CANARIE Annual Business Plan 2017-18

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1 Overview

CANARIE is pleased to present its Annual Business Plan for fiscal year 2017-18 (FY18). The document includes past accomplishments as well as CANARIE's future plans to achieve its expected results. Risks and risk mitigation strategies are also presented.

CANARIE's programming and activities are defined by the following trends that are shifting the research and innovation landscape:

1) the digitization of research,

2) the use of data analytics in all research fields,

3) data preservation and reuse, and

4) the adoption of cloud technologies in all sectors.

These trends continue to drive CANARIE's programs and investments into Canada's National Research and Education Network (NREN). In FY18, CANARIE will continue to launch and execute programs that build on strong foundations and evolve to support better alignment and integration of the components of digital research infrastructure.

CANARIE's planned activities include the ongoing evolution and expansion of the research and education network; management of the Research Software program and the expansion of the user community for these powerful research software tools; and the evolution of services, and expansion of the user base for the Digital Accelerator for Innovation and Research (DAIR) program. To complement its key programs, CANARIE will continue to offer value-added services (access and identity management solutions) to introduce efficiencies in research workflows as well as to improve the user experience. CANARIE will work with the research community and the granting councils to foster the development of a national approach to research data management through its support of Research Data Canada. Lastly, CANARIE will continue to work with its private sector and academic partners in the Centre of Excellence in Next Generation Networks (CENGN), to support the rapid commercialization of leading-edge networking technologies.

2 About CANARIE

Role of CANARIE

CANARIE's role in Canada's innovation ecosystem was set out in its 1993 Articles of Incorporation: *to contribute to Canadian competitiveness in all sectors of the economy, to wealth and job creation and to the quality of life of Canadians.* CANARIE achieves this by designing and delivering digital infrastructure, and driving its adoption among Canada's research, education and innovation communities.

This direction to CANARIE to contribute to competitiveness "in all sectors of the economy" informs the horizontal perspective that CANARIE takes to Canada's innovation ecosystem. Rather than addressing the needs of a specific vertical sector, CANARIE looks across the public, private and not-for-profit research, education and innovation sectors to identify gaps, and then, through community engagement, works to address those gaps with a range of services and programs.

This horizontal view has driven CANARIE activities over the course of its history, and has helped shape Canada's digital infrastructure landscape. The following represents a sampling of these initiatives:

- laying the groundwork, with universities and provincial partner networks, for the first commercial Internet in Canada;
- incubating the Internet Registration Authority in Canada, now known as CIRA;
- supporting hundreds of Canadian businesses, educational and health organizations in their transition to digital models and processes via the Technology Development, Technology Diffusion program, Technology Applications Development program, and E-business, E-learning and E-health programs; and
- developing the grid certificate authority in Canada that provides secure access to data generated from the Large Hadron Collider and other advanced digital technologies.

More recently, CANARIE has:

- worked with provincial and territorial network partners to continually evolve what is arguably one of the world's leading National Research and Education Networks, which supports Canadians from coast to coast to coast engaged in advanced research, education and innovation;
- worked with global peers to align international research and education infrastructures to support globally collaborative research, including, most recently, the completion of the world's first 100G transatlantic network link for research and education purposes;
- ensured Canadians benefit from a robust Identity and Access Management framework, aligned with international frameworks, that provides secure access to digital services and resources in Canada and around the world;
- identified the gap in research software in the ecosystem and championed the development of powerful research software tools to accelerate discovery, including the creation of a software registry that makes reusable software tools available to all researchers;
- recognized the need to develop and evolve a national strategy for research data management, and is supporting Research Data Canada as it works with stakeholders to develop this strategy; and
- incented Canada's small business community to embrace cloud computing technologies, providing more than 600 businesses with cloud resources that enable rapid product development and accelerated time-to-market.

CANARIE's current activities build on these successes and respond to evolving research, technology and policy environments. CANARIE understands the value and impact of ever-increasing amounts of digital data on research, education and innovation, and works with stakeholders to ensure Canadians have the digital infrastructure ecosystem that can leverage these data assets to support Canadian leadership in multidisciplinary discovery and innovation.

CANARIE Funding

The majority of the funding for CANARIE is provided by the Government of Canada through a Contribution Agreement with Innovation, Science and Economic Development Canada. The Government of Canada's ongoing confidence and investment in CANARIE since 1993 is a testament to the critical nature of the infrastructure and the role that digital infrastructure plays in leveraging complementary government investments in research and innovation.

Focus of Activities: 2015 – 2020 Mandate

CANARIE's focus in its current mandate is on strengthening Canada's digital infrastructure ecosystem, as Canadians engaged in data-intensive, collaborative research and innovation are increasingly dependent on this critical infrastructure.

CANARIE will also work with the community to improve the security of the NREN and of institutions connected to the NREN. Through the Joint Security Project, NREN partners and representatives from connected institutions will work collaboratively to develop a national view of the security position of the NREN and institutions connected to it.

CANARIE activities in the current mandate will focus on the following three areas, which align directly with the Expected Results outlined in CANARIE's Contribution Agreement with the Government of Canada.

Network Operations

In order to address the evolving needs of users in the research, education and innovation communities, CANARIE operates and evolves a pan-Canadian collaboration capability through the delivery of a world-leading high performance network and network-based services. CANARIE will:

   a) Increase network capacity and performance to keep pace with the growth in demand (currently an annual average growth rate of ~50%);

   b) Expand network reach to address the needs of the research and education communities from coast to coast to coast; and

   c) Evolve the network services portfolio to enhance research, collaboration and innovation.

Technology Innovation

To bring new collaboration capabilities not previously offered to Canada's research community by creating and funding new software technologies. CANARIE will:

   a) Drive the adoption of software tools and services to utilize and exploit data;

   b) Increase the impact of tools and services to users;

   c) Support research data management through the development of tools and applications; and

   d) Promote the collaborative development of data management tools.

Private Sector Innovation

In order to leverage CANARIE resources to stimulate commercialization, CANARIE delivers a cloud-based program, the Digital Accelerator for Innovation and Research (DAIR) that enables advanced information and communications technology (ICT) research and provides an opportunity for entrepreneurs to accelerate time-to-market. CANARIE will:

a) Leverage the network to support innovation, development and adoption of transformative ICT technologies; and

b) Facilitate academic and private sector partnerships to drive collaborative innovation and commercialization.

To leverage the investment in the network, CANARIE supports CENGN's role to foster innovation and commercialization of new ICT technologies in partnership with CENGN. CANARIE will:

a) Allow access to the CANARIE network to support the CENGN testbed

3   2015-16 Accomplishments

The following sections describe CANARIE's accomplishments under each of the three Eligible Activities outlined in the Contribution Agreement that governs CANARIE's programs from 2015-2020:

3.1   Network Operations

To evolve and expand the CANARIE network in a flexible and cost-effective manner over the long-term, CANARIE's vision is to deploy fibre from coast-to-coast across Canada. In high-use, high-growth network corridors, CANARIE purchased fibre and therefore has the flexibility to add capacity and deploy transformative technologies at a considerably lower incremental cost. The alternative, which is a leased services model, has the cost/traffic curve that is linearly much higher, and would become prohibitively expensive as network traffic continues to grow annually at ~50%.

In FY16 CANARIE

- Collaborated with NORDUnet, Internet2 and SURFnet to operationalize the Advanced North Atlantic (ANA-200G) infrastructure and migrated all services from the previous 10Gbit/s circuit to the new ANA infrastructure.

- Completed the build of the 100Gbit/s redundant infrastructure from Vancouver to Montreal, including 100Gbit/s wavelengths to international Research and Education (R&E) exchanges in Seattle, Chicago and New York.

- Completed the deployment of the high availability connection service from coast-to-coast, and migrated most of CANARIE Lightpath services to the new service.

- Completed 80% of the Atlantic fibre system build. An interim solution was deployed to link the Montréal hub to Halifax hub until the full fibre system is completed. In addition, the New Brunswick Regional Network provisioned some of their network services over the new fibre system.

- Deployed the first Network Operations Centre (NOC) portal tool to allow *eduroam* administrators to access monthly *eduroam* usage reports.

- Continued to explore more cost effective alternatives to existing connections for increasing network capacity to the north.

- Collaborated with its provincial and territorial partners on a cybersecurity initiative that formalizes the procedure and process of detecting and reporting Distributed Denial of Service (DDoS) attacks; and, continued to work with its partners to develop and implement best practices in network security monitoring.

- Continued to work with provincial and territorial network partners to evolve the National Research and Education Network (NREN) through the NREN Program. Key accomplishments include:

  o Defined and launched the first competitive call of the 2015-2020 mandate, which resulted in thirteen funded projects that upgrade equipment, extend the network, and increase network capacity and reliability.

- - o Worked in partnership with the RANs to engage a consultancy firm to develop a strategic plan for the NREN. The plan forms the basis for the NREN to work on shared national priorities and initiatives.

    - o Defined a funding model to support the implementation of national initiatives resulting from the NREN Strategic Plan.

- Continued to represent Canada in other international initiatives to advance research and education networks:

    - o CANARIE participates in, and is co-chair of the Global Lambda Integrated Facility (GLIF), an international consortium that provides advanced networking services to support data-intensive scientific research. The GLIF brings together the world's leading R&E networking engineers to develop an international infrastructure and advanced services.

    - o CANARIE led Canada's involvement in the Global Ring Network for Advanced Applications Development (GLORIAD), a network of networks linking research networks across Asia, North America and Europe, allowing scientific and research communities on 3 continents to move large volumes of data effortlessly.

- Continued to operate the Canadian Access Federation (CAF), a service to enable higher-education communities to access Wi-Fi services (through *eduroam*) and other protected online content using their existing institutional credentials (i.e. username and password). Use of these services continues to increase with the addition of new participants and more wide spread use of eduroam and single-sign on.

3.2 Technology Innovation

1) Research Software

CANARIE continued to champion the development of powerful research software tools that accelerate discovery and enable research funds to focus on research activity rather than software development. Research software enables users to seamlessly access digital infrastructure and resources without having expert knowledge of these infrastructures, thereby expanding use of these resources across many research domains.

These tools are available via CANARIE's online research software portal (science.canarie.ca). The online portal, the first of its kind in Canada, allows users to find reusable software services and examine each service's availability and usage statistics. The online portal creates a national clearinghouse for research software, and provides seamless access to advanced software tools in order to spur broad adoption by the research community.

In FY16, CANARIE

- Oversaw the completion of 53 research platforms and components from the last two calls of the 2012-2015 mandate. Forty-four components from these calls were added to the portal at science.canarie.ca, bringing the total number of registered items to 67.

- Completed the NEP-RPI sustaining call. This call allowed platform developers from the final two calls of the previous mandate to continue to evolve and support their platforms until the re-launch of the program in this mandate.

- Completed the maintenance phase of projects funded in the previous mandate. Past program participants were funded to extract the initial group of services from their existing platforms and to maintain these services on behalf of users until March 2016.

- Defined and launched Research Software Call 1 for the 2015-2020 mandate. This call included an Expression of Interest (EOI) round which allowed CANARIE to encourage participants to explore software development collaborations prior to proposal creation. Six (6) projects were funded under this call.

- Collaborated with the CFI and Genome Canada to explore mechanisms for aligning software projects in the community.

- Began defining Research Software Call 2, a pilot call based on software sharing through direct platform reuse.

2) Research Data Management

In FY16, CANARIE

- Provided funding, consistent with community input, to support Research Data Canada (RDC). RDC is an organization whose overarching goal is to improve the management of research data in Canada. CANARIE also hired an Executive Director for RDC.

3.3 Private Sector Innovation

Under the Private Sector Innovation objective, CANARIE leveraged its infrastructure and relationships to support adoption of digital technologies by Canadian SMEs to advance innovation and commercialization.

In FY16, CANARIE

- Leveraged strong partnerships with a range of organizations to increase the visibility of the DAIR offering to Canadian SMEs. These include the Funding Road Show, Startup Canada, the IRAP Concierge program, the Association of University Research Parks, colleges, and a range of incubators across the country. These partnerships supported a 72% year over year growth of DAIR users, growing the user base from 370 to 635.

- CANARIE became a founding partner in the Centre of Excellence in Next-Generation Networks. CENGN is a consortium of industry, academic and research leaders who are pooling their expertise and equipment to lower the commercialization barrier for Canadian SMEs and researchers. CANARIE supported CENGN in a number of activities related to the development of its testbed including directly using the CANARIE network to enable the trial of an advanced networking solution involving two emerging Canadian solution providers.

4 2017-18 Planned Activities

FY18 is the third fiscal year of CANARIE's 2015-2020 mandate. In order to deliver on its expected results for the mandate, CANARIE will undertake the following activities in the 2017-18 fiscal year:

4.1 Network Operations

CANARIE will continue to undertake all required activities to support and evolve the existing CANARIE network and the services delivered over it.

1) Network Program – As a result of this program, the CANARIE network will continue to operate and evolve as essential research infrastructure to support research, education and innovation. To achieve the results of this program, the following activities will be undertaken in the 2017-18 fiscal year:

   i. Operate the network

   ii. Increase capacity, redundancy, and reliability

   iii. Continue to enhance network security and measurement monitoring tools

   iv. Continue to enhance user access to support tools

   v. Trial software-driven network services

   The following measurable short and medium term outcomes will be achieved in FY18:

   - Renewal or development of an alternative to the Western ROADM fibre

   - Improved core node reliability

   - Implementation of network security monitoring and measurement system

   - Software Driven Network Service developed

   - Deployment of support tools accessible through the user portal

   - RFP launched to explore opportunities to increase connectivity to northern regions

2) NREN Program – Through this program, CANARIE will continue to strengthen the impact of the co-delivery model with the regional networks to ensure greater consistency of access to infrastructure and services across the NREN. To achieve this, the following activities will be undertaken in the 2017-18 fiscal year:

   i. Extend capacity, redundancy, and reliability through RAN networks

   ii. Extend 100Gbit/s reach outward from CANARIE

   iii. Connect institutional facilities

   iv. Strengthen NREN partnerships

   v. Launch third competitive call

   The following measurable short and medium term outcomes will be achieved in FY18

   - Third competitive funding call will be issued to meet NREN requirements

   - Increased reliability and capacity on network segments shared by RANs

- Strategic alignment of NREN partners on the evolution of the NREN and the development and launch of priority projects in security and identity management

3) Canadian Access Federation (CAF) Program – As a result of this program, Canada will continue to benefit from robust identity and access management services that enable secure and efficient remote access to distributed resources and tools, anytime. To achieve the results of this program, the following activities will be undertaken in the 2017-18 fiscal year:

   i. Adapt services to evolving standards

   ii. Increase awareness and adoption

   iii. Increase ease of service deployment, operation, and use

   iv. Expand identity services

The following measurable short and medium term outcomes will be achieved in FY18:

- Increased adoption of CAF services, projected to grow to 151 participants by the end of FY18 based on the FY17 projected count of 141.

4) Infrastructure Extension Program (IEP) – As a result of this program, government research institutes will continue to leverage the research network in support of collaborative research with national and international partners. To achieve the results of this program, the following activities will be undertaken the 2017-18 fiscal year:

   i. Provide high-speed network connections to government research facilities

   ii. Ensure connections are adequate to meet user needs

The following measurable short and medium term outcome will be achieved in FY18:

- Connections continued to government research facilities that meet the performance needs of the government science community.

4.2 Technology Innovation

1) Research Software – As a result of this program, CANARIE will continue to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers. To achieve the results of this program, the following will be undertaken in the 2017-18 fiscal year:

   i) Continue to enhance and promote the research software portal at science.canarie.ca

   ii) Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community

   iii) Support and monitor funded projects in Calls 1 and 2

   iv) Define and launch Call 3 based on the results of Call 2

   v) Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers

The following measurable short and medium term outcomes will be achieved in FY18:

- Increase in visits to science.canarie.ca by 4,000 unique visits over FY17 levels

- Contracts in place and execution underway for all approved Call 2 platform contribution projects

- At least one additional research team adopting each of the platforms contributed in Call 2

- Results of a Canada-wide survey of research software developers available to shape the ongoing evolution of the Research Software program

2) Research Data Management – As a result of this program, CANARIE will contribute towards promoting that Canada's publicly funded data be available to accelerate discovery and commercialization by the academic and private sectors. The following activities will be undertaken in the 2017-18 fiscal year:

   i. Community coordination in support of policy creation, national standards, infrastructure and tools

   ii. National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations

   iii. Communication with international data infrastructure providers to work towards Canadian research data infrastructure that is compatible with international approaches

As Research Data Management is a stakeholder led initiative, the ability for CANARIE to develop targets is limited. However, the following measurable short and medium term outcomes will be achieved in FY18:

- Research data management projects and initiatives that enhance Canadian reuse of research data.

- Completion of a vision document describing Canada's research data management ecosystem, including gaps, opportunities and international partnerships

4.3 Private Sector Innovation

The activities undertaken will include the delivery of the following programs, along with key initiatives listed under each program:

1) DAIR Cloud Testbed – As a result of this program, CANARIE will continue to leverage the CANARIE network to support Canadian firms' ability to develop and test innovative ICT applications. To achieve the results of this program, the following activities will be undertaken in the 2017-18 fiscal year:

   i. Operate the cloud platform

   ii. Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market

   iii. Create and publish educational content related to efficient use of cloud services

The following measurable short and medium term outcomes will be achieved in FY18:

- Continued increase in the total number of DAIR users to 1050 by the end of FY18 based on the FY17 projection of 850.

- New features added to the DAIR cloud infrastructure

- Content released to educate SMEs on efficient use of cloud services

2) CENGN Network Testbed – As a result of this program, the CANARIE network will be used to foster innovation and commercialization of new ICT technologies in partnership with CENGN. To achieve the results of this program, the following activities will be undertaken in the 2017-18 fiscal year:

   i. Network connectivity and related support for CENGN test bed initiative

The following measurable short and medium term outcome will be achieved in FY18:

- Additional participants in CENGN will be able to leverage the CANARIE network to support advanced testing and demonstration of new ICT products and services.

5 Program Delivery Timelines

Eligible Activities	Initiatives	2017-18			
		Q1	Q2	Q3	Q4
Network Operations					
Network Program	Operate the Network	Ongoing			
	Increase capacity, redundancy, reliability	Next project to increase network redundancy			
	Continue to enhance network security and measurement monitoring tools		Deployment of monitoring services		
	Continue to enhance user access to support tools	Development of support tools			
	Experimental software driven network services			Project to create software driven services	
NREN Program	Extend capacity, redundancy, reliability through RAN networks	Ongoing			
	Extend 100G reach outward from CANARIE	Ongoing			
	Connect institutional facilities	Ongoing			
	Strengthen NREN partnerships	Ongoing			
	Launch third competitive call			EOI/ Proposals	Approval
CAF Program	Adapt services to evolving standards	Ongoing			
	Increase awareness and adoption	Ongoing			
	Increase ease of service deployment, operation, and use	Ongoing			
	Expand on identity services	Ongoing			
IEP Program	Provide high-speed network connections to government research facilities	Ongoing			
	Ensure connections are adequate to meet user needs	Ongoing			
Technology Innovation					
Research Software Program	Continue to enhance and promote the research software portal at science.canarie.ca	Ongoing			
	Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community	Ongoing			
	Support and monitor funded projects in calls 1 and 2	Ongoing			
	Define and launch Call 3 based on the results of Call 2			Launch	
	Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers	Ongoing			
Research Data Management	Community coordination in support of policy creation, national standards, infrastructure and tools	Ongoing			
	National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations	Ongoing			
	Communication with international data infrastructure providers to work towards Canadian research data infrastructure that is compatible with international approaches	Ongoing			
Private Sector Innovation					
DAIR Cloud Testbed	Operate the cloud platform	Ongoing			
	Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market		Create content		
	Create and publish educational content related to efficient use of cloud services		Create content		
CENGN Network Testbed	Network connectivity and related support for CENGN testbed initiative	Ongoing			

6 Financial Plan

Economic Action Plan 2015 announced $105 million in funding for CANARIE over five years to support the activities of CANARIE. CANARIE has identified a cash flow requirement of $23.3 million for the 2017-18 funding year.

CANARIE covenants and agrees to hold, invest, administer, and disburse that amount in accordance with the stipulations of the Contribution Agreement. No interest or investment income is payable by the Minister on the funds to be provided.

6.1 Program Revenues and Expenses

For the fiscal year	**2017-18**
(in 000s)	
REVENUES	
FUNDING	
Innovation, Science and Economic Development Funding	23,300
TOTAL FUNDING	**23,300**
PROGRAM REVENUES	
User Fees	537
Interest Income	62
TOTAL PROGRAM REVENUES	**599**
TOTAL REVENUES	**23,899**
EXPENSES	
PROGRAM EXPENSES	
Network Operations	
Network Infrastructure & Services	13,324
NREN Program	2,576
Technology Innovation	
Research Software	3,007
Digital Infrastructure Innovation	350
Research Data Management	310
Private Sector Innovation	1,189
TOTAL PROGRAM EXPENSES	**20,756**
Operating Expenses & General Overhead	3,143
TOTAL EXPENSES	**23,899**
EXCESS OF REVENUES OVER EXPENSES	**0**

6.2 Cost Recovery

The following table summarizes CANARIE's cost recovery projections for the fiscal year.

For the fiscal year	2017-18
(in 000s)	
CASH	
IEP End User Fees - federal	100
IEP End User Fees - Non-federal	195
CAF Participation Fees	240
DAIR User Fees	2
TOTAL CASH	**537**
IN-KIND	
Research Software	**292**
MATCHING FUNDS	
NREN Program	648
DAIR	49
TOTAL MATCHING FUNDS	**697**
TOTAL COST RECOVERY	**1,526**

Throughout 2017-18, CANARIE will continue to charge fees to users of CANARIE services and programs.

- As part of the legacy infrastructure extension program (IEP), CANARIE supports the costs to connect federal and non-federal labs to the NREN. The federal IEP connections cost recovery is a fixed annual amount paid by Shared Services Canada to offset the total annual cost of supporting these connections. For non-federal IEP connections, 2017-18 is the fifth year of a five-year plan to wind down funding for those connections; the amount in the budget represents 100% cost recovery of planned expenditures.

- The cost recovery for the CAF program will consist entirely of participation fees. The DAIR program cost recovery is comprised of user fees.

- In-kind cost recovery for the Research Software program represents a contribution from users that can include the time spent during development by the Principal Investigator, university faculty or administrative staff.

- The overall NREN program will result in at least a 65/35 split of costs between CANARIE and other funding sources (e.g., provincial government, RAN's partner funds, etc.) for funded projects. CANARIE's contribution level will be determined on a project-by-project basis – i.e., some may have a higher than 65% contribution (up to 100%) from CANARIE, and others may be lower. CANARIE will ensure the outcome of the NREN program meets its overall cost recovery target, hence, greater priority will be given to projects which have leveraged contributions.

- The DAIR program expects to realize matching funds on funded projects.

6.3 Funding Requirements

As indicated in the Program Revenues and Expenses shown above in Section 6.1, CANARIE's cash requirement for the 2017-18 fiscal year is $23.3 million. Subsequent to the 2017-18 cash requirement, the

balance remaining to be drawn down from the $105 million Contribution will be $46.7 million for the final two years of this mandate.

6.4   Investment Policy and Strategy

CANARIE shall continue to invest and manage any advanced funds according to investment policies, standards and procedures that a prudent person would follow in making investment decisions regarding property belonging to others. CANARIE will manage the funds in accordance with the Contribution Agreement and in particular, the investment directives contained in Article IV of the Contribution Agreement. The objectives are twofold: (a) to provide funds on an "as needed" basis to meet the disbursement needs of CANARIE and (b) to maximize the investment income earned by CANARIE, subject to the Investment Policy and Investment Strategy adopted by CANARIE.

The Investment Policy and the Investment Strategy specify permitted transactions, risk limitations for all market and credit risks faced by CANARIE, and levels of authority of officials who can commit CANARIE to different types of transactions. The Investment Policy and Investment Strategy must be updated at the beginning of the mandate and then reviewed annually. The Policy and Strategy were most recently updated, reviewed, and approved by the Audit and Investment Committee in October 2016. The Investment Policy is guided by the constraints contained in the Contribution Agreement.

7 Risk Assessment, Mitigation Strategies, and Performance Monitoring Strategies

Due to the diversity and complexity of the ecosystem CANARIE operates in, risk management is essential for CANARIE to achieve the expected results defined in the Contribution Agreement.

Identified risks are classified based on the likelihood of occurrence of the risk, as well as the severity of the negative impact of the risk. The treatment of identified risks will vary based on these two dimensions as per the table below:

		Likelihood		
		Low (LL)	**Medium (ML)**	**High (HL)**
Potential Impact	**Low (LI)**	Accept risks	Accept risks with monitoring	Monitor and manage risks
	Medium (MI)	Accept risks with monitoring	Develop formal risk mitigation measures	Develop formal risk mitigation plan
	High (HI)	Identify mitigation steps and monitor regularly	Develop formal risk mitigation measures and monitor regularly	Develop formal risk mitigation plan and monitor regularly

1) Risks to delivery of the Contribution Agreement expected results:

   a) Insufficient funds to meet emerging needs over the duration of the mandate (ML, MI)

   Risk Statement:

   The amount of funding has remained flat from the previous mandate and may hinder the organization's ability to fully deliver on its expected results.

   Risk Mitigation:

   - Where possible, continue to reduced fixed costs in the network as well as in the IEP program, as these represent the highest recurring annual costs to the organization;

   - Monitor cost recovery to ensure targets are being met; and,

   - Leverage Board oversight to ensure appropriate balance of investments across programs.

   b) Network Operations Risks (ML, MI)

   A critical component in undertaking the Network Operations activities is the completion and operationalization of the 100G national backbone from Halifax, NS, to Victoria, BC.

   Risk Statement:

There is a risk that fibre needed to complete certain segments is either unavailable or too costly to procure or maintain. Among other things, this would make CANARIE less agile to respond to the needs of the research community, as well as face ever-growing network costs through the use of a growing number of leased wavelength services.

Risk Mitigation:

- Establish and maintain senior level relationships with fibre and equipment providers;

- Engage Board and advisory committee members, where appropriate, to work within their organizations to support this initiative; and

- Identify suppliers of new fibre to build additional capacity in the main east-west network corridor.

c) Technology Innovation Risks (LL, HI)

The main program supporting this activity is the Research Software program. This program goal is to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers, while addressing a broader set of research disciplines.

Risk Statement:

Low adoption of the new interdisciplinary software development and the approach by the broader research and education community poses a significant risk to this program.

Risk Mitigation:

- Continued early engagement with research developers and researchers by using workshops, online communication tools etc.;

- Continued engagement with the Research Advisory Committee and ensuring its evolution to allow researchers' input to guide the program, while gaining their buy-in; and

- Strengthen alignment with other research software funders e.g. the CFI and Genome Canada, partnering with them to ensure greater synergies among funded platforms.

d) Research Data Management (ML, LI)

The mission statement for Research Data Canada (RDC) is to work with stakeholders to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Statement:

There is a risk that the stakeholder community remains fragmented with limited alignment on the objective to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Mitigation:

- Use of RDC working groups to address various topics required for alignment;

- Continued advocacy and engagement of stakeholders; and

- Advocacy of international best practices in research data management.

e) Private Sector Innovation Risks (LL, HI)

The main program supporting this eligible activity is the Digital Accelerator for Innovation and Research (DAIR) service. The primary goal of this program is to incentivize growth of Canada's ICT sector.

Risk Statement:

There is a risk that DAIR will not evolve to offer new services that are critical to the changing needs of the ICT sector, SMEs in particular and, therefore, become less relevant.

Risk Mitigation:

- Continuous interactions with SMEs and commercialization-supporting organizations (e.g. incubators, accelerators) to evolve the DAIR program;

- Marketing outreach programs to increase the awareness of the DAIR service;

- Working with other organizations that focus on SMEs such as IRAP to develop a consolidated offering; and

- Assess the utility of the service via user surveys and performance metrics.

2) Program Delivery Risks

   a) Service Delivery via RANs (LL, HI)

   Risk Statement:

   The provincial and territorial RAN partners are separate organizations and, as such, may have objectives, which are not aligned with CANARIE objectives. As a result, this non-alignment could impact, or impede, CANARIE's ability to deliver on its mandate.

   Risk Mitigation:

   Ongoing effort to ensure alignment of provincial and territorial objectives with national objectives is essential. Specific activities include:

   - Ongoing support for the NREN Governance Committee, comprised of CANARIE and RAN presidents;

   - Creation of an NREN Business Strategic Plan to identity NREN priorities;

   - Ensure program funding to the RANs is structured in a manner to assist in attaining NREN objectives that also support CANARIE's network objectives; and

   - Ensure one CANARIE Board member represents RANs.

   b) Attrition (ML-MI)

   Risk Statement:

   Loss of senior staff, key employees or key Board members could jeopardize the organization's ability to deliver on its programs.

   Risk Mitigation:

   For Board members:

   - Board members are asked for a minimum 3 year term commitment;

   - The Vice-Chair is the planned successor to the Chair and agrees to a 6 year term commitment upon commencing as Vice-Chair; and

- The Governance and Nominating Committee meets at least quarterly.

For internal staff:

- Succession planning for key staff;

- Performance evaluation with career discussions with all employees every 6 months; and

- Ongoing IT investments for information and knowledge retention.

3) Performance Monitoring Strategies

CANARIE collects metrics internally for all its programs, services, and for the network. External performance metrics are collected from the community in the form of user surveys and reports, and reporting from the regional networks. CANARIE works with Innovation, Science and Economic Development to integrate this information as part of an overall performance management strategy. Additionally, performance data for each eligible activity are included as part of CANARIE's annual reporting.

8 Representation

CANARIE Inc. represents that it is not in default under the terms of the Contribution Agreement that is currently in force.