THE DIGITAL TALENT DIVIDEND: SHIFTING GEARS IN A CHANGING ECONOMY
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RESEARCH BY:

INFORMATION AND COMMUNICATIONS TECHNOLOGY COUNCIL (ICTC)

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Preface

ICTC is a national center of expertise with the vision of strengthening Canada’s digital advantage in the global economy. Through forward-looking research, evidence-based policy advice, and creative capacity building programs, ICTC fosters innovative and globally competitive Canadian industries, empowered by a talented and diverse workforce.

The Digital Talent Dividend: Shifting Gears in a Changing Economy is a follow-up to ICTC’s 2016 report, Digital Talent: Road to 2020 and Beyond, Canada’s first national digital talent strategy. The Digital Talent Dividend highlights the shifting opportunities and challenges facing Canada’s digital economy from 2016 onward. These include the changing nature of work and the growing presence of fractional employment and the gig economy, the shifting emphasis from occupations and job titles to skills, and the importance of ensuring that diversity and inclusion is at the centerfold of our quest to create transitional pathways and robust skill development strategies that utilize all human capital streams in growing our competitive advantage in the digital economy.

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EXECUTIVE SUMMARY

We are currently witnessing a new era of industrialization and socio-economic shifts that are profoundly reshaping our economy and society. The heightened urbanization of the world population, changing environmental trends, increased demand for peer-to-peer consumerism, and the rise of intelligent and autonomous systems are but a few facets of our changing world.

Today, cities are home to over 55% of the world’s population and account for 70% of the global GDP. This growing urbanization of metropolitan areas, coupled with emerging hyper-connectivity is set to continue in Canada and around the world, paving the way for smart cities and an expanding gig economy where freelance, part-time and project – or “gig” – based work is increasingly common.

The ability to rely on autonomous systems, and perform federated manufacturing from across the globe, while simultaneously leveraging the best of our labour market and growing synergies are new realities. We are living in the age of the fourth industrial revolution – or Industry 4.0 – where digital technologies are transforming industries from manufacturing, to finance, to healthcare and others in new and profound ways.

The dynamics of such economic and societal trends are giving way to frequent shifts in business models and employment prospects. The projected adoption of data-fueled Artificial Intelligence (AI), 5G connectivity, Blockchain, Virtual and Augmented Reality (VR & AR), and 3D Printing will herald a new era of heightened demand for skilled talent, while also generating a contraction in low skilled jobs. Free-lance jobs and project-based – or “fractional” and “gig” – employment are all manifestations of the changing nature of work that is upon us.

In Canada, innovation has played a defining role in recent years. Since 2016 alone, the digital economy has seen a growth of $2.43 billion GDP or 3.4%. This figure is 1% higher than the growth seen in the overall Canadian economy. More, the increasing integration of innovation and technological advancement is spurring renewed economic strength across our traditional industries. No longer viewed in isolation, in recent years, technology has permeated all sectors of the economy, including finance, manufacturing, healthcare, and even transportation – the latter in which the rise of autonomous vehicles is expected to generate nearly 35,000 digitally-skilled jobs in Canada by 2021 [1].

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This change brings with it the accelerated global need for digital talent. With an estimated demand for more than 216,000 digitally-skilled workers across the economy in Canada by 2021 [2]; more than 800,000 in the European Union; and over 1 million in the US during the same time frame [3], this talent crunch is one that is felt around the world.

As of 2017, the Canadian digital economy employed nearly 1.5 million ICT professionals, with slightly more than 1/3rd of that figure employed only the ICT sector. By contrast, nearly 800,000 ICT professionals – 60% - were found to be working in all other sectors of the economy. With total employment of ICT professionals outpacing the entire economy by a rate of 6 to 1 in 2017, this growth in demand for digital talent is the most profound witnessed in Canada over the last 15 years.

Considering this upward trend, the importance of ICT talent with key digital skills is clear. With the benefits of digital integration becoming increasingly evident for Canadian companies - research indicates that tech-savvy SMEs grow their revenues 15% faster than their counterparts”[4] - many Canadian employers are beginning to seeking talent with a broad skillset, including a range of basic to specific digital skills. From basic skillsets like proficient use of MS Office, to specific skillsets like knowledge of human-machine interface, the value of digital skills across the economy is becoming a solid reality.

The race to innovation does not end at our borders. With global changes that are quickly taking hold of our institutions, generating new agreements and fostering fresh normative practices are imperative to our ability to remain competitive. More than 13 years after its ratification, the North-American Free Trade Agreement (NAFTA) is up for renegotiation. At the same time, in September 2017, the Comprehensive Economic and Trade Agreement (CETA) entered into force, offering Canada preferential treatment to the European Union’s economy - a market boasting annual economic activity totaling $19 trillion [5]. On top of that, political and social circumstances are shifting, paving the way for the possible formation of additional economic partnerships - such as with India and China - that can offer Canada extended economic opportunities on a global scale. With this, of course, comes the accelerated need to focus on existing mechanisms that support economic competition, including government-led interventions like R&D investment and FDI (foreign direct investment) attraction, as well as industry-enabled developments like skills training, education upgrading and others.
Effectively leveraging existing talent streams to meet the needs of the rapidly-expanding influence of technology on our industries is key. In many cases, this will involve a confluence of policy implementations and skill development initiatives, including revisions to our educational curriculums and academic institutions – the latter of which is essential to ensuring a steady supply pipeline of graduates that can hit the ground running in their careers. Other initiatives include placing a greater emphasis on diversity and targeted initiatives that seek to effectively include and empower underrepresented groups including women, individuals with disabilities and indigenous populations into the quickly-evolving digital economy. Lastly, it is imperative to understand that we cannot do this alone. Leveraging and sourcing top skilled talent from around the world will be one of the main ingredients ensuring our ability to remain competitive within an economy where innovative solutions to societal challenges are the new currency. Investing in and supporting the growth of a digitally-skilled talent base must come from all angles.

The increasing integration of digital technology into our lives makes it evident that action is necessary - and soon. The future digital economy, in many ways, is already here and immersing itself across all industries – this is something that will happen independently of how we as a country choose to act on it. However, generating key talent streams today and equipping them with essential digital skills is one way to not only effectively leverage and weather the disruptions of the digital economy, but rather, to help all Canadians thrive and grow as they take place.
INTRODUCTION

The past few years were benchmarks for digital disruption. Around the world, technological developments reshaped and recalibrated our increasingly intertwined economies and in many cases, changed the way we conceptualize many aspects of our lives. In Canada, they ushered in significant changes, such as the development of the Innovation Agenda under Budget 2017, and the first Canadian-made autonomous vehicle testing the streets of Ottawa in October 2017. There is no doubt that we are living in a time of substantial, phenomenal and groundbreaking change; one that will witness the evolution of our business models, advance the need for new jobs and skills – including ones that do not currently exist today – and continue to reshape and redefine the nature of work itself.

The impact of these changes has been profound, not only on our daily lives, but on our collective economic footprint. Estimated to add $1.3 trillion to the global economy by 2020, digital technologies are increasingly playing a key role across all industries. In Canada, similar trends are noted, with the economic impact of the digital sector totaling more than $76 billion in 2017, an increase of $3 billion from the year prior. More, the impact of digital technology is surpassing the realms of the tech sector. With developments like 3D printing, revamping the manufacturing sector; to Blockchain that is poised to reshape the financial sector among others; to 5G that will set the new standard for data transmission, the future of our collective economies can no longer be separated from technology. Simply put: digital technology is increasingly necessitating business growth, and business growth is increasingly tied to digital technology.

With these developments emerges the need for careful and strategic planning that not only ensures our ability as a nation to compete in the global economy, but allows us to be a leader in it. This means that more and more Canadian businesses will be required to adopt, and embrace digitization – whether that means training employees on basic digital skills, investing in cybersecurity platforms, enabling digital adoption among Canadian SMEs and other interventions. In some cases – particularly relevant for Canadian SMEs who may experience greater challenges to digital adoption than large firms – this requires greater emphasis on digitization and leveraging critical transitional training programs that help employees gain the digital skills they need to survive in the economy of tomorrow.
Compounding this need, key technologies are reshaping the way that we think of business, and changing traditional business practices. Artificial Intelligence (AI), with the ability to perform deep analysis of large data sets will revamp many of our sectors; and Blockchain, through the secure transmission of private and sensitive data, will necessitate sweeping change of our financial institutions. These are just some of the transformative technologies that will drastically impact our future, and with them, bring along a demand for new jobs, skillsets and competencies across the board. Understanding this today and creating the pathways to fill these gaps is of utmost importance. Ensuring Canada’s strength in the digital economy of tomorrow must remain a top priority.

Canada has vast potential to lead in the digital economy of the future. With one of the most highly educated populations in the world [6], Canada consistently tops OECD ranks for tertiary education attainment. Coupling this achievement, more and more, Canada is playing a considerable role in the space of research, development and growth in STEM fields. Enrollment in ICT and STEM at Canadian universities has increased by nearly 25% since 2010 [7], and the value of work-integrated learning programs are increasingly evident; but more work is needed to ensure Canada’s leadership in this field. This means creating pathways for training, both at post-secondary institutions and elsewhere; leveraging the changes that come with the rising gig (or project-based) economy; and ensuring that industry growth and diversity and inclusion are at the centerfold of Canada’s trajectory. Together, with collaboration and action-oriented dialogue between industry, policymakers, academia and other relevant stakeholders, we can shape a future where Canada is a leader in the digital economy.
I. KEY INDUSTRIAL AND SOCIAL TRENDS

Undoubtedly, our cities and communities - in both their composition and their purpose - are changing. More and more, urbanization and its byproducts are reshaping our lives, with technology and digital skills playing increasingly important roles. As of 2016, nearly 55% of the world’s population were living in urban centers [8]. This is a trend that is only set to increase on the global scale, with estimates suggesting that by 2050, 65% of the world’s population will be city-bound [9]. As a result, our cities, our communities, our economies and our lives are already beginning to face significant change, with much of that change resultant from not only technology, but a few central transformative technologies that are reshaping our world.

5 Key Transformative Technologies

The five transformative technologies that will usher in wide-ranging change across not only the Canadian, but the global economy are: 5G, Artificial Intelligence, Blockchain, Augmented and Virtual Reality (AR/VR) and 3D Printing. The following provides a short glimpse into each.

5G

While research is currently being conducted on 6 and even 7G connectivity, 5G is the newest platform set for large-scale implementation, that allows for the fast and effective transmission of large batches of data across networks. With transmission speeds anywhere between 600-1,000 faster than our current LTE networks [10], 5G can collect, transmit and store data at exceedingly rapid rates. Central to many features of the digital and connected economy, 5G is quickly becoming the new standard for widespread connectivity, and one of the key enablers of a variety of revolutionary developments, ranging from autonomous vehicles to e-health solutions.

Artificial Intelligence

Artificial Intelligence (AI) possesses the vast potential to generate groundbreaking innovations, with computing power that far outstrips the capacity of the human brain. This includes the use of quantum computing, enabling AI to provide solutions to a variety of current-day challenges, ranging from environmental concerns to space travel [11]. With its worldwide economic impact expected to reach up to $13 trillion by 2025 [12], Artificial Intelligence is a central pillar to the shifting nature of our global economy.
Blockchain

Blockchain, comprised of a decentralized network of information “blocks”, offers never-before-seen possibilities for the secure transmission of all data – including sensitive or personal data. Acting as a general public ledger “chaining” together transactions, blockchain records and stores data about these transactions across a network of unrelated computers. This is a process that allows data to be transmitted without exposing any confidential details about the transaction itself, or the parties involved [13]. This development represents unprecedented potential for anything from financial transactions, to identity identification, supply chain management, e-voting [14], financial audits and tax compliance, among many others.

Augmented and Virtual Reality (AR/VR)

Augmented and virtual reality (AR/VR) is a technology that is not only impacting the entertainment sector, but also has the potential to produce far-reaching applications for sectors such as healthcare and transportation. AR/VR integrates elements of artificial intelligence with robotics, and creates immersive interactive experiences for users [15]. This can be used in a variety of ways, including diagnostic testing for new vehicles, planes or other transportation mechanisms [16]. Additionally, AR/VR can be used for applications in the the healthcare sector, with real-life applications including Osso VR, a platform that simulates complex surgeries, primarily used by medical trainees [17].

3D Printing

3D printing is reshaping mass manufacturing and materials production, making it easier, more cost-effective and safer to manufacture materials in large volumes. According to recent estimates, a 3D printer can print complex designs directly from CAD (computer-aided design) in a few hours. Compare this to the time required to draft, lay a mold and design an item using traditional manufacturing: a process that can take up to several weeks [18]. This heightened time and cost-saving measure is already being implemented by variety of companies; one of the most prominent being Adidas, who have recently unveiled a prototype for their first mass-manufactured 3D printed shoe, Futurecraft 3D [19]. Estimated to be worth up to $550 billion per year globally by 2025 [20], the practical applications of this technological development are endless.
Economic Impact of the ICT Sector

Coupled with the rise of key transformative technologies, along with increased investment and support for technological growth, the economic impact of ICT in Canada during recent years has been substantial. Growing by nearly $3 billion from 2016 alone, the real gross domestic product (GDP) produced by Canada’s ICT sector totaled $76.3 billion in 2017 [21]- this is 4.3% of the total Canadian GDP of $1.7 trillion [22]. Representing a compound annual growth rate (CAGR) of more than 4%, this growth is substantially higher than that seen across the overall Canadian economy. Moreover, as the adoption of ICT products and services in all economic sectors continues to increase, and digital technology becomes a central focus of business operations, the economic impact of ICT on Canadian GDP will only grow.

Figure 1: Canadian and ICT Sector GDP (in billion dollars)

Source: ICTC, Statistics Canada
During 2017, ICT services [23], representing 95% of the total Canadian ICT sector GDP, also saw a significant growth of more than 4% from 2016. ICT manufacturing [24], by contrast, contributing approximately 5% of total Canadian ICT sector GDP, increased by 0.7% or $26 million from 2016. While clearly showcasing the dominance of the service sector, the continued positive strength of ICT in manufacturing paints a notable picture of the job-creation potential that new technology (i.e. 3D printing) can offer to this, and other goods-producing sectors. Since goods-producing sectors tend to be more heavily impacted by external economic fluctuations and policy changes than the service sector, this is a promising trend.

Figure 2: Canadian annual growth of GDP (in billion dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall Economy</th>
<th>ICT Sector</th>
<th>ICT Manufacturing</th>
<th>ICT Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3.5%</td>
<td>3.8%</td>
<td>3.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>2011</td>
<td>3.3%</td>
<td>3.8%</td>
<td>1.9%</td>
<td>1.3%</td>
</tr>
<tr>
<td>2012</td>
<td>-3.9%</td>
<td>1.3%</td>
<td>1.3%</td>
<td>-13.6%</td>
</tr>
<tr>
<td>2013</td>
<td>2.5%</td>
<td>-0.8%</td>
<td>2.3%</td>
<td>-8.9%</td>
</tr>
<tr>
<td>2014</td>
<td>2.6%</td>
<td>1%</td>
<td>3%</td>
<td>-3.2%</td>
</tr>
<tr>
<td>2015</td>
<td>1.2%</td>
<td>3.7%</td>
<td>1.8%</td>
<td>3.7%</td>
</tr>
<tr>
<td>2016</td>
<td>1.4%</td>
<td>2.9%</td>
<td>2.2%</td>
<td>2.9%</td>
</tr>
<tr>
<td>2017</td>
<td>3%</td>
<td>4.1%</td>
<td>0.7%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Source: ICTC, Statistics Canada
Economic Performance of the ICT Sector

Since 2014, the ICT sector has outperformed the overall Canadian economy as well as several other sectors including: manufacturing, professional, scientific and technical services, utilities, and construction. Growing at a rate that was 1.3% faster than the growth across the overall economy of 3%, in 2017, this trend was only amplified in recent years. Particularly driven by the rapid expansion of emerging subsectors that include artificial intelligence (AI), augmented reality and virtual reality (AR & VR) and advanced manufacturing, Canada’s ICT sector is strongly intertwined with the overall economy. This connection is exemplified by the 71% positive correlation [25] between growth in the ICT sector and growth in the overall Canadian economy over the last eight years.

From a geographical perspective, Ontario remained Canada’s provincial leader in the ICT market during 2016, contributing a total of $33.1 billion to the national ICT GDP. Other notable ICT contributors were Quebec ($16.1 billion), British Columbia ($9.3 billion) and Alberta ($8.7 billion).

Figure 3: Provincial Contributions to the Canadian ICT Sector

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Source: ICTC, Statistics Canada
Composition of the Canadian ICT Sector

In 2016 there were more than 39,000 companies operating in the ICT sector in Canada. While the sector does contain some major players—both locally-grown success stories like Shopify, or international transplants, such as Microsoft—it is still primarily comprised of small and medium-sized enterprises (SMEs). In 2016, there were approximately 110 large ICT companies operating in Canada that employed more than 500 people. Compare this to the approximately 33,500 micro ICT companies with fewer than 10 employees. Interestingly, ICT manufacturing companies tended to be larger, with approximately 16% of them employing more than 50, compared to 3.2% of service-oriented ICT companies [26].

A Snapshot of Canada’s Digital Economy

Canada’s digital economy encompasses more than just the ICT sector, with the term “digital economy” broadly referring to markets that are based on digital technologies. Noting the growth of cross-sectoral technological solutions, and particularly the rise of the five transformative technologies, the digital economy is becoming more integrated with other sectors, outside of ICT. This intermingling of technology with traditional sectors makes it that much more pertinent to understand how all human capital streams can be leveraged going forward.

At this stage, talent in the digital economy is comprised primarily of two components: ICT workers employed in every sector of the economy; and ICT workers employed in the ICT sector [27]. As of 2017, Canada’s digital economy employed more than 1,441,900 professionals, 1,297,200 of which were ICT professionals. This figure includes 516,500 ICT professionals working in the ICT sector, 780,600 ICT professionals working in sectors other than the ICT sector (i.e., manufacturing, transportation, natural resources, etc.) and approximately 144,700 non-ICT professionals working in the ICT sector.
Digital is Business and Business is Digital: the Permeation of ICT Across Other Sectors of the Economy

As the Canadian digital economy continues to expand, many traditional industries will see a growing need for digital talent, equipped with the necessary agglomerated skills to drive business forward. While all industries will witness this need to some extent, currently, those most affected by this trend in Canada are: manufacturing, healthcare, retail, finance and transportation. These industries in particular will require a strong infusion of digital talent to expand business capacities, support and spur further innovation, and ensure economic success.

The Manufacturing Sector and Digital Changes

Making up 9% of total employment and over 60% of total exports in Canada [28], manufacturing is a critical industry for the Canadian economy. In recent years, the growth of 3D printing has shown vast potential for manufacturing, across the board. Capable of generating significant cost-savings, 3D printers are able to take a product from design to prototype, to finished product, in a fraction of the time required using traditional manufacturing methods.
Second only to the mass industrialization of mechanics, 3D printing brings with it a change that will drastically alter the labour market needs and skill competencies of workers in this field.

With a 3D printer able to print a basic design in less than 10 minutes [29], this technological development will usher in a heightened need for highly-skilled employees that are able to create the designs that are fed into the printers, as well as repair and maintain the printers themselves. As a result, roles like mechanical engineers and designers will become more present in this sector; as will employees that possesses key digital skillsets, such as knowledge of industrial design, aptitude with Phyton language, CAD, and SolidWorks proficiency [30], among others.

**The Healthcare Sector and Digital Changes**

In 2017, it is estimated that a total of $242 billion was used towards total health expenditure [31]. The rise of digital technology offers an avenue in this sector for reduced spending, through the introduction of innovative interventions that help patients better manage their own progress and/or track their conditions. For example, curable conditions like excess weight or obesity currently costs the Canadian healthcare system approximately $4.6 billion each year [32]. 5G and artificial intelligence are gearing up to make impressive changes in this realm, and applications already exist today that allow individuals to track their health goals. These include fitness apps like Fitbit or Jawbone, as well as more complex applications like Medici [33], permitting patients to text with their doctors in real time.

Through the use of these apps, patient lifestyle data can be collected, analyzed and aggregated to paint a “picture” of the given individual – this data can then be compared against thousands of others in order to draw conclusions on the general population. Access to applications like these can help individual patients manage and improve their overall health; and timely, accurate and real-time insights into the health status of a large population can prove useful for planning and budgeting on healthcare spending.
The Finance Sector and Digital Changes

One of the major vulnerabilities of our current financial systems is data centralization. Acting as a key cause of cyber breeches, data centralization means that when a breech occurs, it affects an entire network, rather than just one specific transaction.

Blockchain, with the ability to decentralize transmitted data into individual blocks, may significantly reshape our financial sector and with this, generate an increasing demand for digital skills. Increasingly, workers in the finance sector will need to possess not only knowledge of finance and economics, but to also understand trading technology, analytics, cryptography and database management [34]. The same way that the rise of ATMs changed the nature of bank teller jobs in the 1990s - something that led to a skills shift, requiring bank tellers to offer personal advice [35] - blockchain and other key technologies will increasingly require banking and finance professionals to possess an understanding of certain foundational digital technology.

The Retail Sector and Digital Changes

With the rise of online shopping platforms like Amazon, eBay and Shopify, the very nature of retail is changing. While the Canadian retail market is still largely dominated by brick and mortar shops - with ecommerce representing 2.3% of all sales in 2016 [36] - global estimates suggest that the overall share of this market will only continue to grow. As this sector evolves, we will see an increasing need for digitally-skilled talent, with key discernible skills. This includes talent with content writing and marketing skills, able to effectively communicate with customers; data analytics skills, allowing them to discern trends in buying and selling patterns and generate sales reports; as well as search engine optimization skills [37], allowing for targeted marketing and meaningful sales campaigns.

The Transportation Sector and Digital Changes

Lastly, with the advent of emerging technologies like autonomous vehicles, the transportation sector will undergo an extensive overhaul that will change the way we view mobility. ICTC’s report Autonomous Vehicles and the Future of Work in Canada outlines how Autonomous vehicles (AVs) will change our lives, our labour markets and revamp the way we think of driving.
AVs will utilize various key technological developments, most notably being artificial intelligence and 5G, in order to capture, analyze and interpret the large streams of data that they receive about their surroundings. With autonomous vehicles capturing details of their surrounding at a rate that exceeds 20 times per second [38], this blend of technologies are crucial to their success.

Naturally, this will lead to an increase in the need for skilled talent like mechanical and electrical engineers, as well as urban planners and computer programmers. At the same time, skill needs will also change and shift among these and other occupations. For example, a software engineer working in the autonomous vehicle space will require experience with artificial intelligence and diagnostic testing, as well as cloud computer services like AWS, SQL and Tableau [39].

Canada’s Rate of Digital Adoption: Where Do We Stand in Comparison?

While it’s becoming increasingly clear that digital adoption must be a top priority for Canadian businesses to stay competitive in the changing economy, the question remains: Where does Canada stand? Are Canadian businesses leaders in digital adoption, or are we trailing behind?

According to recent statistics, while Canadians themselves are heavy users of the Internet – with one of the highest Internet penetration rates in the world – Canadian businesses have been somewhat slow to develop an online presence. As of 2014, fewer than 50% of Canadian businesses had websites, this figure amplified to nearly 60% for small businesses [40]. The effects of this trend were reflected in profits and sales. In 2015, only 18% of Canadian businesses were found to be engaged in e-commerce – a figure significantly lower than some of our international competitors, including Japan, the UK, Germany and Australia, where 22%, 24%, 27% and 44% of companies were engaged in e-commerce, respectively [41].
Staying competitive in the digital economy is increasingly tied to investing in key digital technology and equipping employees with the strong digital skills; and while digital adoption has been lower than average [42] in the past, promising trends are beginning to emerge. In 2017, a majority of Canadian businesses reported that they would begin to focus on investments in technology and digital skills training. According to a survey of small and medium Canadian businesses conducted by the Canadian Chamber of Commerce, more than half noted that in the coming years, they will invest 1-5% of their total revenue in training. Moreover, 37% of these businesses specifically noted that they will invest in digital skills training, with another 50% pledging to invest in software training and 31% in cyber security training [43].
Trade Agreements and Their Impact on the Canadian Digital Economy

In 2017, Canada was the world’s 10th largest economy. Placing just behind Brazil in annual GDP, at $1.7 trillion, Canada’s contribution represented slightly more than 2% of the global economy [44]. The relative small size of the Canadian marketplace – in comparison to some key international competitors – makes the leveraging of international trade agreements that much more pertinent, and paramount to Canada’s ability to engage with the world’s economic leaders.

2017 was a notable year for Canada when it came to strengthening ties internationally. 2017 saw the beginning of the North American Free Trade Agreement (NAFTA) re-negotiation. Entering into force nearly 25 years ago in January 1994, NAFTA is a long-standing agreement between Canada, the United States and Mexico, setting among other aspects, a standard for tariff-free trade and the streamlined movement of skilled professionals across borders. While NAFTA gives Canada preferential access to the world’s largest single-country economy – the United States – negotiations are currently still underway and expected to continue through March 2018 [45].

Late 2017 also saw the entering into force of the Canada-European Union Comprehensive Trade Agreement (CETA). This agreement sets standards for the trade of goods and services, investments, government procurement, labour, and of course, the development of non-tariff barriers [46]. Generating over $19 trillion annually, the European Union is the largest (combined) market in the world [47]. CETA gives Canada preferential access this crucial economy, while also allowing Canada to bid on EU government contracts – the EU having the largest procurement market in the world.

During this year, the 10th round of negotiations were also held for the Canada-India Comprehensive Economic Partnership Agreement (CEPA) – an agreement that, if implemented, would increase cross-border trade in goods and services, ecommerce, telecommunications and others [48] between Canada and India. Representing nearly 3% of the global economy, forging this kind of preferential relationship with India can act as an important development for Canada.

While still in very early stages, some initial steps have also been taken at the federal level towards consultations with China on a potential trade agreement.
Here, the government solicited the views of Canadians on a possible Canada-China free trade agreement (FTA) [49], and Prime Minister Trudeau visited China in December 2017 for an exploratory discussion on the topic [50]. China represents the world’s second largest economy and one of the fastest-growing markets. While this type of relationship can present both challenges and opportunities, there is much groundwork to be laid before negotiations can truly begin.

These are only a few examples of actionable steps taken by Canada during the past year, in the interest of working collaboratively with top players in the global economy. This integration, discussion and free dialogue is foundational to Canada’s competitive advantage in the increasingly growing and expanding digital economy.

II. CANADIAN LABOUR MARKET OUTLOOK

Demand for Digital Skills

With revolutionary technological changes underway, it is increasingly clear that all sectors of the Canadian economy are in need of ICT workers and digitally-skilled talent. As a result, the demand for top ICT talent continues to grow and has resulted in expanding career options for ICT professionals, across the economy. In 2017, 60% of ICT workers were spread across all sectors of the economy, and the remaining 40% were employed in Canada’s ICT sector.

Figure 8: ICT Employment by Sector

Source: ICTC, Statistics Canada Labour Force Survey
Moreover, with rapid technological innovation and digitalization taking place across the country, digital skills are in steady and growing demand. Companies in the professional, scientific and technical services industry employ 35% of all ICT professionals in Canada and are by far the largest employers of digitally-skilled talent. By comparison, the next five sectors employing ICT workers are: manufacturing (15%), trade (14%), the information, the cultural and recreation industry (10%), and both public administration and the finance and insurance industry (6%).

Figure 7: ICT Employment Across Sectors

Source: ICTC, Statistics Canada Labour Force Survey
Demand for Digitally-Skilled Talent

In 2017, there were 1,441,900 professionals employed in the digital economy. Driven by the rapidly expanding ICT sector and increasing demand for ICT talent across all industries, employment in the digital economy grew substantially, adding 67,300 new jobs from 2016-2017. This represents a 5% increase in employment, the largest over the last 10 years. Moreover, the growth in digital employment has outpaced employment in the overall economy, the latter of which was only 1.8% from 2016-2017.

According to ICTC’s economic modeling, Canada’s digital economy is predicted to continue to grow significantly over the next five years. ICTC forecasts that by 2021, employment in Canada’s digital economy will reach 1,637,000 jobs, creating approximately 216,000 new vacancies which will need to be filled with qualified digital talent.

Figure 8: Employment Levels

![Employment Levels Graph]

Source: ICTC, Statistics Canada Labour Force Survey
Talent Supply: Composition and Features

Women

Representing almost half of working age Canadians, women are a critical talent stream for the high-quality digital jobs that will support our future economy. That said, the participation of women in ICT professions has remained relatively constant, averaging between 24% and 25%, for more than 10 years. This represents a three-to-one ratio of men to women employed in ICT positions – a trend that suggests there is clearly room for improvement though renewed focus on diversity and inclusion.

Figure 9: ICT Employment Breakdown by Gender

Source: ICTC, Statistics Canada Labour Force Survey
Unfortunately, the employment gender gap is not the only imbalance seen among ICT talent. While gender wage parity is a pressing concern for many industries, as well as several countries worldwide, disparity in wages across gender was also evident in the Canadian ICT sector. In 2016, female ICT workers earned 91 cents for each dollar earned by men – this represented a difference of more than $7,500 annually. Taking active steps to close gender gaps like the above are key measures to ensure that the digital economy of the future is not only strong, but inclusive.

**Youth**

Youth (aged 15-24) currently represent 6% of the total number of ICT workers in Canada. However, totaling 13%, older workers (55-65 years) – some of which are nearing retirement – represent the largest portion of the Canadian ICT workforce. As many workers are nearing the age where they will be exiting the workforce altogether, building and reinforcing the strength of the youth supply pipeline will be of critical importance.
Figure 11: ICT Employment Breakdown by Age

<table>
<thead>
<tr>
<th>Year</th>
<th>15-24</th>
<th>55-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>6.0%</td>
<td>13.1%</td>
</tr>
<tr>
<td>2007</td>
<td>7.6%</td>
<td>9.0%</td>
</tr>
</tbody>
</table>

Years of age

Source: ICTC, Statistics Canada Labour Force Survey

Figure 12: Employment Annual Growth Rate by Age

Employment Level Growth Rate by Age

Source: ICTC, Statistics Canada Labour Force Survey
Currently, we are seeing positive trends for this when it came to ICT employment. Between 2007 and 2017, ICT employment among those aged 15 to 24 increased by 9%. Compare this to the 6% decline witnessed over the same time period for this age group in the overall economy. This discrepancy is also clear when analyzing unemployment rates. In 2017, the unemployment rate of youth ICT professions totaled 3.9%, yet the unemployment rate in 2017 for youth in the overall Canadian economy was more than triple that of the ICT sector, totaling 12.7%.

Immigrants

Immigration plays an important role in Canada, not only in enriching our national culture and society, but in acting as a key supply stream for employment. Immigration is also particularly crucial to the growth of the Canadian digital economy and in 2017, roughly 492,800 or 37% of the total ICT jobs in Canada were held by immigrants [51]. Moreover, the representation of immigrants in ICT professions has grown steadily over the past decade, rising to 37% from 30% in 2007.

Figure 13: Immigrant Employment 2007-2017

![Figure 13: Immigrant Employment 2007-2017](chart)

Source: ICTC, Statistics Canada Labour Force Survey
When compared to the overall economy, the ICT sector employs a substantially greater volume of immigrants than average. In 2017, 26.3% of all jobs across the entire economy were held by immigrants – a figure that was more than 10% lower than the representation of immigrants in ICT. This demand for internationally-sourced talent was evident when it came to unemployment rates, as well. In 2017, the unemployment rate of immigrant professionals in the ICT sector was 2.4%, a figure that was less than half the unemployment rate among immigrants in the overall Canadian labour market, totaling 7.0% during the same year.

The rapid advancement of technology, coupled with the aging domestic workforce, underlines that the ability to attract digitally-skilled workers from international sources is critical for Canadian businesses in the digital economy.

Figure 14: Growth in Employment Among Immigrants

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall Economy</th>
<th>ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.4%</td>
<td>-3.2%</td>
</tr>
<tr>
<td>2009</td>
<td>2%</td>
<td>-0.3%</td>
</tr>
<tr>
<td>2010</td>
<td>1.5%</td>
<td>2.3%</td>
</tr>
<tr>
<td>2011</td>
<td>2.7%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2012</td>
<td>3.6%</td>
<td>9.4%</td>
</tr>
<tr>
<td>2013</td>
<td>4.1%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2014</td>
<td>2%</td>
<td>2.8%</td>
</tr>
<tr>
<td>2015</td>
<td>2.8%</td>
<td>6.9%</td>
</tr>
<tr>
<td>2016</td>
<td>5.9%</td>
<td>9.6%</td>
</tr>
<tr>
<td>2017</td>
<td>3.4%</td>
<td>7.6%</td>
</tr>
</tbody>
</table>

Source: ICTC, Statistics Canada Labour Force Survey
Indigenous Peoples

Despite being the fastest-growing demographic group in Canada - growing by 19% from 2011-2016 - Indigenous peoples remain an underutilized talent pool in the Canadian economy and the ICT sector. In 2016, a total of 1,673,780 people in Canada identified as Indigenous, yet a year prior in 2015, only 483,600 Indigenous peoples were found to be employed in the Canadian economy. This is a figure that is only 2.7% of the entire employed population of Canada. More acutely felt in the ICT sector, only 3,900 or 0.3% of all ICT jobs in Canada were held by Indigenous peoples. Unfortunately, this is a trend that has also remained stagnant over the last several years, with Indigenous peoples employed in ICT roles landing around the 0.2% mark from in 2007-2014 and only increasing to 0.3% in 2015.

That said, despite the currently low representation of Indigenous peoples in the ICT sector, promising results are noted when compared to Indigenous employment across the board, adding credence to the importance of Indigenous engagement with ICT. In 2015, the unemployment rate among Indigenous peoples that were employed in ICT occupations totaled 7%. While this figure is higher than the overall rate of unemployment in the ICT sector across Canada is significantly lower than the total unemployment rate of Indigenous peoples across the entire Canadian economy (12%). ICT showcases the potential for generating high-quality employment prospects for this demographic – something that, in turn, can help spur improved economic outcomes for Indigenous communities across the country.

Figure 15: Indigenous Employment, 2007-2015

Source: ICTC, Statistics Canada Labour Force Survey
The Changing Nature of Work

Further accentuating the demand for skills in our digital economy is the changing nature of work itself. While the Monday to Friday full-time employee may still currently represent the normative standard across the Canadian economy, increasingly, we are seeing a rapid growth in the presence of remote work (online network, completed anywhere from across the province to across the world), part-time and contract work [52], as well as freelance work (fractional or “gig” employment).

These changes are an important consideration to companies, creating shifts in traditional business models, hiring practices and recruitment needs. By 2025, it is estimated that the global market for online platforms offering freelance work opportunities will contribute an additional $2.7 trillion to global GDP, an increase estimated to benefit 540 million people [53]. The growing presence of freelance and online work - or rather, work that is farmed out piecemeal on an “as needed” basis - is one of the most dramatic shifts in the labour market of our time [54]. Aside from recalibrating our conceptions of employment, this change also presents far-reaching impacts for the labour market on wages, on future occupations, and skill needs. While freelance employment may offer increased flexibility, current estimates suggest that on the whole, these jobs tend to be shorter duration assignments with lower pay rates than traditional full-time work [55]. Additionally, under these scenarios, it can be that much more difficult for employers to really “know” who the digital talent are, where they are located, and if they are available for work - something that adds an extra element of complexity to traditional hiring practices.

Compounding the challenge of finding workers with key digital skills under this model is the fact that many of these freelance “gigs” can be completed from anywhere in the world. As a result, this may lead to a higher portion of Canadian employers outsourcing work to lower-cost jurisdictions. One central example of this is the growing presence of startup outsourcing to Ukraine, the country that was recently ranked as one of the world’s hottest tech scenes for outsourced ICT work [56].

Needless to say, this changing dynamic in the way that work is completed and where it is completed, places an additional emphasis on the need to ensure that Canadians are equipped with key digital skills.
Currently, Statistics Canada estimates that non-traditional work – i.e. freelance, self-employed, part-time – may account for more than 1/3rd of total Canadian employment [57]. This is a figure that based on current global trends, is likely to continue to grow. Gaining, maintaining and continually developing the important digital skills that are needed across industries is one way for Canadians to remain competitive in this increasingly gig-oriented and globally-interconnected economy.

III. NATIONAL DIGITAL TALENT STRATEGY: ONE YEAR LATER

Educations and Skills

As our industries continue to grow, develop, and become increasingly intertwined in the digital landscape of tomorrow, leveraging and strengthening the supply of digitally-skilled talent to fill in-demand roles is a top priority. And with the advent of 216,000 digitally-skilled occupations that will need to be filled by 2021 [58], the importance of creating these pathways among all supply streams, including youth, is clear.

Post-secondary graduates have always been and continue to be a key contributor to our supply pipeline for filling in-demand occupations across all industries. However, while the enrollment of students in ICT programs has increased by nearly 25% since 2010 [59], tomorrow’s graduates will need to be equipped not only with a relevant degree, but with the relevant skills – both technical and practical – to survive and flourish in the growing digital economy.

Research has indicated that the value of work-integrated – or practical experience – during post-secondary studies is unparalleled in preparing students for the workforce. By allowing students the opportunity to gain real-life experience during their studies, they will be better equipped with the practical experience needed by industry upon graduating, while also making students aware of the current economic landscape. These skills include technical skills, as well as a foothold in cultural, interpersonal, and business skills that are critical in the global economy [60]. More, throughout their experiences, students gain not only practical experience, but also career exploration, networking, personal growth and enhanced transitions into the workplace. At the same time, employers gain access to high-quality students to fill labour needs [61].

THE DIGITAL TALENT DIVIDEND: SHIFTING GEARS IN A CHANGING ECONOMY

www.ictc-ctic.ca
Recent examples, including Budget 2017’s boost towards work-integrated learning platforms across Canada, signify that the value of work-integrated learning is evident across various channels.

Secondly, increased collaboration between academia and industry is crucial in bridging the gap between theoretical knowledge and ensuring that education is coupled with actual skill needs of the future. Under this type of scenario, industry leaders may act as advisors, lecturers or even part-time mentors to post-secondary students. Though this collaboration, students will not only be able to put their current theoretical knowledge into practice, but they will be exposed to the most up-to-date and timely skills deemed relevant by industry, itself [62].

Under a traditional academic environment, curriculums are planned according to a long-term basis. This means that most post-secondary programs take anywhere between 2-5 years to complete. While post-secondary education provides the necessary foundational groundwork for students to become engaged in the digital economy, at the rate that technological evolution is taking place, the potential of digital skills undergoing drastic transformation within a post-secondary program is a distinct possibility. Increased collaboration with industry is key in order to ensure that students graduating possess not only that foundational groundwork, but an active and solid understanding of the specific skillsets needed to compete within the economy of today and tomorrow.

**Diversity and Inclusion**

There is no question that Canada is one of the most ethnically diverse countries in the world. The 2011 Canadian census found that of the total 33 million population of Canada, over 7.2 million and another 5.7 million were first and second-generation immigrants - that’s nearly 40% of the total population [63]. Moreover, with nearly 1.6 million Canadians identifying as Indigenous, this group remains the fastest growing demographic group in Canada, rising by nearly 43% from 2006 to 2016 [64]. Not only is diversity part of the backbone of our demography, the exchange of different perspectives, ideas and values that come along with it have been proven to be beneficial for business.

Increased diversity in the workplace has the potential to enhance cultural knowledge, to develop new and unique problem-solving strategies, to increase the rates of entrepreneurship and potentially even to broaden access to international markets.
Recent research has shown companies that embrace diversity are better positioned to deal with change, and to reduce conflict, while simultaneously gaining a reputation as socially responsible [65] - all things that may lead to a growth in business. Particularly relevant for jobs that are high-risk, complex and non-routine, diversity has shown to be a contributor to success, with studies from around the world including the Netherlands, New Zealand, the United States and the United Kingdom showing gains in productivity, innovation and wages, among companies that hired a greater percentage of immigrants [66].

In Canada, a recent study analyzing results from nearly 8,000 workplaces across 14 sectors, and more than 140,000 employee responses under the Workplace and Employee Srvy (WES) found that in the majority of sectors, there was a significant positive relationship between ethnocultural diversity and increased productivity and revenue. Specifically, this study found that as little as a 1% increase in ethnocultural diversity resulted in a nearly 2.5% increase in revenue and a 0.5% increase in productivity across all workplaces surveyed [67]. These findings were particularly relevant for the technology sector, where the presence of immigrants tends to be higher than average. The highest revenue and productivity increases were found among businesses in the information and cultural industries, and business services and manufacturing - all boasting productivity increases of more than 3%, due to workforce diversity [68].

Leveraging Canada’s diverse workforce for greater inclusivity in the growing digital economy is a key component of our success in the future. Moreover, the focus on inclusivity and diversity is essential to ensuring that the digital economy - bringing forth innovations and technological shifts that demand new skills and competencies - does not become an elitist one. Focusing on the value of diversity and the importance of inclusion is tantamount in our collective success as a country. A recent study by Deloitte found that this is an understanding that is becoming more commonplace among employers. Here, the study reported that more and more Canadian employers are beginning to see the value of diversity in their operations. Of the nearly 50% of employers that invested in diversity within the last 5 years, the primary reasons for doing so were noted to be: enhancing employee engagement, building the organization’s brand, and enhancing the organization’s ability to acquire new talent [69]. These and other elements are central to meeting the demands of the future digital economy which is increasingly diverse, intertwined and global.
Continued engagement, dialogue and research, with measurement-driven strategies – including the consultation of national taskforces – is essential to ensuring that diversity is gainfully utilized to ensure Canada’s competitive advantage in the economy of tomorrow.

**Industry Growth**

Promoting industry growth in Canada is, and will always be a top priority for both policymakers and industry. Helping Canadians not only become entrepreneurs, but build companies that will grow, survive and thrive – even among the frequent disruptions of technology itself – is crucial. Part of this investment needs to come from government support for traditional programs like R&D and relevant immigration policies. Recent examples of this include public R&D investment that totaled 1.6% of GDP in Canada [70], and the recent *Global Skills Strategy* unveiled under the 2017 Budget, which set a 2-week processing time for work permits for high skilled international talent filling in-demand roles [71].

At the same time, other skills development strategies include the Budget 2017 investment of an additional $1.8 billion (in addition to the $3 billion annually) over six years to expand the Labour Market Development Agreements. These agreements offer Canadians looking for work opportunities to upgrade their skills, receive employment counselling, gain experience and/or get help starting their own businesses [72] - all support levers that promote the expansion of Canadian industry.

Other necessary investments include industry-led developments like Business Enterprise Research and Development (BERD) investment, and increased collaboration with academia and other relevant stakeholders in order to help build strong talent pipelines, attract and retain high-skilled workers and support the acquisition of FDI and venture capital. BERD investment is key to supporting strong networks of innovation across the board. In fact, some of the most innovative countries in the world like Israel, South Korea, Japan and the USA continuously report strong BERD investment, with 2015 levels totaling 3.5%, 3.2%, 2.7%, and 1.9%. Compare this to Canada, where BERD investment totaled 0.8% during the same year [73].

Increased collaboration between industry with the local ecosystem has also led to a strong growth of startup support systems across Canada.
As of 2016, there were more than 140 accelerators and incubators across the country, with more than half of them specifically serving ICT, biotech and clean tech companies [74]. Institutions such as these are essential in not only encouraging entrepreneurship, but supporting its growth and resilience through job creation and the attraction private-sector follow-on investment. For example, in 2016, Canadian Accelerators were found to create nearly 5 new jobs per client with $350 million of follow-on investment, and Incubators were found to create 7.5 jobs per client with $260 million in follow-on investment [76]. These support networks are paramount to encouraging entrepreneurship and supporting the sustainable growth of the local economy.

**CONCLUSION**

Canada has a lot to offer the world and the digital economy. Canada has continuously ranked highly across several top-ranking international indexes, including the Global Peace Index, the Global Prosperity Index and the Digital Evolution Index. In 2017, Canada placed first among seven comparison countries in the Global Peace Index and the Global Prosperity Index, the former measuring the country’s social and political stability, and the latter measuring national purchasing power and economic growth. During the same timeframe, Canada also placed third among seven on the Digital Evolution Index [76], an index measuring nations’ ability to innovate and implement digital technologies. Pull factors like these and others are crucial to substantiating nationally-driven investment, attracting FDI and business interest from around the world, as well as facilitating the development of trade agreements and acting as a top destination for highly-skilled international talent.

Combined with other characteristics including a high quality of life, a highly-educated talent base, strong growth in the ICT sector and a growing permeation of digital technology across industries, it is clear that Canada possesses the basic ingredients to continue to succeed, despite digital disruptions and the changing nature of work, itself. That said, by blending these attributes with a renewed focus on spurring digital adoption, on promoting and supporting training programs and educational pathways that help Canadians gain key digital skills, and on the role of diversity and inclusion as cornerstone to the expansion of our collective future, Canada can become more than just a competitor in the digital economy of tomorrow.
By continuing to nurture what we’re doing well, by understanding and acting on what we can improve, and by leveraging our strengths with evidence-based research and results-driven strategies, Canada can be more than just a key player in tomorrow’s digital future; Canada can be a leader.

RECOMMENDATIONS

1. Recognizing the changing nature of the Canadian economy and its impacts on employment prospects, concerted effort between policymakers, industry, and academia should be made to build cross-sector transitional strategies that allow for rapid upskilling and redeployment of Canada’s workforce into fast growth sectors of the Canadian economy. This will translate to:
   
   a. Timely and accurate understandings of the displacement and absorption rates in the labour force across various sectors of the Canadian economy.
   
   b. Accrued understanding of the make-up of in-demand and emerging skills for high growth sectors of the Canadian economy.
   
   c. The development, with the collaboration of industry and academia, of short duration programs aimed at cross-skilling and redeploying displaced workers into high-growth sectors of the Canadian economy.

2. In 2017, the vibrant and changing nature of the digital economy has yielded a growth that has outpaced the rest of the economy by a ratio of 6:1. While many of these jobs are STEM-based, the rampant growth of this economy has created a range of ancillary occupations that allow for the broader participation of all Canadians in the digital economy. Initiatives that can support this transition and inclusion of all Canadians in tomorrow’s economic future include:
   
   a. The development of programs offering an accrued understanding of the non-STEM and ancillary job growth in the digital economy.
   
   b. Close collaboration between policy makers with industry and academic institutions to develop broader pathways for non-STEM disciplines to enter careers in the digital economy.
3. Diversity is, undoubtedly, a central pillar to Canada’s success in the digital economy. Industry and relevant research organization(s) should collaborate in order to promote and support research on the value of diversity in the workplace, as it relates to revenue and employment growth. The outputs of such an initiative include:
   
   a. The development of a more inclusive digital economy, via the creation of pathways for the inclusion and empowerment of diverse groups into the digital economy (including women, Indigenous peoples, persons with disabilities, immigrants and others).
   
   b. Increased productivity and revenue enhancement at the industry level, via improved idea exchange and discourse.

4. Charting our path to leading the digital economy is important. Knowing where we stand and where we need to go, is crucial. Policymakers and industry should collaborate with relevant research organization(s) to develop relevant measurement metrics that seek to understand and classify our progress in innovation, and measure the impact of talent strategies. Doing so would help to ensure that:
   
   a. National innovation activities are tracked and measured, allowing for long-term trend assessment and evaluation – both key to substantiating evidence-based investment.
   
   b. Talent solutions and strategies are measured according to their outputs, allowing for the accurate and timely identification of what’s working, and assessment of actual impact on Canadian job seekers and Canadian employers.

5. Policymakers, industry and industry support groups like incubators and accelerators should collaborate to offer resources and incentives for SMEs to invest in digital skill training and digital adoption. The outputs of such an investment include:
   
   a. Increased online presence of Canadian businesses, leading to improved sales revenue generation.
   
   b. Increased international presence of Canadian companies, via increased online presence.


74. Ibid, 23.

75. Ibid, 24.