Tech North: Building Canada’s first technology supercluster

THE TORONTO-WATERLOO INNOVATION CORRIDOR

Canada’s nascent technology supercluster in the Toronto-Waterloo region has the potential to become one of the world’s top innovation ecosystems. This report examines how this can be achieved and what could move Toronto-Waterloo to global technology supercluster status.

INSIDE

A chapter detailing McKinsey & Company’s analysis of technology superclusters, their impact, and the factors that drive their creation and acceleration and a chapter summarizing a series of informal roundtables involving entrepreneurs, business leaders, and policy experts.
INTRODUCTION

This report was inspired by an informal group of technology entrepreneurs, thought leaders, and academics in the Toronto-Waterloo Innovation Corridor who feel that the corridor is Canada’s best chance to build a top tier innovation ecosystem. They sought external analysis and expert views to understand how to create a better foundation for a top tier innovation ecosystem that could catalyze growth in the region and across Canada.

Transforming the Toronto-Waterloo Innovation Corridor into a world-class technology supercluster is a unique opportunity to drive productivity and build a brighter Canada. Technology superclusters are forming across the world, drawing talent, capital, and innovative ideas, and Canada lacks one.

Today, the corridor represents over 17% of national GDP. It is also home to the largest number of tech companies and one of the world’s most sophisticated financial sectors.

Despite its strong positioning, the equity value of the corridor’s tech companies lags far behind those of peer cities like Chicago, Boston, Berlin, and Singapore. Catching up, if not surpassing them, might require bold ideas, a concerted effort, and leadership across public and private sectors alike. The measure of success is equity value creation – how much value is created by technology entrepreneurs and companies.

Chapter 1 is an overview of McKinsey & Company’s analysis of technology superclusters, their impact, and the factors that drive their creation and acceleration.

Chapter 2 is a “blueprint” for fostering a supercluster in the Toronto-Waterloo Innovation Corridor based on the findings of the informal working group. A summary of the key recommendations is provided on page 20.

Important notes

▪ Although this document focuses on the Toronto-Waterloo Innovation Corridor, the success of this cluster does not preclude that of similar efforts in other regions. Instead, we hope it serves as a catalyst for the development of tech clusters across Canada – winning begets winning.

▪ The ideas presented in this paper are not intended to be exhaustive. They are intended to serve as inspiration for organizations across the region and to augment the many opportunities that are in various stages of development.
Chapter 1 summarizes the fact-based research and analysis of technology clusters performed by McKinsey & Company. It includes an assessment of the relative position of the nascent technology supercluster in Toronto-Waterloo and addresses the benefits of superclusters and how they are formed. It frames the potential benefits to the Toronto-Waterloo region, and the broader Canadian economy, against a longer-term growth aspiration for 2025. Finally, this section lays out a conceptual model for how to think about the factors that drive the creation and acceleration of a technology supercluster.
Chapter 1 – Executive Summary

Canada faces the possibility of an uncertain economic future, with productivity consistently lagging that of its peers in the developed world. The forces that once buoyed the economy – rising commodity prices and a growing workforce – cannot be relied on in the future.

In the meantime, technology superclusters around the world are attracting talent and capital to fuel growth and productivity. Clusters like Silicon Valley, London-Cambridge, and Tel Aviv-Haifa are able to achieve non-linear gains in both job creation and economic value accumulation. These clusters spark innovation and turbocharge economic growth.

A Canadian supercluster could be a significant first step to helping jump-start economic growth. The Toronto-Waterloo Innovation Corridor, which also includes several surrounding municipalities, such as Guelph, Hamilton, Kitchener, and Mississauga, has the potential to develop into a world-class technology supercluster. However, this may require a concerted effort to address persistent structural gaps in talent and capital, together with initiatives that promote connectivity and scale.

The Ontario government is actively shaping education priorities for the knowledge economy, which will support the talent imperative in driving the corridor and through which there is much scope for industry partnerships to grow a uniquely skilled workforce.

There is a critical mass of universities and incubators to supply the needs of a growing cluster. The universities include: University of Toronto, McMaster University, University of Waterloo, Wilfrid Laurier University, York University, Ryerson University, Conestoga College, and University of Guelph. Startup incubators include: Communitech, MaRS, Velocity at University of Waterloo, DMZ at Ryerson, NEXT Canada, and Creative Destruction Lab at Rotman School of Management, along with several other University of Toronto entrepreneur centres.

Turning the Toronto-Waterloo Innovation Corridor into a global innovation hub has the potential to deliver a $50 billion increase in direct equity value, $17.5 billion in direct annual GDP, and more than 170,000 high-quality jobs by 2025.

The opportunity is there, but the window could be closing quickly. Observers predict that approximately 80% of cluster gains will accrue to 5 global superclusters in the medium to long term. Participating in these gains will require policy changes, new approaches, and significant near-term investments, but the upside potential is enormous.
WHERE A TECHNOLOGY SUPERCLUSTER IN CANADA COULD MAKE A DIFFERENCE

Canada’s human capital ranks with the best in the world. Despite this advantage, Canadian incomes lag those of its OECD peers, especially its biggest trading partner, the United States.

Data show that Canada’s “prosperity gap” might be driven by decreasing productivity:

- From 1995 to 2012, Canada’s average annual productivity growth rate ranked 26th of 35 OECD countries.
- The gap between Canadian and US business-sector productivity growth doubled from an average of 0.8 (1985-2000) to 1.6% (2001-2011).
- Business productivity levels in Canada are 70% those of the United States, negatively impacting Canadian competitiveness and standards of living.

The recent downturn in energy prices may not be temporary and major demographic changes over the next decade point to declining growth in labour force participation. Even if the status quo persists, Canada’s prosperity relative to the United States could drop by 30%.

GDP per capita is approximately $11,000 lower in Canada than in the United States. Despite an increase in hours worked, Canada has not been able to close a persistent productivity gap.

A step-change in productivity is required to maintain current standards of living and drive economic growth. A technology supercluster would drive innovation, productivity, and growth at the national scale.


Source: UN Development Indicators; The World Bank; US Energy Information Administration; IMF; OECD; Government of Ontario; Statistics Canada; Business proprietary data

Fact base prepared by McKinsey
THE BENEFITS OF A TECHNOLOGY SUPERCLUSTER

Technology superclusters typically help nurture and grow companies, generate new successes, and help close countries’ prosperity gaps.

Clusters energize economies by creating large, accessible talent markets, facilitating knowledge spillover, driving business specialization, and cultivating global anchor companies. These champions drive productivity, growth, and density for long-term cluster success.

Winning tech companies are the champions of successful clusters. While scaling and growing into large companies, they create and further strengthen new tech champions, resulting in superclusters. Examples of this virtuous cycle are seen around the world in high-performing, geographically concentrated clusters like Silicon Valley, New York City, Tel Aviv, and Berlin.

The fundamental case for cultivating strong, dense clusters is premised on the non-linear gains that clusters make possible. As of 2015, 50% of all VC investment in the United States went to Silicon Valley.

Non-linear gains can also have a national economic impact, especially as strong clusters are the breeding ground for technology champions and disruptive innovations. Large technology companies tend to create platforms that smaller firms can grow on. In the process, they accelerate high-value job creation and spur innovation, entrepreneurship, and economic growth.

Source: Harvard Business Review; Moody’s Economy; Silicon Valley Institute for Regional Studies; US Bureau of Labour Statistics; Dow Jones VentureSource

Silicon Valley – the world’s preeminent technology supercluster – is a major economic growth engine. It attracts a huge proportion of growth capital, and its employees contribute approximately 30% more economic value than the average American employee.

Share of VC Deals
Q2 2010-Q2 2013

Silicon Valley share
Southern California share
Washington State share

Fact base prepared by McKinsey
THE BENEFITS OF A TECHNOLOGY SUPERCLUSTER

Empowered and supported by superclusters, technology champions create economic wealth and high-paying jobs.

Tech salaries in high-performing clusters are 35 to 38% higher than average salaries and outgrow other industries. Each job created in the high tech sector generates up to five new indirect jobs. The resulting economic impact is substantial.

**Young firms create a disproportionate number of new jobs when scaling up:**

- Those that survive more than 5 years tend to exhibit higher rates of job creation than mature firms.
- Larger firms invest more and create more wealth, which enriches the greater population through increased spending and tax revenues.

**Large tech companies can also play a direct role in alleviating productivity gaps.** The Canadian tech sector was the largest spender on business enterprise R&D (BERD) in Canada in 2015, accounting for more than 50% of national BERD spending. Evidence also suggests that the larger the tech company, the more productive it is likely to be.

The creation of a technology supercluster could, therefore, help bridge Canada's prosperity gap. The technology champions created in that supercluster will help nurture it, accelerate productivity growth, and create growth, wealth, jobs, and expertise from which the entire country could benefit.

Source: Kauffman Foundation; The World Bank; Enrico Moretti; Mercer; Robert Half Technology; Statistics Canada; NYU Stern; Bay Area Council; McKinsey Global Institute

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Silicon Valley was catalyzed by companies like Apple, Google, Salesforce, Facebook, and Intel

Companies in Silicon Valley contributed $235 billion to California’s GDP in 2015 or +1% of the total US GDP

$235 billion GDP contribution from Silicon Valley

California GDP, 2015

$2.45 trillion

Source: Silicon Valley indicators; Silicon Valley Institute for Regional Studies, 2015

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Fact base prepared by McKinsey
HOW ARE SUPERCLUSTERS FORMED?

Clusters: Harvard Business School professor Michael E. Porter coined the term “cluster” to describe geographic concentrations of interconnected companies, suppliers, service providers, and associated institutions.

1. Capital and resources organically concentrate in a geographic region.
   When a group of companies that shares an industry and a geography forms, resources, capital, and talent begin to concentrate. Once this group reaches a critical mass of companies, a cluster is born. Such a tech cluster has formed in the Toronto-Waterloo Innovation Corridor.

2. Agglomeration amplifies winning companies.
   Once there is a nascent supercluster, the success of winning companies needs to be amplified. The key is not to pick winners but to turbocharge technologies and firms that are leaders in applying these technologies to disrupt traditional market and sectoral models. Winning tech companies in the Toronto-Waterloo Innovation Corridor include established players like Google Canada and Medtronic Canada and newcomers like Financeit, Thalmic Labs, Revlo, and Kira Talent, and they are accelerating the growth of this cluster.

3. Success begets success and nurtures a virtuous cycle.
   A virtuous cycle for growing and strengthening the nascent supercluster can be enabled by being laser-focused on ensuring winning companies and adequate infrastructure are in place. The Toronto-Waterloo Innovation Corridor has the potential to become a supercluster. Building a productive collaboration between businesses, government, policymakers, investors, and academia will support its development.
The Toronto-Waterloo Innovation Corridor is Canada’s largest cluster measured by the equity value of tech companies.

Can the Toronto-Waterloo Innovation Corridor Become a Supercluster?

The Toronto-Waterloo Innovation Corridor is Canada’s top technology cluster, with both Toronto and Waterloo in the top 25 globally. Thinking and acting as a “connected corridor” with the supporting infrastructure would make the whole greater than the sum of its parts.

The development of winning clusters is grounded in factors that are common across all ecosystems, even those as diverse as Berlin and Bangalore:

- The presence of world-class academic and research centres
- A large, high-quality talent pool
- Access to capital
- Connective infrastructure and community
- High standards of living
- Access to early adopters or receptive markets.

The Toronto-Waterloo Innovation Corridor has the ingredients to reach top tier scale among Canadian technology clusters. It is home to some of the world’s leading research universities and a large pool of capital.

Major universities within the corridor are noted for their academic excellence and serve 20% of the country’s university students.

- The University of Toronto (ranked in the top 25 universities globally and the top 50 most innovative universities in the world) and its partner hospitals raised the most research funding of any university in Canada, totalling $1.1 billion in 2016.
- Hamilton’s McMaster University (ranked in the top 100 universities globally) has the country’s leading industry-sponsored research programs.
- The University of Waterloo has the world’s largest co-op education program. Waterloo is also the #1 Canadian university for venture-capital-backed student businesses.
- The University of Guelph is a leader in ag-biotech and global agricultural research.
The corridor’s cities are home to a vibrant and growing technology ecosystem.

Toronto-Waterloo is also home to Canada’s largest group of tech employees working for 15,000 high-tech companies. Toronto, Canada’s financial capital, has the second-highest concentration of large bank headquarters in the world and accounts for more than $1.5 trillion in institutional investor capital. The corridor’s largest urban centre, Toronto, has been consistently ranked one of the world’s most liveable cities. Nearby Waterloo has the second-highest density of startups in the world.

The Government of Ontario is a willing partner and is actively planning to reshape education to serve the needs of tomorrow. The release of the report “Building the Workforce of Tomorrow” shows strong commitment and highlights the opportunity for the technology industry to actively support education priorities.

There is a critical mass of universities and incubators to supply the needs of a growing cluster. The universities include: University of Toronto, McMaster University, University of Waterloo, Wilfrid Laurier University, York University, Ryerson University, Conestoga College, and University of Guelph. The startup incubators include: Communitech, Velocity at University of Waterloo, DMZ at Ryerson, NEXT Canada, and Creative Destruction Lab at Rotman School of Management, along with several other University of Toronto entrepreneur centres.

These factors could uniquely position the Toronto-Waterloo Innovation Corridor in Canada to become a technology supercluster. Its geography and infrastructure density make it an extremely cohesive cluster – its major urban centres are all less than a 2-hour drive from one another. Toronto offers world-class arts and culture and easy access to Canada’s largest airport, Pearson International, which provides global connectivity.

1 List not exhaustive

Source: Economist Intelligence Unit; Invest Toronto

Fact base prepared by McKinsey
Canada is lagging peer countries in attracting the level of growth capital required to drive scale.

Global dynamics are changing and competition is intensifying. Density is key for winning clusters: they require the geographic concentration of economic value and large or growing firms. Larger, faster-growing clusters tend to have higher “equity density” (i.e., cluster equity value per capita). To successfully compete, Canada should focus on increasing density where it already exists—in its growing clusters.

Technology clusters across the world are vying for the same global pool of talent and capital. Denser clusters, like Boston, Berlin, and Los Angeles, are attracting three to five times as much VC investment as Toronto-Waterloo. The competition for capital parallels an equally difficult challenge: attracting and retaining top talent. Talent could fuel growth, bring new entrepreneurs, and build a community to sustain the corridor’s success.

To attain these benefits, Canada must consider focusing its efforts on building density and enabling companies to scale for global success.

**Breakdown of total VC funds invested by stage**

<table>
<thead>
<tr>
<th>Country</th>
<th>Seed</th>
<th>Early</th>
<th>Expansion &amp; Later</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>8.5</td>
<td>41.5</td>
<td>50.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total =</td>
<td>$1.6B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>4.4</td>
<td>39.5</td>
<td>56.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total =</td>
<td>$5.1B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>5.6</td>
<td>46.0</td>
<td>48.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total =</td>
<td>$5.5B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>3.6</td>
<td>33.4</td>
<td>63.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total =</td>
<td>$73.6B</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Source: Pitchbook 2016

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**CHAPTER 1**

TIMING COULD AFFECT POTENTIAL SUCCESS

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Source: Compass; Government websites; Universities Canada; University of Toronto; University of Waterloo; McMaster University; Pitchbook

Fact base prepared by McKinsey
Supercluster growth and diffusion could create a hub-and-spoke effect, breeding and strengthening clusters across the country, based on the success of the Toronto-Waterloo Innovation Corridor.

Establishing one technology supercluster could lead to other global-scale technology clusters across Canada.

In fact, if successful, a Toronto-Waterloo supercluster could serve as a platform and model for other top tier clusters across the country – much as Silicon Valley spurred the development of US clusters like New York, Boston, and Austin.

Canada has emerging clusters in Calgary, Halifax, Montreal, Ottawa, and Vancouver and strong connectivity to a Toronto-Waterloo supercluster would be positive for all, building the Canada technology and innovation brand.
The ambition: The Toronto-Waterloo Innovation Corridor in 2025

The success of this corridor could lead to a more innovative and productive economy, the emergence of global technology champions, and more high-value jobs.

A top tier technology ecosystem could bridge Canada’s prosperity gap by unleashing the economic potential of our technology companies. The wealth and expertise they generate could create a spillover effect and build economic momentum for the region and country.

Addressing structural gaps within the corridor and creating conditions that enable growth could form the foundation for achieving the goals of this initiative.

The payoff by 2025 could include:

1. Raising the direct equity value of tech companies in the Toronto-Waterloo Innovation Corridor by up to $50 billion within 10 years by creating new companies or scaling up existing companies
2. Contributing up to $17 billion in direct gains to the GDP
3. Creating up to 170,000 new jobs, including indirect jobs, as a result of the expansion of the corridor
4. Advancing Canadian leadership in key disruptive technologies – in particular, artificial intelligence and quantum computing
5. Tripling VC investments in sectors of strategic interest – in particular, HealthTech and FinTech
6. Making the Toronto-Waterloo Innovation Corridor brand a recognized top tier global ecosystem.

Source: MGI Global Economics; Statistics Canada; NYU Stern; Bay Area Council Tech Report; Compass Global Startup Ecosystem Ranking, 2015; government websites

Fact base prepared by McKinsey
Globally competitive tech companies are crucial to uplifting the entire economy. They also deliver spillover gains in productivity, capital, and talent that could unleash an unprecedented economic transformation.

Creating a technology supercluster would have real impact for Canadians. If successful, the Toronto-Waterloo Innovation Corridor could directly contribute up to $2,100 GDP per capita in the region\(^2\). Other regions could replicate this success to generate value across the country, resulting in exponential gains for decades to come.

Talented young graduates, straight out of university, could have access to up to 170,000 new jobs\(^2\).

What are the challenges and where are the gaps to making this 2025 vision a reality?

**Assumptions**

- **Status quo**: 0.8% p.a., based on historical productivity growth (1.1%) and forecast employment growth (-0.3%)
- **Target growth**: 1.9% p.a., based on historical productivity and employment growth (1.1 and 0.8%)

The initiative’s initial focus is to help bridge Canada’s prosperity gap with the United States.

**THE BENEFITS: THE TORONTO-WATERLOO INNOVATION CORRIDOR IN 2025**

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>+$2,100 per capita in the Corridor</td>
<td>+170,000 jobs(^2) created</td>
</tr>
<tr>
<td>+$8,000 per capita opportunity</td>
<td>Over 94% employment rate</td>
</tr>
<tr>
<td>+$570 Increase in housing and household budget</td>
<td>For the average household in the Corridor</td>
</tr>
<tr>
<td>+$310 Increase in transportation budget</td>
<td>$210 Increase in food budget</td>
</tr>
<tr>
<td>+$570 Increase in housing and household budget</td>
<td>1 Assumes $17B of direct GDP will be created, and the 2025 population of the Toronto-Waterloo Innovation Corridor to be 8M</td>
</tr>
<tr>
<td>+$310 Increase in transportation budget</td>
<td>2 Includes new tech sector jobs and indirect jobs</td>
</tr>
<tr>
<td>+$210 Increase in food budget</td>
<td><strong>Source:</strong> Statistics Canada; Business proprietary data</td>
</tr>
</tbody>
</table>

Fact base prepared by McKinsey
The Toronto-Waterloo Innovation Corridor currently ranks with slower-growth Tier 4 clusters, lagging peer regions globally.

WHERE ARE THE GAPS?

The Toronto-Waterloo Innovation Corridor is currently a slow-growth Tier 4 cluster. The corridor’s largest city, Toronto, fell in the global ecosystem rankings from #8 to #17 between 2012 and 2015, driven by gaps in commercial activity and talent, capital deficits, lack of connective infrastructure, and limited access to early adopters. All these factors were underpinned by the marked absence of globally competitive tech companies.

To turn the corridor into a technology supercluster, seven main challenges should be addressed:

1. The Toronto-Waterloo Innovation Corridor hosts some of the world’s best academic and research centres, but it lags in commercialization activity.

Canadian universities account for approximately 40% of total Canadian R&D. Despite having some of the world’s leading research universities, Canada consistently lags its peers in converting research strength into commercial success. The missed opportunities are most acute in Toronto-Waterloo, which is home to some of the country’s largest and most research-intensive universities.

Part of the commercialization lag is due to IP ownership and management rules, as well as revenue-sharing requirements in Canadian universities. Most universities retain IP ownership, control the transfer of technology, and keep a share of future revenue from research done on campus – this limits incentives to pursue commercialization.

Moreover, many universities do not offer flexibility and support for faculty engaging in entrepreneurship, such as offering a leave of absence to pursue business development or providing access to business mentors with the expertise needed to commercialize their inventions.

To translate its research advantage into commercial success, Canada could provide stronger incentives and business support to researchers to help accelerate commercialization efforts.

Source: Business proprietary data; Statistics Canada; NYU Stern; Bay Area Council Tech Report; government websites

Fact base prepared by McKinsey
WHERE ARE THE GAPS?

1. Canada is losing the global competition to attract capital.

Global capital is critical to the success of a startup and of a cluster. 72% of the top 100 technology companies (90% of the top 10) have leveraged VC investments at some point to grow and scale globally. The vast majority of these VCs are based in Silicon Valley.

In 2015, Canada attracted just 1% of global VC investments and approximately 2% of the capital invested in Europe and the United States, well below its relative GDP. Even as the average transaction size across most top technology clusters grew, the corridor witnessed negative growth of -19%.

To successfully scale Canadian companies, global capital sources should be attracted and incentivized to invest locally.

2. Canada has a deficit of “scale up” technical and business talent.

Although Canada produces some of the best technical talent in the world, it has too few employees with hands-on experience scaling companies, a shortfall that is slowing growth. This reality is echoed in a recent survey conducted by the Lazaridis Institute that found 53% of industry stakeholders citing insufficient executive and managerial talent as the primary impediment to scaling tech companies in Canada.

To create the broad and deep talent pool needed to sustain a technology supercluster, bold reforms that will equip existing talent with the right skills and lead to a better access to global talent could be pursued.
WHERE ARE THE GAPS?

4. The corridor lacks the connective infrastructure required to facilitate density and community.

The infrastructure connecting the urban centres in the corridor, mainly via traditional commuter rail and highways, has long been cited as insufficient for facilitating access between residents of the different cities. This limits spillover between the pockets of expertise forming in each city. The Toronto-Waterloo Innovation Corridor also lacks any formal coordinating body to build strategy and cohesiveness within the corridor, exacerbating the lack of connectivity.

To build a strong community of entrepreneurs, investors, and industry sponsors within the corridor, connectivity between the corridor’s urban centres could be strengthened.

5. Companies in the Toronto-Waterloo Innovation Corridor need better access to early adopters and customers.

Canada is home to several concentrated industries, including financial services, healthcare, and telecommunications. These technologically advanced industries, combined with a sophisticated public sector, create a significant population of ready customers for corridor companies’ products. Entrepreneurs, however, consistently cite difficulties navigating the complex processes to access these customers, including very risk-averse procurement systems, as serious impediments to conducting business.

For Canada to become home to global technology champions, early-stage firms need to gain access to large corporate and government customers, and these organization should view procurement as a potential source of innovation and competitive advantage.

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The primary impediments to scaling up as cited by to executives and stakeholders

<table>
<thead>
<tr>
<th>Impediment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient executive and managerial talent</td>
<td>53%</td>
</tr>
<tr>
<td>Insufficient access to capital</td>
<td>16%</td>
</tr>
<tr>
<td>Complex ecosystem dynamics (founder ambition, risk tolerance, business culture)</td>
<td>20%</td>
</tr>
</tbody>
</table>

The most prevalent business challenges include

- Optimizing operations (#1)
- Marketing and sales (#3)
- Strategy setting (#4)

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1 Lazaridis report, 2016
Source: BDC competitiveness survey, 2014

2 Source: Lazaridis Institute; Compass

Fact base prepared by McKinsey
WHERE ARE THE GAPS?

6. Canada lacks global champions that can promote cluster density and strength.

Canadian tech companies are disproportionately composed of small firms. Firm size is highly correlated with productivity in the tech sector, and the preponderance of small firms in our technology clusters has hindered our ability to achieve density and the expertise and wealth spillovers that large tech companies usually create.

Creating large global technology firms based in Canada is vital to building Canada's tech ecosystem.

7. The Canadian tech cluster needs strong brands.

A strong brand is central to the success of any company. The power of a strong brand is doubly important when creating a supercluster, as strong brand presence attracts national and international attention and capital. Innovative and well-established brands also attract top talent. Silicon Valley’s deeply rooted brands, such as Google and Apple, are magnets for much sought-after talent that values the opportunity to work for innovative and successful companies.

Building a globally competitive supercluster in the Toronto-Waterloo Innovation Corridor would be facilitated by the emergence of large tech companies with strong brand presence.

Except for Nortel and RIM, Canada has produced no global brand multi-billion-dollar technology companies in recent memory.
Despite its world-class human capital and infrastructure, Canada lags its OECD peers in productivity levels and growth.

Technology superclusters help countries prosper and drive productivity and innovation in economies.

Superclusters form when a group of companies that share an industry concentrate in a geographical region, allowing resources, capital, and talent to concentrate – the Toronto Waterloo Corridor is an example of such a cluster.

Once there is a nascent supercluster, the success of winning companies and technologies needs to be amplified to gain the necessary density to attract the talent and capital that generates further growth:

- Global technology clusters (i.e., Boston, New York, Berlin, Los Angeles) are vying for the same global pool of talent and capital.

Canada lags its global peers – Toronto-Waterloo is classified as a slow-growth Tier 4 cluster and fell to #17 from #8 in global ecosystem rankings between 2012 and 2015.

The payoff by 2025 is substantial: $17 billion of direct GDP, 170,000 new jobs, and $50 billion of direct equity value for tech companies:

To catalyze growth, Canada must focus on the following activities to close gaps:

- Accelerate commercialization efforts and liberalize IP ownership
- Incentivize and attract global capital to invest locally
- Better equip local talent with the necessary skills and open up to global talent
- Build a stronger community of entrepreneurs, investors, and industry sponsors and strengthen connectivity between the corridor’s centres
- Encourage large corporate and government entities to procure from firms within the corridor and view it as a source of competitive advantage.
Chapter 2 was prepared by an informal “working group” of the Toronto-Waterloo technology executives, investors, thought leaders, and academics who believe strongly that Canada can and should invest in developing the Toronto-Waterloo Innovation Corridor into a technology supercluster that can compete on a global stage. This group, who brought together deep experience in entrepreneurship, technology, and economic issues generally, and with respect to the Toronto-Waterloo region specifically, conducted a series of informal meetings and hosted several roundtables, with a range of other stakeholders, to develop a blueprint for how governments, the private sector, and philanthropic organizations could collaborate to accelerate technology innovation and growth in the Toronto-Waterloo Innovation Corridor.

**The work presented here was completed in the spirit of doing what is best for Canada.** We truly believe that focusing and building one major supercluster – that can serve as an example and model for other successful Canadian tech clusters in the future – is the best way for Canada and all Canadians to win.

**Disclaimer:** The ideas contained in this section represent the views of the individual members of the working group and do not necessarily reflect the views of any of the organizations with which members are associated.

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Executive Summary: A proposed blueprint with catalyzing ideas to help kickstart a Toronto-Waterloo technology supercluster

**Build a strong foundation for success**

**Talent**
- Dramatically scale up fast-track work visa (Global Skills Visa) and immigration programs
- Incent commercialization of university research (e.g., IP rights, mentorship)
- Work with education institutions and government to shape education programs (i.e., coding classes)
- Create a re-skilling (reverse co-op) program in partnership with universities
- Support the Ontario government’s Planning and Partnerships Table (PPT) to encourage skills growth
  - Increase availability of internships for students planning careers in technology and engineering
  - Support teacher training in computer science and engineering
- Aggressively recruit top talent from around the world
- Scale up co-op and upskilling programs

**Capital**
- Create a large matching fund to incent investment in the corridor’s companies
- Encourage major Canadian corporations to sponsor VC funds
- Implement an innovative tax incentive model to motivate angel and growth investments
- Promote and attract VC investments and equity crowdfunding

**Infrastructure**
- Invest in hard and soft infrastructure that enhances connectivity (e.g., renew and expand large-scale computing infrastructure assets, commuter passes)
- Implement quick wins around existing infrastructure assets
- Become early adopters of transformational infrastructure (e.g., autonomous vehicles, next generation wireless)

**Community**
- Create an agency dedicated to promoting collaboration and strengthening the Toronto-Waterloo brand
- Build the world’s leading tech ecosystem information system
- Promote existing resources and incubator-accelerator ecosystems
- Create a major annual event to recognize and celebrate Canadian entrepreneurs

**Customers**
- Consider legislation allowing unsolicited bids
- Create a Small Business Innovation Research (SBIR) program
- Launch a civilian Canadian “DARPA” agency
- Adjust Industrial Regional Benefits (IRB) to incent technology purchases from Canadian SMEs (e.g., extra credit for investing in technology companies)

**Develop disruptive technologies**

**Artificial Intelligence**
- Accelerate the development of a world-class AI academic centre of excellence
- Double down and accelerate the growth of AI commercialization programs
- Sponsor industry-led innovation labs across the corridor for AI

**Quantum Computing**
- Double down on being the world-leader in quantum computing, leveraging resources out of Waterloo
- Promote incentives to commercialize quantum computing research
- Sponsor industry-led innovation labs across the corridor for quantum computing
- Create a quantum computing commercialization fund

**Health Technology**
- Consolidate and secure clinical data in a single provincial healthcare “data lake”
- Create a one-window access system for researchers to test technology
- Invest in a multi-stage funding programs (from angel incentives to the matching fund)
- Streamline access and address procurement and market entry for the corridor’s entities

**FinTech**
- Create the world’s most sophisticated “open access” FinTech data system
- Become the world’s most “FinTech friendly government”
- Create new OSFI, FCAC, and CDIC branches to set and propose FinTech-specific standards
- Create “FinTech passport” services

**Propel new strategic sectors**

**Deepen existing sectoral strengths**
- Expand internet of things (IoT), big data, and sensors capabilities
- Incent advanced manufacturing technologies for mass customization, including additive manufacturing, digital manufacturing for design and production, mobile robotics, and automation

Contributed by informal working group members 20
A potential Toronto-Waterloo blueprint: at a glance

1. Strengthening a strong foundation for success through strategic initiatives that attract **top talent**, enhance **access to capital**, build **connectivity** through infrastructure and community, and enable **access to customers**

2. Doubling down on disruptive technologies

   Focusing on key technologies that could have **cross-sector and national impact** on innovation and productivity, especially
   - Artificial intelligence
   - Quantum computing

3. Propelling new high-potential sectors

   Leveraging organic traction and favourable fundamentals (e.g., concentrated customer base, significant capital) in two large sectors
   - FinTech
   - Health Technology

Contributed by informal working group members
Building on this analysis and roundtables with entrepreneurs, business leaders, financial market experts, and public policy thinkers, the Toronto-Waterloo Blueprint has been developed with three fundamental components:

1) Strengthening a strong foundation for success by introducing strategic initiatives that attract top talent, enhance access to capital, and build connectivity through infrastructure and community and by enabling access to customers.

2) Doubling down on two disruptive technologies that could have cross-sector and national impact on innovation and productivity – artificial intelligence and quantum computing.

3) Empowering global technology champions – particularly within two of the corridor’s new high potential sectors, FinTech and Health Technology. This should eventually apply to other important sectors and work synergistically with emerging clusters in other regions.

These proposals reinforce existing assets, cultivate an entrepreneurial culture, and build platforms for global champions. These initiatives are meant to be cross-sector and built on partnerships involving provincial or federal governments, corporations, universities, NGOs, and the entrepreneurial community. No one stakeholder alone can deliver on these goals. The essence of a successful effort to create a Canadian tech supercluster is to galvanize the kind of broad collaboration necessary to help build a more prosperous future for the corridor and Canada.

The Toronto-Waterloo Blueprint for cultivating a world-class supercluster includes building on existing successful investments and making strategic investments in AI, quantum computing, FinTech, and Health Technology.
Proposed initiatives in the foundation for success are aimed at creating **system-level conditions** for more density, entrepreneurialism, and innovation. These initiatives can also address several fundamental gaps that exist in the corridor’s technology ecosystem today.

Many of the proposals listed here are national in **scope** and all of Canada stands to benefit from their implementation – they are, however, **imperative** if the corridor’s aspirations of becoming a supercluster are to be realized.
Leveraging the corridor’s assets

The Toronto-Waterloo Innovation Corridor is home to 20% of the 979,000 full-time university students in Canada.

The Canadian entrepreneurial ambition received an A Grade on the Conference Board of Canada’s Innovation Report Card.

Toronto was ranked the 4th most liveable city in the world.

Talent development and attraction is critical to fostering cluster density and providing the critical human capital to create and grow high-tech businesses.

1. Scale up immigration and establish fast-track work visas for high-skilled tech and business professionals and entrepreneurs.
2. Challenge universities to adopt attractive incentives for inventors to commercialize their inventions (royalty sharing agreements, equity participation) and connect inventors with business mentors.
3. Work with education institutions and government to shape education programs (i.e., coding classes).
4. Create a re-skilling program (reverse co-op) for the existing tech workforce in industry in partnership with universities.
5. Support the Ontario government’s Planning and Partnerships Table (PPT) to encourage skills growth via internship opportunities and teacher training.
6. Launch a corridor-coordinated talent prospecting program to proactively reach out to and attract the best and brightest.
7. Scale up academic-corporate learning partnerships, (e.g., the University of Waterloo’s successful co-op model) and other experimental learning approaches.

Contributed by informal working group members.
Benefits of the matching fund

**Smart Capital:** This fund will inject the capital required to propel local firms that have already proven their scaling potential in competitive private capital markets. The fund will leverage the skills and efforts of sophisticated investors.

**Global knowledge and expertise:** The matching fund can attract top-tier global and domestic capital that has access to international networks, talent, information, and additional capital not accessible to small Canadian firms. These investors have been instrumental in the growth of 72% of today's top 100 tech companies.

**Sector expansion:** Scaling several companies will grow the human, financial, technological, and reputational capital in the corridor—allowing, in turn, an ecosystem and a more experienced domestic financial capital to develop.

**Local presence:** Fund recipients are incentivized to maintain local HQs since funds would be repayable if headquarters are moved.

Access to capital and the presence of large anchor tech companies could facilitate faster company growth and knowledge spillovers, amplifying non-linear gains in the cluster.
Infrastructure in the corridor

Toronto and Waterloo are only 115 kilometres apart, connected by road, rail, and air.

Canada will have tariff-free access to \(60\%+\) of global GDP if ongoing free trade agreement negotiations are successful.

Canada was ranked the 2nd most cost-competitive country in the world in 2016.

Source: Google maps; Statistics Canada; BEA; World Bank; KPMG
How Silicon Valley does it

Small companies are constantly seeking **scale**

**Risk taking** is encouraged – the mantra is “Move fast and break things”

Companies are **innovative** in their businesses as well as in the ways they treat and reward their employees

Source: Experts interviews

BLUEPRINT FOR TORONTO-WATERLOO COMMUNITY

A strong sense of community, coordinated shared services, streamlined data access, and a focused marketing campaign would help build momentum around the Toronto-Waterloo Innovation Corridor.

1. Create an agency dedicated to promoting collaboration and to strengthening and marketing the Toronto-Waterloo brand
2. Build the world’s leading tech ecosystem information system, tracking key metrics for employers, investors, entrepreneurs, and municipal governments
3. Promote existing resources and incubator-accelerator ecosystems available to SME’s in the corridor (e.g., Communitech, DMZ, MaRS, OneEleven, Next Canada, Creative Destruction Labs, Velocity, Accelerator Centre)
4. Create a major annual event to recognize and celebrate world-class entrepreneurs in the corridor – e.g., the “Toronto-Waterloo Champions” Award

Contributed by informal working group members
How the United States does it

Involving the customers in the innovation process rather than thinking of them as the “target”

Funding the US Small Business Innovation Research Program, with more than $2 billion to foster small business R&D

Mandating the Defense Advanced Research Projects Agency to invest in providing solutions to the world’s most intractable problems by setting up annual grand challenges

Source: SBIR program; DARPA
Doubling down on disruptive technologies

The Toronto-Waterloo Innovation Corridor is well-positioned to lead the world in artificial intelligence, but the window of opportunity is rapidly closing:

- The University of Toronto’s Geoff Hinton pioneered Deep Learning, the core innovation that is propelling the AI boom globally.
- The University of Toronto has 28 AI faculty, many with strong ties to other AI communities outside the corridor, such as Université de Montréal.
- The University of Waterloo’s Operational AI capability and “Compact Brain” teams develop and deploy customized AI technologies across sectors.

The corridor also has the potential to develop and scale quantum computing:

- Canada has the world’s fifth-largest cohort of scientists specializing in quantum research.
- Waterloo hosts two of the world’s largest quantum technology research facilities, the Institute for Quantum Computing and the Perimeter Institute (PI).

Despite these strengths, Canadian research leadership is being challenged by universities in the United States, Europe, and Asia that have substantial long-term investments in AI and quantum technology.1

The global relevance of AI and quantum computing and Canada’s leadership in its development could have catalytic economic impact. Just as silicon technology formed the backbone of innovation in Silicon Valley, AI and quantum computing will be at the heart of every sector – the regions that lead will dominate for years to come.

Contributed by informal working group members

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1 $100 million to $1 billion
Source: Canada first research excellence fund; Experts interviews
Doubling down on disruptive technologies

Promoting the adoption of products and services built by corridor tech companies could rapidly accelerate scaling and market awareness within these two disruptive technologies, but Canada must act quickly.

1. **Invest in the rapid development of a world-class AI academic centre of excellence – AI Institute** – that builds on the existing expertise and resources of the University of Toronto Machine Learning group and University of Waterloo’s deep ties with industry to:
   - Cultivate new AI applications and spearhead proliferation across sectors
   - Rapidly increase the training of specialists in AI
   - Attract corporations to locate AI research operations in the region
   - Rapidly expand operational AI teams that develop and deploy real-time AI technologies that directly address the industry’s unique needs.

2. **Accelerate the growth of AI commercialization programs:***
   - Rapidly scale up the Creative Destruction Lab’s AI program at the University of Toronto’s Rotman School of Management
   - Support the development of Next Canada’s “Next AI” effort to support startups across Canada.

3. **Promote strong connections** between the Montreal and Toronto AI communities. This would translate into major benefits for both regions and Canada in general.

4. **Strengthen Canada’s global leadership** in quantum computing and associated technologies, being led out of the University of Waterloo and PI.

5. **Establish Canadian leadership in the commercial development of AI and quantum technology research** through industry-sponsored innovation labs across the corridor focusing on next-gen product development.

6. **Create a quantum computing commercialization fund** with existing government research budgets directed at matching private sector investments to commercialize pre-market quantum technologies.

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U of T ranks among the world’s largest institutions in terms of faculty and student bodies focusing on AI research

Waterloo is home to two of the world’s largest quantum computing research facilities

The Rotman School’s Creative Destruction Lab (CDL) admitted 50 AI companies from around the world this year. This represents the greatest concentration of AI companies in any program on Earth

NEXT Canada is about to launch a major new program to build an AI ecosystem in Canada. Once NEXT AI launches, these programs (CDL-ML, NEXT AI), which will work collaboratively, will be the dominant nexus of AI startups in the world.

Contributed by informal working group members
Winning companies create successful clusters that in turn nurture new companies. Many sectors in the corridor have the potential to create global champions, including film and media, telecommunications, and software. In some sectors, Canada has already produced global champions based in the corridor. When the global economy was rocked by the great recession, Canadian banks emerged as risk-management exemplars and pursued international expansion. The Waterloo-based RIM was once a global telecom behemoth.

The initiatives outlined here are not aimed at “picking winners.” To enable the formation of a supercluster, efforts should focus on turbocharging companies and teams that the market has already signalled successful and accelerating the virtuous cycle. This will help nascent winners to scale and succeed more quickly and more significantly.

Other high-impact solutions could emerge from key players in the corridor that have the opportunity to support growth not only for startups, but also for larger established enterprises through a broader range of disruptive technology platforms.

Health Technology¹ and FinTech are examples of promising sectors that could be encouraged in the corridor. Thoughtful support for these sectors could give rise to new global private sector technology champions and hopefully result in similar strategies being applied across other areas in the future.

¹ Including biomedical sciences, pharmaceuticals, and medical devices

Contributed by informal working group members
Cultivating high-potential sectors: Health Technology

The corridor’s healthcare system is already positioned to enable successful healthcare technology companies to win. The Toronto-Waterloo Innovation Corridor has leaders in areas such as genomics, regenerative medicine, and medical devices. Together with McMaster University, The Toronto Academic Health Sciences Network boasts some of the world’s leading hospitals and medical research facilities.

Despite the natural advantages of the corridor’s healthcare ecosystem, barriers remain to scaling innovations and new technologies. Entrepreneurs are concerned about:

- The system’s risk aversion
- The slow pace of digitization
- The lack of integrated data systems
- The technology transfer strategy
- Access to patient risk capital to fund longer clinical evaluations.

All of these concerns are critical hurdles that must be overcome to create the next generation of global healthcare champions.

The provincial government is already overseeing efforts to adopt new health technologies ranging from devices to process management systems. Coupled with the development of AI and quantum computing capabilities, the corridor’s healthcare ecosystem could be a platform for phenomenal economic value, with innovation in digital healthcare delivery tools, personalized medicine, regenerative medicine, advanced imaging, IoT medical devices, and new therapies.

Programs like MaRS Excite are already helping to break down barriers between innovators and the health system and should be expanded across the region.

Toronto is home to healthcare commercialization hubs like MaRS, JLABS, the Centre for the Commercialization of Antibodies and Biologics, and the Centre for Commercialization of Regenerative Medicine.

There are already 1,900 companies in the life sciences industry that have leveraged Ontario’s healthcare system to scale and have begun exporting globally.

The sector is also economically vital for the region and contributes more than $38.5 billion in annual provincial GDP.
Cultivating high-potential sectors: Health Technology

Life sciences in Ontario

Ontario has the 2nd largest life sciences cluster and 4th largest R&D community in North America.

As many as 50 global pharma companies and 17,000+ new health professionals are trained annually in Ontario, mostly along the Toronto-Waterloo Innovation Corridor.

Its single-payer healthcare system facilitates streamlined access to a large consolidated buyer of new products.

Source: Life Science Ontario

BLUEPRINT FOR TORONTO-WATERLOO
HEALTH TECHNOLOGY

Leverage the vibrant healthcare ecosystem in the corridor to develop global leaders that can commercialize innovative health technologies and improve patient outcomes.

1. Consolidate and secure clinical data within a single provincial healthcare “data lake,” facilitating and streamlining access for public and private sector stakeholders and entrepreneurs to develop precision medicine and health tech applications.

2. Create one-window access mechanisms for entrepreneurs and researchers to access and test technology in healthcare facilities by networking existing innovation hubs. This could lift and align existing incubators to amplify entry and scaling of technology and products.

3. Unlock investment in the HealthTech industry by applying a capital foundation strategy that uses multi-stage programs, from angel incentives to large matching funds. This will support companies, build an ecosystem of financing and management expertise, and drive growth.

4. Invest in Ontario’s Office of the Chief Health Innovation Strategist to streamline access and address procurement and market entry for merging SME, MSE, and LSE with corridor affiliation.

Contributed by informal working group members
Cultivating high-potential sectors: FinTech

FinTech is disrupting the financial services industry through enhanced customer engagement, technology-driven efficiencies, and innovative new product platforms. FinTech solutions aim to digitize how consumers store, save, borrow, invest, pay, and protect their money, which is having a dramatic impact on retail payments and lending.

The Toronto-Waterloo Innovation Corridor is well-positioned to take advantage of the sector’s explosive global growth. Toronto is the financial capital of Canada and home to some of the world’s leading financial institutions.

These conditions are amplified by the corridor’s tech talent, a rapidly expanding community of FinTech startups, and local expertise in FinTech solutions, including:
- Interac
- Tap & pay
- Cybersecurity
- Mobile privacy solutions
- Algorithmic solutions.

To enable the sector’s success, the corridor must leverage linkages with its concentrated financial services industry. Government could be an early adopter, creating a regulatory environment open to FinTech innovation and connecting the corridor’s FinTech to the global marketplace.

As Canada’s financial centre, Toronto employs more than 250,000 financial services professionals.

FinTech attracted investments of more than $24 billion in 2015 alone, a 10-fold increase since 2011.

In FinTech, 19 “unicorns” (private companies valued at more than US $1 billion) have emerged since 2011.

Source: Toronto’s Financial services; Invest Toronto

Contributed by informal working group members
Cultivating high-potential sectors: FinTech

FinTech in the corridor

A concentrated financial services sector with high corporate interest in innovation

The Toronto-Waterloo Corridor employs 205,000+ tech workers, second only to Silicon Valley in North America

First-mover advantage with enabling tech (e.g., Interac) and growing startups (Wealthsimple, Market IQ, Borrowell, Zafin, etc.)

Source: Toronto’s Financial services; Invest Toronto

Create the world’s most sophisticated “open access” FinTech data system. Consolidate and secure existing payment processing data, providing open access to government, industry, and entrepreneurs

Create “FinTech passport” services, allowing Canadian companies to pilot products in other countries by leveraging existing trade agreements with reciprocal access to Canadian markets

Create new OSFI, FCAC, and CDIC branches to set FinTech-specific standards (e.g., Blockchain), promote adoption across other regulatory bodies (e.g., CSA, IIROC), and develop an appropriate deposit insurance framework

Become the world’s most “FinTech friendly government” through federal and provincial mandates aimed at digitizing high-volume transactions between government, employers, employees, and suppliers (payroll taxes, EI premiums, etc.)

Create a regulatory environment open to FinTech innovation and connect the corridor’s FinTech to the global marketplace.

Contributed by informal working group members
The Toronto-Waterloo Innovation Corridor’s path to success must include: engaged leaders from all sectors; clear, ambitious direction; world-class pace; and excellence in execution.
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DISCLAIMER
The ideas contained in this section represent the views of the individual members of the working group and do not necessarily reflect the views of any of the organizations with which members are associated.
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