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Introduction

The Little Book of Clusters: A Guide to Big Ideas, is an introductory guide for those interested in economic clusters and their role in the regional economic development of Southern Ontario's Greater Golden Horseshoe (GGH). The purpose of this guide is to show how clusters are formed, their growth pattern, and their essential components.
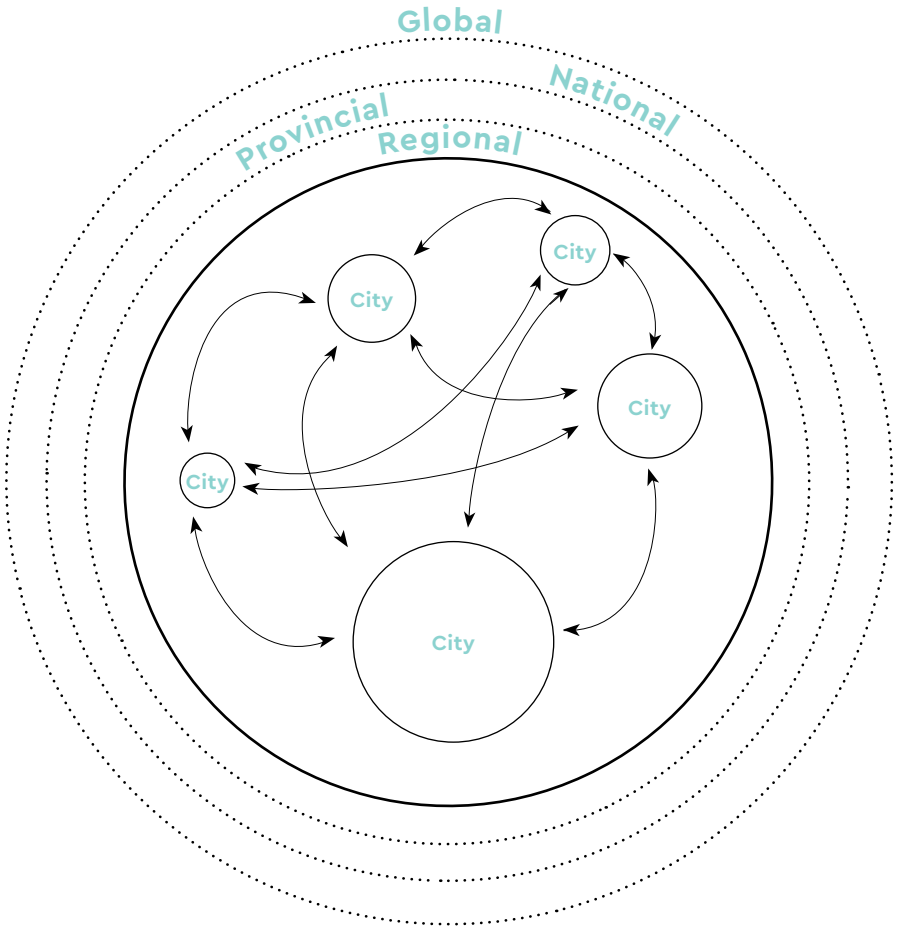
What is a Region?

A region is a geographic area defined by physical characteristics and boundaries. Economic clusters must be examined on a regional scale to avoid the pitfalls of planning economic development on a city-by-city basis. Canada is comprised of three levels of political organization – federal, provincial and municipal.

The flow of people and goods that sustain a cluster cross borders, and a regional economy cannot thrive if restricted to these historic political boundaries. Looking at clusters from a regional perspective is an appropriate scale to foster and understand the symbiotic connections, assets and interdependent relationships that sustain clusters.

The flow of people and goods that sustain a cluster cross borders

Key Geographic Elements
of the San Diego Cluster

Natural Features

Land Grants

Geography

San Diego Military Cluster

Zoning

Climate

Land Availability

Additionally, regions are important to cluster development as key cluster strengths are linked to a geographic location. An example of this is San Diego's strategic position within the Pacific. The location has enabled it to become the largest concentration of U.S. military assets in the world.

For the military research institutes in San Diego, the climate and availability of land was of central concern and the city assisted by amending zoning and providing land grants. The region's natural endowments also led to a high quality of life, which attracted a talent pool. These geography-specific conditions lead to the development of San Diego's innovation cluster and many other similar clusters in the area.

Key cluster strengths are tied to a geographic location

The Greater Golden Horseshoe Region
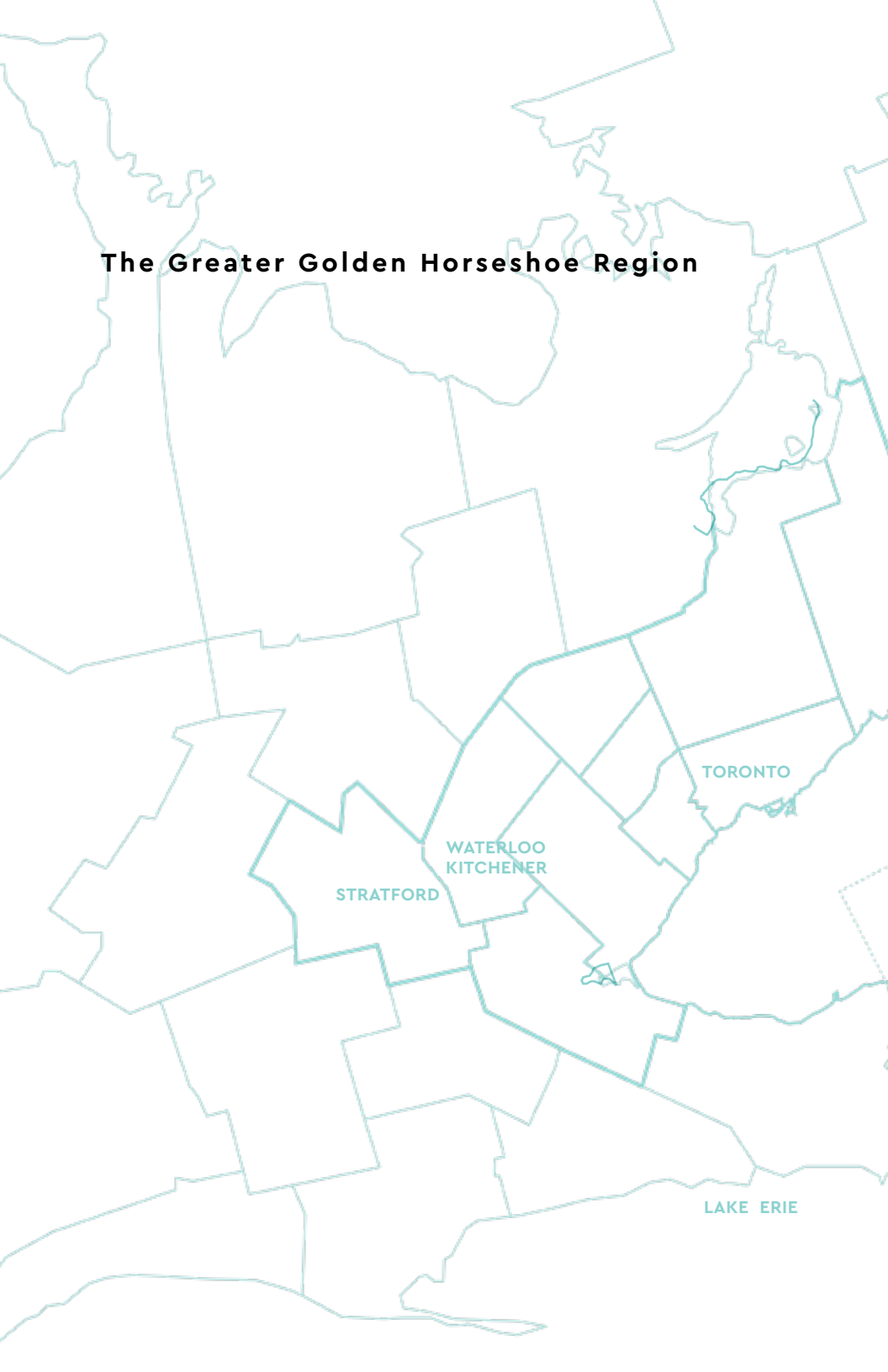
TORONTO

WATERLOO
KITCHENER

STRATFORD

LAKE ERIE

PETERBOROUGH

COBOURG

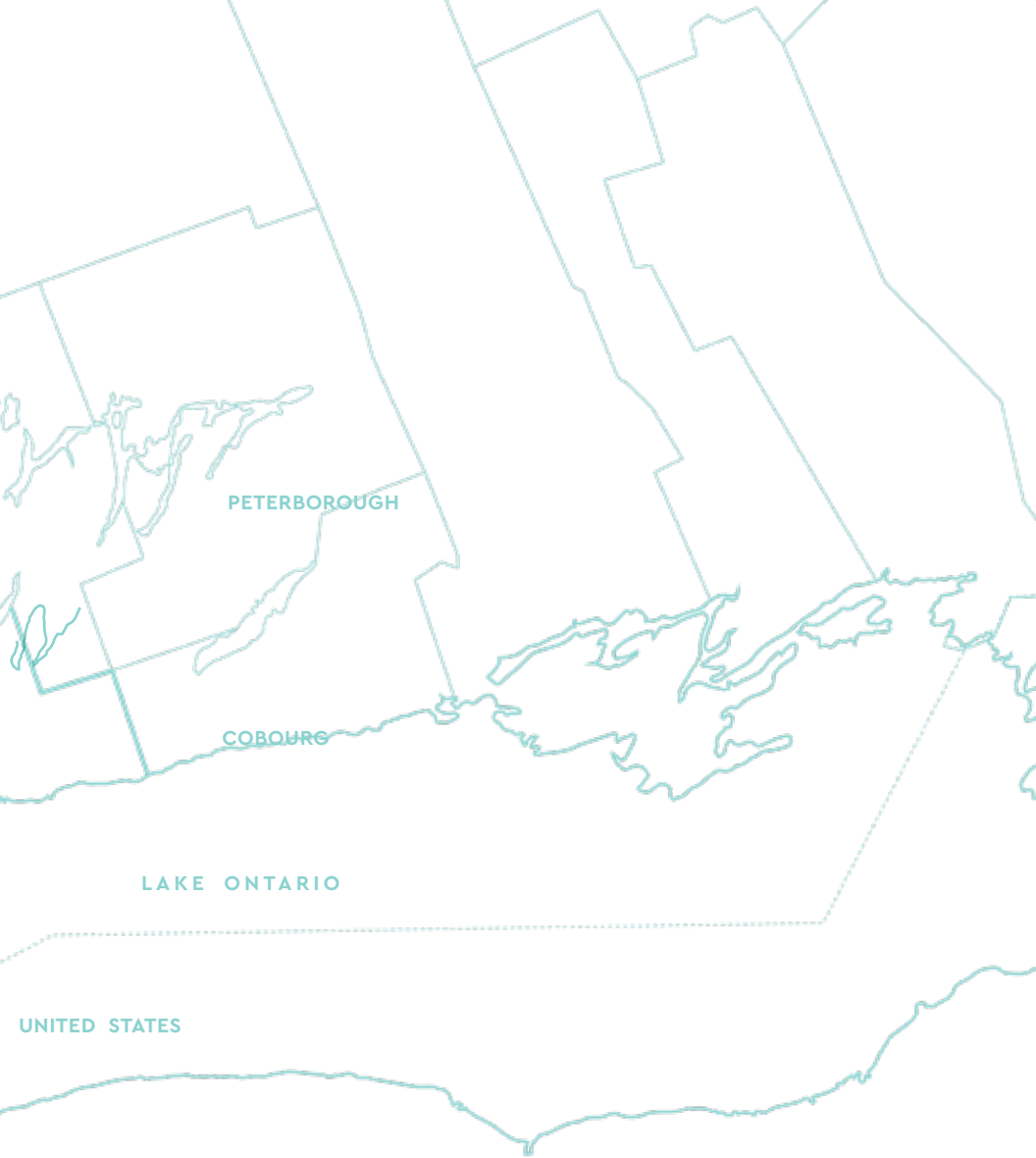LAKE ONTARIO

UNITED STATES

The Greater Golden Horseshoe of southern Ontario, Canada is
one of the fastest growing regions in North America.

The geographic area covers more than 31,562 km2 stretching
from the western end of Lake Ontario, to north of Georgian Bay,
south of Lake Erie, west to Kitchener/Waterloo, and east to
Cobourg and Peterborough.

Toronto Region:

- Home to 25% of Canada's population
- 1 in 3 immigrants to Canada come
  to the Greater Golden Horseshoe
- Population projection:

  2018 .... 9 million

  2041 .... 13.5 million

Key clusters include:

- Financial Services
- Information Technology
- Telecommunications
- Automotive
- Food & Beverage
- Biotech
- Aerospace
- Health Sciences

The Little Book of Clusters: A Guide to Big Ideas explores the extent of a cluster's impact on the economy of the Greater Golden Horseshoe region, as defined by the flow of goods and people. It will also address how the region's geographic qualities impact cluster development. This publication contains case studies from the GGH region to shed light on critical cluster ingredients, how clusters can evolve, and how clusters are perceived over time, space and response to disruption.

This guide offers the beginning of a conversation to facilitate collaboration amongst communities and municipalities. It is intended to foster cluster growth, drive economic development and help shape the identity of the GGH.

This guide offers the beginning of conversation...

Clusters have a
gravitational force
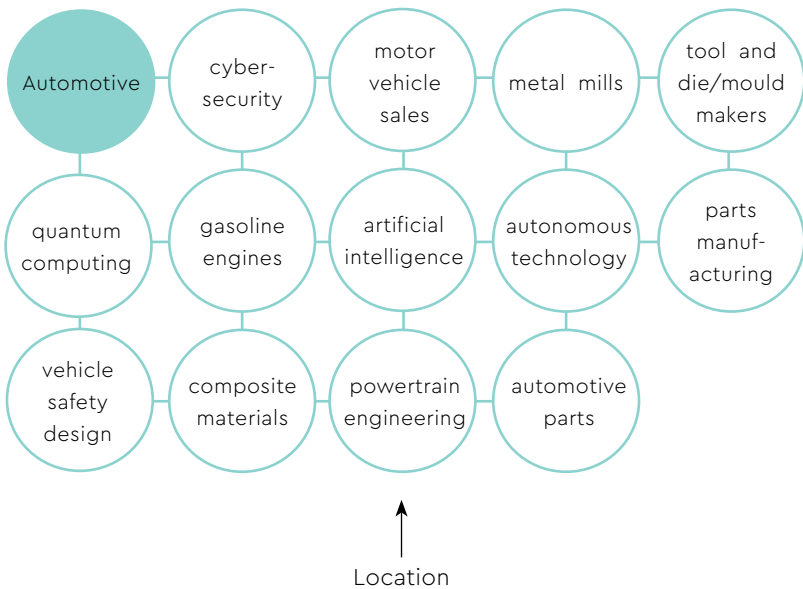
What is a Cluster?

An economic cluster is a geographically concentrated network of partnerships, connections, research, start-ups, businesses, services and talent that share knowledge, data and resources through collaboration, competition and experimentation.

Sector vs. Cluster

Sectors

- Utilities
- Transportation & Warehousing
- Finance & Insurance
- Healthcare
- Retail Trade
- Real Estate, Rental & Leasing
- Manufacturing
- Construction
- Educational Services
- Wholesale Trade
- Information
- Tourism
- Public Administration
- Arts and Recreation
- Agriculture, Forestry, Fishing & Hunting
- Mining, Quarrying, Oil & Gas
- Accommodation & Food Services
- Company Management
- Professional, Scientific & Technical Services
- Automotive
- Other Services

Southern Ontario Automotive Cluster

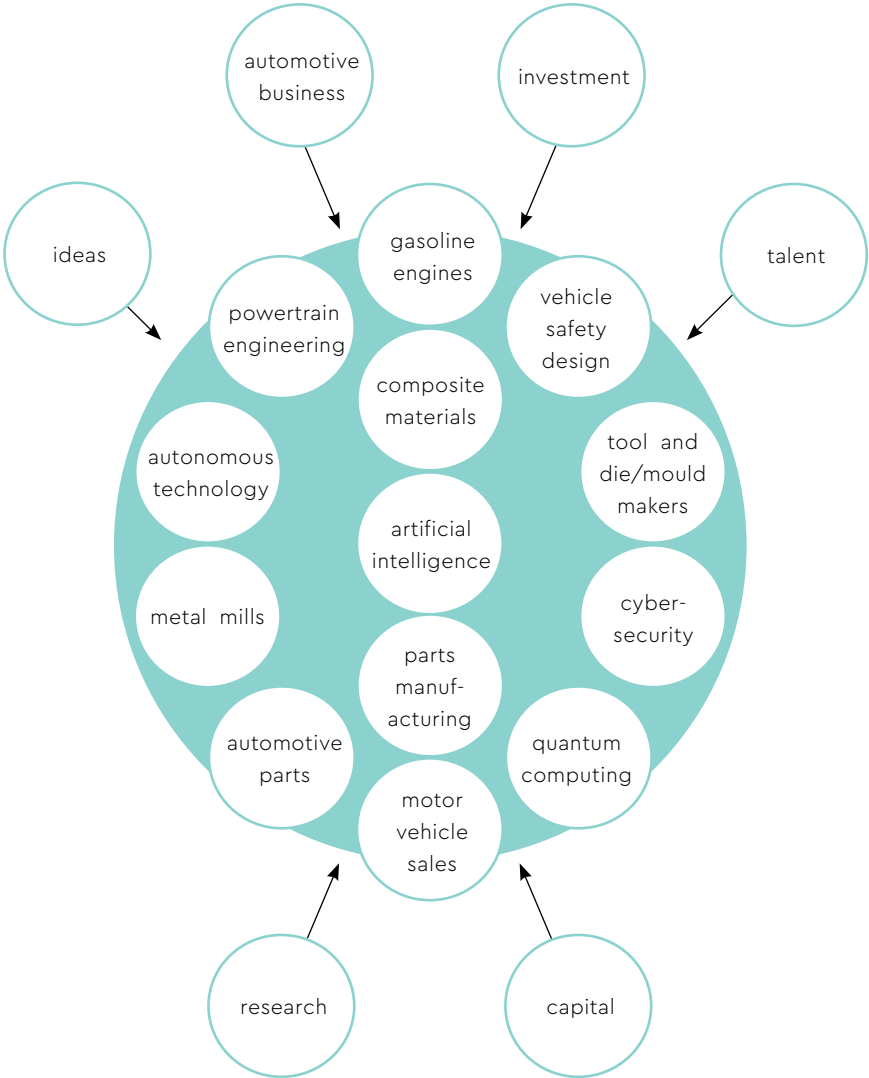|				
Automotive	cyber-security	motor vehicle sales	metal mills	tool and die/mould makers
quantum computing	gasoline engines	artificial intelligence	autonomous technology	parts manuf-acturing
vehicle safety design	composite materials	powertrain engineering	automotive parts	

Location

A sector is a category of industry that operates in same area of the economy or shares a similar business model. Clusters are not to be confused with sectors. Ceramics, industrial machinery, furniture, textiles and apparel are all examples of sectors.

In contrast, a cluster is a concentration of a sector in a geographic location. While a sector includes industries that operate within the same segment of the economy, a cluster is a concentration of industry.

For example, within the GGH region the automotive cluster includes automotive parts, gasoline engines, metal mills and foundries and motor vehicle sectors. It is the concentration of these industries that make up the cluster.

Gravitational Force of the Automotive Cluster

automotive business

investment

ideas

gasoline engines

talent

powertrain engineering

vehicle safety design

composite materials

autonomous technology

tool and die/mould makers

artificial intelligence

metal mills

cyber-security

parts manuf-acturing

automotive parts

quantum computing

motor vehicle sales

research

capital

Clusters have a gravitational force that attracts talent, ideas, businesses and economic activity. Industry concentration is important for assessing what supporting infrastructure is needed. Effective management of clusters is key to sustaining a healthy regional economy. This can be accomplished with initiatives that can lead to interactions, innovations and prosperity.

Clusters provide opportunities for growth and prosperity through the complex connections and interdependent relationships that exists across a region. When a region is prepared to identify and assess its existing and growing clusters, it is better able to capitalize on the potential for economic growth and prosperity.

A successful cluster is a leader, driver and exporter of innovation. It provides equal access to opportunities for all.

While many parameters are used to determine the success of a cluster, these parameters are often based on nothing more than economic indicators. Clusters must also be assessed with indicators such as quality of life, attitudes, and cultural values. Rapid growth in an area can potentially lead to a rising cost of living and degradation of natural resources and infrastructure that support quality of life.

Therefore, a successful cluster is a leader, driver and exporter of innovation. It provides equal access to opportunities for all. A successful cluster drives the economy with an open-minded approach, aspiring to foster innovation with equal access to opportunity. The growth of a cluster is only acceptable if it increases standards of living for all the region's citizens.
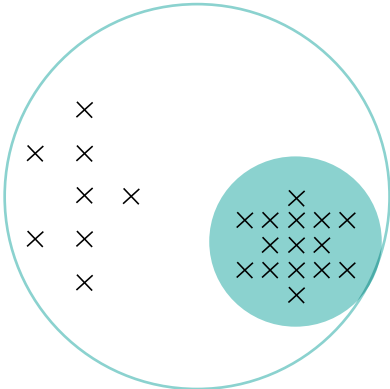
Location Quotient

LQ < 1

LQ = 1

National Average
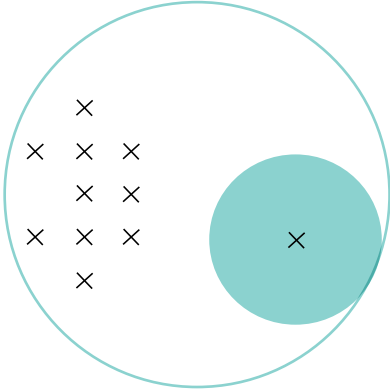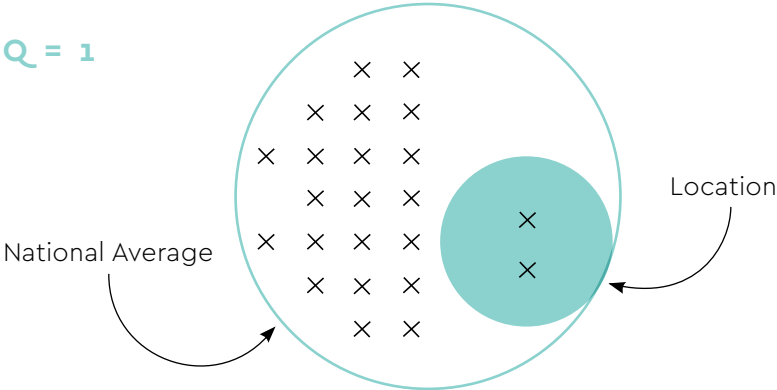
Location

LQ > 1

How to Spot a Cluster

The location quotient (LQ) is a tool most commonly used to measure concentrations of industries, occupations or demographic groups within a region, as compared to other measures of geographic scale. The LQ reveals what makes a particular region unique in comparison to the national average.

The LQ is the key marker for determining a cluster, based on the density of employment, earnings and networks – all metrics that demonstrate the strength of a cluster. Industry LQ demonstrates how concentrated an industry is within a geographic area. It is calculated by comparing the industry's share of regional employment with the share of national employment.

An LQ = 1 indicates that the regional concentration is the same as the national average. Anything higher than 1 is a good indicator of a possible cluster. For example, Detroit, Michigan has high LQ indicators for their manufacturing sector, specifically in industries related to automobile and light truck manufacturing.

2016 Top 10 Traded Clusters in Ontario by LQ

Automotive . . . . .LQ = 2.1

Music and Sound Recording. . . . . .LQ = 1.6

Metal Working Technology. . . . . .LQ = 1.5

Marketing Design and Publishing . . . . .LQ = 1.5

Downstream Chemical Products . . . . .LQ = 1.4

Upstream Metal Manufacturing. . . . . .LQ = 1.4

Financial Services . . . . .LQ = 1.4

Plastics . . . . .LQ = 1.4

Lighting and Electrical Equipment . . . . .LQ = 1.3

Information Technology and Analytical Instruments . . . . .LQ = 1.3

Institute for Competitiveness & Prosperity

Traded and Local Clusters in Canada

51

Traded Clusters

- exposed to national and international competition
- serves national and international markets

16

Local Clusters

- not exposed to national or international competition
- serves local markets

Local and Traded Clusters

Regional clusters are either traded and local, each with different patterns of geographic distribution and competitive dynamics.

Local clusters are comprised of industries that serve the local market. They are located in every region of the country. This results in a region's employment in a local cluster to be proportional to its population. Health Services, education and training, community and civic organizations are all local clusters in the GGH.

Traded clusters are groups of related industries that produce goods and services, but serve markets beyond the region in which they are located. The global reach of the cluster enables it to be less geographically specific. The hospitality cluster is an example of the GGH's well-known traded clusters.

"Ontario's Hospitality & Tourism cluster encompasses the accommodation, entertainment, sporting events, and tourism services and attractions sub-clusters. These sub-clusters all depend on the region's ability to draw in visitors. For this reason, the Hospitality & Tourism cluster is most tightly linked to the Marketing, Design & Publishing cluster. The St. Catharines-Niagara census metropolitan area (CMA) is one of the top destinations for tourism in Ontario. The region is famous for its vineyards, seasonal festivals, pristine lake-front, and Niagara Falls. It is also brimming with tourist accommodations (such as bed and breakfasts, and hotels) and boasts a wide range of entertainment and tourist attractions. Overall, the region has successfully brought together players within the cluster to create a unified brand. Importantly, this brand has a strong draw despite no single company being responsible for attracting tourism".

Institute for Competitiveness & Prosperity

Inputs & Outputs
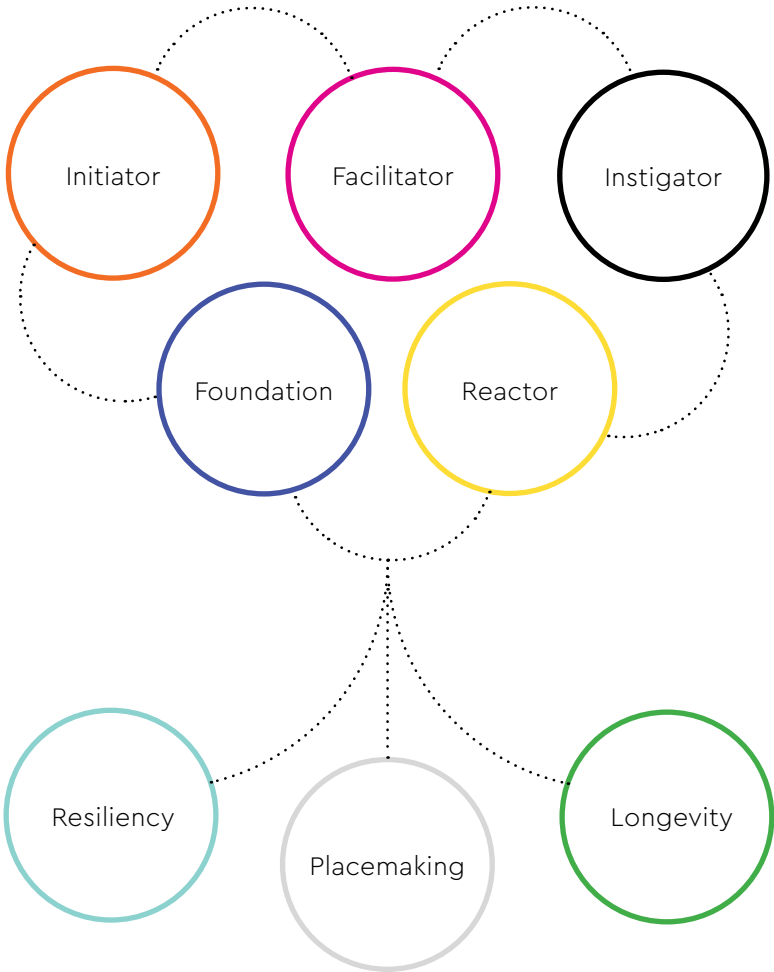
The two categories of cluster ingredients are Inputs and Outputs. Inputs are ingredients that interact with and support one another. Outputs are cluster ingredients that are the outcome of input interaction.

Ingredients of a Cluster

To identify, understand and build stronger regional clusters, one must first understand cluster anatomy. These ingredients are integral to the birth, development and decline of clusters.

Cluster ingredients can be used to evaluate a cluster's dependencies, assets and connections. The ingredients act as a framework for municipalities to better support cluster development through identification of key ingredients and gap analysis.

Georges Melies was a French illusionist and film director famous for leading many technical and narrative developments in the earliest days of cinema. He was an innovator in the use of special effects.
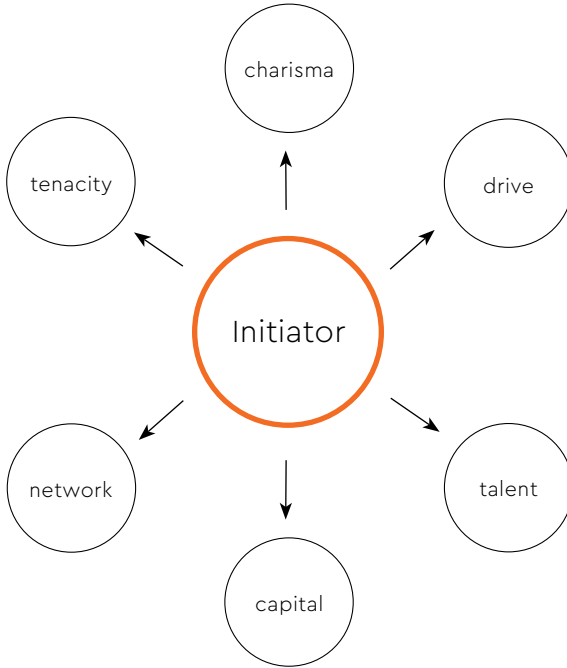
Initiator

An Initiator is an individual or group that influences an existing or developing cluster. This new impact can be in the form of a business, corporation, innovation or event. Initiators act as a driving force, sparking a new pathway for cluster growth.

Initiators are essential in the development and continuation of clusters. They have the ability to extract underlying and sometimes even hidden potential. They take initiative to pioneer a way forward, willing to face setbacks; they are the first to drive change.

The Initiator possesses a strong desire and passion for achieving their goal. They have the ability to leverage potential within their environment in order to realize their vision. To achieve their vision or goal, Initiators require a number of supports such as access to network, capital and talent.

Initiators create new impacts

Tools of an Initiator

Initiators often share a common set of personality traits including drive, charisma, and tenacity. They are often trusted members of their community. These personality traits help them gain the supports required to achieve their goal. If they do not possess these traits themselves, they require access to partners who do.

Initiator

Dr. John Evans – a businessman, founding Dean of McMaster University's Medical School and founder of Mars Discovery District, is a good example of an Initiator.

The launch of MaRS required all of his creative genius, multidimensional expertise and broad networks built over his extraordinary career. Opened in 2005, MaRS focuses its work on four main sectors: health, cleantech, fintech, and work and learning.

MaRS is where entrepreneurship and innovation collide. The 1.5 million-square-foot space is home to 150 companies, totaling 6,000 people who have access to early-stage capital, cutting-edge research facilities, top tech talent and a network of advisors.

Educators, researchers, social scientists, entrepreneurs and business experts all exist under one roof "creating a vanguard of entrepreneurs working to improve society for future generations and making a difference beyond our borders."

"If there is no place on earth like MaRS, it is because there was no one on earth quite like John Evans."

Dr. Ilse Treurnicht, CEO of MaRS
Discovery District

The 400-series highways throughout the southern portion of the Ontario, Canada form critical cluster foundations for the flow of people and goods throughout the Greater Golden Horseshoe (GGH).

Foundations

Cluster Foundations are the pre-existing resources and assets within a geographic location. They are the underlying conditions that support cluster development. Foundations include existing infrastructure, geography, location, talent, local and international relationships, social infrastructure, skills, natural resources, safety and stability, mobility systems, rules & regulations, and cultural & societal ideologies.

They provide the basis for clusters to develop and mature over time, and drive the larger system that houses a cluster. Infrastructure is a crucial Cluster Foundation. Atlanta became a hub for the Georgia Railroad more than 150 years ago, and since then the region transformed from a transportation hub to an international commercial centre.

Cluster Foundations can be both inherited and created. Inherited Cluster Foundations include geography, climate, and population, and in the case of the Greater Golden Horseshoe, proximity to the U.S. market. Created Cluster Foundations include entrepreneurship, the presence of research and training institutions, and the composition of the regional economy. A successful cluster will build on inherited Foundations, but will also create new assets which will become the future Foundations for subsequent cluster development.

Cluster Foundations are the pre-existing resources and assets within a geographic location

Reactor

Reactors are individuals or companies that respond to the new opportunities created by Initiators. Reactors are also triggered by disruption, new market opportunities, competition, collaborative opportunities, unmet needs and market gaps.

Reactors come from related and unrelated industries and/or sectors. They are a vital cluster ingredient and it is important to identify Reactors to not duplicate existing resources.

Reactors respond to Initiators

Research Triangle Park ranks number one in the United States in terms of concentration of clinical trial research support firms.

Reactor Example

The Research Triangle Park of North Carolina is one of the largest research parks in the world. In the late 1950s, this area was among the lowest in the country in terms of wage and employment levels. Despite having three strong local universities, university graduates frequently left the area after receiving their degrees.

In 1951, a group of Initiators from business, academia and government worked together to create and develop the Research Triangle Park. The Park offered companies easy access to physical infrastructure, human resources and knowledge assets.

These new opportunities attracted Reactors to the region. The park is now home to over 200 companies employing 50,000 workers and 10,000 contractors, including the second largest IBM operation in the world. These companies were the Reactors who responded to innovation.

Facilitator Action

Initiator

Facilitator
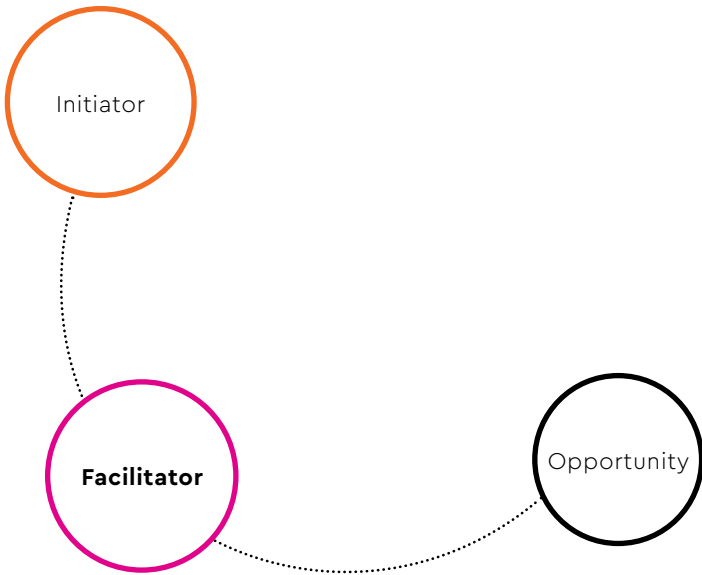
Opportunity

Facilitator

Facilitators act as channels for other ingredients such as a Reactor or Instigator. Facilitators connect and capitalize on opportunity. Facilitators include government financial incentives, policy, venture capital investment, supply chain, market access, and partnerships. Facilitators are important as they enable a cluster to reach its full potential by maximizing unique strengths within that cluster.

Facilitators act as channels for other ingredients

Ontario Smart Grid Fund

Start-up firm

**Smart Grid Fund**

Shift to renewable energy
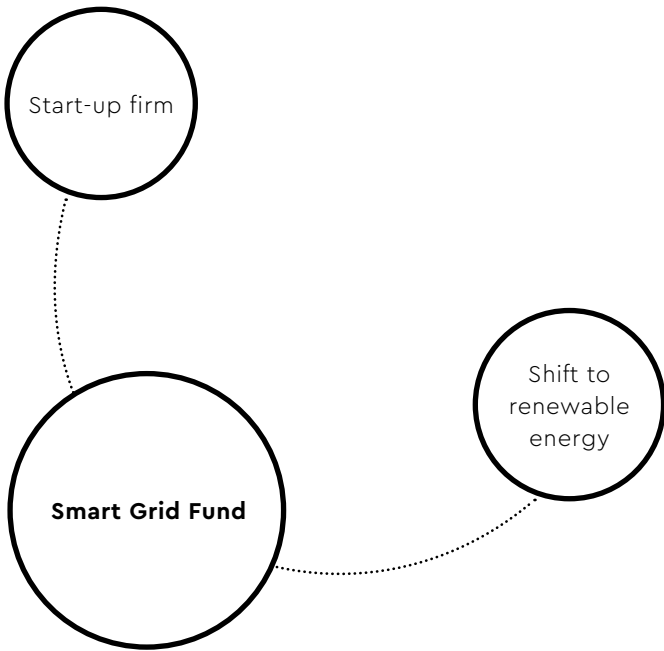
Facilitator Example

The Smart Grid Fund is a Facilitator helping modernize Ontario's electricity transmission grids. The fund supports innovators to develop new technologies with the intention of making Ontario's energy market more operable while giving customers more choice and control over their power use.

The fund acts as a Facilitator as it brings together talent from business, academia and research institutes to develop solutions and strategies for energy projects. The fund also provides money to test, develop and launch the next generation of technologies to modernize Ontario's electricity transmission grids.
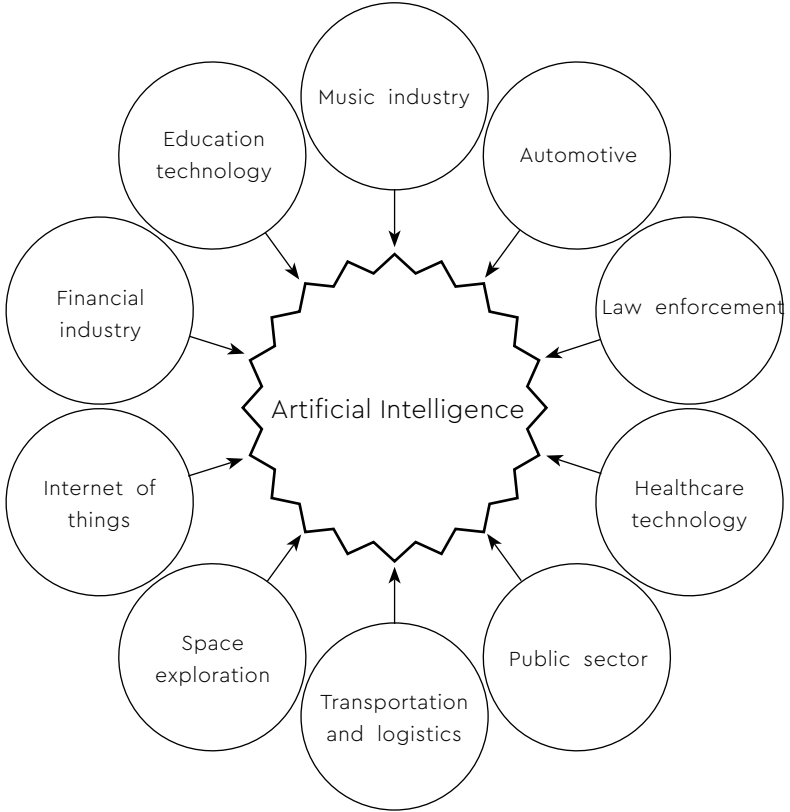
Initiator Responds to Instigator
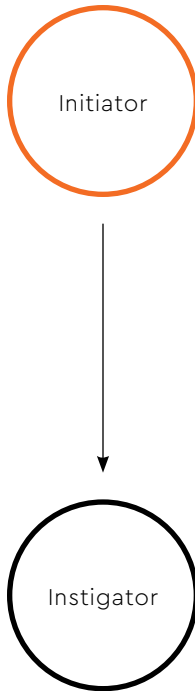
Instigator

Instigators are elements within a cluster that trigger a response from an Initiator. Instigators include new market opportunity, disruption, competition, opportunity for collaboration, unmet needs and unprecedented events. Reactors and Initiators are capable of creating new Instigators.

An Instigator is a catalyst for change in the face of a disruption. This change becomes significant enough to create a larger and more important directional shift.

In response to a disruption, Instigators can act as prompts to provoke a response within a cluster. They are critical to a cluster because they act as the force determining if a cluster will survive, collapse or evolve into something new.

Instigators are elements within a cluster that trigger a response from an Initiator

Industry Responds to Instigator

Music industry

Education technology

Automotive

Financial industry

Law enforcement

Artificial Intelligence

Internet of things

Healthcare technology

Space exploration

Public sector

Transportation and logistics

Instigator Example

Rapid technological change is an Instigator that creates disruption within a number of clusters. Technological change and its associated market disruptions create opportunities and challenges. Disruptive technological life-cycles can initiate the emergence of new regional industrial clusters or create opportunities for the further development of existing ones.

The Bollywood film industry is a reflection of placemaking that originally stemmed from Hollywood, California. This sense of place has spoken to an international audience, recognizable as it transcends the geographic space.

Placemaking

Placemaking is a state of mind or virtual space and is also associated with a geographic location. Placemaking is linked to site-specific stories and memories. Placemaking capitalizes on assets, inspiration and the potential of a geographic location. It demonstrates the significance of how a sense of place speaks to a community.

Internationally recognized evidence of Placemaking is Hollywood, California. Hollywood is notable as the home of the U.S. film industry and its name has come to the be a shorthand reference for the industry. Hollywood has exerted such dominance in world cinema that its name has been adapted to describe both the film industry of India (Bollywood, Indywood) and Nigeria (Nollywood). Indian cinema is the world's largest film industry, and Nollywood is currently ranked the third largest film industry in the world based on revenue.

# Placemaking is linked to site-specific stories and memories

Resiliency is
a necessary
ingredient
for a cluster
to overcome
obstacles and
adapt to change

Resiliency

Resiliency is the ability to adapt quickly to disruption caused by an Instigator. Resiliency is a necessary ingredient for a cluster to overcome obstacles and adapt to change. Resiliency is a crucial output for a cluster to overcome obstacles and remain resilient in the face of change. This allows for cluster stability, growth and innovation.

To build a resilient cluster it is important to first identify gaps and make value assessments that respond to these gaps. A resilient cluster does not allow disruptions to hinder its development. The ability to adjust seamlessly through new policy, incentives and market pivots, is one of the most effective ways to allow a cluster to survive.

The emergence of Fintech startups in Toronto has disrupted the financial sector by creating a new way to provide services to consumers with efficient, cost-effective and innovative solutions. Banks within the traditional financial sector are recognizing the value of these innovations and adapting to embrace Fintech to stay up-to-date, keep up with demand, and avoid becoming irrelevant. An example of an in-house fintech hub within a financial institution is Scotiabank's Digital Factory, which operates as an incubator to create digital solutions for its 23 million customers.

Industry   Initiator
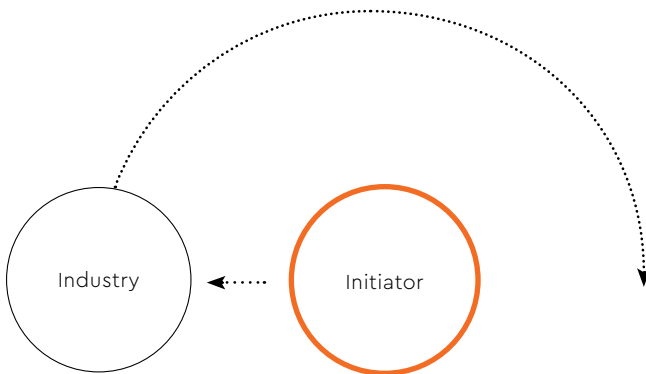
Serendipity?

Another variable beyond inputs and outputs are unexpected serendipitous moments. Chance events are often important to the birth of a cluster. The early formation of Initiators, Foundations or events in a location, often show entrepreneurship not completely explainable by pre-existing local circumstances. Happenstance and unexpected opportunities occur throughout the life of a cluster.

Many highly localized industries can be traced back to some seemingly trivial historical accidents. Variations in tastes and preferences among regions may be one of the sources of chance events that trigger the formation of industry clusters. For example, Eugene, Oregon's sporting goods and apparel cluster, including firms such as Nike, Adidas America, and Columbia Sportswear, trace back to the popularity of running and jogging in the 1960s.

Many highly localized industries can be traced back to some seemingly trivial historical accidents.

Chance alone rarely explains why a cluster takes root. Although chance events do play a role in the formation and development of clusters, conscious efforts to support cluster development, competitiveness and innovative capacity can actually influence the course of a cluster. When chance can provide a central explanation for a cluster's development, it is rarely the sole explanation.

Location raises the odds that chance events will occur, but also can raise the odds that chance events will lead to competitive firms and industries. Perhaps running and jogging were so popular in Oregon because of of the temperate climate. Successful regions do not rely on chance, but rather seek to institutionalize the innovative process by supporting cluster ingredients that facilitate innovation and entrepreneurship.

Ingredients in Action Case Study:
The Shakespeare Effect

The village of Stratford, Ontario, was founded in 1832 and its name stems from William Shakespeare's birthplace Stratford-upon-Avon, England. The Grand Trunk railway and subsequent locomotive repair shops and furniture manufacturing were the most important parts of the local economy by the early twentieth century.

In 1933, a general strike started by the furniture workers and led by the Communist Workers' Unity League, marked the beginning of the end of furniture manufacturing in the town. The Grand Trunk Railway (later Canadian National Railway) locomotive repair shops were the major employers for many years, employing upwards of 40% of the local population.

The town is also well known for being the home of the Stratford Festival (previously known as the Stratford Shakespeare Festival). When the railway and furniture industry declined in Stratford by the early 1950s, journalist and Initiator Tom Patterson devised an idea for resuscitating the city's economy – A festival of Shakespearean theatre. Patterson brought his vision of a Shakespeare theatre festival to the city's decision-makers and community members.

As a result of his vision, Patterson initiated a new economic direction for the city. The following presents some of the key moments in the evolution from an early nineteenth-century rural village to a city with over one million visitors annually.
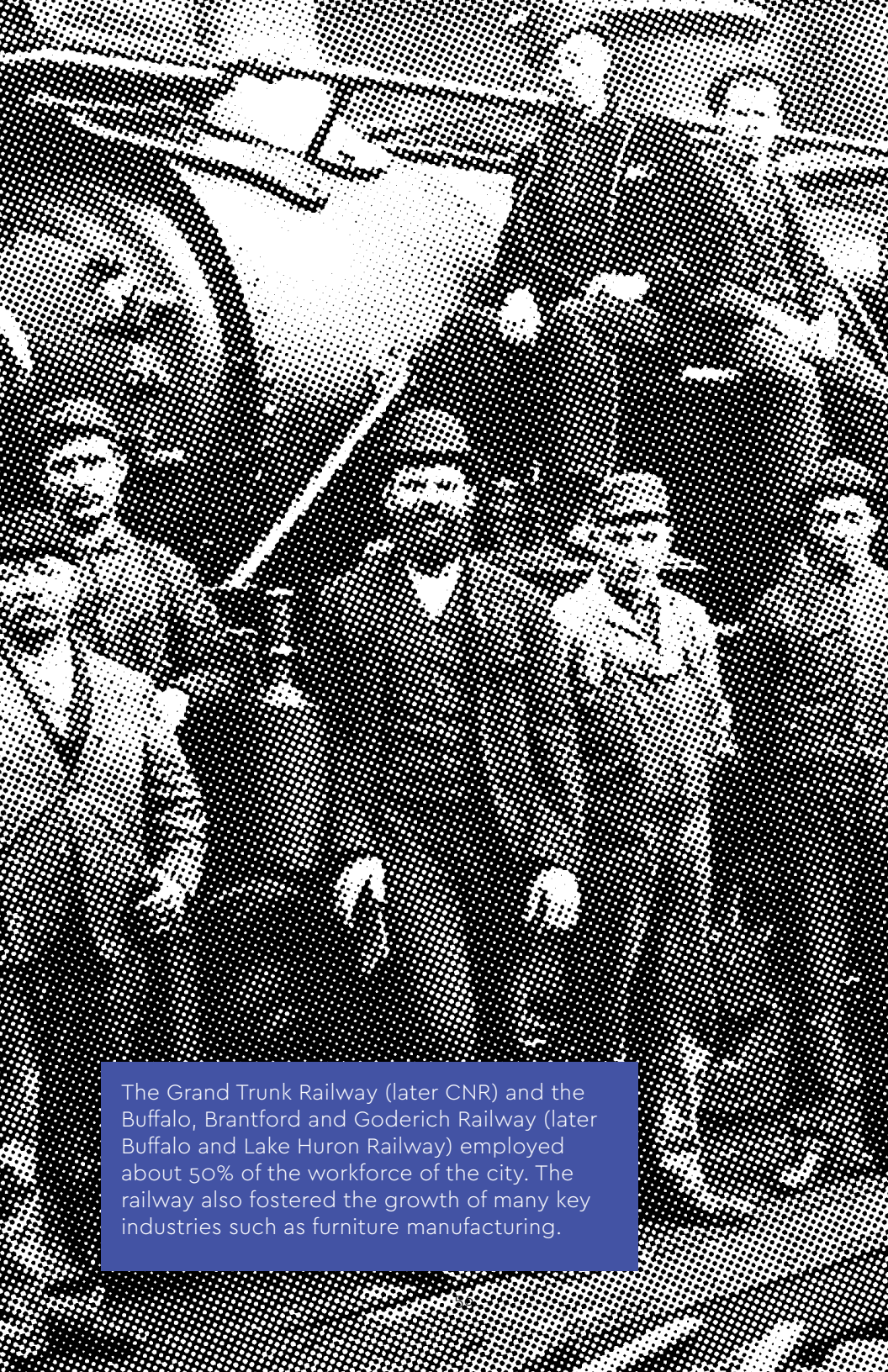
Recent additions to the city of Stratford include a $300 million RBC data centre, a University of Waterloo satellite campus and Canada's only testing location for driver-less cars. The Cluster Ingredients framework will be applied to analyze this following case study.

In 1953, for the Stratford festival's inaugural season, the stage and auditorium was housed under a giant canvas tent. Performances were held there for the three seasons that followed until it was replaced by the Festival Theatre.

Initiator: Tom Patterson

Tom Patterson is a journalist from Stratford, Ontario who founded the Stratford Festival of Canada. This is the largest theatre festival in Canada. At the time of the festival's inauguration, the town experienced economic decline due to changes in the rail and manufacturing industries. Patterson – with little experience of the theatre – proposed the idea of a Shakespeare festival and persuaded the town council to back it. He also convinced internationally known British theatre director Tyrone Guthrie to become the first artistic director. Without Patterson's vision the festival may have never come into existence.

The Grand Trunk Railway (later CNR) and the
Buffalo, Brantford and Goderich Railway (later
Buffalo and Lake Huron Railway) employed
about 50% of the workforce of the city. The
railway also fostered the growth of many key
industries such as furniture manufacturing.

Cluster Foundations: Railway

The most important factor in the early development of the town of Stratford was the arrival of two different railways in the 1856 – the Buffalo,Brantford and Goderich Railway and the Grand Trunk Railway (later CN rail). The rail crossroads created by the junction of these two competing railways led to Stratford being chosen as the location of locomotive repair shops and as a Divisional headquarters for the Grand Trunk Railway. The railway also encouraged the growth of key industries in the area such as agriculture and furniture manufacturing, and rail played a large role in creating the standard of living that the city enjoys to present day.

Placemaking: What's in a Name?

Stratford was settled by Irish, Scottish, English immigrant farmers in 1832. This lead to the town being named after Stratford in England, and the Little Thames river being renamed the Avon River (a clear connection to Shakespeare). Such iconic names linked the small town to its colonial roots in England, capitalizing on the assets, inspiration, potential, stories and memories of Shakespeare's original home.

Longevity: University of Waterloo

The University of Waterloo opened a satellite campus in Stratford, Ontario in 2009. Universities are classic examples of cluster longevity as they accelerate knowledge and innovation and bring together students, researchers, industry, and entrepreneurs. University campuses enrich their communities socially, culturally and economically, and inspire success.

As more people came to Stratford for the theatre, the number of restaurants and cafes grew at a rapid pace. As a result of this, the Stratford Chef School was created in 1983 to keep up with demand for well trained restaurant staff.

Intentional Reactor: Restaurant Culture

A rise in restaurant and food culture in Stratford, Ontario was a response to the Stratford Festival opening in 1953. The festival influenced the development of the city as a culinary destination with opportunities for fine dining, bistros and restaurants to suit every taste. The number of restaurants increased from 18 in 1951 to 78 by 1989. Restaurants opened during this period provided locals, theatre-goers, and actors with gourmet dining and put the city on the culinary map

Instigator: Economic Decline

With the introduction of the Ford automobile, passenger rail traffic dramatically declined, especially in the 1960s. In 1970, many passenger routes were closed down.

This decline in the rail industry led to an economic downturn in the town, leading Patterson to envision new income flows while taking advantage of the existing resources available in the city.

Facilitator: Funding

Patterson was able to achieve his goal of starting the Stratford Festival after gaining support from Mayor David Simpson and the local city council. On January 22, 1952, the city council approved a grant request to travel to New York to seek artistic advice.

Resiliency: Stratford Festival

The City of Stratford continually shows its ability to adapt to different types of change, including economic and social. Such an example is the Stratford Festival.

As the railway industry pulled out of Stratford, in the early 1950s Tom Patterson had the idea for breathing new life into his native city's economy: A festival of Shakespearean theatre.

Travel and tourism have become a significant part of the city economy, with the Stratford Festival being a major anchor. As the festival builds a global audience through international broadcasts of stage productions, it continues to evolve and grow into the future.

In 2009, the University of Waterloo opened a satellite campus in Stratford, Ontario.

As a cluster, the Stratford example may be small in comparison to the Toronto-Waterloo corridor (case study to follow), but it demonstrates the ingredients in action. Made up of a variety of intersecting desires and needs, each area within the cluster can support and feed other areas.

" **In healthy regions, competitiveness and innovation are concentrated in clusters, or interrelated industries in which the region specializes. The nation's ability to produce high-value products and services that support high wage jobs depends on the creation and strengthening of these regional hubs of competitiveness and innovation."**

Professor Michael E. Porter,
Harvard University

Clusters are Regional

A region is a geographic area that may be broadly defined by physical characteristics such as bodies of water, landforms, soil, climate, biology, human constructs such as borders and culture, and the intersection of humans and the environment. Geographic regions are typically understood to have a lack of neatly defined boundaries that are subject to change.

The density of a highly qualified labor force, a high concentration of first class educational and research institutions and access to venture capital allows the Greater Golden Horseshoe region to become the focus of numerous economic clusters.

Density of connection is the key defining feature of economic clusters

Clusters are key organizational units for understanding and improving the performance of regional economies. Although there are set borders and political boundaries defining the GGH, there exists the possibility to work beyond these restrictions. Cluster boundaries will adapt and change as new clusters begin to develop or existing clusters grow to open new areas of opportunity.

The regional scale is the optimal for cluster analysis as it allows academics, policymakers and citizens to identify ingredients, gaps and areas of opportunity. Analysis is not easy on a smaller municipal scale due to the lack of interdependencies and connections that may exist beyond municipal boundaries. Conversely, it is challenging to analyze cluster ingredients on a larger scale such as provincial or national because of the difficulty in correlating significant cluster ingredients.

Density of connection is the key defining feature of economic clusters. Reactors find it profitable to locate in markets with the greatest density of consumer access. Individual workers minimize their economic risk by residing in a place with many possible employers. Concentrations of reactors create a market for suppliers and provide the scale needed for suppliers to refine and specialize their expertise. Regions with a high density of firms and workers with similar interests will lead to firms and workers adding and refining knowledge in a cumulative way. The broader geographic regional scale allows for more opportunity by capturing a broader range of constituencies.

Greater Golden Horseshoe
Regional Infrastructure

The regional scale reveals the many symbiotic connections, interdependent interactions and relationships tied to specific geography. A region is also a better working scale of population, defined by the flow of people and goods. Additionally, strong cluster foundations including physical and social infrastructure is a baseline requirement to establish and sustain a prosperous regional economy.

Good quality roads, highways, airports, railroads, water and electricity support the efficient movement of people, goods, and services as well as the quality of life of citizens. These cluster foundations are part of many of the clusters of the GGH and they clearly exist across many municipalities of the region.

Building strong regional economies is a long process, spanning decades. There are many steps in building a regional economy, for example, developing inherited assets, creating new assets, linking companies to these assets, and attracting international firms . When the ingredients work together through productivity, connections, competitiveness, interrelated industries and innovation, it increases the region's desirability as a potential place to expand and invest in.

A diverse population includes over 51 per cent foreign-born people and over 180 languages and major dialects spoken within the Greater Golden Horseshoe Region.

When considering cluster regional characteristics, academics, policymakers and citizens should do the following:

O 1 Build on the unique strengths of domestic regions rather than attempting to emulate foreign examples. Different regions have different sets of economic development opportunities and cluster Foundations. Successful regions leverage their unique assets to build specialized clusters. Not every place can or should aspire to be Silicon Valley. No single policy or strategy will work for all regions.

O 2 Create Facilitators, support Initiators and Reactors to foster an environment that helps new clusters grow rather than creating a cluster from scratch. Strengthening established clusters should be one of the early priorities in regional development. It is difficult to artificially propagate new clusters. Instead, policymakers should promote and maintain economic conditions that will enable new clusters to emerge, supporting cluster Foundations such as knowledge creation and research institutions, Reactors (entrepreneurship, new firm formation), and Facilitators (such as availability of capital). Cluster development thrives from its interactions, where insights, skills, and technologies from various fields can merge and spark innovation.

VELOCITY GARAGE

Attracting and retaining top talent is crucial to supporting Reactors of a cluster. Velocity Garage is an incubator at the University of Waterloo that helps scale startups.

Toronto Region Overview

Labour Force:

Over 6.4 million people

A labour force of more than 4.7 million

Over 800,000 businesses

40 percent of Canada's business headquarters

18.5 percent of Canada's GDP

A CDN $332 billion economy

Nearly 100,000 new immigrants annually

A diverse population with over 51 percent foreign-born

Over 180 languages and major dialects spoken

Over 240 ethnic groups

130 million people within a 500-mile radius

Fourth-largest city in North America

Third-largest tech sector in North America

Second-largest financial centre in North America

Second-largest food and beverage industry in North America

Two airports serving 200 global destinations in 55 countries

Trade agreements that provide access to nearly 1.7 billion consumers with a combined GDP of more than US$62 trillion or more than one-half of the world's output of goods and services

Five world-renowned universities and six internationally-recognized colleges

Case Study: Tech North

The Toronto-Waterloo Region Corridor is a global centre of talent, growth, innovation and discovery. Rivaling the best in the world, it is the second largest technology cluster in North America. Following the footsteps of Silicon Valley and being labeled as "Tech North" of Canada, the Toronto-Waterloo Regional Corridor is a hub for trailblazing companies producing more than $360 billion in annual GDP. A diverse ecosystem with strengths in everything from financial services to business services, health care, clean tech and advanced manufacturing. Tech North is focused on real world problems with clear growth and investment potential.

Regional Corridor
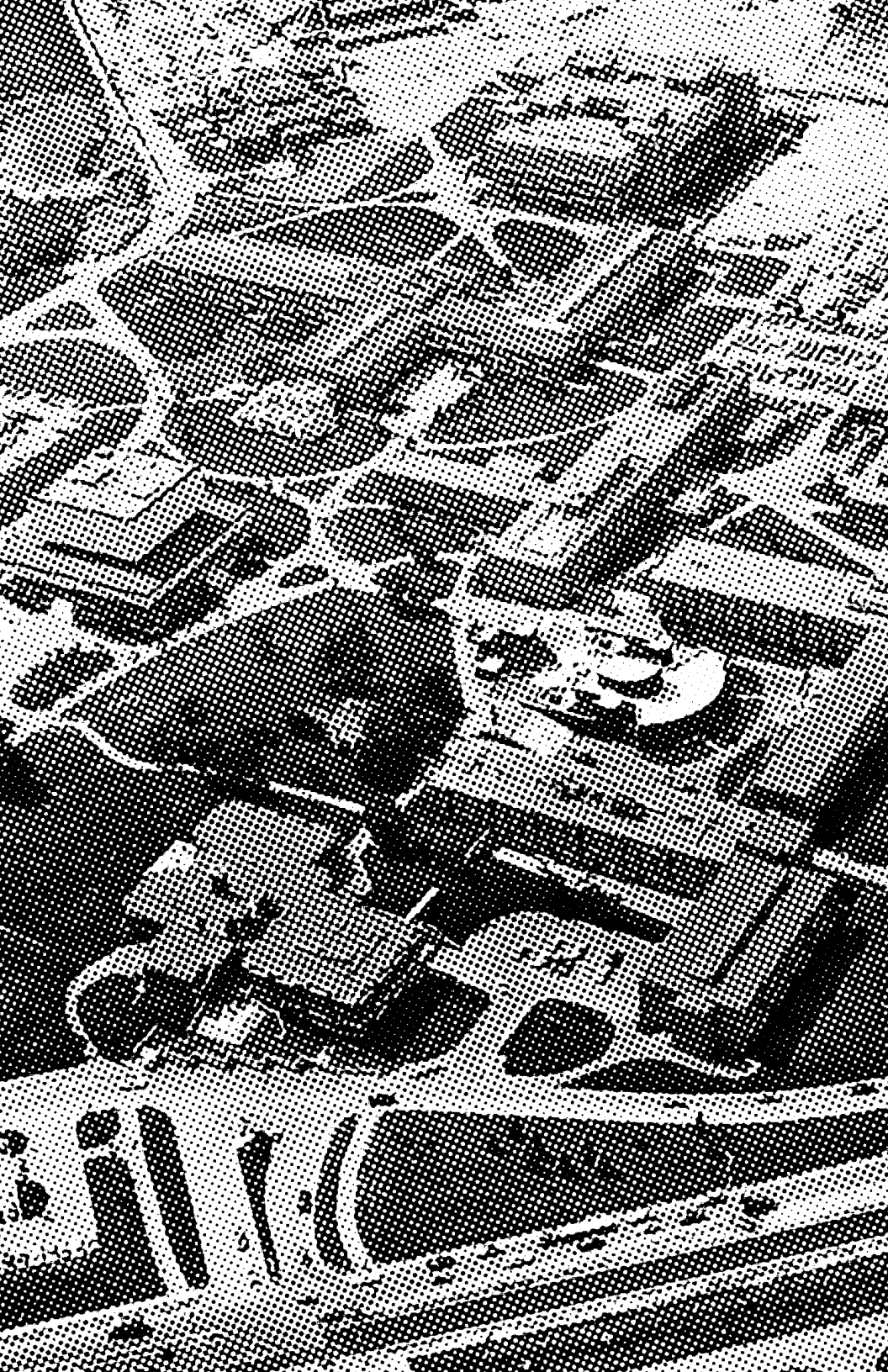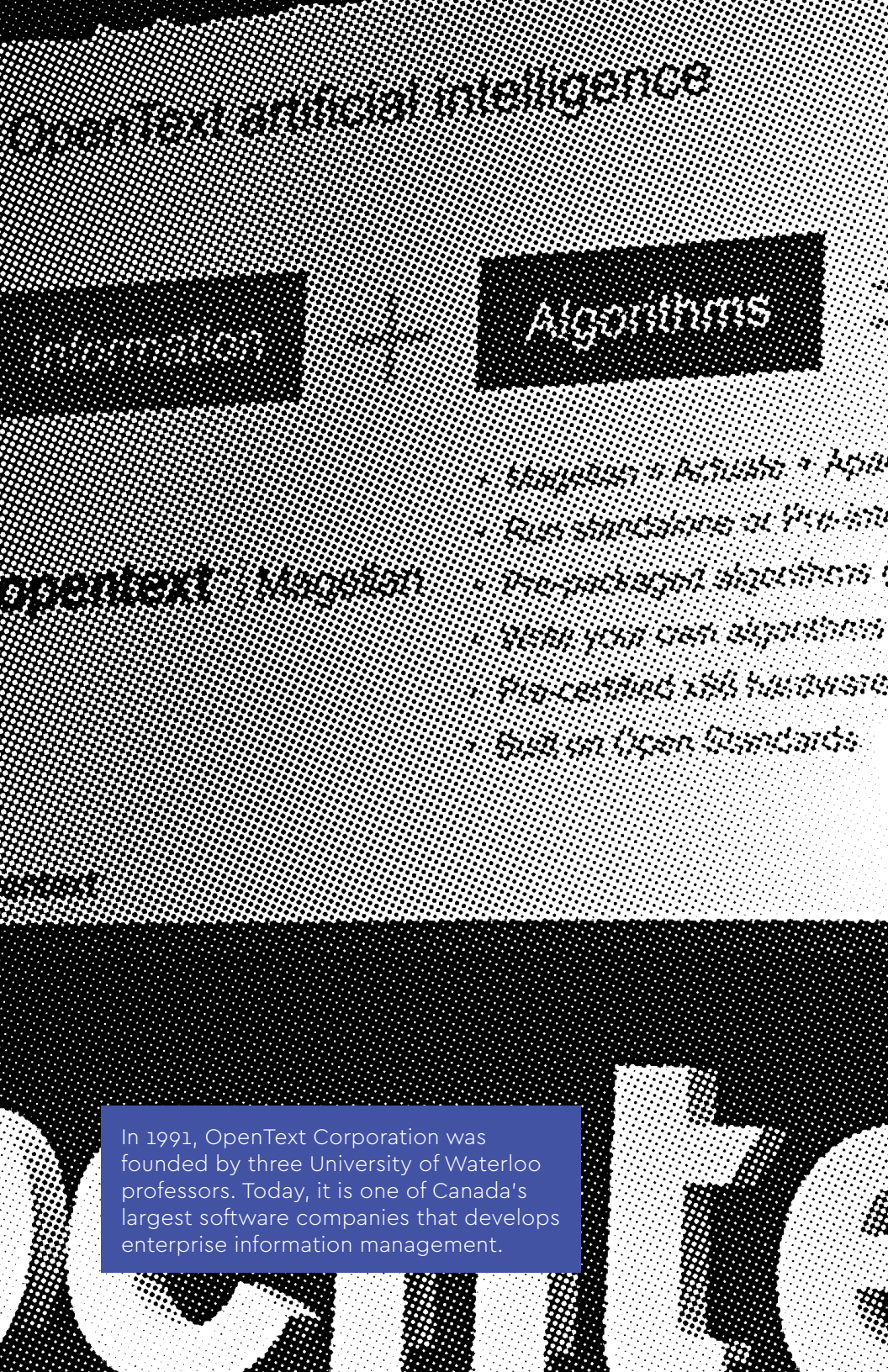
OpenText artificial intelligence

Information + Algorithms

opentext Magellan

In 1991, OpenText Corporation was founded by three University of Waterloo professors. Today, it is one of Canada's largest software companies that develops enterprise information management.

As a part of the Toronto-Waterloo Region Corridor, the city of Waterloo houses a curious mix of entrepreneurial spirit and business savvy that has propelled this small city along a unique growth trajectory. It houses the world-renowned University of Waterloo (UW) along with various think tanks such as the Pembina Institute and start-ups like OpenText. Waterloo's influence extends to its Goliath neighbor to the southeast – the City of Toronto.

The Toronto-Waterloo corridor is a prime example illustrating regional clusters as the ingredients are evident. This corridor is a regional cluster containing a critical mass of interconnected businesses, suppliers, start-ups, incubators, accelerators and research institutions geographically linked with a strong support network. Tech North is growing every day and has the potential to increase productivity and competitiveness, on both a national and global level.

Small cities were once touted as the future of growth. However many small Canadian municipalities fell by the wayside on account of overlapping jurisdictions, competing interests and short-sighted political decisions. A strong culture of philanthropy coupled with effective management of talent and technology, successful placemaking, and the integration of academia, government and private sector all created the necessary preconditions to set Waterloo on a path toward success.

The following timeline presents the story of Waterloo's evolution from a typical North American city, to a technology pioneer and innovation powerhouse.

Tech North Timeline

1780- 1850

1784 Land is given to the Six Nations by the British as a gift for their allegiance during the American Revolution.

1796 & 1798 Six Nations sell 38,000 hectares to Loyalist Colonel Richard Beasley.

1803 Portion of the land is purchased by German Mennonite farming families from Pennsylvania who want to live in an area. This will allow them to practice their beliefs without persecution. Mennonites purchase land, creating 160 farm tracts.

1816 Waterloo township established. The population increases due to the 19th century exodus from the continental German states of skilled craftsmen, artisans and tradesmen, as well as farmers and agricultural labourers.

The War of **1812** Mennonite settlers refused to carry arms so were employed in non-combatant roles in camps and hospitals during the war.

1850–1900

1856 The Grand Trunk railway reaches Berlin (now Kitchener) Ontario. The Grand Trunk and the Canadian Pacific railways provide transportation and as a result, furniture manufacturing and other industries begin to open in the area.

1869 Waterloo County builds the "House of Industry and Refuge" to minimize the number of people begging, living on the streets or incarcerated. It is inspired by the cultural sentiment that pauperism is considered a moral failing and can be erased through order and hard work.

1900–1950

1949 A team of professors and graduate students at the University of Toronto begin building Electronic computer Mark I (UTEC for short) – the first functional computer in the country.

Waterloo industry receives large orders to be filled to support war efforts.

Waterloo starts to grow as an agricultural community. Waterloo develops into an industrial base and urban hub.

1950 – 1960

1955 The first computer is installed for use in industry in Canada.

1956 George Ira Needles gives a speech that offers a different approach to education that will include both studies in the classroom and training in industry. This eventually becomes the basis of the Co-operative education program at the University of Waterloo.

1956 Space Race begins.

Reactor   Instigator   Facilitator   Initiator

Cluster Foundations

1957 Waterloo College Associate Faculties is established. Later changed to University of Waterloo incorporated as a university with the passage of the University of Waterloo Act by the Legislative Assembly of Ontario in 1959. It was established to fill the need to train engineers and technicians for Canada's growing postwar economy.

1957 Introduction of the Co-op program helps ensure that UW will have a strong technical and scientific focus.

1957 IBM invents first disk with memory, and the first FORTRAN compiler is developed for IBM 704. These events are crucial to computing at UW. Waterloo's creation of unique WATFOR compilers brings an international reputation to the institution.

1957 The first group of Co-op engineering students embarks upon their initial work terms. The alternating work-study program at Waterloo profoundly influences the character of the University of Waterloo. Its computing programs early on acquire a practical application in the creation of software. Program eventually expands to other disciplines at UW.

1959 UW Mathematics lecturer J. Wesley Graham's determination to take computing to undergraduate students becomes a hallmark of the UW experience and students respond by designing early computer languages (WATFOR, WATFIV). This makes Waterloo recognized around the world. Graham's contacts in the area of computing enhance university's reputation and its acceptance in new and rapidly developing field.

1959 UW's first computer installed in Physics and Mathematics building (a Bendix G-15). Graduate Program in Mathematics established. Faculty switches to a credit system enabling the system of co-operative education to expand within the faculty.

1960 – 1970

1960 The IBM 610 computer is installed. UW begins teaching undergraduate Computer Science courses to students in mathematics, science, and engineering. Several courses also being taught at the graduate level.

1964 Co-op is introduced into the mathematics curriculum. Forty students expected, yet 100 enroll. Program includes options in Computer Science. The popularity of the course increases 100%. Co-operative Mathematics with Computer Science Options (the official name of the Co-op course) is the only academic program of its type in the world.

1970 – 1980

1969 UW becomes one of the world's largest computer science programs.

1970 Oil crisis. Rapidly rising oil prices create an inflationary spiral, which raises interest rates. Recession follows. Jobs are increasingly lost to mechanization in industry. Economy slows.

1975 Vietnam war ends.

1973 Ethernet invented.

1971 Ted Hoff, Federico Faggin, Stanley Mazor build the first single-chip computer.

1976 Apple 1 is released.

Tech North Timeline

1980–1990

Doug Wright (UW President 1981–1993) enacts policy whereby students and staff retain intellectual property rights to whatever they develop.

1984 Research in Motion (RIM) is incorporated, started by Mike Lazaridis and Douglas Fregin.

1984 UW secures contract with Oxford University Press to computerize the Oxford English Dictionary.

1989 World Wide Web is developed.

Faciliator   Initiator

Reactor   Instigator

Cluster Foundations

1990–2000

1999 Mike Lazaridis gives $100 million of his own money to establish the Perimeter Institute for Theoretical Physics in Waterloo – a leading centre for scientific research, training and educational outreach in foundational theoretical physics.

People and businesses around the world communicate by email and cellular phones. Investments in R&D significantly reduced in the early to mid-1990s as the federal government struggled with a growing deficit and public debt.

Economy display less volatility in growth, unemployment and inflation than in previous decades. Growth is driven by increases in labor productivity, fueled by information and communications technology.

1997 Communitech is founded by group of dedicated entrepreneurs aspiring to raise the profile of the Waterloo region tech community. Their vision includes more tech talent, global recognition for the tech sector and better support for firms.

1991 OpenText Corporation (spin off of Oxford English Dictionary project) is founded by University of Waterloo professors Frank Tompa, Timothy Bray and Gaston Gonnet.

2000–2005

2001 RIM co-CEO, Jim Balsillie addresses world politics and government with a $20 million donation to establish the Centre for International Governance Innovation (CIGI) in Waterloo.

2002 The federal government's role in financing R&D is clarified and gains momentum with the launch of "Canada's Innovation Strategy".

Between 1973 and 2001, UW helps initiate over 59 high-tech firms.

2000 Not-for-profit corporation MaRS (Medical and Related Sciences) founded in Toronto.

2005–2010

2007 RIM co-CEO, Jim Balsillie gives $50 million to UW, Wilfrid Laurier U and CIGI, as part of an initiative to found the Balsillie School of International Affairs.

2005 Apple introduces the iPhone. The revolutionary product generates substantial media attention. Numerous media outlets call it the "BlackBerry killer".

In the United States, BlackBerry hit its peak in September 2010, with almost 22 million users (37%) of the American smartphone market.

2010–2015

2013 Communitech partners with "Google for Entrepreneurs".

2015–2019

2016 Under the GO Regional Express Rail initiative, Metrolinx transformed the GO rail network to include the Kitchener GO corridor. This provides faster and more frequent GO train service across the region. Weekly trips across the entire GO rail network are expected to grow from about 1,500 to nearly 6,000 over the next ten years.

Only 1.59 million (0.8%) of the 198.9 million smartphone users in the United States used the BlackBerry platform. In contrast, 87.32 million (43.9%) were on iPhones.

Toronto-Waterloo Corridor helped Ontario improve from 14th to 8th in attraction of venture capital, while capturing more foreign capital investment than any other North American jurisdiction.

Waterloop, a student design team at the University of the Waterloo, unveiled to the public the new prototype they designed and built for the upcoming SpaceX Hyperloop competition.

Initiator: Ira George Needles

In 1956, Ira George Needles gave a speech that offered a different approach to education, proposing classroom studies in conjunction with industry training. With a professional background working for B.F. Goodrich, as well as serving as the chancellor for the University of Waterloo, Needles recognized the value of traditional university education combined with non-traditional industry experience. This became the foundation for the unique cooperative education program offered at the University of Waterloo, operating the largest post-secondary co-operative education program in the world.

DAILY REC

ennonites Now Free
To Come Into Canad

-in-Council passed by Union Government
orbidding Mennonite Immigration Into This
ountry Has Been Annulled By King Govern-
ent As Result of Steps Taken By W. D. Euler
P.

S INJUSTICE TO DESIRABLE PEOPLE

(Exclusive to Record)

AWA, June 9.—The order-in-council promulgated by the Un-
ernment during the war restricting all Mennonite immigration
ada has just been annulled by the Liberal government as a
the efforts of W. D. Euler M. P., according to information re-
y Record's press gallery representative at Ottawa. The Men-
te now as free to enter Canada as the adherents of any other
This announcement will be received with considerable pleasure
housands of Mennonites in Kitchener, Waterloo and the county

MEMBERS OBJECTED

919 the Union Government passed an order-in-council forbid-
nnonite immigration into Canada. This was done in spite of
rous protests of W. D. Euler, M. P., I. E. Pedlow, M. P., of
enfrew and others. The member for North Waterloo held
regulation was unfair and offensive to many of the people of
county and elsewhere, the sons and daughters of its pioneers
admittedly the most desirable citizens.

REMOVES DISCRIMINATION

on as the King government took office, the member for North
immediately took steps to have this objectionable regulation
As a result the government has annulled the order-in-coun
removes the discrimination against the Mennonite people.
ctionable regulation interfered with visits of American Men-
with their Canadian relatives and friends. This particularly
able feature has been removed in the annulling of the order-

MENNONITES PLEASE

The announcement of
epeal of the order-in-cou
restricting Mennonite immi
tion into Canada will be
ceived with a great deal
pleasure by the Mennonite
ple of North Waterloo, acc
ing to a statement made
the Record today by D. B. B
ner of this city, when infor
by the Record of the annull
of the restrictions. The ne
Mr. Betzner said, will be a n
ter of extreme gratification
the Mennonites of Canada.

TEA AND SUGAR
PRICES ADVA

Two Increases In Sugar Yest
No Hope For Relief Fro
Higher Prices This Year

Cluster Foundations: Mennonite Immigrants

In the early 1800s, the Township of Waterloo was established by Mennonite immigrants from Pennsylvania. In 1869, Waterloo County built the House of Industry and Refuge, a pioneering social welfare facility intended to reduce the number of homeless people through lodging, food, healthcare and other necessities. It was built around the cultural sentiment that pauperism was a moral failure and could be reformed through order and hard work. This relentless philosophy of the Mennonite community influenced the development of Waterloo.

JLabs opens in MaRS as a life sciences incubator representing a range of sectors including therapeutics, medical devices and consumer health solutions for early stage innovation.

Intentional Reactor:
MaRS Discovery District

In 2000, MaRS Discovery District, a not-for-profit corporation, was founded in Toronto with the objective of commercializing publicly funded medical research and other technologies through public-private partnerships. The establishment of MaRS was a response to the rise in technology within research institutions as well as cluster growth in the Waterloo region. This growth created a network of relationships forming a corridor linking talent and knowledge across both industry and the region.

Instigator: Research In Motion Collapse

In 2007, Apple Inc. introduced the iPhone, generating substantial media attention and being declared the "BlackBerry killer". This lead to a decline in Waterloo-based Research In Motion's (RIM) BlackBerry sales as Apple became the new tech powerhouse. Apple's new revolutionary device caused operational losses and financial troubles for the Canadian tech giant. RIM eventually lost more than 95% of its market share by 2008, sparking rumors of collapse as consumers made the shift to Apple.

Citizenship and Immigration Canada

When you are a very small company finding one or two or three people is huge for us."

We Help Companies Achieve Hockey-stick Growth Using Data

Facilitator: Global Skills Visa

The Canadian government's global skills visa program – part of its Global Skills Strategy – was inaugurated on June 12, 2017. The $7.8-million, 24-month pilot program was designed to allow high-growth firms to bring in international talent within two weeks, in stark contrast to the current wait time of up to one year. The program also streamlines the process of issuing visas for family members.

BlackBerry

Mel
In Chicago!
I will give them a call – I don't
see it being an issue at all.

Greg Stark
Thanks again Mel! See y
there.

Mel
Can't wait.

Placemaking:
Research in Motion

In 1984, Research in Motion Limited (RIM) was founded by two engineering students in Waterloo, Ontario. RIM became the first wireless data technology developer in North America, introducing multiple wireless communication innovations throughout the 1990s. With headquarters based out of Waterloo, this put the area on the map as a key leader of enterprise software and services, attracting valuable talent.

The company later invented BlackBerry in 2000, as a revolutionary device that shifted from conventional cellphones to a multi-functional, data-centric smartphone. This was a fundamental change to wireless devices and drew global recognition to the RIM and to consumer markets, placing the Waterloo Region as the centre of Canadian technology innovation.

It was a community that thrived off the collaboration between academia, government and business partnerships, producing greater value with a multiplier expansion effect to create the Tech North ecosystem that flourished due to the density of tech entrepreneur excellence in the surrounding area.

Resiliency: Communitech

In 1997, Communitech was founded by a group of dedicated entrepreneurs as a key resource to leverage and accelerate the Waterloo Region tech community. RIM's collapse paved the way for former RIM employees to begin an incubator and start-up boom in Waterloo and Kitchener, as approximately 450 start-ups opened for business by 2013.

The growth of the Tech North cluster created the appropriate conditions such as access to infrastructure and a strong business climate for entrepreneurs to capitalize on opportunities and realize their ambitions. This allowed entrepreneurs to move past the RIM-era to find success once again with government funding, private capital and angel investments in start-ups in the "Golden Triangle" (Kitchener, Waterloo, Cambridge) of the Waterloo Region. This kept talent in the area and enabled subsequent recruitment of new talent from surrounding academic institutions in the Greater Golden Horseshoe.

Cluster development is organic and complex

This is Just the Beginning

Collaboration and competitiveness will help foster innovation, especially when it happens on a regional scale. The GGH region will gain recognition as a global leader for business and growth if it recognizes and encourages collaboration within and between clusters. With the GGH home to a wide variety of clusters ranging from financial services to food and beverage, there are numerous opportunities to experiment, foster and strengthen relationships.

Through collaboration, there is the possibility to facilitate interactions that can spark natural moments of innovation. Creating partnerships increases opportunities with mutual benefits. Municipal stakeholders require the ability to communicate with one another, as well as the space to interact, which in turn could lead to future opportunities for economic growth and prosperity.

Cluster development is organic and complex. Successful economic development includes collaboration and innovation within and among clusters. There could be multiple iterations before successful collaboration is achieved.

Cluster ingredient analysis is a way to provoke and structure public policy discussions around the future of a regional economic development. It is intended to engage and inform a wide range of constituencies, including industry leaders, public officials, supporting institutions and regional residents. A cluster analysis should be integrated with these public discussions and policymaking processes, tapping the knowledge and insights of actors in the cluster, and focusing research on the greatest strengths of the GGH region.

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