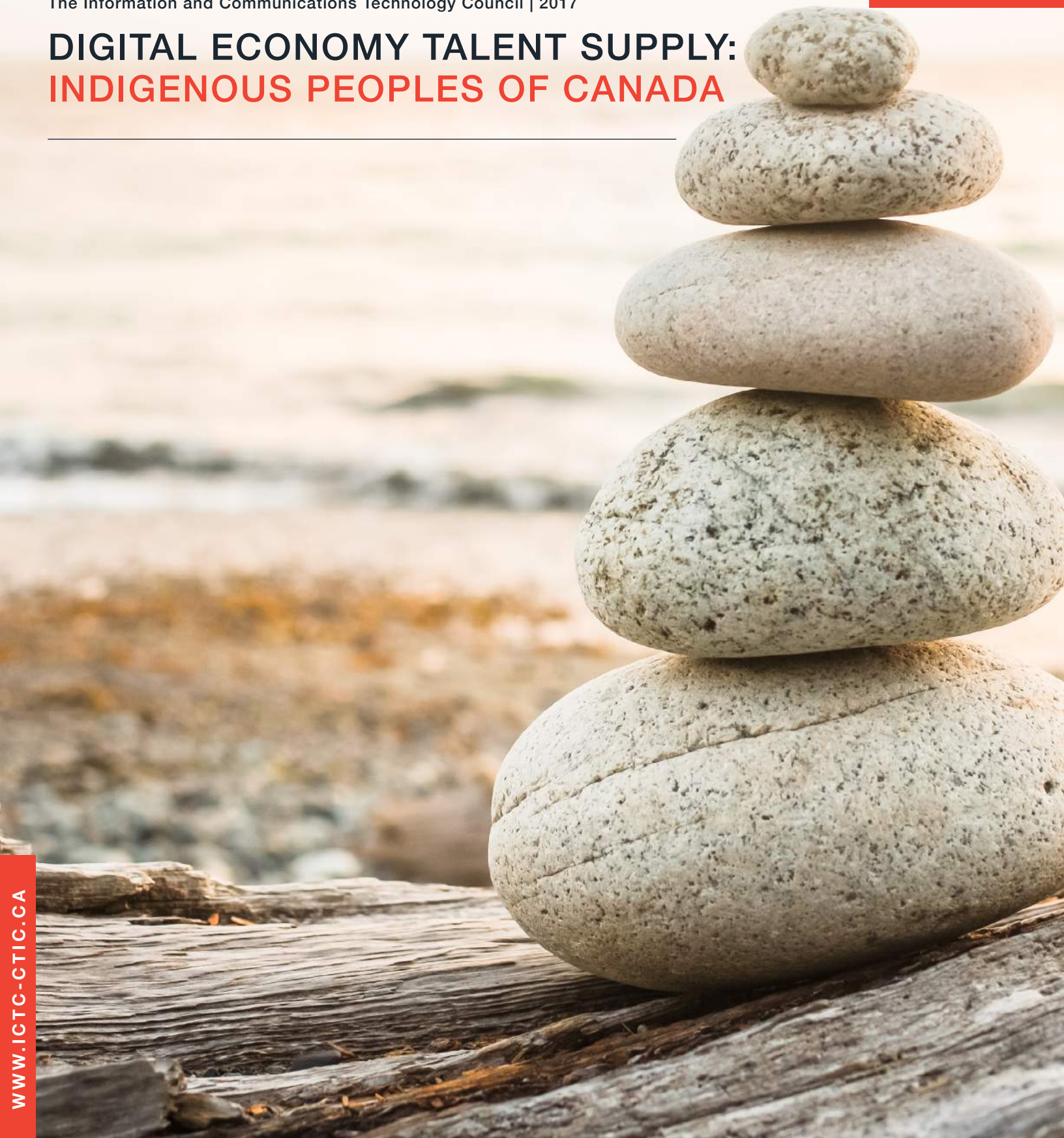
The Information and Communications Technology Council | 2017

DIGITAL ECONOMY TALENT SUPPLY:
INDIGENOUS PEOPLES OF CANADA



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PREFACE

ICTC's trusted labour market research provides critical economic and labour market insights to inform innovative workforce and skills solutions, as well as practical policy advice. Together, these drive the development of a more prosperous Canadian workforce and industry in a global digital economy. This report was made possible with the support of Employment and Social Development Canada.

This report was developed on the land of the Algonquin nation.
The authors made all reasonable efforts to ensure accuracy and fair reflection of the diverse perspectives gathered during consultations in compiling the document. The opinions and interpretations in this publication are those of the authors and do not necessarily reflect those of the Government of Canada.

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ACRONYMS

3-Dimensional	3D
Aboriginal Peoples Survey	APS
Building Brighter Futures	BBF
Canadian Radio-television Telecommunications Commission	CRTC
Gross Domestic Product	GDP
Information and Communications Technology	ICT
Information and Communications Technology Association of Manitoba	ICTAM
Information and Communications Technology Council	ICTC
Internet of Things	IoT
Innovation, Science and Economic Development	ISED
Joint Economic Development Initiative	JEDI
Kilobits per second	Kbps
Labour Force Survey	LFS
Megabits per second	Mbps
National Household Survey	NHS
National Occupational Classification	NOC
Social media, mobile, analytics, apps, and cloud	SMAAC
Small- and medium enterprises	SME

FOREWORD

DARRICK BAXTER
CEO

As the technology sector continues to develop and grow, and automation increasingly permeates various components of the economy, Canada is faced with the challenge of filling roughly 219,000 ICT jobs by 2021. Doing so will necessitate a strong and reliable supply pipeline, including a local talent pool that is well-equipped with the skills to succeed in a digital economy. The first step in utilizing our local talent pool is understanding the various strengths, cultures and capacities that comprise it. Digital Economy Talent Supply: Indigenous Peoples of Canada utilizes in-depth research and analysis to showcase first-hand the value of diversity and inclusion in Canada's growing digital economy. Displaying opportunities, challenges and the unique needs of Canadian Indigenous communities in the move towards ICT engagement, the report shines a spotlight on one of Canada's most significant talent streams.

Among the largest economies in the world, Canada is increasingly playing a central role in the digitally connected and decentralized global economy. With robust research capacities, innovative discoveries and a diverse makeup promoting idea-sharing and knowledge transfer, as Canadians, we continue to contribute to the evolving digital age and innovation economy. Traditionally underrepresented in the technology sector, Indigenous peoples are a key component of Canadian history and culture. Carving a greater share of the digital sector will function to grow the economy on a national scale, while simultaneously producing strong positive outcomes for Indigenous communities. Based on robust research and insightful feedback from Indigenous leaders, this report underlines the many opportunities to enhance ICT engagement among Indigenous peoples. Resultantly, communities will become equipped with the tools to advance economic outcomes and pave the pathways for self-determination. Understanding the immediate impacts of Indigenous contributions into the digital economy is crucial for the ability to forecast Indigenous needs, develop solid research and education frameworks, as well as build

infrastructure that supports ICT growth. With inclusivity at the pinnacle, these initiatives will not only improve the quality of life in Indigenous communities, but will ultimately result in an enhanced and fuller Canada.

> The potential of Indigenous success in ICT is unbounded: future generations will be communicating using tools that are yet to be developed, on networks yet to be designed, based in technology that is yet to be discovered.

Our role as innovators is to think critically, creatively and inclusively. The first step in this quest involves understanding our own fast-evolving digital landscape, and the people that comprise it. Indigenous peoples of Canada are, and will continue to be a central contributor to this ecosystem. Our collective and individually unique perspectives are a result of our history, our cultural heritage and our rich Indigenous ancestry. Digital Economy Talent Supply: Indigenous Peoples of Canada paints a detailed picture of Canadian Indigenous peoples, their current-day relationship to the ICT sector, and the endless opportunity of increased engagement. With recommended initiatives incorporating education, mentorship, supportive infrastructure and the understanding of unique cultural considerations, this report acts as a roadmap to further ICT engagement in Indigenous communities. With the help of Indigenous communities across the country, Canada will be increasingly well-positioned to continue as creative, innovative and sustainable leader in the global digital economy.

DARRICK BAXTER

CEO

Ogoki Learning Inc.

EXECUTIVE SUMMARY

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Technological innovations, namely digital technologies, have become drivers of economic productivity, growth, and prosperity in Canada as well as other developed economies. Canada is expected to play an important role in the $3.8 trillion global information and communications technology (ICT) economy focusing on traditional areas of software services, as well as emerging areas such as advanced manufacturing and intelligent retail. Canada's favourable investment climate, world-class economy and highly skilled workforce provide a strong base for leading the global shift towards artificial intelligence, blockchain, and 5G.

Despite the importance of technology adoption to business sector innovation and competitiveness, Canada's adoption rate remains low compared to our international counterparts. One of the principal reasons behind this is the lack of skilled workers who can assess and implement technological innovations. This, coupled with the integration of digital technologies into other sectors of the economy — such as manufacturing, finance, and healthcare — has created an even higher demand for skilled ICT talent. Despite this, Canada is experiencing a shortage of skilled ICT talent, largely in relation to demographic shifts as well as an insufficient volume of youth in the post-secondary supply pipeline. The ability to engage all available talent, including Indigenous peoples, will be critical in mitigating these gaps. However, The benefits of engaging more Indigenous peoples in the ICT and STEM labour force extend far beyond filling labour shortages. ICT adoption in Indigenous communities functions to shape a workforce that is able to respond to challenges and integrate into tomorrow's digital economy. This is something that ultimately translates into real economic gains for Indigenous communities and Canada as a whole.

In 2016, more than 10,300 (1.2%) Indigenous peoples were employed in ICT jobs in Canada's digital economy. The unemployment rate for Indigenous ICT professionals in 2016 was approximately 2.8%, a figure that is slightly higher than the overall ICT unemployment rate of 2.6% but markedly lower than the unemployment rate for Indigenous peoples in the overall economy (12.3%). Showing positive growth since the 2008 global recession, the proportion of Indigenous peoples employed in the digital economy has increased steadily each year.

Indigenous ICT professionals are a diverse and educated talent pool:

- 31.4% of all Indigenous ICT professionals in Canada are employed in the ICT sector.
- 47% of Indigenous ICT professionals are First Nations, 47% are Métis, 2% are Inuit, 2% are from another Indigenous background and 0.45% are from multiple Indigenous creeds.
- Indigenous ICT professionals are younger than the non-Indigenous ICT workforce: 8.2% of the Indigenous ICT workforce is between 15 to 24 years of age and 29.3% is between 25 to 34 yearws of age.
- Women represent about 27% of the Indigenous ICT workforce.
- About one-third have a university degree at the Bachelor level and 36.9% possess a college or CEGEP diploma.

As the quest for talent intensifies, our success in remaining a competitive and innovative nation will depend on how organizations, government, policy makers, and industry leverage the opportunities Indigenous people offer the digital economy and Canada. Additionally, building trust with Indigenous communities is a necessary ingredient in

to acknowledging past traumas and the marginalization that Indigenous peoples have experienced in the labour market and our society. Implementing policies that allow us to build Canada's Indigenous ICT talent pool in a collaborative and inclusive way with Indigenous communities themselves, is important in securing our collective social and economy prosperity. In order to do so, we recommend the following actions:

- Industry and associations, in collaboration with Indigenous communities should work together to build awareness of ICT use, while brainstorming ideas on how to incorporate digital technologies into the community. This approach must be tailored to meet each community's unique situation and requirements. This approach should include:
    - Tailoring the business case and action plan to implement ICT technologies in order to meet the community's specific needs (such as education, eHealth, economic development, social and community work, and cultural preservation through technology).
    - Basic skills, digital literacy training and other supports designed in collaboration with community elders. These resources should be made available to the entire community.
- Policy makers, industry, and associations should continue to expand high-speed broadband connectivity to Indigenous communities. This may be facilitated through strategic partnerships between Indigenous economic development groups and industry — including small- and medium enterprises (SMEs) — that provide Internet connectivity resources.
- Industry, educators, and associations should work with Indigenous communities to highlight the work of Indigenous role models employed in ICT, especially to Indigenous youth. Media, government and industry coverage displaying success stories of Indigenous workers in ICT and STEM professions can help to foster increased awareness and enhanced understanding of the career opportunities in the digital economy.
- Government at all levels and industry should increase the amount of support available to teachers and school administration staff, in order to assist them in integrating ICT and STEM into curriculums that are culturally appropriate. This should include:
    - Ensuring funding provided for on-reserve students, is equal to non-Indigenous students.
    - Equipping teachers with the resources, materials, and professional development opportunities to learn how to integrate ICT and STEM content into lesson plans in culturally relevant and appropriate ways for Indigenous youth.
    - Educating teachers, without an Indigenous background, who will be teaching in Indigenous communities, Indigenous culture and the pedagogical methods that best suit Indigenous learners.
- Educators, industry, and policymakers should improve access to and increase the number of co-operative education, internship, and wage subsidy opportunities for Indigenous peoples specific to ICT. Policymakers should also consider expanding enrollment criteria for Indigenous wage subsidy and internship programs, so that they are not always exclusively tied to age this will allow career transitioners and mature students to participate as well.
- Educators at the post-secondary level should improve the access to mentorship and coaching programs, writing courses, and academic advising at post-secondary institutions, to support Indigenous students throughout their university and college programs and improve their educational outcomes.

These recommendations form part of Canada's National Digital Talent Strategy Digital Talent - Road to 2020 and Beyond, designed to ensure that Canada's current and future workers and entrepreneurs are equipped with the skills and competencies needed to succeed in our increasingly digital and global economy.

INTRODUCTION

Canada's digital economy encompasses more than just the information and communications technology (ICT) sector. The term "digital economy" broadly refers to markets based in or heavily reliant on digital technologies. Moreover, resultant of increased automation, these technologies are becoming more integrated with other sectors of the economy, reflecting the broad reach and impact of technology adoption across the board. ICT and digital technologies are the key enablers behind this revolution, providing organizations with the means to increase productivity, reduce operational expenses, and boost overall efficiencies. Even though Canada's ICT sector is a $72.6[1] billion dollar per year stand-alone industry, it's the value-added contribution that digital innovations bring to other industries and sectors that ultimately enable Canada to become a global economic leader.

Under the larger umbrella of the Internet of Things (IoT), social, mobile, apps, analytics, and cloud (SMAAC) technologies continue to reshape every facet of the Canadian economy and society. It is expected that in the next several years, these five key technology drivers will cause the greatest disruption in the digital economy. The main propellants of this change will be centered on the following advancements:

- artificial intelligence (applications range from autonomous transportation, to services in banking, manufacturing, retail, and many more),
- 5G mobile (broad applications in smart and connected cities, vehicles, and media),
- virtual & augmented reality (applications in health, retail, media, construction, and many more),
- 3D printing, also known as additive manufacturing (applications in manufacturing, health, and others), and
- blockchain (applications in finance, asset management, retail, identity and personal security management, and music).

All economic sectors are rapidly transforming and integrating these technologies in an effort to increase productivity and efficiency, reduce costs, generate revenues, and improve collaboration and innovation.

Furthermore, entrepreneurs have been leading the way in developing digital innovations for all areas of the economy. Canadian entrepreneurship, in general, is healthy. In the Canadian tech ecosystem, the birth rate of new firms is higher than the death rate, and survival rates at both

1 Information and Communications Technology Council (2016). Quarterly Monitor of Canada's ICT Labour Market.

the one-year and the five-year point are above 50%.[2]

Digital technologies are changing the way companies do business, resulting in quick and easily accessible data and communications, information consistency, responsive case management and seamless information exchanges. Many sectors in Canada, such as ICT, government, finance, healthcare, manufacturing, professional services and others have already embraced digital technologies. Yet, despite this progress, there are several obstacles that prevent mass digitization from seamlessly occurring. Financial realities can make investing in digital technologies a significant challenge for many businesses, namely at the level of small and medium-sized enterprises (SMEs). At a rate of 17% gross fixed capital formation, ICT investment in Canada is lower than several international competitors. Compare this to the United States, where ICT investment totaled 30% or to countries like Sweden, Denmark and the United Kingdom, where ICT investment amounted to 20% of gross fixed capital formation[3] on average.

Even when equipped with sufficient financial capital (for both adopters and entrepreneurs), the adequate supply of talent with the right skills, plays a crucial role in effectively leveraging digital technologies. This digital economy is knowledge-based and relies predominantly on intellectual capabilities and a workforce with strong technical skills. As a result, this growing reliance on the knowledge economy further reduces reliance on traditionally-dominant sectors like natural resources and other goods-producing faculties. In this ecosystem, knowledge, skills, and expertise are as critical as any other economic resource needed to succeed in an increasingly interconnected, globalized economy.

By 2021, Canada will need to fill more than

216,000

ICT positions, making the effective and inclusive utilization of our local workforce a top priority.

TALENT LANDSCAPE IN THE DIGITAL ECONOMY

As of 2016, Canada's digital economy employs more than 1 million Canadians, of which 861,000 are ICT professionals.[4] During the same year, the unemployment rate of ICT professionals stood at 2.6%, a figure that is substantially lower than the 7% national average.[5] Employment has grown consistently from the collapse of the dot-com bubble at the turn of century to today. From 2001 onward, over 333,200 new ICT jobs have been created in Canada, with ICT job growth outpacing job growth in the overall Canadian economy in almost every year up to 2010. With an ever increasing percentage of Canada's new jobs emerging as a direct result of the ICT sector, an average of 36,560 new ICT jobs have been created in Canada annually over the last five years. This equates to an average annual employment growth rate of 5%, the highest amongst all industries.

Therefore, due to the accelerated pace of technological change, the demand for skilled digital talent in Canada has never been greater. Based on ICTC's projections, more than 216,000 ICT positions will need to be filled by 2021. As digital adoption across all sectors increases and the emerging subsectors continue to grow, the ICT labour market is expected to tighten even further.

By 2021, ICTC predicts the most in-demand, but short supply roles in the digital economy will include: information systems analysts and consultants, computer programmers and interactive media developers, industrial instrumentation technicians and technologists, computer and information systems managers, and database analysts and data administrators.

2 Innovation, Science and Economic Development Canada (2010). The State of Entrepreneurship in Canada. Retrieved from https://www.ic.gc.ca/eic/site/061.nsf/vwapj/SEC-EEC_eng.pdf/$file/SEC-EEC_eng.pdf

3 The Conference Board of Canada (2013). ICT Investment. Retrieved from http://www.conferenceboard.ca/hcp/details/innovation/ict.aspx

4 Information and Communications Technology Council (2016). Quarterly Monitor of Canada's ICT Labour Market.

5 Ibid.

One main source of talent for these roles is Canada's post-secondary institutions. However, while annual ICT enrolment rates have increased by 24% since 2010,[6] the total output of ICT graduates is still expected to be insufficient to satisfy labour market needs. For example, even though 2015 saw just under 30,000 graduates from ICT related degrees, nationwide, this figure still only represents only a fraction of the total volume of workers needed to meet employer demand. In addition, as a result of employment growth and replacement demand due to skills mismatch, retirements and other exits, demand–supply imbalances are expected to affect some occupations (e.g., information systems analysts, computer programmers, database analysts and administrators) more than others.

Not unlike many technology powerhouses the world around, Canada's supply shortages of this in-demand talent is resultant of problematic shortages in the pipeline of available workers. This includes an aging population, low fertility rates and an increase in the number of retiring baby boomers. Since the mid-1990s, Canada's population growth has remained stagnant at 1% per year, with the contribution of natural increase (i.e., the difference between births and deaths) predicted to further decrease over the next 20 years.[7] In 2015, over 90,000 ICT workers were nearing retirement — only a year later, this jumped to 102,000.[8] While this number will continue to grow as more baby boomers retire and exit the workforce in the coming years, the challenge rests with finding, shaping and mentoring the next generation of ICT workers to take their place.

One of Canada's fastest-growing demographic groups, current estimates suggest that Canada's Indigenous workforce may increase by an additional

45,000

by the year

2021

INDIGENOUS PEOPLES — A CRITICAL TALENT POOL

As more businesses adopt digital technology, and ICT innovations merge with other areas of the economy — like manufacturing, trades, natural resources, and finance — the demand for ICT talent with strong digital skills will continue to grow. This reality only functions to highlight the importance of engaging all available talent into the digital economy, in an effort to mitigate the impact of talent shortages on the ability of business to innovate and compete. Despite being one of the fastest-growing populations in Canada, Indigenous peoples remain significantly under-represented within Canada's labour force. Moreover, often overlooked, Indigenous peoples are not always seen as a potential solution to filling the existing labour gaps that are creating roadblocks for Canadian companies seeking to increase their presence on a global scale.

However, Indigenous peoples have a lot to offer the Canada's digital economy. The share of Indigenous peoples with university degrees has markedly increased over the past decade, an increase that is estimated to have accounted for $4.92 billion of GDP generated in 2011.[9] Currently comprising approximately 4% of Canada's total population, the long-term economic benefits of further increasing Indigenous peoples' access to and progression towards educational attainment and labour force participation are staggering. Research estimates that eliminating the gap in educational attainment, employment rate, and income between Indigenous and non-Indigenous populations to 2011 levels by 2031 would cumulatively generate an additional $335 billion in real economic activity.[10] Furthermore, an increase in labour force participation rates among Indigenous peoples would translate into a greater supply of skilled talent for the digital and overall economy.

Estimates predict that Canada's Indigenous workforce could increase by more than 45,000 by

6 Information and Communications Technology Council (2015). Digital Economy Supply: Canada's Post-Secondary Education Stream.

7 Laurent Martel (2015). "Recent Changes in demographic trends in Canada." Statistics Canada.

8 Information and Communications Technology Council (2016). Digital Economy Annual Review.

9 Centre for the Study of Living Standards (2015). Closing the Aboriginal Education Gap in Canada: Assessing Progress and Estimating the Economic Benefits.

10 Ibid.

2021, more than 72,000 by 2026, and approximately 103,500 by 2031.[11] Some predictions even place this growth as high as 145,000 workers by 2031.[12] Failing to properly train, equip and utilize this fast-growing demographic would prove detrimental for Canadian economic growth. As automation continues to change the type of work we do and the nature of work itself, the ability to recruit homegrown talent, such as Indigenous peoples, to fill these jobs becomes more crucial than ever.

The economic and social outcomes of integrating a higher volume of Indigenous peoples into Canada's ICT sector are mutually beneficial to Indigenous peoples and their communities. Collaborative partnerships between Indigenous and non-Indigenous businesses bring employment and economic development to communities, while preserving the need for self-determination in the communities, themselves. Historically, this type of relationship has been particularly prevalent in the resource sector, but it has also been seen in finance and business services. Improving employment levels and outcomes would not only create direct economic benefits, such as providing individuals with stable the sources of income, but it can also function to positively impact other social elements including health and wellbeing. According to the Aboriginal Human Resource Council, "Aboriginal people want to work, they want to contribute, they want to be financially independent, and they need the opportunity."[13]

Through unique perspectives and rich cultural heritages, Indigenous peoples can act as key drivers of workplaces that are diverse, inclusive, collaborative and sustainable.

Business benefits

With a rich cultural background and strong community spirit, Indigenous peoples offer unique skills and knowledge to organizations, while also providing insights into niche market opportunities that have yet to be fully realized. TD Economics estimated that by 2016, the value of the Indigenous market may eclipse $32 billion.[14] Indigenous peoples can also provide their own perspectives on how organizations can help enhance collaborative partnerships between local Indigenous communities (both urban and rural) and employers.[15] Furthermore, Indigenous peoples can help foster a workplace culture that respects different perspectives, diverse cultural backgrounds, and different modes of thinking - all proven drivers for successful innovation.[16] Research suggests that organizations benefit from Indigenous leaders who value collectivism, cooperation, group cohesiveness and consensus-based decision-making as well as other key competencies within team-based work environments.[17] On the whole, it is clear that the impact and benefits of Indigenous peoples in the workforce is not isolated to one organizational sector or another. Rather, it is evident in businesses across all areas of economy, including ICT.

In order to fully realize the value of Indigenous ICT talent, we must understand their characteristics and employment experience across Canada. Since science, technology, engineering, and mathematics (STEM) are intricately linked to ICT and increasingly merging into the digital domain, we will use STEM occupations and industries as a comparator where possible. The data and analysis in this report will not only shed more light on the labour market characteristics of Indigenous ICT talent, but will also highlight key insights gleaned from interviews on how to engage more Indigenous youth to explore careers and studies in ICT. Lastly, the report will provide insights for all stakeholders — including policy makers, organizations, economic development agencies, non-profits and industry associations — affording them the foundation by which to tailor strategies and policies for the purpose of further building and enhancing Canada's Indigenous ICT talent pool.

11 Rick Miner (2014). The Great Canadian Skills Mismatch: People Without Jobs, Jobs Without People and More.aeceperio. Et ligni dent genimi nvelest volest quae

12 Centre for the Study of Living Standards (2015). Closing the Aboriginal Education Gap in Canada: Assessing Progress and Estimating the Economic Benefits.

13 Caitlin Crawshaw (2010). "Aboriginals Can't Sustain Growing Labour Demands: Study." Canadian HR Reporter

14 TD Economics (2011). Estimating the size of the Aboriginal market in Canada.

15 Natasha Caverley (2002). What Works: Effective Policies and Programs for Aboriginal Peoples of Canada.

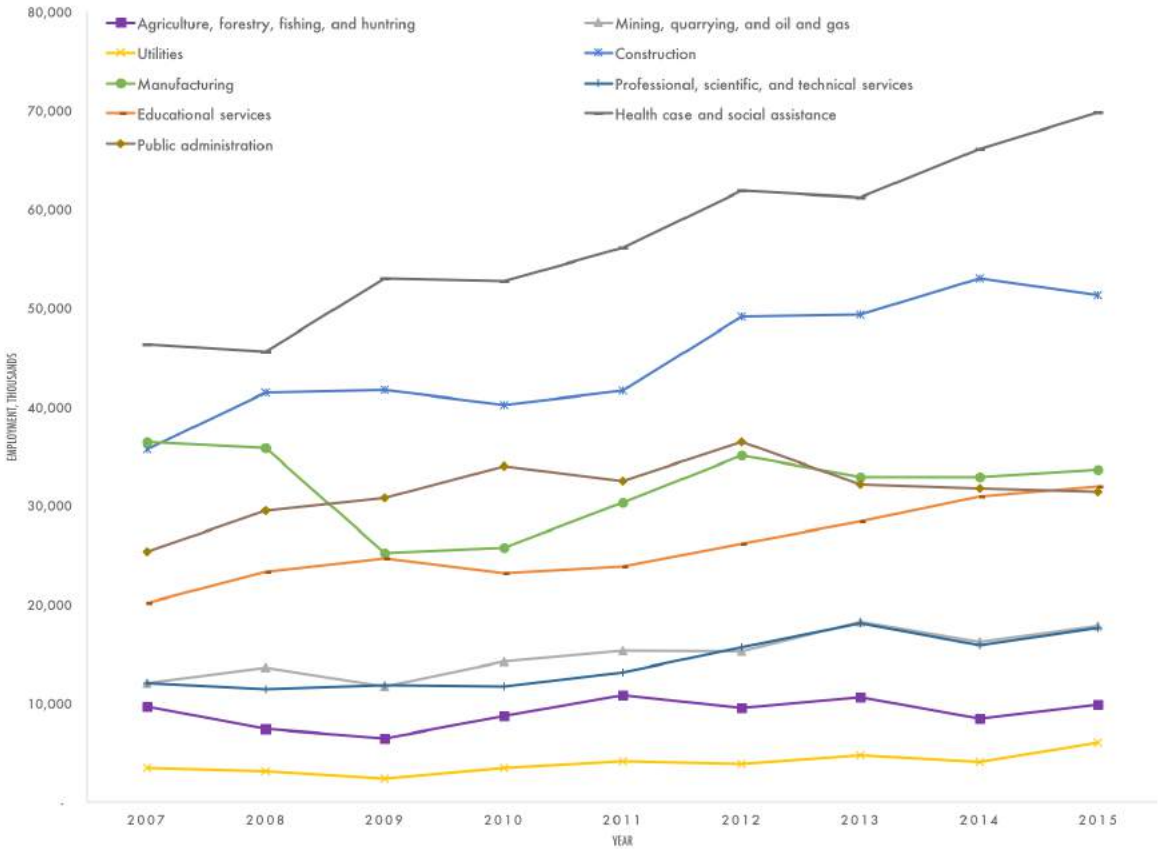
16 Ibid.

17 Ibid.

SNAPSHOT OF INDIGENOUS PEOPLES IN ICT

In 2016, there were over 514,800 Indigenous peoples employed in Canada across all occupations and all sectors.[18] The unemployment rate for Indigenous peoples (off-reserve) in 2016 was 12.3%[19], a figure noticeably higher than the national average of 7%. Industries such as health care and social assistance, construction, public administration, and manufacturing were found to employ the highest number of Indigenous peoples. This is a trend that remained relatively stable over the past 8 years (Figure 1).

EMPLOYMENT OF INDIGENOUS PEOPLES ACROSS CANADA BY INDUSTRY, 2007 TO 2015 Figure. 1



SOURCE: ICTC; STATISTICS CANADA (2016).

18 From monthly Labour Force Survey estimates. This survey does not include Indigenous peoples on-reserves and in the Territories. Actual total number of Indigenous people maybe larger due to these sampling methods and possibility of people not self-identifying when completing the survey.

19 Ibid.

2016 saw more than

10,300

Indigenous ICT workers in Canada's digital economy

Speaking to the volume of ICT talent, as of 2016, there were over 10,300 Indigenous ICT professionals employed in all sectors of the economy in Canada (Figure 2).[20] This means that Indigenous ICT professionals represent approximately 1.2% of all ICT professionals, nationally. Furthermore, the unemployment rate for Indigenous ICT professionals in 2016 was approximately 2.8%, a level slightly higher than the national ICT unemployment rate of 2.6%, but markedly lower than the unemployment rate of Indigenous peoples in the overall economy (12.3%).

Since the 2008 global recession, the proportion of Indigenous peoples employed in the digital economy has increased steadily each year. In 2011, within the ICT sector itself, Indigenous peoples make up 1% of all ICT professionals and 1.3% of all employees across all occupations (i.e. technical and non-technical). Of the Indigenous peoples employed in the ICT sector, 40.3% are working in ICT jobs and 31.4% of all Indigenous ICT professionals in Canada are employed in the ICT sector, itself. Other top industries for Indigenous ICT professionals include public administration (18%), professional, scientific, and technical industries (excluding ICT industries) (9%), manufacturing (5.5%), education services (5.2%), and information and cultural industries (5.2%) (Figure 3).

Unemployment among Indigenous ICT professionals totaled

2.8%

in 2016

Adding a detailed understanding of demographic breakdown, National Household Survey (NHS) data from 2011, estimates that approximately 47% of Indigenous ICT professionals identify as First Nations, 47% identify as Métis, 2% identify as Inuit, 2% identify as being from another Indigenous background not listed above, and 0.45% identify as having multiple Indigenous backgrounds/creeds.

Figure. 2

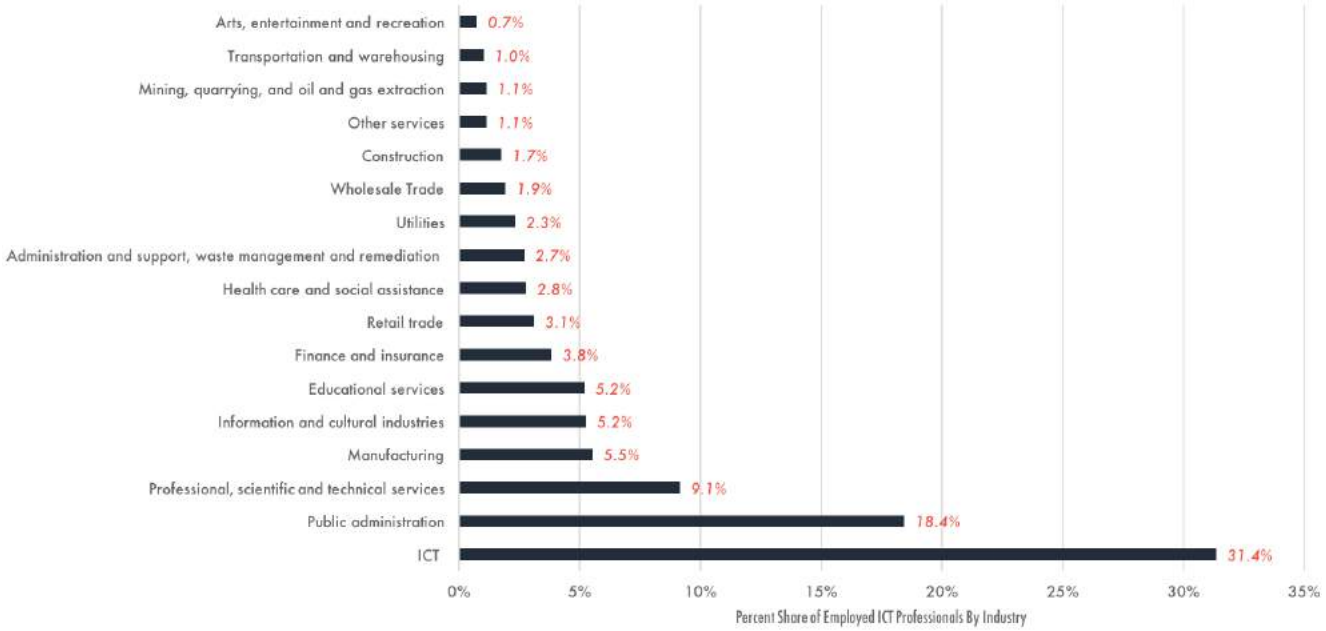
EMPLOYMENT LEVEL OF INDIGENOUS ICT PROFESSIONALS, 2009 TO 2016

SOURCE: ICTC; STATISTICS CANADA (2016).

20 From monthly Labour Force Survey estimates. This survey does not include Indigenous peoples on-reserves and in the Territories. Actual total number of Indigenous people maybe larger due to these sampling methods and possibility of people not self-identifying when completing the survey.

Figure. 3

SHARE OF EMPLOYED ICT PROFESSIONALS BY INDUSTRY



SOURCE: ICTC; STATISTICS CANADA (2016).

OCCUPATIONS

The ICT occupations with the highest proportion of Indigenous peoples include information systems analysts and consultants, user support, technicians, computer network technicians, and graphic designers and illustrators (Table 1). With many of these occupations projected to be among the most in-demand over the next four years, Indigenous ICT professionals are concentrated in some of the most vital jobs in the digital economy.

Table. 1

PROPORTION OF INDIGENOUS PEOPLES IN ICT OCCUPATIONS IN CANADA

ICT OCCUPATIONS	NUMBER	PERCENT
Information systems analysts and consultants	1,620	18.3%
Computer programmers and interactive media developers	940	10.6%
Software engineers and designers	210	2.4%
User support technicians	1,160	13.1%
Computer and information systems managers	510	5.6%
Database analysts and data administrators	195	2.2%
Computer network technicians	1,100	12.5%

ICT OCCUPATIONS	NUMBER	PERCENT
Electrical and electronics engineering technologists and technicians	840	9.5%
Information systems testing technicians	105	1.2%
Telecommunication carriers managers	160	1.8%
Broadcast technicians	60	0.7%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

However, despite being employed in some crucial occupations in the digital economy, on a comparison of the share of Indigenous workers in ICT jobs relative to the rest of the Canadian workforce, it is evident that Indigenous peoples are underrepresented in ICT professions. On the whole Indigenous peoples are also underrepresented in other STEM occupations, such as engineering, sciences, and health sciences (Table 2). By contrast, the occupations where the proportion of Indigenous workers is similar to or greater than the rest of the Canadian workforce are include the trades, social and community workers, public protection and support, education, law and policy, labourers in natural resources, trades helpers and labourers, and retail and service.

Table. 2

PROPORTION OF INDIGENOUS WORKFORCE AND CANADIAN WORKFORCE IN VARIOUS OCCUPATIONAL GROUPS

OCCUPATION GROUP	INDIGENOUS WORKFORCE	TOTAL WORKFORCE
ICT	1.7%	4.1%
Engineers	0.64%	1.5%
Sciences	2.3%	3.7%
Trades	7.5%	6.1%
Health sciences	3.6%	5.3%
Business and administration	15.9%	18.9%
Education	4.8%	5.1%
Law and policy	1.6%	1.7%
Social and community workers	7.1%	4.3%
Public protection and support	1.9%	1.3%
Arts and culture	0.7%	1.1%
Retail and service	25.4%	22.8%

OCCUPATION GROUP	INDIGENOUS WORKFORCE	TOTAL WORKFORCE
Trades helpers and labourers	2.3%	1.1%
Labourers in natural resources	3.3%	1.9%
Operators and labourers in manufacturing and utilities	3.8%	4.5%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

AGE

Overall, the Indigenous population is younger than the non-Indigenous population, as is the Indigenous ICT workforce, in comparison to the non-Indigenous. Indigenous youth make up 2% of all ICT youth. Compare this to the non-Indigenous ICT workforce, where about 5.3% of all workers are aged 15 to 24 and 27.5% of all workers are aged 25 to 34. These breakdowns increase to 8.2% and 29.3% respectively for the Indigenous ICT workforce (Table 3). There are also different trends between the various Indigenous groups, with the Métis and Inuit ICT workforce having a higher proportion of ICT professionals under the age of 35 compared to the First Nations ICT workforce.

INDIGENOUS ICT PROFESSIONALS BY AGE CATEGORY Table. 3

AGE GROUP	INDIGENOUS ICT WORKFORCE (ALL CREEDS)	FIRST NATIONS ICT WORKFORCE	MÉTIS ICT	INUIT ICT WORKFORCE	NON-INDIGENOUS ICT WORKFORCE
15 to 24 years	8.2%	6.5%	8.1%	8.3%	5.3%
25 to 34 years	29.3%	25.8%	31.8%	33.3%	27.5%
35 to 44 years	32%	36.8%	27%	11.1%	31.3%
45 to 64 years	29.7%	29.4%	28.6%	0%	34.8%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

GEOGRAPHY

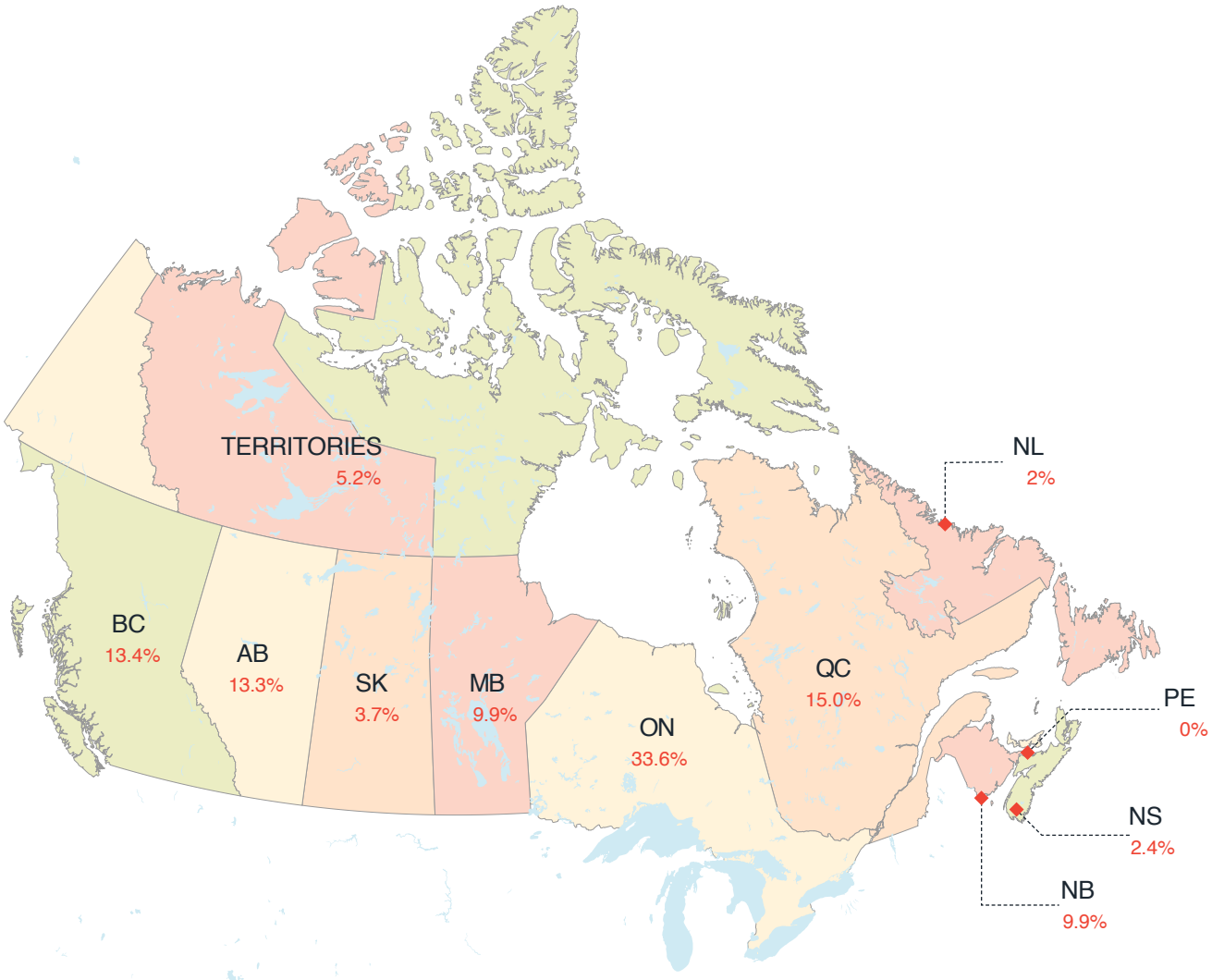
Approximately 33.6% of Indigenous ICT professionals are located in Ontario, followed by Quebec (15%), British Columbia (13.4%), Alberta (13.3%), and Manitoba (9.9%). Furthermore, there were different trends found among the various Indigenous groups and geographic locations:

- In Ontario, British Columbia, and New Brunswick, almost 1 in 2 Indigenous ICT professionals is First Nations.
- In Manitoba, three-quarters of Indigenous ICT professionals are Métis. In Saskatchewan and Alberta this changes to just under 60%.
- The geographic regions with the highest proportion of Inuit ICT professionals were the Territories, Newfoundland and Labrador, and Quebec.

Indigenous peoples are also living in urban areas and cities, not just in remote or rural communities. Top city locations for Indigenous ICT professionals were Ottawa followed by Toronto, Winnipeg, and Vancouver.

Figure. 4

INDIGENOUS ICT PROFESSIONALS BY PROVINCE



SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

GENDER

Currently, about one in four Indigenous peoples employed in an ICT position is female (Table 6). The exact ratio is slightly higher than the proportion of females in the non-Indigenous ICT workforce (24.8%). Moreover, the proportion of women in overall Canadian workforce is approximately 48%, whereas the proportion of women in the Indigenous workforce in Canada is slightly higher, nearing 49%. This comparison highlights that there are similar challenges and barriers to attracting and integrating Indigenous females into ICT and STEM.

Outstripping the representation of non-Indigenous women in ICT, Indigenous women made up more than

27%

of the Indigenous ICT workforce.

With respect to specific ICT occupations, the proportion of females in the non-Indigenous ICT workforce and females in the Indigenous ICT workforce is similar. Yet, for some of these — like information systems analysts, computer network technicians, and broadcast technicians — the proportion of females in the Indigenous ICT workforce is noticeably higher than the non-Indigenous workforce. Conversely, for occupations such as software engineers, the ratio of females in the Indigenous ICT workforce is considerably lower than the non-Indigenous workforce. Overall, based on the comparison of Indigenous vs. non-Indigenous females in ICT to that of other occupation groups in STEM, the share Indigenous females is relatively similar to non-Indigenous female, with the exception of engineering (Table 7).

Table. 4

GENDER DISTRIBUTION IN ICT OCCUPATIONS

ICT OCCUPATION	PROPORTION OF FEMALES IN NON-INDIGENOUS ICT WORKFORCE	PROPORTION OF FEMALES IN THE INDIGENOUS ICT WORKFORCE
Telecommunication carriers managers	31.7%	31.3%
Computer and information systems managers	23.3%	18.6%
Electrical and electronics engineers	11.1%	13.1%
Computer engineers (except software engineers and designers)	12.1%	10.4%
Information systems analysts and consultants	27.9%	38.9%
Database analysts and data administrators	35.2%	35.9%
Software engineers and designers	17.3%	9.5%
Computer programmers and interactive media developers	17.6%	13.8%
Web designers and developers	32.3%	35.7%
Electrical and electronics engineering technologists and technicians	10.3%	10.1%

Average weekly wages for Indigenous ICT professionals totaled more than

$ 1000

in 2016, a figure that is

42%

higher than the average weekly wage of Indigenous peoples in the overall economy.

ICT OCCUPATION	PROPORTION OF FEMALES IN NON-INDIGENOUS ICT WORKFORCE	PROPORTION OF FEMALES IN THE INDIGENOUS ICT WORKFORCE
Computer network technicians	19.2%	30.2%
User support technicians	23.5%	27.2%
Information systems testing technicians	41.1%	38.1%
Broadcast technicians	23.6%	50%
Graphic designers and illustrators	45.5%	44.8%
Total in ICT occupations	24.8%	27.2%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

Among some of the top projected in-demand roles by 2021, more than

18%

of all Canadian Indigenous ICT professionals are employed as information systems analysts, with another

10.6%

working as computer programmers and interactive media developers.

Table. 5

GENDER DISTRIBUTION IN ICT OCCUPATIONS

OCCUPATIONAL GROUPS	PROPORTION OF FEMALES IN NON-INDIGENOUS WORKFORCE	PROPORTION OF FEMALES IN INDIGENOUS WORKFORCE
ICT occupations	24.8%	27.2%
Engineering occupations	13.6%	8.9%
Science occupations	31%	31.8%
Trades occupations	2.8%	2.5%
Health sciences occupations	75.6%	78.6%

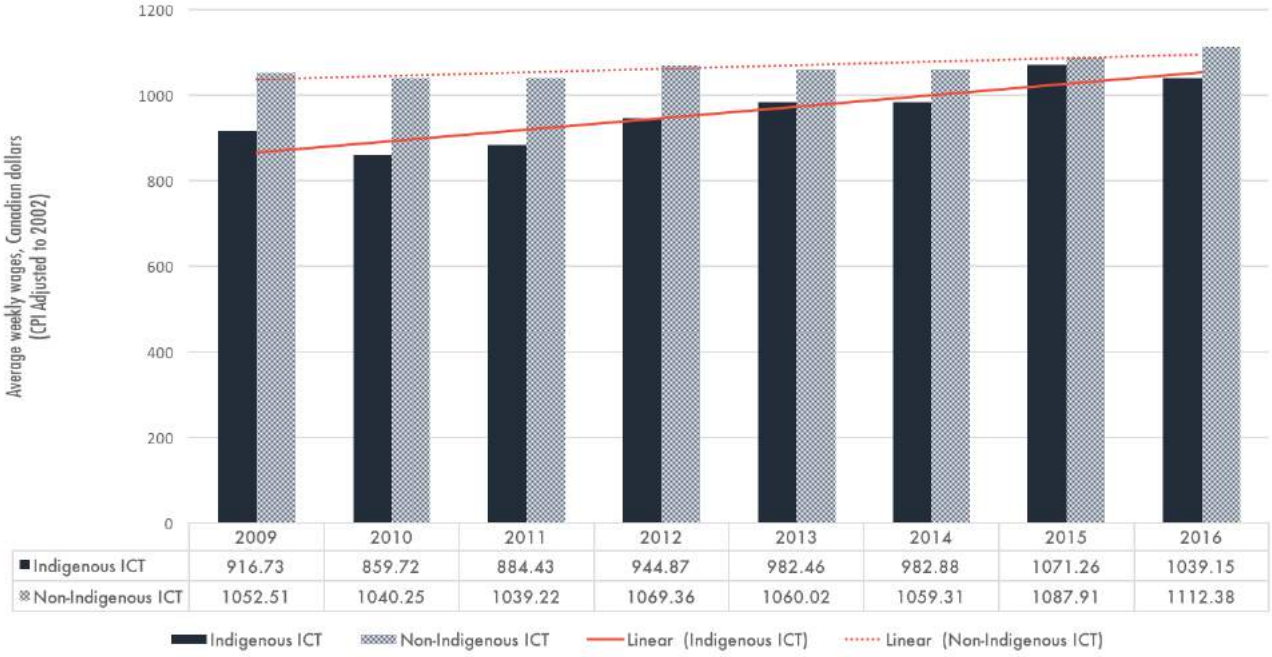
SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

WAGE

In 2016, the average weekly wage of an Indigenous ICT professional was $1,039.15 . This is a figure that is 42% higher than the average weekly wage of an Indigenous person in the overall economy ($734.11). However, even though ICT jobs are known to be higher paying positions, there is a discrepancy between Indigenous and non-Indigenous ICT professionals' wages (Figure 4). While the difference in wages has narrowed over the past 9 years, todays Indigenous ICT professionals' average weekly wages are still found to be 7% lower than those of non-Indigenous professionals.

Figure. 5

SHARE OF EMPLOYED ICT PROFESSIONALS BY INDUSTRY



	2009	2010	2011	2012	2013	2014	2015	2016
Indigenous ICT	916.73	859.72	884.43	944.87	982.46	982.88	1071.26	1039.15
Non-Indigenous ICT	1052.51	1040.25	1039.22	1069.36	1060.02	1059.31	1087.91	1112.38

SOURCE: ICTC; STATISTICS CANADA (2016).

DIGITAL ECONOMY TALENT SUPPLY: INDIGENOUS PEOPLES OF CANADA

INDIGENOUS YOUTH IN ICT

K-12

Elementary and secondary education are important channels for learning the foundational skills that students need when pursuing further education or employment. According to the 2011 census, approximately 20% of Indigenous peoples (off reserve and on reserve) did not possess a secondary or post-secondary degree. Furthermore, only 24% were found to have held a high school diploma or equivalent. In an assessment of on-reserve Indigenous peoples,

the proportion of individuals without a degree increases to 59% and it is clear that the total with a high school diploma or equivalent drops to 16.8%. As discussed earlier, developing policies that focus on increasing the level of education among Indigenous peoples is essential. At the basic level, increasing the number of individuals who graduate from high school would function to heighten the number of Indigenous peoples with the potential to attend post-secondary institutions and obtain gainful employment. Combined, these factors create an opportunity for economic progress at the community, and national levels, alike.

Ensuring that youth become engaged in ICT and STEM during their formative education years is critical to paving the way for greater access to post-secondary education in these fields, and eventually, for future careers as well. However, the development of this pathway is dependent on avenues that create awareness, promote knowledge sharing and offer experiential learning. Here, our key informant interviews highlighted a potential missing link: that is, a lack of awareness amongst youth about the opportunities in ICT and STEM careers, combined with insufficient resources available to fully integrate ICT into K-12 curriculum in a culturally appropriate manner, and inadequate infrastructure to ensure consistent access to high speed Internet.

Numerous interviewees indicated that while Indigenous youth may be interested in digital technologies, this interest tends to manifest itself on the consumer side, rather than as a propellant, encouraging youth to engage in the ICT sector as entrepreneurs or professionals. Understanding the reasons for this is the lack of awareness of the career opportunities and pathways that ICT and STEM offer is a challenge that resonates with Indigenous and non-Indigenous youth, alike. Several of our interviewees noted that a number youth from their own communities tended to express more interest in careers in public safety, health, trades or social and community services, simply due to the higher presence of such workers in their communities. Under such conditions, it is clear that role models play an important role for many Indigenous youth. Wanting to emulate leaders in their communities who are employed in these roles, Indigenous youth may be attracted to such occupations, noting the potential for positive impact on their community. Linking Indigenous youth in urban and remote communities to role models in ICT, and helping them understand how careers in ICT can benefit their communities will be an important step in encouraging more youth to consider careers and post-secondary education in this field. For example, ICTAM's Tech Trek directly links Indigenous youth in urban and remote communities with ICT professionals. Under this program, professionals and youth work together to complete coding, robotic, and other ICT challenges and tasks. This experience exposes youth to the opportunities the field offers while also allowing them to build connections and relationships with Indigenous ICT professionals who can help guide them.

Linking Indigenous youth to role models in ICT, and helping them understand how careers in ICT can benefit their communities is an important step in the successful engagement of Indigenous youth in the sector

Research has showcased that other barriers to completion of high school include teen pregnancy, financial problems, and child care provisions.[21] High schools with day care and financial assistance programs can also prove helpful in alleviating these challenges. In so doing, they can assist more individuals in graduating, undertaking ICT challenges, ultimately helping more post-secondary studies and eventually working in ICT careers.

Familiarity with technology needs to start at an early age. Integrating digital skills into the K-12 curricula and creating "21st century learning environments" in all schools is important. 21st century learning environments help students become comfortable with ideas and abstraction, and become skilled at analyzing and synthesizing new information, while learning

21 Aboriginal Peoples Survey (2012).

quickly and flexibly in a creative, innovative and team-centered environment. Under this kind of environment, students would spend significant time on basic skills including reading, writing and and math, where teachers would function as facilitators and coaches, helping students find information they need while making informed judgements about its accuracy and relevance. Students acquire these skills through applied, project-based interdisciplinary learning, collaborative and personalized approaches, discovery and investigation, and using technology for learning, information access and the generation of new ideas. For Indigenous students, these pedagogical techniques can be mixed with other teaching methods that also suit Indigenous learners — promoting the use storytelling, incorporating hands-on activities and using mediums other than print such as video and audio. One interviewee explained the success in implementing BC's new curriculum — which places a strong emphasis on coding and digital skills in K-9 — to Indigenous children by using Scratch block coding programs and mixing this with storytelling activities to teach coding. Furthermore, emphasizing the importance of allowing students to feel successful, reward, recognition, and then ceremonies (such as storytelling) are also important in building confidence and maintaining motivation.[22]

Interviews with teachers and school administrators at the local Indigenous community level indicated that Indigenous youth, similar to non-Indigenous youth, tend to thrive in these experiential, hands-on, applied-type of learning environments. However, interviewees' experiences had been that many schools do not have the funding and/or teachers with know-how to create these types of learning environments. In their experience, teachers who come from non-Indigenous backgrounds were not equipped with the necessary knowledge about Indigenous culture, history, and the community as a whole, including the realities (such as isolation, if they are living in a remote community) of the location they are living in. Lack of funding also presents significant issues, with some estimates indicating a gap of $2,000 to $3,000 per student for on-reserve schools.[23] Our interviews also suggested that under-funding is a source of frustration amongst teachers acting as a significant contributor to the higher teacher turnover rate that numerous schools in Indigenous communities' experience.[24] Organizations like Indspire (see promising practice text box) offers resources and an educator-peer mentoring program through their K-12 Institute, in an effort to support teachers and improve Indigenous K-12 education. Providing more accessible funding, resources, support, and professional development to educators would create more culturally appropriate technology-rich learning environments for K-12 youth.

Infrastructure

Whether through highlighting the role of ICT in Indigenous communities, or shaped within the curriculum itself, addressing the specific needs of Indigenous culture is a critical ingredient in building a strong and sustainable Indigenous ICT ecosystem.

In order to create technology-rich 21st century learning environments, schools must have the necessary infrastructure, especially in reserves and rural communities, to support this. However, there remains a digital divide between Indigenous communities, particularly rural and Northern communities, and the rest of Canada. In 2011, the Canadian Radio-television Telecommunications Commission (CRTC) set a goal for Canadians to have residential Internet access capable of supporting download speeds of at least 5Mbps and upload speeds of at least 1Mbps. Innovation, Science and Economic Development Canada's (ISED), formerly Industry Canada, goal for Northern and rural communities was download speeds of 1.5Mbps and upload speeds of 384 Kbps. While a number of communities have become connected over the past several years, — either through terrestrial backhaul, high throughput satellite or industrial/institutional capable broadband — many Indigenous communities still fall short of the CRTC's and ISED's target connectivity speeds.[25] However, even among communities

22 Ellen Godfrey (2006). Gap Analysis of First Nation Technology Training: Closing the Gap between Technology Training and Remote Community Capacity.

23 TD Economics (2013). Literacy Matters: Unlocking the Literacy Potential of Aboriginal Peoples in Canada.

24 Ibid.

25 Conference Board of Canada (2013). Telecommunications and Broadband Connectivity.

do obtain Internet connections that meet those targets, the reality is that these speeds don't allow the user to take full advantage of the technology. To put this into context, Internet connectivity at these speeds let you to surf the web, but streaming or downloading videos is extremely difficult. Comparatively, in Canadian urban areas, the estimated average download speed in Canada is closer to 66Mbps.[26] Improving Internet connectivity in Indigenous communities also allows Indigenous businesses in rural and remote communities to further compete and connect with domestic and international markets.

Our interviews found that different communities lie along different points on the ICT adoption and connectivity spectrum. While some students are living in communities that struggle to provide basic services like adequate housing, others possess the support and resources needed to provide students with access to digital technology. In these communities the focus is on developing and/or enhancing ICT capabilities, and determining how to best leverage digital technology in the community's culture. While this disparity is significant, it does not mean that those who are in the budding stages of ICT adoption do not need Internet connectivity, or are not open to using the Internet. Rather, this suggests that the case for how and why needs to be tailored to each individual community's needs.

Formerly, the First Nations School Net Program connected reserves to online sources, which allowed students to acquire skills and knowledge in order to confidently use and leverage digital technologies. An evaluation of the program in 2009 found that it was successful in addressing the needs of students in First Nations schools, and fulfilling the need for Internet connectivity for communities as well. Successes include, but are not limited to: boosting confidence in students through the use of technology, helping students feel less isolated and more connected to the world, and encouraging support and preservation of First Nations culture.[27] Brining back this type of program and scaling it up, in conjunction with upgrading the infrastructure that supplies Internet connectivity to communities, will be a vital step in creating classrooms that engage and nurture students' interest in ICT. If terrestrial high-speed broadband is not a viable option, programs that provide Internet connectivity through satellite connections like Cisco's Connected North program (see promising practice text box) should also be explored.

Culture

Connection to and respect for Indigenous culture is an extremely important ingredient to Indigenous communities across Canada. This was a key theme that consistently arose during the course of our interviews. While some interviewees felt that it was not always necessary to teach ICT using Indigenous cultural concepts, the majority asserted that the connection needs to be made between ICT and Indigenous culture, whether this means highlighting how ICT fits into the broader Indigenous community and culture, or is presented through the curriculum itself. A connected recommendation, some of Truth and Reconciliation Commission's calls to action include developing culturally appropriate curricula and providing funding for the integration of Indigenous knowledge and teaching methods into the classroom,[28] this must be applied to ICT and STEM learning too. There are programs that currently exist which work to link Indigenous culture, elders, mentors and teaching digital skills together, for the purpose of youth engagement in ICT (see Skins Aboriginal Storytelling and Video Game Design Workshops in promising practices text box). Weaving all these community stakeholders into

26 Canadian Internet Registration Authority (2017). Broadband availability at a glance. Accessed at https://cira.ca/factbook/2014/the-canadian-internet.html

27 INAC. (2009). Evaluation of the First Nations SchoolNet Program.

28 Truth and Reconciliation Commission of Canada (2015). Truth and Reconciliation Commission of Canada: Calls to Action

the educational experience will help to showcase the ways in which ICT is linked to Indigenous culture, understanding how ICT can play a role in the community, as well as preserving Indigenous culture.

POST-SECONDARY

The level of post-secondary educational attainment among the Indigenous population in Canada has markedly increased over the past several years. In 2006, approximately 15% of the overall Indigenous population had college or CEGEP, with fewer than 8% holding a university certificate or degree. By contrast, in 2011, approximately 20% had a college or CEGEP diploma and more than 10% of Indigenous peoples had a university certificate or degree. This change came slower for the on-reserve population, where 10% of Indigenous peoples had a college or CEGEP diploma, and less than 3% had a university certificate or degree at the Bachelor level or above, These figures are considerably lower than the overall Indigenous population (Table 8). With respect to the Indigenous ICT workforce, in 2011 nearly 37% had obtained a college diploma, one-third had a university certificate or degree at a Bachelor's level, and about 2% held a Master's degree (Table 9). Even though the level of education for Indigenous peoples in ICT and STEM is increasing at the university level, few Indigenous peoples are pursuing degrees in these areas, and as a result are heavily underrepresented (Table 10).

GENDER DISTRIBUTION IN ICT OCCUPATIONS

Table. 6

LEVEL OF EDUCATION	PERCENT
Apprenticeship or trades certificate or diploma	9.2%
College or CEGEP	10.2%
University certificate, diploma or degree at Bachelor level or above	2.9%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

GENDER DISTRIBUTION IN ICT OCCUPATIONS

Table. 7

LEVEL OF EDUCATION	INDIGENOUS ICT WORKFORCE	NON-INDIGENOUS ICT WORKFORCE
Apprenticeship	7.1%	3.9%
College/CEGEP (in Quebec)	36.9%	30.1%
University certificate, diploma or degree at Bachelor level	32.7%	46.7%
Master's degree	1.7%	9.6%
Doctorate degree	0%	1.2%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

Table. 8

INDIGENOUS UNIVERSITY DEGREE HOLDERS AT THE BACHELOR LEVEL BY FIELD OF STUDY

FIELD OF STUDY	INDIGENOUS PEOPLES ON RESERVE	INDIGENOUS PEOPLES OFF RESERVE	NON-INDIGENOUS PEOPLES
Education	40.3%	21.5%	13%
Health care and social services	5.7%	11.5%	12%
Public administration and social services	13.8%	6.5%	1.9%
Area, ethnic, cultural, gender, and group studies	3.1%	1.3%	0.2%
Legal studies	2.7%	3.5%	2.7%
Business, management, and marketing	8.9%	11.4%	18.9%
Mathematics, computer, and information sciences	0.8%	2.2%	4.8%
Engineering	1.4%	4.1%	10.6%
Physical and life sciences	1.5%	5.7%	7.4%

SOURCE: ICTC; NATIONAL HOUSEHOLD SURVEY (2011).

Financial considerations are an often cited barriers to further education for Indigenous youth, with costs preventing a number from pursuing post-secondary education.[29] While the federal government does provide funding to First Nations and Inuit nations/governments for their students to attend post-secondary schools through the Post-Secondary Student Support Program (PSSSP), there are no similar programs for non-status Indigenous peoples and Metis.[30] With Metis making up almost 50% of the total population of Indigenous youth and Indigenous ICT professionals in Canada, this represents a significant under-supported segment of the population. Even with federal government funding, there is more demand than available funds in these programs, with the financial cap limiting a First Nation's ability to fund all students interested in attending post-secondary education.[31] Organizations like Indspire (see promising practice text box) represent an important alternative source of funding for those unable to secure financial support.

One method to ease the transition from living on-reserve to education and employment off-reserve could include partnerships between economic/workforce development communities with post-secondary institutions and industry. For example, JEDI NB teaches mobile apps

29 Aboriginal Peoples Survey (2012).

30 TD Economics. (2012). Debunking Myths Surrounding Canada's Aboriginal Population

31 Levi Garber. (March 7, 2017). "Federal Finance Committee Recommends Removal of Funding Cap on Scholarship and Bursary Program for Indigenous Students". The Manitoban. Access at: http://www.themanitoban.com/2017/01/federal-finance-committee-recommends-removal-of-funding-cap-on-scholarship-and-bursary-program-for-indigenous-students/30292/

training and are targeted mostly to Indigenous peoples from reserves (see promising practices text box). The content is provided by CCNB from their mobile development program and then slightly altered for the Indigenous context, but all the technical content remains the same. Such programs have been found to produce better experiences, since classes teach only Indigenous students and are taught by an Indigenous instructor. Once the course is complete, JEDI NB makes sure that students get connected with industry or mentors, so that transition from education to employment is smooth.

Indigenous learners' needs are very different from those of the non-Indigenous student population. This is especially critical to those attending post-secondary and postgraduate education and training. Assumptions about the necessary support and individual needs based on the average non-Indigenous student are likely to be incompatible with the learning needs of Indigenous students. For example, English can often be overlooked as a barrier at the post-secondary level, but it can act as a significant barrier for Indigenous students, similar to international students.[32] Indigenous students are willing and eager to overcome this, but resources and supports need to be in place in order to help students enhance their English skills.[33]

Furthermore, post-secondary institutions and industry should consider providing more mentoring and coaching opportunities, so that Indigenous students have the experiences and capacities to strengthen their soft skills, as well as develop the relationships that are so crucial in the transition from school to employment.[34] Having Indigenous mentors and role models at this level, similar to K-12, plays a key role in building confidence and providing an opportunity to talk with someone who will understand the unique life experiences of these students.

The 'stages of life' and assumptions about family composition inherent in programs associated with post-secondary education may need to be adjusted. Indigenous peoples, and Indigenous women in particular, may not experience the stages of life at the same age, and in the same order as the non-Indigenous population.[35] Removing age restrictions placed on funding for education or training measures, as well as on employment opportunities would prove beneficial. Expanding access to programs like co-op placement funding, summer student funding, and wage subsidies for employers to hire students, should be re-considered given these differences.[36] Support initiatives should include family members such as grandmothers, aunts and sisters (that would normally target the parent), in the event that these persons are acting as the caregiver to the learner.[37]

PROMISING PRACTICES FOR ATTRACTING MORE INDIGENOUS YOUTH INTO ICT AND STEM K-12 AND POST-SECONDARY STUDIES

First Nations School Net Program: By integrating ICT into learning settings, the First Nations School Net program enables schools and learning centres, especially in reserves, to connect to online sources and acquire skills and knowledge that will help them participate in the expanding knowledge-based economy. In 2009, the Indigenous and Northern Affairs, Canada carried out an evaluation of the program to determine whether or not it was meeting the expectations intended upon its formation. The result of the evaluation showed that the FNS is not only consistent with the objectives of the Government of Canada (GOC) and Indigenous and Northern Affairs Canada (INAC), but that it also remains an appropriate response in

32 Dwight Powless and Linda Manning. (2015). Algonquin College. Building on Strength: Collaborating for Indigenous Student Success.

33 Ibid.

34 Dwight Powless and Linda Manning. (2015). Algonquin College. Building on Strength: Collaborating for Indigenous Student Success.

35 Native Women's Association of Canada (2009). Strengthening Aboriginal Girl's and Women's Success.

36 Ibid.

37 Ibid.

addressing the needs of students in First Nations schools, and fulfilling a need for connectivity in the communities. Successes of the FNS include, but are not limited to: contributing towards First Nations education and boosting confidence in students through the use of technology, helping students feel less isolated and more connected to the world and encouraging support and preservation of First Nations culture. It is recommended by the INAC that FNS program be renewed in order to ensure access to Information and Communications Technology and e-learning, both of which contribute to the overall objectives for education and support the educational outcomes of First Nations learners.
Source: INAC. (2009). Evaluation of the First Nations SchoolNet Program.

Cisco's Connected North Program: By leveraging Cisco's TelePresence® technology, Connected North works to foster engagement and enhanced education outcomes in remote Indigenous communities. The program delivers interactive education through virtual two-way video technology. For example, students in Iqaluit are benefitting from directly engaging with subject matter experts brought into the classroom through two-way video, for interactive sessions lasting up to 40 minutes. Students can also connect with peers of the same age throughout Canada as part of the program's Classroom Connect component, to share educational and cultural experiences. An evaluation of the program found that 89% of students reported feeling that the remote learning experience made science more enjoyable. Likewise 81% said they felt they learned more in the virtual sessions than they did through traditional classroom learning. Connected North also brings youth mental health services to Northern Indigenous and Inuit communities by partnering with the Tele-Link Mental Health Program developed by Toronto's Hospital for Sick Children (SickKids).Tele-Link provides mental health services to children, youth and their families in difficult to access rural areas, using videoconferencing and other technologies. Since September 2013, there are more than 30 TelePresence enabled sites in Canada and over 400 virtual sessions have been held.
Source: Cisco. Connected North. Accessed at: http://www.cisco.com/c/m/en_ca/never-better/csr-connected-north.html ; Connected North. Accessed at: https://www.connectednorth.org/ ; Nation Talk (April 2, 2014). Cisco Launches Connected North to Enhance Education and Healthcare Services in Remote Northern Communities. Accessed at: http://nationtalk.ca/story/cisco-launches-connected-north-to-enhance-education-and-healthcare-services-in-remote-northern-communities

Skins at Concordia — Aboriginal storytelling in digital media: Skins is a video game workshop for Indigenous youth (ranging in ages, but in the past mainly targeted to high school students) offered by an Indigenous team of game designers, artists and educators. The workshop begins with traditional storytelling and proceeds to teach participants how to tell a story in a new way, through virtual environments and video games. Students then learn important skills for the production of video games and virtual environments, such as, game design, art direction, 3D modeling and animation, sound, and computer programming. Lessons are taught by a mix of game-industry professionals, Indigenous artists and senior Concordia University students from the Computation Arts undergraduate programme. The workshop also engages Indigenous elders and mentors who can lend their considerable expertise as cultural consultants and provide moral support to participants. SKINS aims to empower Indigenous youth to be more than just consumers of these new technologies by showing them how to be creators and builders themselves. To date, there has been four major Skins workshops, one over the course of an entire academic year (2008 to 2009), one as a 14 day intensive

one over the course of an entire academic year (2008 to 2009) inherent in 14 day intensive workshop in 2011, another over four months in 2012, and one as a three-week intensive program from May to June in 2013. The workshops produced three videogame prototypes: Otsi:! Rise of the Kanien'keha:ka Legends; The Adventure of Skahion:ati: Legend of the Stone Giants; Skahiòn:hati: Rise of the Kanien'kehá:ka Legends and Ienién:te and the Peacemaker's Wampum.
Source: AbTeC. Projects. "Skins: Storytelling in Cyberspace (or How to Translate The Oral Tradition Into Virtual Reality". Access at: http://abtec.org/projects.html ; AbTeC. Skins — Aboriginal Storytelling & Video Game Design Workshops. Access at: https://vimeo.com/channels/skins.

JEDI: The Joint Economic Development Initiative (JEDI) is an Indigenous organization dedicated to supporting Indigenous participation in New Brunswick's economy. JEDI works to foster Indigenous communities and organizations seeking support in entrepreneurship, business development career development and training. The initiative also works with public and private sector organizations looking to partner with Indigenous people, communities, and organizations. JEDI has a relationship with all the 15 First Nations of New Brunswick and other Indigenous economic development and community organizations in New Brunswick and across Canada. For over 2 years, JEDI has been offering a mobile app development, software testing, and big data/data mining program targeted mostly to Indigenous peoples from reserves. The content is provided by academia (CCNB) and industry and then slightly altered for the Indigenous context, while the overall technical content remains the same. For example for the mobile app program, some of CCNB's French specific courses are removed, and the career developed courses are customized and designed by JEDI — So far, anecdotal evidence indicates that this program has produced a better learning experience. At the end of the program, students come out with a full college diploma. Once the course is complete, JEDI makes sure that students get connected with industry, so that transition from education to employment is smooth. Graduates from the program have gone on to secure full-time employment in large ICT organization like IBM or SMEs such as PQA testing and PLATO.
Source: JEDI. Who We Are: About Us. Access at: http://www.jedinb.ca/about-us.html ; Interview with Pierre Clavet, Conseiller sectoriel - TI, Technologies et Sciences naturelles • Secrétariat général • Siège social, CCNB, November 16, 2016.

Indspire: Indspire is an Indigenous-led registered charity that invests in the education of Indigenous people. They serve First Nation, Inuit, and Métis students in remote communities as well as urban centres across Canada. Their flagship program, the Building Brighter Futures (BBF) program was awarded over $12.2 million through 3,792 scholarships and bursaries to Indigenous students across Canada in 2015 to 2016. This program represents the largest scholarship and bursary program for Indigenous students outside the Government of Canada. Based on data Indspire gathered from 1,248 students who received funding from 2000-2001 and 2012-2013, 93% graduated from their program and 82% of these graduates are employed. Indspire's K-12 Institute is a virtual resource centre that serves educators, communities, and other stakeholders who are committed to improving kindergarten to grade 12 outcomes for Indigenous youth. Indspire's K-12 Institute has over 5,130 members across Canada as of 2016. Indspire also organizes multiple career conferences where high school students can learn more information about the myriad of career and post-secondary education options from educators and industry. In 2015-16 alone, more than 1,000 Indigenous youth across

Canada received information about careers including those in ICT and STEM. Additionally, Indspire's Rivers to Success mentorship program matches Indigenous students finishing their post-secondary education with professionals in their chosen field of study to help facilitate the school-to-work transition. In 2015 alone Indspire matched 52 pairs of students and mentors. *Source: Indspire. About Indspire. Access at: http://indspire.ca/about-indspire/ ; Charity Intelligence. Indspire. Access at: https://www.charityintelligence.ca/charity-details/609-indspire*

ATTRACTING AND RETAINING INDIGENOUS PEOPLES IN ICT AND STEM

The Information and Communications Technology Council | 2017

While Indigenous peoples, particularly those who are educated and highly-skilled — such as those in ICT and STEM — are seeing increasingly better employment outcomes in Canada, there still remains a number of challenges and systemic barriers they encounter which limit their ability to seamlessly integrate into the workplace. Similarly, organizations also encounter barriers and challenges in terms of acquiring and securing Indigenous digital talent. Success in the fast-paced global digital economy, while the overall technical content remains the same. on incorporating best practices and taking proactive approaches where possible to build the relationships, and create the environments that welcome Indigenous talent.

Some organizations may devise an Indigenous/Aboriginal strategic employment plan which provides a framework for how the organization will design and implement specific initiatives that center on recruiting (if used in rural areas will be strategically centred on specific jurisdictions), training and developing Indigenous peoples to work in permanent positions that fit a given organization needs or are in high demand.[38] The Indigenous employment strategic plan is then integrated into other HR practices such as succession planning.

Flexible and inclusive recruitment and hiring practices are important for removing systemic barriers that Indigenous job applicants may face. Additionally, creating a flexible and inclusive work environment that appreciates the talents, perspectives, and backgrounds of all employees, including Indigenous peoples, is extremely important. Training all staff about cultural codes, intercultural communication, and unconscious bias helps to equip people with the awareness and sensitivity necessary to recognize their own and others' potential biases. Moreover, organizations wanting to create a workplace that is safe and inclusive for Indigenous peoples should take this a step further and introduce Indigenous awareness and cultural sensitivity training. The purpose of this is to provide managers, supervisors, human resource management staff, and employees with an understanding of the history of Indigenous peoples in Canada and the unique issues, racism, biases and issues facing Indigenous peoples in the workplace.

38 Natasha Caverley (2002). What Works: Effective Policies and Programs for Aboriginal Peoples of Canada.

This measure was also included as part of the Truth and Reconciliation Commission's calls to action and is seen as part of the path towards reconciliation in Canada.[39]

Altogether, these practices play a part in the journey towards creating a culturally inclusive organization that respects and values Indigenous peoples, creating an environment that promotes different thinking styles -- something that is critical for innovation.

CONCLUSION AND POLICY RECOMMENDATIONS

The quest for talent in Canada's evolving, dynamic digital economy is predicted to intensify over the upcoming years due to demographic shifts and retiring workers. Our success in the quest for talent will depend on how organizations, government, policy makers, and industry address the advantages and opportunities that Indigenous peoples offer the digital economy and Canada. Implementing policies that allow us to build Canada's ICT and STEM talent pool with more Indigenous youth participants and ensuring they secure employment, will be important in securing our and their social and economic prosperity.

There are a couple of important elements that underpin the success of any intervention or policy route taken. Programs that have the highest success rates are those where the Indigenous community is in the 'driving seat', however Non-profits can also help by acting as important intermediaries between communities and government. Also critical to the success of any such initiative is deep stakeholder collaboration — that is, government at all levels, industry, associations, educators, and individuals, and most importantly, Indigenous communities - working together. Through cooperation, collaboration, as well as idea and culture-sharing, stakeholders can work together to build trust with Indigenous communities, shape policies that create lasting benefits, and ultimately, move us all forward on the path towards reconciliation.

We recommend that:

- Industry and associations, in collaboration with Indigenous communities work together to build awareness of ICT use among Indigenous communities. This approach must be tailored to meet each community's unique situation and requirements. This approach should include:
    - Tailoring the business case for and plan to implement ICT technologies to the community's specific needs (such as education, eHealth, economic development, social and community work, cultural preservation through technology)

39 Truth and Reconciliation Commission of Canada (2015). Truth and Reconciliation Commission of Canada: Calls to Action.

    - Ensuring that basic skills and digital literacy training and supports, designed in collaboration with community elders are made available to the entire community.
- Policy makers, industry, and associations should continue to expand high-speed broadband connectivity to Indigenous communities. This may be facilitated through strategic partnerships between Indigenous economic development groups and industry — including small- and medium enterprises (SMEs) — that provide Internet connectivity resources.
- Industry, educators, and associations should work with Indigenous communities to highlight the work of Indigenous role models employed in ICT, especially to Indigenous youth. Media, government and industry coverage displaying success stories of Indigenous workers in ICT and STEM professions can help to foster increased awareness and enhanced understanding of the career opportunities in the digital economy.
- Government at all levels, in collaboration with industry should increase the amount of support available to teachers and school administration, in order to assist them in integrating ICT and STEM into curriculums that are culturally appropriate. This should include:
    - Ensuring the amount of available funding per student for Indigenous on-reserve students, is equal to non-Indigenous students.
    - Equipping teachers with the resources, materials, and professional development opportunities, allowing them to learn how to integrate ICT and STEM content into lesson plans in culturally relevant and appropriate ways for Indigenous youth.
    - Educating teachers, without an Indigenous background, who will be teaching in Indigenous communities, Indigenous culture and the pedagogical methods that best suit Indigenous learners.
- Educators, industry, and policymakers should improve access to and increase the number of co-operative education, internship, and wage subsidy opportunities for Indigenous peoples specific to ICT. Policymakers should also consider expanding enrollment criteria for Indigenous wage subsidy and internship programs so that they are not always exclusively tied to age. This will allow career transitioners and mature students to participate as well.
- Educators at the post-secondary level should improve the access to mentorship and coaching programs, writing courses, and academic advising at post-secondary institutions, to support Indigenous students throughout their university and college programs and improve their educational outcomes.
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These recommendations form part of Canada's National Digital Talent Strategy Digital Talent — Road to 2020 and Beyond, designed to ensure that Canada's current and future workers and entrepreneurs are equipped with the skills and competencies needed to succeed in our increasingly digital and global economy.

APPENDIX: RESEARCH METHODOLOGY AND ANALYTICAL FRAMEWORK

To sufficiently address the key research questions, ICTC's team used proven quantitative and qualitative research methods, including the collection of primary and secondary data, reviewing existing literature and environmental scanning of the skills gap issue globally and nationally. Hence the analytical framework for this study relied on following approaches:

- Secondary data:
  - **Labour Force Survey (LFS) data:** Monthly survey gathered from over 100,000 employers across Canada. The LFS provides information about the size of employed and unemployed workforce and is categorized using the 2011 National Occupational Classification system (NOC). The LFS provides data on Indigenous peoples for off-reserve individuals only. Due to suppression, only data at the national level across all sectors is reliable for Indigenous groups.
  - **National Household Survey (NHS)/Census data:** Conducted in 2011, this data-set provided detailed information about geography, educational background, and age allowing us to cross-tabulate these variables with occupation. The NHS also includes Indigenous peoples located on-reserves.
  - **Aboriginal Peoples Survey (APS) 2012:** The Aboriginal Peoples Survey provides social and economic conditions of off-reserve First Nations, Métis, Inuit, and other Aboriginal peoples in the areas of education, employment, health, language, housing, and mobility.
- **Review of the existing literature and data:** ICTC team conducted an extensive literature review, including a meta-analysis of academic research, industry reports, government initiatives, and public policy papers related to related to engaging, educating and employing Indigenous peoples in ICT and STEM in Canada.
- **Key informant interviews:** About 20 people were interviewed throughout the course of this report. Interviews were primarily held with individual Indigenous people who are located on reserves or work with Indigenous communities. Other interviews were with thought leaders, associations or businesses who work with or employ Indigenous peoples. The information and insights from these interviews was used to supplement the data from the quantitative analysis and literature review.