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Responding to Automation

How Adaptable Is Canada's Labour Market?

Issue Briefing | March 2020





The Future Skills Centre – Centre des Compétences futures (FSC-CCF) is a forward-thinking centre for research and collaboration dedicated to preparing Canadians for employment success. We believe Canadians should feel confident about the skills they have to succeed in a changing workforce. As a pan-Canadian community, we are collaborating to rigorously identify, test, measure, and share innovative approaches to assessing and developing the skills Canadians need to thrive in the days and years ahead.

The Future Skills Centre was founded by a consortium whose members are Ryerson University, Blueprint ADE, and The Conference Board of Canada.

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Contents

- 4 Key findings
- **5** Introduction
- **5** Occupational mobility
- 6 High-risk, low-mobility occupations
- 6 High-risk, low-mobility employment in Canada
- 12 Next steps
- 13 Appendix A Bibliography
- 14 Appendix B Methodology





Key findings

- Nearly one in five Canadian employees are in occupations at high risk of automation, with few or no options to transition into lower-risk occupations without significant retraining.
- The top five industries in which these occupations are most concentrated are:
 - accommodation and food services
 - manufacturing
 - retail trade
 - construction
 - health care and social assistance
- Based on total number of people employed, the top five occupations of this type in Canada are:
- food counter attendants, kitchen helpers, and related
- cashiers
- administrative assistants
- general office support workers
- cooks
- Workers who identify as one or more of the following groups are disproportionately represented in most of the top five occupations:
 - Indigenous
 - female
 - youth (aged 15-24)
 - visible minority

Introduction

Technological change has always affected how humans organize and work. Rapid technological change makes it more critical than ever that Canadian leaders understand how the adoption of new technologies impacts Canada's labour markets. Yet, there is a wide range of opinion on what types of and how many jobs could be lost to automation or radically changed by technology. Estimates range from 9 per cent¹ to 47 per cent,² depending on the country, time frame, and modelling assumptions. However, there is broad agreement on the types of occupations most exposed to automation.

These include occupations that:

- do not require higher levels of formal education;
- do not involve significant interaction with other people;
- involve repetitive tasks.3

However, understanding the number and types of occupations at risk of automation is not enough to accurately forecast Canada's labour gap. Another key consideration is the ability of those who are displaced by automation to find other forms of employment.

Occupational mobility

Occupational mobility is "the ability of workers to switch career fields in order to find gainful employment or meet labour needs."⁴ The Organisation for Economic Co-operation and Development (OECD) recently published a report that examines occupational mobility in the context of automation. First, it analyzed career transitions between occupations that are technically possible with varying amounts of training. Second, it determined whether these transitions were acceptable from individual and societal perspectives.⁵

Possible transitions involve:

- reasonable upskilling needs
- moderate differences in on-the-job tasks
- similar knowledge requirements

Acceptable transitions involve:

- at most, a 10 per cent wage reduction
- limited excess skills, as overqualified employees tend to be unhappy



- 1 Arntz, Gregory, and Zierahn, The Risk of Automation for Jobs in OECD Countries, 4.
- 2 Frey and Osborne, "The Future of Employment," 1.
- 3 Frontier Economics, The Impact of Artificial Intelligence on Work, 39-40.

- 4 Investopedia, "Occupational Labor Mobility."
- 5 Bechichi and others, Occupational Mobility, Skills and Training Needs.

High-risk, low-mobility occupations

Using well-known occupational automation probability estimates,⁶ the OECD highlighted "occupations for which 6 months of training is insufficient to identify a transition towards an acceptable occupation which is not at high risk of automation."⁷ A simple way to describe these occupations is "high-risk, low-mobility," or HRLM. Without substantial retraining (i.e., one year or more), people will find it difficult to transition away from these occupations into ones that are less susceptible to automation. (See Appendix B for more discussion on the methodology.)

For this research project, we used this list of HRLM occupations to prioritize which Canadian industries are most ripe for disruption resulting from the adoption of new technologies. In other words, we asked, "In which Canadian industries is HRLM employment most concentrated?"

The purpose of this briefing is not to say that automation-enabling technologies will fully replace workers in these occupations and that these workers will have to switch occupations. Our research into emerging skills highlights the importance and ability of workers and employers to adapt to rapidly changing job roles and work environments.⁸ We're simply highlighting occupations that have a higher risk of significant transformation and few options for workers to transition into lower-risk occupations if they have to.

High-risk, low-mobility employment in Canada

In total, there are 92 HRLM occupations in Canada.⁹ By examining labour data from the 2016 Canadian census by occupation and industry, we know that the 92 HRLM occupations account for 20.3 per cent of total employment in Canada.¹⁰ (See Chart 1.) This amounts to 3.5 million people.

Chart 1

High-risk, low-mobility employment as a share of total employment in Canada for select industries (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

9 See accompanying data download for the full list of HRLM occupations.

10 Statistics Canada, 2016 Census of Population.

⁶ Frey and Osborne, "The Future of Employment."

⁷ Bechichi and others, Occupational Mobility, Skills and Training Needs, 37.

⁸ Conference Board of Canada, The. "There's A Revolution Happening in Skilled Trades."

HRLM employment is particularly concentrated in five key industries. These five account for 46.3 per cent of total employment and 58.4 per cent of HRLM employment in Canada. (See Chart 2.) In each of these industries, the number of people in HRLM occupations is as follows:

- Accommodation and food services: 552,205
- Manufacturing: 542,160
- Retail trade: 418,435
- Construction: 306,615
- Health care and social assistance: 223,335

Chart 2

Share of high-risk, low-mobility employment by industry (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

As shown in Chart 3, we can also examine where HRLM employment is concentrated, based on the total number of people employed in each occupation.¹¹ The top five HRLM occupations account for 7.8 per cent of total employment and 38.6 per cent of HRLM employment in Canada. They are as follows:

- Food counter attendants, kitchen helpers, and related support occupations: 358,130
- Cashiers: 316,755
- Administrative assistants: 240,790
- General office support workers: 225,680
- Cooks: 210,630

Chart 3

Share of high-risk, low-mobility employment by occupation: all industries (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

11 See accompanying data download for the number of Canadian workers in all 90 HRLM occupations.

Many groups that are traditionally less engaged in the workforce are found disproportionately in HRLM occupations. For example, Indigenous Canadians have above-average representation in all five of the top HRLM occupations. (See Table 1.) As well, women and youth are disproportionately represented in four of the top five. Even within occupations, youth are at higher risk than older workers. This is because young workers' roles often "do not involve providing advice, supervising others, [or] performing research (tasks linked with lower automatability)."¹² Finally, visible minorities¹³ are disproportionately represented in three of the top five.

Table 1

Share of HRLM employment by occupation and demographics (per cent)

Occupation	Indigenous	Female	Youth	Visible minority
Total employment	3.7	48.3	12.7	21.3
Food counter attendants and related workers	4.9	62.7	55.3	31.1
Cashiers	5.9	82.1	55.4	26.9
Administrative assistants	4.0	95.6	6.5	13.3
General office support workers	4.8	83.9	15	19.8
Cooks	6.1	41.7	31.8	29.1

Note: Bold numbers indicate over-representation in that occupation. Sources: The Conference Board of Canada; Statistics Canada. Canadian leaders need to focus on how job roles are changing, who is most affected by these changes, and how employees can "re-skill" to thrive in the future of work.

Accommodation and food services

In the past three years, there have been many stories about the future of fast food and food counter attendants. Several multinational fast-food chains have already installed touch-screen kiosks that replace cashiers,¹⁴ or automated deep fryers or burger-flipping machines to replace food preparation workers.¹⁵ This trend is in its infancy and is likely to continue to grow.¹⁶

The top five HRLM occupations account for 45.2 per cent of accommodation and food services employment and 96.9 per cent of HRLM employment in the industry. (See Chart 4.)

Chart 4

Share of high-risk, low-mobility employment by occupation: accommodation and food services (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

14 Schweitzer, "Automation Comes to McDonald's."

- 15 Haddon, "McDonald's Tests Robot Fryers and Voice-Activated Drive-Throughs."
- 16 Premack, "Robots Are Already Working in Fast-food Restaurants."

13 Statistics Canada, quoting the *Employment Equity Act*, defines visible minorities as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour."

Manufacturing

Although robotics is a well-established source of disruption for manufacturing, increasingly sophisticated artificial intelligence (AI) and advanced robotics allow non-routine and dexterous tasks to be automated. Combined with technologies such as the Internet of Things (which will significantly improve production yield and efficiency) and 3-D printing (which is becoming increasingly rapid and versatile), it is clear why these industries and their labour markets are ripe for disruption.¹⁷

The top five HRLM occupations account for only 12.9 per cent of manufacturing employment and 36.0 per cent of HRLM employment in the industry. (See Chart 5.) This highlights the fact that HRLM employment is widely distributed across different occupations in the manufacturing industry, rather than only a handful in other industries.

Chart 5

Share of high-risk, low-mobility employment by occupation: manufacturing

(per cent)



Retail trade

The Internet of Things is set to disrupt the retail industry by improving the customer experience, optimizing the supply chain, and creating new channels and revenue streams.¹⁸ AI and big data will drive new customer insights, while augmented reality and drones will facilitate the convergence between online and brick-and-mortar stores.¹⁹

The top five HRLM occupations account for 16.7 per cent of retail employment and 79.6 per cent of HRLM employment in the industry. (See Chart 6.) The majority (72.2 percent) of all cashiers are in retail trade.

Chart 6

Share of high-risk, low-mobility employment by occupation: retail trade (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

Sources: The Conference Board of Canada; Statistics Canada.

18 Gregory, The Internet of Things.

19 Pilkington, "How Will Technology Affect the Retail Industry?"

17 Rodriguez and others, Exponential Technologies in Manufacturing.

Construction

Construction tasks tend to require a high degree of adaptability; however, the potential for automation has increased with technological change. Prefabrication and modularity, for example, allow for reduced task variability in more-controlled environments.²⁰

The top five HRLM occupations account for 18.6 per cent of construction employment and 74.0 per cent of HRLM employment in the industry.

Chart 7

Share of high-risk, low-mobility employment by occupation: construction

(per cent)



Sources: The Conference Board of Canada; Statistics Canada.

Health care and social assistance

Telemedicine – or telehealth – services are already changing the nature of how, where, and when health care services are delivered, and this trend is expected to grow in the coming decades.²¹ As health care delivery shifts more toward digital services, there will be less demand for office support staff.

The top five HRLM occupations account for 8.4 per cent of health care and social assistance employment and 77.7 per cent of HRLM employment in the industry.

Chart 8

Share of high-risk, low-mobility employment by occupation: health care and social assistance (per cent)



Sources: The Conference Board of Canada; Statistics Canada.

21 Dinesen and others, "Personalized Telehealth in the Future."

Next steps

We are currently interviewing senior executives from organizations across Canada in the five industries identified here. We're asking them:

- What have been the biggest technology-related changes in your industry over the past decade?
- How has your industry responded to those changes?
- How do you foresee your industry changing in the coming decade?
- What new skills, behaviours, or attitudes might workers in your industry need?

We are also conducting a survey of Canadian organizations to better understand the different factors affecting their adoption of automation-enabling technologies.

Lastly, we are conducting a second research project that will apply this HRLM lens at the regional level across Canada. This will allow us to establish a foundation for a regionally tailored approach to skills development and enable more effective planning to address local skills gaps.



Appendix A

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Appendix B

Methodology

The OECD's methodology in Occupational Mobility, Skills and Training Needs provides the backbone for this research. It examines the transitions between different occupations as they are impacted by technology adoption and automation. It applies the following steps:²²

Possible transitions

First, it identifies which occupational transitions are possible. Possible transitions meet the following three criteria and could be bridged within a maximum of three years of training.²³

Reasonable upskilling needs

Upskilling needs are based on the literacy and numeracy scores in the OECD's Survey of Adult Skills.²⁴ Reasonable upskilling needs involve an increase of no more than seven points in literacy and numeracy scores per year of training.

Moderate differences in the frequency of some of the tasks performed on the job

Differences in task frequency are measured by the shortage or excess of five task-based skills between occupations. These taskbased skills include ICT skills, management and communication skills, accountancy and selling skills, advanced numeracy skills, and self-organization skills.

Similar knowledge areas

This has two sub-conditions. First, occupations cannot be too concentrated within one field of study (i.e., they cannot be specialized). The fields of study are also based on what was considered the highest qualification reported by workers in the OECD's Survey of Adult Skills.²⁵ Second, occupations must have at least one of their most frequent fields of study in common with each other.

22 Bechichi and others, Occupational Mobility, Skills and Training Needs.

- 23 However, small training needs could mean that upskilling could be achieved within as little as six months. It is important to note that OECD methodology assumes the equivalence between years of education and cognitive skills.
- 24 OECD, Survey of Adult Skills (PIAAC).

25 Fields of study include general programs; teacher training and education science; humanities, languages, and arts; social sciences, business, and law; science, mathematics, and computing; engineering, manufacturing, and construction; agriculture and veterinary; and health and welfare; services.

Acceptable transitions

The OECD then identifies which occupational transitions are acceptable. The intent is to capture what is acceptable from a societal perspective. Acceptable transitions are ones that are possible and meet the following criteria:

No more than a moderate wage reduction

A maximum wage reduction of 10 per cent was considered because it corresponds to the average annual earnings loss of workers one year after job loss.²⁶

Limited excess skills

Highly overqualified individuals could translate into unhappy employees and reduced productivity. Untapped literacy and numeracy skills are limited to 3.5 points for up to six months of training and 7.0 points for up to three years of training.

Automation risk

Finally, the OECD further restricts occupational transitions to those that reduce the risk of automation.²⁷ In other words, occupational transitions must be possible, acceptable, and move workers from occupations at high risk of automation to ones at low or medium risk of automation.

Using well-known occupational automation probability estimates, the OECD highlighted "occupations for which six months of training is insufficient to identify a transition towards an acceptable occupation which is not at high risk of automation."²⁸ The authors also highlighted a subset of those occupations that have no acceptable transitions with up to a year of training. We use the larger list for this project to get an initial overview of these occupations in Canada.²⁹

Identifying occupations

The OECD's list of occupations is provided in the format of the International Standard Classification of Occupations. For this issue briefing, we used Statistics Canada's concordance tables to map these occupations to Canada's National Occupational Classification. From there, we used Statistics Canada's 2016 Census data and analyzed which industries had the highest concentrations of high-risk, low-mobility employment.

See the additional data download for the full list of these occupations and conversions.



26 OECD, OECD Employment Outlook 2013, 206.

- 27 Occupations at high risk of automation were identified based on experts' assessment of tasks that could feasibly be automated, given the current state of machine learning technology and big data analytics. (See Frey and Osborne, "The Future of Employment.")
- 28 Bechichi and others, Occupational Mobility, Skills and Training Needs, 37.
- 29 In our research project that applies this methodology at the regional level, we will differentiate between occupations based on the training effort required, and then calculate the lost economic potential associated with that training effort.

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