

SKILLSNEXT

Understanding the Future of Skills

Trends and Global Policy Responses

JANUARY 2020

Michael Crawford Urban &
Sunil Johal





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The Diversity Institute conducts and coordinates multi-disciplinary, multi-stakeholder research to address the needs of diverse Canadians, the changing nature of skills and competencies, and the policies, processes and tools that advance economic inclusion and success. Our action-oriented, evidence-based approach is advancing knowledge of the complex barriers faced by underrepresented groups, leading practices to effect change, and producing concrete results. The Diversity Institute is a research lead for the Future Skills Centre.

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The word "Canada" in a large, serif font, with a small Canadian flag icon integrated into the letter 'a'.

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ABOUT THE PROJECT

Canadians' needs for skills training are changing rapidly. Through Skills Next, the Public Policy Forum and the Diversity Institute—in its role as a research lead for the Future Skills Centre—are publishing a series of reports that explore a number of the most important issues currently impacting the skills ecosystem in Canada. Each report focuses on one issue, reviews the existing state of knowledge on this topic, and identifies areas in need of additional research. This strong foundation is intended to help support further research and strengthen policymaking. A diverse set of authors who are engaged in the skills ecosystem through various roles, including through research, activism, and policymaking, have been carefully selected to provide a broad range of perspectives while also foregrounding the Canadian context. Their varied backgrounds, experiences, and expertise have shaped their individual perspectives, their analyses of the current skills ecosystem, and the reports they have authored.

Skills Next includes reports that focus on:

- **Global comparison of trends to understand the future of skills**
- **Knowns and unknowns about skills in labour market information**
- **Rethinking the relationship between technology and the future of work**
- **Defining digital skills and the pathways to acquiring them**
- **Barriers to employment for immigrants and racialized people in Canada**
- **Barriers to employment for persons with disabilities**
- **The return on investment of industry leadership in skills and training**
- **Approaches to improving the transitions of university graduates from education to the workforce**



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EXECUTIVE SUMMARY

The future of skills has become a subject of global debate. So far, most of the attention from the Organisation for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), major management consulting firms, think tanks and banks has taken the form of reports warning about occupations most at risk of automation, the number of jobs that will be lost, and the skills and occupations likely to be immune from obsolescence.

But what if that focus is misplaced?

The inherent unpredictability of technological progress means that within the growing literature, one report projects 59% of jobs to be at high risk from automation, while another predicts 6%. And the timeframes within which these impacts are predicted to occur are similarly broad, ranging from 10 to 50 years.

Taking a different approach, this paper looks at initiatives in nine countries, highlights key projections from eight of the most important reports to date on the skills of the future, and distills the effects of drivers of skills change into five key impacts that will influence the direction and form of the future of skills, and the future of work, namely:

- 1. A decline in routine work;**
- 2. An unbundling of tasks;**
- 3. A greater need for adaptability and resilience on the part of workers;**
- 4. A premium on workers' ability to work with technology; and**
- 5. An increased emphasis on hard-to-automate skills.**

In so doing, this paper analyzes the relationship between projections and examines how the methods used to create these projections have evolved and built upon each other.

This elevated perspective is followed by a more in-depth discussion of one interesting initiative that is already underway in one of the selected countries. The goal is to understand what drives success in skills training initiatives along seven key dimensions of analysis, including labour market information, active labour market programs, special initiatives and legal reforms.

Canada, and countries around the world, are positioning themselves to adapt to the future of work. This set of global comparisons aims to inform Canada's approach to the future of work and skills, which is outlined in the final section of this report. With this information, the Future Skills Centre and policymakers can better grasp opportunities to help Canadians equip themselves with the skills they will need to thrive in the future of work.



This paper includes a high-level examination of nine countries and their preparations for the future of work along seven key dimensions, including labour market information, active labour market programs, special initiatives, and legal reforms.



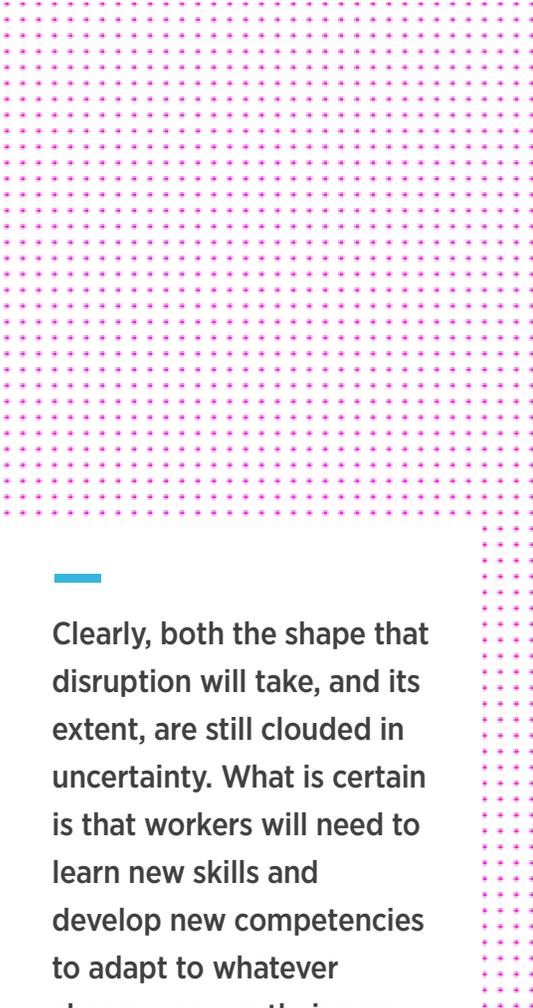
INTRODUCTION

The future of skills has become a subject of global debate. Organizations including the Organisation for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), major management consulting firms, think tanks, banks and governments are providing analyses and publishing reports on this topic. So far, the reports that have captured the most attention have offered projections of the types of occupations most at risk of automation, the number of jobs that will be lost, as well as the skills and occupations likely to be immune from obsolescence.

But what if this focus is misplaced? The inherent unpredictability of technological progress means that within this growing literature, the proportion of jobs in developed countries projected to be at high risk of automation ranges widely, from 6% to 59%. These estimates are even higher for developing countries. The timeframes within which these impacts are predicted to occur are similarly broad, ranging from 10 to 50 years.

Layered on top of this uncertainty around the depth of impacts and timing of change are more unanswerable questions regarding the social norms and preferences that may influence how quickly, if at all, technological solutions replace human labour, and the industries in which this replacement could occur.

This is not to say that disruption is not occurring or that it will not become more pronounced in the future. Clearly, both the shape that disruption will take, and its extent, are still clouded in uncertainty. What is certain is that workers will need to learn new skills and develop new competencies to adapt to whatever changes are on their way. This recognition



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is critical because current approaches to skills training for adults in Canada are underfunded, deliver uneven outcomes and are characterized by highly disjointed and complex ecosystems involving large numbers of diverse stakeholders.

This report surveys the future skills literature and governments' policy responses. The most important papers published in this field are reviewed, to highlight their similarities and points of divergence. For example, as discussed above, there is significant disagreement on just how vulnerable the workers of the world are to automation. Conversely, there is significant consensus on the main drivers of the coming disruption and the ways in which they will disrupt the world of work.

Next, we examine national efforts in nine countries to prepare societies and workers for the coming challenges of technological disruption. Finally, we close the paper by examining the Canadian context and how the recently created Future Skills Centre can strengthen the Canadian skills development ecosystem.

REVIEW OF KEY PROJECTIONS

Research conducted by the [Diversity Institute](#) has identified more than [about 1400](#) reports on the future of work that have been published in the past 10 years.¹ The current discussion regarding the threat automation poses to jobs was sparked by Carl Benedikt Frey and Michael A. Osborne's 2013 paper, *The Future of Employment*.² While not the first to warn of the potential for unemployment driven by technology,^{3, 4} the paper made waves by introducing a new approach to estimating and quantifying the

¹ The Diversity Institute has created an annotated bibliography that summarizes some of the key works in this area.

² While Frey and Osborne's original working paper was published in 2013, we refer to their peer-reviewed 2017 article: Frey, C. and Osborne, M. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological forecasting and social change*, 114, p. 254-280. Both advance the same argument with the same findings. While much of the current popular attention being paid to the future of work was sparked by their 2013 paper, Frey and Osborne were by no means the first to focus on these issues. Some notable forerunners include:

Charles, K. K., Hurst, E. and Notowidigdo, M. J. (2013). [Housing booms, manufacturing decline, and labor market outcomes](#). NBER Working Paper No. 18949. National Bureau of Economic Research;

Jaimovich, N. and Siu, H.E. (2012). [Job polarization and jobless recoveries](#). NBER Working Paper No. 18334. National Bureau of Economic Research;

Autor, D., Levy, F. and Murnane, R.J. (2003). [The skill content of recent technological change: An empirical exploration](#). *Quarterly Journal of Economics*. 118(4): 1279-1333;

Goos, M. and Manning, A. (2007). [Lousy and lovely jobs: The rising polarization of work in Britain](#). *Review of Economics and Statistics*, 89(1): 118-133; and

Autor, D. and Dorn, D. (2013). [The growth of low skill service jobs and the polarization of the US labor market](#). *American Economic Review*. 103(5): 1553-1597.

³ For example, see Keynes, J. (2010). Economic possibilities for our grandchildren. In *Essays in Persuasion*. p. 321-335. Palgrave MacMillan.

⁴ See Brynjolfsson, E. and McAfee, A. (2011). *Race against the machine: How the digital revolution is accelerating innovation, driving productivity and irreversibly transforming employment and the economy*. Digital Frontier Press.

potential scale of this disruption. Many follow-up papers applied their approach and assumptions in different national contexts.

Other responses quickly applied alternative approaches, or further developed and built on Frey and Osborne's work. Figure 1 summarizes the findings of some of the most important of these reports from a Canadian perspective.

Figure 1: Summary of Key Future Skills Reports

Paper Title (Year)	Key findings
<p>The Future of Employment: How Susceptible Are Jobs to Computerisation? (2013/2017)</p> <p>Carl Benedikt Frey; Michael A. Osborne; <i>Oxford Martin School</i></p>	<p>Forty-seven percent of total U.S. employment is concentrated in occupations that are highly susceptible to automation in the next 10 to 20 years. Occupations with high educational attainment requirements and higher wage levels are found to be less at risk of automation. While the authors do not state that all jobs that are susceptible to automation will be automated, their point is that these jobs are technically automatable given existing technologies.⁵</p>
<p>Technology at Work v2.0: The Future Is Not What It Used to Be (2016)</p> <p>Carl Benedikt Frey; Michael A. Osborne; Craig Holmes; <i>Oxford Martin School and Citi</i></p>	<p>The percentage of jobs in the developing world that are in occupations susceptible to automation ranges from 55% in Uzbekistan to 85% in Ethiopia. Large countries such as India (69%) and China (77%) have relatively high percentages of susceptible jobs. The percentage of susceptible jobs in OECD countries is estimated at an average of 57%.⁶</p>
<p>The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis (2016)</p> <p>Melanie Arntz; Terry Gregory; Ulrich Zierahn; <i>OECD</i></p>	<p>An average of 9% of jobs in the OECD are highly susceptible to automation. Country-specific figures vary, with 6% of jobs in South Korea identified as susceptible while 12% of jobs in Austria were found to be susceptible.⁷</p>
<p>A Future That Works: Automation, Employment, and Productivity (2017)</p> <p>James Manyika; Michael Chui; Mehdi Miremadi; Jacques Bughin; Katy George; Paul Willmott; Martin Dewhurst; <i>McKinsey</i></p>	<p>Globally, 49% of activities that workers are paid to do could be automated using existing technology. Less than 5% of occupations are susceptible to total automation. For about 60% of occupations, at least 30% of the activities involved are technically automatable today.⁸</p>

⁵ Frey, C. and Osborne, M. (2017). [The future of employment: How susceptible are jobs to computerisation?](#) Technological Forecasting and Social Change, 114: 254-280.

⁶ Frey, C., Osborne M. and Holmes, C. (2016). [Technology at work v2.0: The future is not what it used to be.](#) Oxford Martin School and Citi.

⁷ Arntz, M., Gregory, T. and Zierahn, U. (2016). [The risk of automation for jobs in OECD countries: A comparative analysis.](#) Working Paper No. 189. OECD Publishing.

⁸ Manyika, J., et al. (2017). [A future that works: Automation, employment, and productivity.](#) McKinsey & Company.

<p>The Future of Skills: Employment in 2030 (2017)</p> <p>Hasan Bakhshi; Jonathan M. Downing; Michael A. Osborne; Philippe Schneider; <i>Nesta, Oxford Martin School and Pearson</i></p>	<p>Arguing that any projections ought to recognize a higher level of uncertainty, 9.6% of occupations were identified as likely to see employment growth, employment prospects for 43.2% of occupations were found to be uncertain, and 18.7% were identified as likely to experience contraction. Six bundles of job features (four in the U.S. and two in the U.K.) were identified as providing an approximation of new occupations likely to emerge by 2030.⁹</p>
<p>The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution (2016)</p> <p><i>World Economic Forum</i></p>	<p>Jobs losses were projected to be 7.1 million, with two-thirds of these losses concentrated in the “office and administrative” job family. Aggregate job gains of about two million were projected across several smaller job families. Overall, 5.1 million net job losses were predicted.¹⁰</p>
<p>The Talented Mr. Robot: The Impact of Automation on Canada’s Workforce (2016)</p> <p>Creig Lamb; <i>Brookfield Institute for Innovation + Entrepreneurship</i></p>	<p>In Canada, 42% of jobs were identified as being highly susceptible to automation while 36% were identified as being at low risk of automation, according to Frey and Osborne’s approach. Using Manyika and colleagues’ approach, only 1% of occupations in Canada were deemed totally automatable, while 18% of occupations were found to comprise activities where at least 70% of these activities could already be automated.¹¹</p>
<p>Future Shock? The Impact of Automation on Canada’s Labour Market (2017)</p> <p>Matthias Oschinski; Rosalie Wyonch; <i>C.D. Howe Institute</i></p>	<p>Canadian industries where less than 25% of jobs are susceptible to automation account for 27.5% of total employment (4.9 million jobs). Industries where more than 75% of jobs are at a high risk of automation account for only 1.7% of employment (310,000 jobs).¹²</p>

⁹ Bakhshi, H., et al. (2017). [The future of skills: Employment in 2030](#). Nesta.

¹⁰ World Economic Forum. (2016). [the future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution](#). Global Challenge Insight Report. WEF.

¹¹ Lamb, C. (2016). [the talented Mr. Robot: The impact of automation on Canada's workforce](#). Brookfield Institute for Innovation + Entrepreneurship.

¹² Oschinski, M. and Wyonch, R. (2017). [Future shock? The impact of automation on Canada's labour market](#). Commentary 472. C.D. Howe Institute.

None of these reports were written in a vacuum; together they capture important portions of an important conversation that is evolving over time. And as the review below makes clear, there is still significant disagreement on just how vulnerable workers are to automation.

Frey and Osborne’s methodology involved asking a group of experts to examine occupation descriptions for 70 occupations and predict whether the occupation could be sufficiently specified “to be performed by state of the art computer-controlled equipment.”¹³ They used these assessments to train a machine-learning algorithm that assessed the automatability of the full range of 702 occupations listed in the United States Department of Labor’s O*NET database. Based on this analysis, they estimated the proportion of jobs in the U.S. which were “potentially automatable over some unspecified number of years, perhaps a decade or two.”¹⁴

The estimate they produced—that 47% of jobs in the U.S. were susceptible to automation—provoked alarm and garnered significant media attention. A host of other studies reproduced their analysis for other countries and found, in some cases, even higher levels of potential disruption. For example, working with Citi, Frey and Osborne estimated that 57% of jobs in 21 OECD countries and as many as 77% of jobs in China were susceptible to automation.¹⁵

Frey and Osborne’s approach had its critics. In a paper published by the OECD, Melanie Arntz and collaborators argued that by focusing on the

Automation is continuing but the proportion of Canadian jobs in occupations that are not easily automatable is growing as the labour market responds to technological advancement.



¹³ Frey, C. and Osborne, M. (2017). [The future of employment: how susceptible are jobs to computerisation?](#) Technological Forecasting and Social Change, 114: 254-280, p. 263.

¹⁴ Ibid., 265.

¹⁵ Frey, C., Osborne M. and Holmes, C. (2016). [Technology at work v2.0: The future is not what it used to be.](#) Oxford Martin School and Citi, p. 18-19.

automatability of occupations, Frey and Osborne’s approach overestimated the likely impact of technological change. Instead, they argued the focus should be on the automatability of the discrete tasks that make up an occupation.¹⁶

Arntz and her collaborators implemented this “task-based” approach by transferring Frey and Osborne’s estimation of the automatability of an occupation to the tasks that make up the occupation using survey data from the Programme for the International Assessment of Adult Competencies, which describes the tasks that are part of an occupation on a country-specific basis. Using this method, they found that the proportion of jobs at risk of automation in 21 OECD countries was, on average, only 9%.¹⁷

James Manyika and colleagues further developed these ideas in a report published by the McKinsey Global Institute. They accepted Arntz and her collaborators’ criticisms of occupation-level analyses and focused instead on “activities” within an occupation.¹⁸ Additionally, they argued that the proportion of time an individual spends on an activity is an important consideration when estimating how automation will impact an occupation.¹⁹

Moreover, they argued that in addition to technological change, four other factors (cost of development and deployment, labour market dynamics and the cost of labour, economic and performance benefits of automation, and regulatory and social acceptance) play critical roles in influencing whether activities are automated.²⁰ While Frey and Osborne’s work had acknowledged this point, it did not explore it in any detail.

Manyika and colleagues estimated that, globally, it was already technically possible to automate 49% of the activities that individuals are currently paid to do. Moreover, while they find that less than 5% of occupations could be fully automated, 60% are structured such that at least 30% of the activities that comprise them are already automatable.²¹

In another paper published by Nesta, Hasan Bakhshi and a team of collaborators updated Frey and Osborne’s methodology. Instead of asking experts if an occupation was automatable, they asked them to

¹⁶ Arntz, M., Gregory, T. and Zierahn, U. (2016). [The risk of automation for jobs in OECD countries: A comparative analysis](#). Working Paper No. 189. OECD Publishing, p. 11.

¹⁷ Ibid., 8.

¹⁸ Manyika, J., et al. (2017). [A future that works: Automation, employment, and productivity](#). McKinsey & Company, p. 1.

¹⁹ Ibid., 4.

²⁰ Ibid., 2.

²¹ Ibid., 5.

predict whether there would be greater, the same or lesser demand for an occupation by 2030, and to provide the level of confidence they had in that prediction. They also used a much richer database of job “features”—120 skills, abilities and knowledge bases needed to do the job and their relative importance to the occupation—to train the algorithm that assessed an occupation’s automatability.^{22, 23}

They also departed from Frey and Osborne’s original approach in how they presented their findings. Recognizing the significant uncertainty that characterizes these projections, instead of identifying the percentage of jobs susceptible to automation, they estimated the occupations that are likely to see employment growth (9.6%), occupations with uncertain growth prospects (43.2%) and occupations likely to see contractions (18.7%).²⁴ They also used this analysis to develop a small set of bundles of “job features” to provide an approximation of what the new occupations that will be created by 2030 will look like.

Taking a more direct approach, the WEF surveyed human resources executives at the 100 largest employers globally in each of its industry sectors, asking them to predict whether there would be an increase or decrease in employment in their industry by 2020.

Based on these responses, the WEF predicted that 7.1 million jobs would be lost globally in the 2015-2020 period, with two-thirds of those losses concentrated in “office and administrative” jobs. They also predicted a gain of two million jobs spread among several smaller job families, thus resulting in a net impact of 5.1 million jobs lost to automation by 2020.²⁵

In Canada, the Brookfield Institute for Innovation + Entrepreneurship applied the approaches of Frey and Osborne and Manyika and colleagues to Canadian data. Using Frey and Osborne’s approach, Brookfield concluded that 42% of Canadian jobs were at high risk of automation and that 36% were at low risk.

Using Manyika and colleagues’ approach, Brookfield found that 42% of the activities currently carried out by the Canadian labour force were automatable using existing technology and that 18% of occupations were structured such that more than 70% of their activities could already be automated.²⁶ Only 1% of Canadian jobs were in occupations found to be 100% automatable.

²² Frey and Osborne (2017) only used nine features to train their algorithm and did not include consideration of their importance.

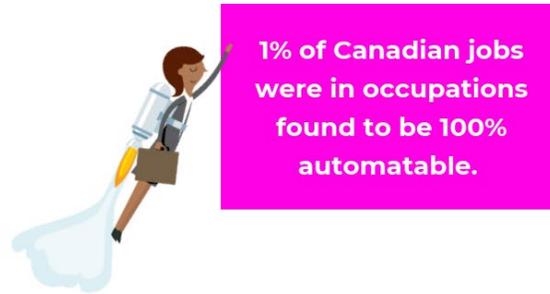
²³ Bakhshi, H., et al. (2017). [The future of skills: Employment in 2030](#). Nesta, p. 43.

²⁴ Ibid.

²⁵ World Economic Forum. (2016). [The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution](#). Global Challenge Insight Report. WEF, p. 13.

²⁶ Lamb, C. (2016). [The Talented Mr. Robot: The impact of automation on Canada’s workforce](#). Brookfield Institute for Innovation + Entrepreneurship.

PERCENT OF CANADIAN JOBS VULNERABLE TO AUTOMATION



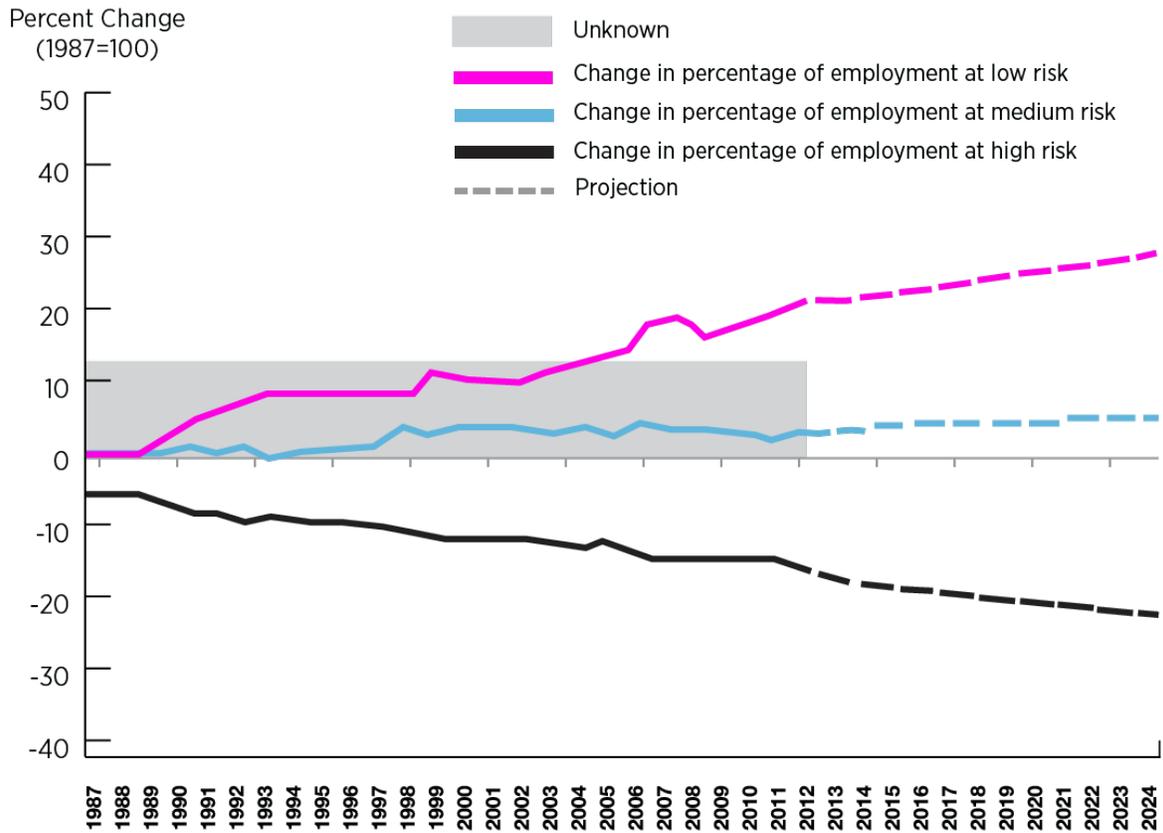
Source: Lamb, C. (2016). [The talented Mr. Robot: The impact of automation on Canada's workforce](#). Brookfield Institute for Innovation + Entrepreneurship.

Writing for the C.D. Howe Institute, Matthias Oschinski and Rosalie Wyonch also used an occupation-based approach to evaluate the likelihood of job losses due to automation in Canada. Their analysis differs from Frey and Osborne's in two important respects. First, they consulted their own experts to produce an updated list of skills that were not easily automatable. Second, they follow Bakhshi and colleagues in weighting the importance of these skills in their analysis according to the importance assigned to them by O*NET's survey.²⁷

Their major finding is that automation is a continuous process that has been going on for years and that the occupations and industries in Canada with the highest susceptibility to automation are those that have already been moving towards high levels of automation in recent decades. Automation is continuing but the proportion of Canadian jobs in occupations that are not easily automatable is growing as the labour market responds to technological advancement.

²⁷ Oschinski, M. et Wyonch, R. (2017). [Future shock? The impact of automation on Canada's labour market](#). Commentary 472. C.D. Howe Institute, p. 15.

Figure 2: Composition of Employment by Risk Category



Source: Oschinski, M. and Wyonch, R. (2017). Future shock? The impact of automation on Canada's labour market. C.D. Howe Institute.

KEY TRENDS AND THEIR IMPACTS

Some of the reports reviewed in the preceding section focus on making projections of automation's impact on jobs, or on improving the methodologies by which previous projections were made. Others, however, take a step back to examine the wider trends driving these changes.

Reports such as the one written by Manyika and colleagues focused on intermediary trends that would impact the rate at which automation would occur, such as technical feasibility, labour market dynamics and the cost of labour, and regulatory and social acceptance. More broadly, many reports identified trends that are propelling change in the labour market, both independent of and as drivers of automation. The report by Bakhshi and his collaborators, the most comprehensive of these, identified the following seven trends:

1. **environmental sustainability;**
2. **urbanization;**
3. **increasing inequality;**
4. **political uncertainty;**
5. **technological change;**
6. **globalization; and**
7. **demographic changes.**²⁸

Given the scope of this report, it is not possible to review all these trends and their likely impact on work and skills. Instead, this report focusses more narrowly on the main ways in which technological developments are changing the future of skills.

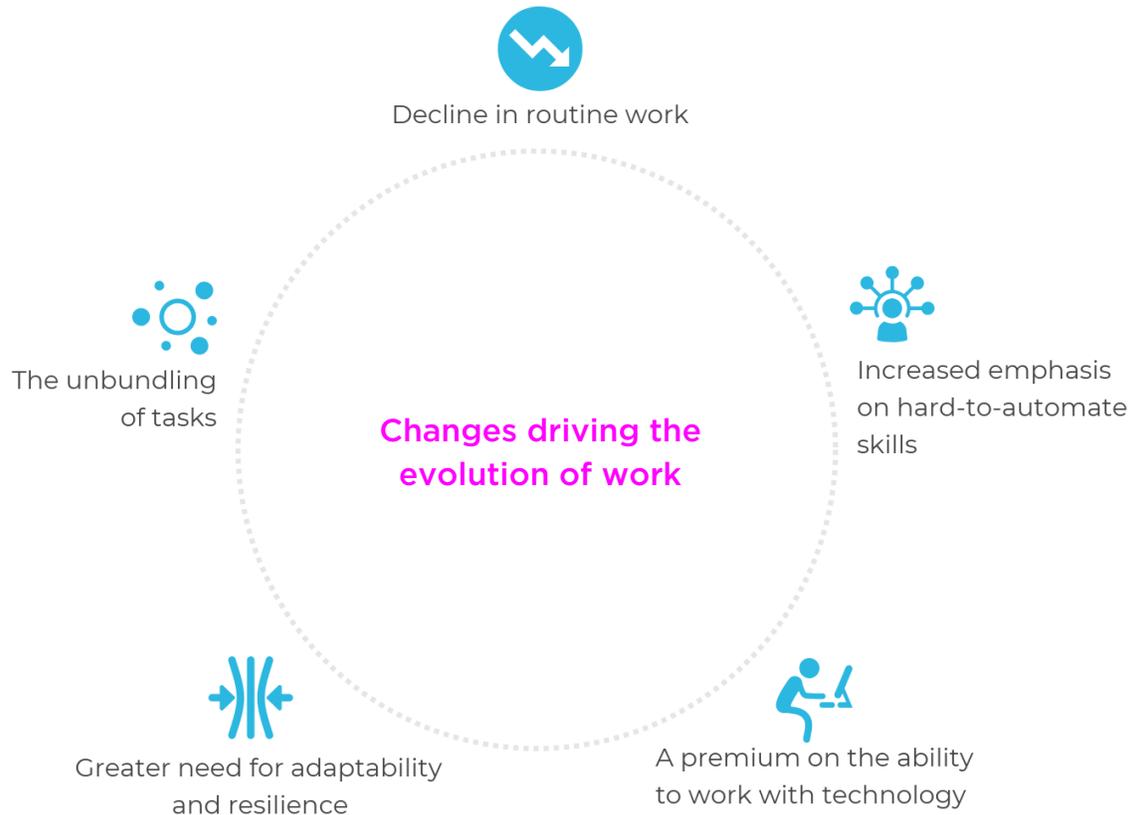
Frey and Osborne's original examination of the impact of automation on jobs was focused on two key technological developments: machine learning and mobile robotics.²⁹ Whatever other trends were identified by the increasing catalogue of reports in this area, these two trends are central to nearly all their analyses. But they are not the only key technological developments likely to impact the future of skills. Others have identified the rise of various forms of telepresence and virtual/augmented/mixed forms of reality, as well as the expansion of digital platforms as key trends that will have important impacts on the future of skills, either alone or in combination.³⁰

²⁸ Bakhshi, H., et al. (2017). [The future of skills: Employment in 2030](#). Nesta, p. 25-28.

²⁹ While Frey and Osborne focus on machine learning in their work, this report adopts a wider perspective and focuses on artificial intelligence, a concept that includes, but is not limited to, machine learning.

³⁰ For example, see Manyika, J., et al. (2017). [A future that works: Automation, employment, and productivity](#). McKinsey & Company; or Policy Horizons Canada. (2019). [The future of work: Five game changers](#). Government of Canada.

Together, these technological developments are driving important changes in the workplace and the labour market that will have profound impacts on the future of skills. Five critical impacts can be distilled from the literature.



Decline in Routine Work

Routine work, whether manual or cognitive, is in decline.³¹ These tasks and the jobs associated with them tend to be the most “codifiable,”³² meaning that they are the easiest to specify sufficiently in computer code—the key criteria for automatability accepted by all of the authors discussed earlier. Once tasks can be coded, the biggest obstacle to automation has been overcome and, in many cases, it is only a matter of time before they will be automated. Thus, as the capabilities of artificial intelligence (AI) systems increase, and the abilities of complementary technologies like physical robots multiply, the number of tasks, jobs and occupations susceptible to automation will continue to grow.

³¹ Oschinski, M. and Wyonch, R. (2017). [Future shock? The impact of automation on Canada's labour market](#). Commentary 472. C.D. Howe Institute, p. 7-9.

³² The World Bank. (2019). [World Development Report 2019: The changing nature of work](#). The World Bank, p. 2.

The Unbundling of Tasks

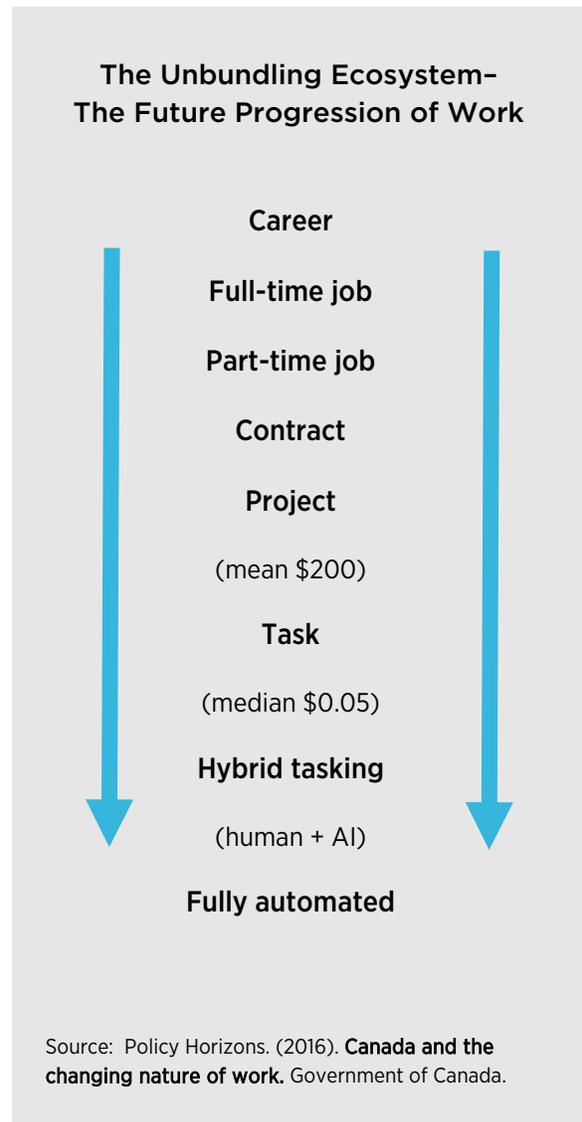
As Arntz and colleagues point out, few occupations are fully automatable, meaning that a focus on individual tasks is critical. But as occupations and jobs are disaggregated into more discretely defined tasks, the commodification of these tasks also becomes easier. When combined with the advent of digital platforms and their increasingly effective AI-enabled matchmaking, it becomes more likely that a more fluid piecework-based labour market will emerge, characterized by increasing numbers of temporary and contract workers.^{33,34}

Greater need for adaptability and resilience

The factors driving the decline in routine work and the unbundling of tasks will make worker adaptability and resilience more important.^{35,36} These attributes will be critical for workers to successfully navigate the need for professional pivots and reinventions that will likely characterize the labour market of the future.³⁷

A Premium on the Ability to Work with Technology

As software and robots take over more of the tasks currently performed by humans, many of the tasks that will remain will involve inventing, monitoring, directing and repairing these technologies.³⁸ This means that a growing



³³ Policy Horizons Canada. (2019). [The future of work: Five game changers.](#) Government of Canada, p. 4.

³⁴ Frey, C., Osborne M. and Holmes, C. (2016). [Technology at work v2.0: The future is not what it used to be.](#) Oxford Martin School and Citi, p. 11.

³⁵ The World Bank. (2019). [World Development Report 2019: The changing nature of work.](#) The World Bank, p. 6.

³⁶ Morissette, R. (2017). [Planning for Canada's future labour market.](#) Policy Options.

³⁷ Ibid. 3.

³⁸ Frank, K. and Frenette, M. (2018). [Will automation worsen job prospects for vulnerable workers?](#) Policy Options.

proportion of jobs will require knowledge and training in working with technology in these ways. Many, but certainly not all these skills, will fall under the STEM (science, technology, engineering and mathematics) umbrella of disciplines.³⁹

Increased Emphasis on Hard-to-Automate Skills

Many reports point to the importance of tasks requiring skills that are difficult to automate and will likely remain so for the foreseeable future.⁴⁰ These tasks involve “abstract, complex-decision-making skills with a strong focus on creativity, critical thinking and interpersonal social skills.”⁴¹ Many jobs that involve significant interactions with other people, such as managers, teachers and nurses, include tasks that require these skills.

³⁹ Manyika, J., et al. (2017). [A future that works: Automation, employment, and productivity](#). McKinsey & Company, p. 19.

⁴⁰ Frank, K. and Frenette, M. (2018). [Will automation worsen job prospects for vulnerable workers?](#) Policy Options.

⁴¹ Oschinski, M. and Wyonch, R. (2017). [Future shock? The impact of automation on Canada's labour market](#). Commentary 472. C.D. Howe Institute, p. 1.

GLOBAL COMPARISONS

Policymakers and leaders from many countries have prioritized the future of work and skills. At the 2018 G20 summit, the future of work was a key topic and the five critical impacts outlined above were a common thread running through much of the leaders' discussions. The G20 Leaders' declaration coming out of the summit committed to supporting people through transitions; promoting vocational training and skills development, including reskilling workers; and fostering cognitive, digital and entrepreneurship skills.⁴² National governments around the world have made similar statements.

Numerous approaches to skills development and retraining have either demonstrated success over the long term or are showing promising signs of delivering strong results. Many approaches share some or all of five key design features, which align in many ways with the five key impacts identified in the last section. Characteristics that are common to these approaches, and the initiatives and programs they comprise, include:

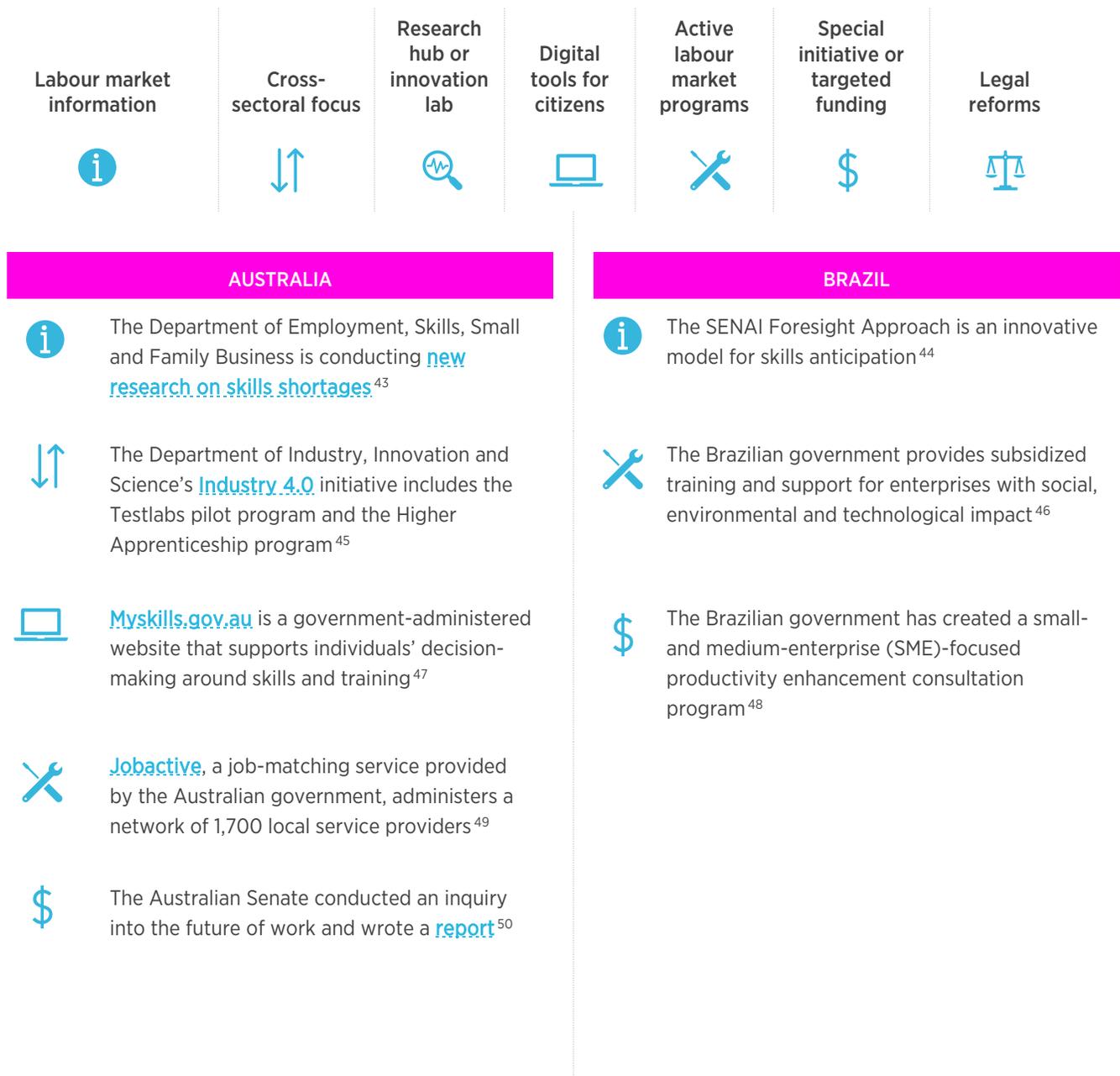
- **A strong focus on outcomes;**
- **Well-established evaluation frameworks that provide rigorous evidence of what works and what does not, based on relevant and timely labour market information;**
- **Digital service delivery and online platforms to provide information to clients and exchange information between initiative partners, or both;**
- **The flexibility to adapt to the specific circumstances and needs of the clients being served through continuous program innovation and iteration; and**
- **Cross-sectoral approaches that align with other program and policy interventions to focus resources effectively and avoid overlap and duplication.**

Figure 3 below summarizes key actions nine countries have taken as part of their formal strategies for preparing for the future of work. These efforts are categorized according to the most common features, such as the improvement of labour market information, adoption of a cross-sectoral focus, and building research hubs or innovation labs. These efforts include entirely new initiatives to prepare for the future of work as well as tweaks and adaptations of previously existing institutions, programs and initiatives designed to help countries respond to these new challenges.

Some of the world's most influential countries are examined, as well as some that are recognized as leaders in this area. While some of these countries have governmental, social or economic structures that are more comparable to Canada's than others, each provides useful examples of ways to prepare for the future of work.

⁴² G20 Argentina. (2018). [G20 Leaders' Declaration: Building consensus for fair and sustainable development](#). G20.

Figure 3: Summaries of Key Countries' National Future of Work Strategies



⁴³ Department of Employment, Skills, Small and Family Business. (2018). [Australia getting it right on skills assessments](#). Government of Australia.

⁴⁴ Bakule, M., et al. (2016). [Developing skills foresights, scenarios and forecasts: Guide to anticipating and matching skills and jobs](#), Volume 2 European Training Foundation, European Centre for the Development of Vocational Training, and International Labour Office, p. 125-133.

⁴⁵ Department of Industry, Innovation and Science. (2019). [Industry 4.0](#). Government of Australia.

⁴⁶ G20 Framework Working Group. (2018). [G20 menu of policy options for the future of work](#). G20, p. 6.

⁴⁷ Department of Employment, Skills, Small and Family Business. (n.d.) [Myskills](#). Government of Australia.

⁴⁸ G20 Framework Working Group. (2018). [G20 menu of policy options for the future of work](#). G20, p. 6.

⁴⁹ Department of Employment, Skills, Small and Family Business. (2019). [Jobactive](#). Government of Australia.

⁵⁰ Select Committee on the Future of Work and Workers. (2018). [Hope is not a strategy—our shared responsibility for the future of work and workers](#). The Senate of Australia.

DENMARK

-  Denmark developed the Labour Market Balance system as an updated form of skills anticipation⁵¹
-  In 2017, the Danish government launched the “Disruption Council” to prepare responses to technological change⁵³
-  Danish Agency for Labour Market and Recruitment [integrated program evaluation and impact assessment](#) into decision-making⁵⁵

FRANCE

-  French statistical agencies have added new questions to many of their surveys to collect more relevant information on new parts of the economy⁵²
-  The [Réseau Emplois Compétences](#), a project of the government think tank *France Stratégie*, connects partners to observe and anticipate skills developments⁵⁴
-  [Bob-emploi.fr](#), a private job-matching website partially funded by the state, uses AI to match job seekers to opportunities⁵⁶
-  France’s [Compte personnel d’activité](#) provides every citizen with financial support for skills training⁵⁷
-  The 2016 El Khomri law requires digital labour platform firms to make more of the social security contributions traditionally associated with employment, which firms had previously avoided, and enables platform workers to unionize⁵⁸

⁵¹ World Economic Forum. (2017). [Accelerating workforce reskilling for the fourth industrial revolution: an agenda for leaders to shape the future of education, gender and work](#). WEF, p. 9.

⁵² Organisation for Economic Co-operation and Development. (2019). [Policy responses to new forms of work](#). OECD Publishing, p. 78.

⁵³ Ibid., 79.

⁵⁴ France Stratégie. (2019). [Réseau Emplois Compétences](#). Government of France.

⁵⁵ Danish Agency for Labour Market and Recruitment. (2018). [Evidence-based policy-making](#). Government of Denmark.

⁵⁶ Bob-emploi.fr. (2019). [Où en sommes-nous?](#) Bob-emploi.fr.

⁵⁷ Service-public.fr. (n.d.). [Qu’est-ce que le compte personnel d’activité \(CPA\)?](#) Government of France.

⁵⁸ Organisation for Economic Co-operation and Development (OECD). (2019). [Policy responses to new forms of work](#). OECD Publishing, p. 62 and 73.

SINGAPORE

 Employers describe expected changes on an industry-by-industry basis and their impacts on skills. This feedback informs the creation of “industry transformation maps”⁵⁹

 The Institute for Adult Learning is focused on supporting the professionalization and improvement of the continuing education system⁶⁰

 The Adapt and Grow initiative provides an online job marketplace that enables job seekers to find employers and match with them, as well as a series of other related tools⁶¹

 The interest generated by the Lifelong Learning Endowment Fund is used to support skills acquisition programs; the SkillsFuture program subsidizes the supply of skills programs as well as the enrolment of learners⁶²

UNITED KINGDOM

 The UK is reforming its economic statistics to enable it to better capture digital economic activity⁶³

 [The United Kingdom Commission for Employment and Skills](#) conducted cross-sectoral research on the future of work⁶⁴

 [Unionlearn](#) is a trade union-led organization supporting skills acquisition. It focuses on learners with limited or no prior qualifications⁶⁵

 The Flexible Learning Fund supports the development and testing of flexible and accessible training delivery methods with a focus on improving access⁶⁶

UNITED STATES

 In 2017, the Bureau of Labor Statistics conducted a [special survey](#) to learn about four alternative employment arrangements: independent contractors, on-call workers, temporary help agency workers and workers provided by contract firms^{67,68}

 The [Occupational Information Network \(O*NET\)](#) is the primary source of occupational information and is developing information relevant to the future of work, such as regularly updated reviews of which software skills are in demand⁶⁹

⁵⁹ Palmer, A. (2017). [Special Report: Lifelong education: learning and earning](#). The Economist, p. 11.

⁶⁰ World Economic Forum. (2017). [Accelerating workforce reskilling for the fourth industrial revolution: An agenda for leaders to shape the future of education, gender and work](#). WEF, p. 9.

⁶¹ G20 Framework Working Group. (2018). [G20 menu of policy options for the future of work](#). G20, p. 12.

⁶² World Economic Forum. (2017). [Accelerating workforce reskilling for the fourth industrial revolution: An agenda for leaders to shape the future of education, gender and work](#). WEF, p. 3.

⁶³ Ibid., 16.

⁶⁴ UKCES. (n.d.). [UK Commission for Employment and Skills](#). Government of the United Kingdom.

⁶⁵ Palmer, A. (2017). [Special report: Lifelong education: Learning and earning](#). The Economist, p. 10.

⁶⁶ Organization for Economy Cooperation and Development (OECD). (2019). [Policy responses to new forms of work](#). OECD, p. 63.

⁶⁷ U.S Bureau of Labor Statistics. (2018). [Contingent and alternative employment arrangements – May 2017](#). Government of the USA.

⁶⁸ Kosanovich, K. (2018). [Workers in alternative employment arrangements spotlight on statistics](#). U.S. Bureau of Labor Statistics.

⁶⁹ Lewis, P. and Norton, J. (2016), [Identification of “hot technologies” within the O*NET® system](#), National Center for O*NET Development.

JAPAN



The Prime Minister's Council for the Realization of Work Style Reform conducted consultations and designed labour reforms designed to modernize the Japanese labour market⁷⁰



The Prime Minister's [Human Resources Development Revolution](#) is an initiative designed to increase human capital in Japan, including through [lifelong learning](#)⁷¹



The "Future of Work 2035: For Everyone to Shine" is a government research initiative that included tripartite consultations and produced a [report](#)⁷²



Work-Style Labor Reforms implemented changes designed by the prime minister's council including changes to provide [non-standard workers with more rights](#)⁷³

The initiatives summarized in Figure 3 are worth closer examination than is possible in this short paper. Instead, this section closes by briefly examining one noteworthy example from each of the seven categories.



⁷⁰ OECD. 2018. [Japan: Action Plan for the Realization of Work Style Reform](#). OECD. p. 4. See also Ogino, N. 2017. Government Decides "Action Plan for the Realization of Work Style Reform". Japan Labor Issues, 1(1). p. 3-6.

⁷¹ Naitou, K. 2017. ["Human resources development revolution" as a priority issue](#). Mizuho Research Institute and Cabinet Public Relations Office. 2019. [Abenomics: Diversity & Empowerment of People](#). Government of Japan.

⁷² "Future of Work 2035: For Everyone to Shine" Panel. 2016. ["Future of Work: 2035" -For Everyone to Shine](#). Government of Japan.

⁷³ Sanjo, Y., Webster, F. Rousseau, S. 2019. [Japan Adopts Work-Style Labor Reforms](#). Mercer.

Labour Market Information: Singapore's Industry Transformation Maps

Singapore generates labour market information through regular consultations with employers. In these consultations, employers are asked, on an industry-by-industry basis, to describe their expectations for the evolution of their sector and what skills will be required for the next three to five years.

The information derived from these consultations is used to generate “industry transformation maps” that individuals can then use to set their own learning priorities.⁷⁴ These maps support Singapore's wider FutureSkills initiative by informing citizens' choices about which skills to acquire and informing the tools that government uses to help citizens make these choices, such as the Adapt and Grow program.⁷⁵

Cross-Sectoral Focus: *Réseau Emplois Compétences*

The *Réseau Emplois Compétences* is a project of the French government think tank France Stratégie. The *réseau* (network) brings together representatives of the state, social partners, regional representatives, producer organizations, academics and other experts. In so doing, the network enables individuals and organizations active in the skills development field to informally share information and lessons learned.

The network has produced thematic reports focused on the future of skills and skills needs in France and supports experiments that align with this work, such as new recruiting tools for the metallurgical industry and food supply chain businesses. The network's research theme for 2019 is the mobilization of skills by businesses in their human resources practices.⁷⁶

⁷⁴ Palmer, A. (2017). [Special report: Lifelong education: learning and earning](#). The Economist, p. 11.

⁷⁵ G20 Framework Working Group. (2018). [G20 menu of policy options for the future of work](#). G20, p. 12.

⁷⁶ France Stratégie. (2019). [Le Réseau Emplois Compétences en 2019. nouvelles perspectives](#). Government of France.

Research Hub or Innovation Lab: O*NET

The Occupational Information Network (O*NET) is a research hub funded by the U.S. Department of Labor’s Employment and Training Administration. Its database describes almost 1,000 occupations using hundreds of standardized and occupation-specific descriptors. This database is continually refreshed and updated with input from people working in these occupations from across the U.S.

Access to the database is provided to the public free of charge and is used by organizations and firms to help job seekers and workers identify the training they need and the careers they would like to pursue, while also helping employers find the workers with the skills they need.⁷⁷ Additionally, O*NET conducts its own independent research, such as the ongoing identification of “hot technologies”—that is, software skills currently in demand in the U.S. economy—through the analysis of millions of job postings.⁷⁸

Digital Tools for Citizens: myskills.gov.au

To provide Australians with better information about their skills and training options, the Australian government created myskills.gov.au. This website serves as a national directory of vocational education and training organizations and educational offerings.⁷⁹ Information on the website comes directly from national and state-level accreditation authorities and updates every day. The website also provides data about course outcomes, drawn from a national survey of students and labour market data.

This data is provided by the Department of Employment, Skills, Small and Family Business’s [Job Outlook](#), another service of the Australian government that enables Australians to learn about pay, tasks and the demands that characterize various occupations, as well as the skills knowledge and abilities required to work in these occupations.⁸⁰ The service is also integrated with [jobactive](#), Australia’s government-provided job-matching service.

Active Labour Market Programs: Danish Agency for Labour Market and Recruitment

Denmark is widely known for its “flexicurity” employment system. One of the pillars of this system is a highly flexible labour market that includes significant labour mobility (up to 25% of Danes in the private sector switch jobs every year).⁸¹ This system relies on strong, active labour market interventions. These

⁷⁷ O*NET Resource Centre. (2019). [About O*NET](#). O*NET.

⁷⁸ Lewis, P. and Norton, J. (2016). [Identification of “hot technologies” within the O*NET® system](#). National Center for O*NET Development.

⁷⁹ Department of Employment, Skills, Small and Family Business. (n.d.). [About Myskills](#). Government of Australia.

⁸⁰ Department of Employment, Skills, Small and Family Business. (n.d.). [Your guide to Australian careers](#). Government of Australia.

⁸¹ Ministry of Foreign Affairs of Denmark. (n.d.). [The Danish labour market](#). Government of Denmark.

interventions are rigorously evaluated, and municipalities are limited to delivering programs with proven track records of success.

Led by the [Danish Agency for Labour Market and Recruitment](#) (STAR), researchers are funded to conduct studies on domestic and international active labour market programs, and the results enter a knowledge bank that is available to stakeholders. Most STAR evaluations are randomized control trials, considered the gold standard in evaluation, and are supplemented by qualitative and econometric approaches.⁸²

Special Initiative or Targeted Funding: Germany's Central Innovation Programme

Germany is renowned for its *Mittelstand*, its large number of successful SMEs that employ large numbers of workers and make up a large proportion of its industry. Concern is growing, however, that these firms are vulnerable to disruption by new technologies. In response, the German government established the Central Innovation Programme for SMEs, which provides funding to SMEs to partner with research organizations, such as universities, to develop new products or substantially improve existing ones and increase their innovation capacity and competitiveness.^{83,84}

The program also includes the establishment of SME 4.0 competence centres across the country. These centres support companies, at no charge, to develop and adopt new business models, leverage new technological innovations, and provide demonstration and testing opportunities.⁸⁵

⁸² Danish Agency for Labour Market and Recruitment. (2018). [Evidence-based policy-making](#). Government of Denmark.

⁸³ German Federation of Industrial Research Associations (AiF). (n.d.). [Central Innovation Programme SME](#).

⁸⁴ Federal Ministry of Economics and Technology. (2012). [Central Innovation Programme for SMEs: Boosting innovation](#). Government of Germany.

⁸⁵ G20 Framework Working Group. (2018). [G20 menu of policy options for the future of work](#). G20, p. 7.

Legal Reforms: Workstyle Labour Reforms

In 2018, Japan enacted significant labour reforms to modernize its labour laws. These reforms aimed to fulfill Prime Minister Shinzo Abe's pledge to structurally reform Japan's economy as a means of stimulating economic growth. The reforms targeted a problem that is important for the future of work: the bifurcation of the labour market between workers in standard employment relationships and those in alternative forms.⁸⁶

The reforms included new dispute resolution mechanisms for "non-regular" workers, as well as prohibitions against unreasonable differences in working conditions, such as pay and benefits, based solely on workers' status as regular or non-regular.^{87,88}

⁸⁶ Tanaka, A. and Sutton, T. (2019). [Significant changes to Japan's labor laws will take effect in April 2019: Are you prepared?](#) Littler Mendelson PC.

⁸⁷ Sanjo, Y., Webster, et F. Rousseau, S. (2019). [Japan Adopts Work-Style Labor Reforms](#). Mercer.

⁸⁸ No author. (2018). [Work style reform bill enacted](#). Japan Labor Issues, 2(10). p. 2-7.



CANADA IN CONTEXT

Many organizations and programs are already helping prepare Canadians and the Canadian economy for the future of work and skills across many of the areas identified in the preceding section.

Provincial governments hold the primary responsibility for education and skills in Canada and have undertaken extensive planning and program delivery, as well as a number of new initiatives, designed to meet the challenge posed by the future. As an example of one of these new initiatives, some provinces have begun to shift the curricula in their primary and secondary education systems away from traditional content-based curricula towards more competency-based ones, a move that has been supported by the Council of Ministers of Education, Canada.^{89,90} Some provinces have struck expert panels to identify imminent and potential challenges and provide recommendations for how to prepare.⁹¹

⁸⁹ Council of Ministers of Education, Canada. (n.d.). [Global competencies](#). CMEC.

⁹⁰ British Columbia Ministry of Education. (n.d.). [Curriculum overview](#). Government of British Columbia.

⁹¹ See, for example, Conway, S., et al. (2016). [Building the workforce of tomorrow: A shared responsibility](#). Government of Ontario.

In addition to their widely understood responsibility for primary, secondary and post-secondary education, provincial governments lead other forms of skills programming. Provincial agencies such as Emploi-Québec, Alberta Works, WorkBC and Employment Ontario lead provincial efforts in these areas.

Different provinces have also adopted various approaches to skills delivery. Emploi-Québec, for instance, delivers many skills programs directly, while the Government of Ontario contracts with not-for-profit and private entities to deliver many skills programs. The federal government plays an important funding role for some programs, especially those linked to employment insurance (EI), but the provinces deliver them. Additionally, provinces have developed a wide range of programs designed to focus on subjects ranging, for example, from literacy and basic skills, to the skills needs of newcomers and foreign-trained professionals, to apprenticeships.⁹²

Provinces have been forced to respond to workforce transformations in more *ad hoc* fashion as well. For example, in response to the significant scaling back of production at the Oshawa facility of General Motors (GM), the Government of Ontario has partnered with Unifor and GM to create a Jobs Action Centre. This Centre will serve as a hub for a variety of initiatives that have been designed to help support workers facing career transitions. Partners include educational institutions like Durham College, Centennial College and Trent University, as well as private sector employers. Services include the provision of a job-matching function, job fairs, retraining, and education opportunities.^{93,94}

In recognition of the value of sharing and collaboration, provincial, territorial and federal governments have in some instances partnered to create a number of coordinating mechanisms. The creation of the [Labour Market Information Council](#) (LMIC) is one such example. The LMIC was created by the [Forum of Labour Market Ministers](#), which is itself an intergovernmental collaboration platform that brings together provincial, territorial and federal ministers responsible for labour market policies and programs. The LMIC's mandate is to improve "the timeliness, reliability and accessibility of labour market information" for Canadians.⁹⁵ The federal government also plays an important support role through the collection, analysis and dissemination of labour force data through [Statistics Canada](#).

The federal government has recently sought to support provincial efforts in a number of new ways. As part of a broader initiative, the Government of Canada created the [Future Skills Council](#) to provide advice to the Minister responsible for Employment and Social Development Canada by examining "how technologies and other emerging trends" will impact the future of work. Based on its findings, it will

⁹² Parkin, A., Hartmann, E. and Morden, M. (2017). [How to build a skills lab: A new model of institutional governance in Canada](#). The Mowat Centre, p. 8.

⁹³ General Motors Canada. (2019). [GM Canada and Unifor reach agreement to save hundreds of jobs with a \\$170 million investment in Oshawa](#). General Motors Canada.

⁹⁴ Ministry of Economic Development, Job Creation and Trade. (2019). [Ontario welcomes new investment at GM Oshawa](#). Government of Ontario.

⁹⁵ Labour Market Information Council. (2018). [About](#). LMIC.

advise the government on national and regional skills development and training priorities.⁹⁶ Additionally, the federal government has created the [Future Skills Centre](#) (FSC), an arms-length consortium designed to ensure that Canadians are equipped with the skills they need to thrive in the global economy. The Skills Next series, of which this paper is a part, is one of the FSC's initial outputs. The FSC will focus on promoting collaboration, sharing information, and evaluating, replicating and scaling what works with a particular focus on underrepresented groups.⁹⁷

Finally, the private sector is increasing the attention it is investing in preparing for the future of work and skills in Canada. Many large and small employers are experimenting with new approaches to recruitment, training and support to simultaneously prepare their workers and businesses for the future. Many are active on the policy front as well. In fact, it seems that almost every other week a new report focused on some aspect of the future of work is published.^{98,99,100,101} Some larger firms are launching initiatives like RBC's [Future Launch](#) program (helping young Canadians prepare for the future of work) and TD's [The Ready Commitment](#) (grants to organizations improving income stability), aimed not only at their own workers, but also the wider population.

⁹⁶ Employment and Social Development Canada. (2019). [Future Skills Council](#). Government of Canada.

⁹⁷ Future Skills Centre. (2019). [Latest from the Future Skills Centre](#). FSC.

⁹⁸ See for example, Deloitte and Human Resources Professional Association. (2017). [The intelligence revolution: Future-proofing Canada's workforce](#). Deloitte;

⁹⁹ See for example, Royal Bank of Canada. (2018). [Humans wanted: How Canadian youth can thrive in the age of disruption](#), RBC;

¹⁰⁰ See for example, Devillard, S., et al. (2019). [The present and future of women at work in Canada](#), McKinsey & Company;

¹⁰¹ See for example, Desire2Learn and Colleges and Institutes Canada. (2018). [The future of work and learning in the age of the fourth industrial revolution. Canadian Edition](#), D2L and CICAN.

CONCLUSION

Canada has traditionally lagged behind peer countries when it comes to public investment in skills training and active labour market policies.^{102, 103, 104} Employer investments in worker training have declined in recent decades, and many of the workers who are most tenuously attached to the labour market are not eligible for skills training programs, leaving them unable to access training.¹⁰⁵ These types of systemic and structural issues warrant closer attention, and addressing them will be vital to ensuring that all Canadians are well equipped with the skills they need to thrive in tomorrow's economy, whatever shape it may take.

While the future cannot be predicted with either certainty or precision, we can take lessons from long-term trends and emerging technological developments. Using these lessons to anticipate potential scenarios is the best bet to ensure that Canadians can benefit from effective skills development and training infrastructure.

¹⁰² Maxwell, J. and Saunders, R. (2007). [Adjusting to freer trade: Two policy failures](#). Policy Options.

¹⁰³ Johal, S., et al. (2018). [Robots, revenues & responses: Ontario and the future of work](#). The Mowat Centre, p. 24.

¹⁰⁴ Munro, D. (2014). [Employers must start investing in skills training or risk having public policy nudge them along](#). Financial Post.

¹⁰⁵ Johal, S. and Hartmann, E. (2019). [Facilitating the future of work through a modernized EI system](#). Public Policy Forum.

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