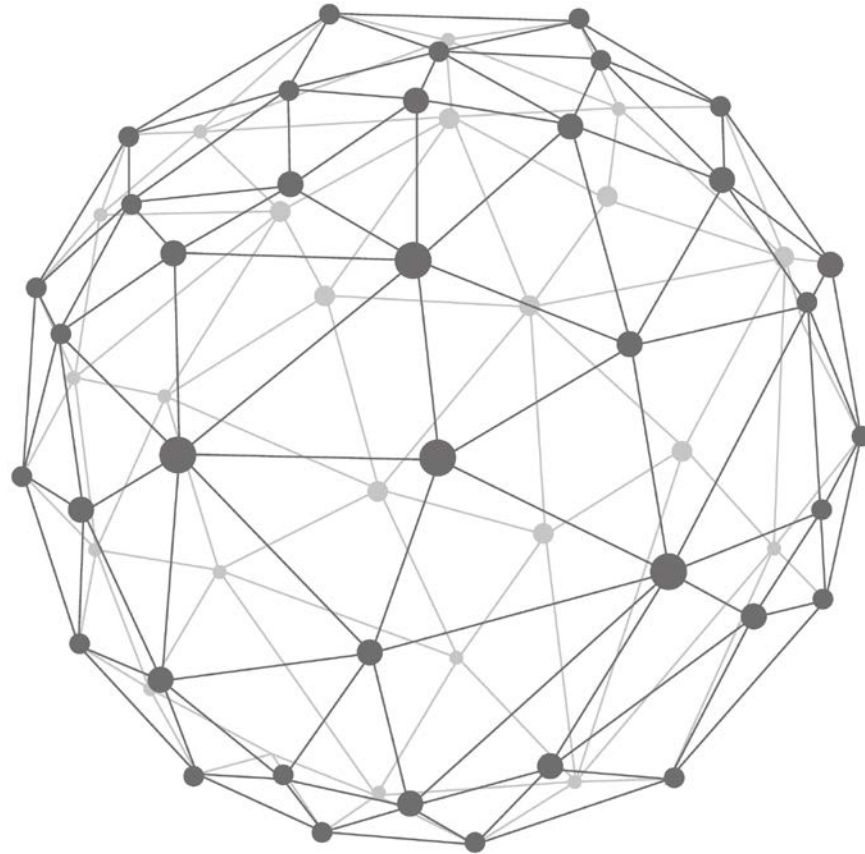




Ontario Centres of Excellence

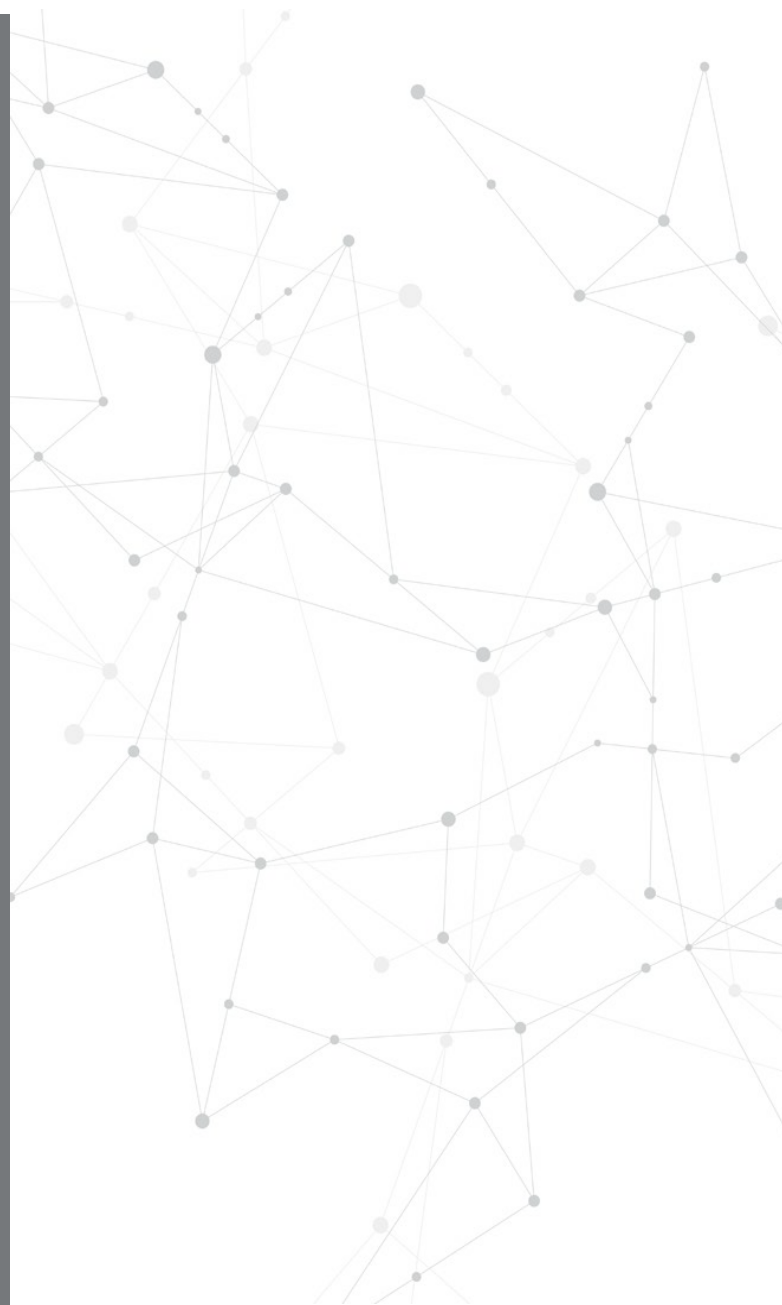
Economic Contributions Analysis

September 2018

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Executive Summary

Ontario Centres of Excellence (OCE) is contributing to the transformation of the Ontario economy

OCE engaged Deloitte to undertake an assessment of the economic impact of OCE-funded project investments.

To understand the importance of OCE's contribution to the Ontario economy, it is essential to understand the main policy issues that OCE is helping to address.

Context

Ontario needs to transform its main drivers of economic growth and prosperity.

Ontario has a mature, advanced economy and it has many strengths; but, it is also experiencing tectonic forces that are disrupting economic performance, constraining innovation and hampering competitiveness. These forces limit growth in living standards and are creating fiscal pressures.

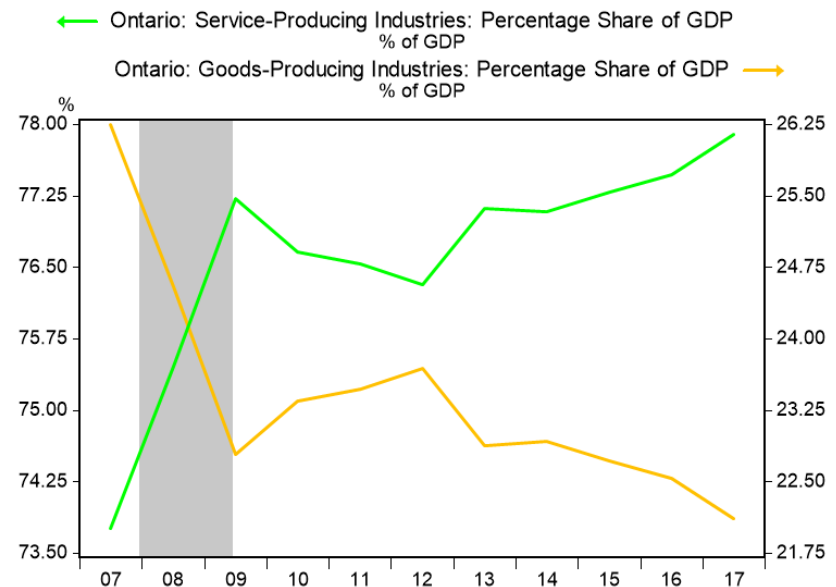
Globalization and technical change have increased foreign competition, changed the nature of demand for labour market skills, and weakened the growth rates of many sectors that have traditionally fueled the province's economic growth. At the same time, demographic pressure from an aging population is slowing labour force growth.

As a result, the composition of the Ontario economy is structurally shifting towards services and high-tech manufacturing, but there are obstacles to this transition which means markets require some incentives to facilitate change. OCE's activities are an example of such incentives.

An economic conundrum in Canada and Ontario is the trend of slowing productivity growth, which is the primary source for a rising standard of living. Many different factors are likely contributing. Commonly cited factors are: limited R&D, low patent creation, slow commercialization, reluctance by businesses to make capital investments, difficulty scaling businesses, and risk aversion.

A key dimension often flagged in economic studies about Canada's commercialization challenge is that a large portion of R&D is done at post-secondary institutions, rather than at private sector firms. This slows or stalls the process from innovation to commercial application.

OCE's activities are targeted at addressing the above mentioned core issues. It does this by taking a leadership and co-investment role with the goal of building a competitive, knowledge-based Ontario economy.



Source: Statistics Canada/Haver Analytics

Executive Summary

Ontario Centres of Excellence's (OCE's) mission is to accelerate innovation through commercialization of leading research in order to create sustainable prosperity

OCE is a not-for-profit organization that was formally established in 1987 as seven independent centres that evolved and amalgamated into the Ontario Centres of Excellence Inc. in 2004.

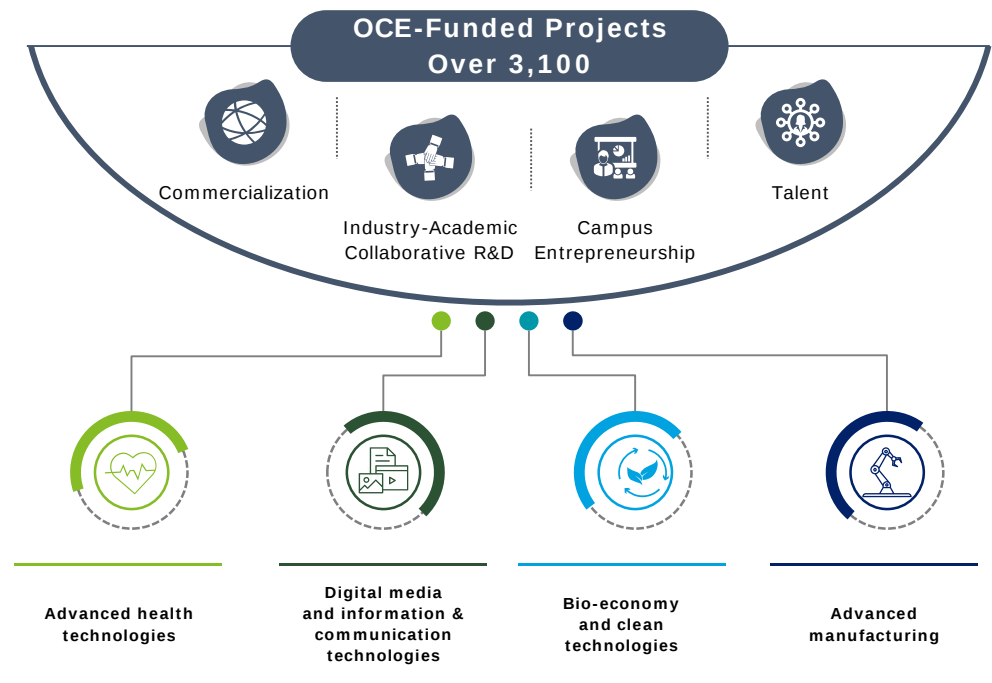
OCE receives funding primarily from the Ontario government with additional program funding from the federal government. This funding is matched by industry, with industry contributions being approximately 2.2 times the funding provided by the government. This model creates an incentive for investment.

On behalf of the Ontario government, and in partnership with industry, OCE co-invests to commercialize innovation originating in the province's publicly-funded colleges, universities and research hospitals. This approach unlocks the productivity-enhancing potential of public-sector research.

OCE also supports and invests in early-stage companies. By investing provincial government funding, OCE also supports Ontario's economic development efforts by supporting entrepreneurs, start-ups, industry, academia and investors to commercialize new products, services, and technologies, create new jobs, and grow their businesses. This is a catalyst for increased economic activity and opportunities.

As shown to the right, the provincial funding for projects through OCE is offered through four program areas that are focused on four of Ontario's key economic sectors. This not only fosters economic growth, but also contributes to the development of economic clusters.

Overview of OCE Program Areas and Priority Sectors (F2015-18) *



*F2015-18 refers to April 1, 2014 to March 31, 2018 throughout this report.

Executive Summary

The OCE business delivery model is based on the participation of the private sector to equally match, at a minimum, OCE's initial project investment. This private sector co-investment requirement is the defining feature that enables further economic activity throughout the Ontario economy. This delivery structure can be viewed as a catalyst to attract subsequent follow-on investments by angel investors and venture capital funds to the OCE-program participant firms.

The analysis conducted in this report has two dimensions:

1. Segmentation of OCE-funded project activity, encompassing:
 - (i) OCE project investment funding
 - (ii) Co-investments by industry in OCE projects
 - (iii) Follow-on investments in firms that undertook OCE projects; and, incremental sales generated by OCE-project participating firms
2. Estimation of the economic contributions associated with all of the above segments.

1. Segmentation of OCE-funded project activity

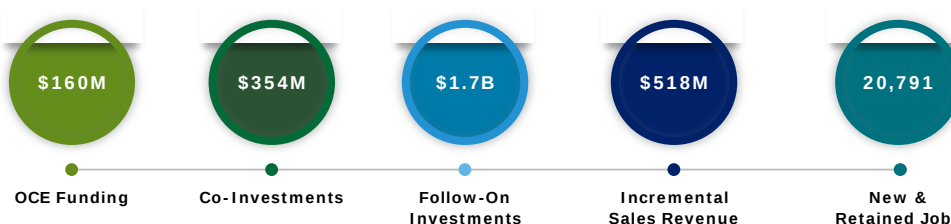
OCE has made cumulative investments of \$160 million over the past 4 years in provincial program projects in over 125 communities across Ontario. OCE's projects are funded based on an independent review of funding applications, with the aim of selecting the most qualified projects across the province.

OCE-funded projects have attracted \$354 million of additional funding through co-investments from industry.

The combined investment of \$514 million by OCE and industry partners has attracted \$1.7 billion in follow-on investments in the OCE-project participating firms. It also generated \$518 million in incremental sales at these firms.

To conduct this analysis, OCE project data was combined with survey results from OCE-project participating firms to segment the approximately 3,100 projects and identify the type of OCE programs that the projects belonged to; the proportion of OCE funding and partner co-funding provided to the project; and, information regarding outcomes from the OCE-funded project as self-reported by participant firms. The outcomes attributable to the funded projects reported in the survey data included estimates of additional sales growth, new and retained jobs, follow-on investments attracted, new products and patents created, etc.

Measures of Activity Supported by OCE Project Investments



Analysis of project results were not extrapolated beyond those reported by project participants, instead relied on self-reported information provided by survey respondents on the impacts that could be directly attributed to OCE funding.



2. Economic Contribution Assessment

The economic contribution assessment of the OCE-funded project activity is estimated using a provincial input-output model, which allows the impact to be gauged in terms of direct and indirect effects.

The direct contributions are associated with the expenditures on OCE-funded projects (i.e. spending on suppliers and employees)

The indirect contributions are associated with expenditures through businesses supply chains, such as providing goods and services to companies that have received direct program funding from OCE.

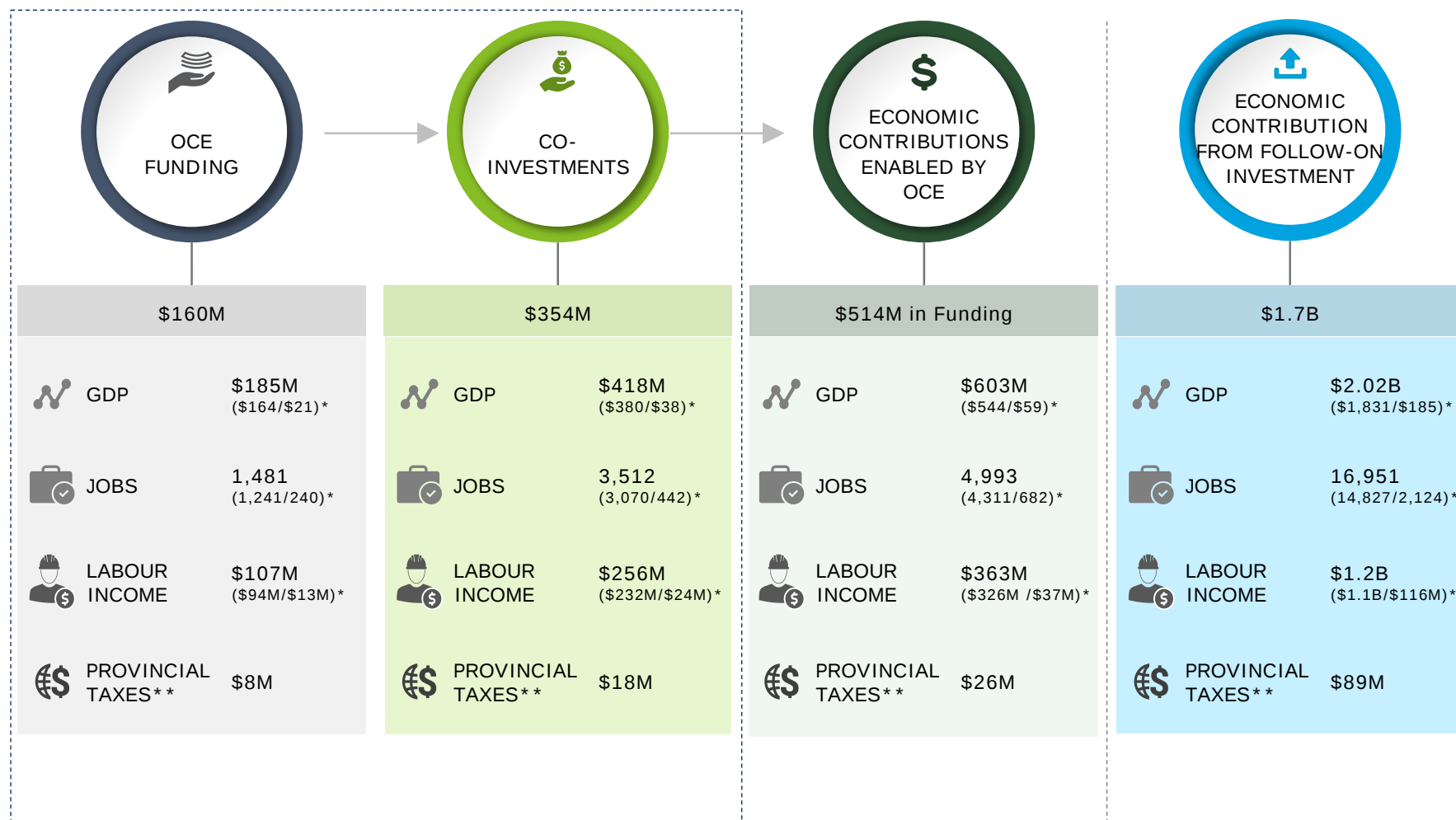
The economic contribution is measured in terms of Gross Domestic Product (GDP), employment, labour income, and government revenue.

The highlights are:

OCE project investments contributed \$603 million in GDP, supported almost 5,000 jobs, generated \$363 million in labour income and added an estimated \$26 million to Ontario government coffers. The bulk of the economic contribution was direct, with 9% to 14% of the benefits being indirect.

The follow-on investments into firms participating in OCE projects contributed roughly \$2 billion to GDP, 17,000 jobs, \$1.2 billion to labour income and added \$89 million to Ontario taxes. Again, direct impact was the dominant contributor.

Economic Contributions Enabled by 3,100 OCE-Funded Projects F2015-18



* Split of (Direct/Indirect)

** Projects also contribute to federal and municipal taxes. Further details can be found in the report

Executive Summary

OCE Implications and Impacts on the Ontario Economy

The impact assessment provides only one perspective of the economic value from OCE investment projects. As outlined at the start, OCE activities help to address fundamental challenges facing the Ontario economy. Below we present a snapshot of the broader benefits:



Supporting job creation

- OCE leverages provincial dollars into targeted projects that can support the next generation of new jobs in the economy at a time that labour markets are being disrupted by technical change. During F2015-18, OCE program participants have reported the creation/retention of 20,791 jobs as a result of OCE funding, including 805 internship and fellowship opportunities. This job impact is in line with the economic impact assessment on the previous page.



Enabling procurement

- OCE programs, such as REACH and SBIC, can open-up valuable government and public-sector procurement contracts for program participants – diversifying the range of solutions governments have access to, and providing a channel towards potentially long-term sales opportunities. Access to government procurement can help firms to scale.



Bridging the gap between industry and academia

- OCE programs provide a platform through which industry and academic partners can connect and work together.
- Key benefits of this type of collaboration in the economy can include:
 - Access to the latest research findings and innovative new methodologies that can save costs associated with exploratory early-stage research.
 - Exposing private sector research, design and business talent to academic subject matter expertise.



Supporting campus entrepreneurship

- OCE's Campus-Linked Accelerator programs channel support to high-potential youth entrepreneurs by helping break down barriers, develop peer networks and support youth employment opportunities. This helps to build Ontario's talent pool and can lower youth unemployment.



Supporting commercialization

- OCE's Commercialization portfolio is able to support patent creation which can support economic growth and de-risk market entry for developers.
- OCE also supports developers to successfully prototype new processes, products and services, which enables new sales opportunities.



Stimulating private sector investment and follow-on investment

- OCE has successfully stimulated over \$350 million in co-investments across all four program categories during F2015-18.
- For every \$1 invested by OCE, another \$2.21 is attracted by funding partners (co-investments).

Executive Summary



OCE Implications and Impacts on the Ontario Economy (cont'd)



Addressing Ontario's productivity gap

- OCE's ability to support the development of new products and services as well as the quality of entrepreneurship talent can combine to enhance the physical and human productivity for participants.
- Viewed this way, OCE's activities can help to address Ontario's productivity gap which has hampered the Ontario and Canadian economy for decades.



Growing the capabilities of Ontario's workforce

- OCE is able to support the enhancement of Ontario's workforce by providing program participants across sectors, regions and age groups with benefits such as:
 - Exposure to new skill sets
 - Broadening of networks
 - Opportunities to develop leadership and project management skills
- In addition, OCE channels specific support towards STEM talent – a key requirement of a future-ready labour force.



Economic contributions from commercialization and business growth

- Estimated economic contributions resulting from OCE investments, co-investments and follow-on investments are driven by the delivery of the programs and projects funded by OCE. For example, the employment of highly skilled professionals and purchases of equipment and materials to develop a new technology.
- Additional and continued economic benefits are generated following the successful commercialization of the products and services developed by OCE-funded projects. For example, the emergence of new financially viable companies in Ontario or growth of existing companies funded by OCE.

OCE connects industry, academia and government in translating leading-edge research into viable, commercial opportunities that have led to the creation and retention of jobs

Report Background and Scope

OCE makes important contributions to the Ontario economy by connecting industry, academia and government with resources and expertise in translating leading research into viable, commercialized technologies and opportunities.

A defining feature of OCE is its execution of programs through partnerships within both academia and industry, including ties with provincial colleges, universities, research hospitals and the greater entrepreneurship community. Specifically, the majority of OCE programs require industry partners to co-invest in projects. Further, OCE-funded projects attract additional funding from other external investors including angel and venture capital investors, which facilitates economic growth resulting in more labour and economic spin off. OCE amplifies provincial funding dollars by attracting additional funding into innovative business ventures across the province, thereby increasing the overall scope and impact of OCE project investments.

To understand the extent to which OCE activities contribute to the Ontario economy, OCE engaged Deloitte to undertake an assessment of the economic contributions associated with OCE-funded projects and identify and characterize a range of broader contributions of OCE's activities to the economy.

This report categorizes OCE-funded project activities, and estimates economic contributions arising from OCE project investments made during the four fiscal years¹ between 2014-15 and 2017-18 using the data provided by OCE.² In particular:

- To conduct this analysis, OCE project data was combined with survey results from OCE-project participating firms to segment the approximately 3,100 projects and identify the type of OCE programs that the projects belonged to; the proportion of OCE funding and partner co-funding provided to the project; and, information regarding outcomes from the OCE-funded project as self-reported by participant firms. The outcomes attributable to the funded project reported in the survey data included estimates of additional sales growth, new and retained jobs, follow-on investments attracted, new products and patents created, etc.
- The analysis also estimates the economic activity and contributions created and enabled by OCE-funded project activities at both the direct and indirect level, in terms of gross domestic product (GDP), labour income, employment, and government revenue. The economic activity generated by OCE project investments is classified into the following distinct investment streams:
 - Economic contributions created by provincial investments in projects through OCE;
 - Economic contributions created by co-investments in OCE-funded projects;
 - Economic contributions enabled by follow-on investments catalyzed by OCE support for projects.

This report identifies the broader benefits of OCE project investments including implications to the Ontario economy and society such as its ability to bridge the gap between industry and academia, supporting job creation, and the commercialization and development of productivity enhancing goods and services.

Introduction



Our analysis is conducted at an aggregate level, and does not compare program outcomes, economic impacts, overall success between specific projects, or programs, or the opportunity cost of government funding. Instead, gross economic contributions are estimated for the province as a whole.

To complete this report, Deloitte undertook several methodological approaches detailed in Appendix B:

- Reviewed and analyzed historical OCE participant survey data, project specific data, and other data elements provided by OCE;
- Reviewed program descriptions and intended outcomes;
- Developed an economic model to estimate the economic contributions arising from OCE project investment activities during the four fiscal years of 2014-15 to 2017-18 including estimates of GDP, labour income, employment, and government tax revenues. All economic contributions analyzed were estimated at direct and indirect levels; and
- Conducted secondary literature review and analysis of the descriptions and mandates of OCE programs to identify broader implications and benefits OCE is able to drive across the Ontario economy

About Ontario Centres of Excellence (OCE)

In 1987 the Government of Ontario established seven independent Centres, each with a focus on a single technology sector (IT, nanotechnology, advanced manufacturing, etc.). Subsequent to the formation of the Centres, a number of them were merged, with four independent Centres remaining as of 2003.

In 2003, the provincial government made the decision to merge the four remaining Centres into a single organization, which in 2004 resulted in the formation of Ontario Centres of Excellence Inc. (OCE), a not-for-profit organization with a mandate to drive the growth of a globally competitive economy in Ontario. As part of its mandate, OCE supports the development of Ontario's economy through investments in research and development (R&D) to accelerate innovation through working with public academic research institutions and research hospitals to foster industry collaborations that create innovative new technologies, products and services. Through investments in projects, OCE supports Ontario's economic development efforts by supporting entrepreneurs, start-ups, industry, academia and investors to help support the creation or retention of jobs, commercialization of new products, services, and technologies and growth of businesses.

OCE receives funding primarily from the Ontario government with additional program funding from the Federal Economic Development Agency for Southern Ontario (FedDev Ontario).³ OCE also leverages federal funding from agencies including the Natural Sciences and Engineering Research Council (NSERC), National Research Council Canada (NRC) and Sustainable Development Technology Canada (SDTC) to further support project and company investments.

Partnerships across public research institutions and industry are a critical component to the success and competitiveness of businesses in an economy. Increasingly, the extent to which an economy is able to create these partnerships reflects its ability to support entrepreneurship and innovation. In turn, as new products and services are developed and tested, new businesses are formed and jobs are created.

OCE designs and executes programs that foster partnerships between Ontario's industry and the academic and research institutions including universities, colleges and research hospitals. OCE co-invests to accelerate innovation through:

- Supporting collaborative R&D between industry and academia;
- Investing in early-stage commercialization technology of emerging technologies;

Introduction

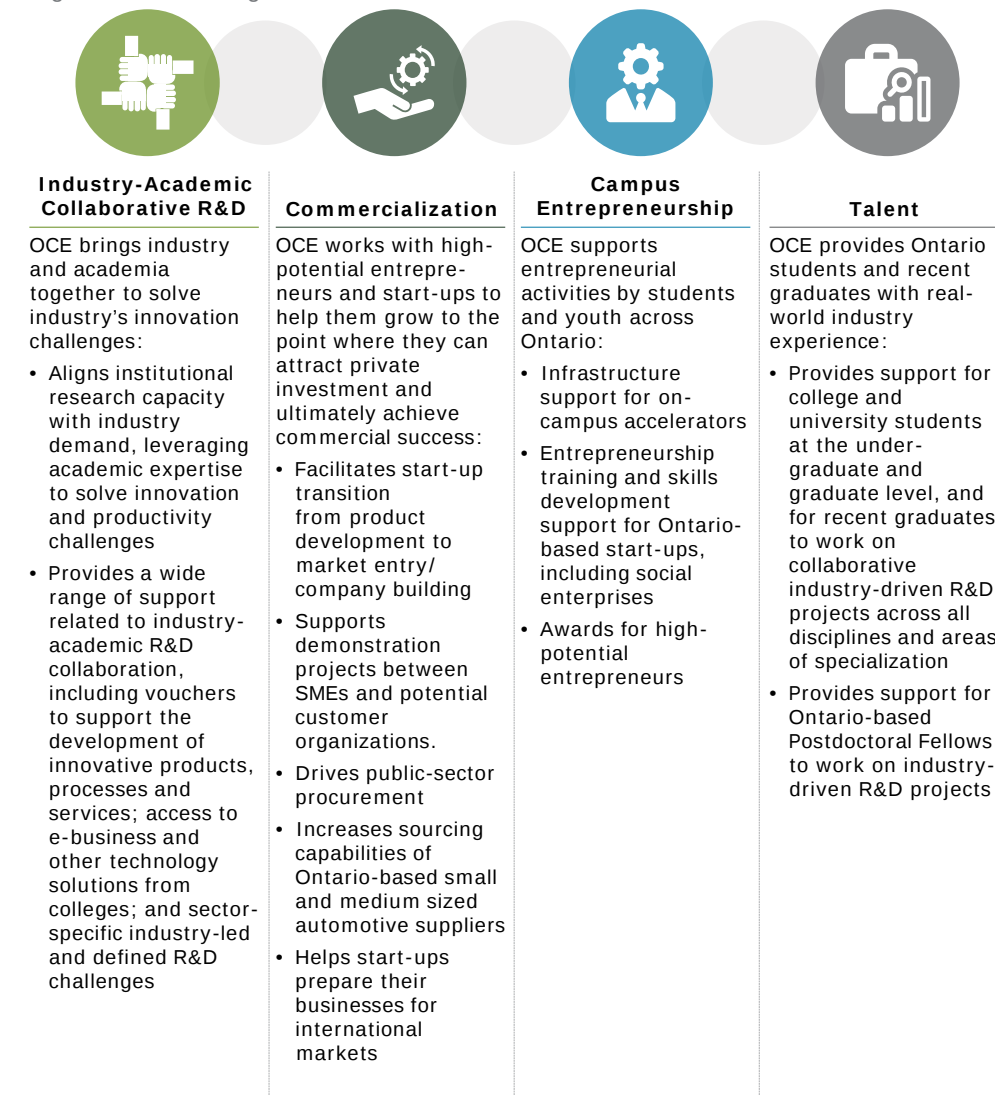
- Fostering campus entrepreneurship; and
- Leading and developing networks around high-potential, business-led opportunities.

OCE works collaboratively with the Ontario government to co-design and implement programs to address specific challenges faced by the Ontario business community. It also supports and invests in early-stage companies as well as entrepreneurial activities by students and youth across Ontario. Supporting entrepreneurship and innovation is not a 'one size fits all' activity; instead, it requires the careful execution of different types of support. Today, OCE supports a range of projects that fall under four program areas depicted in Figure 1.

OCE's suite of programs are designed to provide support across the research-development-commercialization continuum and fill important gaps in Ontario's economy. OCE has found that industry-academic programs are a key feeder to programming that focuses on accelerating commercialization, fostering campus entrepreneurship, and driving market entry and scale-up.⁴

These programs can identify and help to remove barriers that inhibit the transformation of knowledge into products and services, and engage with and support organizations and entrepreneurs in their quest to deliver on R&D. By enabling entrepreneurs to recognize and explore the commercialization potential for their ideas, by providing links to funding and resources, which includes the public-sector as first customers of innovation, and by facilitating access to global markets and investors, these programs help to prepare and support early-stage technologies to grow, succeed, and move into the commercial marketplace.⁵

Figure 1: OCE Program Areas



Introduction

OCE project investments are also focused around key sectors and employment bases in Ontario's economy. OCE's four sectors of focus are:

- Advanced health technologies;
- Advanced manufacturing;
- Bio-economy and clean technologies; and
- Digital media and information & communication technologies.

Each of these sectors is home to unique nodes of public and private sector investment across the province. In addition, the needs of entrepreneurs can vary by sector, location in the province, and age and experience of founders/business teams.

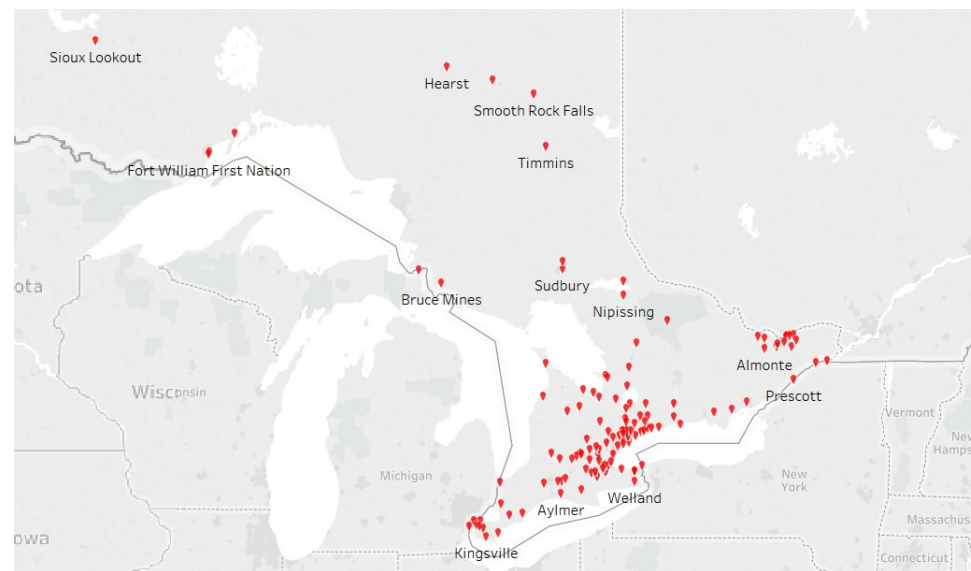
Overview of OCE Projects and Project Investment Streams

Over the study period, OCE, and industry partners together have invested approximately \$514M in over 3,100 projects that span different program areas and priority sectors as identified by the Province. Notably, the number of projects funded through OCE has grown year-over-year at an average annual growth rate of 23% since fiscal year 2014-15.

A key feature of OCE's impacts in Ontario's economy is its geographic reach. OCE programs have supported projects in over 125 communities in Ontario. OCE's ability to reach a broad number of communities is derived by its over 40 business development specialists co-located in 11 offices across the province to identify and develop partnerships between academic and research institutions and industry to

facilitate cutting-edge research. The following figure provides an overview of the geographic distribution of OCE-funded projects applicants distinct communities during the four fiscal years of 2014-15 through 2017-18.

Figure 2: Overview of the Geographic Distribution of Selected OCE Funding Applicants Communities



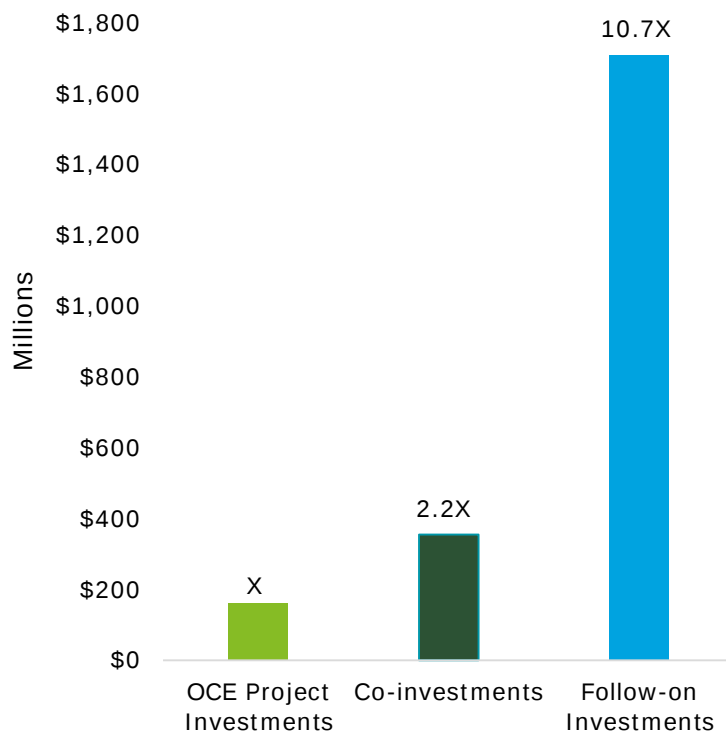
Source: Deloitte Analysis and OCE, 2018

OCE provides the initial investment in projects, which plays a valuable role in de-risking projects. This has attracted additional funding through industry and other government partners, and has enabled follow-on investments from angel and venture capital investors. The funding has also enabled further impact through supporting projects or business growth, resulting in incremental sales revenues.

Introduction

Accounting for the additional project investment streams enabled by provincial funding, co-investments, follow-on funding; it is estimated that for every \$1 of provincial investment in projects during the four fiscal years of 2014-15 through 2017-18, approximately \$12.9 in additional funding was attracted from other sources. Figure 3 provides a summary of leveraged project investment streams during the four fiscal years between 2014-15 and 2017-18.

Figure 3: Project Investment Streams Leveraged by Provincial Funding



OCE Implications and Impacts on the Ontario Economy

In addition to the impacts quantified using the above methodology, this report explores a range of other potential impacts of OCE on the economy that have been identified through a secondary literature review, and observed through our own experience in this area, such as the recently completed review of MaRS and Ontario Network of Entrepreneurs; these include:

- Bridging the gap between industry and academia;
- Supporting job creation;
- Supporting commercialization and market opportunities;
- Supporting campus entrepreneurship;
- Supporting the development of products and services that enhance productivity and help address Ontario's productivity gap;
- Stimulating private sector investment in research and development and follow-on investment;
- Growing the capabilities of Ontario's workforce; and
- Supporting the growth of Ontario's key sectors and emerging clusters*.

* A cluster is a geographic concentration of related companies, organizations, and institutions in a particular field that can be present in a region, state, or nation (Harvard Business School).

The Deloitte assessment has two dimensions:

1. Segmentation of OCE-funded project economic activities enabled and supported by the following funding streams:
 - a) OCE funding
 - b) Co-investments
 - c) Follow-on investments

This analysis is conducted based on the direct analysis of OCE's project data and survey results and reports on selected measures of firm and project economic outcomes, (i.e. additional investments, sales revenues growth and jobs generated and retained as reported by survey respondents).

2. An economic contribution analysis to measure the impacts created and enabled by OCE project investment streams specified above.

This approach uses an economic Input-Output (IO) based analysis to estimate GDP, labour income, employment, and tax revenues. The economic contributions are estimated at the direct and indirect levels.

The economic contributions modeled represent the economic activity created and enabled by OCE through the projects operational and capital spending funded through the four investment streams. The provincial funding is viewed as the enabler, catalyzing the additional investments into OCE-funded projects and companies. However, we note that it is likely that only a portion of total economic contributions resulted from OCE-funded projects may be directly attributed to provincial funding.

Data Sources and Limitations

Project data used in this report is obtained from OCE; OCE collects data from OCE-funded projects and/or companies through surveys conducted during the project, as well as at the end of the project. Some additional data is collected through OCE's retrospective survey one, two, and three years out from the end of the project.

The impacts on firm performance as it relates to additional investments raised, growth in sales revenues and creation and retention of jobs are based on direct reporting on the project outcomes accrued as a direct result of OCE-funded projects. The analysis is based on data directly reported by OCE funding recipients through survey responses collected by OCE during the four fiscal years of 2014-15 through 2017-18.⁶ Noteworthy data limitations include:

- The fiscal year 2017-18 Campus Entrepreneurship program data pertaining to follow-on investments, sales revenues, and jobs are not included in the analysis due to data unavailability at the time of publishing this report.
- While OCE funding is primarily provincial funding, the provided data includes federal funding (FedDev Ontario) of approximately \$7.7 million under the SmartStart Seed Fund. Under this program, OCE generally invests in a start-up using half provincial funds and half federal funds for each project.⁷

Analytical Approach

Economic Contributions of OCE Project Investments

To assess the economic contributions created and enabled by OCE project investments to Ontario's economy, an input-output methodology is used based on Statistics Canada's provincial input-output tables and industry multipliers (see details in Appendix B).

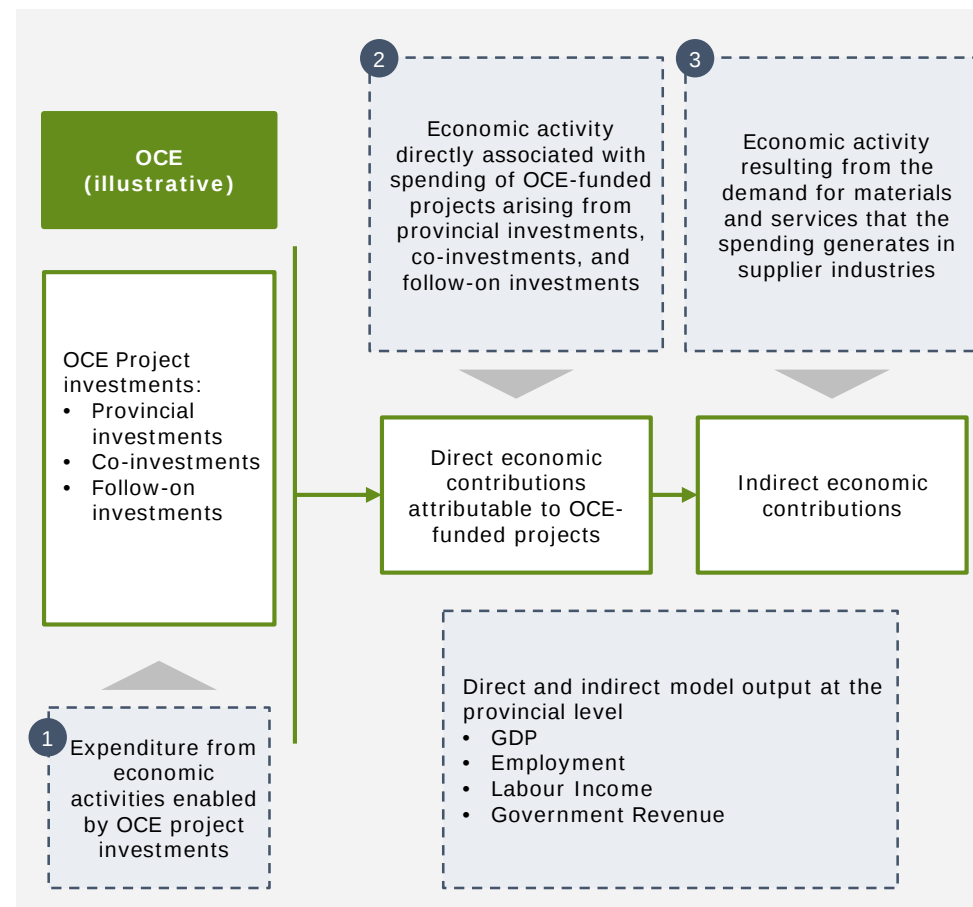
We quantify the economic contributions associated with the execution of programs and projects directly funded by OCE. These contributions are associated with the economic activity generated from the **expenditures** required to deliver these projects – for example, the employment of R&D professionals and purchases of machinery, equipment and materials required to develop a new technology.

Economic Impacts Modeling Approach

This report estimates two levels of contributions:

- **Direct Contributions** associated with the spending arising as a result of spending by OCE-funded projects (i.e. spending on suppliers and employees); and
- **Indirect Contributions** resulting from activities of businesses in supply chain industries providing goods and services to companies that have received direct program funding from OCE.

These levels of contribution are illustrated below and further discussed in Appendix B.

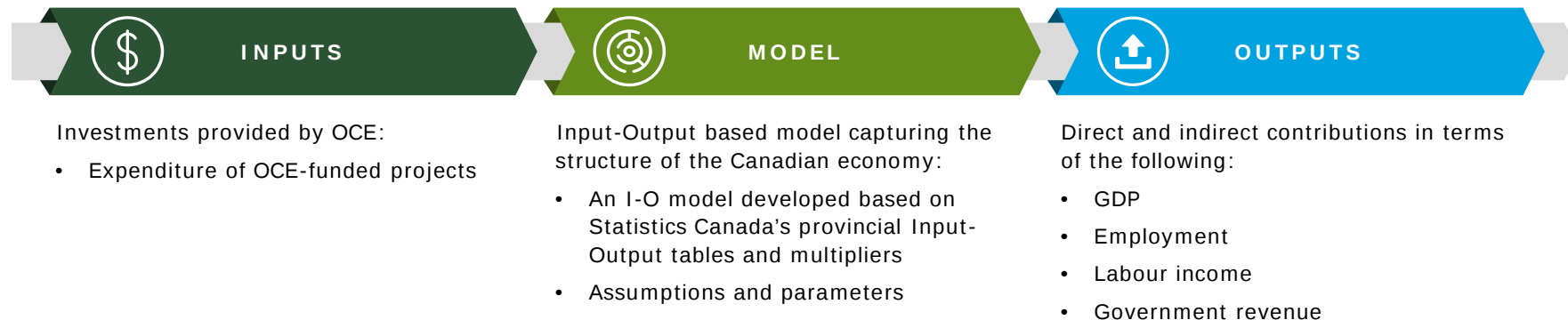


Analytical Approach



I-O Model Components

The economic contributions of the expenditure categories arising as a result of OCE project investments are estimated using an I-O based quantitative model; the components of the model are illustrated below:



OCE Implications and Broader Impacts

In addition to the impacts quantified using the above methodology, this report explores a range of other benefits OCE diffuses across the Ontario economy. This is achieved through a review of the quantitative outcomes of OCE funding and identification of the benefits OCE drives across the economy to both users and on non-users of OCE programs. The quantitative data is supplemented by publicly available information to characterize the importance of these benefits to policy makers.

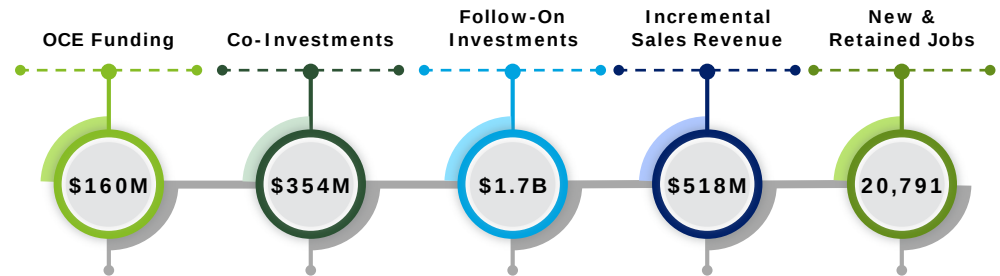
Segmentation of OCE-Funded Project Activity

The findings in this section are based on the analysis of OCE's project data and survey results and reports on selected measures of firm and project activities and outcomes (i.e. attraction of additional investments, growth in sales revenues, and generation and retention of jobs generated and retained as reported by survey respondents).

Contributions of OCE Project Investments to Firm and Project Outcomes

Based on OCE project data, the organization has made cumulative investments in projects resulting from provincial programs of \$160 million over the past four years. OCE-funded projects have attracted additional funding through co-investments and follow-on investments and generated sustained benefits through the growth of the funded projects and companies in terms of incremental sales revenue and jobs.

Figure 4: Measures of OCE Project Investments Firm Performance



Provincial Investments

The total provincial investments in projects during the four fiscal years of 2014-15 to 2017-18 is \$160 million. These investments are allocated across approximately 3,100 projects that align with different OCE program areas and provincial priority sectors. The projects are aimed at driving economic activity in Ontario through the creation of new jobs, products, services, technologies and businesses.

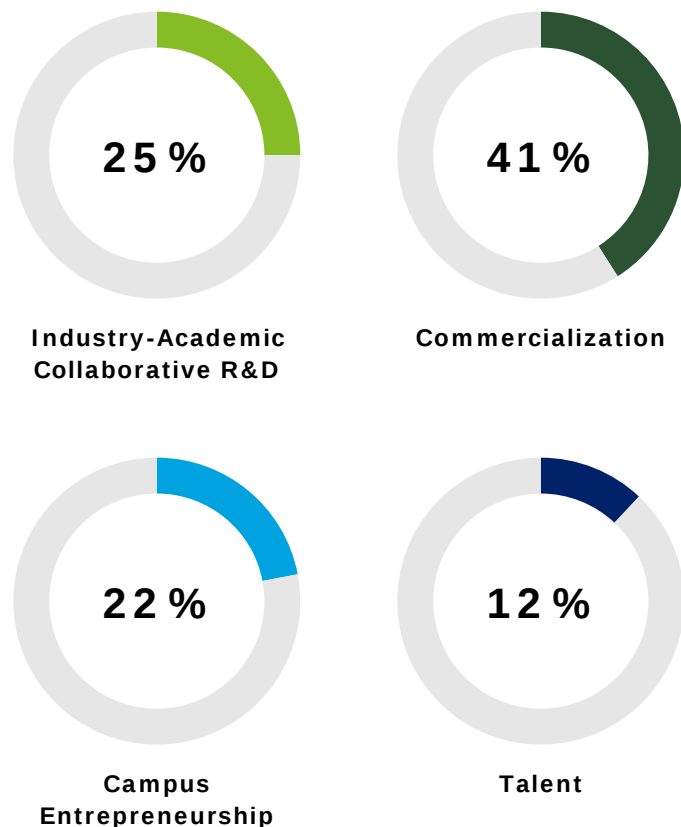
In terms of program areas, provincial investments are distributed in the following four program areas:

- Industry-Academic Collaborative R&D;
- Commercialization;
- Campus Entrepreneurship; and
- Talent.

The largest share of the funding within this period is allocated towards supporting projects to take research to the marketplace (commercialization).

Segmentation of OCE-Funded Project Activity

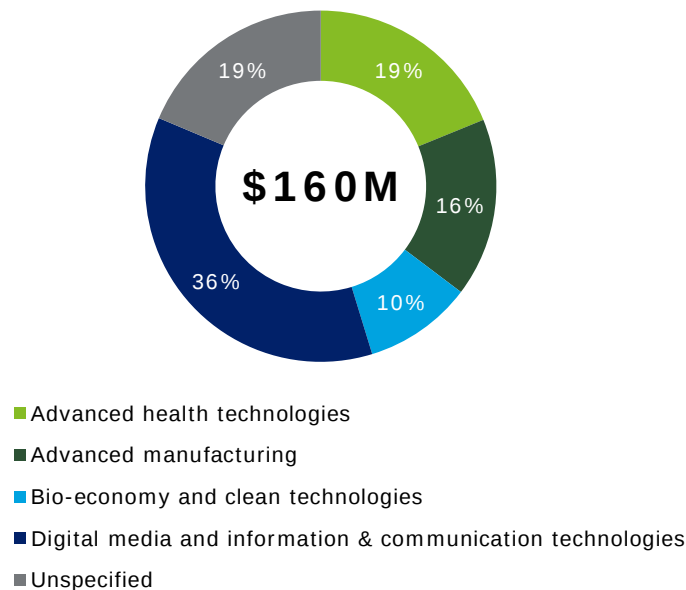
Figure 5: Allocation of Provincial Investments by Program Area



OCE's programming extends across sectors, with support dispersed across the wider economy. Provincial investments are distributed across projects that fall within the four priority sectors. The funding is spread across the following sectors as shown in Figure 6:

- Advanced health technologies;
- Advanced manufacturing;
- Bio-economy and clean technologies; and
- Digital media and information & communication technologies.

Figure 6: Allocation of Provincial Investments by Project Sector



Segmentation of OCE-Funded Project Activity



The distribution of projects by sector reflects a strong concentration of projects in the digital media and information and communication technologies sector. During F2015-18, over one third (36%) of OCE-funded projects have been in the digital media and information and communications technologies sectors. The concentration in digital media and information and communication technologies can be viewed as reflective of a strong ecosystem for the sector in Ontario. Independent studies show that Canada is the most cost-competitive country for digital services of all the G7 countries, as well as Australia and the Netherlands.⁸

Similarly, the other sectors reflect existing or growing concentrations of activity and investment:

- Ontario's bio economy has established strength. With more than 200 commodities grown, the province represents Canada's most diverse agricultural sector. Ontario's universities have attracted world-renowned scientists to conduct bioproduct research and generate commercial uses⁹
- Similarly, 35% Canada's innovative clean technology companies are located in Ontario¹⁰
- Finally, medical technologies (a subset of advanced health technologies) in Ontario can be viewed as a mature industry – collectively earning \$12.2 billion in revenues annually, with exports totaling \$1.45 billion.¹¹

Co-Investments

In contrast to other government funding programs that directly provide provincial funding to support eligible projects and/or individuals, a defining feature of OCE programs is the requirement for private sector co-investment. Importantly, this investment creates a context for Ontario businesses to tap into the expertise within hospitals, universities and/or colleges, which can stimulate new investment in R&D activities across the province, improve the competitiveness of businesses and drive increased economic outcomes.

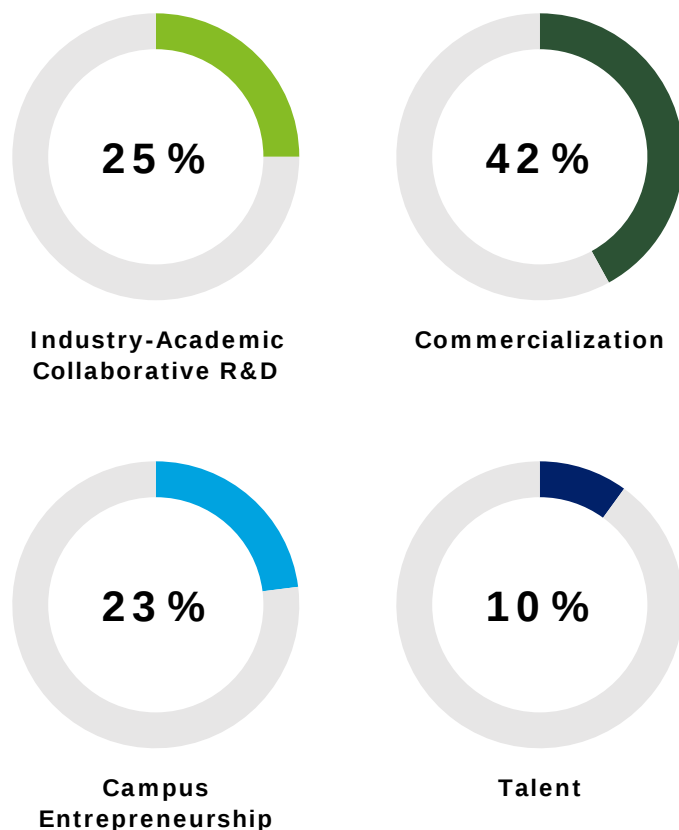
To this end, OCE provides a platform that enables partnerships amongst government, industry, academia, investors and other key innovation players to leverage funding and resources to identify and deliver projects that complement its mandate.

In the period reviewed, the provincial investments have attracted simultaneous co-investments from industry and other partners leading to additional funding attributed to initial contribution in the projects. During the four fiscal years of 2014-15 through 2017-18, OCE invested \$160 million which was co-invested by industry and other partner organizations in the amount of approximately \$354 million. Every \$1 of OCE investments in projects resulted in an additional parallel \$2.21 in investment from industry and other partner organizations.

Segmentation of co-investments by program area indicates that a notable share of the co-investments is channeled towards the commercialization program area (42%). Figure 7 illustrates the allocation of co-investments by program area.

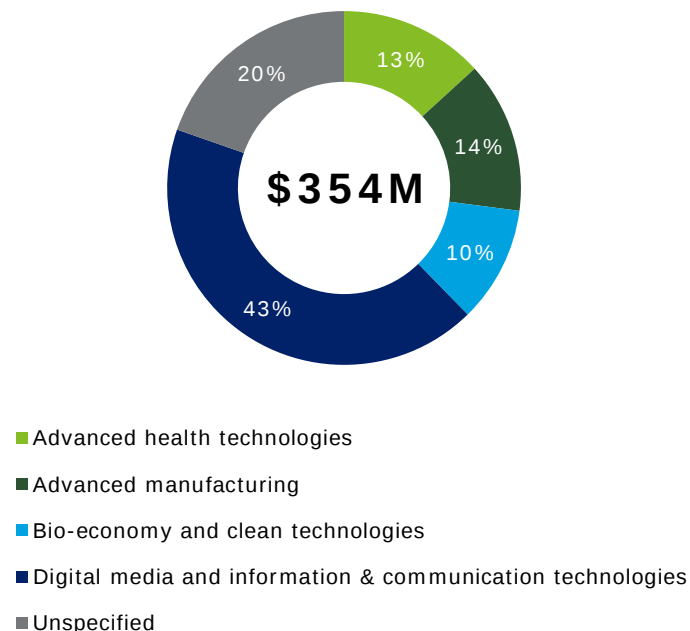
Segmentation of OCE-Funded Project Activity

Figure 7: Co-Investments by Program Area



Similarly, the classification of co-investments by sector indicates that the largest portion of the co-investments are channeled towards projects in the digital media and information and communication technologies sector (43%). Figure 8 illustrates the allocation of co-investments by project sector.

Figure 8: Co-Investments by Project Sector



Segmentation of OCE-Funded Project Activity

Follow-on Investments

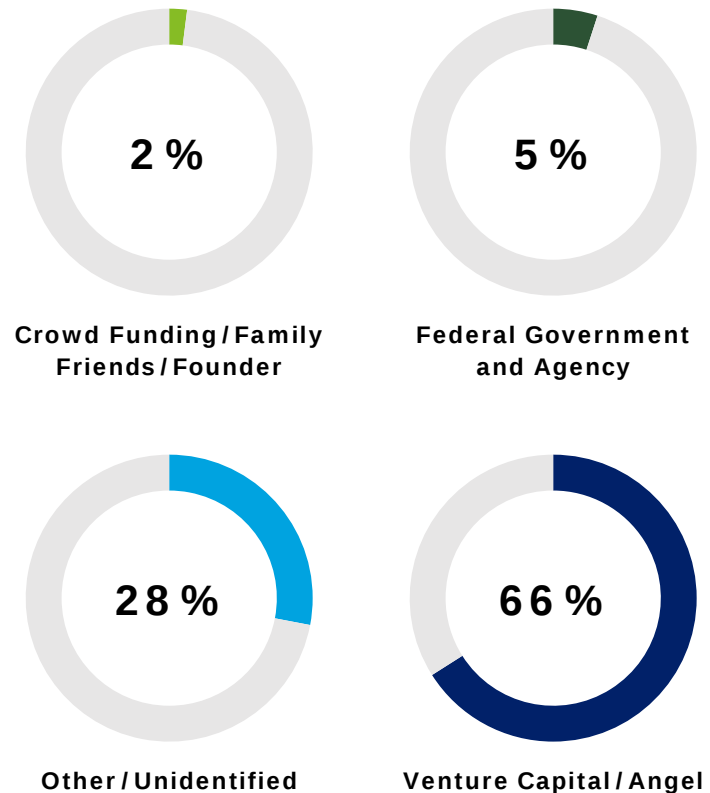
Start-ups and small and medium-sized enterprises (SMEs) that received OCE funding have subsequently raised additional funds from other sources after the OCE-funded project has commenced. The amount of follow-on investments received is reported through annual surveys. During the four fiscal years of 2014-15 to 2017-18, the start-ups and SMEs raised approximately \$1.7 billion in follow-on investments (excluding 2017-18 Campus Entrepreneurship program data due to unavailability at the time of analysis). That means for every \$1 of OCE investment in funded projects, the result was an additional \$10.70 in investment from investors.

The three primary sources of follow-on investments attracted include:

- Venture Capital/Angel Funding;
- Crowd Funding/Family Friends/Founder; and/or
- Federal Government and Agency Funding

Venture capital and angel investments accounted for the largest share of follow-on investment as shown in Figure 9.

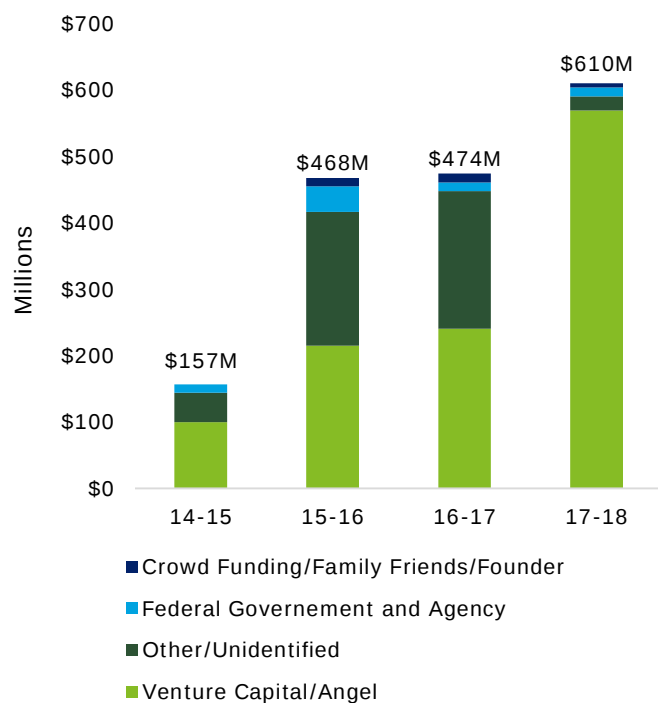
Figure 9: Follow-on Investments by Source



Segmentation of OCE-Funded Project Activity

The amount of follow-on investments received by OCE-funded projects and/or companies has been increasing annually as shown in Figure 10. The data indicates that angel and venture capital investments account for the largest share of funding over the period, showing a 470% increase during the four fiscal years of 2014-15 to 2017-18.

Figure 10: Year-over-Year Follow-on Investments by Source



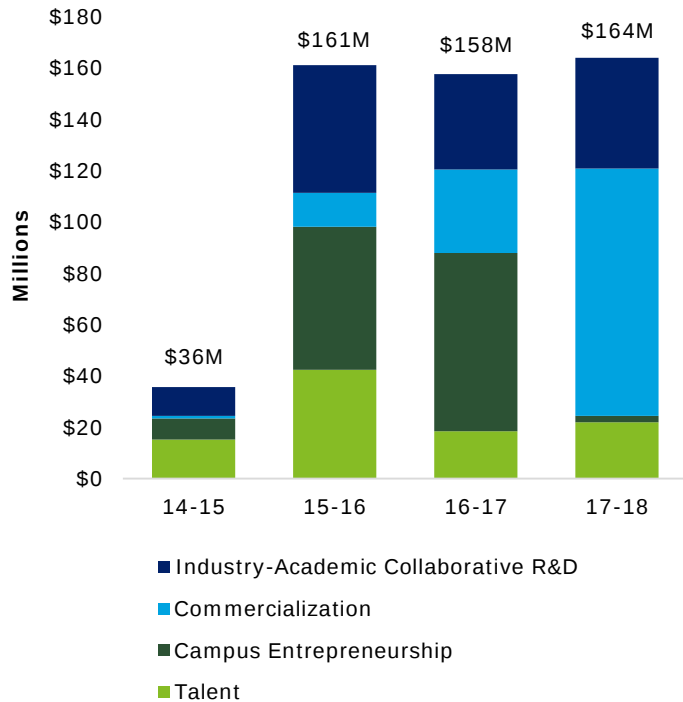
Sales Growth

During the fiscal years of 2014-15 to 2017-18, OCE-funded companies have reported incremental sales revenue of \$518 million, and have indicated that the additional revenue is directly attributed to provincial investments made by OCE.

Figure 11 shows the year-over-year incremental sales by program area attributed to provincial funding. While noting that at the time of this report the full Campus Entrepreneurship figures are not included for 2017-18, preliminary analysis indicates that the commercialization programs have experienced the highest growth in sales annually while the industry-academic collaboration program area has experienced the highest overall sales over the report period.

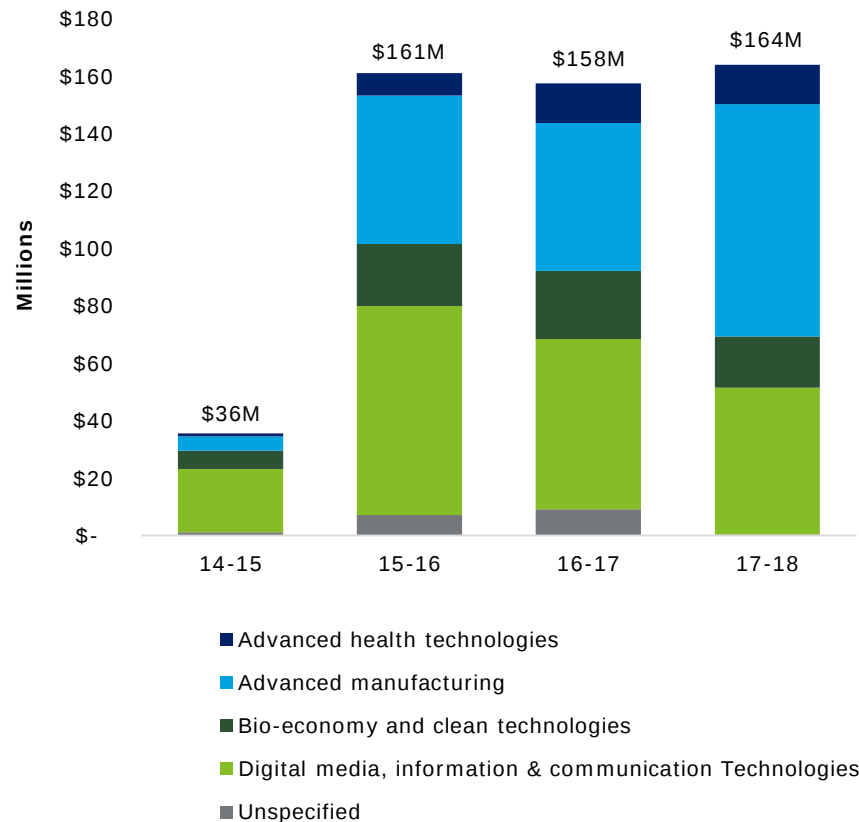
Segmentation of OCE-Funded Project Activity

Figure 11: OCE-Funded Projects' Incremental Sales by Program Area



In terms of distribution of sales by project sector, the advanced manufacturing sector reported the highest level of aggregate sales. Figure 12 shows the year-over-year incremental sales by project sector attributed to OCE funding.

Figure 12: OCE-Funded Projects' Incremental Sales by Project Sector

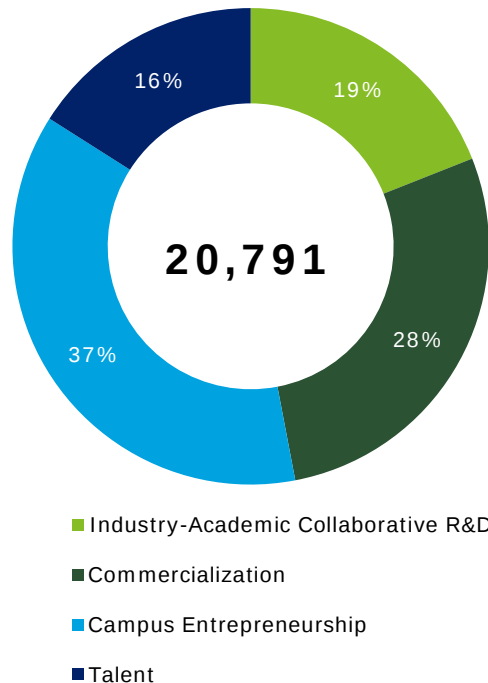


Segmentation of OCE-Funded Project Activity

New and Retained Jobs

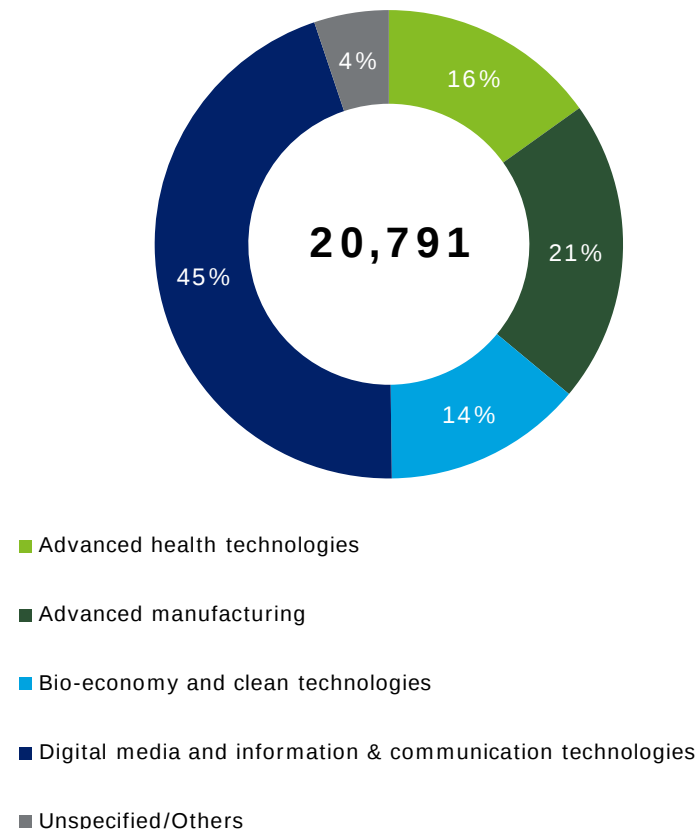
During the four fiscal years between 2014-15 and 2017-18, OCE-funded companies reported a total of 20,791 jobs (excluding 2017-18 data on Campus Entrepreneurship jobs due to data unavailability), including jobs created or retained, that are directly attributed to provincial funding. The largest share of jobs created or retained was in projects within the Campus Entrepreneurship programs. Figure 13 shows the total jobs created and retained by program area attributed to provincial funding provided by OCE.

Figure 13: Distribution of Jobs Created or Retained by Program Area



The distribution of jobs by project sector indicates that most jobs were created or retained within the digital media and information & communication technologies sector. Figure 14 shows the total jobs created and retained by project sector attributed to provincial funding.

Figure 14: Distribution of Jobs Created or Retained by Project Sector



Economic Contributions Analysis



Introduction to Economic Contribution Analysis

In this section, we quantify the economic contributions associated with the execution of programs and projects directly funded by OCE. These contributions are associated with the economic activity generated from the **expenditures** required to deliver these projects – for example, the employment of R&D professionals and purchases of machinery, equipment and materials required to develop a new technology. Notably, these contributions occur regardless of the commercial success of the program or project invested in. The economic benefits from product commercialization and adoption are discussed on their own in the section that follows.

To estimate the economic contributions we have used an “input-output” methodology, which traces how a particular expenditure or investment ripples through a region’s economy by creating demand for goods and services across industries.

Scope of Analysis

The economic contributions are estimated during the four fiscal years of 2014-15 to 2017-18, and are quantified in terms of:

- Gross domestic product (GDP)
- Employment (FTEs)
- Labour income, and
- Federal, provincial and municipal taxes, including personal income taxes, corporate taxes, and taxes on products and production

We have estimated the economic contributions at both **direct** level, and **indirect** level, which accounts for the economic contributions of suppliers to the projects in scope. Notably, we have adopted a conservative approach of excluding **induced** economic contributions, which stem from the spending of wages and salaries earned as a result of OCE investments.

The economic impacts measured are limited to the economy of Ontario and they do not include economic impacts on other provinces that may be benefiting from such activity in Ontario.

We have provided a breakdown of the direct and indirect economic contributions for each funding source:

- OCE investments
- Co-investments in OCE-funded projects, and
- Follow-on investments catalyzed by OCE support for projects;

A breakdown of economic contributions by sector is detailed in Appendix C.

Economic Contributions Analysis

Expenditure Profile of OCE-Funded Projects

The spending pattern of projects funded by OCE was provided by OCE and analyzed for each program area. The main expenditure categories include:

- Capital expenses, such as purchase of equipment and hardware
- Operating expenditures, such as spending on R&D activity and hiring of 3rd party contractors
- Staff salaries
- Other expenses, including administrative expenses, and
- Travel expenses

The analysis assumes that co-investments and follow-on investment in OCE-funded projects result in a similar expenditure pattern.

Table 1 below shows the distribution of spending of OCE-funded projects incurred during the four fiscal years of 2014-15 to 2017-18.

Table 1: Distribution of Expenditure (\$Million)

	OCE investments	Co-investments	Follow-on Investments
Capital	\$1	\$1	\$14
Operating	\$58	\$106	\$498
Other expenses	\$4	\$7	\$32
Salary	\$94	\$232	\$1,123
Travel	\$4	\$8	\$42
Total*	\$160	\$354	\$1,709

*The numbers may not exactly add-up to the total presented due to rounding.

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Summary of Economic Contributions

Accounting for both *direct* and *indirect* economic contributions, it is estimated that the OCE-funded projects had enabled the following economic contributions in Ontario over the period F2015-18.

Table 2: Summary of Direct and Indirect Contributions by Investment Stream

Investment	Investment Amount	GDP	Labour income	Employment (FTEs)	Government Taxes
OCE Funding	\$160 Million	\$185 million in total GDP to Ontario's economy	\$107 million in labour income in Ontario	1,481 FTE jobs created or supported in Ontario	\$19 million in federal taxes, \$8 million in provincial taxes and \$1 million in municipal taxes in Ontario
Co-Investments	\$354 Million	\$418 million in total GDP to Ontario's economy	\$256 million in labour income in Ontario	3,512 FTE jobs created or supported in Ontario	\$42 million in federal taxes, \$18 million in provincial taxes, \$1 million in municipal taxes revenue in Ontario
Follow-on Investments	\$1,709 Million	\$2,015 million in total GDP to Ontario's economy	\$1,219 million in labour income in Ontario	16,951 FTE jobs created or supported in Ontario	\$204 million in federal taxes, \$89 million in provincial taxes, \$6 million in municipal taxes revenue in Ontario

A detailed breakdown of economic contributions by funding source follows.

Economic Contributions Analysis

Economic Contributions of OCE Investments

Accounting for direct and indirect impacts, it is estimated that the spending of \$160 million of OCE funding contributed \$185 million in GDP to Ontario's economy, generated \$107 million in labour income, and created or sustained 1,481 full-time equivalent (FTE) jobs across Ontario over the 4-year period.

It is estimated that OCE funding also generated \$28 million in federal, provincial and municipal taxes, accounting for personal income taxes, corporate taxes, and taxes on products and production (i.e. retail sales tax, licenses, fees and permits).

The results indicate that:

- For every provincial dollar invested in projects in Ontario, an estimated \$1.15 in GDP is generated in the Ontario economy directly or indirectly
- For every provincial dollar invested in projects in Ontario, an estimated \$0.67 in labour income is generated in the Ontario economy
- For every million provincial dollars of spending arising from OCE project investments, projects and/or companies are estimated to create or sustain 9.24 FTEs in Ontario.

Figure 15: Contributions to GDP, Labour Income and Employment

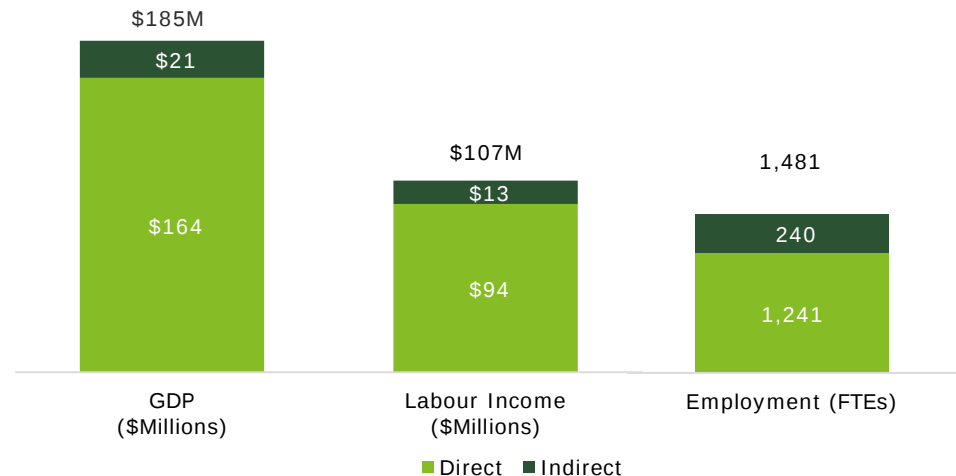


Figure 16: Contributions to Federal, Provincial and Municipal Government Revenues



Economic Contributions Analysis

Economic Contributions of Co-investments

Accounting for direct and indirect impacts, it is estimated that the spending of \$354 million of co-investments in OCE-funded projects contributed \$418 million in GDP to Ontario's economy, generated \$256 million in labour income, and created or sustained 3,512 full-time equivalent (FTE) jobs across Ontario over the 4-year period.

It is estimated that co-investments also generated \$61 million in federal, provincial and municipal taxes, accounting for personal income taxes, corporate taxes, and taxes on products and production (i.e. retail sales tax, licenses, fees and permits).

The results indicate that:

- For every dollar co-invested in OCE-funded projects in Ontario, an estimated \$1.18 in GDP is generated in the Ontario economy directly or indirectly.
- For every dollar co-invested in OCE-funded projects in Ontario, an estimated \$0.72 in labour income is generated in the Ontario economy.
- For every million dollars of spending arising from co-investments, OCE project investments are estimated to create or sustain 9.91 FTEs in Ontario.

Figure 17: Contributions to GDP, Labour Income and Employment

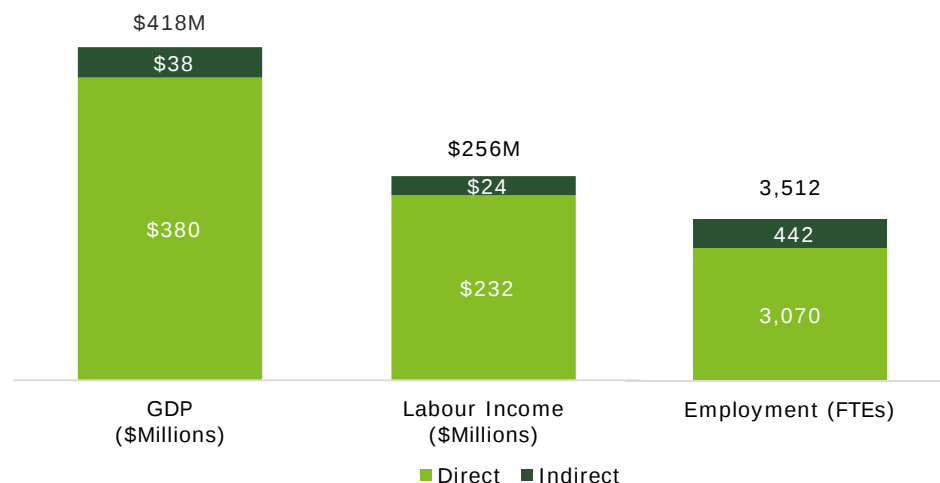


Figure 18: Contributions to Federal, Provincial and Municipal Government Revenues



Economic Contributions Analysis

Economic Contributions of Follow-on Investments

Accounting for direct and indirect impacts, it is estimated that the spending of \$1.7 billion of follow-on investments in OCE-funded projects contributed \$2.02 billion in GDP to Ontario's economy, generated \$1.24 billion in labour income, and created or sustained 16,951 full-time equivalent (FTE) jobs across Ontario over the 4-year period.

It is estimated that follow-on investments also generated \$299 million in federal, provincial and municipal taxes, accounting for personal income taxes, corporate taxes, and taxes on products and production (i.e. retail sales tax, licenses, fees and permits).

The results indicate that:

- For every follow-on funding dollar invested in OCE-funded projects and/or companies in Ontario, an estimated \$1.18 in GDP is generated in the Ontario economy directly or indirectly.
- For every dollar co-invested in OCE-funded projects and/or companies in Ontario, an estimated \$0.73 in labour income is generated in the Ontario economy.
- For every million dollars of spending arising from follow-on investments, OCE project investments are estimated to create or sustain 9.92 FTEs in Ontario.

A segmentation of contribution(s) based on OCE priority sectors across the three streams of investments analyzed in this section have been included in Appendix C to provide further details on how OCE's portfolio of programs interacts with the economy.

Figure 19: Contributions to GDP, Labour Income and Employment

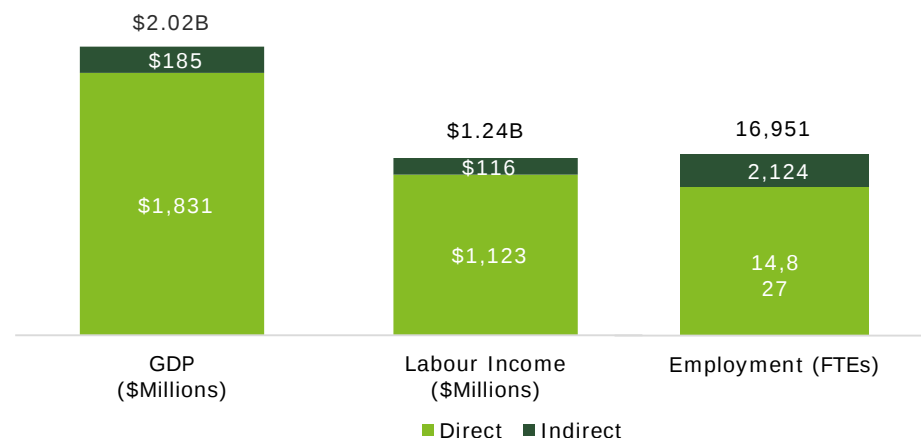
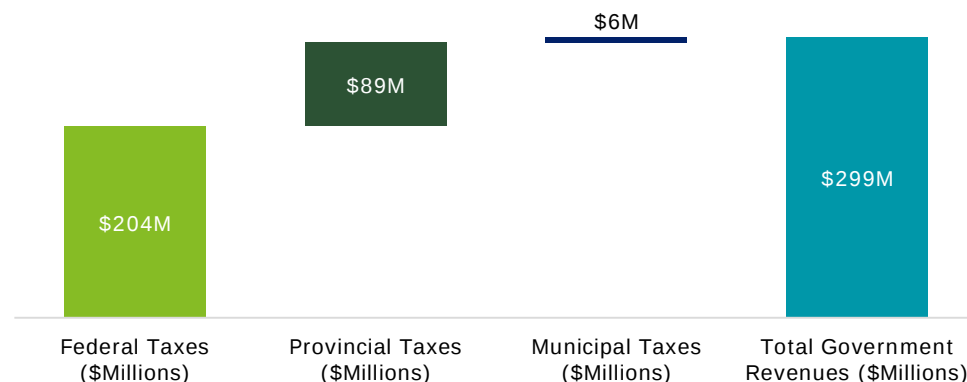


Figure 20: Contributions to Federal, Provincial and Municipal Government Revenues



Economic Contributions Analysis



OCE Funding and Stimulated Taxes

Spending of the OCE funding by program participants within the economy stimulates tax revenue for the government. The direct and indirect government taxes generated by OCE project investments during the four fiscal years of 2014-15 to 2017-18 are provided in Table 3 below.

Table 3: Government Taxes Contribution Generated by OCE Project Investments

Tax Category	OCE Funding	Co-investments	Follow-on Investments	Total Taxes
Federal Taxes (millions)	\$19	\$42	\$204	\$265
Provincial Taxes (millions)	\$8	\$18	\$89	\$115
Municipal (millions)	\$1	\$1	\$6	\$8
Total Tax Impacts (millions)	\$28	\$61	\$299	\$389

*The numbers may not exactly add-up to the total presented due to rounding.

During the four fiscal years of 2014-15 to 2017-18, OCE provided \$160 million in funding towards projects. Accounting for the provincial tax impacts created and enabled by OCE project investments, it is estimated that OCE project investments generated a total of \$115 million in provincial tax revenues at the direct and indirect level.¹²



Comment on OCE Organizational Efficiency

OCE can be viewed as a key delivery agent of public programming in Ontario. OCE has an ambitious mandate to support the development of Ontario's economy by helping create new jobs, products, services, technologies and companies. OCE does this using its integrated approach in which selected agencies partner with OCE to provide an efficient process for clients to access complementary innovation services and funding provided by OCE at the provincial and/or federal level.

Between F2015-18, OCE has supported over 3,100 projects, each of which requires an industry and/or academic participant.¹³ Program participants are required to report to OCE on progress and participate in surveys and/or meet program specific milestones in order to be eligible for the next advance from remaining project funds.

In 2018, OCE conducted an internal analysis that identified a reduction in operating costs over time as a percentage of the provincial and matching funding deployed.¹⁴ This analysis has been framed by OCE as a demonstration of its commitment to efficient and effective program delivery. Key elements within OCE's efficiency analysis provided to Deloitte include:

- An existing program management and delivery infrastructure that allows the organization to rapidly deploy new programs in an efficient manner. New programs have incremental costs associated with them such as:

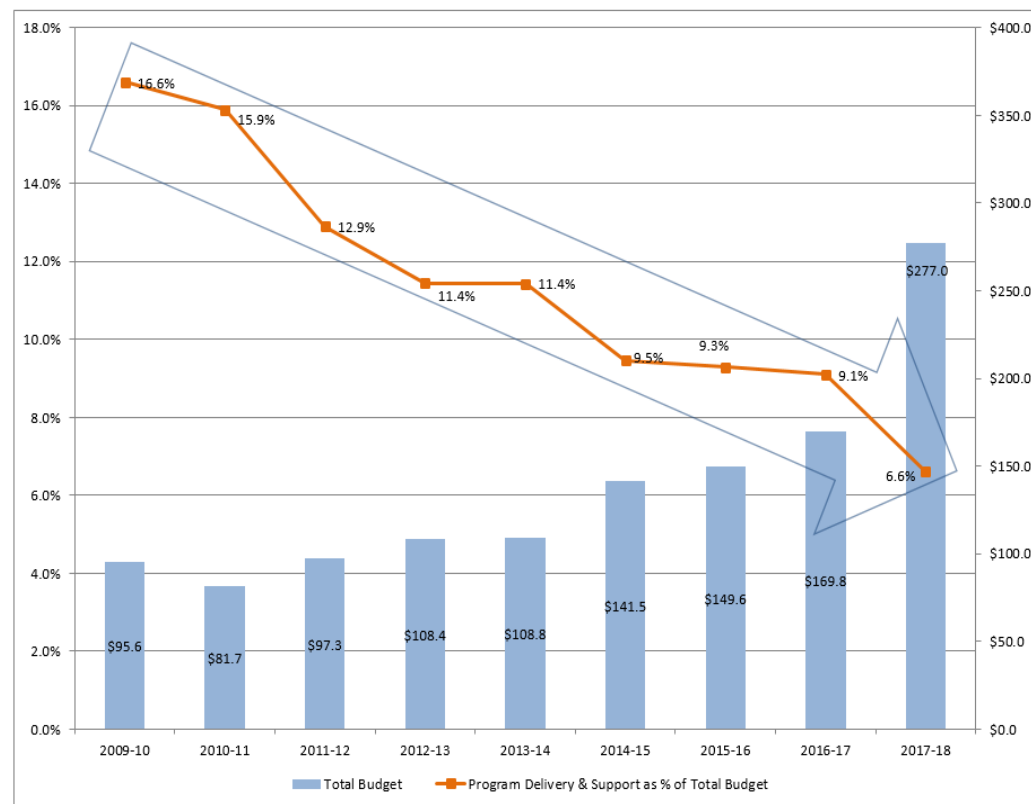
- Program specific marketing and industry outreach to generate demand and drive uptake;
 - Business development and program management resources;
 - Program specific web content and design;
 - On-line application intake; and/or
 - Compliance with funder reporting requirements; finance support costs to process contracts, reimburse claims, audit, etc.
- Effective delivery mechanisms to deliver programs on behalf of the Government of Ontario, including the ability to scale-up operations and funding deployment with only minimal associated incremental costs as a result of OCE's existing infrastructure and established program delivery platform.
 - OCE analysis continues to see a decrease in the cost of delivering programs as a percentage of total funding deployed. This outcome is the result of an ongoing commitment to efficiency and leveraging the expertise of the existing organization to deliver new programs and ongoing measures to streamline delivery.¹⁵

OCE Organizational Efficiency

According to OCE, a key mandate is to attract and deploy industry matching funding as part of its obligations under the agreements with government and, as such, a portion of the operational funding provided by the province is used to attract industry matching funding on a project-by-project basis. Therefore, OCE views its efficiency in deploying program funding as a function of the cost of obtaining matching industry funding and the cost of deploying the government and matching funding (notwithstanding that the matching industry funding may not flow directly through OCE).

OCE also identified that the total amount of funding deployed per OCE employee is increasing year-over-year, demonstrating OCE's ability to manage, execute and deliver larger dollar amounts across programs, while maintaining an effective employee headcount through program efficiencies and synergies across the organization. Taken together, OCE's findings indicate an organization that monitors its efficiency levels and has identified continued improvements in its program delivery capabilities.

Figure 21: Reducing Operating Costs (OCE)



Source: OCE Analysis

Note in the above OCE developed figure:

- Total budget = OCE investment in projects + co-investments + program management and delivery costs for all projects/initiatives in a given fiscal year
- Excluding co-investments, the cost is 18.3% of the budget in fiscal year 2017-18

OCE Business Development Operations Outreach Strategy

OCE also has a business development operations outreach strategy. OCE has provided the following description of the strategy and its advantages to communities. As the one organization that uniquely covers the province through on-the-ground business development resources, OCE is the Province's central catalyst for curating business-led ecosystems across numerous communities in the Province.

For an entrepreneurial community-based ecosystem to thrive, it must be nurtured, maintained and managed in order to create real scale-up businesses capable of long-term success. Many local communities are made up of key support organizations, including Regional Innovation Centres (RICs), Campus-Led Accelerators (CLAs), private accelerators, Small Business Enterprise Centres (SBEs), Chambers of Commerce, Business Improvement Association's (BIAs), Business Advisory Teams (BATs), and economic development agencies. Due to the fact that these resources continually change and evolve, as a result it is very difficult for growing businesses to navigate these ecosystem partners, derive value from them, and remain meaningfully engaged for the long-term.

Growing businesses need timely access to capital, technology and talent. As a business scales and becomes more complex, so too does the business' challenges and opportunities. And because no two community ecosystems are the same, it becomes difficult, if not impossible to have a holistic approach to drive meaningful programming support across the Province.

OCE has a unique, 31-year history of having first hand working knowledge of every community that it serves across the province through its business development team. OCE is an organization that plays a central role in curating stakeholders that can best work together, collaboratively, to meet the needs of the local community and help these most-promising businesses grow in a meaningful way. As the case studies enclosed in this report demonstrate, no two communities are the same, therefore, OCE's business development team embeds itself in each community it serves, to build trusted relationships and create local ecosystems that drive positive outcomes.¹⁶

OCE Implications and Broader Impacts on the Ontario Economy

During the four-year period of F2015-18, OCE has supported over 3,100 projects across the province. OCE program participants benefit from the organization's skilled delivery of programs designed to support job creation, economic growth, talent development, entrepreneurship and innovation. The experiences, skills, funding and support gained by program participants through OCE can enhance their careers and directly contribute to the development of new products and services.

The next section is a snapshot of OCE's broader impacts on the province and identifies why these impacts are important facets of OCE's total contribution to Ontario.

The benefits to be discussed include:

- Supporting job creation;
- Bridging the gap between industry and academia;
- Supporting commercialization;
- Enabling procurement;
- Supporting campus entrepreneurship;
- Stimulating private sector investment and follow-on investment;
- Addressing Ontario's productivity gap;
- Growing the capabilities of Ontario's workforce; and
- Supporting the growth of Ontario's key sectors.

Each of these areas represent a unique way OCE contributes to Ontario. The crucial outcomes have been recognized in secondary literature as meaningful ways to support an economy's overall competitiveness and health.

Included in this section of the report are case studies of selected program participants that have been provided to Deloitte by OCE. These case studies reflect real-world examples of OCE's programming contributing to business success or innovation in the province.¹⁷

Supporting Job Creation

OCE leverages provincial dollars into targeted investments in projects and/or companies that can support the generation of new jobs in the economy. During F2015-18, OCE program participants have reported the creation/retention of 20,791 jobs including 805 internship and fellowship opportunities.¹⁸

These jobs are reported to be directly attributed to the OCE-funded projects, highlighting OCE's ability to stimulate job creation, which is aligned with the Ontario government's focus on job creation as a key driver of economic development. Aside from these impacts, OCE's ability to support new employment opportunities is beneficial to the economy in several ways:

- **Increased spending:** New employment opportunities allow for previously unemployed or under-employed workers to increase take home pay and better meet their financial obligations. Higher overall spending in the economy, and increased employee earnings could potentially lead to a higher rate of consumer spending, which benefits other businesses who depend on consumer sales to stay open and pay vendors.
- **Addressing Ontario's scale-up challenge:** Larger firms can be better positioned to address market pressures and challenges associated with accessing new markets and competing in the marketplace. Several reviews of Ontario's entrepreneurship and innovation environments have identified the province as having a 'scale-up' challenge in technology companies specifically.
 - Relative to other Canadian industries (e.g., utilities), Canada's technology sector is comprised of a disproportionate number of very small firms. In 2015, 68.8% of all tech sector firms had less than 5 employees, compared to the 54.1% on average in other industries.¹⁹

OCE Implications and Broader Impacts on the Ontario Economy

Bridging the Gap between Industry and Academia

Industry-academic collaboration is viewed as a necessary condition of a competitive innovative economy. Public investment in platforms supporting the development of public-private research and entrepreneurship partnerships is an increasingly common tactic in economic development and innovation strategies globally. This tactic is viewed as desirable, as they can reduce the risk of failure that results when governments try to "pick winners" through traditional R&D subsidization approaches.²⁰

Public-private partnerships entail the competitive selection of participants with greater influence from the private sector in project selection and management, helping ensure that the best participants are targeted towards projects/initiatives with potentially high returns.

Despite these advantages, industry and academia often do not work together due to barriers such as their fundamentally different business models, resource shortages, rigid program requirements that do not adequately reflect the needs of potential participants and/or challenges in successfully developing internal business cases to seek funding for collaboration projects. OCE provides a platform designed to counteract these design differences by:

- **Design and administration of programs:** OCE works collaboratively with the province to design and administer programs that clearly articulate the roles and responsibilities for private and public stakeholders, and reflect the needs of businesses and the public;

- **Co-investing:** OCE's business development team actively connects companies and academia to potential co-investment partners. In doing so, OCE can support and facilitate additional private and/or public-sector investment into projects. This ability not only enhances the capital available for project teams, but has the potential to reduce the up-front investment required for any specific project participants;
- **Deploying project management and oversight:** OCE supports program participants with advisory services to meet project milestones and enforces regular reporting via surveys that can contribute to the effective use of provincial/private investment into projects; and
- **Providing access to subject matter experts:** OCE partners program participants and business development, scientific and project management subject matter experts with project participants to augment program delivery teams and support the development of successful projects.

Most importantly, OCE's programs can be viewed as successful amongst the business community thereby reflective of the needs of industry. Examples of this success are that:

- Over 61% of OCE-funded projects had private sector funding of over 100% of the provincial funding provided by OCE, suggesting partners have confidence in OCE programs and platforms and that significant investments are made to support projects;
- Close to 97% of OCE program participant survey respondents stated OCE-funded projects met their expectations. Only 1% indicated their expectations were not met, while the remaining either did not know at the time of the survey or did not reply.²¹
- The proportion of OCE projects cancelled or not completed is very low, suggesting that OCE selects high-potential, well-designed projects to which partners are committed.

OCE Implications and Broader Impacts on the Ontario Economy



Taken together, these findings can reflect confidence and support from the business community in the design of OCE's projects. Several reviews have identified industry-academic collaboration as a driver of business success. Firms engaged with academic partners benefit in several ways including, but not limited to:

- Access to latest research results and innovative new methodologies which can save costs associated with exploratory or early-stage research;
- Potential access to post-secondary laboratory and/or technical testing facilities, typically out of reach for private firms;
- Facilitation of, or initiation of longer-term research, employment or mentoring partnerships and relationships;
- Generation of shared patents;
- Diffusion of academic expertise to industry; and/or
- Exposing private sector research, design and business talent to academic subject matter expertise.²²

OCE Implications and Broader Impacts on the Ontario Economy



 Harrow, ON

Industry-Academic Collaborative R&D

OCE Investment:

- \$150,000

ROI ²³

- 25 jobs created or retained
- \$4 million incremental sales
- 5 new customers secured

Mori Essex Nurseries - Harvesting a bushel of benefits for the apple rootstock production industry in Ontario

Apples don't fall far from trees, nor do they grow far from rootstocks — a stem with an established root system that is required to produce fruit crops by grafting a bud from another apple plant onto it. Selecting the right rootstock is important for apple producers, as it can impart properties to above ground tissues, making them well-adapted to specific environments. Most rootstocks are not currently produced in Canada. Instead, Ontario apple growers must import them from international producers, leading to delays in production, inconsistent plant growth, trees that are ill-suited to local climates and unpredictable costs due to currency fluctuations.

The University of Guelph's Gosling Research Institute for Plant Preservation (GRIPP) partnered with Mori Essex Nurseries and Harster Greenhouses to cultivate a domestic supply of apple rootstocks on a commercial scale, with support from the Voucher for Innovation and Productivity (VIP) II program, managed by Ontario Centres of Excellence on behalf of the Ontario Government. Building on the success of an earlier VIP I project, GRIPP researchers used plant tissue culture to propagate rootstocks responsible for traits that are well-adapted for Ontario's climate. To ensure nothing was lost in translation from the lab, Dr. Mukund Shukla, a member of GRIPP's research team, worked closely with staff at Harster Greenhouses to create a protocol for Harster's commercial-scale tissue culture facility. The mass-produced rootstocks were then field-tested at Mori Essex's sites in Harrow, Ontario. "The beauty of this project is that we collaborated with industries that have almost everything in place to produce these plants," says Dr. Praveen Saxena, Director of GRIPP. "The technology went straight from the university lab to a commercial production centre and from there, to the field to test."

The project provides a bushel of benefits for Ontario apple growers, making it possible to purchase locally-produced rootstocks at a lower cost and resulting in millions of dollars retained within the province. It also ensures access to a reliable supply of rootstocks that are resilient to colder temperatures and less vulnerable to infestations, which has led to the faster production of healthy trees for Mori Essex Nurseries. A similar process can be applied to produce other types of rootstocks. "It shows that money invested by OCE has really returned the value," says Saxena. "This could signal the beginning of a domestic industry in Ontario, not just for apple crops but also for other fruits."

OCE Implications and Broader Impacts on the Ontario Economy

Supporting Commercialization

Under the commercialization program portfolio which accounts for approximately 41% of projects funded within the period covered by this report, OCE delivers several programs designed to support high-potential entrepreneurs and start-ups to help them grow to the point where they can attract private investment and achieve commercial success. Included within this portfolio are programs such as the SmartStart Seed Fund and Market Readiness that are designed to support the successful generation of new start-ups and/or Ontario-made intellectual property and patents that introduce new products and services into the market, creating business revenue and employment opportunities. During the four fiscal years of 2014-15 to 2017-18, OCE has financially supported an estimated 1,771 patents and 1,361 licenses.

OCE's support for entrepreneurs developing patents has specific and important benefits that diffuse into the economy:

Supporting economic growth: Patents can be viewed as the outcome of expenditure on research. Intellectual property protection does not directly lead to growth, but it can create an incentive structure that encourages R&D, which in turn leads to increased innovation, which can generate greater rates of economic growth.²⁴

De-risking market entry: Patenting technology or a product significantly decreases the risk of market entry by protecting against competitors mimicking intellectual property and enabling developers to seek payment for the use of technologies.

OCE's support for licenses has an analogous benefit for inventors and can enable companies to develop agreements

between buyers/users to employ/deploy invented technology. These agreements can enable inventors to showcase technologies in target industry settings and to limit the likelihood of commercial disputes.

Similarly, OCE's support for prototyping has specific benefits to inventors. Prototypes can enable inventors to showcase inventions prior to the development of the final product and to seek insights and guidance from technical, financial and academic subject matter experts. In addition, over the impact analysis period, OCE has supported the development of 3,795 prototypes and the launch of 1,943 prototypes.

Analogous to patenting and licensing, the activity of prototyping can reduce the risk that a design may not perform as intended and enables designers and manufacturers to test parts of design most at risk of failure. Examples of the benefits of support for prototyping include:

Potential recovery of cost for inventors: In some instances, a successful patent that enables innovators to enter the market allows the owner to recover the expenses invested in the R&D phase.²⁵ Consequently, OCE's support for patents helps support the creation of new businesses and reduce barriers to entry for new businesses.

Supporting sales opportunities: OCE extends its support for commercialization for program participants to helping to secure market opportunities. Relative to other subnational North American markets (e.g., California) the Ontario market is small, and can be fragmented between rural and urban communities. This can challenge start-ups and entrepreneurs in accessing domestic sales opportunities. Several reviews have attributed Canada/Ontario's combination of the relatively small size of the domestic market, and barriers to accessing global markets as structural challenges for Canadian SMEs. This challenge can be particularly acute for smaller, start-up firms that may lack resources and talent to identify and navigate sales channels.²⁶ Key examples of programs that can enable sales opportunities include the AdvancingHealth and AdvancingEducation Programs, SmartStart Seed Fund and Market Readiness program.

These programs connect entrepreneurs and developers directly with public organizations in demand for innovative new solutions/technologies through demonstration projects that show a clear potential for scaling-up to the system-level and can help build strong cases for adoption within organizations.²⁷

OCE Implications and Broader Impacts on the Ontario Economy



Toronto, ON

Commercialization

OCE Investment:

- \$350,000

ROI

- \$13,800,000 in follow-on investment
- 25 new jobs created and 35 jobs retained
- 20 new Canadian customers secured and 10 new international customers secured
- Incremental sales of \$1,000,000 in Canada and \$1,500,000 internationally

AlayaCare - Bringing Healthcare Management Home

The journey to receiving health care can be a long and drawn-out task. It's enough to make several people tired before even seeing a care provider. This is especially true for patients who are chronically ill and require frequent care. Hospital visits and readmissions can become a time-consuming and arduous task. Toronto-based AlayaCare, a Software-as-a-Service (SaaS) start-up that develops cloud-based home healthcare software, aims to provide a solution.

Through the AdvancingHealth program, which OCE administers on behalf of the Ministry of Government and Consumer Services, AlayaCare, in collaboration with Southlake Regional Health Centre and CBI Health Group, undertook a project that utilized its technology platform to allow clients to monitor their vital signs and complete a clinician-designed daily self-monitoring workflow remotely. The goal of the project was to help clients/patients with one or more chronic conditions better manage their own care at home and reduce the number of hospital visits required.

Earlier this year, the company announced the acquisition of Canesto Systems Inc., a leading contact and resource management software provider for home and community care organizations. In 2018, AlayaCare received \$13.8 million in follow-on investment from venture capital firms like iNovia Capital and Fonds InnovExport.

OCE Implications and Broader Impacts on the Ontario Economy

Enabling Procurement

OCE also addresses traditional sales barriers for Ontario firms by opening access to valuable government and public-sector procurement contracts. Prohibitive procurement frameworks in Ontario have been identified in several reviews as lost opportunities for Ontario businesses. For example, a 2014 review by the Ontario Chamber of Commerce found that through improving the efficiency and effectiveness of procurement, governments have an opportunity not only to potentially save significant taxpayer dollars, but also to drive economic growth.²⁸ OCE's REACH (Resources for Evaluating, Adopting and Capitalizing on Innovative Healthcare Technology) Program is designed to support Ontario health care provider organizations in using new methods to procure solutions to their high-priority needs.²⁹ Similarly, SBIC (the Small Business Innovation Challenge) supports the growth of high-potential, technology-driven SMEs in the province. The program uses public-sector challenges, identified by participating ministries of the Government of Ontario, as a platform for inspiring SMEs to develop and test innovative technology solutions.³⁰

OCE's ability to deliver these programs has a dual benefit to the Ontario economy, as program participants are given pathways to access government and public-sector contracts that are often difficult to access, while simultaneously providing the public-sector with a funnel of potential solutions and/or goods and services to meet its technical needs.

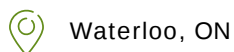
Supporting Campus Entrepreneurship

OCE's campus entrepreneurship portfolio concentrates programs on students in Ontario post-secondary institutions through its Campus-Linked Accelerator (CLA) and On-Campus Entrepreneurship Activities (OCEA) programs. In doing so, OCE can support the next generation of innovators and leaders in the economy. OCE's ability to execute programs dedicated to stimulating youth entrepreneurship has important benefits for the economy such as:

- **Breaking down barriers:** Youth can encounter challenges in joining networks due to a lack of resources, experience in entrepreneurship and labour market experience. Specifically, youth can have limited exposure to formats through which they can learn about best practices in entrepreneurship and business. CLAs and OCEAs directly address this challenge by providing training, peer network learning and mentorship to promising youth entrepreneurs.³¹
- **Developing peer networks:** In contrast to those with more senior levels of education or work experience, youth can lack a network of potential colleagues, business contacts and/or potential customers. Participants within CLA and OCEA institutions have opportunities to liaise with each other and develop peer networks that can contribute to important business and professional relationships in the future.
- **Supporting youth employment:** OCE's support for youth-led ventures and/or entrepreneurs can translate to the creation of youth employment opportunities. Participating youth can leverage their experience within CLAs and OCEAs to acquire full or part-time employment or they can be self-employed in jobs related to companies and/or ventures supported by OCE.

Importantly, the benefits participants gained through entrepreneurship programs can be realized throughout their education and career.

OCE Implications and Broader Impacts on the Ontario Economy



Waterloo, ON

Campus Entrepreneurship

OCE Investment:

- \$37,500 via SmartStart
- \$125,000 via Market Readiness

ROI

- 9 new jobs created and 8 jobs retained
- 3 new Canadian customers and 2 new international customers

Ecopia – Revolutionary Visual Recognition for Geospatial Imagery

Millions of geospatial images are captured everyday by satellites, airplanes, drones and other vehicles. Extracting useful insights from the flood of pixels is an extremely time-consuming and costly endeavour, making geospatial data analysis largely inaccessible for those who need it most.

Waterloo-based Ecopia is an industry-leading artificial intelligence (AI) company that specializes in extracting insight from geospatial big data. Ecopia's intelligent proprietary systems leverage groundbreaking advancements in machine learning to convert high- resolution imagery of our earth into HD maps. Ecopia has experience applying its technology to extract HD Maps from satellite imagery, aerial orthoimagery, aerial oblique imagery and street-view imagery. Ecopia provides actionable insights for observing, analyzing and monitoring business processes like urban planning, and asset monitoring for industries such as energy, insurance, real estate, telecom and location-based services.

Ecopia is a graduate of the Accelerator Centre in Waterloo, which is supported by Ontario's Campus-Linked Accelerator program. With further support from the SmartStart Seed Fund, Ecopia was able to formalize business practices, develop strategic partnerships and get their technology ready for market adoption. Additional funding from the Market Readiness program allowed the company to continue to develop its product and increase its customer base.

Ecopia currently employs 25 people in Ontario and its suite of products are being used internationally.

OCE Implications and Broader Impacts on the Ontario Economy

Stimulating Private Sector Investment and Follow-on Investment

OCE is differentiated from other forms of government support to companies in its requirement for matching industry co-investment. In doing so, OCE encourages new R&D spending in the economy.

OCE seeks to collaborate and continuously develop new partnerships with private sector investors, leveraging both its network and unique place in the ecosystem, in order to drive further investment support for companies.

OCE has been successful in stimulating over \$354 million in co-investments across all four program categories. Our analysis also estimates that every \$1 of provincial investment has attracted an additional \$2.21.

This feat is of particular importance in Ontario:

- Several reviews of Ontario's innovation performance have identified ensuring robust private R&D is critical to the overall competitiveness of the economy;
- There has been a 17% decline in business spending on R&D in Ontario since 2000;³²
- This declining performance mirrors challenges at the national level. On a per capita basis, business and public expenditure on R&D in Canada has historically been behind that of peers (i.e., less than half of the U.S.) and has declined since 2007.

This trend comes while peers such as South Korea have almost doubled business expenditure on R&D from 2007 to 2014, effectively widening the gap between Canada and its global peers and reflecting lower levels of innovation investment and activity amongst Canadian firms.

OCE's ability to support follow-on investment is a unique feature of its economic impacts. During the four fiscal years of 2014-15 to 2017-18, OCE-funded projects generated approximately \$1.7 billion in follow-on funding. The majority of this funding came in the form of angel and venture capital funding. This accumulation of venture capital contributes to the economy by improving the output elasticity of R&D activity, contributing to productivity growth and enhancing the absorption of the knowledge generated by universities and firms.³³ In the long-term, this can improve aggregate economic performance.

Addressing Ontario's Productivity Gap

OCE's support for the development of new products and services, as well as the quality of entrepreneurship talent in the economy also plays a role in addressing Ontario's productivity gap. While support for productivity may be an obvious choice for a government, it is particularly relevant to the Canadian economy. Canada has struggled with a productivity gap against key peers for decades. Canadian workers have persistently been less productive than peers with GDP per capita and per hour worked consistently behind peers.³⁴

In reviews of the challenge, the 'productivity gap' has been identified as the outcome of low levels of business investment in productivity enhancing technologies – an area where international peers have aggressively grown in recent years.³⁵ Each OCE program category funds activities that can enhance productivity in the economy in different ways. Below are elements of productivity that are directly supported and enhanced by OCE programs:

- **Physical capital:** the stock of equipment and structures that are used to produce goods and services (i.e., the Voucher for Innovation and Productivity program which funds research projects lasting up to 2 years);

OCE Implications and Broader Impacts on the Ontario Economy

- **Human capital:** the knowledge and skills that workers acquire through education, training, and experience (i.e., the TalentEdge Internship and Fellowship Program which supports Ontario college and university students and recent graduates to work on industry-driven R&D projects in all sectors); and
- **Technological knowledge:** society's understanding of the best ways to produce goods and services (i.e., OCE's Market Readiness program which provides funding for the development of repeatable, scalable sales processes).

Growing the Capabilities of the Ontario Workforce

One of OCE's most important contributions to the economy is its enhancement of Ontario's workforce. OCE supports talent development in Ontario both directly and indirectly. Approximately 12% of OCE's provincial spending within the analysis period is concentrated in the Talent program category, providing Ontario students and recent graduates with real-world experience, enabling interns and postdoctoral fellows to apply their expertise, exposing them to the latest tools to solve industry problems.

For participants, there are several benefits to participating in OCE-funded projects that can accrue or mature during the lifetime of their career such as:

- Exposure to new skill sets, methodologies and/or technical skills;
- Broadening of network within an industry/discipline; and/or
- Opportunity to develop leadership and project management skills.

Support for STEM talent: Several of OCE's programs explicitly focus on Science Technology Engineering and Math (STEM). Key examples include:

- CFIPP (The Cybersecurity Fintech Innovation Pilot Program) specifically supports innovative solutions to cybersecurity challenges and providing them with cybersecurity talent;³⁶
- HTF (The Health Technologies Fund) which supports the development of made-in-Ontario health technologies by accelerating evaluation, procurement, adoption and diffusion in the Ontario health system; and
- The IBM Innovation Incubator Project which focuses on helping SMEs gain access to advanced computing and global supply chains.

STEM skill literacy and/or expertise can have specific, positive impacts on individuals' career trajectories. A 2014 review by the Canadian Council of Academies found that Canada's capacity to support advanced STEM skills was an important determinant of the country's future competitiveness, innovation and productivity. In addition, the review found that individuals holding STEM qualifications can have the ability to rapidly adjust to changes in response to future labour market uncertainties.

Faced with long-term opportunities and uncertainties related to the present labour market and economic impacts of disruptive technologies in Canada, the Council found that investments in STEM skills represented "[an appropriate] response to growing uncertainty about the future of technology, the changing nature of work and expected demand for skills".³⁷

More specifically, skill sets related to analytics, mobility, big data, security, the Internet of Things (IoT) and the cloud have been identified as specific areas that will drive demand for highly-skilled technology talent. Demand is expected to come from traditional technology firms but is inclusive of virtually all industries.

Taken together, OCE's ability to provide individuals with exposure and R&D opportunities in fields related to these skill sets is important to the development of a future-ready Ontario labour force.

OCE Implications and Broader Impacts on the Ontario Economy



 Ottawa, ON

Talent

OCE Investment

- \$58,500

ROI

- Over 30 new jobs created
- Over 120 customers secured
- Over \$1 million in sales with 85% from outside of Canada

MindBridge AI – Artificial Intelligence for the Financial World

The MindBridge Ai Auditor™ project uses artificial intelligence (AI) and machine learning models to help protect organizations against suspicious financial activities and reduce the time it takes to detect these potential breaches from months (due to manual auditing) to near real-time. To accomplish this, Ottawa-based MindBridge turned to the TalentEdge Fellowship Program, which is administered by OCE on behalf of the Ministry of Economic Development, Job Creation and Trade. Through this program, companies can tap into world-class talent from Ontario's post-secondary institutions to develop new products, services, and processes, while PhD graduates receive vital industry experience.

"TalentEdge has been a great help in connecting me with MindBridge," says Robert Peace, the fellow brought on board through the TalentEdge Fellowship program. "I walked into the MindBridge offices as a fresh PhD graduate, to talk about partnerships between Carleton and MindBridge. I'm sure MindBridge's decision to hire me was influenced by the support OCE provides."

During the course of MindBridge's participation in the program, the company has created more than 30 new jobs, secured over 120 customers and tallied over \$1 million in sales, with 85 percent coming outside of Canada. As a result of this successful TalentEdge project, MindBridge aims to continue working with universities and colleges to grow the AI ecosystem in Canada.

"As a conduit between us (industry to university), OCE's TalentEdge has helped tremendously," says MindBridge AI CEO Eli Fathi. "OCE, with all the knowledge of engineering, AI, and all disciplines in universities, connected us with the right people and, of course, the financial support was the icing on the cake. Our intern contributed to our effort to create this technology, which has enabled us to be the leading company in the field." Peace agrees: "I believe that finding opportunities through programs like TalentEdge that innovate while providing immediate value to society in the process is critical to the ongoing success of the AI sector."

OCE Implications and Broader Impacts on the Ontario Economy

Supporting the Growth of Ontario's Key Sectors

OCE supports the attractiveness of Ontario as a destination for businesses, talent and investment by:

- **Supporting the development of clusters:** Supporting industry-academic collaborations can spawn the development of new sector expertise or support existing concentrations of public and private spending. OCE has specialized programming available via its suite of Talent programs that support talent development in future-oriented segments of the Ontario economy, such as cybersecurity, autonomous vehicles and data analytics.

Each of these technology areas are complex, but align with each other through features of the Ontario economy that have been identified by the Ontario government as potential areas of expertise and competitive advantage, and align with broader patterns of investment and development activity in Ontario. Below we demonstrate examples of how OCE programming aligns with areas of existing momentum and/or potential competitive advantage in the province:

- **Cybersecurity:** In a profile of Ontario's cybersecurity capabilities, the government of Ontario notes that globally leading firms located in the province, including BlackBerry, Certicom and Open Text, are evidence of the province's developed cybersecurity expertise;
 - Similarly, Deloitte ranked Canada's cybersecurity sector fourth in venture capital deal flow from 2012 to 2016. The Deloitte report concludes that Ontario, where SMEs have received over \$250 million in VC funding from 2011-15, has all the ingredients to become a global hub for cybersecurity innovation.³⁸
- **Data analytics:** The Government of Ontario has identified the province to be the second largest IT cluster in North America.³⁹ Included in this diverse sector are significant examples of public and private investment in R&D related to analytics such as the Centre for Advanced Computing, and SOCSIP (the Southern Ontario Smart Computing Innovation Platform);⁴⁰ and
- **Autonomous vehicles:** OCE's support for autonomous vehicles is aligned with the next generation of Ontario's long-established automotive sector. In 2016, the Ontario government became first jurisdiction in Canada to allow on-road testing of automated vehicles when a pilot project launched.

The pilot was a defined platform for activity related to autonomous vehicles to scale. Similarly, the province launched a Demo Zone in Stratford as a part of the Autonomous Vehicle Innovation Network (AVIN) delivered by OCE on behalf of Ontario. As a key part of the AVIN program suite, the Demo Zone is unique in that it will allow companies and researchers to test and develop their connected and autonomous technologies in a wide range of realistic traffic and weather conditions

OCE Implications and Broader Impacts on the Ontario Economy

- **Canada's digital infrastructure:** Globally competitive digital infrastructure can be viewed as a necessary condition for innovation. OCE partners with the province on several initiatives with objectives to enhance Canada's digital infrastructure:
 - Through ENCQOR – a Canada-Quebec- Ontario partnership focused on research and innovation in the field of 5G disruptive technologies, on adoption initiatives and system uses, OCE is supporting the first ever Canadian pre-commercial 5G digital infrastructure;
 - The Next Generation Network Program supports the development and implementation of ultra-high-speed digital infrastructure to interconnect digital innovation hubs within Ontario and support SMEs, proof of concept projects, develop talent, support export development activities and access technical and business support personnel services;⁴¹ and
 - The IBM Innovation Incubator Project offered through a partnership between OCE and IBM that delivers an integrated suite of globally disruptive, advanced computing technology infrastructure and programming to Ontario's SMEs.

In partnership with the province, OCE's specialized support for these sectors is specifically targeting areas of existing momentum in public and private investment, contributing to elements of existing competitive advantage and job creation. By focusing specifically on talent development, OCE contributes to the lifeline of Ontario's activities in these areas of technology and reinforces the province's talent advantages.

The characteristics of Ontario's economy vary significantly across different locations within the province. The market challenges faced by entrepreneurs may vary depending on the specific community they are working in. During F2015-18, OCE has supported projects in over 125 communities. Provincial spending through OCE stretches across metropolitan and rural communities, demonstrating its applicability across the province and an ability to stimulate job creation in different types and sizes of economies.

Conclusion



Our analysis of the economic contribution of OCE demonstrates that the organization is an important catalyst in Ontario's economy. OCE plays a unique role in connecting academia, industry and capital partners in supporting meaningful projects that align with some of Ontario's most important sectors; and can be considered as a key government partner to drive innovation and economic growth in the province. OCE's unique role as a connector in the economy catalyzes new R&D, commercialization, sales opportunities and job creation, that otherwise may not have been realized.

The results of this analysis indicate that during F2015-18 OCE's \$160 million in contributions were able to catalyze and support:

- \$354 million in co-investments;
- \$1.7 billion in follow-on investments;
- \$518 million in incremental sales revenue; and
- \$115 million in provincial government tax revenue

OCE's contributions to the economy are multifaceted in nature. Our analysis reveals that OCE's key program areas support a set of meaningful economic outcomes and benefits that prepare the future of Ontario's work force, and address key challenges faced by the Ontario economy. OCE's impacts are broad, and extend across a vast set of communities, sectors and settings.

Appendix A: Report Disclaimer

Disclaimers and Limiting Conditions

This report has been provided to Ontario Centres of Excellence (“OCE”) for the purpose of assessing economic contributions associated with OCE project investments, as well as identifying and characterizing a range of broader contributions of OCE’s activities to the economy.

This report does not represent a cost-benefit analysis for OCE or any other stakeholder and does not represent a comparison of potential economic contributions of provincial funding to potential impact of an alternative use of resources. In particular, the report does not examine the total provincial investment in OCE, the delivery or administrative costs of OCE programs included within the analysis of this report, or the opportunity costs for OCE and other stakeholders. A detailed review of OCE’s operational, financial and delivery efficiency is not included in the scope of this engagement. Comparison of OCE’s impacts against relevant peers is not included in the scope of this engagement. Case studies included within the report were provided by OCE and not independently verified by Deloitte. Efficiency analysis included in this report was provided to Deloitte by OCE and not independently verified by Deloitte.

Deloitte does not assume any responsibility or liability for losses incurred by any party as a result of the circulation, publication, reproduction or use of this report contrary to its intended purpose. This report has been made only for the purpose stated and shall not be used for any other purpose.

The analyses are provided as of September 7, 2018, and we disclaim any undertaking or obligation to advise any person of any change in any fact or matter affecting this analysis, which may come or be brought to our attention after the date hereof. Without limiting the foregoing, in the event that there is any material change in any fact or matter affecting the analyses after the date hereof, we reserve the right to change, modify or withdraw the analysis.

Observations are made on the basis of economic, industrial, competitive and general business conditions prevailing as at the date hereof. In the analyses, we may have made assumptions with respect to the industry performance, general business, and economic conditions and other matters, many of which are beyond our control, including government and industry regulation.

No opinion, counsel, or interpretation is intended in matters that require legal or other appropriate professional advice. It is assumed that such opinion, counsel, or interpretations have been, or will be, obtained from the appropriate professional sources. To the extent that there are legal issues relating to compliance with applicable laws, regulations, and policies, we assume no responsibility therefore.

We believe that our analyses must be considered as a whole and that selecting portions of the analyses or the factors considered by it, without considering all factors and analyses together, could create a misleading view of the issues related to the report. Amendment of any of the assumptions identified throughout this report could have a material impact on our analysis contained herein. Should any of the major assumptions not be accurate or should any of the information provided to us not be factual or correct, our analyses, as expressed in this report, could be significantly different.

Appendix B: Methodology Details

I. Economic Impact Analysis Framework

Introduction to Input-Output Modelling

Input-output models (I-O models) are used to simulate the economic impact of an expenditure on a given basket of goods and services or the output of one of several industries. Input-output analysis uses data on the flow of goods and services among various sectors of the economy, and attempts to model how an expenditure, increase in demand, or investment ripples through a region's economy. This is done by mapping the production of products and services by each industry, and identifying the intermediate inputs used in the production of each final product or service used by consumers, sold as an export, or purchased by government. The model can then aggregate all of the employment and value-added impacts generated in the supply chain as commodities are produced. I-O models also consider the role of imports, which tie the supply chain to the global economy. This data is combined into a single model of the economy which can be solved to determine how much additional production is generated by a change in the demand for one or more commodities or by a change in the output of an industry.

Assumptions and Limitations of the Model

The Input-Output model is subject to a number of general assumptions and limitations. The model reflects a simplified macroeconomic structure, and does not include some variables of interest for macroeconomic analysis such as interest rates, unemployment rates, or income tax rates. The model assumes that the Canadian economy has the capacity to produce the goods and services stimulated by the economic shock. The model is not able to forecast situations in which demand may outpace the capacity to produce the required goods and services, however it does estimate the portion of goods and services sourced from other provinces in Canada and internationally. The model makes a basic underlying assumption that the number of jobs created maintains a linear relationship with short-term gross output. "This approach can be considered sound if the value and quantity measures are for the same year and the analysis is focusing on the structure of the economy for that same year. When used for projecting beyond the IO model year, the relationship between values and quantities may be [impacted] by price variations." For more information on the assumptions and limitations of the model, please refer to "The guide to using the input-output simulation model", which is available free of charge upon request from Statistics Canada.

II. Economic Impact Measures

The following table provides economic measures analyzed for each level of impact assessment. The economic impact measures are analyzed under two classifications: by program category and project sector.

OCE Project Investment Categories of Impact	Four distinct categories of Economic Impacts based on the source of economic activity: • Economic impacts created by OCE spending on projects - This category includes the economic impacts generated through spending of OCE's investments in projects. • Economic impacts created by co-investments in OCE-funded projects - This category includes the economic impacts generated through the spending of co-investments in OCE-funded projects. • Economic impacts enabled by follow-on investments in OCE-funded projects - This category includes the economic impacts arising from the spending of additional funds leveraged (i.e. additional funds raised by OCE-funded projects after the project has commenced, or after completion of contract) from other sources as a result of OCE's initial investment in projects. • Economic impacts associated with the growth (incremental sales revenues) in OCE-funded projects and companies as a result of OCE project investments - This category includes the economic impacts arising from the spending of incremental sales revenue that are directly attributed to the OCE-funded project (e.g. commercialization of a product developed by a project funded by OCE).
Direct Impacts	• Provincial GDP • Labour income (wages and salaries) • Employment • Government revenue Estimation Methodology: Industry multipliers attributed to each expenditure category are applied to estimate impacts. Estimation of taxes will include federal, provincial, and municipal product and production taxes such as sales taxes, licenses and permits, property taxes, as well as personal income tax and corporate income tax as applicable.
Indirect Impacts	• Provincial GDP • Employment • Labour income (wages and salaries) • Government revenue Estimation Methodology: Industry multipliers are applied to estimate impacts generated by the expenditure for all economic measures.

III. Economic Impact Definitions and Levels of impact

The model estimates select direct and all indirect economic contributions in terms of GDP, employment, labour income, and government revenue as defined below. The following table provides associated details on economic impacts definitions and modeling assumptions:

Measures	Description	Levels Modeled
Gross Domestic Product (GDP)	GDP is the total unduplicated value of goods and services produced in the economic territory of a country or region during a given period. GDP includes household income from current productive activities (wages, salaries and unincorporated business income) as well as profits and other income earned by corporations. In the context of our report GDP serves as a measure of the total economic value-added resulting from the spending associated with the categories of expenditure identified. It is estimated through identifying the sectors associated with OCE project investment streams spending and applying the respective provincial multipliers.	- Direct - Indirect
Employment	In this report direct employment impacts are reported as provided by OCE. Indirect employment is are estimated in terms of full-year equivalent positions for ongoing employment (i.e. employment contribution associated with annual expenditures). Full-year equivalent positions are counted according to their duration and not according to whether they were employed on a full-time or part-time basis. That is, two part-time employees would be counted as one full-year equivalent if the total time they spent on the job adds up to one year. This approach is consistent with standard statistical terminology.	- Direct - Indirect
Labour Income	Labour income represents the total earnings of employees (including employees of suppliers to the projects), consisting of wages and salaries as well as supplementary labour income (such as employer's contributions to pension funds, employee welfare funds, the Unemployment Insurance Fund and Workers Compensation Fund). In this analysis, direct labour income is estimated using the reported jobs and average salaries for different program categories.	- Direct - Indirect
Government Revenue	In this report government revenue is only partially accounted for, specifically including federal, provincial, and municipal product and production taxes such as sales taxes, licenses and permits, property taxes, as well as personal income tax and corporate income tax as applicable. This is estimated through identifying the sectors associated with investment spending and applying the respective provincial multipliers.	- Direct - Indirect

IV. Data Assumptions

OCE Project Investment Streams: Provincial Funding, Co-Investments, Follow-on Investments and Incremental Sales Revenues

- Analysis is based on data provided by OCE for projects funded during the four fiscal years of 2014-15 through 2017-18, all projects outside this period are excluded from analysis.
- The spending pattern of the OCE funding was provided by OCE for each program name in the following key expenditure areas:
 - Capital expenses e.g. purchase of equipment, hardware, etc.
 - Operating expenditures e.g. R&D, hiring of 3rd party contractors, etc.
 - Other expenses, e.g., admin
 - Travel expenses
 - Salaries
- Analysis assumes that the co-investments were spent in the same way as the initial OCE project investments (i.e. similar spending distribution).
- Analysis assumes that projects included have been active long enough to realize results.

Appendices

Appendix C: Estimated Economic Impacts of OCE Project Investments

Economic Impacts Resulting from Provincial Funding by Sector

Table C1 shows a breakdown of the economic impacts arising from the spending of provincial funding in projects by sector. Accounting for direct and indirect impacts, the digital media and information & communication technologies sector contributes the largest share of impacts attributed to provincial funding.

Table C1: Economic Impacts Created by Provincial Funding in Ontario by Sector

Sector Categories	GDP (Millions)	Labour Income (Millions)	Employment (FTEs)	Government Revenues (Millions)
Advanced Health Technologies	\$34	\$19	257	\$5
Bio-Economy and Clean Technologies	\$19	\$12	161	\$3
Advanced Manufacturing	\$30	\$17	241	\$5
Digital Media and Information & Communication Technologies	\$67	\$38	530	\$10
Unspecified ⁴²	\$35	\$21	292	\$5
Total Impacts	\$185	\$107	1,481	\$28

Economic Impacts Resulting from Co-investments by Sector

Table C2 shows a breakdown of the economic impacts arising from the spending of co-investments in projects by sector.

Table C2: Economic Impacts Created by Co-investments in Ontario by Sector

Sector Categories	GDP (Millions)	Labour Income (Millions)	Employment (FTEs)	Government Revenues (Millions)
Advanced Health Technologies	\$54	\$30	413	\$8
Bio-Economy and Clean Technologies	\$44	\$27	372	\$7
Advanced Manufacturing	\$56	\$32	448	\$9
Digital Media and Information & Communication Technologies	\$182	\$117	1,590	\$27
Unspecified	\$82	\$50	689	\$12
Total Impacts	\$418	\$257	3,512	\$62

*The numbers may not exactly add-up to the total presented due to rounding.

Appendices



Economic Impacts Resulting from Follow-on Investments by Sector

Table C3 shows a breakdown of the economic impacts arising from the spending of follow-on investments in OCE-funded projects and/or companies by sector in Ontario.

Table C3: Economic Impacts Enabled by Follow-on Investments by Sector

Sector Categories	GDP (Millions)	Labour Income (Millions)	Employment (FTEs)	Govern-ment Revenues (Millions)
Advanced Health Technologies	\$426	\$271	3,690	\$62
Bio-Economy and Clean Technologies	\$189	\$124	1,677	\$28
Advanced Manufacturing	\$276	\$173	2,360	\$41
Digital Media and Information & Communication Technologies	\$966	\$576	7,924	\$144
Other ⁴³ / Unspecified	\$159	\$95	1,300	\$24
Total Impacts	\$2,015	\$1,239	16,951	\$299

*The numbers may not exactly add-up to the total presented due to rounding.

End notes



1. The OCE funding year runs from April 1 to March 31.
2. OCE provided all the data on all projects funded during the four fiscal years of 2014-15 and 2017-18, including total OCE investments, co-investments, follow-on funding and incremental sales.
3. OCE primarily receives funding from the provincial government for investments in projects with the federal government providing co-investments in the SmartStart program. In this analysis, the OCE project investments include this amount.
4. OCE 2018
5. OCE 2018
6. Project data is collected by OCE as reported by the OCE-funded projects during the project, as well as at the end of the project; some additional data is collected through OCE's retrospective survey one, two, and three years out from the end of the project.
7. OCE 2018
8. Interactive digital media. Government of Ontario. Web source: <https://www.investinontario.com/digital-media#discover>
9. Ontario's Bio Advantage: Local Source. Global Strength. Web source: <http://www.omafr.gov.on.ca/english/research/ktt/local-global.htm>
10. Cleantech. Web source: <https://www.investinontario.com/cleantech#intro>
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43. Includes investments in nanotechnology, agriculture, water technologies, financial services, and forestry.









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