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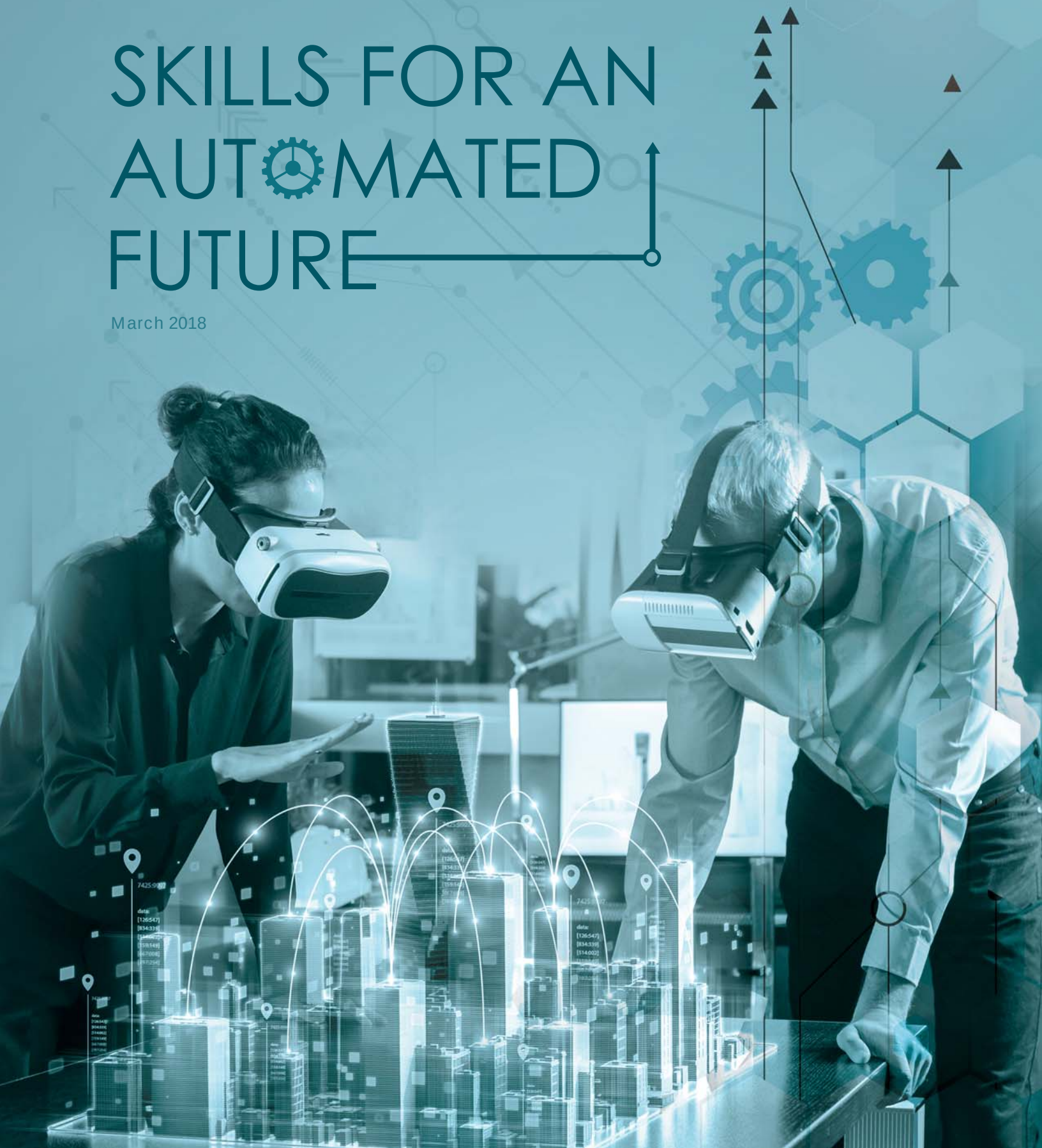
Le porte-parole des entreprises canadiennes^MD

SKILLS FOR AN AUTOMATED FUTURE

March 2018



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EXECUTIVE SUMMARY

Globally, labour markets are adapting to the impact of new technology, and the demand for skills is changing to match. This change was described by one participant at a Canadian Chamber of Commerce roundtable as, "moving from a knowledge economy to a wisdom economy."

> "Moving from a knowledge economy to a wisdom economy."

Some economic sectors are seeing a decline in employment, while other sectors are struggling to find the workers with the skills they need to grow. This report examines the impact of technology and the implications for training systems and skills development, in light of six main questions:

1. Who is going to be replaced? How many people is this going to affect?
2. How much might retraining all of those people cost? Can we afford it?
3. What is the upside of automation? Why should we embrace it and how?
4. How are we doing at giving people the skills they need so far?
5. Will every group in Canada be able to acquire the skills needed to be employable? What can we do about it?
6. What kinds of connections do businesses, government, educators and students need to build so they can better manage this transition?

Waiting until after employees lose their jobs to automation and relying on traditional full-length programs could mean a training challenge affecting hundreds of thousands of people and costing an estimated $6-18 billion per year. But, with better measurement of the skills people have and the skills jobs demand and by making training an ongoing activity, we can cut this cost to a manageable level.

Employees can build essential skills that are resistant to automation in advance and adapt to rapidly changing technology by accessing new learning mechanisms, like short duration programs, micro-credentials certification of work experience and self-directed learning.

Businesses need to view employee development as a competitive edge for attracting and maintaining the best talent and raising productivity at all levels. By supporting a wide range of skills pathways, businesses can develop a culture of ongoing skills development.

Educational institutions need to build on new learning pathways, expand recognition of prior experience, support self-directed learning and work in partnership with business. Collaboration models, such as program advisory committees and sector councils, can ensure technical skills taught by programs remain relevant to the workforce and support the adoption of new technology.

Finally, government support for employee development requires updating funding mechanisms for training to recognize the various educational pathways and ensure quality and access. The measurement of the skills and competencies needed in the workforce, the transferability of qualifications and more flexibility for educational institutions can all support the workforce adaptation for future technology.

Businesses need to view employee development as a competitive edge for attracting and maintaining the best talent.

Surveying the Landscape of Automation

The Canadian Chamber of Commerce undertook this report in response to the concerns from business that automated technology is creating new workforce challenges and widening skills gaps and the demand for a new perspective on the acquisition and application of skills.

There is nothing new about machines replacing human labour. Machinery for that purpose dates back to the industrial revolution, and so do concerns about skilled craftsmen being put out of work.[1] Today, technology offers new capabilities for automation, in the space of cognitive and communications activity, with increasingly adaptable machines that can perform a larger number of tasks.

The current generation of automation has also been called the "fourth industrial revolution," [2] as a means of distinguishing the use of digital technology, AI, software and robotics from stages that were previously defined by technologies such as steam power, electricity and electronics.

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1 Robert Ayres, *Technological Transformations and Long Waves*, International Institute for Applied Systems Analysis, 1989, 16-17 http://webarchive.iiasa.ac.at/Admin/PUB/Documents/RR-89-001.pdf

2 OECD "The Next Production Revolution – Implications for Government and Business", January 2018, accessed online: https://twitter.com/OECD/status/952918334789619712

"Mechanization" and "Digitization"

We can distinguish between the older and newer kinds of automation. The older, mechanical kind depends on the use of specific hardware designed for specific tasks. The newer digital kind focuses on software, data and communications, rather than hardware alone.

The older form of "mechanization" continues in many existing industries. This is often cited as the main example of "automation eliminating jobs," such as in patterns of declining employment in manufacturing and agriculture, as shown by OECD figures.[3] Examples of this kind are widely seen in improved factory robotics, better tools and other improved industrial devices.

Meanwhile, the newer digital type of automation is summed up by the 2011 essay, *Why Software Is Eating the World*,[4] and by participants of the Canadian Chamber's roundtables who stated, "Now, every business is a software business." Examples of this kind include the move from physical to digital media, digital finance, online sales, online work and mobile ordering.

The new model requires less specialized equipment, few or no physical storefronts and fewer regular employees. It uses software to link together existing infrastructure such as data centres, smartphones, home computers, cars, apartments or networks of contractors.

> "Now, every business is a software business."

The impact pattern depends on the type of automation being examined. As an example of the mechanized kind, Canada has seen a loss in manufacturing employment, with present employment at roughly 76% of the level in 2002, despite employment in the economy as a whole growing by roughly 20% over the same period.[5] Other countries have seen similar trends to different degrees. In Japan, overall

3 *OECD Science Technology and Industry Scoreboard*, Figure 1.34, "Where people gained and lost jobs – 2010-2016," September 2017, accessed online: http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-scoreboard-2017_9789264268821-en

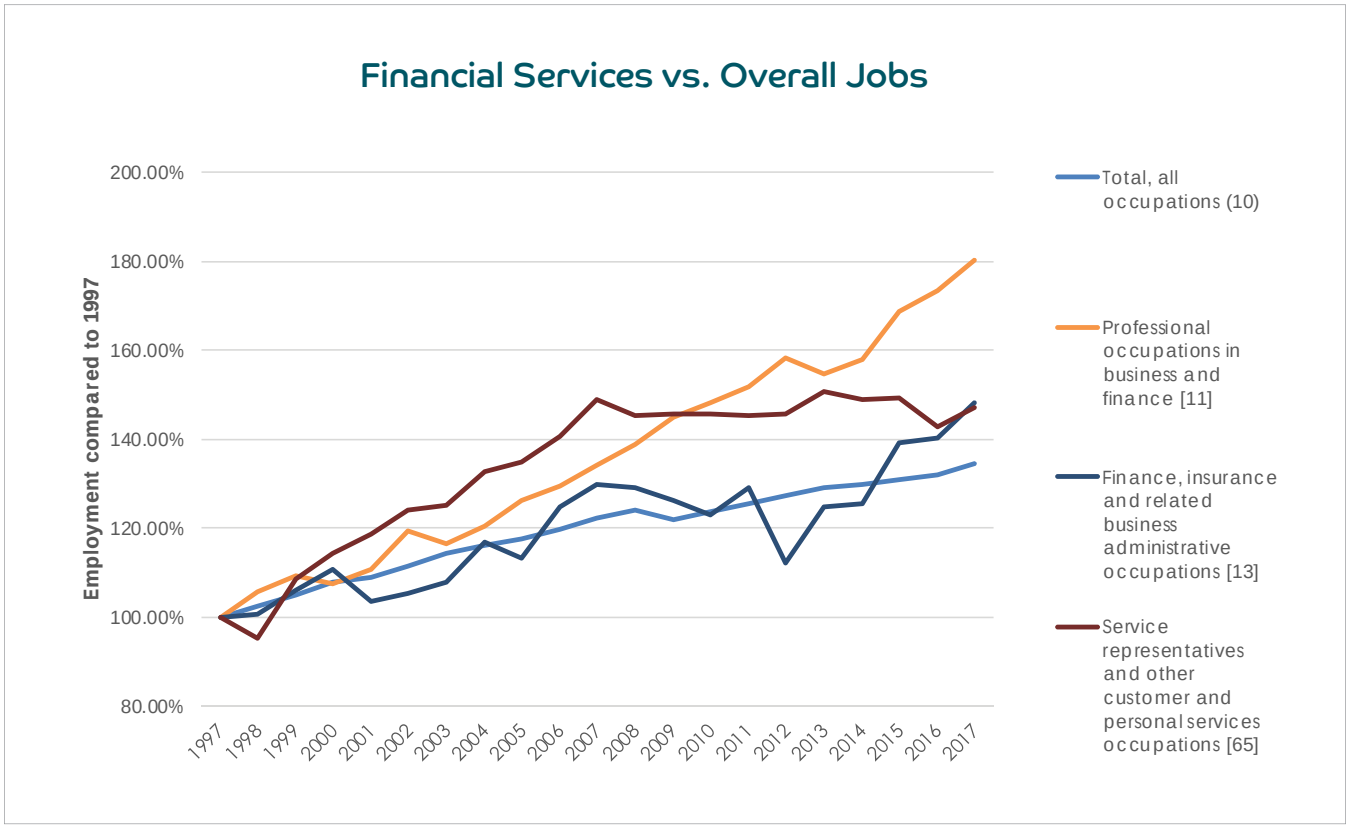
4 Marc Andreesen, "Why Software is Eating the World," *Wall Street Journal*, August 20 2011, accessed online: www.wsj.com/articles/SB10001424053111903480904576512250915629460

5 Statistics Canada, *Labour Force Survey*, CANSIM table 281-0024, March 2017.

manufacturing today is at 86% of the levels seen in 2002, and Germany has seen similar disruptions, having fallen somewhat since the peak in 2007, and is now at 94% of that peak level.[6]

However, it is too simplistic to draw a direct line from automation to job loss. Manufacturing automation in Canada is lower than other competitor countries that have experienced significantly less job loss in that sector.[7] This shows a more nuanced picture, as automation may contribute to a net reduction in labour demand, but in countries that have more rapidly adopted robotics and automation, job losses were mitigated and more employment was preserved by being more competitive.

In sectors, such as finance, that have seen significant automation in the form of ATMs, we also see the employment effects are more complex than the "elimination of jobs" narrative. Employment in financial services has seen faster growth than the overall economy since 1997, even for teller-type jobs, which peaked in 2008 and remained stable since. At the same time, the fastest growth has been seen in more senior positions among finance professionals.



6 Organization for Economic Co-operation and Development, *Employment by Economic Activity: Manufacturing: All Persons*, retrieved from FRED, Federal Reserve Bank of St. Louis, May 16, 2017

7 International Federation of Robotics, *Welcome to IFR Press Conference*, September 2016

This demonstrates the best understanding of automation's impact may be a "transformation of jobs." As one HR expert from RBC explained, the job of "teller" has changed significantly. In the past, tellers focused on processing transactions and handling cash, but today, the role is shifting towards financial advising, sales and customer service, leaving the routine payments to machines. Meanwhile, efficiencies from automation helped grow new opportunities in other areas such as managing investments, new financial products and other services.

For the digital type of automation, prominent examples of disruption include the bankruptcy of Blockbuster in 2013,[8] Sears in June of 2017 and music store chain HMV in January of 2017. This also accounts for the rapid rise of competitors in traditionally stable markets such as taxis, hotels and other sectors. These bankruptcies happened in short timeframes and disrupted major existing employers, rather than following a pattern of slow declining employment.

Also, the high profile stories overlook the innumerable small businesses and part-time work arrangements created online, which challenge standard definitions of "jobs." While these do raise valid concerns about stability and job quality, this also represents an opportunity for workers who would not otherwise have the chance to participate in the economy at all and allows many entrepreneurs to start a small business that they otherwise could not.

This report examines a number of particular skills challenges related to various forms of automation. In order to provide a unique perspective, the Canadian Chamber of Commerce brought together businesses, educators and other stakeholders and combined research with feedback it received at a series of roundtables it held in Ottawa, Toronto and Calgary. The Canadian Chamber thanks its hosts at Ryerson University, Algonquin College and the Southern Alberta Institute of Technology and all those who participated in these events.

8 Christopher Harress, "The Sad End of Blockbuster Video," *International Business Times*, December 2013, accessed online: www.ibtimes.com/sad-end-blockbuster-video-onetime-5-billion-company-being-liquidated-competition-1496962

SKILLS CHALLENGE 1

Who is going to be replaced? How many people is this going to affect?

What we heard at our roundtables:

- "We are moving from a knowledge economy to a wisdom economy."
- "42% of current jobs in the Canadian labour market are at high risk—lower paid jobs in particular, such as data collection, data processing, predictable physical work. Lower skilled workers have the highest vulnerability."
- "45% of paid activities can be automated, though not necessarily full jobs."
- "There is a lower risk for automation in areas like stakeholder interaction/relations management, human interaction/ services, education."
- "Regional trends in automation are affected by diversity of local labour pools—wide variations by region, with some more vulnerable than others."
- "Ontario is moving on the need for good labour market information (LMI)."
- "Businesses need to understand and utilize LMI better."
- "We can learn from a lot of countries, such as Sweden and Denmark. Learn from their best practices."
- "Nationally, we can benefit from a move to a skills-based system that is tied to the EU qualification system that allows mobility in all directions."

The adoption of automation is essential to maintaining living standards.

Automation adds between 0.9% to 1.5% to overall GDP growth.

Nobody is certain yet about the precise impact of automation. Estimates vary depending on the assumptions and definitions used. But, by looking at different studies, we can get a general idea of what experts expect to happen and what patterns of displacement in the workforce are the most likely.

Osborne and Frey, in 2013, examined the U.S. labour market from an occupation-based approach[9] and estimated that in the next 10 to 20 years, as many as 47% of U.S. jobs could be automated.[10] Using a similar methodology, Employment and Social Development Canada (ESDC) estimated that within the Canadian economy, approximately 43.6% of occupations had a "high probability of computerization."[11] According to these studies, occupations susceptible to automation tended to be in areas requiring less than university while occupations with a "low probability of computerization" were primarily in management, university or college-level categories.

The OECD analyzed professions using a task-based approach to determine how susceptible those jobs are to automation, rather than overall occupations. They estimate 9% of the Canadian workforce is at risk of job loss and a mean automatability of approximately 44% as a whole.[12] Using a similar methodology, the Brookfield Institute estimates that nearly 42% of the labour force is at a high risk of being affected by automation in the next 10 to 20 years.[13]

The CD Howe Institute, on the other hand, concluded that industries where more than three quarters of the jobs are at highest risk of automation account for only 1.7% of total employment, or 310,000 jobs.[14] However, its estimate also concludes that roughly 35% of Canadians are employed in occupations highly susceptible to automation, and that while these occupations would continue to exist, the skills required will change as technology advances.

9 Carl Frey and Michael Osborne, *The Future of Employment*, 2013, Oxford Martin School, University of Oxford

10 Carl Frey and Michael Osborne, *The Future of Employment*, 2013, Oxford Martin School, University of Oxford, 43

11 Employment and Social Development Canada, *Canadian Occupational Projection System 2015 Projections, 2015-2024*, December 2015

12 M. Arntz, T. Gregory and U. Zierahn, "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis", *OECD Social, Employment and Migration Working Papers*, No. 189, OECD Publishing, 2016, accessed online: http://dx.doi.org/10.1787/5jlz9h56dvq7-en

13 Creig Lamb, *The Talented Mr. Robot: The Impact of Automation on Canada's Workforce*, June 2016

14 Matthias Oschinski and Rosalie Wyonch, *Future Shock? The Impact of Automation on Canada's Labour Market*, CD Howe Institute, March 2017

Lastly, McKinsey Global Institute examined the question globally, estimating that roughly 5% of occupations could potentially be fully automated and nearly 60% of all occupations could have up to a third of their activities automated.[15] It further concludes that the adoption of automation is essential to maintaining living standards with an aging population and counteracting the rising dependency ratios and falling economic growth rates, adding between 0.9% to 1.5% to overall GDP growth.[16]

These estimates reflect a consensus view on several issues. Routine tasks, whether manual or cognitive, are likely to be increasingly taken over by machinery and software in the coming years. The remaining demand for human labour is increasingly in non-routine activities, whether those are either physical or mental, and workers will require the skills to perform those non-routine activities to remain employable.

Much of the uncertainty rests on not knowing whether a reduction in routine activities within an existing job will result in either the elimination of that job or its transformation into one that focuses on existing non-routine activities, human interaction and other methods of adding value. For instance, in the case of cashiers, the automation of checkout and payment processing may result in a loss of employment or it may result in a refocusing of that position into customer service or sales.

Because of the centrality of skills and competencies on the impact of automation and future opportunities, the measurement of skills and competencies is essential for estimating the impact of new technology. Examples of such a competency-based systems are found in previous reports, such as the Canada West Foundation *Matchup* report,[17] which offers a potential model for Canada and cites comparable models overseas, such as the European Qualifications Framework.

Demand for human labour is increasingly in non-routine activities, whether those are either physical or mental.

15 McKinsey Global Institute, *A Future That Works: Automation, Employment and Productivity*, January 2017, 5

16 McKinsey Global Institute, *A Future That Works: Automation, Employment and Productivity*, January 2017, 92

17 Canada West Foundation, *Matchup: A Case for Pan-Canadian Competency Frameworks*, accessed online: http://cwf.ca/research/publications/matchup-a-case-for-pan-canadian-competency-frameworks/

Canada has begun to take steps to measure employment profiles in terms of a range of specific essential skills in the workforce, listing nine key skills: reading, writing, document use, numeracy, computer use, thinking, oral communication, working with others and continuous learning.[18] The importance of this competencies model is also reflected in the CMEC Global Competencies initiative, which is centered on six "pan-Canadian Global Competencies:" critical thinking and problem solving; innovation, creativity, and entrepreneurship; learning to learn/self-awareness and self-direction; collaboration; communication; and global citizenship and sustainability.[19]

Within the private sector, RBC has already begun significant initiatives around the future of work,[20] examining the changing transitions and the changing environment for employment and skills. This project contributed to this report and demonstrates the possibility of improving job transitions by looking through the lens of skills that apply across jobs.

Predictions are only as good as the data available, and Canada still needs to improve on the data it collects and publishes. Gaps remain in information about new modes of work and various pathways to training. In Ontario, the Ontario Labour Market Information (LMI) website seeks to offer more detail on jobs, outlook, education and income.[21] Federally, changes to the Job Bank website parallel some of these improvements, such as education profiles, income, training programs and outlook. As competency models gain adoption, they should eventually be applicable to these sites as well to better inform job seekers. These sites can also begin to profile new working arrangements.

New initiatives have been launched, such as the future skills lab and Labour Market Information Council with the Forum of Labour Market Ministers. These should embrace the

18 Employment and Social Development Canada, *Understanding Essential Skills*, September 2015, accessed online: www.canada.ca/en/employment-social-development/programs/essential-skills/definitions.html

19 Council of Ministers of Education of Canada, Global Competencies, accessed online: www.cmec.ca/682/Global_Competencies.html

20 Royal Bank of Canada, *Introducing RBC Future Launch: RBC's largest-ever commitment to help young Canadians prepare for the future of work*, March 28, 2017, accessed online: http://www.rbc.com/newsroom/news/2017/20170328-rbc-future_cnews.html

21 Ontario Ministry of Training, Colleges, and Universities, Ontario Labour Market Information Website Questions and Answers, July 2017, accessed online: www.tcu.gov.on.ca/eng/eopg/publications/lmi-website-qs-as-en.pdf

measurement of new modes of work, more granular measurement of qualifications to distinguish between different educational pathways and the measurement of a skills and competency perspective on the labour force. Combined with measuring new modes of work, this data can help support a labour force that is better ready for automation.

RECOMMENDATIONS

All stakeholders: Every organization needs to increase its focus on skills development in essential skills that are resistant to automation and examine employees' activities to determine what can potentially be automated.

- Support a general movement away from training for routine, repetitive tasks and towards non-routine and more complex activities, along with better planning around the adoption of appropriate technology as it becomes available.

Government: Implement a competency-based measurement framework towards workforce skills supply and demand. Aim for a complete map of the workforce based on the skills and competencies, at which level, required for each job, and provided by each training program, linked to publicly available resources for employers and employees alike.

- Provincial and federal governments should seek to incorporate new data from competency measurement into tools such, as Ontario's LMI website and Job Bank platform, as they become available.

Government: Labour market information needs to be more granular to better measure alternative pathways to education, different combinations of qualifications, such as mixtures of university programs, college programs, micro-credentials and badges, as well as offer a more detailed measurement of emerging modes of working.

- Government can also leverage existing projects and partnerships to use administrative data and, in conjunction with its data, reach out to private sector actors for greater information on data, such as job postings and new work platforms, as well as partner with private sector labour market information organizations.

SKILLS CHALLENGE 2

How much might retraining all of those people cost? Can we afford it?

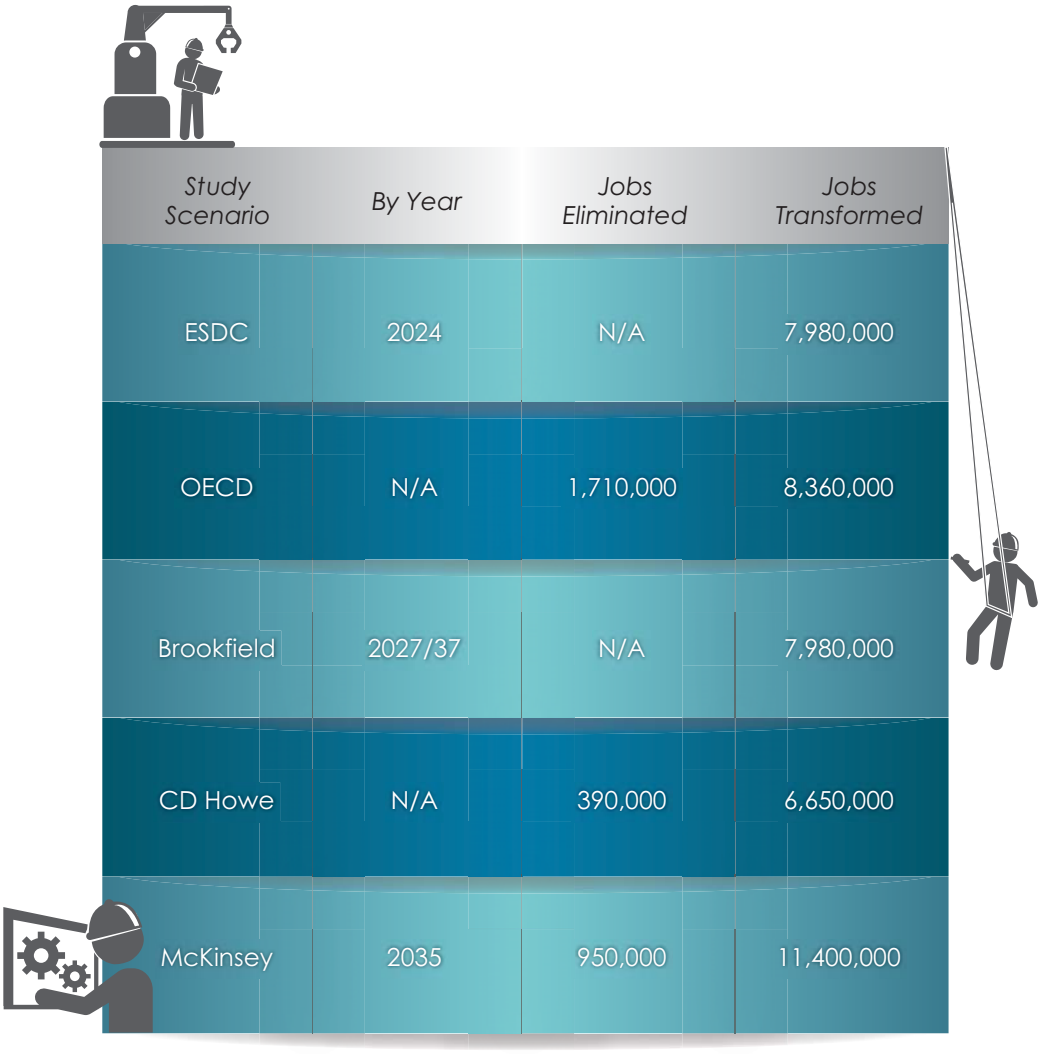
What we heard at our roundtables:

- “Though they are upskilling, people don’t have time to go to school for four years.”
- “If training means going to school, small businesses don’t have the dollars to help train formally, but they have extensive experience at informal training.”
- “Firms need to invest—put every employee into specific training—from new hires to senior management.”
- “Unions need to come in as a partner in continuous learning.”
- “There needs to be a bridge, including time to train and adapt.”
- “Canada Job Grant—is it working? Some companies say it does, others say it doesn’t.”
- “Canada Job Grant doesn’t cover in-house training.”
- “Quebec’s training incentive model offers some interesting ideas.”
- “There is a strong need for shorter credential opportunities; i.e., micro credentials.”
- “Digital skills are key, along with overall technological literacy.”

390,000 to 1.7 million people will see their jobs cease to exist, and 6.6 million to 11.4 million people will see their jobs substantially altered in the next 10 to 20 years.

The cost of retraining depends entirely on the amount of retraining displaced workers will need. The challenge can range from nearly insurmountable to entirely manageable, depending on whether we can be efficient with training dollars and hours.

Canada has a labour force of about 19 million people as of 2017.[22] Different scenarios estimate that 1.7% to 9% of occupations are likely to become entirely automated, and 35% to 60% of occupations are expected to be transformed due to technological change over the coming decades. Applying these estimates to the workforce, 390,000 to 1.7 million people will see their jobs cease to exist, and 6.6 million to 11.4 million people will see their jobs substantially altered in the next 10 to 20 years.



Study Scenario	By Year	Jobs Eliminated	Jobs Transformed
ESDC	2024	N/A	7,980,000
OECD	N/A	1,710,000	8,360,000
Brookfield	2027/37	N/A	7,980,000
CD Howe	N/A	390,000	6,650,000
McKinsey	2035	950,000	11,400,000

22 Statistics Canada, *Labour Force, Employment, and Unemployment, Levels and Rates, January 2017*, accessed online: www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/labor07a-eng.htm

The estimated cost of one year of attending higher education, is approximately $15,798 per year.

This gives a rough estimate of the size and timeline of the retraining issue. Between 390,000 to 1.7 million Canadians may need to be fully retrained into new fields as their prior employment may cease to exist, while 6.6 million to 11 million workers may require additional training in order to remain employed in their present positions as technology transforms their occupation.

The cost of retraining depends on the assumptions about the level and intensity of training. According to most of the estimates, the largest changes will happen to lower-skilled jobs that do not require higher education, and expansions of demand will most likely happen in areas that require some kind of post-secondary qualification or formal training.

If retraining does not occur until after workers have already been displaced, the budget impacts could be substantial. Assume those facing the elimination of their employment require a full two years of full-time training (the duration of a two-year college program or a two-year postgraduate degree), and those facing transformation will require an average of one year of full-time training (the duration of a shorter credential). When the cost of living is considered, the estimated cost of one year of attending higher education, according to the Canadian University Survey Consortium, is approximately $15,798 per year.[23] Total costs under this assumption would equal:

Study Scenarios	Est. Total Cost ($)	Cost Per Year ($)
ESDC (to 2024)	126,068,040,000	18,009,720,000
OECD (to 2037)	186,100,440,000	9,305,022,000
Brookfield (to 2037)	126,068,040,000	6,303,402,000
CD Howe (to 2027)	117,379,140,000	11,737,914,000
McKinsey (to 2035)	210,113,400,000	11,672,966,667

23 Canadian University Survey Consortium, *2015 Survey of Graduating University Student Survey Master Report*, July 2015, accessed online: www.cusc-ccreu.ca/CUSC_2015_Graduating_Master%20Report_English.pdf

This analysis is, unfortunately, limited by the lack of official Statistics Canada information on college and polytechnic tuition fees, let alone other pathways for training. However, it is similar to other recent estimates of cost. The December 2017 Barton report estimates an approximately $15-billion gap in training funds for reskilling due to automation.[24]

Supporting workers for full-duration higher education programs, including living expenses, would be prohibitively expensive with existing funds. The total budget for existing Labour Market Development Agreements under the EI fund is approximately $3.3 billion per year.[25] Even if combined with the entire $1.1-billion federal student loan and grant budget (circa 2015),[26] this still fails to remotely equal the scale of the challenge. Full-time, full-duration programs will remain a necessity in cases of job loss; however, the dependence on this pathway should be minimized as much as possible.

Studying while working drastically reduces this figure. If we assume these workers can take the same educational programs while still in employment and pay only the average undergraduate tuition in Canada of $6,373[27] for each year of study, the figures are less than half of the above amount.

Study Scenarios:	Est. Total Cost ($)	Cost Per Year ($)
ESDC (to 2024)	50,856,540,000	7,265,220,000
OECD (to 2037)	75,073,940,000	3,753,697,000
Brookfield (to 2037)	50,856,540,000	2,542,827,000
CD Howe (to 2027)	47,351,390,000	4,735,139,000
McKinsey (to 2035)	84,760,900,000	4,708,938,889

24 Advisory Council on Economic Growth, *Learning Nation: Equipping Canada's Workforce with the Skills of the Future*, December 2017, accessed online: www.budget.gc.ca/aceg-ccce/pdf/learning-nation-eng.pdf

25 ESDC, *Budget 2017 supports lifelong learning for a changing job market*, March 2017, accessed online: www.canada.ca/en/employment-social-development/news/2017/03/budget_2017_supportslifelonglearningforachangingjobmarket.html

26 Employment and Social Development Canada, *Canada Student Loans Program Annual Report 2014-2015*, December 2017, accessed online: www.canada.ca/en/employment-social-development/programs/canada-student-loans-grants/reports/cslp-2015.html

27 Statistics Canada, *Tuition Fees for Degree Programs, 2016/2017*, September 2016, accessed online: www.statcan.gc.ca/daily-quotidien/160907/dq160907a-eng.htm

With targeted skills development plans, single courses and short boot camps can be sufficient for many transitions between jobs.

While lower, these costs would still challenge federal training funds. Further savings can be realized if the requirements for retraining are reduced to short-duration, targeted courses and the recognition of skills learned while on the job as well as by encouraging better use of freely available resources for self-directed learning.

A single prior learning assessment, for example, can cost under $100 for a single course or under $700 for an entire program, compared to thousands of dollars for a full year of higher education.[28] Individual courses at the university and college level cost a fraction of the full tuition.

Roundtable participant RBC highlights the fact that with targeted skills development plans, single courses and short boot camps can be sufficient for many transitions between jobs. Making use of these types of programs can reduce the cost of a successful job transition by an order of magnitude. These do, however, require better identification of skill gaps in employees and better targeting of skills training for market needs.

28 Algonquin College, Prior Learning Assessment and Recognition, *How much does it cost?*, 2018, accessed online: www.algonquincollege.com/plar/

Savings can be found by leveraging existing private training dollars more efficiently as well. The existing Canada Jobs Grant provides valuable training opportunities; however, it focuses on block grants delivered on a pre-set timeline for only certain kinds of training. The full spectrum of business training activities, such as in-house training, partnering with adult education providers, like colleges and universities, to train employees on-site in the workplace, paid apprentices and paid internships, aren't supported by this type of funding. Even the smallest business engages in training. The CFIB reports that nearly 95% of workplaces offer some form of formalized on-the-job training,[29] and the Business Council of Canada reports that 93% of employers offer formal employer-sponsored training,[30] yet little of it receives support or recognition.

As an alternative for recognizing expenses, Quebec's *Act to Promote Workforce Skills Development and Recognition* acknowledges a wider range of training.[31] This list includes training at eligible training institutions, a portion of employee salaries engaged in training activities, apprentice salaries, replacement employee costs and other expenses. To support new models of training, acknowledging the wider range of potential expenses can allow greater flexibility.

When transitioning jobs, in-house training is not always recognized the same as formal qualifications. To improve the transferability of training, employers can partner with educators to improve their own training, adapt training materials and certify the skills acquired and be encouraged to do so by funding incentives. This can be supported by the collaboration of business educational institutions, the better use of open source training materials and by backing transferrable skills when offering funding incentives.

If the cost of retraining can be reduced by focusing on shorter programs, leveraging existing business training budgets and supporting the upgrading of qualifications towards formal certifications, the costs of automation can be made to fall within the existing training budgets.

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29 Canadian Federation of Independent Business, *Canada's Training Ground: SMEs' $18 Billion Investment in the Nation's Workforce*, 2009, accessed online: www.cfib.ca/research/reports/rr3083.pdf

30 Business Council of Canada, *Developing Canada's future workforce: a survey of large private-sector employers*, March 2016, accessed online: http://thebusinesscouncil.ca/wp-content/uploads/2016/02/Developing-Canadas-Workforce-March.pdf

31 LegisQuebec, *Regulation respecting eligible training expenditures – Act to Promote Workplace Skills and Recognition*, updated Nov. 15, 2017, Chapter D-8, r.3 Accessed online: http://legisquebec.gouv.qc.ca/en/ShowDoc/cr/D-8.3,%20r.%203

RECOMMENDATIONS

Government: Statistics Canada should begin by collecting and publishing more detailed information on education costs and expanding the current published analysis from primarily university tuition to include college costs and a more detailed analysis of courses below the full degree and certificate level, such as prior learning assessments and shorter duration courses.

Government: Support more adaptable funding models for skills training to provide more flexible and lower-cost training models. This means supporting and helping to improve in-house training, certifying skills gained on the job and better connecting short-term programs with a high focus on adult lifelong training and continual education.

- One route for this would be to establish a Premium Reduction Program for training (PRP-Training) under EI for training incentives, recognizing a broad range of training avenues, such as internal training, qualification (degree/diploma) upgrading, short-duration programs, hired external trainers and others similar to recognition of training in Quebec.
- This PRP-Training can offer varying discount rates based on the type of training and expenditures involved, with greater incentives for higher-priority activities. For example, offering increased discounts for upgrading qualifications and support for essential skills and to marginalized workers.
- Through EI discounts, in-house training that meets the minimum criteria for transferrable credentials, quality of training and skills outcomes can be incentivized, improved and measured.
- Creating an automatic discount on premiums based on the type of training provided, with criteria and discount rates established in advance, allows companies to train first and then get refunded rather than waiting on applications.

SKILLS CHALLENGE 3

What is the upside of automation? Why should we embrace it and how?

What we heard at our roundtables:

- "The aggregate levels of job creation through automation are starting to overtake job losses due to automation."
- "Productivity gains correlate to a higher quality of living—supporting automation is a positive strategy for job creation."
- "Technology bridges talent gaps, such as moderate levels of numeracy and technological literacy."
- "Through technology/automation, there will be a decline in off-shoring as labour costs shrink as a share of total costs."
- "Many emerging jobs/professions do not have academic or other training streams as an entry point. They require new combinations of skills that did not exist before."
- "Strategies for lifelong learning and retraining; i.e., *Coding for Coal Miners* is already a success in some areas."
- "Mapping transferability of skills—knowing how existing jobs can transfer to new ones—is a game changer."
- "Empowering career mobility is key—proactively retraining target groups, building resiliency."
- "Skilled trades are difficult to automate. They fit in the non-routine category."

> "Over 30% of all jobs created in the 1990s did not previously exist."

By 2031, the labour force is expected to grow to between 20.5 and 22.5 million, but the share of the population participating in the labour force is expected to fall to 59.7% and 62.6%, the lowest levels since the 1970s.[32] By 2030, Canada is expected to see a significantly increased dependency ratio, with an expected ratio of over 70 Canadians over age 65 or under age 15 for every 100 Canadians between 15 and 65.[33] Given this scenario, maximizing the productivity of the labour force is of paramount importance to ensure the economy can continue to grow and quality of life does not suffer.

As a participant in the Ottawa roundtable noted, "Over 30% of all jobs created in the 1990s did not previously exist." Others reached the same conclusion, such as Deloitte's U.K. study citing the job-creating history of technology, paired with shifts in the demand for particular skills.[34]

Given the expected significant economic upside to automation—adding 0.9% to 1.5% to overall GDP growth[35]—the number of new positions that could potentially be created cannot be ignored. Estimates of the connection between GDP growth and employment link a 1% increase in GDP to an increase in employment of 0.3% to 0.38%.[36] In Canada, for a workforce of 19 million, the additional 0.9% to 1.5% GDP growth from automation would translate into between 51,000 and 108,000 additional new jobs per year. In the baseline scenario, ESDC estimates that, between 2005 and 2014, there was an average of under 200,000 jobs total created per year, so this would represent a significant increase.[37]

The OECD provides some guidance on the skills mix required to capitalize on these emerging technological sectors. The *Skills 2017* report states, "Industries need workers with literacy, numeracy and problem solving skills, prowess in management and communication and a readiness to keep learning. The more firms that have workers with these skills, the more productivity gains from GVCs [global value chains] will spread across whole economies. Yet OECD analysis has found that about one adult in four across OECD member countries has low literacy or numeracy skills."[38] The key mix is both a combination of strong essential skills, such as numeracy and literacy, and a high degree of coordination between industry and education systems for the acquisition of job-specific skills so that training is efficient and effective.

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32 Statistics Canada, *Projected trends to 2031 for the Canadian labour force*, December 2012, accessed online: www.statcan.gc.ca/pub/11-010-x/2011008/part-partie3-eng.htm

33 Statistics Canada, *Population Projections for Canada, (2013 to 2063)* May 2015, accessed online: www.statcan.gc.ca/pub/91-520-x/91-520-x2014001-eng.pdf

34 Deloitte, *Technology and People: The Great Job-Creating Machine*, 2015, accessed online: www2.deloitte.com/content/dam/Deloitte/uk/Documents/finance/deloitte-uk-technology-and-people.pdf

35 McKinsey Global Institute, *A Future That Works: Automation, Employment and Productivity*, January 2017, 92

36 Steven Kapsos, *The Employment Intensity of Growth: Trends and Macroeconomic Determinants*, International Labour Organization, December 2015, Accessed online: www.oit.org/wcmsp5/groups/public/---ed_emp/---emp_elm/documents/publication/wcms_143163.pdf

37 ESDC, *Canadian Occupational Projection System, Job Openings 2015-2024*, October 2017, accessed online: http://occupations.esdc.gc.ca/sppc-cops/l.3bd.2t.1.3lshtml@-eng.jsp?fid=50&lid=64

38 OECD, Employment, *Improving Adult Skills Can Help Countries Benefit From Globalization*, April 2017, accessed online: www.oecd.org/newsroom/improving-adult-skills-can-help-countries-benefit-from-globalisation.htm

The need for specific technical skills in employment is equally echoed in the Burning Glass report on arts graduates, *The Art of Employment.* Short technical programs can double the number of potential job opportunities available for students with general education and high levels of core competency.[39] These programs are accessible without requiring full-length programs and drastically improve labour market outcomes when paired with a strong foundational skill set.

Supporting the shift away from physical markets and towards software is not only a benefit on the consumer side. Businesses increasingly make use of digital products hosted on adaptable infrastructure, such as data centres, along with the internet connections to customers, either physical or wireless. Rather than depending on retail stores or manufacturing plants that must be constructed and scaled-up over time, businesses that exist as software can scale directly to consumer demand. This general-purpose digital infrastructure still requires significant amounts of hardware and resources.

If Canada wants to be the home of emerging companies, then it needs to ensure it has the people to build and maintain it. This requires a mix of workers with newly emerging qualifications in university, college and skilled trades, working in fields such as power, telecommunications, construction and various forms of engineering. These are the kind of technical, job-specific skills that require a high level of coordination between businesses and educators.

Training should anticipate that the same software-centred disruption will continue to happen in a wider range of industries as more digital technologies converge. These might connect together new forms of multi-purpose infrastructure, such as data centres, 3D printing, self-driving cars, autonomous drones and others. These, in turn, can benefit from revolutions in software that enable new business models, such as artificial intelligence, blockchain or big data analytics. As technologies mature, training institutions will have to be ready to adapt to train workers in short periods of time.

The specific industries affected and the specific impact it will have is unknown, but the same trend of requiring skilled workers who can be trained on emerging technology in short amounts of time will remain. To gain the maximum benefit from automation, training institutions will have to continue to instill the mix of literacy and numeracy skills as well as technical qualifications that are required.

Short technical programs can double the number of potential job opportunities available for students with general education and high levels of core competency.

39 Burning Glass Technologies, *The Art of Employment*, August 2013, accessed online: http://burning-glass.com/wp-content/uploads/BGTReportLiberalArts.pdf

RECOMMENDATIONS

Government: Examine the impact of new developments in skills development, such as the new curriculum model in B.C., which emphasizes acquisition of essential skills, such as teamwork, creative and critical thinking, self-motivation and developing an attitude of lifelong learning, and how those impact outcomes and the relationship to higher education pathways.

Government and educational institutions: Support more rapid development and accreditation of programs for emerging training needs, such as micro-credentialing, adult learning and prior learning assessments, to meet the shifting needs of the labour market. Support the development of new programs for emerging industries in shorter timeframes with industry partnership.

- Programs should focus on the parallel goals of building core competencies and essential skills as well as providing technical qualifications for emerging platforms.
- Support pathways and accompanying funding mechanisms so students acquiring skills through diverse means, such as self-learning, on the job training and other sources, can seek recognition and accreditation of their skills through recognized post-secondary institutions.
- Accelerate the program approval process and give institutions more freedom to develop qualifications in less time to meet the needs of industry.
- Ensure student financial aid programs can be applied to these alternative modes of learning, such as short-duration programs, prior learning assessments and micro-credentials, either through existing streams or the creation of new ones.

SKILLS CHALLENGE 4

How are we doing at giving people the skills they need so far?

What we heard at our roundtables:

- "The post-secondary system needs to do a better job of using technology."
- "Businesses can use the opportunity to learn alongside their clients."
- "Examples of impactful foundational skills include people skills, adaptability, interactive, communication and work ethic."
- "Others include communication, problem-solving, team-building—but especially work ethic."
- "Business literacy is in demand—more than just specific skills, but the ability to function in a workplace."
- "Skills assessment is becoming a big business."
- "Employees seem to be asking, "Are skills something that my employer is going to take care of for me?"
- "From an employer perspective, employees should understand the internal shift of the responsibility of each individual for planning and development."
- "Millennials are looking for companies that are willing to train. This is a big factor when looking for new job opportunities."

"Business literacy is in demand—more than just specific skills, but the ability to function in a workplace."

- "Getting industry to recognize the value of micro-credentials. There is a need to set standards and recognition."
- "Though they are upskilling, people don't have time to go to school for four years."
- "When it comes to essential versus technical skills, hiring managers are often short-term thinkers. Today, there is less opportunity to learn on the job."
- "We would not dream of starting a hockey player at 18. They start very young. This needs to be the same for skills and development—start early."

We know that to remain employed and productive, workers need the right mix of essential skills to transition between jobs, along with the key technical skills those jobs require.

Canada has begun to take steps to measure employment profiles in terms of a range of specific essential skills in the workforce.[40] This set of measurements is a positive development, but currently focuses on the measurement of the labour market side and does not yet have a deeper connection to education programs, official qualification recognition and skill improvement.

Canada's K-12 educational systems are among the best in the world, in both developing skills and reaching a broad cross-section of Canadian society. According to the international PISA measurements, Canadian secondary students place among the top countries in the OECD, overall, in the areas of literacy, mathematics and science.[41] Canadian students rank above the OECD average on all three measurements, with a high degree of achievement across social and economic groups as well.

Canada ranks above the OECD average on problem solving, but only equals the average score on literacy and falls below average on numeracy.

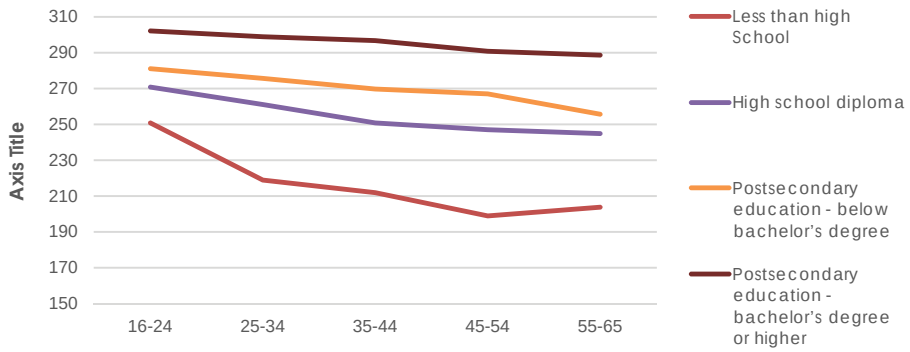
On the Programme for the International Assessment of Adult Competencies (PIAAC) measurements of adult skills, however, the Canadian workforce begins to see some difficulties. Canada ranks above the OECD average on problem solving, but only equals the average score on literacy and falls below average on numeracy.[42] These skills show a significant decline over time in the workforce with participants aged 25 to 34 having the highest skill levels in all three categories and participants aged 55 to 65 having the lowest.

40 Employment and Social Development Canada, *Understanding Essential Skills*, September 2015, accessed online: www.canada.ca/en/employment-social-development/programs/essential-skills/definitions.html

41 Council of Ministers of Education, Canada, *Measuring Up: Canadian Results of the OECD PISA Study*, 2016, accessed online: www.cmec.ca/Publications/Lists/Publications/Attachments/365/PISA2015-CdnReport-EN.pdf

42 Statistics Canada, *Skills in Canada: First Results from the Programme for the International Assessment of Adult Competencies*, 2013, accessed online: www.cmec.ca/Publications/Lists/Publications/Attachments/315/Canadian-PIAAC-Report.EN.pdf

Average PIAAC Numeracy Score, by Age and Education



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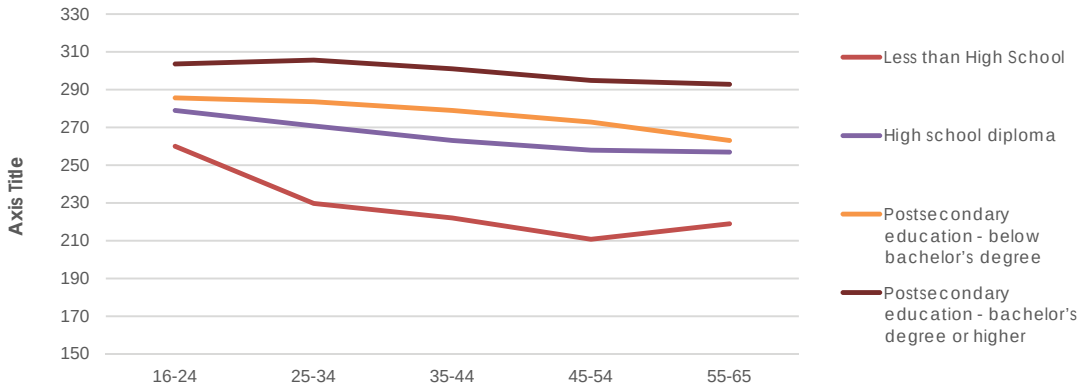
We see that not only do PIAAC scores begin at different levels early on, but the change in skill level over time is significantly different, depending on the education level. Canadians with bachelor degrees or higher education see a decline of less than five points, while those with below high school see a decline of more than 40 points. Similar trends are seen in literacy scores as well.

Average PIAAC Literacy Score, by Age and Education



44

43 Statistics Canada, *Chart 2.6b, Numeracy* — Average scores with 0.95 confidence interval and scores at the 5th, 25th, 75th, and 95th percentiles of population aged 16 to 65, by highest level of completed education and age group, Canada, 2012, November 2015, accessed online: www.statcan.gc.ca/pub/89-555-x/2013001/c-g/desc/desc2.6b-eng.htm

44 Statistics Canada, *Chart 2.6a Literacy* — Average scores with 0.95 confidence interval and scores at the 5th, 25th, 75th, and 95th percentiles of population aged 16 to 65, by highest level of completed education and age group, Canada, 2012, November 2015, accessed online: www.statcan.gc.ca/pub/89-555-x/2013001/c-g/desc/desc2.6a-eng.htm

Overall, in literacy we see a similar low rate of decline, only five points, for those with bachelor degrees or higher, and a similar high level of decline of nearly 40 points for those with less than high school. These declines reflect different levels of ongoing education. There is a high correlation between the education achieved and the participation in lifelong learning.[45]

Employers have cited numeracy challenges as a difficulty in recruiting. Differences in numeracy levels have shown a significant impact on employment and income, with people in the lowest skill categories more than three times more likely to be low income than those with the highest skill categories.[46]

While measurements of outcomes are widespread in Canada for fundamental skills, there is still significant work to be done on the measurement of the advancement of those skills. In the United States, state and federal programs have increasingly shifted towards the measurement of growth instead. This means that rather than measuring the number of students meeting a specific standard, schools are compared based on the amount of improvement students are able to demonstrate.[47] This shift allows a better measurement of the actual impact of specific education programs, which can support decisions regarding funding and prioritizing the pathways to acquire skills.

Furthermore, Canada can look inwards to see the jurisdictions that are pushing the leading edge on skills development. Commentators at the Canadian Chamber roundtables praised the work being done by the B.C. school system around the new curriculum that emphasizes skills like communication, creative and critical thinking and personal and social skills.[48] These are integrated with lessons in acquiring traditional essential skills, such as numeracy and literacy.

Growth measurement is a key consideration for any future skills development plan in Canada, especially for core transferrable skills,

Employers have cited numeracy challenges as a difficulty in recruiting.

45 D.W. Livingstone, D.W. and M. Rakov, *Adult Learning Trends in Canada, Research Studies on Work and Lifelong Learning*, CSEW, University of Toronto, 2013, 7, accessed online: www.wallnetwork.ca/Adult-Learning-Trends-in-Canada-2013.pdf

46 Statistics Canada, *The Association Between Skills and Low Income*, February 2016, accessed online: www.statcan.gc.ca/pub/75-006-x/2016001/article/14322-eng.pdf

47 American institutes for Research, *Proficiency vs Growth: An Exploration of Two Approaches for Writing Student Learning Targets*, April 2015, accessed online: www.air.org/sites/default/files/Exploration-of-Two-Approaches-Student-Learning-Targets-April-2015.pdf

48 Government of British Columbia, *BC's New Curriculum: Core Competencies*, accessed online: https://curriculum.gov.bc.ca/competencies

in order to ensure training mechanisms are effectively making a difference for Canadians who would not otherwise have access to more advanced employment.

Employer-funded Essential Skills Training

Employment training is not simply a responsibility of government. Employers and employees, themselves, make significant investments in training already, both in formal and informal training. Conference Board of Canada data indicates training rates in Canada of approximately 30%[49] higher than the OECD average but lower than many competitor high-tech countries, such as Sweden and Norway. At the same time, analysts have highlighted rises and falls in the amount of employer spending on workplace training. While spending fell between 1993 and 2010, spending increased between 2010 and 2015 to approximately $800 per year.[50]

Recent increases in expenditure on training are a positive development. Issues remain with training, however. The investments with the highest return do not always align with the investments in the most marginalized groups or with employees in danger of displacement due to automation.

Generally, spending tends to be directed towards high-performing talent, especially with formal qualifications.

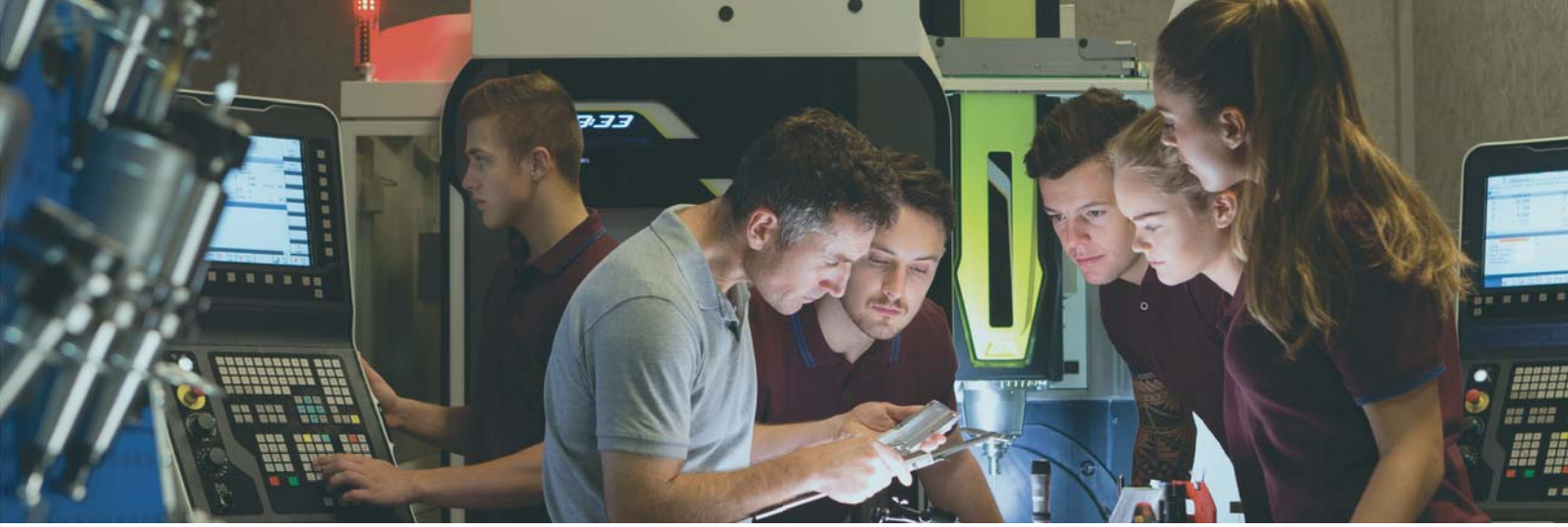
In surveys, businesses report their priorities are for the acquisition and training of high-performing, management-level talent.[51] Meanwhile, the most vulnerable groups are often not those targeted for the kind of skill development needed to overcome employment changes due to changing technology. The challenge for employers is to support training in a way that they support the needs of their business activities and budgets as well as reaching all of the members of the labour force in need of training. This is a key example of an area where targeted public funding interventions can support those in need.

Feedback from roundtable participants confirmed that, generally, spending tends to be directed towards high-performing talent,

49 Daniel Munro, Conference Board of Canada, *Developing Skills: Where are Canada's Employers?*, March 2014, accessed online: www.conferenceboard.ca/topics/education/commentaries/hot-topics-in-education/2014/03/20/Developing_Skills_Where_Are_Canada_s_Employers.aspx

50 Conference Board of Canada, *Turning a Corner – Canadian Employer's investments in Employee Learning and Development on the Rise*, December 2015, accessed online: www.conferenceboard.ca/press/newsrelease/15-12-10/Turning_a_Corner_Canadian_Employers_Investments_in_Employee_Learning_and_Development_on_the_Rise.aspx

51 Business Council of Canada, *Developing Canada's Future Workforce: A Survey of Large Private-Sector Employers*, March 2016, 14, accessed online: http://thebusinesscouncil.ca/wp-content/uploads/2016/03/Developing-Canadas-Future-Workforce.pdf



especially with formal qualifications. In terms of life-long skill maintenance, this is reflected in the divergent outcomes in the measurements of adult skills by education level. This shows a need for stronger incentives to direct training towards employees without formal qualifications.

All roundtable participants agreed on the importance of constant self-development. Employers highlighted the importance of seeking that attitude in new hires. Students supported access to learning at all stages of life, and educational institutions emphasized the importance of integrating those principles into programs.

Entrepreneurship is also an area participants widely supported. Programs are increasingly integrating these lessons into their curriculums. One hurdle young entrepreneurs do face, however, is that those under the legal age of majority can have difficulty starting a company.

At the same time, individuals do take steps to develop their own skills. This trend is only increasing. In Canada, we see explosive growth in online training programs, with the OECD reporting that nearly 77% of youth between the ages of 16 and 24 had participated in an online course, nearly double the numbers compared to the next highest country (Brazil, at 40%).[52]

Online courses offer one possible avenue for bringing marginalized groups into higher education because they can easily accommodate people's locations and work schedules. However, the recognition of credentials remains an issue as online education tends to correlate with prior education. Raising awareness among marginalized groups is the challenge.

In the area of online education, the movement towards involving public institutions in the creation of more materials, such as open educational resources, offers an avenue for supporting learners and businesses alike. Currently, these resources are mainly adapted for educational institutions and students but could be adapted for businesses' internal training programs as well.

52 OECD, *Highlights from the OECD Science, Technology, and Industry Scoreboard 2017 – The Digital Transformation: Canada*, November 2017, accessed online: www.oecd.org/canada/sti-scoreboard-2017-canada.pdf

RECOMMENDATIONS

Government: Support entrepreneurship at the K-12 and post-secondary levels by creating the opportunity to gain experience in launching businesses and by implementing changes to permit minors to operate their own businesses with reduced parental/guardian oversight.

Government: Use the measurements of skill and competency outcomes to establish the improvement resulting from different training programs. Models that demonstrate the greatest improvement in students can be promoted as best practices among educational institutions and adapted for the particular needs of other institutions.

- Support the development and adaptation of online repositories of open educational resources (OERs) to reduce training costs, support self-directed learning and provide materials that businesses can adapt for internal training programs, bringing them in line with formal training that leads to credentials. Sector collaborative groups can serve as an advisory resource for adapting and promoting open source materials as well.
- Ensure business expenditures on adapting OER materials for internal training programs constitute an EI premium reduction eligible expense.

All stakeholders: Ensure students are provided with useful and relevant information early on about the demand for skills in the labour market, with an emphasis on providing information on the diverse pathways to acquiring the skills and the certifications that are available.

- As improved data on skills supply and demand is acquired through skills-focused LMI analysis, it should be shared with educators and students at all levels.
- Particular questions should include the employment relevance and career possibilities of particular skills—both essential skills and the demand for various technical skills.
- Support a communications strategy to share skills demand data, both domestically and internationally, to ensure potential migrants to Canada have a more detailed understanding of the labour market demand.

SKILLS CHALLENGE 5

Will every group in Canada be able to acquire the skills needed to be employable? What can we do about it?

What we heard at our roundtables:

- "Teachers at the primary and secondary education levels need assistance knowing what the changing world of work looks like and what skills are needed today."
- "There is only a one-in-five chance of a child coming from a poor family getting a post-secondary education."
- "The lack of funding for language training is impeding our ability to employ refugees."
- "Companies need to commit more strongly to staff training."
- "There needs to be a bridge, including time to train and adapt."
- "Immigration policy is required that will fills the gaps."
- "The call to 'Keep jobs in Canada!' means making sure the top skilled people are in Canada."
- "Our immigration systems need to favour immigrants with appropriate and adaptable skills."
- "To sustain our standard of living, we need a disproportionate share of the best talent in the world."

> "Women are under-represented in fields, such as scientific and technical professions, where significant growth in demand will happen."

- "How can you teach an entrepreneurial mindset?"
- "How to engage K-12 better to develop a lifelong learning mindset early?"
- "For immigrants applying to work in Canada, there is a transferrable skills tool in the application process. This is not being utilized."
- "Students are making career choices early. Children in primary school need to be sensitized and provided with relevant information about options."

Participants at Canadian Chamber roundtables repeatedly cited the importance of ensuring as much of the population as possible is trained and ready for the economy created by automation. For employers, this is necessary to ensure the workforce can meet the emerging demand, and for employees, it is critical for ensuring they can remain connected to the labour market.

Challenges exist in terms of gender, immigration status, family financial resources and language, among others. Groups facing barriers to higher education now will face further challenges to employment due to automation. The people who will be most affected by automation are those who lack any form of post-secondary education, with only high school or on-the job training, according to estimates from ESDC.[53]

The K-12 system is an institution most Canadians are exposed to, compared to post-secondary systems, such as college and university that only see attendance from a minority of students. Career development information at this stage is particularly important as is the development of entrepreneurial attitudes towards work and skills.

Federally and provincially, governments have taken steps to reduce the cost of higher education in general, and these strategies are showing promise. Many groups that identified as facing barriers to improving their skills will benefit from these. Additional pathways should, nevertheless, be developed to avoid the mentality of one size fitting all in education. Barriers to education and employment affect potential workers due to income, immigration status, language, First Nations or Indigenous status or a range of other reasons, and solutions should be likewise diverse.

Viewed in gendered terms, the impact of automation is complex. The World Economic Forum foresees large job losses in the manufacturing and primary resource sectors, which are disproportionately male.[54] Women are under-represented in fields, such as scientific and technical professions, where significant growth in demand will happen. Fields, like healthcare and nursing, that are predominantly female are expected to be resilient to automation as well.[55]

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53 Employment and Social Development Canada, *Canadian Occupational Projection System 2015 Projections: Job Openings 2015-2024*, January 2016

54 World Economic Forum, *The Future of Jobs*, January 2016, 14

55 Employment and Social Development Canada, *Canadian Occupational Projection System 2015 Projections: Imbalances between labour demand and supply*, January 2016

The lower representation in STEM disciplines means that fewer have the kinds of degrees that indicate high-level numeracy, even where they might possess those skills.

The WEF estimates, "In absolute terms, men will face nearly four million job losses and 1.4 million gains, approximately one job gained for every three jobs lost, whereas women will face three million job losses and only 0.55 million gains, more than five jobs lost for every job gained."[56] Within Canada, ESDC also estimates that shortages will affect men and women in different ways.

"Men are more represented than women in most occupations projected to face shortage conditions, with the exception of occupations in health and in the social science, education, government service and religion sectors. All occupations in trades, transport and equipment or manufacturing and utilities projected to face shortage conditions are male dominated.

Although the share of women in natural and applied sciences and related occupations has increased over the last two decades, all occupations facing shortage conditions in this sector employed more men than women in 2014."[57]

Women increasingly hold a majority of university degrees at the bachelor and post-graduate levels.[58] The gender balance of colleges and trades has remained unchanged over time, with men receiving the largest share of qualifications, and in trades and apprenticeships, men predominate.[59]

Attainment by family income, likewise, shows some sharp divides, with lower-income students completing post-secondary at lower rates. PBO estimates that currently 60% of students in PSE belong to higher-income (upper two-income quintile) families.[60] Existing measures to refocus aid on lower-income families are important and should continue along with additional supports at the K-12 level and in higher education directly.

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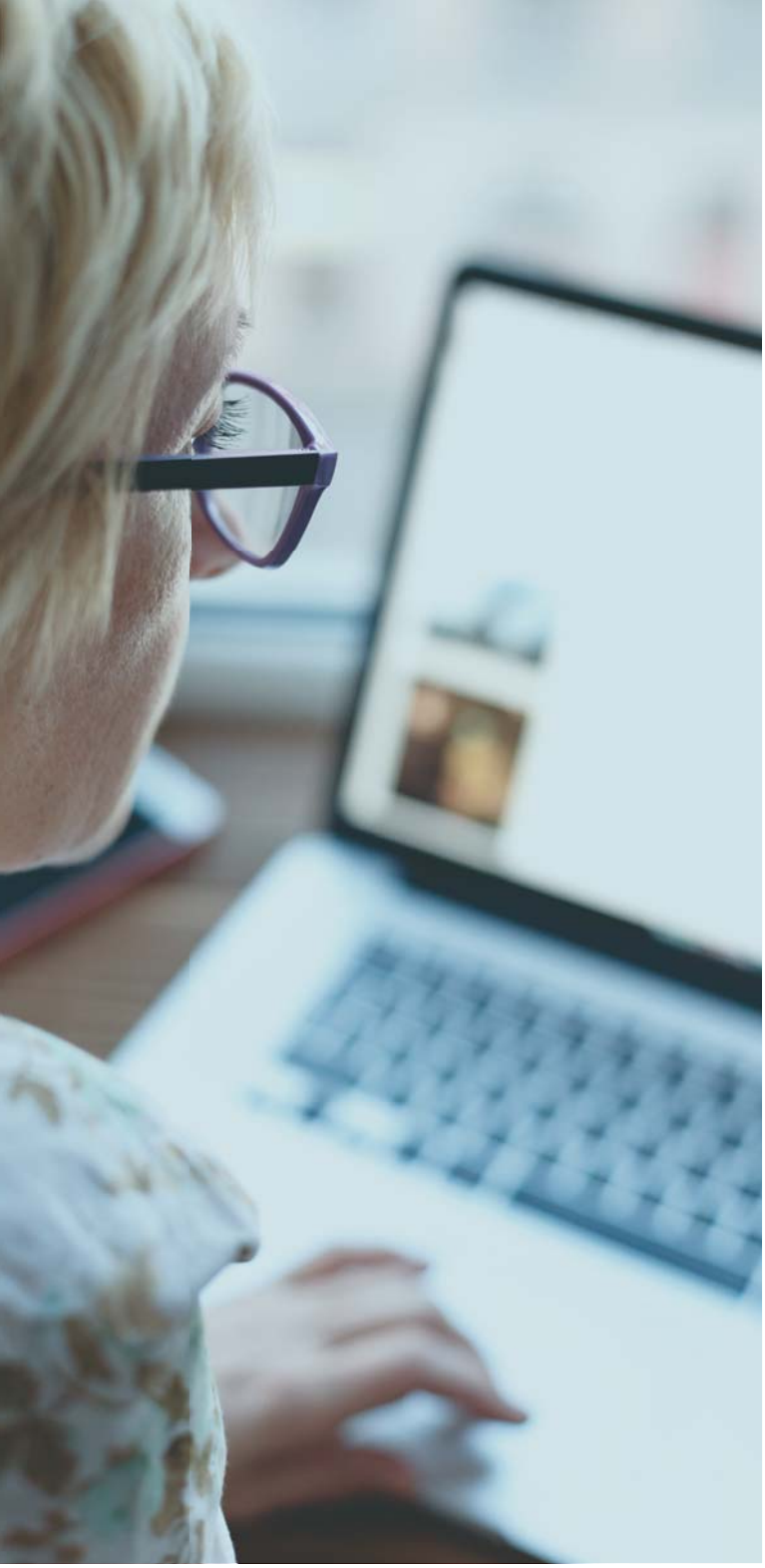
56 World Economic Forum, *The Future of Jobs*, January 2016, 14

57 Employment and Social Development Canada, *Canadian Occupational Projection System 2015 Projections: Imbalances Between Labour Demand and Supply, 2015-2024*, January 2016

58 Statistics Canada, *Proportion of Selected University Degrees as Highest Level of Educational Attainment by Sex and Age Group*, 2011, December 2015, accessed online: www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/2011001/c-g/c-g01-eng.cfm

59 Statistics Canada, *Proportion of Trades and College Qualifications as the Highest Level of Educational Attainment by Sex and Age Group, Canada 2011*, December 2015, accessed online: http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-012-x/2011001/c-g/c-g02-eng.cfm

60 Parliamentary Budget Office, *Federal Spending on Postsecondary Education*, May 2016, accessed online: www.pbo-dpb.gc.ca/web/default/files/Documents/Reports/2016/PSE/PSE_EN.pdf



Immigrants also face barriers due to credential recognition. Estimates show that hundreds of thousands of immigrants are not seeing their credentials fully recognized in Canada, hindering their ability to fully participate in the labour market. Increasing the use of tools for measuring transferrable skills before arrival, making prior learning assessment programs more accessible to new immigrants and supporting language training to overcome essential skills barriers can all contribute to the success of new Canadians.

For First Nations and Indigenous learners, certifying the educational outcomes resulting from existing employment so that experience can be made more transferrable can benefit employability. The outcomes from non-traditional and self-directed learning can also allow more pathways to acquiring recognized post-secondary credentials, which make a significant difference to income gaps.[61]

Re-examining the interaction of programs, skills acquisition and employment can help mitigate the labour market shortages of workers with high-level numeracy. By highlighting high-level numeracy skills of some non-STEM program graduates, some gaps in employment rates due to identity and background might both be mitigated.

In terms of skills demanded by emerging industries, high-level numeracy is one of the top priorities and among the hardest to find. Female students with high school grades between 90% and 100% were less likely to

61 Statistics Canada, *Median after-tax income lower for Aboriginal people: Aboriginal Statistics at a Glance: 2nd Edition*, December 2015, accessed online: http://www.statcan.gc.ca/pub/89-645-x/2015001/income-revenu-eng.htm

attend a STEM program than male students with grades between 80% and 89%.[62] Women represent only 39% of university graduates aged 24 to 35 with a STEM-specific degree.[63] This disadvantages many women since the lower representation in STEM disciplines means that fewer have the kinds of degrees that indicate high-level numeracy, even where they might possess those skills.

Employers have shown a willingness to hire outside of traditional program pathways as long as the workers can demonstrate they have the necessary skills, even in high-skilled science and technology fields. According to U.S. census data, representing one of the world's largest technology workforces, only approximately 33% of STEM graduates worked in a STEM field, and approximately 22% of STEM jobs were held by non-STEM graduates.[64] This could be enhanced by employers increasingly analyzing their own requirements on a skill and competency level.

Certifying skills and competencies and offering assessments of learning will help communicate those skills to potential employers. This also indicates that STEM learners ought to consider the likelihood of winding up in employment in other fields while completing their education. Skills outside of core competencies can translate into valuable workforce assets.

A greater focus on using programs, like prior learning assessments and skills and competency measurement, for certifying skills acquired in the workforce and education can support job transitions for those in lower income and immigrant groups. These programs can demonstrate the acquisition of higher-level skills gained through non-traditional pathways than their formal education credentials might indicate and can endorse skills acquired in foreign institutions that lack equivalency recognition in Canada.

While the encouragement of students of all genders to consider pathways outside of expectations and stereotypes is helpful, it is not the only possible route. An alternative path forward is less a matter of trying to redirect students into particular fields to achieve gender parity in those specific academic disciplines, but rather to increase the cross-pollination of skills between fields. Within the STEM and technical fields, there is a need for improved essential skills, such as communication, teamwork and emotional intelligence, and within the fields that already emphasize those skills, there may be a benefit to improving STEM and technical skills.

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62 Darcy Hango, *Gender Differences in Science, Technology, Engineering, Mathematics and Computer Science (STEM) Programs at University*, Statistics Canada, December 2013, 1, accessed online: www.statcan.gc.ca/pub/75-006-x/2013001/article/11874-eng.pdf

63 Darcy Hango, *Gender Differences in Science, Technology, Engineering, Mathematics and Computer Science (STEM) Programs at University*, Statistics Canada, December 2013, 1, accessed online: www.statcan.gc.ca/pub/75-006-x/2013001/article/11874-eng.pdf

64 United States Census Bureau, Where do College Graduates Work?, July 2014, accessed online: www.census.gov/dataviz/visualizations/stem/stem-html/

RECOMMENDATIONS

Government: Using the skills and competencies based measurement of credentials and training programs, create job transition maps so workers can see potential transfers between jobs based on their current skill levels and connections that require minimal retraining, along with mechanisms for advancing those skills to attain new employment.

- Ensure these maps can be linked to existing public job sites, such as Ontario's LMI website and Job Bank platform, as they become available.

Government: Align the measurement of skills and competencies for immigrants with compatible competency measurements applied to Canadian education outcomes and domestic job requirements. Use various assessments of qualifications, such as transferrable skills tools and prior learning assessments, to better support transitions into the workforce.

- Continue to support and expand language training for new immigrants.

Government: Expand international student visas to cover work-integrated learning and internships under work permits, and make international students eligible for participation in the Canada Summer Jobs Program to attract international students and promote business-post secondary connections.

Educators (PSE): Promote breadth in studies and the recognition of skills acquired outside of a core program of study, such as high-level math, literacy and critical thinking. Offer more educational options outside of core discipline subjects. Continue to promote the use of alternative modes of learning, work-integrated learning and teamwork.

Educators (K-12 and PSE): Ensure students are provided with useful and relevant information early on about the demand for skills in the labour market, career development skills and lifelong learning, along with information on the diverse pathways to acquiring the skills and certifications that are available.

Employers: Use competency measurements to profile each position within the business. Consider employment applications with skills acquired from a wider range of sources, with innovative skills mixes for new positions, and increasingly aim to hire based on essential skills and key qualifications, rather than specific educational programs.

SKILLS CHALLENGE 6

What kinds of connections do businesses, government, educators and students need to build so they can better manage this transition?

What we heard at our roundtables:

- "Competency frameworks and transferrable skills go hand-in-hand."
- "Starting at the lower levels, encouraging curiosity to be an entrepreneur and deal with failure and embrace growth."
- "Considering the relationship with government, post-secondary institutions and business, all participants need to find a more collaborative structure for interaction. Currently, everything is in silos, and we need to bring as many people into the conversation as possible."
- "Local, provincial or federal governments all need to start working together. Skills are global, not local, not regional."
- "Message for government: Any adopted strategy cannot be based on the timeline to the next budget. Government is thinking in two-year segments when it should think in decades."
- "As long as strategy is driven by election cycles, we are never going to get ahead of the curve."

> "Skills transfer needs to be seen as an activity that moves in every direction"

- "SAIT is working closer with the K-12 system. Students come in see the school and learn early in the process."
- "Challenges: developing mutually advantageous relationships with post-secondary institutions."
- "Finding creative and unique partnerships is key; i.e., Shopify and Carleton University."
- "Applied research—it works, but many companies (especially SMEs) have little or no awareness of the benefits or easy access to it."
- "The companies represented around the table must collaborate on an experiential learning strategy."

All participants agreed with the importance of building up relevant connections between business, educators and government. Skills transfer needs to be seen as an activity that moves in every direction: employer feedback to educators can help target programs on the needs of business, and educator feedback to employers can help businesses adopt new technologies and modes of work.

A number of models already exist in Canada for successful collaboration between educational institutions, businesses and government. To quote a recent report from Colleges and Institutes Canada, "PACs are a distinctive feature of the relationship that colleges and institutes, in most parts of the country, maintain with industry and employers. Created by colleges and institutes, PACs are mainly comprised of industry and community representatives. Their primary role is to provide input and advice on program structure and curriculum, based on current and anticipated labour market needs, industry trends and changes occurring as a result of advances in technology and professional practices."[65]

These face a number of challenges to ensure their effectiveness, however. Currently, there are few standard models and there is a need for more sharing of best practices among these organizations. While crucial, PACs are often not as visible as they could be.

Models of sectoral initiatives around training are also a potential avenue for improving collaboration. In the 2013 report, *Closing the Skills Gap: Mapping a Path for Small Business*, participants of a symposium organized by the Canadian Chamber endorsed a model of sectoral cooperation that could support collaboration to make training more relevant for small businesses by working with sectors to develop and deliver programs.[66] In addition to improving collaboration with higher education, sectoral organizations also offer a stronger feedback mechanism around defining the skills and competencies that would be required for a national measurement system.

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65 Colleges and Institutes Canada, *Academic-Employer Connections in Colleges and Institutes: The Role of Program Advisory Committees*, April 2017, accessed online: www.collegesinstitutes.ca/file/academic-employer-connections-in-colleges-and-institutes-the-role-of-program-advisory-committees

66 Canadian Chamber of Commerce, *Closing the Skills Gap: Mapping a Path for Small Business*, February 2013, accessed online: www.chamber.ca/media/blog/130220_SME_Skills_Symposium_Report.pdf

Taken together, these pathways offer a possible route for increasing the ability of sectors to provide feedback and involvement with higher educational institutions. These can also serve as a launching point for other dimensions, such as applied research.

Another area of concern is ensuring educational institutions and businesses are working on compatible technology so that skills learned in education are applicable to the workforce. This can be a challenge for some institutions, and improving the incentives for sharing emerging technology can help programs align with existing business activities.

RECOMMENDATIONS

All stakeholders: Support sectoral coordination for skills development. Collaboration can serve to support educational programs through PACs, support workforce development, assist in the development of skills and competency measurement standards, create or adapt OERs and connect businesses to educational institutions. Sectoral groups can also serve as a clearinghouse of best practices for areas such as work-integrated learning.

All stakeholders: Build on existing Canadian models of collaboration, such as program advisory committees, university-business partnerships and applied research systems, like CCTTs (in Quebec) or Technology Access Centres, and connect business organizations, such as local chambers of commerce, to those services. Aim for a two-way exchange of expertise to allow institutions to update training practices and to share them across the workforce.

Government: Enhance incentives for donations of hardware, intellectual property and software to educational institutions. Gear incentives towards addressing the ongoing challenge of a rapidly changing technological landscape in order to ensure schools have the most up-to-date equipment to work with.

SUMMARY OF RECOMMENDATIONS

SKILLS CHALLENGE 1: Who is going to be replaced? How many people is this going to affect?

All stakeholders: Every organization needs to increase its focus on skills development in essential skills that are resistant to automation and examine employees' activities to determine what can potentially be automated.

- Support a general movement away from training for routine, repetitive tasks and towards non-routine and more complex activities, along with better planning around the adoption of appropriate technology as it becomes available.

Government: Implement a competency-based measurement framework towards workforce skills supply and demand. Aim for a complete map of the workforce based on the skills and competencies, at which level, required for each job, and provided by each training program, linked to publicly available resources for employers and employees alike.

- Provincial and federal governments should seek to incorporate new data from competency measurement into tools such, as Ontario's LMI website and Job Bank platform, as they become available.

Government: Labour market information needs to be more granular to better measure alternative pathways to education, different combinations of qualifications, such as mixtures of university programs, college programs, micro-credentials and badges, as well as offer a more detailed measurement of emerging modes of working.

- Government can also leverage existing projects and partnerships to use administrative data and, in conjunction with its data, reach out to private sector actors for greater information on data, such as job postings and new work platforms, as well as partner with private sector labour market information organizations.

SKILLS CHALLENGE 2: How much might retraining all of those people cost? Can we afford it?

Government: Statistics Canada should begin by collecting and publishing more detailed information on education costs and expanding the current published analysis from primarily university tuition to include college costs and a more detailed analysis of courses below the full degree and certificate level, such as prior learning assessments and shorter duration courses.

Government: Support more adaptable funding models for skills training to provide more flexible and lower-cost training models. This means supporting and helping to improve

in-house training, certifying skills gained on the job and better connecting short-term programs with a high focus on adult lifelong training and continual education.

- One route for this would be to establish a Premium Reduction Program for training (PRP-Training) under EI for training incentives, recognizing a broad range of training avenues, such as internal training, qualification (degree/diploma) upgrading, short-duration programs, hired external trainers and others similar to recognition of training in Quebec.
- This PRP-Training can offer varying discount rates based on the type of training and expenditures involved, with greater incentives for higher-priority activities. For example, offering increased discounts for upgrading qualifications and support for essential skills and to marginalized workers.
- Through EI discounts, in-house training that meets the minimum criteria for transferrable credentials, quality of training and skills outcomes can be incentivized, improved and measured.
- Creating an automatic discount on premiums based on the type of training provided, with criteria and discount rates established in advance, allows companies to train first and then get refunded rather than waiting on applications.

SKILLS CHALLENGE 3: What is the upside of automation? Why should we embrace it, and how?

Government: Examine the impact of new developments in skills development, such as the new curriculum model in B.C., which emphasizes acquisition of essential skills, such as teamwork, creative and critical thinking, self-motivation and developing an attitude of lifelong learning, and how those impact outcomes and the relationship to higher education pathways.

Government and educational institutions: Support more rapid development and accreditation of programs for emerging training needs, such as micro-credentialing, adult learning and prior learning assessments, to meet the shifting needs of the labour market. Support the development of new programs for emerging industries in shorter timeframes with industry partnership.

- Programs should focus on the parallel goals of building core competencies and essential skills as well as providing technical qualifications for emerging platforms.
- Support pathways and accompanying funding mechanisms so students acquiring skills through diverse means, such as self-learning, on the job training and other sources, can seek recognition and accreditation of their skills through recognized post-secondary institutions.

- Accelerate the program approval process and give institutions more freedom to develop qualifications in less time to meet the needs of industry.

- Ensure student financial aid programs can be applied to these alternative modes of learning, such as short-duration programs, prior learning assessments and micro-credentials, either through existing streams or the creation of new ones.

SKILLS CHALLENGE 4: How are we doing at giving people the skills they need, so far?

Government: Support entrepreneurship at the K-12 and post-secondary levels by creating the opportunity to gain experience in launching businesses and by implementing changes to permit minors to operate their own businesses with reduced parental/guardian oversight.

Government: Use the measurements of skill and competency outcomes to establish the improvement resulting from different training programs. Models that demonstrate the greatest improvement in students can be promoted as best practices among educational institutions and adapted for the particular needs of other institutions.

- Support the development and adaptation of online repositories of open educational resources (OERs) to reduce training costs, support self-directed learning and provide materials that businesses can adapt for internal training programs, bringing them in line with formal training that leads to credentials. Sector collaborative groups can serve as an advisory resource for adapting and promoting open source materials as well.

- Ensure business expenditures on adapting OER materials for internal training programs constitute an EI premium reduction eligible expense.

All stakeholders: Ensure students are provided with useful and relevant information early on about the demand for skills in the labour market, with an emphasis on providing information on the diverse pathways to acquiring the skills and the certifications that are available.

- As improved data on skills supply and demand is acquired through skills-focused LMI analysis, it should be shared with educators and students at all levels.

- Particular questions should include the employment relevance and career possibilities of particular skills—both essential skills and the demand for various technical skills.

- Support a communications strategy to share skills demand data, both domestically and internationally, to ensure potential migrants to Canada have a more detailed understanding of the labour market demand.

SKILLS CHALLENGE 5:
Will every group in Canada be able to acquire the skills needed to be employable? What can we do about it?

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For more information, please contact:
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