

Closing Canada's Big Data Talent Gap



Canada's Big Data Consortium
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Executive Summary

Big Data and Analytics¹ are under pressure. Bold promises have been made: exceptional customer insights; better decision-making; improved productivity and performance; and product and service innovation. Positive public and social outcomes have been proposed: improved health care, social services, public safety, and infrastructure; and strengthened research and development, commercialization, and economic growth. Now, it's time to deliver.

But the promise of Big Data and Analytics faces a key constraint: a talent gap that is felt across all of Canada's regions, sectors, and industries. To date, closing this talent gap has posed a significant challenge – in large part because organizations typically have been looking for “unicorns,” those individual candidates with the perfect mix of technical, business, as well as industry and functional knowledge and expertise.

As employers struggle to recruit, retain, and train enough of the right talent to collect, organize, analyze, interpret, and communicate today's unprecedented volumes of data, Big Data and Analytics are at risk of becoming a promise unrealized.

Figure 1. The Promise of Big Data is Constrained by Canada's Big Talent Gap



¹ In this paper, “Big Data and Analytics” may also be referred to as “Big Data,” for brevity.

What Does Canada's Big Data and Analytics Talent Gap Look Like? What Can Be Done?

In a report published 2011, it was estimated that by 2018 the United States alone faces a talent gap of 140,000 to 190,000 professionals with deep analytical skills, and 1.5 million more to interpret and use findings effectively for decision making². How big is this talent gap in Canada, and what can we do to address it?

This paper, "*Closing Canada's Big Data Talent Gap*," represents the results of the first in-depth examination of the size and nature of Canada's Big Data Talent Gap³. Prepared on behalf of Canada's Big Data Consortium, which was formed by Ryerson University in 2014, this study has benefitted from the participation of organizations from coast-to-coast, and across multiple sectors – industry, government, and academia.

Through a two-phased research process, we found that Canada's Big Data Talent Gap is estimated between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect. The gap for professionals with solid data and analytical literacy to make better decisions is estimated at a further 150,000, such as those required for roles like Business Manager and Business Analyst.

We found that Canadian employers across all regions, sectors, and industries are finding it increasingly difficult to recruit, retain, and train Big Data and Analytics professionals. We discovered that Ontario, particularly the Greater Toronto Area, is currently the demand epicentre for Big Data and Analytics talent. And we learned that the industries feeling the most pressure for talent include Finance and Insurance, and Professional, Scientific and Technical Services.

And by all accounts, the situation will worsen unless we take action now. Even when the overall gap is narrowed, we believe a shortage of talent with the right skills will persist unless existing academic and training curriculum are expanded to better meet employers' needs.

Working with senior information technology and information management leaders in Canada, the Consortium has developed six strategies, presented in this paper, to help close this country's Big Data and Analytics talent gap.

But there are no quick-fixes. Constantly changing labour market dynamics mean we will need to remain fluid and adaptable. But we believe the strategies presented in this paper represent solid first steps to help close the talent gap and ensure that Canada is positioned to realize the potential of Big Data and Analytics.

² "Big Data: The Next Frontier for Innovation, Competition, and Productivity," McKinsey & Company, 2011.

³ In this paper, the "Big Data and Analytics Talent Gap" will also be referred to as the "Big Data Talent Gap," or the "Talent Gap," for brevity.

Canada's Big Data Talent Gap Study

In 2014, Ryerson University launched Canada's Big Data Consortium to bring industry, government, and academia together to collaborate on key issues related to Big Data and Analytics. The Consortium's founding partners include:



For its inaugural project, the Consortium led the first national, multi-sector study on Canada's Big Data and Analytics Talent Gap. Our objectives were to better understand the breadth and depth of the talent gap, as well as to develop strategies to help close the gap so that Canada can continue to innovate, compete, and grow its economy.

Phase One: Online Survey and Labour Market Research

From October 2014 to January 2015, a national online survey was conducted. The survey was open to Canadian public and private sector organizations of all sizes, regions, sectors, and industries. A total of 332 survey submissions were received, including 124 completed and 208 partially completed submissions. The findings from the online survey will be published in a subsequent paper.

From February to July 2015, labour market research was conducted, involving an analysis of over 1,700 Big Data and Analytics related jobs posted in 2013 and 2014 from Magnet (www.magnet.today), and over 330 jobs posted in July 2015 from LinkedIn® Corporation (www.linkedin.com).

Phase Two: Canada's Big Data Talent Gap Summit

On April 15, 2015, Canada's Big Data Talent Gap Summit was held. Hosted at Deloitte's Greenhouse in Toronto, the Consortium brought together 30 senior information technology and information management executive participants from leading industry, government, and academic organizations across Canada. Our objectives were to discuss the current state of the talent gap, to share strategies and best practices in recruitment and retention, and to collaborate on the development of strategies for closing the talent gap.

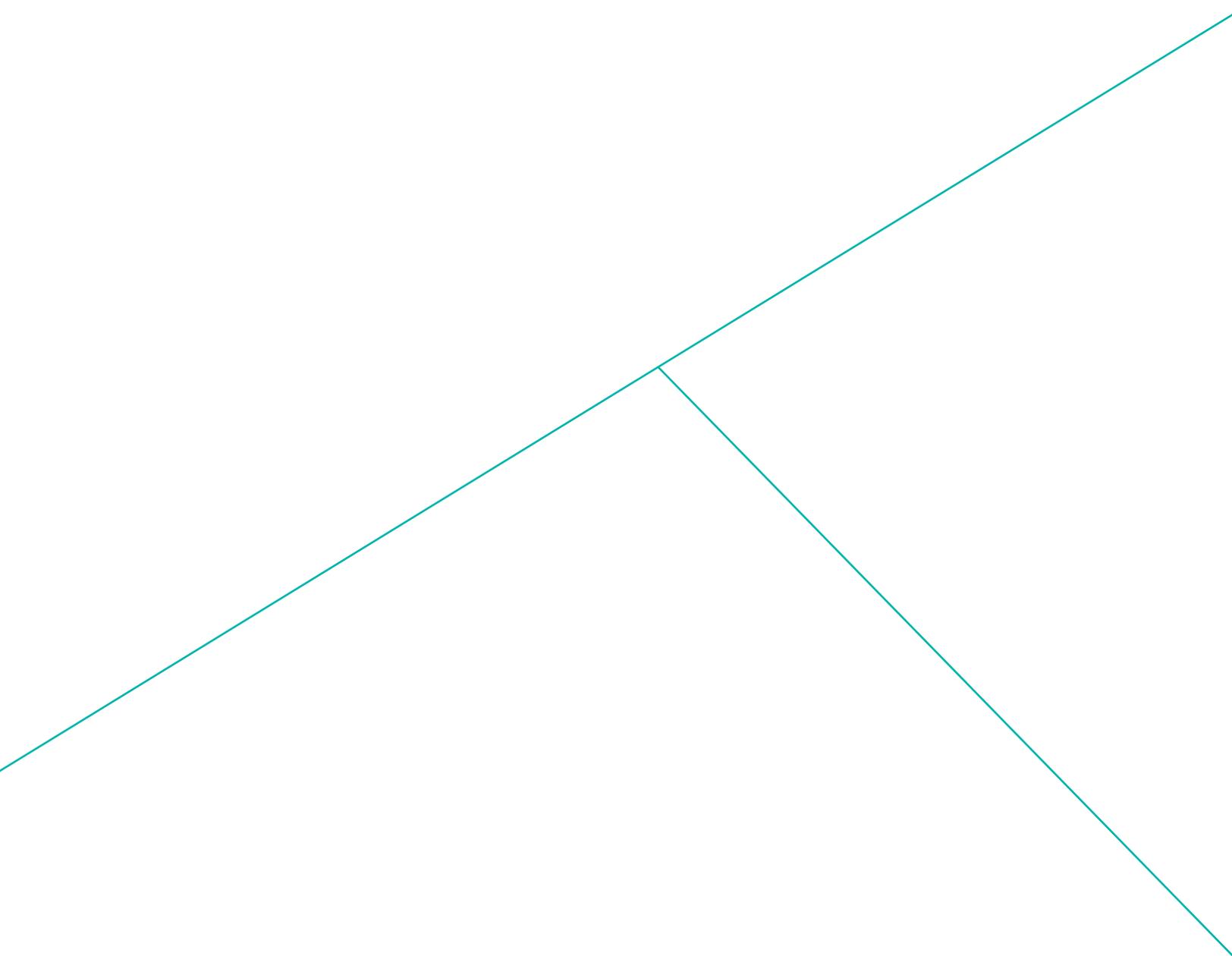
This paper presents the outcomes of our study.

Part One: Canada's Big Data Talent Gap: A Tale of Two Gaps

In the first portion of Canada's Big Data Talent Gap Summit proceedings, the results of *Phase One: Online Survey and Labour Market Research* were presented.

Our research found that there were two distinct Big Data and Analytics Talent Gaps: (1) an overall shortage of talent to meet employers' demand, "I Need Talent"; and (2) a shortage of the specific type of talent that employers are demanding, "I Need the Right Talent."

This section presents the highlights.



Based on our sample of LinkedIn® Jobs, two industries alone accounted for 57% of the demand for Big Data and Analytics talent: (1) Finance and Insurance, representing 29% of relevant job postings; and (2) Professional, Scientific and Technical Services, representing 28% of relevant job postings



1,746 Big Data, Analytics Job Postings Analyzed
(2013-14)



339 Big Data, Analytics Job Postings Analyzed,
including 71 postings with "Big Data" and "Data
Scientist" in Title (July 2015.)

Gap 1: “I Need Talent”

In its 2011 report, *“Big Data: The Next Frontier for Innovation, Competition, and Productivity,”* McKinsey & Company estimated that by 2018 “the United States alone faces a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts to analyze big data and make decisions based on their findings.”

If Canada’s labour market is approximately 10% the size of our U.S. counterpart⁴, using the U.S. figures above, Canada’s overall shortage of talent can be estimated at between 14,000 to 19,000 professionals with deep analytical skills, and 150,000 data literate managers and analysts.

To test and refine this estimate, we turned to Magnet (www.magnet.today), an online job matching service with over 2.4 million jobs stored from sample years 2013-2014 alone. Setting a series of primary search criteria related to Big Data and Analytics, we found 696 and 1,050 relevant job postings in 2013 and 2014, respectively⁵.

According to some estimates, the hidden job market – where job openings are not publicized – accounts for up to 80-90% of hires. Using a conservative estimate where only 10% of open positions are actually publicized, and Magnet’s data point of 1,050 relevant job postings in 2014, Canada’s estimated demand for professionals with deep analytical skills can be estimated at 10,500.

We estimate Canada’s Big Data Talent Gap is between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect.

We further estimate the gap for professionals with solid data and analytical literacy to make better decisions at 150,000, such as those required for roles like the Business Manager and Business Analyst.

Thus, we estimate Canada’s Big Data Talent Gap is between 10,500 and 19,000 professionals with deep data and analytical skills, such as those required for roles like Chief Data Officer, Data Scientist, and Data Solutions Architect. We further estimate the gap for professionals with solid data and analytical literacy to make better decisions at 150,000, such as those required for roles like the Business Manager and Business Analyst.

These numbers are intimidating, but they only illustrate part of the challenge. To truly tackle the talent gap, we believe that understanding its composition is essential to developing targeted strategies.

⁴ According to Statistics Canada, Canada’s population in 2014 was approximately 35.4 million. According to the United States Census Bureau, the U.S. population in 2015 is approximately 321.5 million. Thus, Canada’s labour market is estimated at approximately 10% of its U.S. counterpart.

⁵ Given this targeted sample search criteria, highly relevant jobs with titles that contain terms other than Big Data and Analytics may not have been captured, meaning that actual demand is potentially even greater.

Gap 2: “I Need the Right Talent”

To better understand the shortage of the specific type of talent that employers are demanding, we turned to LinkedIn⁶ (www.linkedin.com). Using LinkedIn[®] Jobs, we identified 339 relevant open and existing job postings across Canada for further analysis. Here are some highlights of what we found.

Ontario is the Demand Epicentre for Big Data and Analytics Talent

Based on our sample of LinkedIn[®] Jobs, Ontario – specifically the Greater Toronto Area – is currently the demand epicentre, accounting for 77% of relevant job postings.

Three other regions showed demand for Big Data and Analytics talent: British Columbia, representing 8% of relevant job postings; and Quebec and Alberta each representing 6% of relevant job postings.

Finance and Insurance, and Professional, Scientific and Technical Services Industries are Driving Demand for Big Data and Analytics Talent

Based on our sample of LinkedIn[®] Jobs, two industries⁷ alone accounted for 57% of the demand for Big Data and Analytics talent: (1) Finance and Insurance, representing 29% of relevant job postings; and (2) Professional, Scientific and Technical Services, representing 28% of relevant job postings. Information and Cultural Industries came in third, accounting for 12% of relevant job postings.

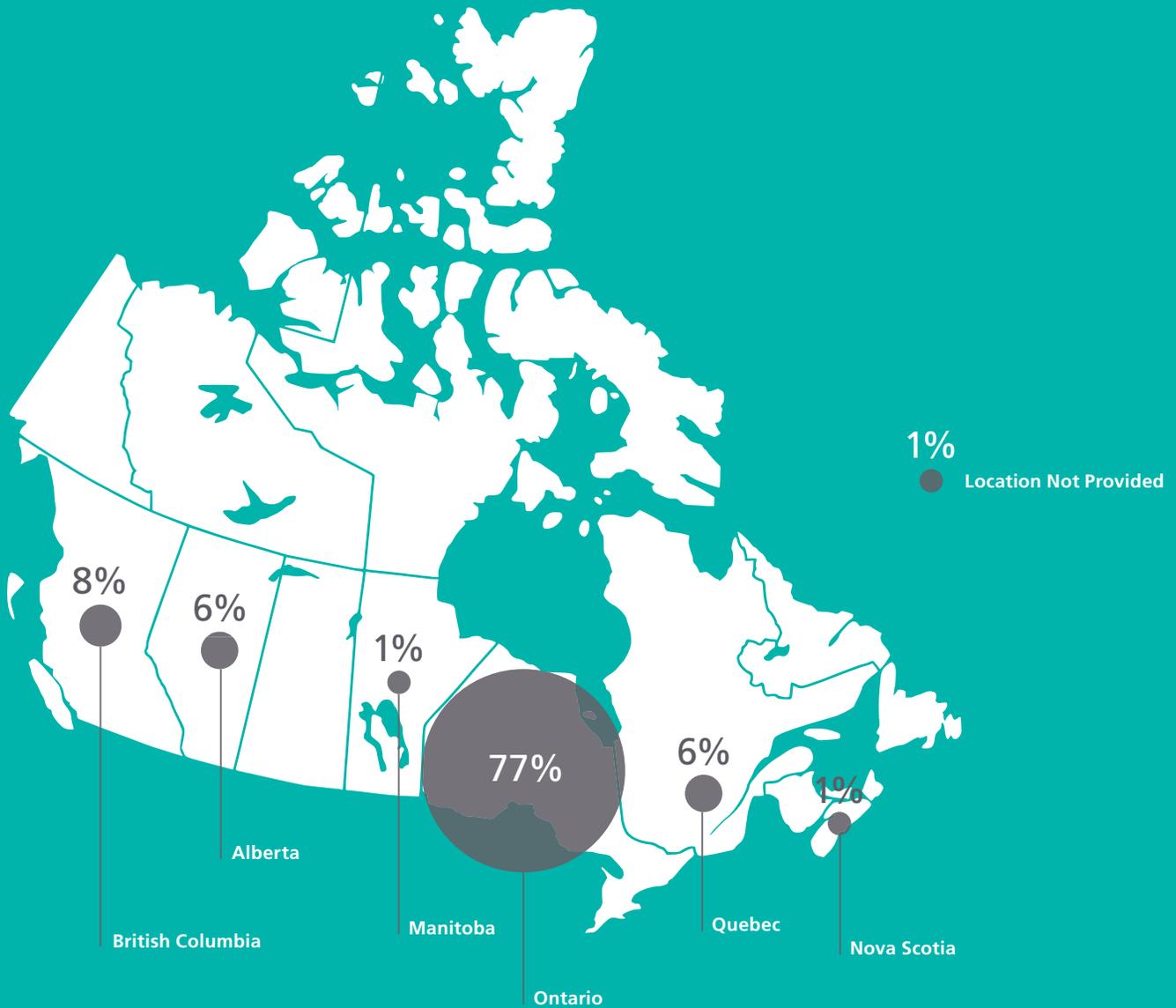
To truly tackle Canada’s Big Data Talent Gap, we believe that understanding its composition is essential to developing targeted strategies.

⁶ Using LinkedIn[®] Jobs, 339 relevant and open existing jobs were identified: 39 jobs with “Big Data” in the title; 32 jobs with “Data Scientist” in the title; and 268 jobs with “Analytics” in the title (July 2015).

⁷ In this study, the North American Industry Classification System (NAICS) was used for industry classifications.

Figure 2. Ontario is the Demand Epicentre for Big Data and Analytics Talent

Based on our sample of LinkedIn® jobs, Ontario — specifically the Greater Toronto Area — is currently the demand epicentre, accounting for 77% of relevant job postings.



Employers are Demanding More Than Just Technical Skills

Based on our sample of LinkedIn® Jobs, we found that for all of the 71 open and existing postings with “Data Scientist” and “Big Data” in the job title, project management and consulting-related skills were identified as either a job requirement or a qualification requirement.

Specifically, all of the jobs within this sample set cited project management, or tasks associated with project management (e.g. overseeing the design, development, implementation of Big Data or Analytics solutions or initiatives), as requirements.

Moreover, all of the jobs within this sample set also cited consulting-related skills (e.g. communications, client interviews for business problem assessment, problem definition, as well as solution option development, evaluation, and recommendation) as requirements.

Jobs within this sample set also often cited industry and functional knowledge and experience, but as qualification assets. This will pose a continuous challenge as these skill sets are best gained through on-the-job experience, rather than through curriculum.

While organizations are certainly demanding technical skills such as data mining and data analysis, employers are clearly telling us that their ideal candidates must possess more than just technical skills.

Based on our sample of LinkedIn® Jobs, we found that for all of the 71 open and existing postings with “Data Scientist” and “Big Data” in the job title, project management and consulting-related skills were identified as either a job requirement or a qualification requirement.

Figure 3. Finance and Insurance, and Professional, Scientific and Technical Services Industries are Driving Demand for Big Data and Analytics Talent



Based on our sample of LinkedIn® jobs, two industries alone accounted for **57%** of the demand for Big Data and Analytics talent.

Even When the Overall Gap is Narrowed, a Shortage of the Right Talent Will Persist

In *Phase One: Online Survey and Labour Market Research*, a sampling of the offerings currently available in the Greater Toronto Area through universities, colleges, and training companies⁸ was analyzed. Here are some highlights of what we found:

- Existing curriculum is typically industry-agnostic. While there are limited industry-specific offerings available (e.g. tailored for Health), our research indicates that other industries, such as Finance and Insurance, and Professional, Scientific and Technical Services, currently represent higher demand for talent, but are not yet addressed by existing curriculum.
- Existing curriculum is typically function-agnostic. While there are limited offerings specific to Sales and Marketing, our research indicates that other functions, such as Corporate Management, Information Technology, and Business Operations, currently represent higher demand for talent, but are not yet addressed by existing curriculum.
- Existing curriculum is typically focused on technical competencies, such as data mining, data analysis, and data solution architecture. Our research indicates limited offerings that cover complementary skills, such as project management and consulting-related skills, which are in demand by employers. This is particularly the case with training companies researched.

Until existing curriculum is expanded to better match employers' needs, even if the overall number of graduates is increased – addressing the “*I Need Talent*” gap – we believe that a shortage of the *right* talent will persist.

⁸ Big Data and Analytics offerings available in the Greater Toronto Area were researched (2014). Ten universities: Athabasca University; Laurier University; McMaster University; Queen's University; Ryerson University; University of Ontario Institute of Technology; University of Toronto; University of Waterloo; University of Western Ontario; and York University. Five colleges: Centennial College; George Brown College; Humber College; Seneca College; and Sheridan College. Three training companies: Learning Tree International, Inc.; Global Knowledge Training LLC; and Simplilearn Solutions.

Part Two: Six Strategies for Closing Canada's Big Data Talent Gap

In the second portion of Canada's Big Data Talent Gap Summit proceedings, the participants collaboratively explored the question, "*What new strategies should we be considering to help close Canada's Big Data Talent Gap?*"

Participants at the Summit were encouraged to think big, and to develop solutions beyond traditional organizational, industry, sector, and regional boundaries. Six key strategies were proposed. This section presents the highlights.

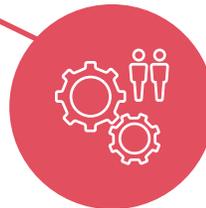
1. Multi-Sector Solution

Canadian organizations across all regions, sectors, and industries are feeling the effects of the Big Data Talent Gap. Even the best efforts to narrow the gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations. Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution. Ryerson University launched Canada's Big Data Consortium with this in mind, and will continue to facilitate and grow the Consortium to collaboratively tackle key issues related to Big Data and Analytics, including Canada's Big Data Talent Gap.



2. Improve Labour Market Clarity

What is a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they do? In the absence of common professional definitions and career pathways, organizations are struggling to clearly express their Big Data and Analytics talent needs, and prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics. Establishing common professional definitions and career pathways would improve labour market clarity; it is a foundational step to tackling Canada's Big Data Talent Gap.



3. Better Meet Employer Demands

Canadian organizations are certainly demanding technical skills such as data mining and data analysis, but the employers we researched cited with equal frequency complementary skills, such as project management, and consulting-related skills. To build the next generation of Big Data and Analytics professionals, academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to incorporate these complementary skills. And, as data literacy becomes an imperative for all professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.



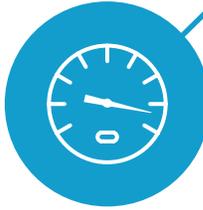


4. Leverage Existing Talent



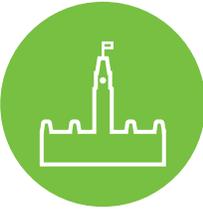
Canadian organizations are relying on recruiting new (external) talent, primarily through traditional recruiting methods to meet Big Data and Analytics requirements. But there are distinct advantages to developing Big Data and Analytics talent from within organizations. Existing (internal) talent possess the deep industry and functional expertise, as well as knowledge of their organization's people, processes, and technologies so essential for extracting value out of data that could potentially take years to acquire. As a complementary strategy to recruiting new talent, organizations should also consider looking in-house to identify additional sources of talent for development.

5. Optimize Talent Utilization



Using shared services models can be an effective strategy to optimize and amplify existing in-house talent to meet an organization's Big Data and Analytics requirements. For organizations that are in the early stages of adoption, such as those looking to complete some proof-of-concepts and pilot projects, a team based model where members collectively fulfill the full spectrum of requirements can be used. As organizations move along the adoption cycle, and Big Data and Analytics often transitions from being a functional resource into an enterprise resource, organizations can begin to build an enterprise-wide Centre of Excellence.

6. Government as Key Enablers



Government is an important advocate of economic growth, competitiveness, and innovation. All levels of government – federal, provincial, and municipal – should collectively assess its strategic levers (e.g. legislation, policies, programs, funding, etc.) to determine which resources could be used to support efforts to close Canada's Big Data Talent Gap, and develop a national talent strategy for Big Data and Analytics accordingly.

1. A Multi-Sector Challenge Requires a Multi-Sector Solution

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, Canadian organizations across all regions, sectors, and industries are feeling the effects of the Big Data Talent Gap.

Industry, government, and academia are all struggling to recruit and retain the talent needed to develop and implement Big Data and Analytics strategies and initiatives, and to conduct ground-breaking Big Data and Analytics research and development.

Academia is striving to design and deliver curriculum that will produce enough graduates with the right expertise to meet employers' ever-growing demand for Big Data and Analytics talent. All the while, government is seeking to support the deployment of talent – a critical national resource – to the right place, and at the right time through its labour market policies and programs.

The challenge is clearly complex. Even the best efforts to narrow the talent gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations.

Participants at the Summit unanimously agreed:

- Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution.
- Canada's Big Data Consortium is an excellent model to facilitate continuing discussion and collaboration.

Canada's Big Data Talent Gap is a multi-sector challenge that requires a multi-sector solution. Even the best efforts to narrow the talent gap – when done within traditional organizational, industry, sector, and regional boundaries – will have limitations.

Despite competition among many of these organizations for the same talent, participants at the Summit were candid about their challenges, and were ready to collaborate on strategies to close the talent gap. Here is what the participants proposed:

- Industry and government (as employers) should provide input on talent needs to help academia expand existing curriculum at all levels – including K-12, high school, undergraduate, graduate, professional, and executive – to build up the Big Data and Analytics talent pool.
- Industry should collaborate as a sector (e.g. via industry associations such as the Canadian Electricity Association, and functional associations such as CIO Association of Canada, and Information Technology Association of Canada) on talent retention and recruitment strategies and initiatives.
- Academia should work with industry and government to secure real-world data sets that students can work on, and co-op and internship placements that students can participate in.

This study and paper are the Consortium's first steps to help close Canada's Big Data Talent Gap. Ryerson will continue to work with the Consortium to establish a framework of ongoing collaboration on key issues related to Big Data and Analytics, including Canada's Big Data Talent Gap. Ryerson will also continue to facilitate and grow the Consortium, and strategically build out working groups, particularly around the talent gap strategies presented in this paper.

2. Improve Labour Market Clarity: Establish Common Professional Definitions, Career Pathways

There is significant variation in professional definitions. What are we referring to when we use the terms, “Big Data,” or the many variants of “Analytics”? What *is* a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they *do*?

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada’s Big Data Talent Gap Summit*, there is significant variation in definitions. What are we referring to when we use the terms, “Big Data,” or the many variants of “Analytics”? What *is* a Chief Data Officer, a Data Scientist, a Data Solution Architect, or a Business Manager? And what do they *do*?

What kind of talent are employers looking for? In the absence of common professional definitions, organizations are struggling to clearly express their Big Data and Analytics talent needs.

Likewise, in the absence of these common definitions and career pathways, prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics.

Participants at the Summit unanimously agreed that common definitions and career pathways are essential foundational steps to tackling Canada’s Big Data Talent Gap. Here is what the participants proposed:

- Industry, government, and academia should propose common definitions for Big Data and Analytics professions, including: key knowledge, experience, competencies, education, and training; and accreditation options.
- Industry, government, and academia should propose career pathways for prospective talent, and roadmaps on how they could become Big Data and Analytics professionals.
- The initial set of roles for common definitions and career pathways should include: Chief Data Officer; Data Scientist; Data Solution Architect; Business Manager; and Business Analyst.

Ryerson will be seeking input from Consortium members, Summit participants, as well as any other interested academic, industry, and government contributors – leading to the development of these common professional definitions and career pathways. They will be publicly shared and available for re-use.

In the absence of common professional definitions and career pathways, organizations are struggling to clearly express their talent needs and prospective talent are finding it difficult to assess their suitability, interest, and candidacy in the field of Big Data and Analytics.

3. Better Meet Employer Demands: Build More of the Right Types of Talent

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, organizations are looking to academic institutions – universities, colleges, and professional training companies in particular – to take the lead in building the next generation of Big Data and Analytics professionals, and a data-literate workforce.

Academia has a dual societal responsibility. On the one hand, it has a responsibility to develop leading research. But it also has a responsibility to develop a nation's talent pool, and highly employable graduates.

Academia recognizes that it has a critical role in helping close Canada's Big Data Talent Gap by designing and delivering the right curriculum, in sufficient volume and frequency, to meet employer needs. Here is what the participants proposed:

Building the Next Generation of Big Data and Analytics Professionals

Based on the research conducted in *Phase One: Online Survey and Labour Market Research*, while organizations are looking for candidates with technical skills, such as data mining and data analysis, employers also value candidates' complementary skills, particularly their project management and consulting-related skills.

As discussed on page 12, our research found that existing curriculum is currently limited in its industry-specific offerings, including for in-demand Finance and Insurance and Professional, Scientific, and Technical Services industries. Our research also found that existing curriculum is currently limited in its function-specific offerings to Sales and Marketing, which overlooks other functions, such as Corporate Management, Information Technology, and Business Operations.

Perhaps most importantly, our research found that existing curriculum is typically focused on technical competencies, such as data mining, data analysis, and data solution architecture, and is limited in covering project management and consulting-related skills. As discussed on page 11, these complementary skills were cited as frequently as technical skills throughout our sample of LinkedIn® Jobs researched.

Yet, a sampling of the Big Data and Analytics offerings currently available in the Greater Toronto Area through universities, colleges, and training companies shows that existing curriculum is not currently meeting the full scope of employer demand.

To build the next generation of Big Data and Analytics professionals, academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to at least incorporate project management and consulting-related skills, and ideally more industry and functional area applications that map to existing demand. And, as industry and functional knowledge and experience are best gained through on-the-job experience, an increase in the supply of internships and co-op opportunities also needs to be addressed.

Academia not only needs to increase its supply of curriculum at all levels (i.e. undergraduate, graduate, professional, and executive), it also needs to expand existing curriculum to incorporate project management and consulting-related skills, and ideally more industry and functional area applications that map to existing demand.

Building a Data-Literate Workforce

Data literacy is rapidly becoming an imperative for all professionals. The ability to analyze data and derive insights to improve decision-making can no longer remain the exclusive domain of the Big Data and Analytics professionals.

Yet, a sampling of the offerings currently available in the Greater Toronto Area through universities, colleges, and training companies shows that existing curriculum is not currently meeting this increasing employer demand for data-literate professionals. New offerings are being introduced, but they are typically offered at the executive education level, which may be cost-prohibitive for the mass market.

If we take a career pathways view for the next generation of professionals, data literacy should start long before where it commonly begins today, which is often at the graduate, professional, and executive education levels. At the Summit, attendee Dr. Fred Popowich, Professor of Computer Science and Director of the Professional Masters Program in Big Data at Simon Fraser University, proposed that data literacy curriculum should actually start as early as K-12, an argument that received unanimous support from participants.

To build the next generation of data-literate professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.

To build the next generation of data-literate professionals, academia needs to review its curriculum at all levels – K-12, undergraduate, graduate, professional, and executive – to ensure data skills are embedded at the right level at the right time.

The academic members of the Consortium will review the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit* and determine how they will adapt their existing curriculum, as well as internship and co-op opportunities, at their individual institutions. Moreover, recognizing that data literacy should start long before where it commonly begins today, Ryerson will continue to facilitate and grow the Consortium, including inviting experts from the K-12 education segment to participate.

4. Leverage Existing Talent: Source and Grow Talent Internally

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, organizations' primary strategy to address their talent gap is to recruit new talent. Over 75% of survey respondents rated recruiting new talent as either very important or important to their overall talent strategy.

But there are distinct advantages to developing Big Data and Analytics talent from within organizations. Existing employees typically have deep industry and functional expertise, as well as knowledge of their organization's people, processes, and technologies that could potentially take years – if not a career lifetime – to acquire. And because extracting value out of data depends so much on context, knowledge and experience possessed by existing talent is essential, if not irreplaceable.

Recruiting new talent alone is not sufficient to close an organization's Big Data Talent Gap.

Participants at the Summit unanimously agreed that recruiting new talent alone is not sufficient to close an organization's talent gap. Here is what the participants proposed:

- Employers should consider reviewing the common professional definitions to be developed as a follow-on to this paper. These common definitions will provide a baseline for key Big Data and Analytics professionals in terms of knowledge, experience, competencies, education, training, and accreditation requirements.
- As a complementary strategy to recruiting new talent, using these common definitions, employers should also consider looking in-house to identify additional sources of talent. An employee's role and responsibilities today does not accurately reflect his or her past experience, or future capacities and capabilities. The right talent can be found in unexpected places – an investment in training and development of in-house talent can be an effective talent strategy.



Talent Recruitment, Meet the Digital Age

Based on the research conducted in *Phase One: Online Survey and Labour Market Research*, organizations are still heavily relying on traditional methods of recruiting external talent: employee referral; company website; university and college career centres; staffing firms and consultants; and online career websites. This finding was confirmed during *Phase Two: Canada's Big Data Talent Gap Summit*.

However, a key issue here is that there appears to be a mismatch between the recruiting methods used, and the talent targeted. The push model of traditional recruitment methods can be effective at reaching the active talent pool, those already interested in a career change, but less effective at reaching the hidden talent pool.

Engage Candidates through Social Media.

Because Big Data and Analytics professionals are already in short supply, the high availability of opportunity means that talent is not easily reached by traditional recruiting methods.

The power currently rests in the hands of talent. Organizations need to stop assuming talent will go to them; instead, they need to go where the talent is and engage them where they are already frequently active – through social media.

Gamify Recruitment. The ideal candidate can come from multiple knowledge, experience, functional, industry, education, training, and accreditation backgrounds. An interest and aptitude for investigation, the love of asking the right questions, a hunger for answers and insights – these characteristics are all essential for extracting value out of data. But the traditional question-and-answer interview method is not well suited to test these types of competencies. Using a variety of non-traditional recruiting tools such as social media, hackathons, and simulations, organizations can better observe candidates showcasing their competencies in actively engaged contexts.

Participants at the Summit all agreed that traditional talent management tactics needed to be modernized, and augmented with new recruitment strategies, such as social media engagement, and gamification.

5. Optimize Talent Utilization: Use Shared Services Models

Based on the research conducted in *Phase One: Online Survey and Labour Market Research* and *Phase Two: Canada's Big Data Talent Gap Summit*, Canadian organizations of all sizes, from all regions, sectors, and industries are feeling the effects of Canada's Big Data Talent Gap.

The impacts of this shortage are being felt at all levels. As a result, organizations are challenged to develop and implement Big Data and Analytics strategies and initiatives. They are unable to design, develop, and implement pilots and proof-of-concepts, let alone a more comprehensive suite of programs and projects.

In some cases, talent exists, but is located in an organization's function (e.g. Information Technology, Business Operations, Sales and Marketing, etc.), and is not readily accessible to other groups. As a result, these high-demand resources cannot be easily shared and leveraged enterprise wide.

Participants at the Summit challenged themselves to stop looking for "unicorns," — those individual candidates that appear to possess that perfect mix of technical, project management, consulting-related, and industry and functional knowledge and expertise. Instead, these leading organizations proposed two alternate strategies:

5.1. Team-Based Model

Based on an assessment of its requirements, organizations can meet their talent needs by establishing a team of multiple resources, each with specific expertise, which collectively fulfills the full spectrum of an organization's Big Data and Analytics knowledge, experience, competencies, education, training, and accreditation requirements. The resources may or may not be dedicated to Big Data and Analytics, can be virtual or co-located, and can belong in any organizational function.

This model is often used in organizations that are in the early stages of Big Data and Analytics adoption, typically up to the point where an organization's function is looking to complete some proof-of-concepts and pilot projects.

Participants at the Summit challenged themselves to stop looking for "unicorns," — those individual candidates that appear to possess that perfect mix of knowledge and expertise and take different approaches to develop collective skills the organization needs. Instead, these leading organizations proposed two alternate strategies: (1) Team-Based Model; and (2) Centre of Excellence Model.

5.2. Centre of Excellence Model

As organizations move along the adoption cycle, Big Data and Analytics often transitions from being a functional resource into an enterprise resource. In doing so, organizations can begin to build an enterprise-wide Centre of Excellence (CoE), either by expanding an existing functional CoE, or by creating a new CoE.

Similar to the team-based model, an organization builds its CoE by assessing its requirements, and then building a team of resources, each with specific expertise, which collectively fulfills the full spectrum of an organization's Big Data and Analytics knowledge, experience, competencies, education, training and accreditation requirements. In a CoE, model, however, resources are fully dedicated to the CoE's Big Data and Analytics mandate.

The concept of building a Centre of Excellence is not new. But in practice organizations have found it to be an effective strategy to optimize and amplify talent that is valuable yet in short supply. For example, projects can be selected and prioritized based on factors such as strategic fit, business need, and business impact, and best practices and lessons learned can be codified and disseminated enterprise wide.

Moreover, CoEs encourage retention and critical on-the-job training through a steady flow of strategic, impactful, and interesting projects. A CoE model means that talent works on projects from any functional area of an organization, which encourages a deep level of understanding of multiple facets of an organization critical for effective strategic thinking.

In practice, organizations have found building Centres of Excellence to be an effective strategy to optimize and amplify talent that is valuable yet in short supply. Moreover, CoEs encourage retention and critical on-the-job training through a steady flow of strategic, impactful, and interesting projects.

Centre of Excellence Case Study 1: Workplace Safety and Insurance Board

The Workplace Safety and Insurance Board (WSIB) adopted a centralized Centre of Excellence (CoE) model in building a Predictive Analytics area back in 2011. Under the leadership of Dr. Eugene Wen, WSIB's Vice-President and Chief Statistician, the CoE became an enterprise-wide resource aiming to *"Deliver predictive analytical insights to staff and management in every line of business at the time they make decisions."*

Today, the Predictive Analytics area collaborates and supports the enterprise on a variety of topics including claim management, compliance, actuary, enterprise risk management and finance, with the overall goal of developing predictive models and carrying out in-depth analytical investigations. New technologies and best practices are also introduced into the organization and become part of routine input into senior executive discussions and decisions.

Building the CoE didn't happen overnight. WSIB senior management made investments into advanced analytics as part of its major strategic business transformation and focused on training and mentoring new recruits.

WSIB incrementally built the CoE looking for a diverse range of competencies and expertise that included statistics, math, computer science, database management, data analysis, consulting, simulation and management. Upon staff on-boarding, intensive training was arranged on modeling, and business process and consulting skills. Opportunities were offered to build business relationships with executives and frontline staff allowing the CoE team to work with different areas across the company and take on a variety of assignments.

Today, the CoE works on enterprise-wide projects originating from WSIB's President and CEO and senior executives in order to address challenging questions and information gaps in their strategic discussions and operational decisions.

Centre of Excellence Case Study 2: Deloitte's Centre of Excellence for Analytics

As Canada's largest professional services firm, Deloitte has long been addressing the challenge of recruiting, retaining, and training this type of niche-talent. As its practice continued to grow, the firm recognized the need to bring together expertise residing across the enterprise and, in 2013, launched its Centre of Excellence for Analytics.

With end-to-end Big Data and Analytics project support in mind, the CoE features two key, complementary facilities: (1) the Greenhouse; and (2) the National Discovery and Analytic Centre (NDAC).

Headquartered in Toronto, Deloitte's Greenhouse is a collaboration facility that enables organizations to explore Big Data and Analytics initiatives in an innovative environment that blends interactive immersive technologies, expert facilitation, and functional and industry expertise. It was here that Canada's Big Data Talent Gap Summit was held. Adjacent to the Greenhouse, the NDAC is a dedicated data and advanced analytics facility designed to manage today's high-volume processing requirements for Big Data and Advanced Analytics projects.

Strategic Resource Utilization, Enterprise-Wide

In addition to providing a maximum security environment for data processing and hosting, Deloitte's Centre of Excellence for Analytics supports Big Data and Advanced Analytics projects of all sizes and complexities, across all of industries that the firm services.

Using this shared-services model, the CoE employs in-demand resources – data scientists, data architects,

data visualization experts, and software and tools experts – who are easily located and deployable across projects in a strategic way. As the CoE is connected to Deloitte's global network, the CoE is able to scale even more by being able to leverage the firm's expertise worldwide. As a result, the firm has been able to accelerate its project work, despite a talent gap in the broader labour market.

Enhanced Talent Recruitment, Retention, and Training

From the recruitment perspective, the CoE has become a beacon for both in-house and new talent. Deloitte has recognized that there is a shortage of Big Data and Analytics talent and as a result, is being intentional in its efforts to attract and retain candidates by providing them with a competitive environment that promotes development and growth opportunities.

In its role as a Big Data and Analytics "evangelist," as the broader firm learns more about the field, in-house professionals have increasingly self-identified as candidates for related roles. And because the CoE is involved in leading-edge Big Data and Analytics projects from across all of Deloitte, its resources benefit from the kind of professional learning and development and continuous on-the-job training that is essential to top talent retention.

Today, external talent identifies Deloitte's Centre of Excellence for Analytics as a key reason for selecting the firm as a preferred employer.

On the surface, building a Centre of Excellence may appear more realistic for larger organizations – they simply have more resources at their disposal. But small and medium-sized organizations can still benefit by building components of a CoE around the right subject matter expert, and then build incrementally.

Alternatively, small and medium-sized organizations can engage relevant industry associations (e.g. the Canadian Electricity Association) and functional associations (e.g. CIO Association of Canada, and Information Technology Association of Canada) to discuss development of a collaborative Big Data and Analytics Centre of Excellence.

Ryerson will work with the Consortium members, Summit participants, and any other interested academic, industry, and government contributors, to conduct further research on the best practices around the development of Big Data and Analytics Centres of Excellence and to explore the feasibility of a multi-sector pilot Big Data and Analytics Centre of Excellence.

6. Government as Key Enabler: Develop a National Talent Strategy for Big Data and Analytics

Participants at the Summit unanimously agreed that the support of all levels of government can amplify industry and academia's collective efforts to close Canada's Big Data Talent Gap. Here is what the participants proposed:

- Currently, there are no governmental talent development programs specific to Big Data and Analytics. Government should consider whether support specific to Big Data and Analytics, as well as any other areas where talent gaps exist or are anticipated, might be appropriate.
- All levels of government – federal, provincial, and municipal – should collectively assess its strategic levers (e.g. legislation, policies, programs, funding, etc.) to determine which resources could be used to support efforts to close this talent gap, and develop a national strategy for Big Data and Analytics accordingly.
- Government should continue to explore ways to better leverage already existing but underutilized talent pools, such as women, older professionals, and immigrants. By minimizing barriers and encouraging participation by these groups, the pool of Big Data and Analytics talent grows.
- Government should continue to explore ways to facilitate the movement of talent within Canada, but also internationally through strategic immigration policies. Summit participants highlighted existing immigration policies as a priority for government

Through their participation in the Consortium, the Government of Canada and the Government of Ontario have demonstrated their interest in collaborating with industry and academia in tackling Canada's Big Data Talent Gap.

review in order to support Canada's ability to source global talent. Moreover, government should continue to develop strategies that help industry and academia to maintain connections with expatriate Canadian talent, to facilitate and encourage their return.

- Government should continue to promote awareness of its already-existing resources. For example, at the federal level, many existing policies, programs, and grants exist (e.g. Natural Sciences and Engineering Research Council of Canada (NSERC), Social Sciences and Humanities Research Council (SSHRC), Canada Foundation for Innovation, National Research Council (NRC), MITACS, etc.), but few participants were aware of, or understood, the programs in sufficient detail to be a beneficiary.
- Government should become a model user of Big Data and Analytics, spurring talent development by sharing its vast data sets through Open Data / Open Information gates, so that students and professionals undertaking education, and training can work on real data sets and problems.

Government is an important advocate of economic growth, competitiveness, and innovation. Through their participation in the Consortium, the Government of Canada and the Government of Ontario have demonstrated their interest in collaborating with industry and academia in tackling Canada's Big Data Talent Gap.

Help Us Close Canada's Big Data Talent Gap

Canada's Big Data Talent Gap is not a future shortage; it's here now. Our economic growth and ability to innovate as a nation, and the competitiveness of our organizations, industries, and sectors, are inextricably linked with our ability to attract and retain the best talent.

This study represents the first in-depth examination of the size and nature of Canada's Big Data Talent Gap; this paper is our Consortium's first step towards addressing talent gap.

We recognize that closing Canada's Big Data Talent Gap will be a journey – and Ryerson University will continue to work with Canada's Big Data Consortium members, Canada's Big Data Talent Gap Summit participants, and any other interested academic, industry, and government contributors to continue to collaborate, to develop strategies, and to act to close the gap.

But there is no silver bullet. Closing the talent gap will take experimentation of new recruitment, retention, and training models by each organization, industry, and sector group. Closing the talent gap will take collaboration, including breaking down the traditional silos between organizations, industries, and sectors.

Throughout the paper, we have identified areas where we are taking action. As we continue to move forward in tackling Canada's Big Data Talent Gap, we invite interested participants to join us in our efforts to help ensure that Canada continues to innovate and grow economically.

Closing Canada's Big Data Talent Gap will take collaboration, including breaking down the traditional silos between organizations, industries, and sectors.

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Canadian Electricity Association
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CIO Association of Canada
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Deloitte
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Information Technology Association of Canada
itac.ca

SAS Institute Inc.
sas.com

TMX Group Inc.
tmx.com

Workplace Safety and Insurance Board
wsib.on.ca

Government

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