Valid response rate	Margin of error / sample error
Partner Surveys									
NCE	115	0	0	0	1	114	21	18%	±19%
Comparison	318	39	9	4	6	257	80	31%	±9%
BL-NCE	88	39[22]	0	0	0	46	23	50%	±14%
NSERC	230	0	9	4	6	211	57	27%	±11%
Researcher Surveys									
NCE	139	0	1	0	0	138	56	41%	±10%
Comparison	655	8	1	0	123	523	207	40%	±5%
BL-NCE	235	8	0	0	121	106	44	42%	±11%
NSERC	326	0	0	0	2	324	139	42%	±6%
CIHR	94	0	1	0	0	93	24	26%	±17%

[22] Note: The 39 BL-NCE partners removed include the 23 interviews completed as well as those who were eliminated during the interview scheduling process (e.g., refused, indicated that they were not involved in the network or not sufficiently involved to contribute, etc.).

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Annex E – Profile of Networks Funded in 2009

Table E-1: Summary Profile of Networks

Characteristic	CMC	GRAND	NeuroDevNet
Focus	To develop game-changing technologies and the business, social and policy frameworks necessary to rapidly reduce carbon emissions associated with fossil fuel production and utilization.	To address complex issues in digital media and transform multidisciplinary research into user-centred solutions.	To accelerate the pace of understanding disorders of brain development and to implement solutions that improve the lives of affected children and families
Reach			
Network members	28 academia 10 government and NGO 6 industry partners	25 academia 21 private sector 6 government 10 NGOs and other 3 other NCEs	18 academia 4 not-for-profit organizations
Researchers	86	133	38
Highly Qualified Personnel (HQP)	270	70	67
Governance			
Board of Directors (BOD)	17 representatives in total	14 representatives; 3 non-voting members (made up of university, industry, federal and provincial government)	15 representatives in total
Scientific Committee	1 scientific director; 1 assistant scientific director; 4 research theme leaders (recovery, processing and capture; enabling and emerging technologies; secure carbon storage; accelerating appropriate deployment of low carbon emission technologies)	1 scientific director; 4 theme leaders, 6 co-theme leaders (nMedia, GamSim, AnImage, SocLeg, TechMeth); 11 international scientific advisory committee	1 scientific director; 10 scientific and advisory board committee members

Table E-1: Summary Profile of Networks

Characteristic	CMC	GRAND	NeuroDevNet
Management team	1 managing director 1 communications director 1 finance director 1 program manager 1 IT director 1 senior advisor 1 HQP Development coordinator 2 administrative assistants	1 scientific director 1 communications and special projects officer 1 operations coordinator 1 communications officer 1 manager, technology transfer and commercialization 1 network manager	1 scientific director 1 business development and stakeholder manager 1 senior administrator 1 finance administrator 1 executive director 1 training and education manager
Resources			
NCE Grant Contributions	$12,962,000	$11,625,000	$9,888,865
Partner Contributions – Cash	$26,569,370	$2,866,652	$288,314
Partner Contributions – In-kind	$269,266	$1,666,592	$80,000
Research Projects	36 research projects	34 research projects	12 research projects[23]

[23] NeuroDevNet has significantly fewer research projects because they fund overarching projects which include a range of sub-projects.

Annex F – Supplementary Tables

Table F-1: Cash and In-Kind Contributions of Partner Organizations
(in $)*

Fiscal Year	University		Industry		Federal		Provincial		Other		Total	
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind
2007	2,352,215	3,900,381	11,273,514	7,511,496	4,923,401	5,581,637	8,194,760	762,111	8,557,683	6,694,843	35,301,574	24,450,468
2008	2,489,747	5,625,352	14,985,809	9,569,143	4,240,060	6,795,206	7,585,935	871,404	7,466,321	5,281,271	36,767,872	28,142,376
2009	3,804,789	4,731,099	18,198,106	10,058,112	5,928,158	5,298,665	15,319,383	1,234,247	8,938,152	4,980,831	52,188,588	26,302,954
2010	1,846,527	4,144,048	15,176,382	16,617,673	6,064,205	9,117,492	15,105,267	2,698,714	9,866,184	5,242,170	48,058,565	37,820,097
2011	1,972,436	6,175,338	16,364,426	9,358,712	9,333,061	8,244,483	9,428,958	1,802,503	7,927,282	8,445,808	45,026,163	34,026,844
Total	**12,465,714**	**24,576,218**	**75,998,237**	**53,115,136**	**30,488,885**	**35,037,483**	**55,634,303**	**7,368,979**	**42,755,622**	**30,644,923**	**217,342,761**	**150,742,739**
	37,041,932		**129,113,373**		**65,526,368**		**63,003,282**		**73,400,545**		**368,085,500**	

Table F-2: Partner Contributions vs. NCE Grants

Fiscal Year	Partner Contributions			NCE Grants	Grand Total	% Partner Contributions			% NCE Program Contributions
	Cash	In-Kind	Total			Cash	In-Kind	Total	
2007	$35,301,574	$24,450,468	$59,752,042	$79,500,000	$139,252,042	25%	18%	43%	57%
2008	$36,767,872	$28,142,376	$64,910,248	$68,909,490	$133,819,738	27%	21%	49%	51%
2009	$52,188,588	$26,302,954	$78,491,542	$79,500,000	$157,991,542	33%	17%	50%	50%
2010	$48,058,565	$37,820,097	$85,878,662	$78,171,500	$164,050,162	29%	23%	52%	48%
2011	$45,026,163	$34,026,844	$79,053,007	$77,059,000	$156,112,007	29%	22%	51%	49%
Total	$217,342,761	$150,742,739	$368,085,500	$383,139,990	$751,225,490	30%	20%	49%	51%

Table F-3: Mechanisms Used to Transfer and Use

Mechanism	CMC	GRAND	NeuroDevNet	Total NCE	BL-NCE	Others
Partners						
Refereed publications	50%	n.a.	65%	63%	25%	55%
Joint refereed publications by academic and private sector researchers	0%	n.a.	12%	11%	22%	31%
Network agreements regarding intellectual property/commercialization	100%	n.a.	12%	21%	65%	44%
Filing of patent applications	0%	n.a.	0%	0%	0%	4%
Patents issued	0%	n.a.	0%	0%	0%	4%
Filing of licensing applications	0%	n.a.	0%	0%	9%	2%
Licenses issued	0%	n.a.	0%	0%	0%	0%
Execution on non-disclosure or confidentiality agreements	0%	n.a.	0%	0%	57%	16%
Filing for protection of copyright or trademark	0%	n.a.	0%	0%	9%	2%
Base (number of respondents)	**2**	**0**	**17**	**19**	**23**	**55**
Researchers						
Refereed publications	60%	84%	62%	75%	30%	66%
Joint refereed publications by academic and private sector researchers	10%	13%	15%	13%	12%	19%
Network agreements regarding intellectual property/commercialization	10%	19%	15%	16%	37%	31%
Filing of patent applications	0%	3%	15%	6%	19%	6%
Patents issued	10%	0%	0%	2%	7%	1%
Filing of licensing applications	0%	3%	0%	2%	5%	1%
Licenses issued	0%	3%	0%	2%	2%	0%
Execution on non-disclosure or confidentiality agreements	0%	22%	15%	16%	40%	15%
Filing for protection of copyright or trademark	0%	0%	8%	2%	5%	3%
Base (number of respondents)	**10**	**32**	**13**	**55**	**43**	**160**

Cells highlighted in yellow indicate statistically significant differences among sub-groups ($p<0.05$).

Table F-4: Canadian Students by Employment Sector

Degree	University		Industry		Government		Other		Unemployed		Unknown		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Employed in Canada														
Master's	534	46	398	34	93	8	83	7	49	4	n.a.	n.a.	1,157	100
PhDs	354	60	141	24	50	9	30	5	12	2	n.a.	n.a.	587	100
Post-Doctoral Fellows	210	65	62	19	22	7	24	7	6	2	n.a.	n.a.	324	100
Total	**1,098**	**53**	**601**	**29**	**165**	**8**	**137**	**7**	**67**	**3**	n.a.	n.a.	**2068**	**100**
Employed in Foreign Countries														
Master's	62	53	36	31	7	6	12	10	n.a.	n.a.	n.a.	n.a.	117	100
PhDs	100	71	26	18	9	6	6	4	n.a.	n.a.	n.a.	n.a.	141	100
Post-Doctoral Fellows	63	76	10	12	4	5	6	7	n.a.	n.a.	n.a.	n.a.	83	100
Total	**225**	**66**	**72**	**21**	**20**	**6**	**24**	**7**	n.a.	n.a.	n.a.	n.a.	**341**	**100**
Total														
Master's	596	34	434	24	100	6	95	5	49	3	496	28	1,770	100
PhDs	545	45	167	14	59	5	36	3	12	1	379	32	1,107	100
Post-Doctoral Fellows	273	45	72	12	26	4	30	5	6	1	199	33	606	100
Total	**1,323**	**38**	**673**	**19**	**185**	**5**	**161**	**5**	**67**	**2**	**1,074**	**31**	**3,483**	**100**

Table F-5: Foreign Students by Employment Sector

Degree	University		Industry		Government		Other		Unemployed		Unknown		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Employed in Canada														
Master's	124	49	95	38	6	2	13	5	15	6	n.a.	n.a.	253	100
PhDs	86	60	30	21	9	6	8	6	10	7	n.a.	n.a.	143	100
Post-Doctoral Fellows	85	68	20	16	9	7	7	6	4	3	n.a.	n.a.	125	100
Total	**295**	**57**	**145**	**28**	**24**	**5**	**28**	**5**	**29**	**5**	n.a.	n.a.	**521**	**100**
Employed in Foreign Countries														
Master's	36	40	41	46	4	5	8	9	n.a.	n.a.	n.a.	n.a.	89	100
PhDs	74	61	36	29	7	6	5	4	n.a.	n.a.	n.a.	n.a.	122	100
Post-Doctoral Fellows	158	77	21	10	7	3	20	10	n.a.	n.a.	n.a.	n.a.	206	100
Total	**268**	**64**	**98**	**24**	**18**	**4**	**33**	**8**	n.a.	n.a.	n.a.	n.a.	**417**	**100**
Total														
Master's	160	37	136	31	10	2	21	5	15	3	91	21	433	100
PhDs	160	48	66	20	16	5	13	4	10	3	70	21	335	100
Post-Doctoral Fellows	243	64	41	11	16	4	27	7	4	1	46	12	377	100
Total	**563**	**49**	**243**	**21**	**42**	**4**	**61**	**5**	**29**	**3**	**207**	**18**	**1,145**	**100**

Table F-6: Total Canadian and Foreign Students by Employment Sector

Degree	University		Industry		Government		Other		Unemployed		Unknown		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Employed in Canada														
Master's	658	47	493	35	99	7	96	7	64	4	n.a.	n.a.	1,410	100
PhDs	440	60	171	23	59	8	38	5	22	3	n.a.	n.a.	730	100
Post-Doctoral Fellows	295	66	82	18	31	7	31	7	10	2	n.a.	n.a.	449	100
Total	**1,393**	**54**	**746**	**29**	**189**	**7**	**165**	**6**	**96**	**4**	n.a.	n.a.	**2,589**	**100**
Employed in Foreign Countries														
Master's	98	48	77	37	11	5	20	10	n.a.	n.a.	n.a.	n.a.	206	100
PhDs	174	66	62	24	16	6	11	4	n.a.	n.a.	n.a.	n.a.	263	100
Post-Doctoral Fellows	221	76	31	11	11	4	26	9	n.a.	n.a.	n.a.	n.a.	289	100
Total	**493**	**65**	**170**	**22**	**38**	**5**	**57**	**8**	n.a.	n.a.	n.a.	n.a.	**758**	**100**
Total														
Master's	756	34	570	26	110	5	116	5	64	3	587	27	2,203	100
PhDs	614	43	233	16	75	5	49	3	22	2	449	31	1,442	100
Post-Doctoral Fellows	516	53	113	11	42	4	57	6	10	1	245	25	983	100
Total	**1,886**	**41**	**916**	**20**	**227**	**5**	**222**	**5**	**96**	**2**	**1,281**	**28**	**4,628**	**100**