Institute for
COMPETITIVENESS & PROSPERITY

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34

THE CANADIAN CLUSTER HANDBOOK

Institute for
Competitiveness & Prosperity

The Institute for Competitiveness & Prosperity is an independent not-for-profit organization that deepens public understanding of macro and microeconomic factors behind Ontario's economic progress. Research by the Institute is intended to raise public awareness and stimulate debate on a range of issues related to competitiveness and prosperity. It is the aspiration of the Institute to have a significant influence in increasing Ontario and Canada's competitiveness, productivity, and capacity for innovation. We believe this will help ensure continued success in creating good jobs, increasing prosperity, and building a higher quality of life. We seek breakthrough findings from our research and propose significant innovations in public policy to stimulate businesses, governments, and educational institutions to take action.

The Institute is advised by Ontario's Panel for Economic Growth & Prosperity, led by Tiff Macklem.

Comments on this report are welcome and should be directed to the Institute for Competitiveness & Prosperity. The views expressed in this report are the views of the Institute.

The Institute for Competitiveness & Prosperity
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THE CANADIAN CLUSTER HANDBOOK

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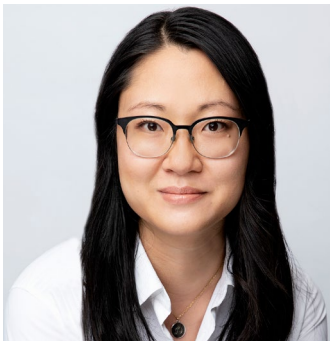
A guiding light on the road of cluster development

Jamison Steeve
Executive Director, Institute for Competitiveness & Prosperity



Dorinda So
Research Director, Institute for Competitiveness & Prosperity

WE ARE PLEASED TO PRESENT WORKING PAPER 34, *The Canadian Cluster Handbook*, of the Institute for Competitiveness & Prosperity. The Institute has presented the economic case for clusters and the positive impact of clusters on Ontario's prosperity since 2001. When Tiff Macklem, Dean of the Rotman School of Management became, in 2015, the Chair of the Institute's advisory body, Ontario's Panel on Economic Growth and Prosperity, he re-invigorated our prior research on clusters.

Canada is now globally recognized for its extraordinary $950 million investment in five superclusters, which comprise a series of related clusters and industries. Since the announcement of the Innovation Superclusters Initiative in 2017, there has been a buzz about clusters in this country and beyond.

The reality is that in Canada, along with many other countries, the practice of cluster development is still relatively new, and mostly unknown. Since releasing *Clusters in Ontario: Creating an Ecosystem for Prosperity* in 2016, we have talked to many Canadians who do not know what a cluster is, much less why clusters are important. We have convened groups of economic, business, and government leaders annually to discuss these very issues, and in 2018 we even hosted the 21st TCI Network Global Conference (TCI 2018) to drive home the message that Canada needs organized and growing clusters. Increasingly, we have met individuals who understand this. They recognize there are certain organizations that can become cluster organizations, and there is a desire to work together.

Developing a cluster is about collaboration. The person in charge of connecting actors and fostering collaboration is the cluster manager, who serves the rest of the cluster directly. Within a cluster, firms should compete as fiercely as possible, while also finding common ground and reasons to collaborate (also known as 'coopetition'). This can be in digital security for a financial services cluster, or developing a platform technology that would make the entire cluster more competitive. Collaboration is not only necessary for cluster initiatives that warrant pooling of resources, it also enables new ways of working with different cluster actors, and across clusters, and it decreases the risk of working with competitors.

Hosting TCI 2018 introduced us to amazing cluster managers and practitioners and taught us that there are many countries that are managing their clusters well and seeing growth from their successful collaboration. Canada needs to be one of these countries, not only because of the incredible investment in the superclusters, but because our small country (population-wise) simply cannot thrive without them.

Clusters do not solve all the business challenges we face as a nation. They require long-term investments in funding to see large scale, positive economic results. Increased levels of innovation and R&D, exports, and new jobs are some of the few benefits that can come from cluster development if so desired by cluster members, but built on the foundation of collaboration and trust between actors. These help the continued growth of our firms.

Throughout the planning of TCI 2018, we learned a lot about cluster development and policy, and it therefore seemed fitting to share these insights. This Working Paper covers the areas that we believe are important to clusters in Canada. Instead of a traditional working paper with analyses and recommendations, we are offering up best practices and ways of doing from the natural occurrence of clusters to their exponential growth. As modern cluster theory and cluster practice are still evolving, we hope that this Working Paper serves as a handbook to those who are already part of or are now entering what appear to be the murky waters of cluster development. We found ourselves equally perplexed at the beginning of our journey to understanding, but now see with clarity that we already have all of the tools and resources to grow clusters. We just need to set our minds to the task, and take steps toward true collaboration.

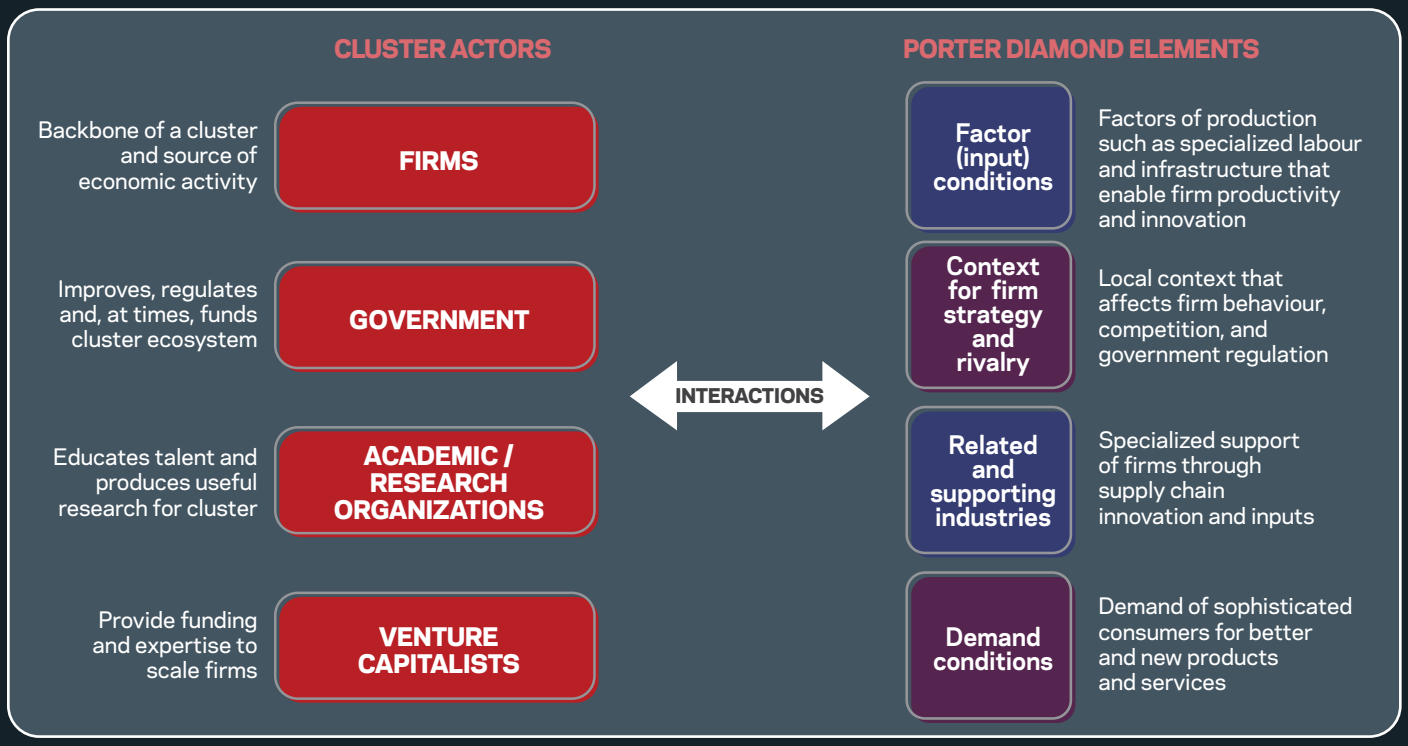
We want to thank the many experts we consulted throughout the writing of this Working Paper, including Merete Daniel Nielsen, Madeline Smith, James Wilson, John Hobbs, Vincent Dugré, the Supercluster executives, and the many who talked to us before, during, and after TCI 2018. We look forward to your comments.

Canada needs to be one of these countries, not only because of the incredible investment in the superclusters, but because our small country … simply cannot thrive without strong clusters.

GROWING CLUSTERS FROM THE GROUND UP

A **cluster** consists of geographically proximate groups of interconnected companies, suppliers, service providers, and associated institutions.

WITHIN A CLUSTER ECOSYSTEM



CLUSTERS CANNOT BE CREATED

They emerge from pre-existing conditions

- Co-location of actors
- Existing industrial strengths
- Specialized knowledge of talent and suppliers

CLUSTERS ACTORS CAN COLLABORATE BETTER WHEN THEY FORMALLY ORGANIZE

- Hire a **cluster manager** who can help connect members
- Cluster managers work in a **cluster organization** made up of cluster members
- They work together on **cluster initiatives**

FOSTERING CLUSTER GROWTH

Cluster evaluation
Determine areas of improvement

Cluster labelling

Strategy
Scale clusters by developing winning strategies

Cluster mapping
Determine networks and linkages

RECOMMENDATIONS FOR CLUSTER ACTORS

FIRMS

- Take the lead on cluster initiatives
- Collaborating always outweighs working alone
- Being inclusive and embracing diversity in talent is a good long-term strategy

GOVERNMENT

FEDERAL GOVERNMENT

- Separate cluster policy from innovation policy
- Collect granular data for effective analysis and improvement
- Train cluster managers and benchmark cluster organizations
- Create body dedicated to support cluster development in Canada
- Keep track of the clusters that submitted ISI proposals

PROVINCIAL GOVERNMENT

- Invest in talent through education and retraining
- Integrate rural regions with urban centres
- Integrate policies with federal and municipal/regional ambitions
- Remove trade barriers and regulations

ACADEMIC / RESEARCH ORGANIZATIONS

- Take the lead in supplying cluster talent
- Establish stronger ties between academia and cluster organizations

CLUSTER FOUNDATIONS

Much has changed in Canadian cluster policy since the Institute's previous working paper on clusters in 2016. While the Ontario government no longer has a specific cluster policy, in 2017 the federal government introduced a bold initiative: a competition to select up to five superclusters. This foray into clusters is certainly not new for the federal government, nor is it new for many countries as successful clusters can lead to increased competitiveness and economic prosperity.

SINCE 2001, the Institute has written about Ontario's prosperity gap as compared to peer jurisdictions. Primarily a result of lagging productivity, the Institute has highlighted a number of causes for this gap, including lack of innovation and commercialization, concentrated trading partners, and low technology adoption. Given the country's small population relative to its size, Canadian firms need to collaborate locally and globally to become more productive and profitable. When firms work together, they share resources, which saves money and decreases risk in new ventures; this efficiency can help them innovate to export goods and services where sophisticated customers demand higher quality goods. In order to compete internationally, firms must innovate further to meet the needs of their customers.

Collaboration often occurs within clusters, as they act as networks connecting firms, government, venture capitalists, academe, and other actors. As such, collaboration helps clusters innovate, export, and be more productive overall. The Institute uses Harvard Business School Professor Michael E. Porter's definition of a ***cluster***: a geographic concentration of interconnected companies and institutions in a particular field.[1] Clusters involve an extensive web of complementary linkages between companies and related actors, such as universities and colleges, research organizations, and sources of financing, and can be found in geographic areas as constrained as Toronto's Discovery or Financial Districts or as sprawling as California's Silicon Valley.

Porter is considered the godfather of modern cluster theory; while clusters themselves are not a new concept, the study and practice of them are. With the dissemination of Porter's work on clusters since the 1980s, the practice of cluster development, such as cluster formalization, best practices, and bodies of work, has emerged.

In 2002, the Institute's first working paper introduced the theory of clusters in the Ontario context.[2] Since then, the Institute has argued that the lack of collaboration via clusters is one reason for the province's prosperity gap. More recently, the Institute refreshed its cluster research in 2016 with the release of *Clusters in Ontario: Creating an Ecosystem for Prosperity*, a working paper that examined clusters primarily from a theoretical perspective.

This Working Paper builds upon the theoretical understanding developed by *Clusters in Ontario* to explore the practice and development of clusters throughout Canada. While planning the 21st TCI Network Global Conference (TCI 2018) held in October 2018 in Toronto, the Institute learned a lot about cluster practice and development. The TCI Network, co-founded by Professor Porter, is the leading global network on clusters, and hosting the global conference in Toronto brought nearly 340 individuals from 37 countries together to share best practices and find ways to collaborate. This Working Paper applies leading global cluster theory and practice to the Canadian context, from cluster development to acceleration. It also examines some misconceptions about clusters and ways that Canada can leverage its existing industrial strengths to foster the development of strong clusters.

What is a cluster ecosystem?

Clusters are characterized by their industrial specialization and an above average concentration of employees within that industry: for example, Modena, Italy's sports car cluster or chocolate in Switzerland. Another hallmark of clusters is that due to their overlapping industries and geographic proximity, there are significant knowledge spillovers between firms and institutions. These can occur formally at seminars organized by a cluster manager, or casually when two professionals meet by chance at a café. These spontaneous connections, catalyzed by overlapping industries and proximity, characterize a cluster.

There are two types of clusters: ***local clusters*** are found everywhere, while ***traded clusters*** are found only in specific regions with factors conducive to the trade of goods and services across jurisdictional boundaries, such as between provinces. Local clusters primarily serve the local market, such as retailing centres or utility companies. Traded clusters have an international client base, and include well-known exporting industries such as aerospace and automotive production. Traded clusters also include non-exporting firms such as educational institutions and hospitality/tourism, whose revenue is generated by foreigners paying for goods and services within Canada. Since traded clusters are able to access a larger customer base by exporting, they are, on average, more innovative and profitable than local clusters.

The Porter Diamond as a cluster model

Through collaboration, clusters increase productivity, innovation, and economic growth. To illustrate the mechanism by which this occurs, Porter developed what is now referred to as the ***Porter Diamond*** (Exhibit 1).[3] The four pillars of the diamond are: factor (input) conditions; demand conditions; related and supporting industries; and context for firm strategy, structure, and rivalry. Each part of the diamond interacts with the cluster actors (government, firms, academia, and venture capitalists) to form a complete cluster model. These interactions are often facilitated by a ***cluster organization***, which serves the cluster by bringing the various actors together to work on ***cluster initiatives*** that will ideally benefit everyone involved. ***Cluster managers*** are at the heart of cluster organizations, and help drive the interactions and collaboration necessary to move the cluster forward.

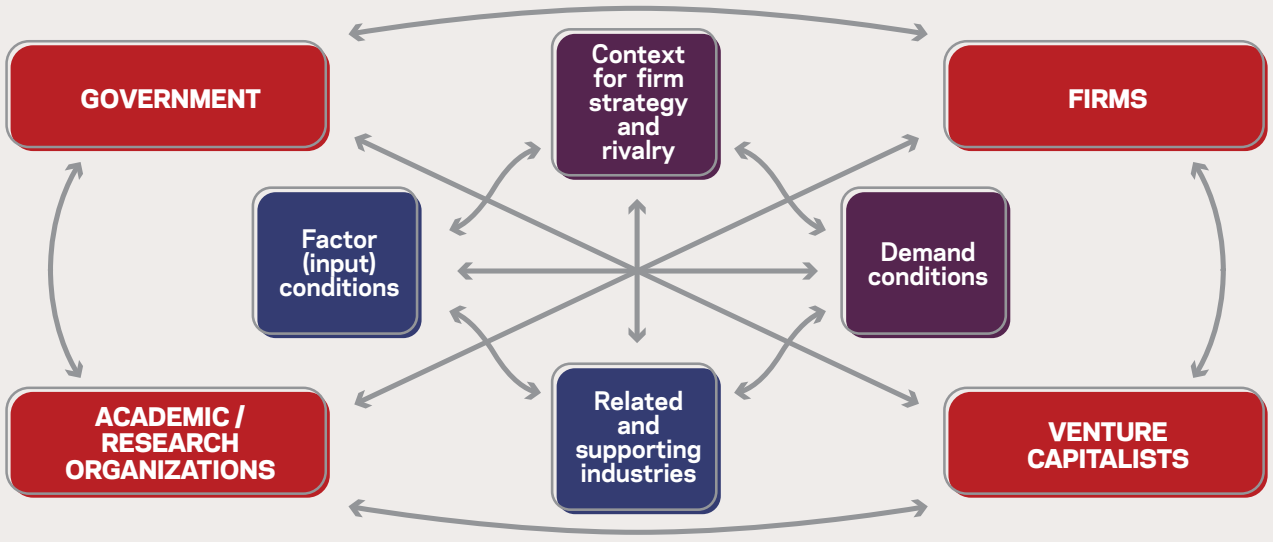
Factor conditions encapsulate inputs that make a cluster competitive. Factors may include aspects of human resources such as labour costs or qualifications, or knowledge resources and infrastructure. Climatic situation, proximity to major markets, stock market liquidity, and access to natural resources also fall under factor conditions. Essentially, these conditions are the endowments that regions possess that make the products and services they produce competitive in international markets. Note that these factors are not static and can change, for example when political and social climates shift.

Home demand conditions depict domestic demand for firms' goods and services. Places with customers who have more sophisticated needs tend to coexist with domestic firms that are able to cater to them. Firms can develop a comparative advantage if they are able to respond to consumer demands before foreign competition. Once an advantage is established in a particular market segment, companies can then address the demands of foreign consumers.

Related and supporting industries determine how competitive firms can be. Access to domestic suppliers, efficient supply chains, and proximity of related industries are bolstered by clusters, and increase firms' competitiveness in international markets. Strong supporting industries also encourage innovation through the emergence of related industries that may act as inputs in the value chain.

Context for firm strategy, structure, and rivalry guide unique behaviour. Strategy reflects a firm's response to local culture and business environments. Family-owned businesses behave differently than large, publicly-owned corporations. Companies located in jurisdictions with risk-averse populations make different strategic choices than those in regions known for their entrepreneurial spirit. The differing business dynamics of each market inform the strategies adopted by foreign actors in order to succeed in a jurisdiction.

EXHIBIT 1 A cluster ecosystem fosters interactions between elements and actors



Source: Institute for Competitiveness & Prosperity analysis based on research of Professor Michael E. Porter.

The roles and responsibilities of various actors

In addition to the Porter Diamond elements, there are four key types of cluster actors, though they may vary depending on the cluster and/or region. Within any dynamic cluster, there are interactions between all actors. Often these interactions lead to informal knowledge sharing and the learning of tacit knowledge and can also result in new partnerships and opportunities to achieve mutual benefit.

Each actor is unique within the cluster ecosystem, and has a specific role. Understanding and executing that role will drive cluster success.

Businesses are the backbone of clusters and the main source of economic activity. Cluster initiatives should always adopt a bottom-up approach, rather than top-down. That is, they should grow naturally over time by leveraging local talent and resources, and the initiatives they jointly engage in should be identified by the firms that make up a cluster. Often, firms make up the majority of cluster memberships and reap the greatest rewards through increased collaboration, innovation, and access to new markets. Government support dictates to what extent firms will participate in a cluster, and regulations set the boundaries to which they operate. Therefore, despite being the pillar of a cluster, firms are best thought of as a keystone – holding the entire structure in place while also being supported by the members around it.

Government plays a crucial yet delicate role, especially in Canada where many clusters are still nascent. Oftentimes, government is the first (and largest) source of funding for new cluster initiatives, particularly in Canada and European countries with cluster policies. Founding a new cluster organization to lead initiatives requires startup capital until the cluster becomes self-sufficient through its members. However, in funding cluster organizations with public money, there are cases where government can overdirect the work of the cluster organization; this is an issue federal and provincial governments must be cognizant of as cluster policies begin maturing in Canada. Under an overbearing government, the private sector may not have the freedom to maximize their profits, which can be detrimental to the overall health of the cluster. Instead, government should focus on what it does best: creating the factor conditions for success, such as introducing or modifying policies and regulations that help firms, and funding research and academic institutions that encourage innovation and generate a talent pool from which to draw.[4] Therefore, government must balance its responsibility to taxpayers with the understanding that clusters should be an industry-led initiative and that ultimately, firms lead the cluster.

Higher educational institutions keep clusters at the forefront of their industries. Colleges and universities are responsible for educating and training the workforce that will eventually join a firm, or another actor within a cluster. They provide the labour firms require to run successful businesses – an issue many specialized companies are grappling with today. The research conducted by universities, research organizations, and think tanks will enable firms to increase their own R&D (difficult for small companies) to stay competitive. Strong linkages between cluster organizations, firms, and educational institutions can create unique educational programs to serve a cluster. For example, Querétaro, Mexico established Mexico's first aeronautical university in 2007 to provide skilled labour for the state's nascent aerospace cluster, and to compete on an international scale.[5] A similar strategy was employed in Aerospace Valley in Toulouse, France, and Odense Robotics in Odense, Denmark, as well as the technology corridor between Toronto and Waterloo. Clusters are also reliant on educational institutions to spur research and development (R&D).

Venture capitalists help fund firms. The final actor is the venture capitalist who can help fund firm growth and exporting initiatives and bring in investment from elsewhere. Capital helps firms grow, which in turn grows the cluster. Investors also bring a wealth of experience and networking connections to growing firms, increasing the likelihood of successful scaling.

The Canadian cluster landscape

Cluster policy in Canada is not new. In 2000, the National Research Council, a federal government agency focused on innovation, science, and technology research worked with universities, industry, and other governmental organizations to encourage the growth of technology clusters across Canada. Eleven technology clusters were identified including health from (health and wellness plants in Saskatoon to biomedical technologies in Winnipeg), and energy (fuel cells and hydrogen technology in Vancouver, and ocean technologies in St. John's).[6] The funding cycle ended in 2008 and overall the project yielded positive results.[7]

Since then, cluster policy has ebbed and flowed based on the priorities of the federal, provincial, and local governments. With government, policy often oscillates from private sector tax incentives to cluster specific policies such as the Innovation Superclusters Initiative (ISI).

Superclusters

With the 2016 Budget, the federal government began shifting its industrial policy toward clusters, promising a Canadian cluster map (now available) and additional investments in clusters.[8] In Budget 2017, the federal government announced the ISI, a grand challenge-style competition that allowed any professed cluster to connect with other like-clusters and come together to develop a network of clusters (also known as a supercluster).[9] In the first round, 50 proposals were submitted and in October 2017 nine were shortlisted and invited to submit a final application.[10] In February 2018, Innovation, Science and Economic Development Canada announced five successful superclusters across the country based on existing regional strengths: Canada's Ocean Supercluster, SCALE.AI, Next Generation Manufacturing, Protein Industries Canada, and Canada's Digital Technology Supercluster. Each will receive a portion of the $950 million federal investment to catalyze their missions.[11]

Regional Development Agencies

Regional development agencies (RDA) exist at a subnational level and serve as conduits to deliver the goals outlined in the federal government's Innovation and Skills Plan. Each RDA includes a clusters approach, many of which are value-added such as clean tech, life sciences, and advanced manufacturing. In addition, each RDA is cognizant of its region's unique strengths such as: oceans and food in Atlantic Canada, agri-tech in the western provinces, aerospace in Québec, and Advanced Manufacturing in southern Ontario.

Community investments have been ongoing since 2015 and have since achieved or been very close to many of the goals set out at the time. One telling metric among the RDAs is the amount leveraged per invested dollar; in 2016-2017, Atlantic Canada Opportunities Agency (ACOA) has leveraged $1.17, Western Economic Diversification Canada (WD) has $1.20, and FedDev Ontario generated $1.47. In addition, inclusion has been a major focus with efforts to diversify entrepreneurship between females, indigenous, visible minorities, youth, and disabled persons. To realize these goals and more, each RDA plans to spend between $150 and $270 million during 2019-2020.

As an example, one of WD's priorities is cluster development. It has invested in knowledge dissemination and asset mapping to complement the work of Protein Industries Canada (PIC) as well as other more regional clusters. Today, WD is well on their way to creating jobs and export growth across Canada's western provinces.

Local clusters

It is important to note that clusters traditionally operate at a local scale, with the size of local varying depending on the country. Canada's large geographical expanse and lack of density relative to European and Asian countries makes it difficult to spur tightknit clusters. Instead, in Canada, the scale of clusters is typically regional: for example, encompassing not just the City of Toronto or Vancouver, but also its neighbouring municipalities. For a country like Canada, this scale makes sense. Anything larger than a regional scale, such as on a provincial or even national scale, can limit the physical agglomeration of actors for collaboration and subsequent growth (See ***Scale and locality matter for clusters***).

Québec

A notable exception to the otherwise nascent formal cluster development in Canada is Québec. In the 1980s, the province moved toward an "innovation cluster competitiveness" approach, for the purpose of internal integration. The Québec government identified 13 clusters, from which five received

Scale and locality matter for clusters

If clusters in Canada are primarily at a regional level, and therefore cross jurisdictional boundaries, it stands to reason that more densely populated countries such as Japan should have clusters within much smaller geographic areas. Interestingly, the famous Sakai knife cluster in Osaka, Japan is one-fourth of the size of Toronto, or just larger than Etobicoke. Sakai is a coastal prefecture in Osaka also known as the "City of Knives." Starting in 1543, the Portuguese sailed to Japan looking to trade guns and tobacco. To harvest tobacco for trade, the Japanese required sharp knives, which necessitated the development of a knife cluster. In fact, 600 years later, 98 percent of all professional chefs in Japan use Sakai knives. Today, Sakai knives are so famous that manufacturers receive the Sakai Wazashu certification, confirming their product's superior quality.[A]

strategic heavy investment: aerospace, pharmaceuticals, IT, metal and mineral refinery, and hydroelectric production and transmission.[12] Since then, its clusters have continued to grow. Les Fonds de recherche du Québec – Nature et Technologies (FRQNT) releases its Strategic Clusters competition annually, providing successful clusters with a minimum of $300,000 annually for two to six years.[13] The annual continuity of the competitions provide cluster organizations with a stable income for at least two years, and adequate time required to slowly grow.

Global cluster landscape

Global cluster ecosystems are decades ahead of where they are in Canada partly due to a stronger understanding among government, businesses, and academia of the benefits that clusters can bring to a jurisdiction. This includes higher incomes and employment growth rates, and so there are fewer barriers to their establishment.[14] Other reasons include the density of many cities, which encourages the creation of clusters where there are more opportunities for interaction, and a more collaborative culture. As such, the largest and most well-known clusters today are found in countries with a solid history of cluster policy. Examples include Mexico's automotive clusters, which were formidable enough to force a renegotiation of the North American Free Trade Agreement, and Tuttlingen, Germany's MedTech cluster, which holds 55 percent share of the world's surgical instrument market with a population of just 35,000.[15]

Globally, clusters are at various stages of development. Region-specific histories play a strong role in shaping what and how clusters form. For instance, clusters have formed in African nations rich with resources, and have developed industries around energy production and resource refinement; Asian nations have strong textile and other goods-producing clusters, and Latin American countries have many strong initiatives in clusters, ranging from agricultural to heavy machinery production.

Many of these clusters are part of TCI Network, giving members access to an international network of like-minded professionals. International collaboration is facilitated through these connections, as well as through other intergovernmental agencies such as the European Cluster Collaboration Platform, the Japan External Trade Organisation (JETRO), India's Cluster Observatory, ProMexico in Mexico, and the Russian Cluster Observatory, to name a few. Oftentimes, clusters under the umbrella of these national cluster agencies will sign Memoranda of Understanding (MoU) with other foreign cluster agencies to spur the internationalization of their domestic clusters.

Clusters in the European Union

The European Union (EU) has one of the most advanced cluster support networks in the world. Many clusters began forming decades ago with the technological changes of the 20th century, and some even hundreds of years before that. A complete ecosystem exists for clusters at virtually every level. A cluster's journey typically begins locally as, for instance, the result of a successful cluster organization competition to secure funding. As clusters grow in their local markets and begin looking outward to other markets, the European Commission (EC) plays a large part in their development through several programs conveniently offered by the EU Cluster Portal. The three main cluster support networks are:

- **The European Cluster Observatory** which offers statistical analyses and profiling for all European clusters, and provides networking opportunities between organizations, as they are able to see with whom they might partner. The Observatory also informs cluster policy at the local, regional, and national levels.

- **European Cluster Excellence Initiative (ECEI)** encompasses two organizations: the European Secretariat for Cluster Analysis and the European Foundation for Cluster Excellence. The former benchmarks clusters with a bronze, silver, or gold label to create a common measure by which other clusters can gauge the strength of another cluster organization, as well as provide feedback for improvement. The latter provides training, particularly of cluster managers.

- Cluster internationalization promotes cluster growth across Europe and abroad. The goal of this initiative is to create strategic cluster partnerships across different business sectors. To facilitate this project, the **European Cluster Collaboration Platform (ECCP)** hosts over 900 cluster organizations with the specific goal of internationalization through matchmaking events and partnerships.

As Canada continues to invest in and develop an understanding of clusters, it joins many global countries in fostering collaboration and networks through their clusters so that they can reap the benefits of collaboration including economic growth and prosperity. For clusters to develop and grow, they will need the support and competitive tensions within their respective cluster ecosystems.

CLUSTER DEVELOPMENT

Clusters do not occur randomly, nor can they be created from nothing. They draw from a local region's specialties, which can range from natural resources to specialized knowledge. Sometimes, clusters emerge as a byproduct of other goals, but they can also be developed out of necessity. Clusters take time to form, formalize, and begin working together. It can take decades to actualize powerful results because a cluster ecosystem, as illustrated in the Porter Diamond, takes time. Patience, the right ingredients, and the will to work together are the seeds needed to grow a strong cluster.

The essence of cluster development

DUE TO THEIR POTENTIAL to create jobs, boost local economies, and solve social issues, the allure of clusters may also make them a magnet for poor policy decisions. It is important for government decision-makers to understand what clusters are, as well as what they can and cannot do, in order to guide sound cluster policy. What successful regional clusters share is the fact that they have leveraged their own local advantages over time. While clusters may share industrial linkages and other similarities, no two clusters are identical, in the same way that no two regions' policies, environments, histories, demographics, or economies are the same. It is for this reason that attempts to copy successful clusters seldom work.

Capitalizing on local advantages

Clusters thrive when the actors of the Porter Diamond use their local resources and circumstances to their advantage. Consider, for instance, Lapland's circular economy cluster in Finland. The remote Finnish region, known for its mining and industrial refining activities, realized the potential of sustainably using its natural resources. Firms benefit by accessing funding to invest in processes that turn waste into new products.[16] The uniqueness of Lapland's Arctic climate coupled with current players' experience in operating with sustainable technologies set the foundation for the development of the circular economy cluster.

Closer to home, Bluewater Wood Alliance is another example of an organization supporting local expertise. Southwestern Ontario has the highest density of wood processing activities in Canada, with 22,500 employees working for 1,400 companies in a relatively small region.[17] This provides wood processing with the right foundations for developing into a cluster. The initiative began when a few firms realized they had growth potential: after attending a cluster academy in Austria, seven founding companies established Bluewater Wood Alliance in 2011 to leverage southwestern Ontario's value-adding wood processing advantage.

Creating clusters from scratch will likely fail

These two examples demonstrate how robust clusters can develop when cluster organizations realize the comparative and absolute advantages their regions have in various economic sectors. Each are specialized in their respective industries compared to adjacent regions, as well as to their countries as a whole (e.g., Arctic mining in Lapland and wood-processing in southwestern Ontario). Due to specialization, skilled and talented workforces have emerged over decades of industrial development within these clusters.

Creating the conditions needed for a cluster foundation was therefore only a matter of setting up an organization to steer the process. Moreover, the uniqueness of these clusters to their local regions makes imitation difficult for foreign competition.

When some of these ingredients are missing, a cluster's story seldom has a happy ending. This was the case for Malaysia's BioValley. When first announced in 2001, there were high hopes that it would help revolutionize the economy. Estimates projected the biotechnology cluster would create 50 new firms, and 32,000 jobs within 10 years.[18] This was not unreasonable at the time, given that Singapore, which shares a similar culture, history, environment, and demographics as Malaysia, was embarking on a comparable path. The key difference was Malaysia's shortfall in skilled employees to work in a multi-billion dollar cluster. The peninsular nation's "Malay first" policies contrasted sharply with Singapore's open-arms approach of inviting skilled labour into the country (many of whom were ethnic minorities disadvantaged by Malaysia's policies).[19] Due to a lack of highly skilled talent, coupled with no foundation in biotechnology and little private sector presence, BioValley was virtually abandoned after just four years.

The consequences of a failed cluster initiative can be severe. First, millions of dollars may be wasted on rushed or misguided efforts. In addition, trust in government is eroded and any future efforts between cluster actors become more challenging. Fortunately, there are indicators that give hints as to the success or failure of a proposed cluster initiative.

The proposed cluster is unknown in that particular region. As was the case with Malaysia's BioValley, developing a cluster without any previous regional specialization will almost certainly fail. An untrained workforce will be under productive, while productive workers remain in more established clusters where incomes are presumably higher. On the flip side, firms find little incentive to relocate to a "new cluster" where there is a lack of skilled labour and weak supply chains.

The proposed cluster is very vague, or an unoriginal copy of another well-known cluster. The success of a cluster does not correlate to its "flashiness." Some major international clusters are known for manufacturing socks, grass seeds, or toothbrushes. In general, if a cluster professes that broad sectors are part of a cluster, it is fair to be skeptical. Typical culprits are biotechnology or advanced manufacturing clusters. Cluster initiatives are better to fall into one of Professor Porter's 67 clusters than be so broad as to encompass multiple clusters. Equally of concern is verbatim copying of another international cluster. Silicon Valley is often the target, with many regions and

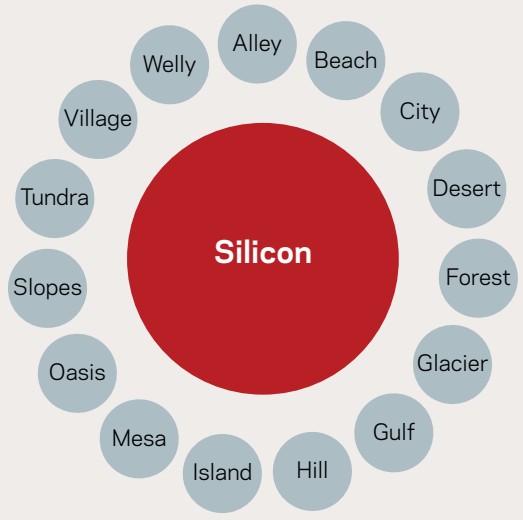
countries attempting to create their own "Silicon Something." None to date, have achieved the level of success as the original Valley (Exhibit 2).

The proposed region is geographically vast. While there are no hard or fast rules as to cluster size, the general principle is that they be tight enough to encourage/give rise to happenstance spillover effects. In the case of Bay Street in Toronto, this might mean chance encounters between financial services executives in the PATH (an underground pedestrian walkway that connects most of Toronto's Financial Services cluster.) Similarly, Silicon Valley's unofficial distance rule is that start-ups seeking venture capital must be within a 20-minute drive from an investor's office.[20] Distance also invariably affects how firms co-operate with one another, as supply-chains dilute when employees are willing to commute over greater distances. Some proposals for Canada's supercluster initiative included clusters whose proposed geographic breadth spanned several provinces, or even coast to coast. These were rightly rejected, as they were better suited to industry projects than a cluster.

Cluster policy as economic development

Clusters can be a tool to spur economic development. It is also true that economic development can accelerate cluster formation.[21] Urbanization always follows economic development, and benefits often accrue in cities as they have a larger pool of skilled employees, and greater specialization in goods and services.[22] Successful regions exploit their advantages to become wealthier and, over time, increased specialization leads to the agglomeration of the actors necessary to build a cluster. This occurred in several places as Canada developed: oil and gas in Alberta, mining in the Canadian Shield, automotive manufacturing in southwestern Ontario, and artificial intelligence in Québec. The objective now is to leverage these specializations into further development for their respective regions.

EXHIBIT 2 Silicon Valley replicas around the world



Source: Institute for Competitiveness & Prosperity analysis based on data from Ifor Ffocws-Williams, *Cluster Development Handbook (2nd Ed.)*. Cluster Navigators Ltd., 2016.

Cluster-based strategies in rural and disenfranchised areas

Cluster-based economic development differs from broader economic strategies by having a more comprehensive approach to solutions.[23] By their nature, the government's goal of cluster development should be to strengthen a region's economy, and help build up a talented workforce. Interventions can take two forms: supply side or demand side. Building supply includes any interventions which increase the ability of a cluster to supply the goods or services it produces, such as training programs, firm relocation incentives, or incubators and accelerators. Demand-side interventions are initiatives which increase demand for a cluster's products, such as procurement, marketing programs, or regulations.[24]

Disenfranchised regions, including rural areas and inner cities, grapple with many of the problems clusters have been known to remediate. Professors Michael Porter and Mercedes Delgado are strong supporters of applying cluster strategies as part of economic development. Consider, for instance, the carpet industry located within a 105 km radius of Dalton, Georgia. This cluster employs over 30,000 people, or about one-third of the population in Whitfield County, and produces 90 percent of the world's functional carpets.[25] Supporting this cluster will have widespread economic impact on the county because clusters yield higher wages due to greater levels of innovation —even in rural areas.

More broadly, workers in firms that are part of rural clusters were found to have wages 13 percent higher than those in non-cluster firms, due to cluster effects, information flow, and higher skill accumulation.[26] However, it is important to remember that no two regions are alike, and cluster interventions must be tailored to a locale's socioeconomic situation. In addition, a cluster alone cannot improve a rural area's long-term situation as single-industry economies are vulnerable to economic shocks. Having a few strong clusters is sufficient to stay resilient during economic downturns. Professors Porter, Delgado, and Stern found that sectors in strong clusters (with respect to innovation and employment) did not see job losses as severe as in other weaker clusters during the Great Recession.[27] That is, it is better for regions to have a few strong clusters rather than many weak ones.

The following are guidelines for long-term cluster policies in rural areas:

Develop connections to population centres. This can be achieved through several different means. Industries on the periphery can be brought into cities for networking events and collaboration opportunities. Another option is to increase investments (or incentives to invest) in rural areas to create new markets and linkages. Third, improvements to telecommunications infrastructure would create more robust manufacturing networks, allowing firms to better integrate themselves into the wider market.

Upgrade the business environment by investing in rural citizens. Returning to the central tenet that it is the people who make a cluster, developing strong rural leadership can translate into strong rural clusters. The Institute found that much of Ontario's social mobility derives from access to strong educational institutions and large population centres.[28] That advantage is nonexistent in more isolated communities. Developing human capital in more rural areas will support an overall cluster development strategy.

Focus on the unique strengths of each region. The first two points address generic weaknesses found among most, if not all, rural economies. While they will undoubtedly help ameliorate setbacks faced by these regions, they will not give them an advantage over urban areas. Therefore, rural areas must consider the economic opportunities cities do not have, such as the ability to insource services from constrained urban markets, access cheap and plentiful land that can be developed as cottage or retirement villages, and create niche agricultural products and produce that can be supplied to urban markets (See ***Savour Muskoka: A rural specialty food cluster***).[29]

The role and potential of industry associations

Industry associations are more common than cluster organizations in Canada, and span virtually every industry. They are often non-profit organizations that encourage collaboration between member firms, advertise on their behalf, and host knowledge-sharing events. It is important to note that, despite their similarities to cluster organizations, they are different entities. Primarily, an industry association only deals with firms in a specific sector (maritime, manufacturing, etc.) whereas a cluster organization can have members across an array of industries. An industry association can be part of a cluster organization, but not vice-versa.[30] Furthermore, cluster managers focus more on developing cluster initiatives between members than advocacy. By including government as part of a cluster initiative, they can already effect policy change.

Industry associations can amalgamate into a cluster through a bottom-up (business-led approach) or top-down (government-led.) New Zealand experimented with the latter approach in the 1990s to encourage several industry associations to cooperate with one another as a unified cluster organization. New Zealand Trade and Enterprise (NZTE), a government organization that promotes exports, provided the funds to create a national cluster facilitator to bring together the necessary actors until they became financially self-sufficient. Since NZTE brought the various industry associations together to co-operate, many local governments have since adopted cluster policies to encourage regional growth.[31]

History shows that forcing the creation of clusters where none previously exist will lead to failure. Clusters must capitalize upon local advantages, in conjunction with every actor of the Porter Diamond. Clusters cannot be developed in isolation, or by one actor alone. Each actor needs to know the role they play, and then act accordingly to bring everyone together.

Savour Muskoka: A rural specialty food cluster

The District Municipality of Muskoka is a rural area in central Ontario that has built a strong reputation for itself as a place of culinary excellence. Savour Muskoka, the cluster organization that oversees the region's food cluster, used a bottom-up approach mainly led and initiated by private firms. Despite lacking agricultural farmland and being somewhat geographically isolated in relation to the rest of Ontario, Savour Muskoka has leveraged its assets to develop a specialty food cluster. The area has a strong tourism industry, because of its picturesque landscapes, complete with resorts, theatres, tours, festivals, and other leisure activities. By capitalizing on the quaintness of this area, Savour Muskoka has used its assets to create a strong, recognizable brand, in the form of a food cluster with 143 members including chefs, famers, artisans, and restaurants.[B]

CHAPTER 3

CLUSTER ORGANIZATION AND MANAGEMENT

There comes a point when firms realize that they have the supply chains and resources needed to formalize a cluster. Clusters are powerful networks that can enable clear communication, and when there is a need and a desire to grow, actors can form cluster organizations and hire a cluster manager to oversee operations. As cluster organizations work with their members on cluster initiatives, they can develop strategies based on their specializations.

EVERY CLUSTER IS UNIQUE. Even when there are two of the same clusters in a country, they vary in the factor conditions, firms involved, and specializations. How they are formed also varies. The top-down approach is to use formal public policies to encourage cluster development and growth. Government presence can be significant, at least in the early stages of cluster development. The bottom-up approach, on the other hand, does not tend to have the same level of government support but occurs when firms come together and begin to collaborate. Canada will almost inevitably fit into the former category, especially with the announcement of the ISI, simply due to the nature of the democratic system and the lack of domestic knowledge surrounding cluster development. In addition, business culture in Canada benefits from government support as a type of "government approval" that sends positive signals to other businesses and industries.

Once a cluster develops a critical mass of actors (specialized talent, supply chains, firms, and academic institutions), they may find that they want to organize themselves to formalize their relationships. The formation of a cluster organization will offer support for the cluster and a cluster manager who can help connect actors who will champion the cluster's cause. For smaller clusters where there are a few critical actors, they may simply want to hire a cluster manager to help them liaise between themselves until they need a larger organization.

Organizing clusters from the ground up

Many clusters have organizations directing resources into growth and development. Most organizations are generally small (three or fewer employees) and have a governing board of directors, with members hailing predominantly from the private sector, followed by academia, the public sector, non-profits, and financial institutions. Governing bodies are non-profits with revenue streams coming initially from public funding in the case of new clusters, and eventually from membership fees as they grow and mature.[32] In general, a cluster should seek to be financially self-sufficient within a few years of formalization, so that emphasis can be on growth over survival.

Managing a cluster initiative

At the helm of cluster organizations are cluster managers. Sometimes, they can have titles such as Process Leader or Sector Development Manager and they are the catalyst that brings together the actors of the Porter Diamond. It is important that a cluster manager has extensive business experience with strong interpersonal and communication skills. Their role is to foster the necessary connections to achieve the cluster's goals in either the development or growth stages, as well as secondary goals such as knowledge spillovers. Arguably, their most important duty is to foster mutual trust between the private sector, academia, government, and other bodies, so as to not hinder any economic or social progress.[33]

Cluster managers are familiar with the workings of clusters, having on average between three and five years' work experience with cluster initiatives. The vast majority have at least some experience in the private sector, with only about 15 percent coming from other areas.[34] By the nature of their role, managers are dynamic and energetic individuals, with strong industry ties from previous work experience, and incredible grit and perseverance. These traits help to build the connections needed to pull the actors of a cluster together.

It is important to realize what a cluster is at its core: groups of people working together to benefit the institutions and sectors which they represent. Firms are groups of business owners and skilled employees; academia comprises researchers, professors, and students; and government comprises elected officials and bureaucrats representing the interests of the public. Each individual player is optimizing their own body's benefit against the interests of others and therefore they may compete against one another. A good cluster manager will understand the sentiments of not just these actors, but of key people within the cluster, and work to find the commonalities and areas of mutual concern so as to encourage collaboration all the while encouraging competition, which feeds firms' desire to innovate in order to specialize and stay ahead of competitors.

Contextualizing the Gap Model

No single company has the capacity or incentive to provide specialized industry services as competitors could free-ride off of its efforts. This reality is what is known as the Gap Model. The description of clusters in Chapter 1 was contextualized in an ideal setting: firms co-operate with government and academia to produce highly specialized industries and export goods to the global economy, which in turn boosts local wages and employment rates. The reality is that clusters rarely work that smoothly. Many real world problems fall back to what are known as "gaps," via competing interests between active players in a cluster ecosystem.

Holding firms at the centre of a cluster ecosystem, there are several potential gaps that can arise. These can be a lack of communication or coordination between firms and

government, firms and academia, and firms and capital investors. The private sector can also find difficulty operating alongside other firms in inter-cluster initiatives, as well as a gap between firms and the global market. The final gap, which is perhaps the most commonly faced, is the inherent gap between firms.

The success of a cluster depends on firms' competitiveness. Without the proper catalyst, inertia keeps private companies focused solely on increasing their own profits. It is difficult for small-and-medium-sized enterprises (SMEs) to allocate human and capital resources to work with a firm, and to trust their competitors with sensitive information and intellectual property.

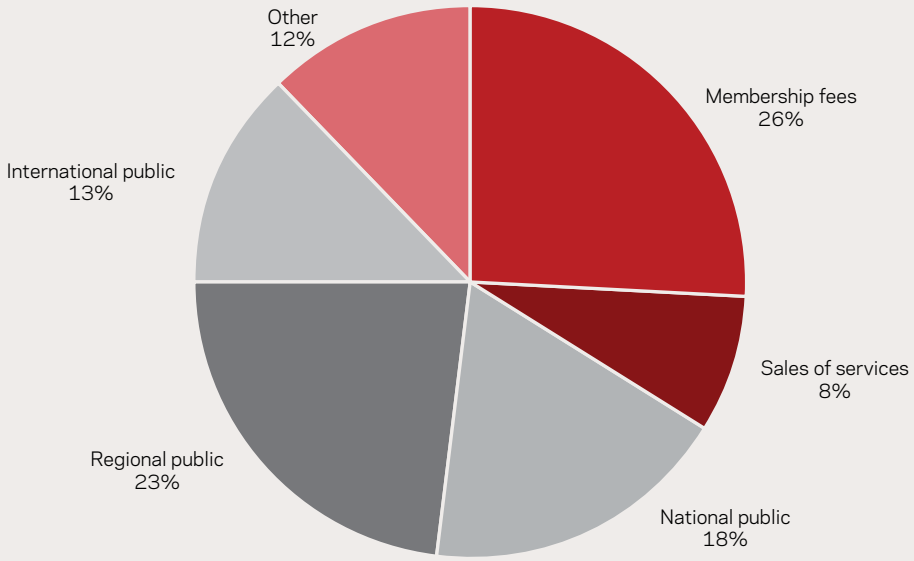
In these gap situations, the experience of the cluster manager is essential in building ties that can strengthen the cluster. In European clusters, the majority of managers are in contact with stakeholders from the private and public sector every day or, at least every week for research/educational institutions and other sectors. These meetings roughly correspond to the importance of building and maintaining relationships between different actors: over 80 percent of managers cited intra-cluster firm collaboration as their first priority, followed by collaboration between firms and academic institutions, and firms and public organizations.[35]

Collaboration and the Triple Helix

Cluster organizations and their managers bring together cluster actors, and most importantly, competing firms and suppliers, to work together to pool resources, reduce duplication, and produce winning initiatives and outcomes that benefit all. Collaboration can produce tacit knowledge, knowledge spillovers between actors and, ultimately, build trust. These elements can be hard to measure objectively, as they are not always easy to develop formally or structurally, but their absence will have resounding impact, adversely affecting the outcomes of collaborative work.

There are also academic models that guide the development of collaboration. For instance, Triple Helix, developed by Professors Henry Etzkowitz and Loet Leydesdorff, describe the collaborative and dynamic relationship between government, firms, and academia within a knowledge-based economy.[36] Cluster initiatives that use a Triple Helix configuration begin with determining the best way to solve a specific issue, and then bring the right actors together to implement the solution. Initiatives are sometimes small, but they are often unique and temporary, such as working to explore foreign direct investment opportunities for the cluster. In this case, firms work with government agencies to connect with international markets, firms, and academia to provide the data and information necessary to determine which countries or firms that would be most ready or suitable for foreign direct investment.

EXHIBIT 3 Revenue sources for European cluster organizations



Note: Reds denote sources of private funding whereas gray tones represent publicly derived funding.
Source: Institute for Competitiveness & Prosperity analysis based on data from Göran Lindqvist, Christian Ketels, Örjan Sölvell, *The Cluster Initiative Greenbook 2.0.*, 2013.

The Triple Helix model guides the development of a cluster initiative by incorporating a variety of perspectives into the design and execution of the initiative, and generates buy-in because individuals are now involved in the cluster initiative. This is important because cluster success cannot be achieved in a vacuum, and requires that all actors do their part to produce the desired result. In practice, Triple Helix can enable knowledge spillovers between the porous boundaries of the three actors.[37] Ultimately, this configuration must place the firm at the centre, rather than academia or government, because firms are the drivers of economic growth in a region. The Triple Helix is particularly potent in the case where cluster initiatives are mutually beneficial for all parties, but where results cannot be achieved on one's own.

Funding, role of members, and cluster initiatives

Countries with well-established cluster policies have robust funding plans in place. The European Union as a whole offers competitions to award funding to clusters seeking expansion into different countries. Requiring cluster actors to work across international borders not only increases collaboration, but helps expand export markets and drive global investments. In general, these competitions are designed to fund the most promising cluster initiatives over a given period (usually five years) until they become financially self-sufficient, and are able to sustain operations through membership fees and other sources of revenue.

Once a cluster organization develops a foothold and weans itself from initial startup funding, there are several revenue streams available to become and remain self-sufficient. Membership fees are the largest income source and on average account for 26 percent of a cluster's revenue (Exhibit 3).[38] This is followed by sales of services (eight percent), federal funding (18 percent), regional funding (23 percent), intergovernmental bodies (13 percent), and other sources (12 percent).

Canadian clusters are already at a disadvantage compared to their European counterparts, since there is currently no governmental body above the Canadian federal government to support cluster formation. Therefore, clusters will either need to rely more heavily on regional and federal public dollars, or increase their share of private revenue through increased sales of services and/or higher membership fees.

It is also important to consider the interplay between incentives and regulations when funding a cluster organization. As shown in *The Final Leg: How Ontario Can Win the Innovation Race*, Sweden consistently ranks high in R&D spending.[39] High levels of research funding can be attributed to policies dating back to 1949, specifically designed to encourage academic output.[40] When it comes to commercialization, however, the nation falls behind the US, even though the former has specific funding in place to encourage academics to conduct research. This is where regulation affects public funding: the US Bayh-Dole Act (1980) gives universities ownership over publicly funded innovations whereas Swedish policies favour individual professors and researchers.[41] Compounding matters, Swedish universities are incentivized to *prevent* faculty from commercializing their research, since they will draw no benefit from it, and will likely lose experienced professors to the private sector. As Ontario and the rest of Canada begin developing cluster policies, it is important to note that regulation often plays a larger role than funding in achieving desired outcomes.

Optimal cluster governance models

The governance model of a cluster is another key component of a manager's position, as it guides the cluster toward its objectives. Governance has a narrower focus than a cluster model, as the former deals with how a cluster organization operates while the latter incorporates the actors of a cluster ecosystem as well as the organization. In studies analyzing the performance of different clusters, collaboration and individual personalities were thought to be the main factors for their success. While those are definitely vital aspects of a cluster organization, much of the success can be attributed to strategic development and the governance model. This is why it is incumbent upon the cluster manager to champion the cluster organization to uphold its values through a governance system that meets its goals. For this, active leadership is needed, so that there is no ambiguity among cluster actors as to who "owns" the cluster, and someone is willing to be accountable for any failures.

A cluster organization will adopt a governance model based on the cluster it represents. The type of cluster model will determine the suitable governance structure, with some flexibility in choosing the most appropriate of six models to reach the cluster organization's goals.[42] There are two types of governance models: innovation networks and cluster networks. Each model has its strengths and weaknesses, so deciding which is the most appropriate for a cluster depends on the existing factor conditions and cluster ecosystem in the region.

Innovation networks

Innovation networks are typically broader than specific clusters, and focus on creating and supporting innovation between cluster actors. Their main functions are to strengthen the

research capabilities of SMEs and bridge the commercialization gap between academia and business. The following are examples of innovation network models:

Innovation networks hosted at a university. All operations are conducted at a university, under the care of an institute. A local steering committee will have representation from academic institutions and the private sector, but usually does not include government. A university-hosted network enables academic and international cooperation, but tends to have fewer business-to-business collaborations than other models.

Innovation networks with other known actors. An organization, can, for example, be established in an innovation network with a knowledge player who can co-finance the organization. This model has equal representation of knowledge and public actors. Knowledge actors also have the chance to use the innovation network for commercial purposes. A draw back is that this model tends to have fewer international partnerships between players than other models.

Innovation networks formed by several clusters. These networks operate across several clusters and are hosted at one of the cluster organizations. Each cluster may be located at different addresses and even have different specializations. Since this model spans multiple clusters, it is excellent for testing potential collaborations and partnerships between actors. The drawback, however, is that there is no specified governance structure, which makes cooperation difficult. Therefore this model should only be used in the presence of an established governance structure.

Cluster networks

Cluster network models generally operate more like a business with a board of directors. They are often specific to a cluster, and enable collaboration between similar clusters across jurisdictions. These networks work well for smaller, regional clusters, as they focus on building the strengths of local clusters.

Cluster interaction model: Nationwide clusters and innovation networks. This cluster-based model focuses on bridging the strengths between local and regional clusters. Board members are largely private sector representatives. In some cases, the cluster manager may also be the network manager. Due to its nature, this model encourages large project portfolios and internationally-focused businesses. Note that these networks tend to grow so quickly that they may lose sight of their original mandate.

Regional cluster models organized as associations. Most board members who form the governance structure of this cluster model are from the private sector, and come with strong regional development strategies. Some networks have smaller local networks or clusters and often co-operate with a nearby university. This model is excellent in focusing on its cluster's specialization (e.g., maritime clusters), but can be equally insular, not allowing other actors to access its services. This issue can be overcome through various internationalization strategies.

Local specialized cluster anchored in an association. Governance structures of these networks vary widely and depend on each particular case. Likewise, actor representation is variable, but usually lacks academic representation. Local networks are excellent at representing a strong community, but may get trapped in a "small" mindset. They are easily caught up in political agendas, and often lack an internationalization strategy, and therefore extra care must be taken to ensure their continued growth.

Determining the best model to use

Cluster Excellence Denmark has a strong history of working with and studying different cluster governance models. For 15 years, Denmark used a national innovation network program to help determine the ideal governance model for different organizations. One method of analyzing the efficacy of the aforementioned models is using data to determine whether an organization is performing as well as it should be. For example, metrics showed that many university-hosted cluster organizations in Denmark are not performing as expected, despite strong research ties and international collaboration.

As things currently stand, innovation networks spanning multiple clusters are the best performers across many metrics, including employment, innovation, and project starts. Since they can operate efficiently and thus grow quickly, networks may become very large in scope, and there is a risk of organizations losing sight of their original mandate, focusing instead on generating revenue.

It is important for cluster organizations to choose a governance model that will allow them to be innovative while also working toward the initial goals at its inception. Maritime clusters, for instance, have a tendency to choose a local governance model, since many are located far from major population centres and knowledge institutions. These networks will grow to a point before plateauing, as they are structured to serve only their local area.

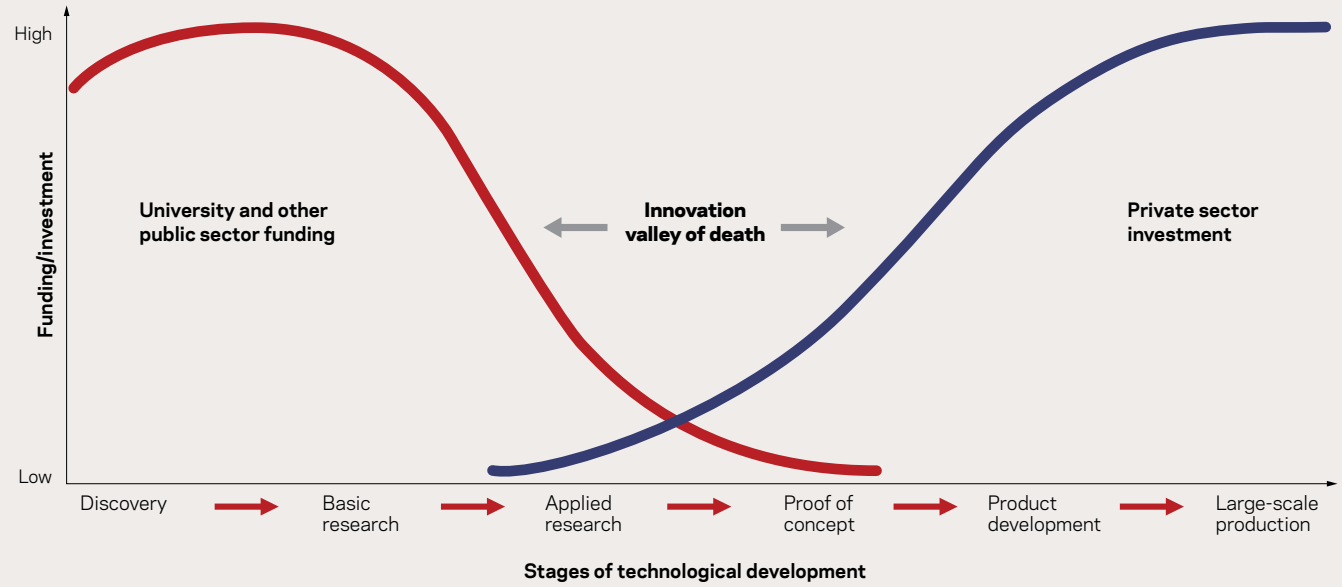
A cluster's governance model is meant to serve as a guide and a means to achieve the goals initially put forth by the cluster. To determine the optimal governance model for a particular cluster, the actors, led by the cluster manager, need to determine the cluster's core tasks and the stakeholders involved. From there, an informed decision can be made to choose an optimal model that can grow the cluster, foster innovation, and achieve its goals.

Role of strategy and smart specialization

In addition to cluster models, good strategies are also determinants of cluster success. Clusters are hotbeds for innovation, which can in turn improve the competitiveness of a region. The Institute defines innovation as "the creation of value-added products, services, and processes that improve economic, health, or social well-being."[43] The problem facing many regions, including Ontario and Canada, is the "innovation valley of death" (Exhibit 4). The early stages of technological development – discovery and basic research – are funded primarily by government, in order to overcome the market failure associated with this type of research. On the other end, during the stages of product development and

In addition to cluster models, good strategies are also determinants of cluster success. Clusters are hotbeds for innovation, which can in turn improve the competitiveness of a region.

EXHIBIT 4 The innovation valley of death



Source: Institute for Competitiveness & Prosperity analysis based on data from "Nanomanufacturing: Emergence and Implications for US Competitiveness, the Environment, and Human Health." United States Government Accountability Office, 2014, as cited in Ryan Zade. "The Fraunhofer Society within the German Innovation Space." Brookfield Institute for Innovation + Entrepreneurship, 2016.

large-scale production, there is much higher funding from the private sector. This leaves a gap between funding in the applied research and proof of concept stages, which make up the innovation valley of death.

The Institute proposed a series of recommendations to address this void, including a network of technology innovation centres similar to the Fraunhofer Society model in Germany.[44] These organizations play a key role in innovation within clusters, often co-locating research and development (R&D) and bringing in private investors to fund projects at a later stage in their research (See ***FACIT bridging the commercialization gap***).[45]

When governments fund research, they often attempt to be equitable, but instead research dollars inevitably become spread thinly across a multitude of sectors, producing little meaningful benefit. Instead, governments should employ *smart specialization*, which "encourages investments in programs that will complement the country's other productive assets to create future domestic capability and interregional comparative advantage."[46] The term smart specialization was coined by the knowledge economists of the K4G (Knowledge for Growth) expert group established by the European Commission's Research Commissioner in 2005 to resolve issues within the European system of research and innovation. As is presently the case in Ontario, the EU had an R&D deficit, whereby business expenditures in R&D (BERD) were much lower than that of the US.

Smart specialization is a set of strategies known as ***RIS3*** (research and innovation strategies for smart specialization) that inform a series of interconnected and coordinated actions.[47] They are not policies *per se* but instead guide the development of policies. Typically, the five kinds of policy areas they cover are:

- **R&D innovation policy** – traditional innovation policy that aims to spur innovation (often technology and knowledge) that leads to commercialization.
- **Industrial policy** – focused on the economic impact of innovation activities for a specific sector.
- **Regional policy** – develops sustainable social and economic growth.
- **Mission-oriented R&D programs and policies** – specific policies for a particular context and situation.

FACIT bridging the commercialization gap

FACIT – formerly the Commercialization Program at the Ontario Institute for Cancer Research (OICR) – was established as an Ontario government-funded corporation to seek out and fund the most promising oncological innovations. This Toronto-based organization bridges the gap between Ontario's world-class cancer research and the lack of commercialization by bringing together scientists, third-party investors, and industries. Since 2012, FACIT has directly invested $39 million in 48 projects by 15 companies, and leverage a total of $644 million. Prospective entrepreneurs pitch their ideas at "Falcons' Fortunes," an annual competition that requires participants to present to a panel of judges for a chance to win $50,000 in commercialization funding. Another form of funding comes through the "Compass Rose Oncology Fund," which invests $1-$5 million in oncological products for achieving a series of milestones in the commercialization process. FACIT is doing fantastic work bridging the gap between research and commercialization in Ontario's biotechnology industry, and similar funding measures should be taken across the country.[C]

- **Promotion of innovation value chains** – In many ways, clusters are a series of value chains and by optimizing them to maximize communication and collaboration, fosters innovation and competitiveness, including at the international level.[48]

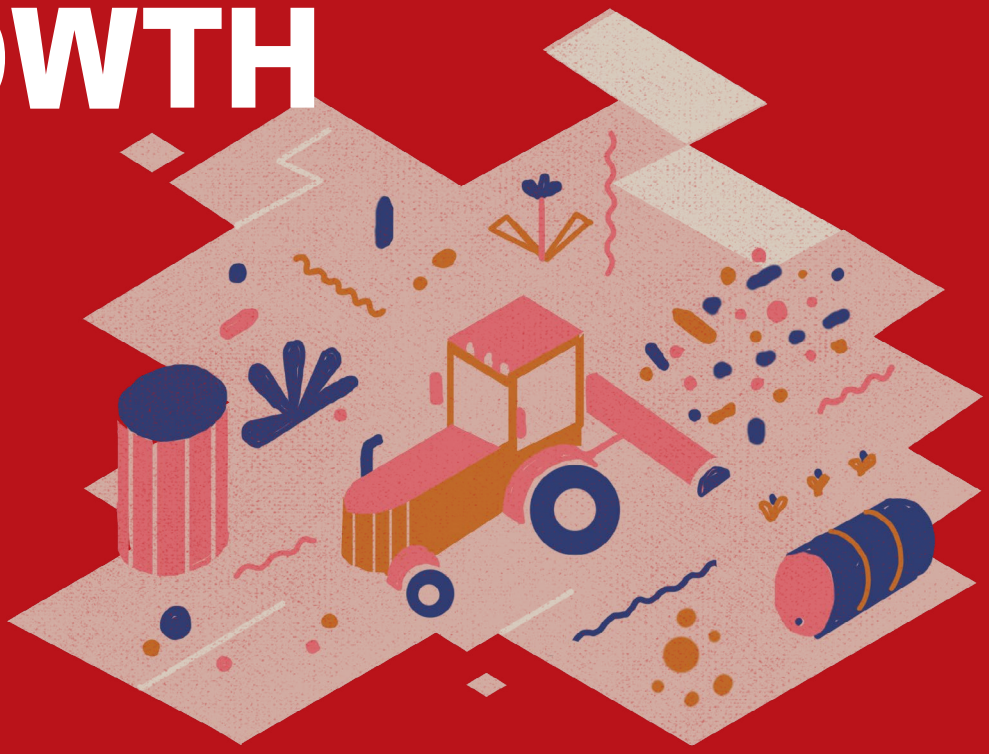
As government is responsible for creating an innovation ecosystem, policies that are not coordinated by government become a patchwork of programs and directives, and may contradict one another. Cluster success through RIS3 by government is predicated on integration and coordination, which requires strong, collaborative leadership. RIS3 invites cluster actors to the table to help guide decision-making, thus overcoming any lack of deep sectoral or cluster knowledge of public servants. RIS3 policies draw on the specialization and differentiation of each cluster to develop policies that address their own unique challenges.[49]

Government's role in the implementation of smart specialization strategies begins with understanding the specialization of a region: sectoral capabilities, potential, and opportunities (e.g., modernization). Only then can the differentiation of each cluster be identified. There are a number of ways to go about this, including network analysis and mapping, as will be discussed in Chapter 5. It is also important to engage academics and business leaders, including entrepreneurs, to help determine what these specializations are. Finally, government should introduce or revise a set of policies and complementary programs and investments to help support growth in these and other burgeoning clusters. As the Institute has previously stated, government should focus on its jurisdictional areas: healthcare, education, tax, and regulation, among other policy areas that help set the foundation for a strong innovation environment for a cluster to thrive in.[50]

Government should focus on its jurisdictional areas: healthcare, education, tax, and regulation, among other policy areas that help set the foundation for a strong innovation environment for a cluster to thrive in.

Clusters can help overcome the innovation valley of death because actors work together to overcome challenges or pursue growth in certain areas. The formalization of the cluster by their representitive organizations and managers can help it continue on its growth trajectory. How a cluster is organized follows its governance, and each model has its benefits and drawbacks. The most important notion is that clusters choose the model of organization based upon their needs and the conditions of the region, recognizing that cluster models and strategies are drivers of cluster success and growth.

CLUSTER GROWTH



Clusters organize to grow, find new partnerships, and develop innovations to create new products and services, and bring more value to sophisticated consumers, as well as find new consumers in global markets. Scaling up is a concept often discussed in policy circles, and clusters can help grow member firms. In many ways, the federal government has jump-started the scaling up process through the creation of superclusters. The Institute offers some guidance to maintain this growth, including bringing in those not traditionally part of the labour market and leveraging the diverse talent in Canada.

Supercluster origins and future

CANADA'S SUPERCLUSTERS present an interesting controlled experiment into clusters. Each of the five winners were carefully chosen by Innovation, Science, and Economic Development Canada and a team of expert reviewers following the same selection procedure. Superclusters are following differing paths because of regional and local differences in the Porter Diamond elements. While policies need to be sensitive to these variations, there are common challenges.

Digital Tech in British Columbia is working on integrating several distinct sectors together under the banner of digital technology. Protein Industries Canada's major challenge is out-innovating emerging competitors in Australia and eastern Europe, while positioning itself to feed the rising global middle class. Next Generation Manufacturing has discovered that its members are already strong leaders in manufacturing across various sectors but, paradoxically, the actors responsible for growth and success remain largely unknown to one another. Looking at these challenges reveals that the superclusters in fact share many common themes.

Supercluster membership opportunities and challenges

For many, the ISI was not necessary in bringing the various actors together as they had already been working and cooperating in their various niche sectors. But the ISI enabled the superclusters to do more with matching government funding. Bringing so many different sectors and industry actors under the umbrella of a supercluster creates many opportunities as well as challenges.

A common theme facing Canada's superclusters is bridging the gap between different sectors. For some, barriers include a lack of awareness of the others' presence despite sometimes being on same the street. Other superclusters face challenges in the cultural and demographic differences between blue and white collar industries. Perhaps the greatest membership barrier is with bringing SMEs into the fold when there are clear disadvantages in cooperating with larger multinationals.

All superclusters are well aware of the challenges they face and the competencies needed to overcome them. One of their many roles is to be the catalyst in bringing actors together through various events. These events let firms learn that they are not alone in the issues they face. By including different sectors, firms from separate but related industries are able to work toward overcoming their constraints without the feeling of competition that faces firms in niche clusters. In one supercluster, the feeling of comradery is already such that firms have privately funded projects while waiting for federal government funding to be distributed.

Transforming business models

An overarching theme and a main intention of the supercluster initiative is that of innovation. As such, effective adoption of technology is a major point of focus for the superclusters and is arguably the underlying theme for many of them. It is quickly being learned that Canadian firms do not have low technological uptake because of a lack of technology but rather a lack of resources and managerial experience. Another challenge, and one that the Institute has advocated for before, is the lack of accurate data that measures the contributions of the services sector.[51] This is a problem on two fronts: foreign investors comparing the US to Canada will view the former as more productive since their statistics include economic contributions of the service sector. Second, many Canadian innovations are pivoting away from manufacturing and towards offering recurring services to their customers which are not captured in GDP data. To attract talent and investment to Canada, as well as to accurately estimate the benefits of clustering and innovation promotion, statistical methodologies will need to adapt to 21st century business models.

The other approach is to transform Canadian businesses through value-added exporting. Producing high quality goods and services for the international market will differentiate Canadian goods from competitors. Business management must focus on running scalable businesses and should also put emphasis on serving the customer through data collection. Collaboration will play a major role in this initiative and is rightfully a priority for each supercluster. Interestingly, where in many countries geographic expanse would limit the amount of collaboration feasible between members, it does not seem to be a concern for Canadian superclusters – at least among firms operating in the same industry. This is one less obstacle to face as they all work towards internationalizing Canadian innovation.

Scaling up via networks, trade, and innovation

Scaling up is a major objective for cluster organizations and firms to achieve the ultimate goal of internationalization. Globally recognized products often come from clusters that have successfully scaled-up: Boeing and Airbus in aviation; Modena, Italy for supercars; and Shenzhen, China for electronics manufacturing. A cluster should strive to internationalize and gain access to lucrative markets, top academic institutions, and global talent. For a cluster to become world class, there are a few necessary steps.

Canada's trade imbalances hinder scaling up clusters

Internationalization is a product of social, economic, political, and business environments. For a comprehensive, national cluster policy, incentives must exist for clusters in one region to work and expand their influence to other regions of their home province and eventually Canada before going international. Yet, as it currently stands, clusters are more likely to work with proximate US markets than other Canadian regions. While this Working Paper does not advocate a nationalist approach toward cluster policy, it is vitally important to understand *why* several industries opt to work across the US border before taking full advantage of the Canadian market.

A key finding in *Unfinished Business: Ontario since the Great Recession* was the incredible dependence of Canadian provincial economies on US export markets, especially those reliant on manufactured goods. On average, the amount of provincial GDP contributed by interprovincial trade is just 11.3 percent.[52] A major setback to promoting interprovincial trade and ultimately scaling clusters within Canada is the mismatch of trade regulations between provinces. Reducing trade costs related to asymmetries or other costs unrelated to distance translates into national GDP gains of over $50 billion.[53] Firms follow the path of least resistance, and with regulations hindering expansion to fellow Canadian consumers across provincial borders, the private sector will inevitably seek out other markets.

A major setback to promoting interprovincial trade and ultimately scaling clusters within Canada is the mismatch of trade regulations between provinces. Reducing trade costs related to asymmetries or other costs unrelated to distance translates into national GDP gains of over $50 billion.

Networking is essential to scaling up

The second key needed for clusters to scale up is networking opportunities. Clusters will begin locally and scale up within their region, while catering to their particular customers' tastes and preferences. These specialties acquired over time will position firms within the cluster to begin fulfilling the same niches in other markets. However, entering new markets may present a challenge to clusters. Supply chains may not exist, or there may be unfamiliarity with local laws or customs and so it is important that partnerships be made which can bridge these gaps.

An excellent instance of this concept is Toscana Promozione (TP) which used its connections to help secure business opportunities for its member firms. In reality, networking is not often this simple and requires all members of the Triple Helix to play their part. Cluster organizations typically offer networking or "matchmaking" services between other firms, academia, and even other clusters. The European Union, through the European Cluster Collaboration Platform, has developed an extensive network specifically designed to facilitate the internationalization of European clusters. They operate a database of over 900 cluster profiles worldwide, as well as national profiles for several countries including Canada.[54] This allows firms and organizations to directly contact others in regions or sectors of their choice, as well as host frequent matchmaking events between EU clusters and various international regions. As Canadian clusters grow and develop, they will need the support of an inter-regional organization to network and bridge the gap toward internationalization.

Cluster branding is also important when internationalizing. Making a cluster name synonymous with a product or sentiment will improve chances of building networks. Successful branding initiatives are how small regions with under 100,000 people can command a majority global share in their cluster's main export, even if the entire population is not involved in those industries. Consider Ontario's Golden Horseshoe food cluster: it is one of the largest in North America thanks in part to a moderate climate, access to fresh water, plentiful arable land, and a skilled workforce. Annually, the cluster generates over $12 billion and employs over 110,000 people.[55] Despite these accomplishments, the food cluster remains largely unknown – not only outside Canada, but even locally. A strong branding and marketing campaign is needed to increase sales, attract investments, bring in talent, and promote internationalization.[56]

Innovation through growth

Firms do not necessarily innovate more simply by being a part of a cluster.[57] What is important for fostering innovation is the number of interfirm interactions in a sector.[58] As a cluster grows and absorbs more members into its ecosystem, the number of unique, complex linkages between firms and other actors grows in tandem. Forming connections between firms does not necessarily have to occur through a cluster (other networks can have the same effect), but clustering is an efficient and effective way to establish these connections. As more firms congregate together, knowledge spillover increases, and it becomes less costly for other firms to appropriate advancements.[59] To use a specific example, an analysis of Toronto's mutual fund companies found that just physically locating the firm and its managerial presence within a cluster (i.e., in proximity to other firms) enhanced innovation.[60]

Using strategy to resolve challenges

Cluster growth requires addressing challenges that are often the result of trying to scale. These could include finding resources, managing many cluster members, and issues with exporting. Compounding these issues are questions around sustainability, environmental stewardship, and philanthropy, as businesses grow in size. To enhance competitiveness and economic success, Professor Porter and his colleague Mark R. Kramer posit that firms have the ability to tap into unserved markets and customers by solving social problems within the communities in which they operate. This defines ***creating shared value*** (CSV), which occurs when companies incorporate a social dimension into their business model, thereby changing the model to ensure that it addresses the community's needs, not just their own.[61] CSV is not corporate social responsibility, which focuses on philanthropy and giving back. Rather, CSV embeds a profit motive with tackling a social problem, creating a win-win situation for both the firm and larger society. With the rise of social entrepreneurship, and a focus on sustainability by customers, CSV can leverage the collaboration approach within a cluster to solve social ills. Management scholars have offered a way to make the decision on how to find a profitable venture that also solves social issues. Much of this is predicated on having norms that are guided by an ethics framework, which is crucial when facing win-lose situations such as using sweatshops.[62] This is done in three steps: (1) reconceiving products and markets to meet unserved markets and customers; (2) redefining productivity within value chains; (3) enabling local cluster development and working with other cluster actors to solve social issues.[63]

Professors Porter and Kramer provide a number of examples of companies that have used shared value for social good including Nestle, Coca Cola, and Intercontinental Hotels.[64] CSV has also been used in health care and by non-profit organizations.

Measuring CSV is slowly evolving, and Professors Porter and Kramer have provided some direction on what to measure, including improved profitability and revenue, along with social indicators such as better health and employee satisfaction.

For CSV to generate real change and results, there are some important foundations that need to be in place first:

- **Existing cluster** – In order to effect change, a business needs to be fully embedded within an existing cluster. The third step of CSV is enabling local cluster development, which requires that the businesses are or become aware of the social issue to tackle.

- **Collaboration** – The firm needs to work within the cluster to share resources and address the social issues presented. Prior experience collaborating is important as well as the space to speak openly about challenges.

- **Strong leadership and implementation** – CSV often requires more resources to implement and can raise the ire of shareholders focused on short-term returns. To invest the appropriate resources and assuage shareholders, an executive(s) within the firm must champion CSV.

- **An understanding of the customer** – CSV is only effective when this unserved customer base recognizes the value created by the firm. Therefore, CSV must be done to meet the needs of customers.

Creating shared value through clusters is practiced around the world. The Bogotá Chamber of Commerce successfully fostered collaboration by convening a committee that focused on tackling the skilled talent shortage within an IT cluster. The Chamber of Commerce and UNIEMPRESARIAL, a private entity created by the Chamber and supported by the German Chamber of Commerce, along with the Secretary of Development of Bogotá, decided that they needed to train and upskill existing talent. They designed and funded a one-year program that combined academic study with work experience. With ten partner companies, they began by training call centre employees, and by January 2015 had trained 180 people, of whom 77 were hired by the firms involved with the program. They also hosted job fairs to fill 424 vacancies in 24 companies, and worked with universities and schools to see if they could tailor educational programs toward software and IT.[65]

In Canada, there are few cases of collaborations across sectors. As such, while CSV is a useful alternative to the sole pursuit of profit which allows firms and shareholders to look beyond the economic value of products and services, it is not a one-size-fits-all alternative, especially in the absence of practical steps and measurement indicators to evaluate and guide CSV.[66]

The Institute proposes that for shared value to be created, a new strategic positioning that focuses on solving social issues must be adopted by not only the firm but the cluster itself, and, most importantly, the cluster manager. In addition, implementing a business model with a social dimension requires a clear strategy, in addition to the data and analysis that Porter and Kramer posit. The Institute suggests that clusters use Roger Martin's work on strategy to implement CSV.

Strategy to guide collaboration

For traded clusters, scaling up is usually the goal for any cluster. However, the cluster initiatives that help the cluster scale up must be done using a good strategy. Roger Martin, Director of the Martin Prosperity Institute and a management and strategy expert, posited that regardless of who (public or private sector) develops the strategy, there are many bad strategies and very few good strategies—that is, strategies that are Pareto distributed. Ultimately, strategy is a series of choices, and even the decision not to have a strategy is itself a strategic choice.[67] Thus, it is more important to be proactive and play offense in order to help shape the future of a cluster. To develop a winning strategy requires answering five questions:

1. **What is your winning aspiration?** That is, what would you like to achieve?

2. **Where will you play?** That is, where are you choosing to compete? Clusters should take into consideration their existing specializations.

3. **How will you win?** Based on the answer to the second question, determine how you will create a competitive advantage and bring value to your customer.

4. **What capabilities must be in place?** What are the core capabilities that will help you achieve your winning aspiration?

5. **What management systems are required?** What supporting structures, systems, and measures do you need in place to execute your strategy?[68]

Answering these questions thoughtfully with cluster members builds a clear strategy for implementation.

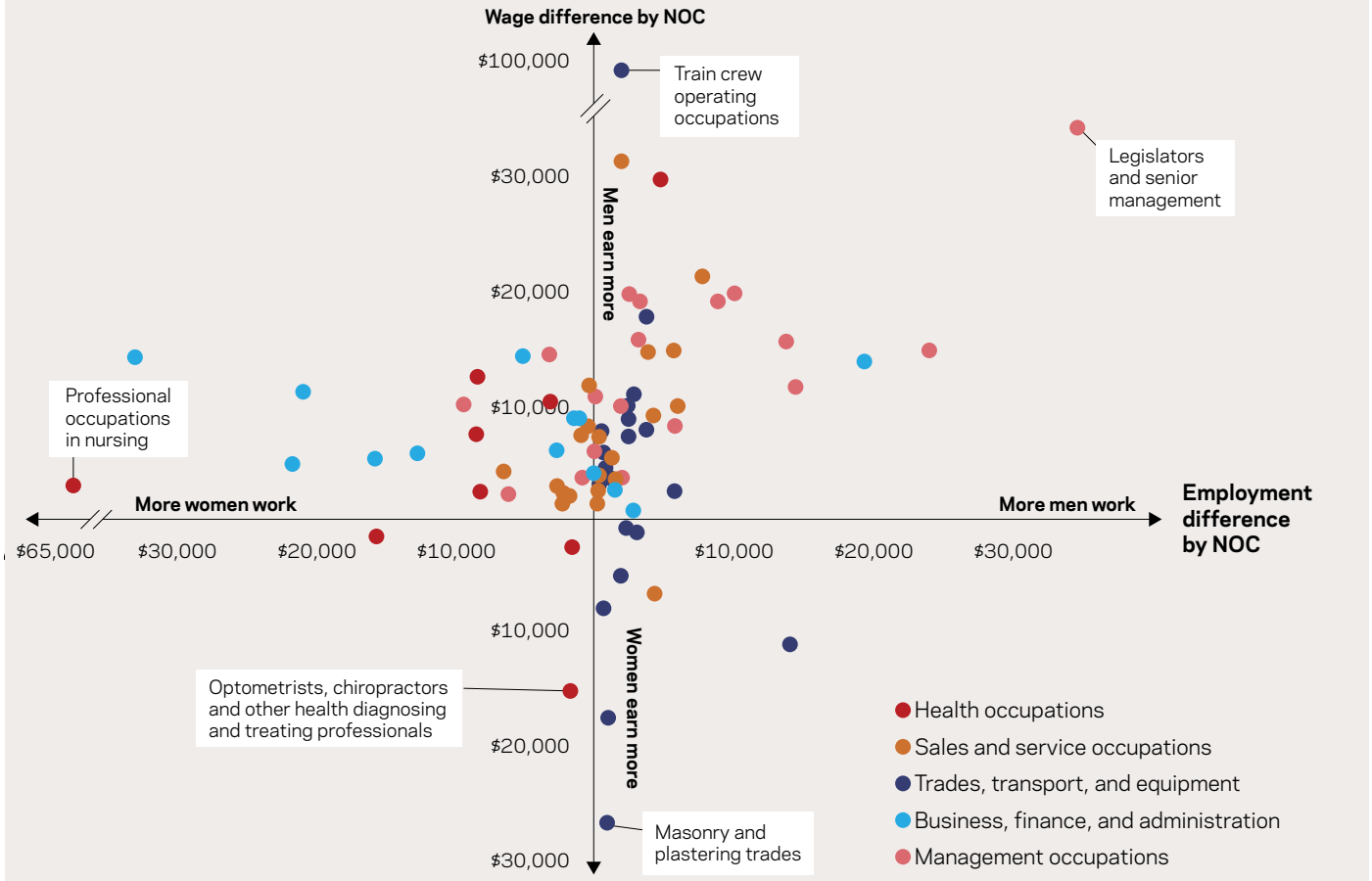
Diversity and inclusion in clusters

One of the key benefits of clusters is the lower barriers to entry for those who may not traditionally be included in a supply chain. Part of this is due to the ease of communication between members (they already know each other) and Triple Helix and other models that enable communication and collaboration. In addition, when resources are shared, it is more cost-effective for organizations to implement initiatives.

In theory, clusters are a great opportunity to address the lack of diversity in firms and other organizations because they offer a forum to share best practices and strategies. Of course, diversity is not solely about gender, but also ethnicity or race, ability, socioeconomic class, gender identity, sexual orientation, among other characteristics. While some aspects may not be visible, workplaces that want to leverage the unique skillsets, abilities, and knowledge of diverse groups of employees must work toward hiring and empowering these individuals, in order to allow them to effectively contribute.

In a globalized world, any desire to export, scale, and build international linkages cannot be done without a diverse and open-minded workforce. As an example, in almost all industries in Canada, the median wage of women is less when compared to men in the same industry, regardless of whether the industry has a majority of either gender. The Institute used National Occupation Classification (NOC) codes for this analysis, which categorize all workers by industry into 140 three-digit codes. Among full-time workers with a bachelor's degree or higher, who worked in 2016, and were part of the core working-age group (25 to 64), there are clear disparities between the genders, in terms of employment counts and median wages (Exhibit 5). There are just four occupations

EXHIBIT 5 Gender differences in employment and wages by 3-digit NOCs, Canada, 2016



Note: Comparisons included individuals between 25 and 64 years old, holding a Bachelor's degree or higher, and working full-time for a full year during the 2016 Census.
Only NOCs (National Occupational Classification) with the five highest employment levels are included.
Source: Institute for Competitiveness & Prosperity analysis based on data from Statistics Canada 2016 Census Table 98-400-X2016271.

where women are the majority of employees and earn more than their male colleagues: optometrists, therapy professionals, dental technicians, and social service professionals. Interestingly, there are several occupations in which women are the minority but earn more than their male counterparts, with most of these jobs being found among trade, transport, and equipment occupations.

This analysis, which examines only one aspect of diversity without incorporating intersectionality, already paints a sombre picture of what occurs in the labour market. The Institute has written extensively on improving the labour market outcomes of diverse groups, including wages, because doing so raises the overall prosperity of the province, and helps close the prosperity gap. Clearly, much more needs to be done to improve this situation, and to provide equal opportunities for women of diverse groups, and others in the workforce seeking greater inclusion, to access the economic prosperity that would benefit us all.

Diversity, equality, and inclusion are ultimately about creating an equitable, safe, and empowering workplace for employees to do their best work. An organization's policies and actions on diversity and inclusion are dictated by their values. Research shows that employees who do not share similar values with their employers are less likely to stay beyond two years.[69] From a business perspective, continuous turnover is a drain on a company's resources, and can negatively affect the morale and culture of the work environment, causing poorer performance. In an economy with labour shortages across many fields, employers need access to as much talent as is available. Creating a workplace that celebrates diversity, inclusion, and belonging takes a concerted effort and in some cases, a realignment of corporate values. Fortunately, there are examples of how to achieve this within the cluster ecosystem (See ***Innovation TIGERS: R&D at the intersection of gender research and gender equality***).

Innovation TIGERS: R&D at the intersection of gender research and equality

Sweden and Norway have long been working on advancing gender equality in clusters, particularly in R&D and innovation. VINNOVA, the Swedish Governmental Agency for Innovation Systems, focuses on sustainable economic growth by funding research and developing effective innovation systems. VINNOVA launched the Applied Gender Research for Strong Research and Innovation Milieus (TIGER) programme in 2008 to change processes and increase gender inclusion in a number of innovation and R&D areas, taking the research produced and integrating it into other areas of VINNOVA's work on cluster development.

TIGER funds three innovation milieus in Sweden that have produced positive results:

Skåne Food Innovation Network – Hosted "gillens" that brought together industry actors across entire production chains to discuss challenges, resulting in new products, partnerships, and applied research.

Triple Steelix – Worked with Dellners Couplers, a train connection manufacturing company, surveying employees from Poland, India, and Sweden on their jobs, and then provided gender equality training. They then held smaller feedback meetings with Swedish employees that produced 100 new ideas that were used to build a model of improving the workplace.

Fiber Optic Valley – Created an inter-organizational gender network, and invited middle managers to join. Regular network meetings included gender coaching, lectures, and literature studies. This helped mobilize middle managers to lead changes to drive gender equality in their units.[D]

There are also many global initiatives and networks available to help clusters address diversity and inclusion. On gender equality, CEOs can sign the CEO Statement of Support of the Women's Empowerment Principles, which focuses on gender equality, as part of the WE EMPOWER Programme of UN Women.[70] Internal commitments are important, but making a public declaration of this commitment not only helps bind the company to making a positive difference for its employees, and ultimately its customers and shareholders, it also helps recruit diverse talent. Moreover, there are many networks for women in clusters including: European Cluster Collaboration Platform, the European Women Management Development Network, the Women4Cyber network, and the European Enterprise Network's Women Entrepreneurship Sector Group.

Solving these challenges can be done within a cluster environment to share ideas and implement solutions across a multitude of companies, with the help of academia and government.[71]

Clusters are not silver bullets that can resolve all societal or economic ills. But they can certainly play a part in addressing issues that are key to helping clusters scale up, the lack of diversity in workplaces being one of them. Fostering collaboration particularly when there are a diverse group of actors can be challenging, and will take time to achieve. Nonetheless, it is certainly an efficient approach, once clusters are formally organized and embark on cluster initiatives that can help firms scale up.

CHAPTER 5

CLUSTER EFFECTIVENESS

Determining cluster success and understanding its intricacies requires data. Like many countries, Canada does not collect robust data that would enable research bodies, cluster organizations, governments, and firms to measure the networks and the activities of a cluster. Yet, these are important to help correct course, for accountability (particularly to taxpayers), and to understand the economic impact of a cluster. There are many ways to collect data but they should be done contextually, using qualitative information to accompany quantitative data. After all, clusters are about people collaborating, which cannot be boiled down to just a few numbers.

IN THE US CONTEXT, clusters are defined using North American Industry Classification System (NAICS) codes.[72] According to methodology introduced by Professors Delgado, Porter, and Stern, 51 traded and 16 local clusters were defined, based on employment and establishment linkages. Each cluster contains a set of related industries by NAICS codes that form the basis of input-output relations between individual firms.

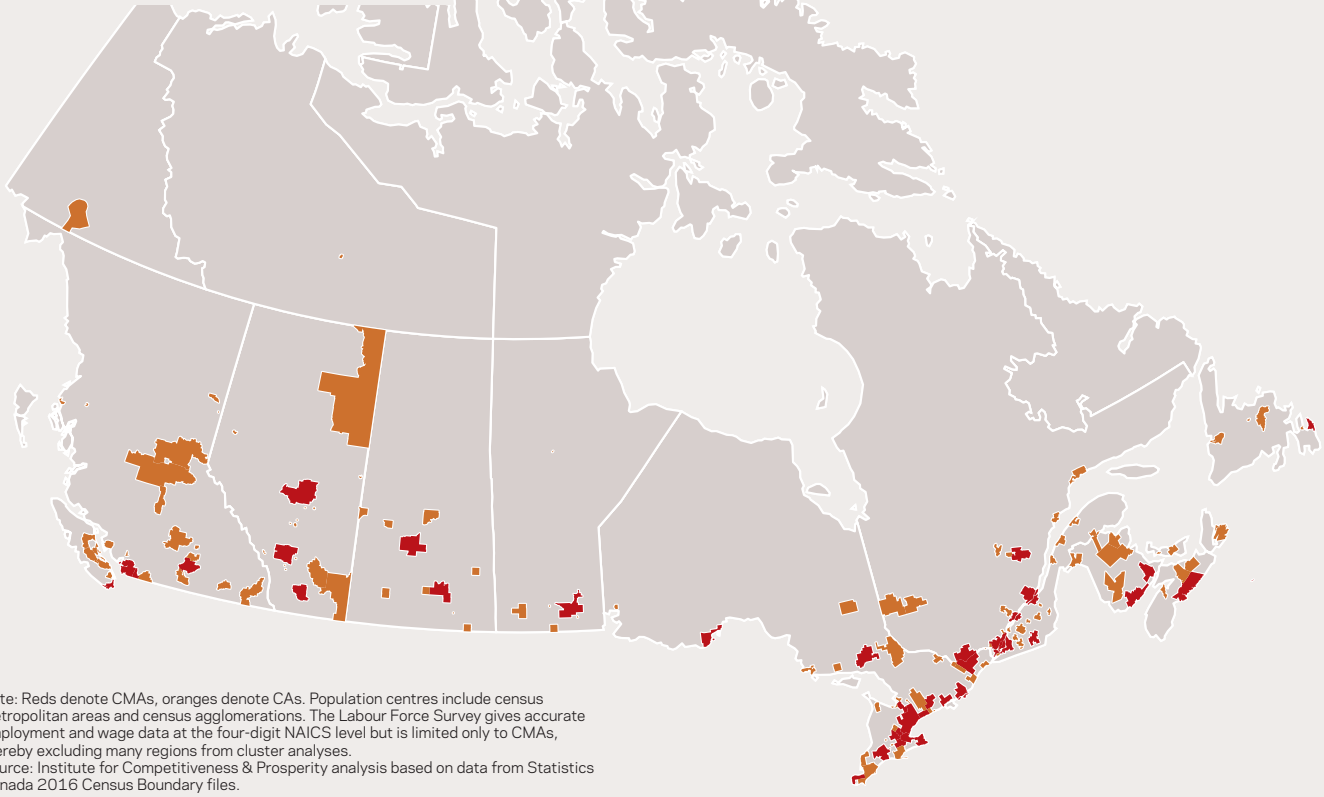
For Canadian cluster analysis, the Institute adopts the aforementioned cluster definitions developed by Professors Delgado, Porter, and Stern. To account for differences between Canadian and US industries, a weighting method is used to convert data from US NAICS into Canadian NAICS codes. While it may be more appropriate to determine the unique clusters that exist in Canada, this is made difficult by a lack of available data. Nevertheless, using Professor Porter's definition of clusters and their corresponding NAICS codes makes it possible to directly compare how Canadian industries compete with their US counterparts. This is particularly important, given the dependence of Canada's economy on the US.

The uses of cluster mapping

A convenient and intuitive way of utilizing cluster data is creating maps to visualize clusters across regions and time. However, doing so for the sake of having a map should be avoided.[73] In the case of Canada and Ontario, geographic size and economic differences between regions justify a mapping project. To that end, this exercise should be initiated by the provincial government to map intraprovincial clusters, or as the federal government has done for a comprehensive Canadian map.

The current Canadian mapping project by the federal government is a well-intentioned initiative, capturing both employment and wage data.[74] Data are mostly consistent at the provincial level and can show employment and wages, but become exceedingly sparse at smaller geographical areas, such as the economic region or census metropolitan area (CMA) levels since clusters are regional phenomena, while the province or economic regions offers employment and wages data. They are not available at the smaller geographies, such as a dissemination area that are blocks of areas covering populations of just 400 to 700 people (Exhibit 6). Caution

EXHIBIT 6 Population centres in Canada, 2016



Note: Reds denote CMAs, oranges denote CAs. Population centres include census metropolitan areas and census agglomerations. The Labour Force Survey gives accurate employment and wage data at the four-digit NAICS level but is limited only to CMAs, thereby excluding many regions from cluster analyses.
Source: Institute for Competitiveness & Prosperity analysis based on data from Statistics Canada 2016 Census Boundary files.

should be exercised when using the Canadian Cluster Map as it allows the user to define a cluster instead of using standard definitions of clusters, and can therefore define a cluster by unrelated sectors.

Besides having inaccurate or undetailed data, the final issue concerning cluster mapping in Canada is the lack of specific geographies smaller than CMAs.

By using Professor Porter's cluster definitions which are based on NAICS codes, it will then become possible to directly compare Canadian clusters to their US counterparts, make benchmarking easier, as well as signalling to international investors and partners the strength of Canadian industries. The Institute explored this idea in *Clusters in Ontario*, and compared location quotients and employment counts for Canadian census metropolitan areas to US metropolitan statistical areas and showed that in several clusters, Canadian CMAs area able to compete on a North American scale.[75]

Network Analysis

Oftentimes, it is beneficial for incumbent cluster actors or investors to have access to a "cluster" map rather than a regional map. A foreign car manufacturer, for instance, may want to invest in Ontario and thus have more interest in how linkages (including supply chains) in Ontario's automotive cluster compare to those of other countries or regions. For this, a network analysis is needed.

Network analysis, as its name implies, is a visual analysis of the connections between various actors in a cluster ecosystem. It is comprised of four different measures:

- **Locational correlation of employment (LC-emp)**, or the pairwise correlation of industry employment between industries in a jurisdiction.[76] In other words, it is the amount of employment overlap between two industries.
- **Locational correlation of establishments (LC-est)**, like LC-emp, is the correlation of industry establishments between two industries in a region.
- **Input-output flows (IO)** are the inter-industry transactions from any given industry to all others.[77]
- **Occupational overlap (Occ)** is the correlation between the occupation composition of any two industries. In Canada's case, that would mean determining how many people from one occupation in any given industry work in all other industries.

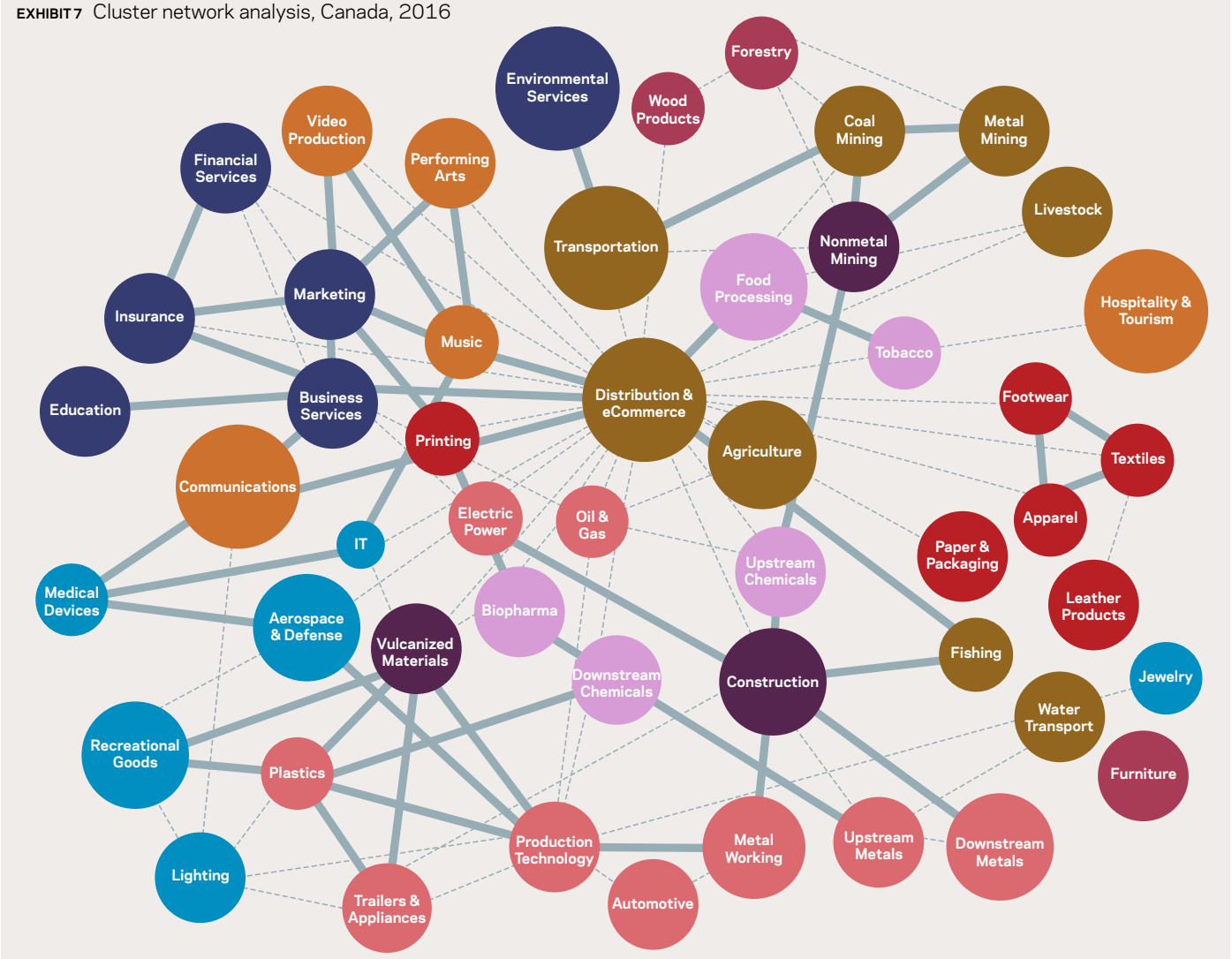
Once each attribute is calculated, determining between cluster relatedness (BCR) is as simple as finding the averages of all attributes among industries between two clusters.[78] Among all cluster-to-cluster connections, the top fifth percentile is used to show the strongest networks. The Institute used a modified methodology in *Clusters in Ontario* to create a network analysis for the Canadian context (Exhibit 7).

As with cluster mapping, Canada's challenge in developing an intra-cluster analysis of domestic clusters lies in the lack of data at the level of granularity required for accurate representation. At present, data are available for establishment, employment, and occupation counts for analysis at the six-digit NAICS level, but only four-digit NAICS are available for input-output data. In theory, it is possible to create a network analysis at the four-digit NAICS level, but it would then give an inaccurate representation of clusters once industries begin to split into different clusters at higher granularities.

Intra-cluster analyses

Clusters are dependent on external factors. It is not uncommon to find highly localized clusters with stronger foreign ties in, for example, research collaborations than with domestic research institutions. For this reason, a network analysis is useful for gauging a cluster's various strengths and weaknesses.

EXHIBIT 7 Cluster network analysis, Canada, 2016



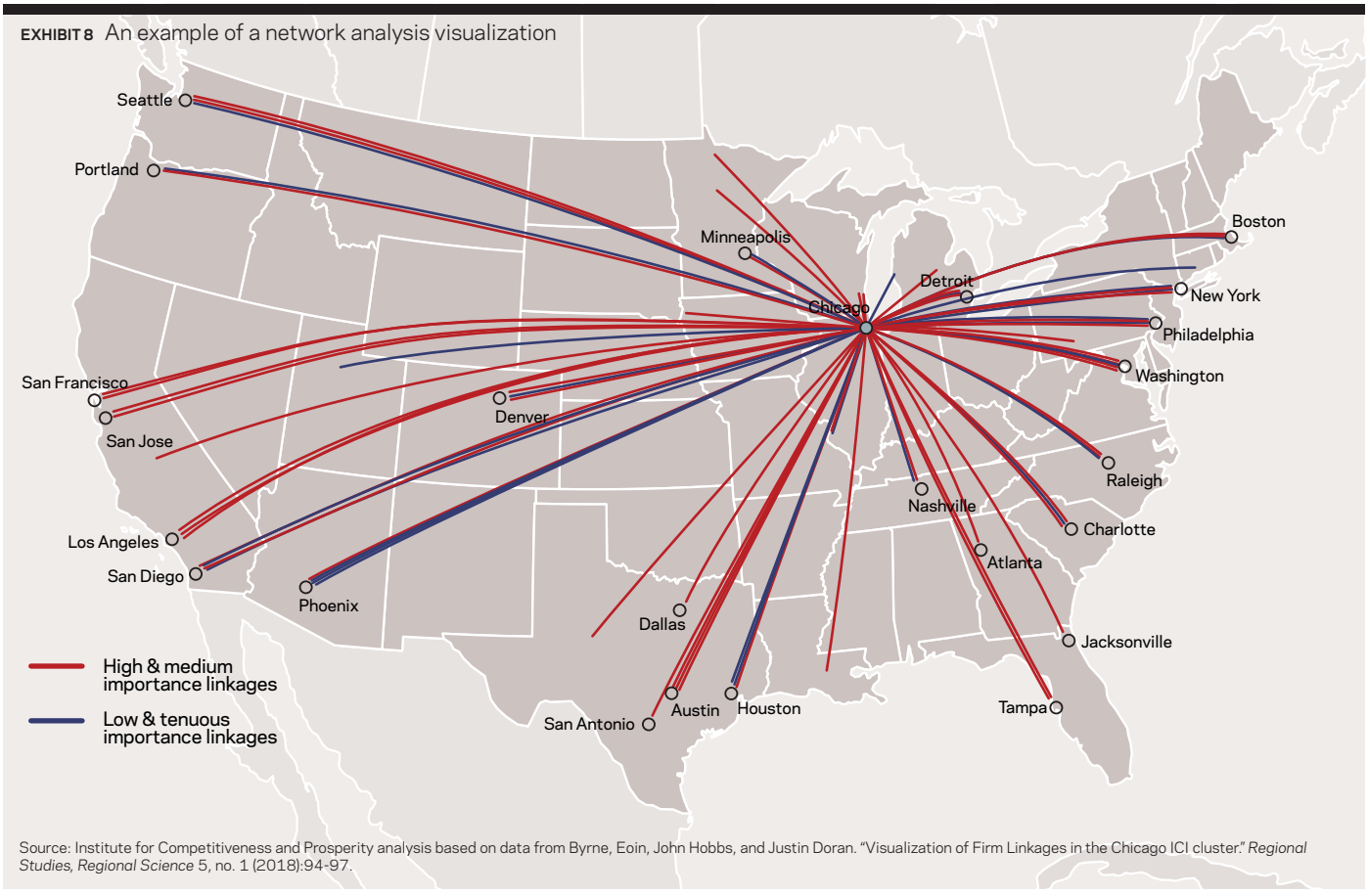
Note: Strength of linkages are denoted by lines conecting the clusters. Strong linkages have thicker lines. Size of cluster circle has no bearing on anaysis. Colours are based on US cluster mapping groupings. Some cluster names have been shortened.
Source: Institute for Competitiveness & Prosperity analysis based on data from "Cluster Linkages in Canada." Institute for Competitiveness & Prosperity. 2017.

Visualization of linkages in networks and clusters (V-LINC) is a methodology for identifying, recording, and analyzing the linkages within which a clusters' firms engage.[79] It categorizes these linkages and groups them by geographic scope: local, national, and international. Furthermore, V-LINC records the business impact of linkages based on the perceptions of firm personnel who engage in the linkages with other companies and organizations. Key personnel from a representative sample of firms in a cluster are interviewed with questions on a Likert scale to gauge the business impact of individual linkages. V-LINC maps give a visual representation of the relative reliance on local, national, or international linkages between customers, suppliers, trade flows, research institutions, and specialists of a company and when combined, of a cluster (Exhibit 8).

V-LINC facilitates policy development at local and national levels through the aggregation of data from a sample of firms. Confidentiality of firms' linkages is maintained throughout the entire process. The result of this type of analysis is two key pieces of information which can inform cluster policy: which linkages exist, if any, between players, and the strengths of the bonds between different actors. Most importantly, at this stage, cluster organizations and policy makers will know all linkages between the private sector, academia, and government, and can subsequently implement policies to target weak points in a cluster, or to develop local skills (rather than relying on outside talent.)

A common theme for clusters – even well-established ones – is that they have a robust governance system, are highly organized, and meet many of their initial stated goals. Yet, a network analysis can reveal that while local ties are strong, academic collaborations may be outsourced to other regions or countries even when the cluster organization is hosted at a knowledge institution.[80] The success of a cluster can oftentimes mask its weaknesses but it is by learning this information that interventions can target these particular shortcomings. In this example, improving the quality of local knowledge institutions within the cluster and increasing collaborative projects between academia and industry will strengthen the overall cluster.

EXHIBIT 8 An example of a network analysis visualization



Source: Institute for Competitiveness and Prosperity analysis based on data from Byrne, Eoin, John Hobbs, and Justin Doran. "Visualization of Firm Linkages in the Chicago ICI cluster." *Regional Studies, Regional Science* 5, no. 1 (2018):94-97.

Similarly, this type of SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis can also reveal prospects for internationalization. Following the above example, connections with strong academic institutions could lead to greater collaboration between a cluster's academic members and ones with strong linkages into the cluster. Even more importantly, by understanding the linkages between a cluster's firms, customers, and suppliers, businesses can make informed decisions on where to source their inputs and which markets to target as they expand. This idea plays back to the home demand conditions of Porter's Diamond, which states that a producer can successfully expand into new markets after developing a comparative advantage domestically.

Cluster Labelling

As cluster organizations form and start working with their members and other actors, a major challenge emerges: their management. For clusters to be effective, they need to be well-managed. Moreover, when clusters from different countries want to work together, there is almost no way to determine whether the cluster they are interested in partnering with is successful or organized well. If the cluster is not well-organized, then the benefits are not realized, limiting the effectiveness of any international partnership.

The success of a cluster can oftentimes mask its weaknesses but it is by learning this information that interventions can target these particular shortcomings.

To resolve this, in 2009, the European Commission launched the European Cluster Excellence Initiative (ECEI). As part of the endeavour, two organizations were formed: the European Secretariat for Cluster Analysis (ESCA) and the European Foundation for Cluster Excellence (EFCE). While the EFCE is responsible for training cluster actors, especially cluster managers, the ESCA conducts cluster labelling. This is an exercise whereby cluster organizations are benchmarked against existing cluster organizations, and given a label of bronze, then silver, and eventually gold. Since November 2010, 1,080 clusters from 43 countries have been certified bronze, 114 clusters from 19 countries have been certified silver, and 102 clusters from 19 countries have achieved gold.

As a first step, to be certified bronze, the cluster organization must provide documentation and data that would help the ESCA benchmarking experts assess the cluster organization across 36 indicators that cover cluster management, governance, services provided, financing, and cluster interactions.[81] The bronze label is usually considered an expression of interest and not a quality label, and is only the first step to full certification (gold), with recommendations provided on where to improve to meet the requirements for the next level. Labelling can be an expensive endeavour for small, publicly-funded

cluster organizations (it costs over C$2,000 for each label) and may involve travel. Therefore only well-established cluster organizations will have the funding to undergo certification (See ***Lithuania's maturing clusters***).

Once the cluster organization has implemented the recommendations and can prove this, it can apply for silver certification. This involves an audit and site visit, after which the benchmarking experts determine whether the cluster meets the minimum requirements (based on previous recommendations) for the silver label.[82]

Finally, in order to achieve gold, the cluster will be analyzed on 31 indicators, and must be deemed to have cluster management excellence with respect to governance, financing, strategy, and services and recognition, in order to be awarded this prestigious label and given areas of continuous improvement.[83]

There were previously two Québec clusters that received bronze certification, but their labels have since expired.[84] There are currently no other cluster organizations that have any other ESCA cluster labels in Canada. The Institute recommends that the clusters within the five superclusters begin the process of undergoing cluster labelling in order to understand the requirements for cluster excellence, and to have a guide toward improvement based on global best practices.

Evaluating cluster initiatives

Like many areas of public policy, evaluation is difficult. For example, measuring the return on investment into research grants, especially for basic research, may indicate that the investment is not viable, due to the fact that basic research can take decades before yielding applicable results. However, from an economic perspective, government can fill the gap where firms will not invest due to market failures.

For superclusters, which are co-investments by the public and private sectors, evaluations are an important part of learning and continued improvement. The Institute has stated before that the key performance indicators (KPIs) that the federal government is employing for the measurement of the ISI are more output rather than outcome measures.[85] For example, the ISI programme states that the five superclusters will, combined, produce more than 50,000 jobs, and increase Canada's GDP by $50 billion over ten years.[86] These purely economic measures are incredibly difficult to track and confidently attribute to the development of the ISI.

Lithuania's maturing clusters

The European Secretariat for Cluster Analysis (ESCA) is the agency responsible for assessing the strength and quality of clusters to award either a bronze, silver, or gold labelling. There is good reason to pursue these milestones, as being certified is a prerequisite for joining matchmaking events and international partnership projects organized by the EU. More colloquially, European clusters without at least a bronze label are not considered clusters but rather seen as cluster initiatives.[E]

That is why Lithuania worked extremely hard in 2018, increasing its number of bronze-labelled clusters from two to ten. These clusters represent industries including energy, environment, and healthcare. Now, with this benchmarking, clusters can increasingly focus on expanding their international export markets. By understanding where these labelled clusters stand, they can now improve their operations and are aiming to have two silver labels by the end of 2019.[F]

Thankfully, the ISI program guide lists economic measures as only one of seven KPIs.[87] The rest are in line with cluster evaluation literature, focusing on the number of funded projects, dollar value of partnerships with the private sector, and the number of firms and participating organizations involved. There are also requirements for gender balance in the leadership teams, and boards of directors for each of the superclusters. The final KPI, which measures how well activities are aligned with the cluster ecosystem's needs, leaves room for qualitative measures.[88] These qualitative measures are important because ultimately the success of clusters is based on collaboration, which requires social capital.[89] It is not to say that there should not be any quantitative measures because they are valuable, but the focus should be primarily on the social capital and the building of strong networks because positive economic results will follow.

It is important to recognize, though, that cluster development is a long-term activity, one that will take much longer than the five-year funding period for the superclusters. It takes time to build trust and design and develop successful initiatives, therefore the design of these initiatives should include evaluation criteria from the onset. Cluster evaluation is not an afterthought, and should be done at key strategic periods, not necessarily based on intervals of time but rather at particular stages of the cluster initiative. In some cases, five years might be too soon to conduct a comprehensive evaluation. Cluster evaluation is a highly subjective and variable activity because it is context specific, and therefore KPIs should be done with the cluster actors. In the end, while cluster evaluation appears to be a purely government-driven activity to demonstrate value in its $950-million investment, for the cluster itself, it is a learning exercise that helps course correct for continued success.[90]

What may also be of particular interest to policy makers and economists is to combine the concepts of network analysis and evaluation in order to determine the economic benefits of clustering. As shown in Chapter 4, many benefits come from increased network density of various firms and other actors, including resiliency to shocks, and increased innovative potential. Impacts of clusters or even sectors within the supercluster on other firms can be quantified and tracked over time, especially as linkages grow in complexity.

Evaluation of clusters is crucial because many cluster initiatives, particularly in their early days, are funded with public dollars. Yet government often struggles to accurately assess the strengths and weaknesses of clusters, or the results they produce. Evaluation is difficult because often politically–driven assessments are pursued, with the goal of only releasing positive results. Instead, evaluation should find areas of improvement to produce additional positive results. Particularly in Canada where the government is spending $950 million, more evaluation is required.

RECOMMENDATIONS

In considering the interplay of economic growth and principles of cluster development, the Institute offers a number of recommendations for various actors in cluster development in Canada. Each actor, namely the firms, government, and academia, needs to operate in accordance with their roles to connect and collaborate to build on existing resources to create something that will help generate prosperity for firms and Canadians alike.

RECOMMENDATIONS FOR THE PROVINCIAL GOVERNMENT

While the scale of clusters is at the regional level in Canada, there is still a very large role for provincial governments in helping clusters grow. Stable provincial government investment over the long term in just a few areas to support clusters would also relieve the economic burdens faced by many municipalities. As the Institute's mandate is focused on Ontario, there are many recommendations for the provincial government that will support clusters, including in the areas of education, infrastructure, and trade but which can also be applied to other provinces.

Invest in talent through education and retraining

Talent forms the backbone of a thriving economy. While Ontario's education system is lauded internationally for its high quality, there are still areas of improvement. For example, The Institute's recent research showed that currently, the provincial education system is not imparting the 21st century skills required of the workforce of the future. Interestingly, while math and complex problem solving are frequently identified as central skills for future careers, reading comprehension and social skills are the most critical.[91]

The Institute also found that for those already in the labour force, there were skill gaps which significantly impacts the retention of local talent. Since employers have, over time, significantly decreased the amount of on-the-job training provided, those looking to upgrade or re-skill for another career have very few options, particularly if employees are laid off. Individuals may move elsewhere to find more suitable jobs in the absence of accessible training that would help them acquire new skills. The previous Ontario government sought to close this gap through Employment Ontario, via programs such as Second Career, which provides a retraining program for those looking to change careers. While 81 percent of those who completed Second Career found jobs within 12 months, these positions are, in turn, highly susceptible to automation in the future.[92] These programs should include employers and academic institutions in addition to government (Triple Helix approach) who can advise innovative ways to reskill those already in the labour force in order to see lasting economic results, and jobs that withstand the shift to automation.

Strong educational institutions have protected southwestern Ontarians from previous economic shocks; and therefore the current educational opportunities must be expanded to include a wider range of options, such as online programs, micro-credits, or satellite campuses.

Reskilling and the skills gap are issues that clusters around the world are grappling with, and addressing within the cluster environment. Firms can specify the kinds of skills they require, and academic institutions can work with government to tailor educational programs to meet these needs, such as creating massive open online courses (MOOCs).[93] This would help both urban and rural regions, in order to retain and upskill local talent.

Integrate rural regions with urban centres

Given extremely high housing costs and stagnant wage growth, there is an increasing proportion of young adults leaving larger cities, seeking more affordable lifestyles. However, many continue to work in urban areas or suburban economic zones, and therefore join the millions of commuters with long commutes, putting further strain on urban and regional infrastructure.

The Institute has long supported mass public transit, particularly in and around the Toronto Region, where density mandates transit that can help alleviate existing congestion. Congestion has many costs, but also limits the mobility and efficiency of trucks and commercial vehicles that can only transport goods using existing roads. Governments and firms need to rethink the way existing roads are used. Mass transit in the form of surface and light rail is crucial to connect cities and regions. As the Institute mentioned in *The Future is Not Destiny*, a single company makes 20,000 trips between Toronto and Kitchener-Waterloo every year![94] Compounded across hundreds of companies, the loss of productivity due to congestion will have an increasingly negative impact on the province's economy.

Infrastructure must be adequate to facilitate the transportation of goods, services, and people to major markets. Mass transit should be efficient, and effectively meet the needs of customers. Frequency is a central concern to address customers' needs and to offer a compelling reason to not choose driving instead. To counter increasing stress on infrastructure and hindered productivity, the provincial government should commit long-term to funding public transit, and encourage other levels of government to do the same.

Another marked trend is seeing the growing rift between urban centres and surrounding rural areas, with the latter's

population shrinking, aging, and earning lower incomes. Clusters can remedy or reverse these trends by taking advantage of regions' unique and underleveraged assets, as in the case of Savour Muskoka.

Integrate policies with federal and municipal/regional ambitions

ISED has kick-started Canadian cluster policy at the national level. Ultimately though, clusters are a regional phenomenon that require support from all levels of government. Thinking beyond superclusters, regions need municipal support to cultivate local clusters, provincial support as they scale up, and finally national support to expand into foreign markets.

Remove trade barriers and regulations

Cluster policy should seek to scale up firms through internationalization. It is often forgotten just how much potential the Canadian economy holds for domestic businesses. Canada is a G7 nation with a $1.7 trillion economy and millions of potential middle class customers. Yet, many local firms choose to skip this market in favour of the US and others because of myriad regulatory hurdles between the provinces, and burdensome protections within Ontario. While there have been calls to address this issue, and memoranda of understanding signed, firms will continue taking their business elsewhere until real action is taken.

RECOMMENDATIONS FOR THE FEDERAL GOVERNMENT

There are a number of challenges for the federal government with the introduction of the ISI: sustaining the funding after five years, and aligning federal policies with the ISI while also working with other levels of government. Clusters are a long-term investment, since building trust, specialization, and collaboration take time and concerted effort. In many cases, it could even be decades before cluster organizations become self-sustaining, producing tangible results that increase the country's competitiveness. A substantial investment will shorten this timeline, but superclusters will need to look to other revenue sources once government funding runs out.

Separate cluster policy from innovation policy

Comparing Canada's ISI program with international initiatives reveals a disparity in the funding of cluster organizations. Compared to international counterparts, the superclusters receive approximately ten times the funding of other clusters in the rest of the world. Worse, with a tenth of the number of proposed initiatives, funding for each cluster per initiative is 100 times higher than in other countries.

This has implications for cluster policy in Canada. International examples show that it is possible to build effective cluster ecosystems at a fraction of the cost for the five superclusters. Spending such a substantial amount of money on superclusters sets very high expectations for these clusters' success. The Institute looks forward to seeing these successes.

In addition, there is concern from those in the global cluster community that the ISI is, in fact, an innovation policy, not a cluster policy. The federal government appears to focus on R&D and innovation to jumpstart Canada's economic competitiveness. Innovation policy is important, but should only be one part of an overall cluster strategy. Increased levels of innovation and R&D are the by-products of an effective cluster ecosystem. Actors work together on cluster initiatives that pave the way to improving processes that currently impede innovation and commercialization. A cluster helps create scale for organizations, especially SMEs that may not necessarily have the inherent customers from the onset.

The ISI is a bold initiative, and has proven to bring many actors together. But other government and cluster actors can rest assured that following best practices demonstrated by global clusters in any future cluster development, can fund cluster organizations and their initiatives at a fraction of the ISI budget, and still generate positive results.

Collect more granular data for effective analyses and improvement

Data is at the heart of informed decisionsand evidence-based policymaking. To give the best chance for Canadian clusters to succeed, it is necessary to know the organizations and firms, trade networks, labour, and investment that comprise each cluster. Canada currently has data to accurately measure employment count by industry, which can then be aggregated into corresponding clusters. However, there remains a lack of data on wages and industry-to-industry trade flows at the granularity (geographic and industry levels) needed for an effective analysis. This will prevent policy makers from understanding the benefit clusters have on their efforts, as well as knowing which clusters are forming the strongest connections. Therefore, this will make it hard to measure the annual changes since the data are often plagued by methodological changes that make comparability difficult, if not impossible.

As Canada's cluster ecosystem develops, there will be a demand for new data (e.g., cluster maps, network analyses, and cluster evaluations) and organizations to undertake the responsibility of collecting and analyzing it. Data needs and evaluations must be designed into the program or initiative at the onset to ensure that they are addressed.

Train cluster managers and benchmark cluster organizations

As emphasized in this Working Paper, the importance of cluster managers cannot be understated. As Canada fully immerses itself in cluster policy, proper leadership will be needed at the helm. All clusters, including those within each supercluster, once formally organized with clusters managers on board, should receive training. Until Canada has a critical mass of cluster managers that would mandate creating a national training program for cluster managers' skill development, they should consider joining the European Foundation for Cluster Excellence. They offer a range of training programs, from the more general Competitiveness School, which covers cluster theory and practice, to Gold Cluster Excellence Manager, an intensive program for cluster managers who want to develop advanced skills. These programs range from five weeks to six months, delivered in-person and online by cluster practitioners and academics from around the world.

Furthermore, cluster organizations should undergo cluster labelling and certification with the European Secretariat for Cluster Analysis, which would include cluster manager evaluation. While this is a lengthy endeavour, the experience will help identify how the cluster organization (and by extension cluster manager) can improve, which ultimately serves their members.

Create a body to support superclusters and clusters in Canada

In addition to the incredible expectations that superclusters face to produce results within a very short period, they are also expected to address many of the prevailing issues identified in this Working Paper. This is a tall order and therefore the Institute recommends that the federal government create a non-profit organization that can support superclusters and other clusters in Canada. Its services can include bringing in international experts to further cluster development knowledge, helping existing industry associations develop or transform into cluster organizations (if needed), helping clusters formalize, providing resources to help with cluster evaluation and addressing the diversity and internationalization needs of clusters, and convene clusters for more inter-cluster collaboration. This organization mirrors the work of Cluster Excellence Denmark, which is the national support organization for innovation networks and clusters.[95]

Keep track of the clusters that submitted ISI proposals

There were 50 proposals submitted as part of the ISI. When the shortlist of 9 applicants were announced, this gave some of the clusters that were not selected the opportunity to join one of the nine. The Institute recommends that ISED continue to track the progress of these clusters. Many of these proposals had potential to move forward but lack the resources and a framework to do so.

RECOMMENDATIONS FOR ACADEMIA

Educational institutions have an important role in training the future and current labour force. Within a cluster ecosystem, they work with firms and government to teach skills and competencies to encourage students to work toward meaningful, in-demand careers.

Take the lead in supplying the cluster's talent

Academia is often the forgotten member of cluster ecosystems, as they are not drivers in the way that firms are, nor do they set regulations like government. But many clusters face challenges in talent attraction, especially in highly specialized industries. Educational institutions have two key roles to address this issue. First, clusters must create 'home-grown' talent by taking secondary school students and preparing them academically for jobs specific to their cluster, side-stepping the need to compete with other jurisdictions or clusters for the same talent. The second key strategy is to use an institution's status to attract the best non-local students, and work with government to retain the human capital post-graduation.

Furthermore, it is increasingly required for academia to lead with re-skilling and re-training talent. This requires a close relationship with firms, and new ways of providing education. Instead of requiring that students appear in person for every class, an increase in the use of MOOCs, online tools, and peer learning can enhance re-training, and provide the legitimacy offered by accredited public institutions.

Establish stronger ties between academia and cluster organizations

In many academic institutions, there is disconnect between the institutions and the cluster organization. Firms often opt to work with foreign institutions rather than the ones within their cluster. Whether this occurs due to personality issues, a lack services offered by the university, or prestige, it is important to understand these issues exist, and that there must be increased collaboration within clusters.

RECOMMENDATIONS FOR THE PRIVATE SECTOR

Firms are at the heart of a cluster and in any Triple Helix partnership. It is not to say, therefore, that other cluster actors must do all the heavy lifting, and acquiesce to the needs of firms. A Triple Helix arrangement should benefit all parties involved. Clusters cannot function without the work of and buy-in from businesses.

Take the lead on cluster initiatives

Private firms tend to wait for the government's lead before starting an initiative at least in Canada. Yet there is no need for government action before organizing a cluster, and firms should consider initiating the process themselves. The ISI provides an opportunity by having 'role model' clusters currently operating in Canada, and a growing network of cluster practitioners, available to offer advice on best practices. Firms, industry associations, and applicants to the ISI should consider joining one of the five superclusters or forming their own initiative to take advantage of the economic benefits brought forth by clustering.

The Institute recognizes, though, that there are certainly cases in which government-funded organizations or industry associations take the lead in formally organizing a cluster, hiring a cluster manager, and creating a cluster organization. Firms should support and join this endeavour.

Collaborating always outweighs working alone

Collaboration is key to successful cluster initiatives. Experience working together makes future cooperation easier. Canadian clusters may be less experienced than their international counterparts, but have the benefit of learning new solutions to issues they face. One such issue that will inevitably arise is that of intellectual property (IP), and the sharing of confidential information. Data sharing agreements should be in place, and government should develop regulations to keep IP within the country. Informal gatherings and social events where leaders can get to know one another have proven effective in establishing the trust required to work together. Institutions for collaboration are part of what are known as "soft (knowledge) infrastructure," that is, services required to maintain a cluster.[96]

Being inclusive and embracing diversity in talent is a good long-term strategy

Canada is currently facing a shortage in skilled labour.[97] Even if firms join cluster initiatives, and develop plans for innovating and exporting in the world economy, it cannot come to

fruition without the necessary labour. As the labour force ages and workers look towards retirement, a shortage of talent will hinder firms' growth opportunities. To compete internationally, firms must become creative in unlocking the potential and latent talent in existing, but under-represented communities.

Inclusion of more women, minorities, and new immigrants will help fill the labour gap. The Institute has written extensively on improving labour market opportunities and outcomes of diverse groups, including youth, women, Indigenous peoples, older workers and immigrants. Some key policy recommendations include:

Commit to the Women's Empowerment Principles (WEPs). Companies need to publicly commit to ensuring gender equality in the workplace. The WE EMPOWER Programme of UN Women offers CEOs the opportunity to sign a public declaration that supports seven principles that focus on gender equality.[98] This is also where cluster organizations can play a role in encouraging members to commit to WEPs, and share resources and best practices on how to implement them.

Use better verification of foreign education. It is challenging for employers to understand the value of education obtained outside of Canada, making it hard to compare a degree from one institution to another, regardless of age and/or gender of the applicants. The Institute has recommended that the Educational Credential Assessment presently used only for immigration processes be expanded and available for use by corporate human resources departments when vetting applicants. This system can be integrated into digital recruitment processes, and even adopted in LinkedIn and other professional network platforms to guide decision-making on a candidate's educational background. In the end, it is up to individual companies to adopt these measures, or use them to inform hiring decisions.

In order for clusters to flourish, firms, academia, and government must commit to learning how to do business within a cluster ecosystem. One reason many clusters are not globally competitive is that often one or more actors is not yet willing to dive into what appears to them to be the murky waters of cluster development. Yet widespread cluster success can only improve the overall prosperity of a region and, in turn, help those within it thrive.

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European Cluster Observatory – http://www.clusterobservatory.eu/index.html

Russian Cluster Observatory – http://map.cluster.hse.ru/

US Cluster Mapping – http://www.clustermapping.us/

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International Cluster Networks

European Cluster Collaboration Platform – https://www.clustercollaboration.eu/

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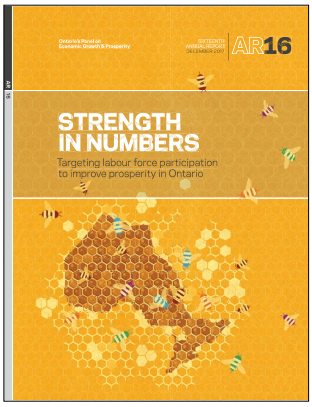

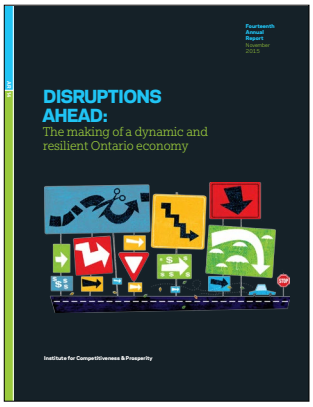

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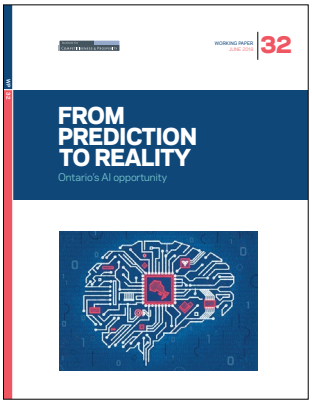

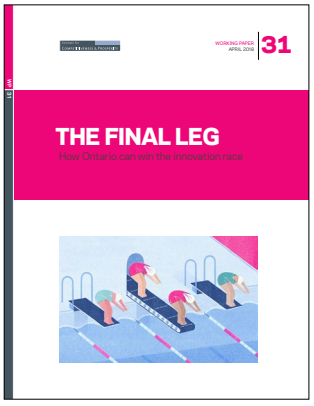

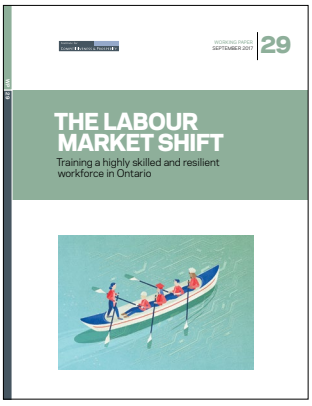

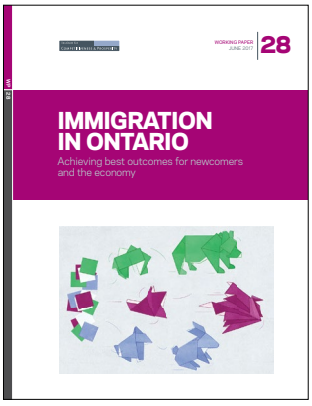

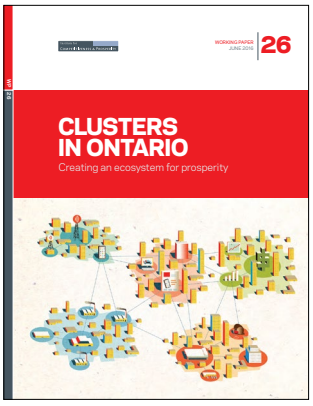

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