Evaluating the Future of Skills, Jobs, and Policies for the Post COVID Digital Economy

Future Jobs Canada

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Motivation for Study

- Mounting concern about skills and employment as Canada transitions to a more digital economy
- The amount of disruption in the transition caused by COVID-19 is unknown
- There is a lack of real-time data that can be used to track the impact

Objectives of the Project

Fill the knowledge gap for organizations and policy makers by:

1. Reviewing broad-based evidence on the shifting landscape for organizations and workers related to technical change in data science, AI and robotic technologies pre- and post- COVID-19
2. Summarizing evidence about predictions for the effect of these technologies on future jobs and skill requirements, and
3. Highlighting policies that may help smooth the transition for workers and organizations.

Methods

Reviewed:

- Official statistics (R&D, employment, GDP, patent filings, vacancy rates by industry/occupation)
- Data on job postings, robot installations, grant applications, LinkedIn title trends, ML package searches and downloads
- Peer-reviewed and grey literature (newspapers, think tank and consulting reports) related to AI, data science, robotics and the labour market

Methods continued

- Employed both Distance Reading methods **(Textual Analysis + topic extraction)** and Close Reading methods (**Systematic Literature Review)**
- Examined both international and Canadian focused literature

*Textual Analysis on consulting/think tank reports + newspaper articles was key to tracking current trends in rapidly changing environment given lack of real time official data

Key Findings

- Theme 1: Trends in adoption and diffusion of AI and data science
- Theme 2: Labour market consequences
- Theme 3: Identified Policy implications

Theme 1: Trends in adoption and diffusion of AI and data science (1/4)

- Prior to the pandemic, the commercialization and diffusion of AI, data science and robotic related technologies was growing at a rapid pace in Canada and globally
- Canada typically lags behind our peers in technological adoption
- Lockdowns and restrictions instated due to COVID-19 caused a severe recession that delayed many Canadian firms' investment and adoption plans for these technologies
- Evidence suggests the pace of innovation related to AI, data science, and robotic related technology slowed on aggregate during the pandemic

Theme 1: Trends in adoption and diffusion of AI and data science (2/4)

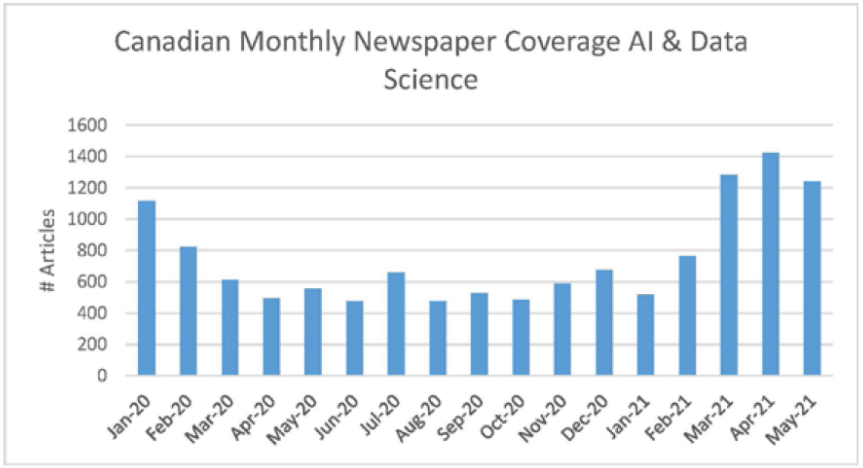


Figure 6: Coverage of data science topics in Canadian newspapers from Jan. 2020 to May 2021.

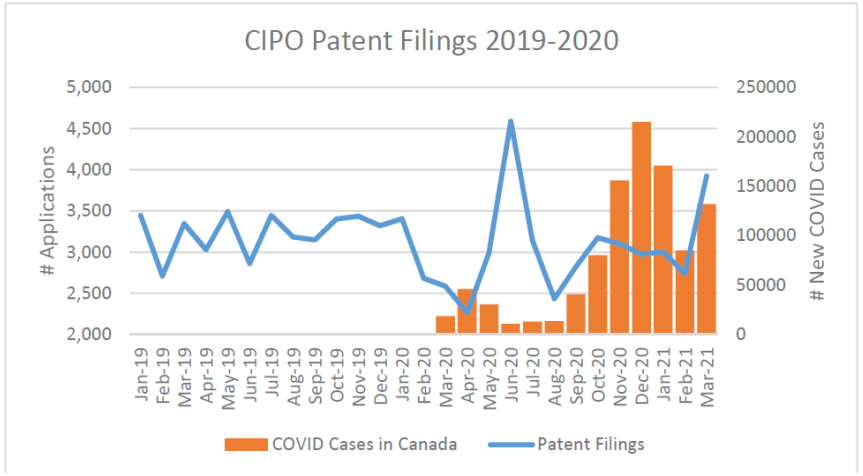
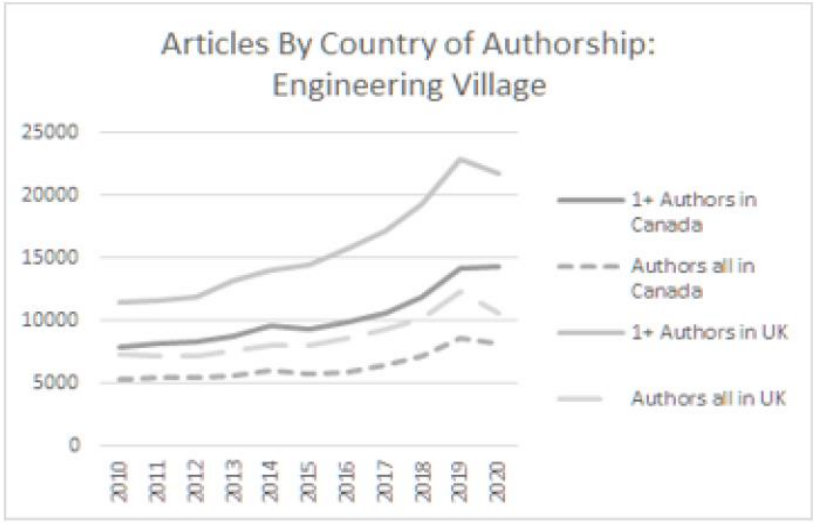
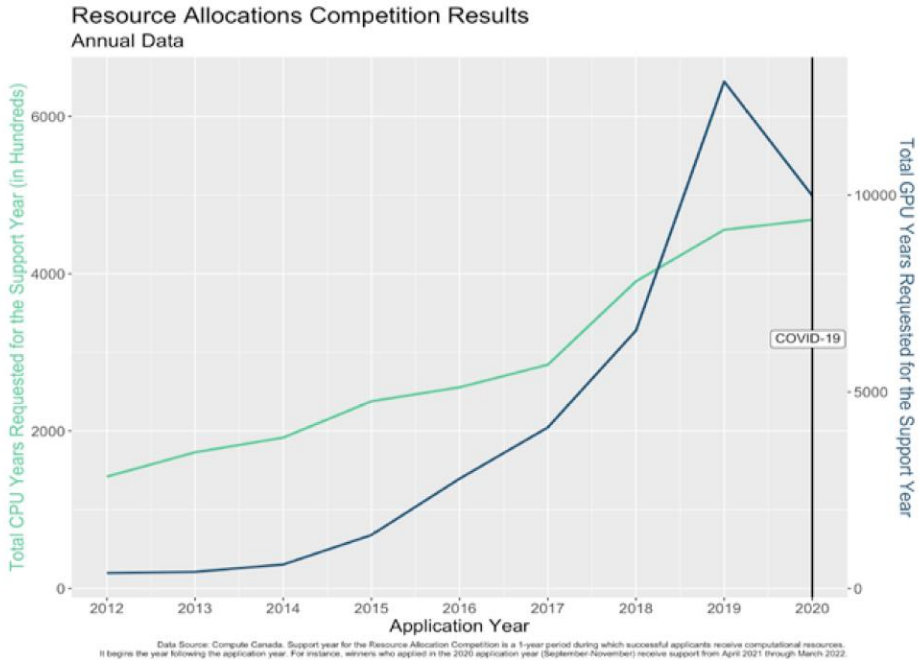


Figure 13: Patent filings in Canada from Jan. 2019 to March 2021 and number of new COVID cases.



Theme 1: Trends in adoption and diffusion of AI and data science (3/4)



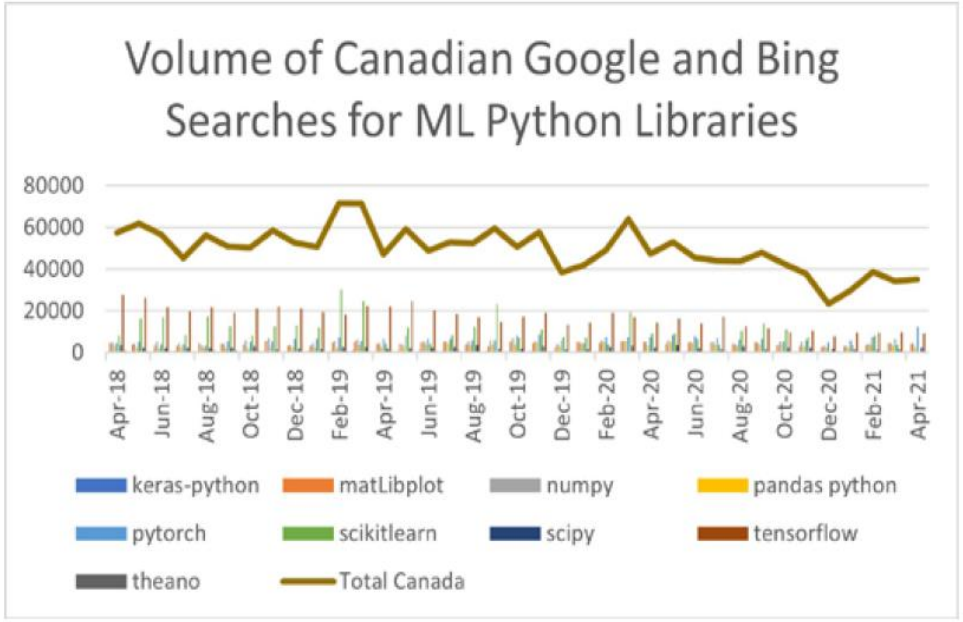


Figure 11: GPU and CPU requests to Compute Canada's Resource Allocations Competition (2012 to 2020).

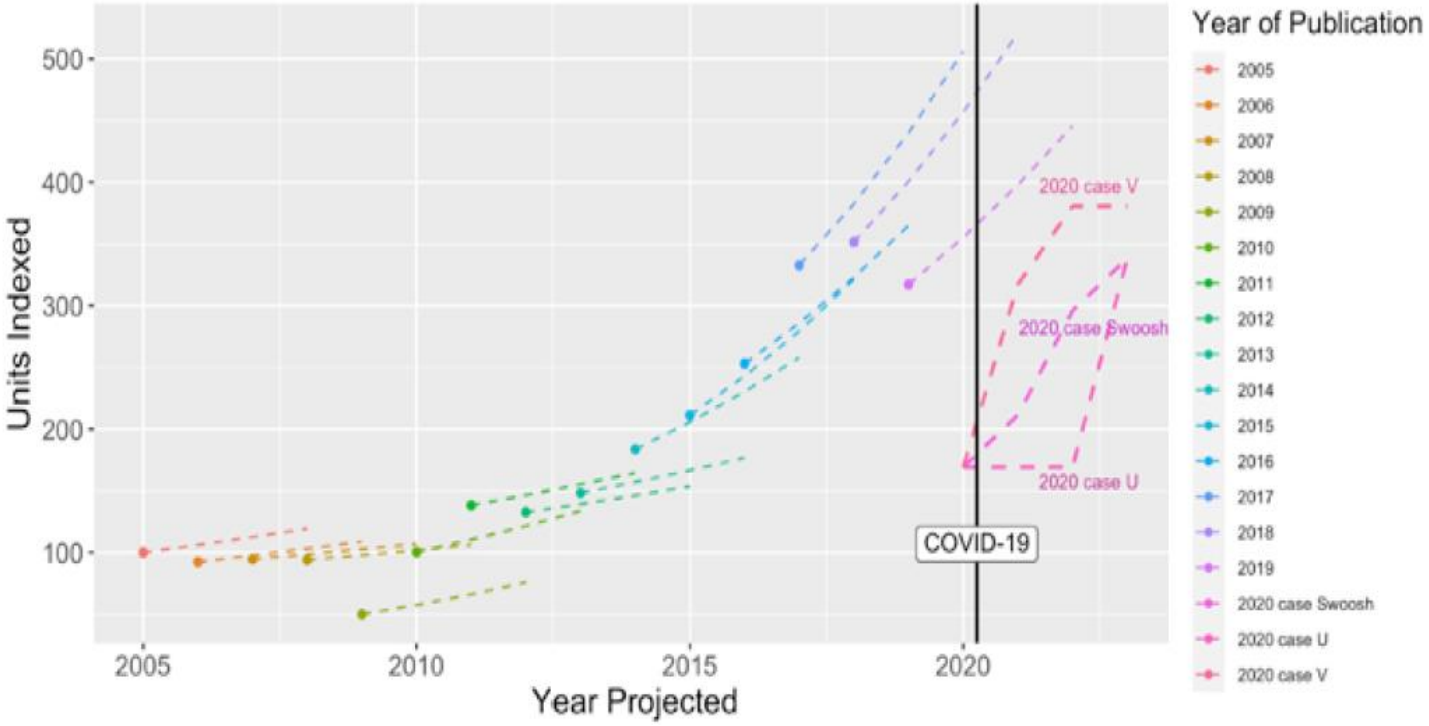
Theme 1: Trends in adoption and diffusion of AI and data science (4/4)

Figure 3

World Projected Installations of Industrial Robots

Annual Data. 2005 = 100

Dots represent observed values. Dashed lines represent forecast values.
Data Source: International Federation of Robotics. Period observed 2005–2023



**The slowdown in commercialization and innovation likely means that the timing of labour market disruptions forecasted prior to COVID-19 may occur a few years later than originally anticipated (with a few notable exceptions e.g., retail)

Theme 2: Labour Market Consequences (1/2)

- Disruption due to automation and job transformation:
  - Most estimates for automation-related risk of job transformation/loss in Canada come from reports undertaken by consulting firms and/or think tanks
  - There are significant differences in the estimated number of jobs that are at risk of replacement and/or transformation as a result of automation in Canada:
    - Most recent studies indicating a range of 10%-22%
    - Previous estimated range of 9%-42%
  - Recent Canadian studies found no significant disparities in the risk of job loss/transformation due to automation related to gender or disability
  - Risk of automation-related job transformation appears to be larger for younger and older workers (18-24 and 55+), for workers in occupations with a higher share of routine tasks, and for individuals with lower levels of educational attainment

Theme 2: Labour Market Consequences (2/2)

- Labour market shortages and skills demand:
  - Labour market shortages in the next 10 years are likely in computer science, computer software, and mechanical engineering areas
  - Canadian firms' demand for digital skills is growing rapidly
  - The number of vacancies in professional, scientific and technical services, and for computer and information systems professionals increased to record levels
  - Skills in these areas may already be in short supply despite current large numbers of unemployed
  - Trends since December 2020 suggest that employment opportunities related to AI and data science will quickly return to their pre-pandemic levels and usher in increased productivity growth

Theme 3: Identified Policy Implications (1/2)

- Most predictions and research related to labour market impacts:
  - Pre-date the onset of the pandemic
  - Do not focus on the Canadian economy
- Important considerations regarding policy:
  - There has been a COVID impact on the diffusion rates of current and future developments in AI, data science and robotic related technologies – at least, short term
  - Impacts on Canadian firms, industries, and workers will need to be inferred using estimates derived from economies such as the US and UK

Theme 3: Identified Policy implications (2/2)

- Mechanisms to help smooth the transition to the digital economy:
  - Basic income supports
  - Programs targeting business investment and encouraging upskilling, and retraining of workers
  - Promoting the acquisition of high-demand skills through micro-credential programs, co-ops or internships, and post-secondary education in STEM related fields
- Supports and interventions for retraining displaced workers:
  - Must consider existing education levels, differences between existing skills set and the required skills
  - Will depend on the speed of the adoption of new technologies and the age distribution of workers
- More high-quality, real-time data is needed for researchers and policy makers to:
  - Improve the tracking of evolving trends in the speed of innovation and diffusion of digital technologies, job vacancies, and skill acquisition
  - Better assess the need for labour market intervention and support for Canadian firms and workers

Knowledge Mobilization Activities

- Presentation at the Bank of Canada's 2021 Fellowship Learning exchange, May 5th, 2021
- Presentation at the Schwartz Reisman Institute for Technology and Society weekly seminar series, October 20, 2021
- Presentation at ISTAS 2021, October 2021:
  - Alexopoulos, M., Lyons, K., Mahetaji, K., & Chiu, K. (2021). Evaluating the Disruption of COVID-19 on AI Innovation using Patent Filings, Accepted for publication in the 2021 IEEE International Symposium on Technology and Society (ISTAS), 28-31 October 2021, Waterloo, Ontario, Canada (Virtual Event), 6 pages.
- Presentation at CASCON-Evoke 2021, November 2021:
  - Alexopoulos, M., & Lyons, K. (2021). Toward understanding the COVID-19 impact on Data Science Innovation in Canada, Accepted for publication in CASCON '21: The 31st Annual International Conference on Computer Science and Software Engineering, November 22-26, 2021, Toronto, Canada (Virtual Event), 10 pages.
- Workshop at CASCON-Evoke 2021, November 2021:
  - Lyons, K., Alexopoulos, M., & Egwaikhide, A. (2021). What will the transition to digital economy look like? Exploring future Skills, Jobs, and policies needed Post COVID, CASCON'21: The 31st Annual International Conference on Computer Science and Software Engineering, November 22-26, 2021, Toronto, Canada (Virtual Event)

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Thank you