Innovation, Technology and Inclusive Economic Growth:

Presentation to the Queen's International Institute on Social Policy

DATE

brookfield institute
for innovation + entrepreneurship

Overview

1. Tension Between Technological Innovation + Inclusive Economic Growth
2. Impact of Automation on Canada's Labour Force
3. Geographic and Regional Implications
4. Tasks and Skills At-Risk and In-Demand
5. Implications and Recommendations
6. Appendices

Part 1) Tension Between Technological Innovation + Inclusive Economic Growth

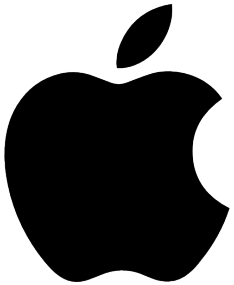
Innovation drives long-run economic growth and prosperity. As Canada's resource industries falter and our population ages, it will be increasingly important to harness innovation to boost Canada's productivity and global competitiveness.

The benefits of innovation are unevenly distributed. For example, new technologies could make many existing jobs obsolete, wealth creation through innovation is often highly concentrated, and new models of gig-based work could impact job security and benefits. This can create and exacerbate existing inequalities between the high and low skilled, urban and rural/remote communities, different industries and different demographic groups.

To be a truly inclusive economy, Canada must simultaneously embrace innovation, help individuals successfully adjust to disruption, and broaden the benefits of an innovation economy to a wider swath of individuals.

Technology: an Engine of Growth

In 2016, for the first time ever, the top 5 companies in terms of market value were all tech—Apple, Alphabet, Microsoft, Amazon and Facebook.



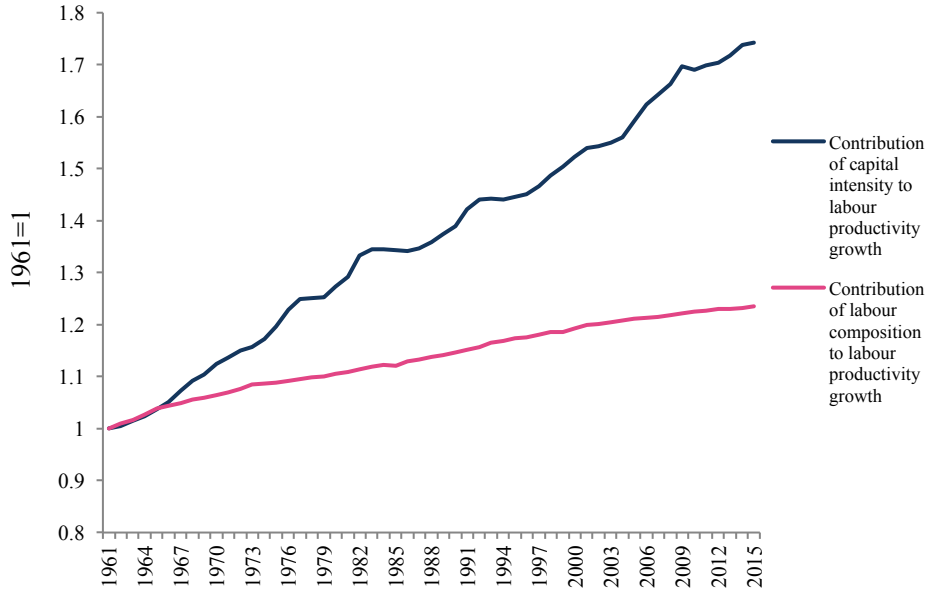
Alphabet

Microsoft

amazon.com

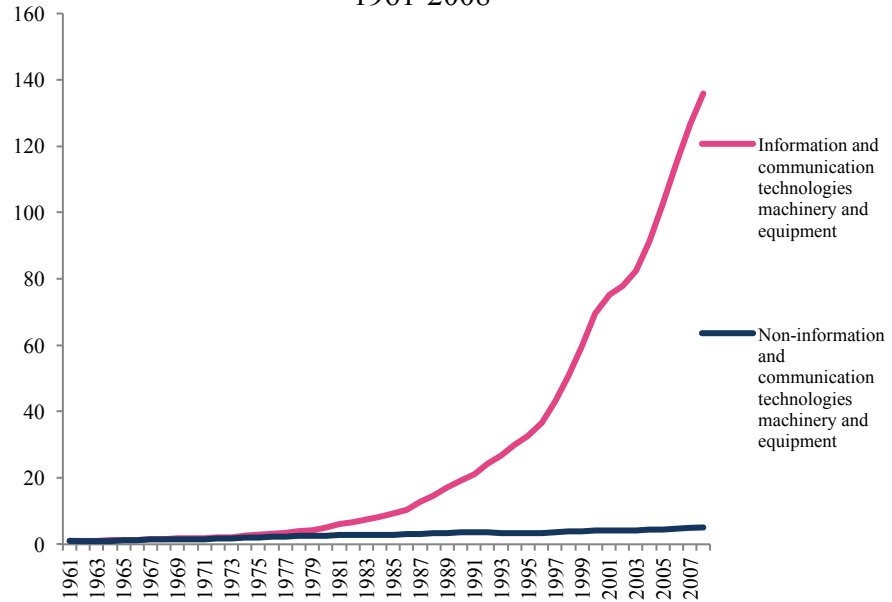
Technology investments are contributing more to productivity gains than labour.

Capital and Labour Contribution to Productivity, 1961-2015



Source: Statistics Canada Cansim Table 383-0021

Capital Stock Growth Canada, 1961-2008

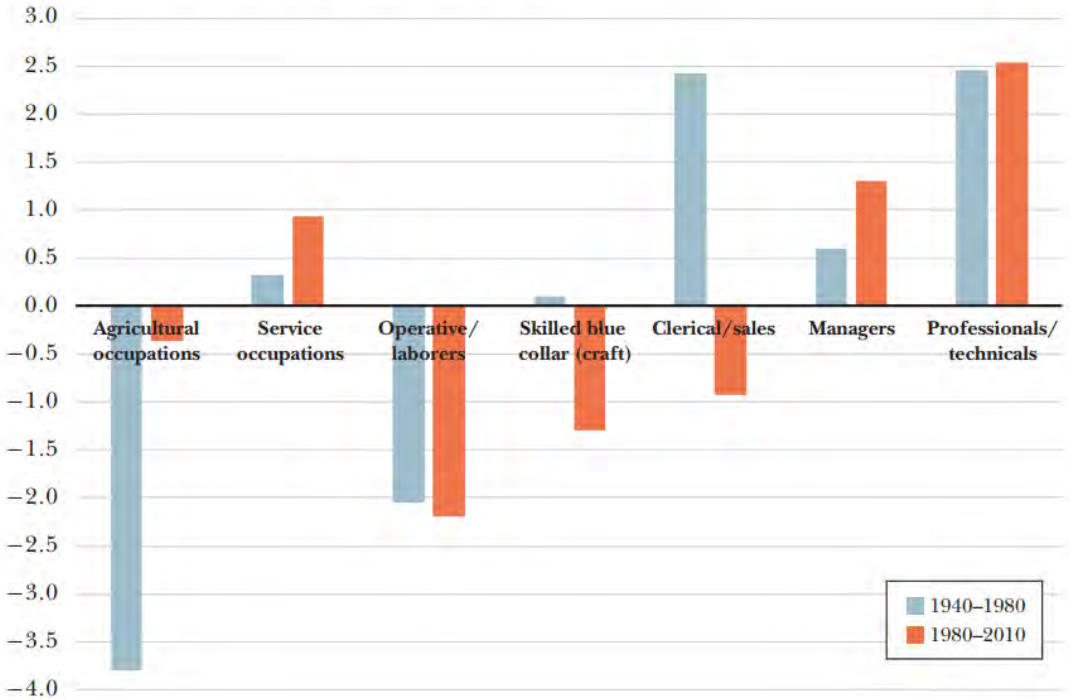


Source: Statistics Canada Cansim Table 383-0025

Technology: Doing More with Less

Technology has been particularly effective at replacing workers' routine tasks, which has been a major driving force behind the decline of middle-skilled, middle-income jobs, such as those in the manufacturing sector.

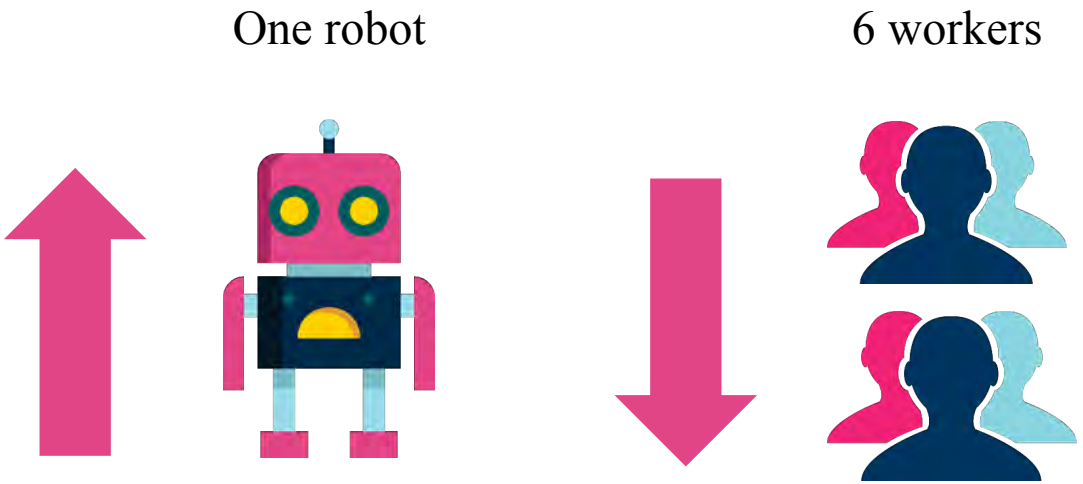
Average Change per Decade in US Occupational Employment Shares for Two Periods: 1940–1980 and 1980–2010



Source: Autor, D. (2015). Why Are There Still So Many Jobs?

Technology: Doing More with Less

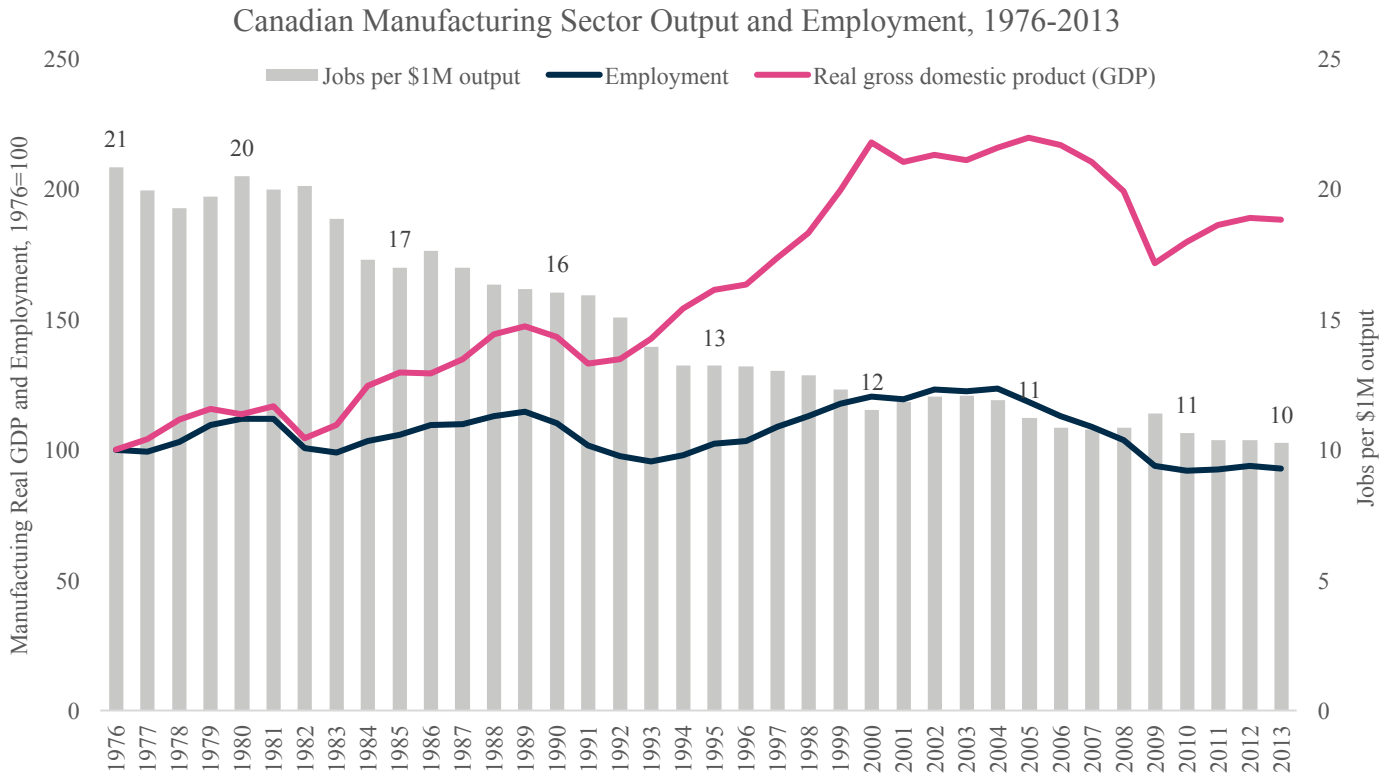
A 2017 US study showed that between 1990 and 2007, the introduction of one additional robot per 100 workers led to a decline of nearly 6 workers.



Source: Acemoglu and Restrepro (2017). Robots and Jobs: Evidence from US Labor Markets.

Technology: Doing More with Less

In 1980, it took 20 workers to produce $1 million worth of manufacturing output in Canada. By 2013, this had declined to 10 workers.



Source: Statistics Canada Cansim Table 282-0008, Table 379-0031, Table 383-0032, BII+E Analysis
Note: GDP Chained 2007 dollars

Part 2) Impact of Automation on Canada's Labour Force

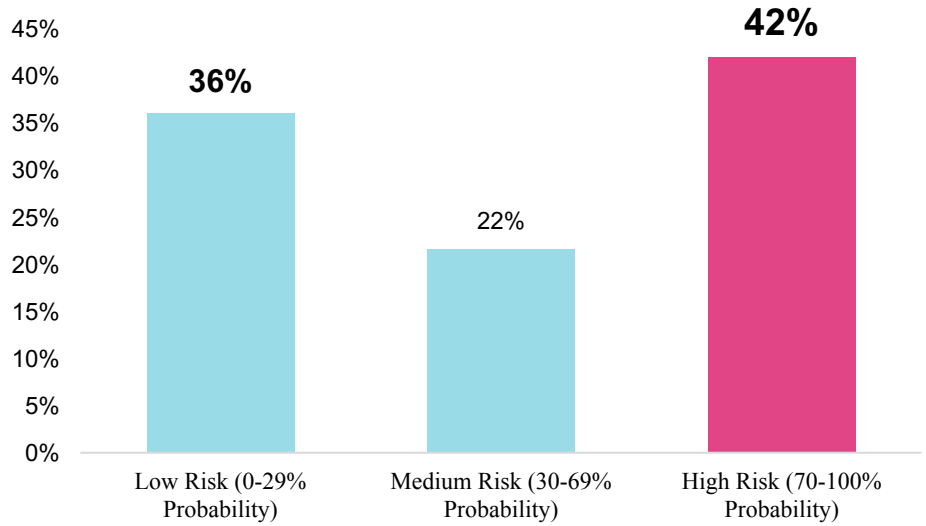
The Talented Mr. Robot:

- Released June 2016
- Extended Frey & Osborne (2013) occupation-based methodology to Canada's labour force
- Examined automation potential for nearly all occupations (498) in Canada (six NOCs were excluded from the analysis)

Part 2) Impact of Automation on Canada's Labour Force

Over the next 10-20 years:

42% of the Canadian labour force is at a **high risk of being affected by automation**

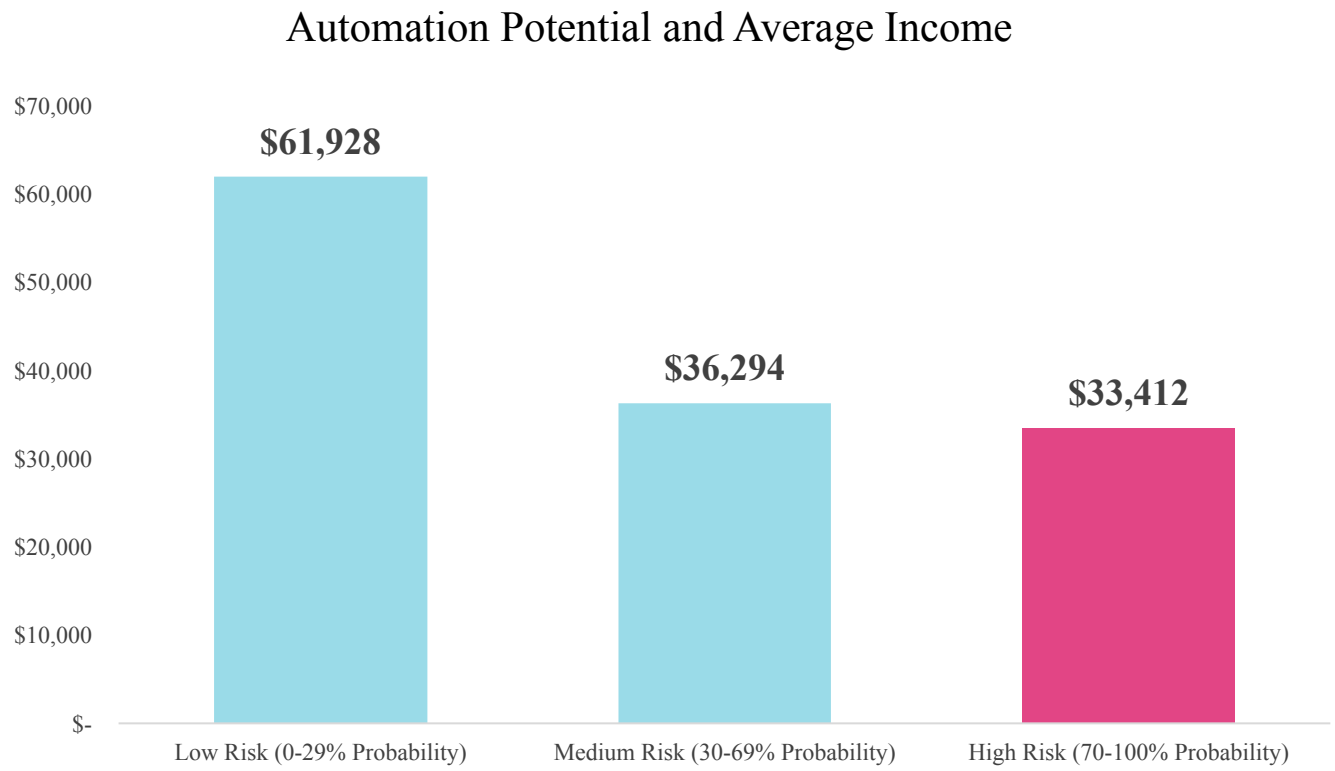


Lower earning

Less educated

Source: BII+E, 2016

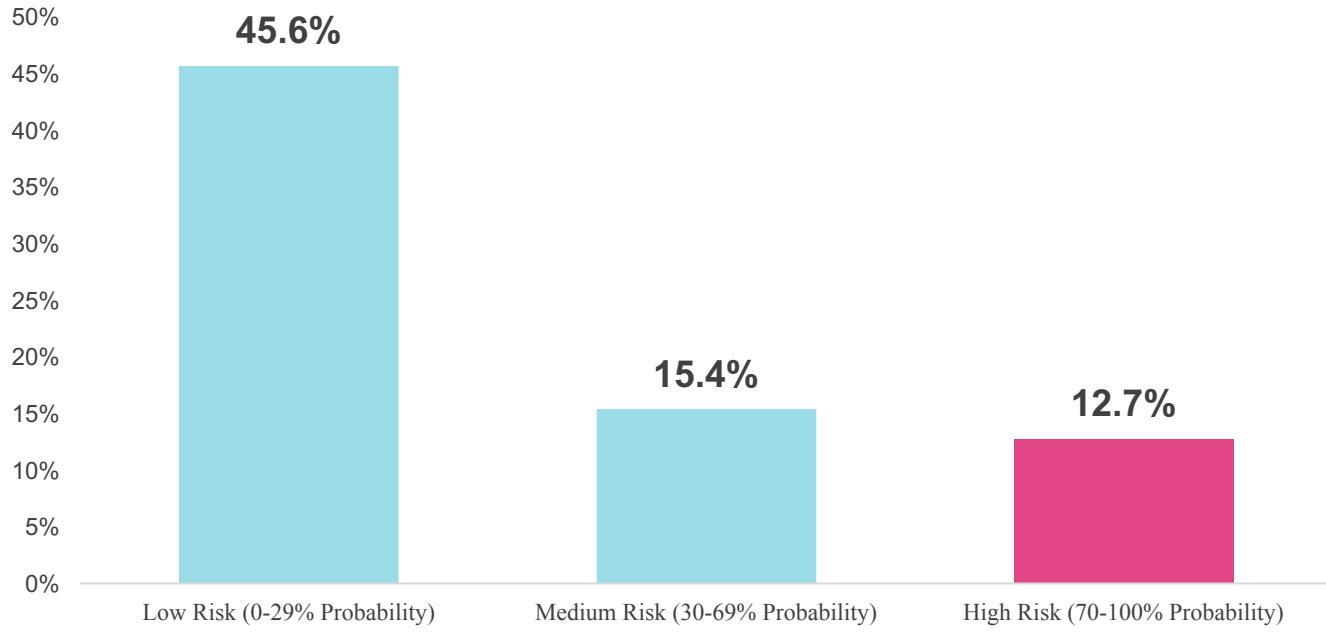
Part 2) Impact of Automation on Canada's Labour Force



Source: BII+E, 2016

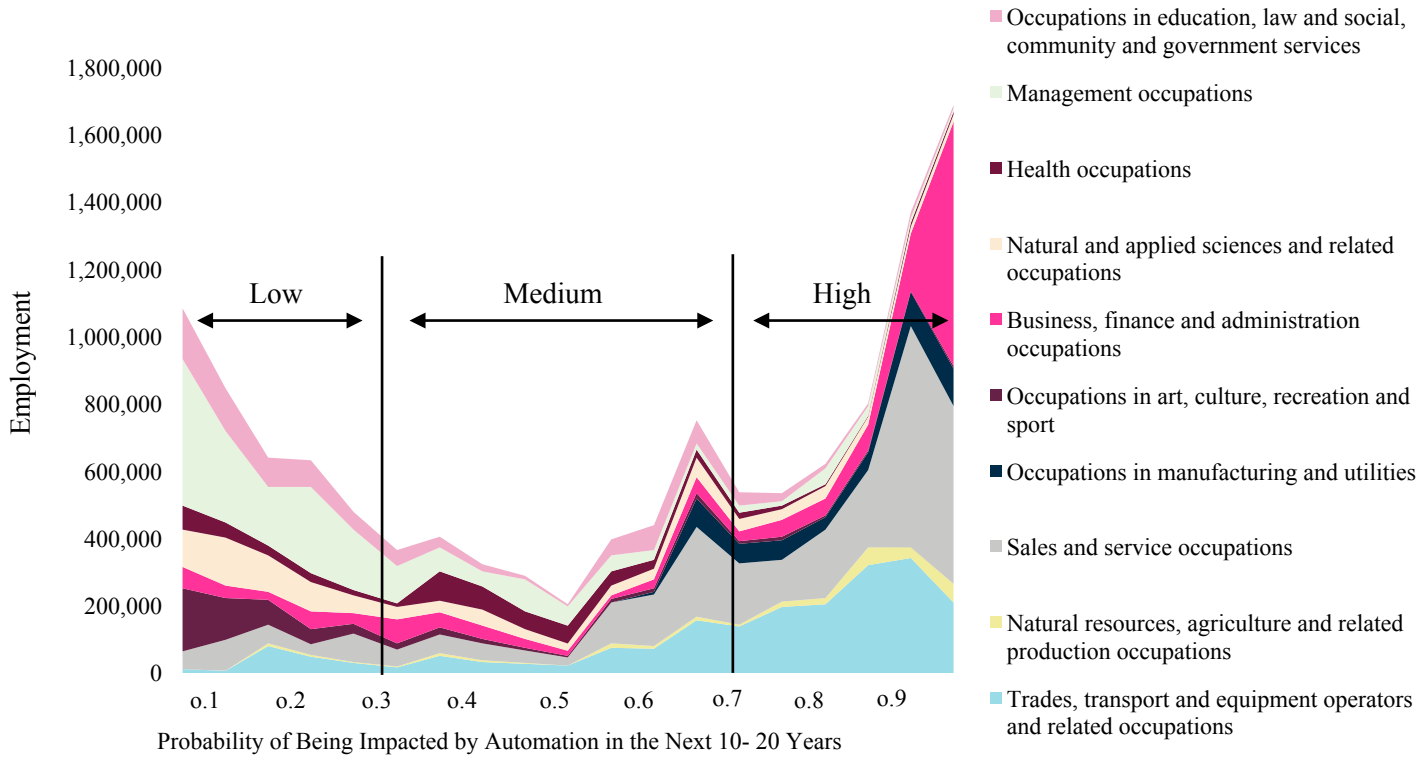
Part 2) Impact of Automation on Canada's Labour Force

Automation Potential and Proportion of Labour Force with University Education (bachelor or above)



Source: BII+E, 2016

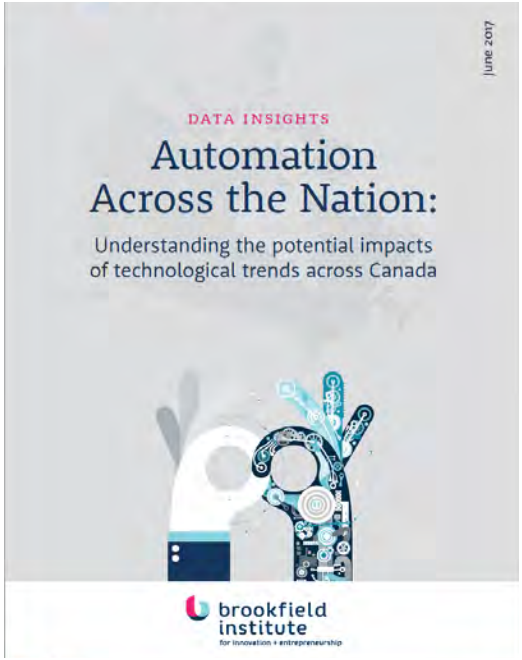
Part 2) Impact of Automation on Canada's Labour Force



office support & general administration, labourers, production and sales and service workers at high risk

Source: BII+E (2016)

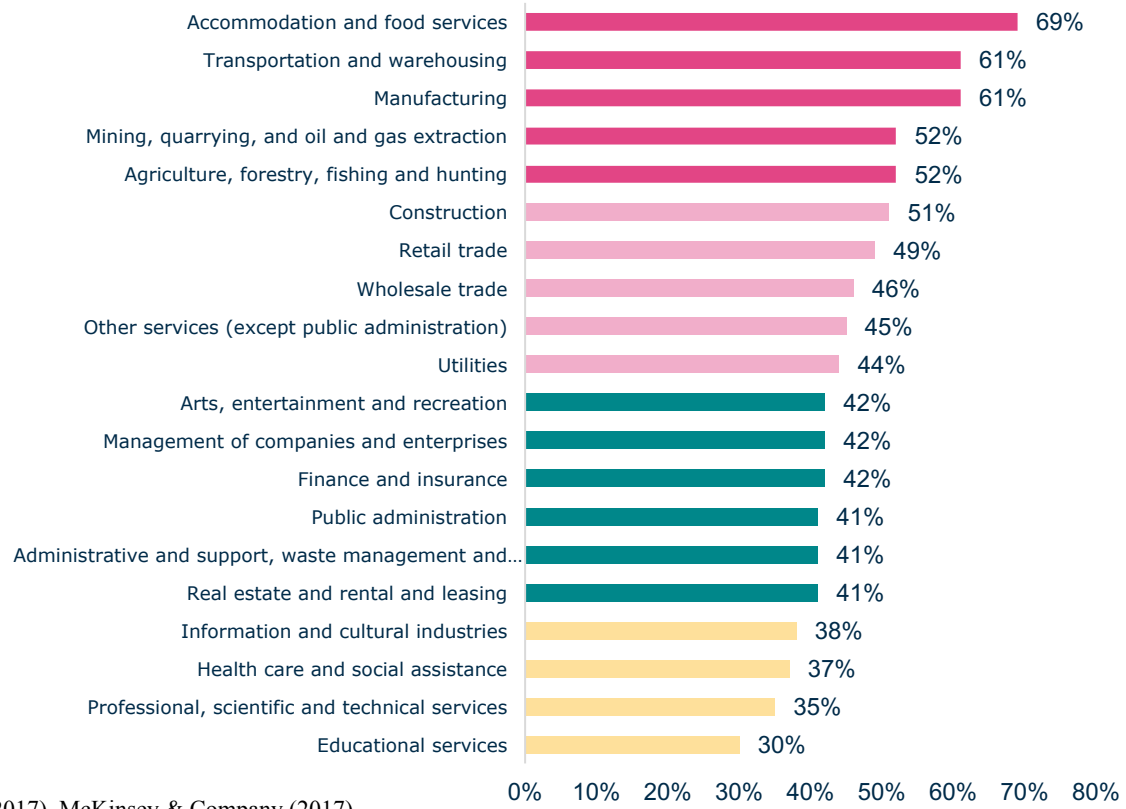
Part 3) Geographic and Regional Implications



Automation Across the Nation

- Released June 2017
- Used McKinsey & Co (2017) work activity methodology
- Mapped onto Canadian Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs) covering roughly 83 percent of the country's labour force
- Used NHS 2011, will update using 2016 Census data

Part 3) Geographic and Regional Implications



These industries have the highest proportion of work activities that are technically automatable (top quartile).

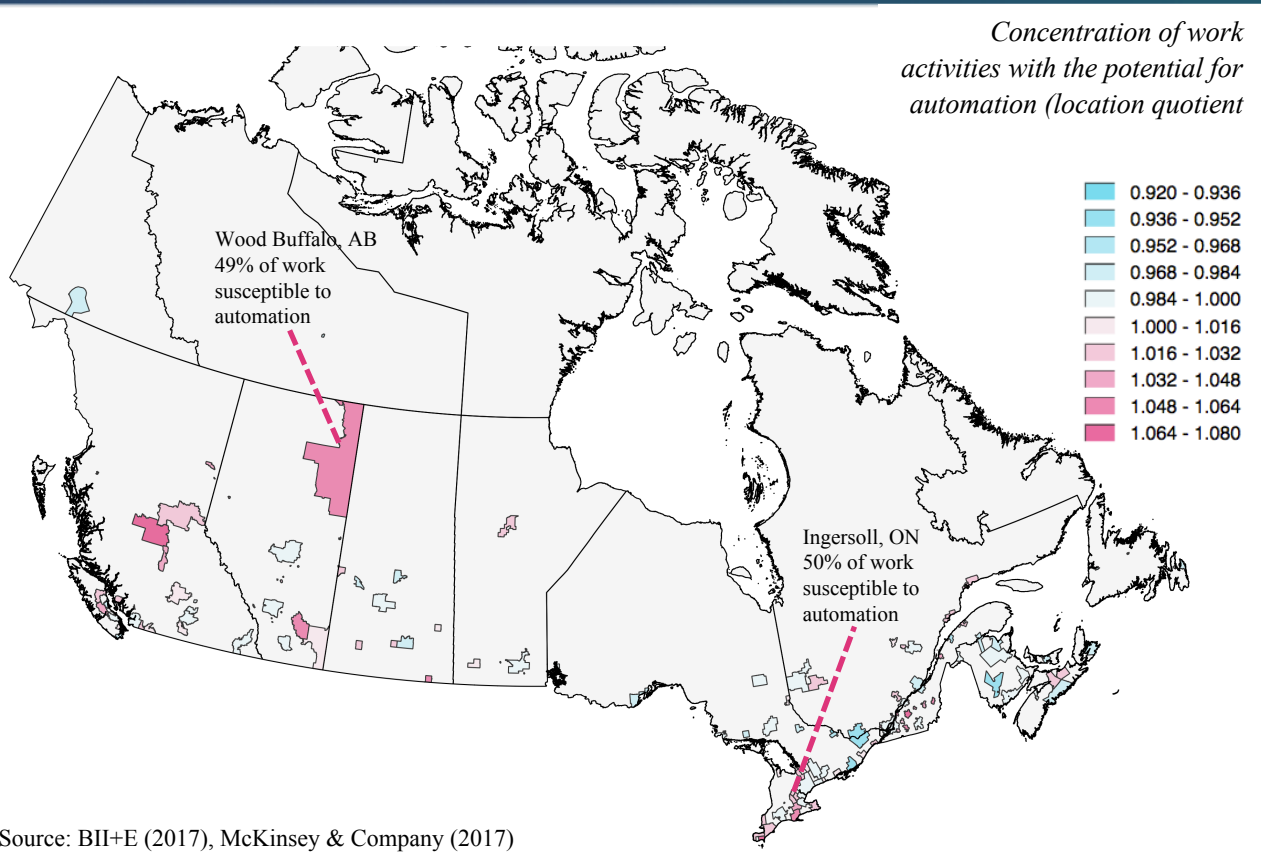
- About 62 percent of work activities could be automated within these industries.
- Equivalent to 2.5 million jobs

These industries are least susceptible to automation (bottom quartile).

- About 35 percent of work activities could be automated within these industries.
- Equivalent of 1.6 million jobs

Source: BII+E (2017), McKinsey & Company (2017)

Part 3) Geographic and Regional Implications



Source: BII+E (2017), McKinsey & Company (2017)

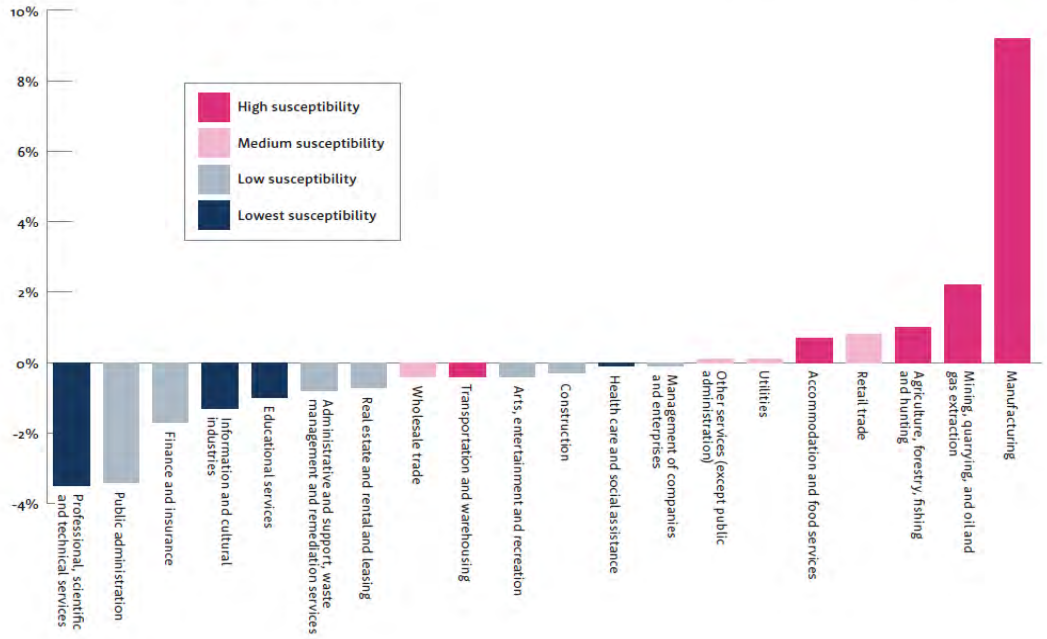
Mapped the susceptibility to automation for all of Canada's CMAs and CAs (83% of population)

For an interactive map visit brookfieldinstitute.ca

Part 3) Geographic and Regional Implications

- Limited variation between cities and towns, meaning automation can impact cities and towns across Canada
- Small regional economies specializing in manufacturing or mining, quarrying, and oil and gas extraction are most susceptible to automation
- Areas less susceptible to automation include cities and towns with a large hospital, post-secondary institution or public sector presence
- Larger, more diverse labour markets, such as Toronto and Vancouver, are more likely to reabsorb displaced labour and weather potential automation impacts

Difference in Industry Proportions, CMAs and CAs Most Susceptible to Automation (Top 20) Compared to National Average, 2011



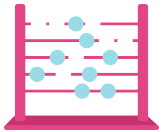
Source: BII+E (2017), McKinsey & Company (2017)

Part 4) Tasks and Skills At-Risk and In-Demand

Overall, 46 percent of work activities in Canada have the potential to be automated, across all industries.

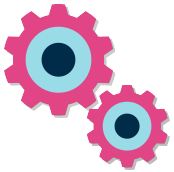
This does not mean that these jobs *will* be automated. Most jobs comprise a mix of work activities, only some of which are automatable; however, this proportion of work activities is significant – equivalent to 7.7 million jobs.

Tasks Most at Risk



Data Collection

Data Processing



Predictable Physical Work

Tasks Least at Risk

Managing/ Stakeholder Interaction

Applying Expertise

Unpredictable Physical Work

Source: BII+E (2017), McKinsey & Company (2017)

Part 4) Tasks and Skills At-Risk and In-Demand

Canada's labour force should be equipped with a broad suite of technical and soft skills that will be important for growth and that can not (yet) be automated, including: **skills associated with digital literacy, entrepreneurship, and social intelligence.**

Part 4) Tasks and Skills At-Risk and In-Demand

A 2016 survey of 90 large Canadian private-sector employers identified **teamwork, communication, and problem-solving capabilities** as some of the most important skills for entry-level positions - skills that current technology can complement but not replace.

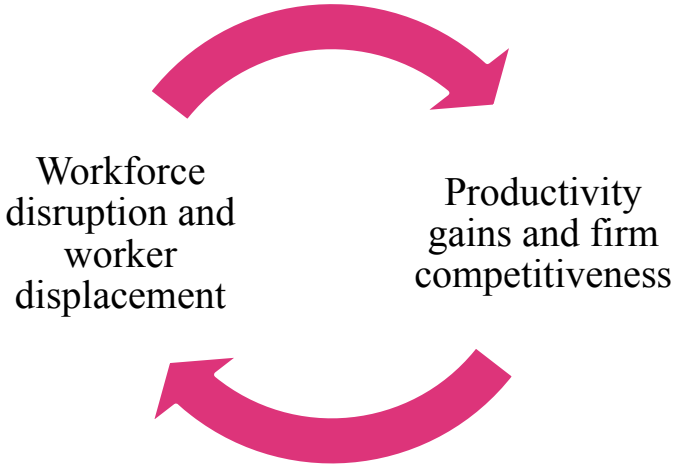
A study from Burning Glass Technologies found that **nearly 7 million job openings in the US in 2015 were for roles requiring coding skills**, representing 20 percent of the total job market for career-track jobs that pay more than $15 an hour.

The pace of change will also increase the value of entrepreneurial skills, not just for startups but for all Canadian firms. Entrepreneurs tend to score high on leadership, identifying opportunities, and managing uncertainty.

Part 5) Implications

Negative Implications:

- Potential for large displacement of workers
- Specifically, low-skilled, low-wage jobs particularly at risk
- However, risks also cut across income ranges and all job categories.
- Likely to have disproportionate impact on less economically diversified areas of Canada
- Political instability / economic anxiety



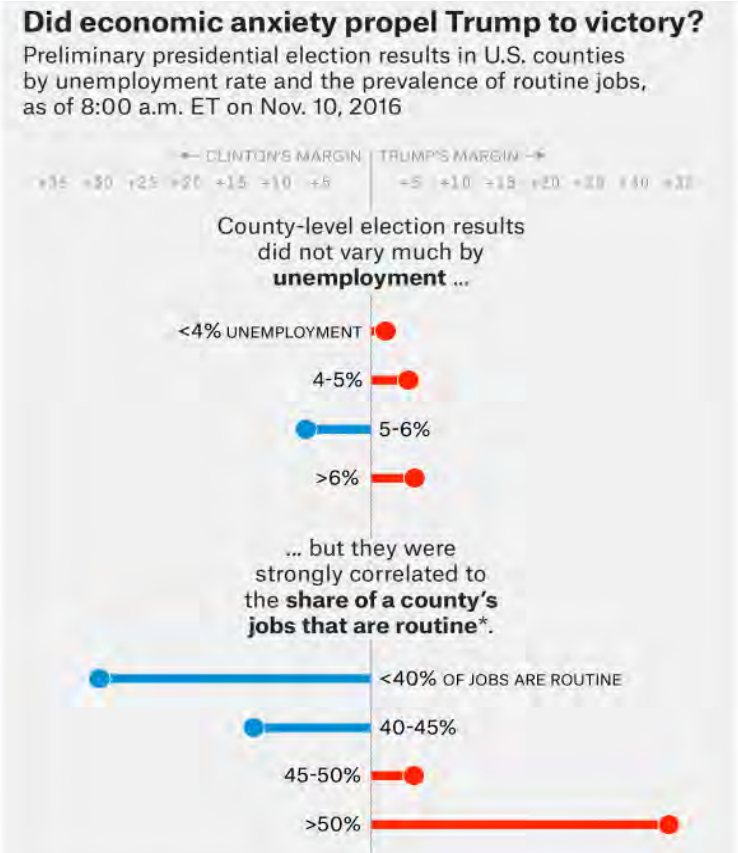
Positive Implications:

- Productivity gains, required to sustain aging population
- Help address talent gaps in particular areas of the economy
- Creation of new jobs of the future
- At firm level, higher labour productivity can increase competitiveness – especially, export-oriented firms
- Emerging market opportunities for firms who seize technology

Part 5) Implications

The rise of populist movements internationally is at least partially in response to the tension between innovation and inclusive growth.

A 2016 analysis of the US presidential election by FiveThirtyEight demonstrated that county-level results strongly correlated to the share of a county's jobs that are routine. President Trump's margin was close to 30 points in counties with more than 50 percent of jobs that are routine.



5) Implications

Areas to explore:

Investments in education and training, e.g.:

- *Accessible digital literacy + coding education*
- *Work-integrated learning*
- *Lifelong learning / rapid up-skilling*

Policies aimed at improving equity, e.g.:

- *Basic income*
- *Changes to tax policy*
- *Changes to labour policy*
- *Policies to address cost of living in cities*

New models for labour market information, e.g.:

- *Improved signaling from employers to trainers + educators*
- *New sources of data*

Test new approaches, e.g.:

- *Co-design new models with users – workers, employers, service providers, unions…*
- *Collect data on program outcomes*
- *Pilot, evaluate, scale*

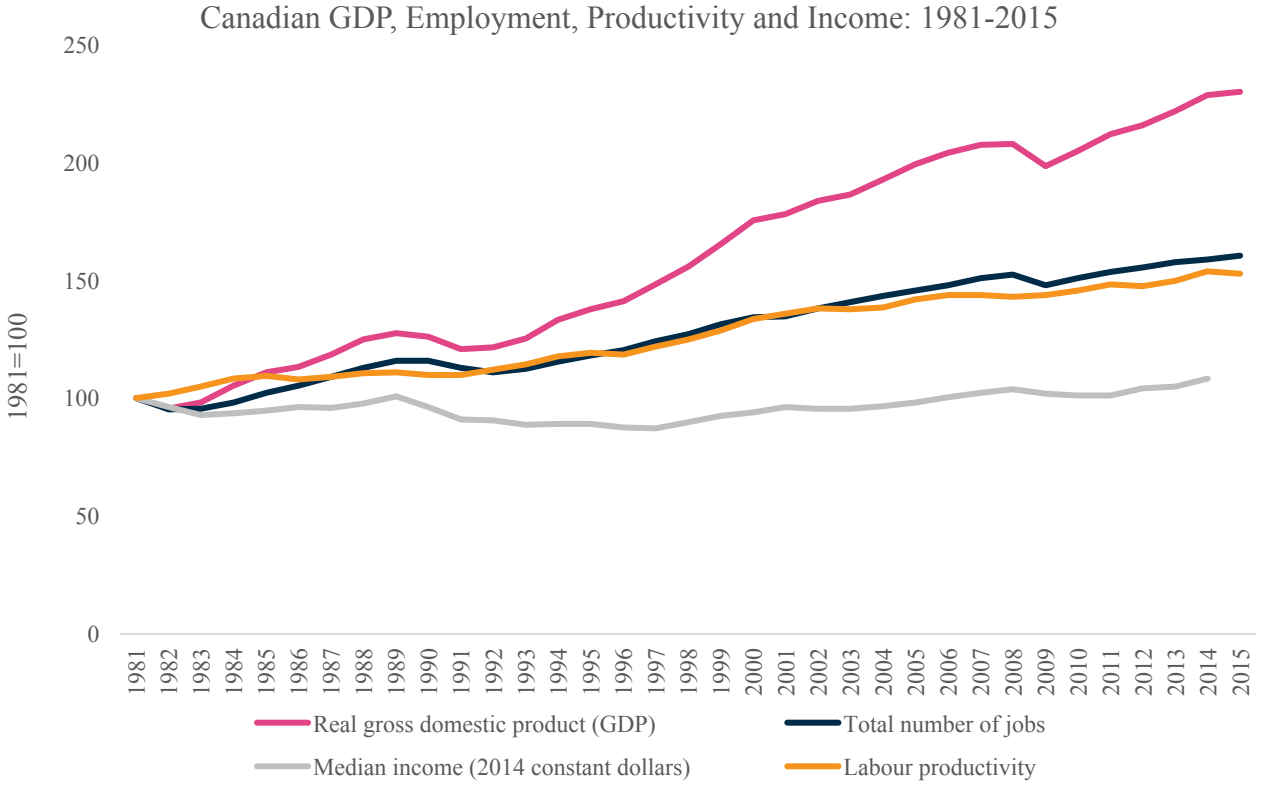
6) Appendices

Information and communications technology (ICT) has been the driving force behind the acceleration of labour productivity growth in Canada and the United States since 1996 (Sharpe, 2006).

Source: Statistics Canada Cansim Table 383-0021

6) Appendices

Brynjolfsson and McAfee (2014) argue that even though technological innovations promise to radically increase productivity, they are also having adverse effects on workers, particularly the low- and middle-skilled. They use stagnant median wages and the falling labour share of income as evidence of cheaper and better digital technologies substituting for labour.



Source: Statistics Canada Cansim Table 383-0008, BII+E Analysis

6) Appendices

Innovation (patents per capita) is driving higher levels of income inequality, accounting for around 17% of the total increase in the top 1% income share on average across US states between 1975 and 2010.

However, innovation also enables entrepreneurs to create businesses and thrive. It is positively correlated with upward social mobility driven mainly by entrant innovators (i.e. startups).

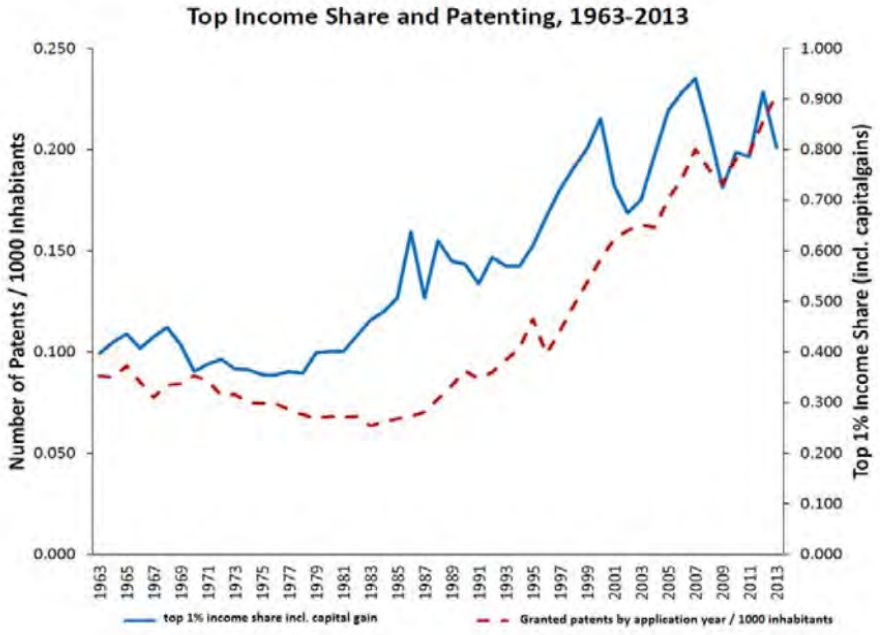


Figure 1: Evolution of the top 1% income share and of the total patent per capita in the US. 1963-2013.

Source: Aghion, P. et. al (2015). Innovation and Top Income Inequality. *NBER Working Paper No. 21247.*