

LABOUR MARKET ADAPTATION IN THE AGE OF AUTOMATION

HIGHLIGHTS

- What does automation mean for the future of employment? Will technology yield big gains in productivity and an improved quality of life? Or does it pose a threat to workers and jobs that will strain the broader socio-economic system in the coming decades? Yes—to both.
- Automation is both a substitute for and a complement to human capital and intelligence. The challenge for workers in the “age of the machine” will be to figure out where they can add value and/or perform non-automatable tasks, and where computers can act as substitutes for human labour.
- BC’s shifting demographic structure, combined with automation, may point to added stresses for our socio-economic system.
- For government and industry, policies to build appropriate skills should be a priority to help address the consequences of automation and prepare for the digital economy. Digitized, computer-generated knowledge, products and services promise gains in productivity and the overall quality of life—but also threaten to leave behind those who are unable to adapt.

As disruptive technologies push the frontiers of automation and encroach on some of the advantages that humans have been thought to possess over machines, the way we work is being transformed.¹ At this point, advances in technology, including those associated with the digital revolution, do not appear to have reduced the level of aggregate employment in the economy – although some analysts believe this will change as time passes. However, the labour market is being restructured as a result of the ever-increasing computing power of the Internet, Big Data, cloud technology,

Artificial Intelligence, the Internet-of-Things, and increased market penetration by disruptive online platforms, such as Airbnb. From choosing a movie to doing a banking transaction or booking a hotel room, new forms of technology are eroding many routine tasks.

It does not stop there. Computers and learning-based algorithms have progressed beyond replacing repetitive, manual labour with machine execution. Recognizing patterns, providing diagnoses, and communicating complex information—three activities once seen as within the sole purview

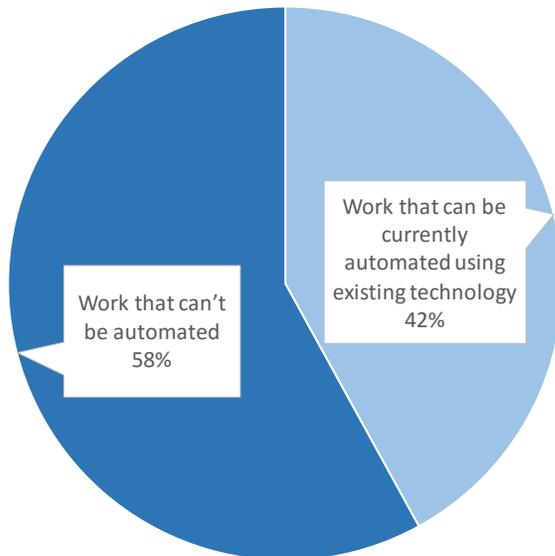
of humans—are now high-level functions that increasingly are being performed by computers. Doctors, lawyers, accountants, and many other skilled professionals now may be joining the ranks of those affected by automation.

What does all of this mean for the future of employment? Will automation yield big gains in productivity and an improved quality of life? Or does it pose a threat to workers and jobs that will strain the broader socio-economic system in the coming decades?

The short answer: Yes—to both.

¹McKinsey & Company, “Automation, jobs and the future of work,” last modified December, 2014. <http://www.mckinsey.com/global-themes/employment-and-growth/automation-jobs-and-the-future-of-work>.

FIGURE 1: **AUTOMATION OF TASKS IN CANADIAN LABOUR MARKET**



Source: Brookfield Institute, *The Talented Mr. Robot* (2016).

WORK, AS WE KNOW IT

Traditional work is changing owing to technological progress. Many jobs that developed over the last century are likely to be displaced via automation within the next 10 to 20 years. Some studies suggest more than 40% of the Canadian labour force may be affected in this way by 2035. A similar share of the “tasks” currently performed by paid employees in Canada could be automated using existing technologies.² Technological displacement is predicted to have the greatest impact on tasks that are routine, administrative, sales and service-oriented in nature.

“Routine” tasks are not labelled as such because they are necessarily mundane, but because they could be fully codified and automated in the

foreseeable future.³ Routine tasks are found in most occupations and are common in many middle-skilled cognitive and manual activities. Examples include mathematical calculations involved in accounting and financial analysis; the organizing of information that is typically part of administrative duties; the physical execution of repetitive work, such as driving; and certain types of research, such as that performed when filing a patent.

Although automation often affects lower-skill, low-wage roles, recent research finds that even workers in highly-paid or senior level occupations perform activities capable of being digitized. As technology marches ahead, computers are learning to automate tasks once thought to require human

intelligence and judgment.⁴ Routine tasks in unpredictable environments, such as driving, may be disrupted by emerging technologies – such as self-driving cars. Intelligent automation, the kind that is programmed into self-driving vehicles, gives computers learning-based algorithms that draw from complex scenarios and expand on their own as they are exposed to new problems or situations, without the need for repeated human programming or updates.⁵

The health care system might also see the fruits of intelligent automation. Some studies estimate only 20% of the knowledge that doctors use to diagnose patients is based on published scientific evidence, as it would take at least 160 hours of reading a week to keep up with new publications.⁶ A lack of widespread knowledge of the latest medical advances, and/or of sufficient time to dedicate to professional development, points to the reality of “too much” information and an inability to process it. Automation presents an opportunity to reduce the gap between the volume of relevant information and the capacity of employees to absorb and make use of it in their work or profession. IBM’s Watson computer, for example, is trained to read medical literature on specific cancers, provide diagnoses, and interact with doctors in real time. The use of intelligent automation in health care offers the promise of both increased productivity and real-time benefits to patients.⁷

² Lamb, Creig. 2016. “The Talented Mr. Robot: The Impact of Automation on Canada’s Workforce.” *Brookfield Institute*. http://brookfieldinstitute.ca/wp-content/uploads/2016/07/TalentedMrRobot_BIIE.pdf.

³ Autor, David. 2015. “Why Are There Still So Many Jobs? The History and Future of Workplace Automation.” *Journal of Economic Perspectives*, 29(3): 3-30.

⁴ *The Economist*, “The future of jobs: the onrushing wave.” Last modified January 18, 2014. <http://www.economist.com/news/briefing/21594264-previous-technological-innovation-has-always-delivered-more-long-run-employment-not-less>.

⁵ *Ibid.*

⁶ “Smart Machines: The New “Human” Capital?” CFO, last modified December 1, 2014. <http://ww2.cfo.com/people/2014/12/smart-machines-new-human-capital/>.

⁷ *Ibid.*

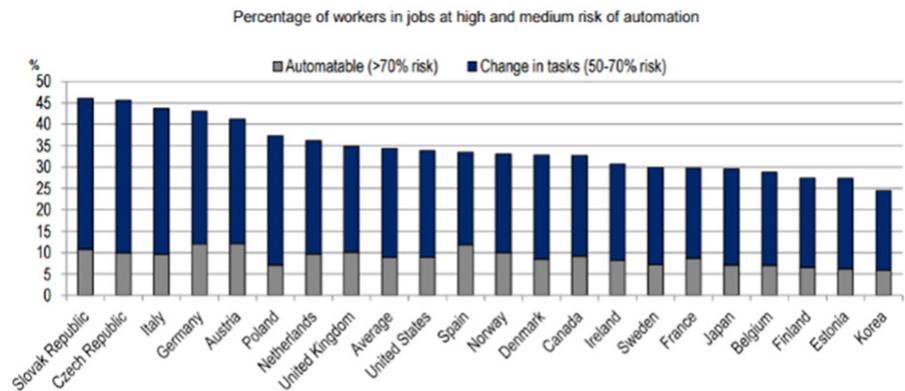
JOBS VERSUS TASKS

A focus on the automation of entire jobs may be misleading, as it paints too bleak a picture of where the labour market is headed. Machines are unlikely to take over all jobs – even ones involving routine and/or repetitive tasks – in the near future, if ever.⁸ It may become harder, however, for some workers to secure and retain full-time employment. One approach to analysing the number of jobs at risk from automation is to focus on the tasks involved in specific types of work, and then consider the task content of individual jobs. When broken down by activities, jobs with the largest portion of automatable tasks presumably are at greatest risk of technological displacement.

The Organization for Economic Cooperation and Development (OECD) recently released a report on this topic.⁹ According to this research, jobs in which 70% (or more) of the tasks are deemed automatable are at the highest risk of displacement. Broadly speaking, workers with less than a secondary level of education are also more vulnerable to job displacement from automation.¹⁰ While machines won't be taking over all jobs, there will

The challenge for workers in the “age of the machine” will be to figure out where they can add value and/or perform non-automatable tasks, and where computers can act as substitutes for human labour.

FIGURE 2: **THE RISK OF JOB LOSS BECAUSE OF AUTOMATION IS LESS SUBSTANTIAL THAN SOMETIMES CLAIMED BUT MANY JOBS WILL SEE RADICAL CHANGE**



Note: Data for the United Kingdom corresponds to England and Northern Ireland. Data for Belgium corresponds to the Flemish Community.

Source: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012) and Arntz, M. T. Gregory and U. Zierahn (2016), “The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis”, *OECD Social, Employment and Migration Working Papers*, No. 189, OECD Publishing, Paris.

be a significant restructuring of the workforce, potentially transforming how businesses and society function in the future.

JOB POLARIZATION

Automation is both a substitute for and a complement to human capital and intelligence. The challenge for workers in the “age of the machine” will be to figure out where they can add value and/or perform non-automatable tasks, and where computers can act as substitutes for human labour. Rapid, widespread displacement of vast numbers of jobs is unlikely in the next 10-20 years. However, the quality of some existing work may be affected as the labour market increasingly polarizes into high- and low-skilled jobs, with few options left in between.

Looking ahead, there may be fewer opportunities for gainful full-time employment for a sizable proportion of the workforce.

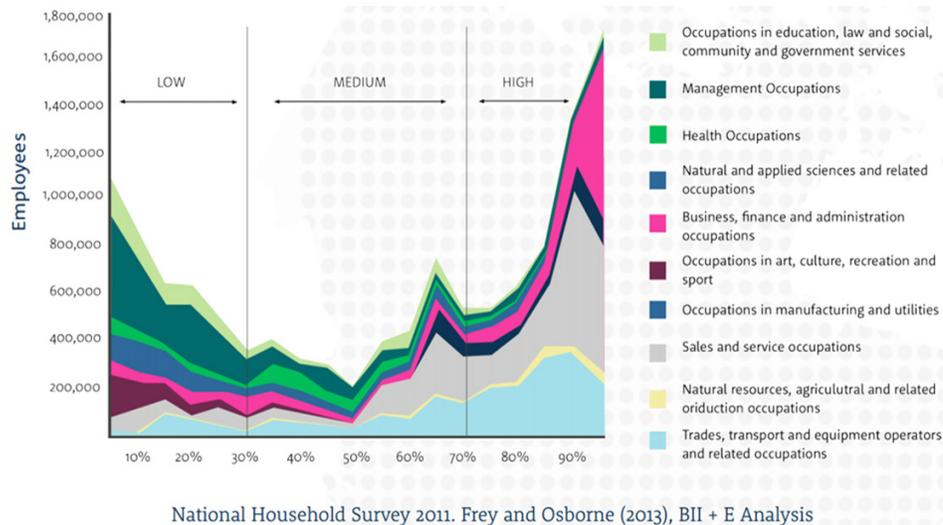
On the one hand, increased automation could boost productivity—a good thing for our economy and society overall. On the other hand, more automation of tasks and jobs may translate into less full-time employment and downward pressure on wages/benefits for some labour market participants. In other words, there may be a widening divide between those whose work and skills mostly complement technology and those who are unable to adapt to the new realities of work in the machine age. If automation continues to advance, the divide between skilled and unskilled employment seems certain to increase. Many working-

⁸ Brynjolfsson, Erik and Andrew McAfee. *The Second Machine Age: Work Progress and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton, 2014.

⁹ “Automation and Independent Work in a Digital Economy.” OECD, last modified May 2016. <https://www.oecd.org/employment/Automation-and-independent-work-in-a-digital-economy-2016.pdf>.

¹⁰ *Ibid.*

FIGURE 3: **HIGH-LEVEL CANADIAN OCCUPATIONS AND PROBABILITY OF BEING AFFECTED BY AUTOMATION**



age people could find themselves trapped in a downward cycle of low-skilled, low-paying occupations, with diminished opportunities to transition into careers that offer a decent income.

STRAINS ON THE SOCIAL FABRIC

Job polarization and the potential for decreased full-time employment will put pressure on the socio-economic system. Relative to fully-employed taxpayers, workers unable to secure decent jobs and faced with lower incomes will have fewer opportunities to advance in life and will contribute less to the social safety net and the broader tax base. Workers unable to move beyond low-skilled, low paying positions generate less tax revenue, often have weaker career progression, lack access to training and upskilling opportunities, and struggle with economic

insecurity. While automation will eliminate certain jobs, arguably this is not the main risk. Of greater concern is how the socio-economic system will respond to a possible future in which a rising share of working-age people cannot adapt to the technological restructuring of the labour market and thus require greater support from governments – which themselves may be presiding over a stagnant tax base due to population aging and a slowdown in the economy’s potential growth rate.

THE BC CONTEXT

The effects of automation in BC are likely similar to those in other provinces and other affluent jurisdictions.¹¹ However, BC’s shifting demographic structure, combined with automation, may point to added stresses for our socio-economic system.

BC’s population has become notably

greyer since 1995, when the median age was 36; today it stands at 44.¹² Two factors help to explain the province’s aging population: 1) BC is a popular destination for retirees and near-retirees; and, 2) people are living longer. These trends inevitably translate into additional strain on health and social service budgets. As the number of retirees swells, there will be relatively fewer working-age BC taxpayers to provide the revenues to pay for public services. On top of this, a lower natural birthrate is also feeding into a more slowly-growing labour force which will also weigh on the future growth of gross domestic product and tax revenues.

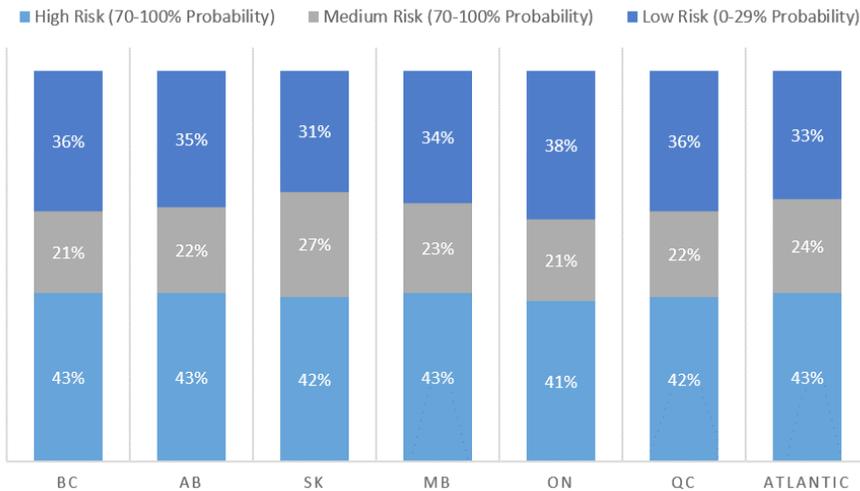
What does all of this mean for BC? As more baby boomers retire, increasing burdens (such as taxes, pensions, health care) are set to fall on the shoulders of younger generations. The challenge does not rest solely on the absolute number of older individuals, but more so on the proportion of older to younger (employed) people. The status quo for health, social services and employment arrangements is unlikely to be sustainable in the face of an aging population and slower

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¹¹ Lamb, *The Talented Mr. Robot*, 2016.

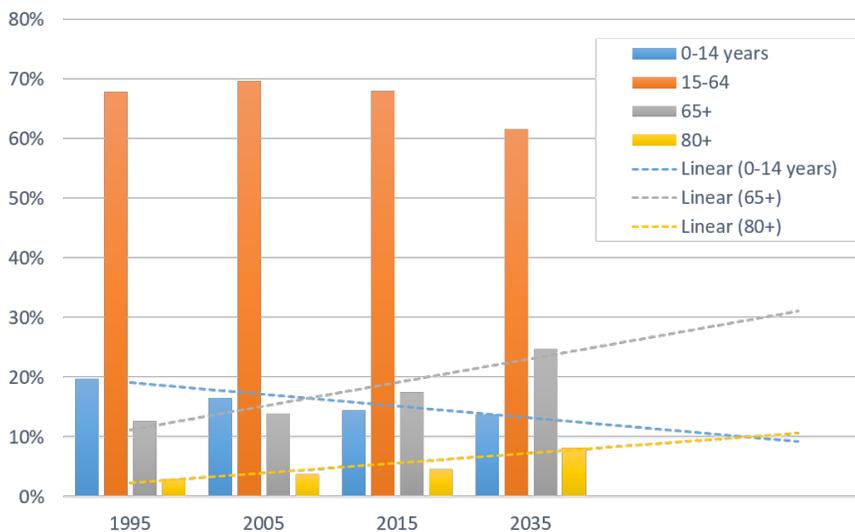
¹² <http://www.bcbc.com/bcbc-blog/2016/millennial-musings-a-policy-response-to-an-aging-population>.

FIGURE 4: **PROVINCIAL EMPLOYED LABOUR FORCE BY RISK OF BEING AFFECTED BY AUTOMATION**



Source: Brookfield Institute, *The Talented Mr. Robot* (2016). All numbers rounded to nearest percent.

FIGURE 5: **AGE DISTRIBUTION IN BC, HISTORICAL (1995-2015) AND PROJECTED (2016-2035)**



Source: [Millennial Musings: A Policy Response to an Aging Population](#).

economic growth.

The threat of automation adds another layer of complexity to the picture. BC's aging demographic suggests the province could be at greater risk if a rising fraction of working-age residents are unable to find decent jobs and careers because

of ongoing technology-driven disruptions to the labour market. Relatively fewer younger workers supporting an ever-expanding cohort of retirees will certainly pose social and fiscal challenges. A scenario of fewer full-time workers with lower incomes as the machine age evolves

would add to the pressure.

ADDING VALUE TO AUTOMATION

An adaptable, well-educated and suitably trained workforce is critical to meeting the changing demands of the labour market. As we do not know how emerging technologies will complement or substitute for human capital and effort, it is best to plan in advance. High schools and post-secondary institutions should incorporate curricula that include computer programming and other courses that allow students to gain relevant IT and digital economy skills. The recent introduction of coding into the BC education system is a step in the right direction. Computer skills are not just about STEM-related learning; they are an integral part of a strategy to allow people to succeed in a dynamic labour market.

For government and industry, policies to build appropriate skills should be a priority to help address the consequences of automation and prepare for the digital economy. Digitized, computer-generated knowledge, products and services promise gains in productivity and the overall quality of life—but also threaten to leave behind those who are unable to adapt.

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