Jobs impact of automation: Bigger than the thought leaders say it is

David Ticoll
CDO Conference May 2017
Common approach: labour substitution
• Prominent sources re labour market impact of automation:
  o Brynjolfsson/McAfee (MIT, 2011) – *Race Against the Machine*
  o Frey/Osborne (Oxford 2013) – 47% of jobs at risk
  o Amtz/Gregory/Zierahn (OECD 2016) – 9% of jobs high automatability (but focus on tasks!)
  o McKinsey Global Institute (2017) – 47% of activity FTEs in Canada, 51% in US

• Methodological consistency: repeatable algorithm (automatable task characteristics)
FIGURE I. A sketch of how the probability of computerisation might vary as a function of bottleneck variables.
All based on currently demonstrated technology

% of time automatable:
- Canada: 47
- US: 46
Example occupations

Sewing machine operators, graders and sorters of agricultural products

Stock clerks, travel agents, watch repairers

Chemical technicians, nursing assistants, Web developers

Fashion designers, chief executives, statisticians

Psychiatrists, legislators

Share of roles (%)

<5% of occupations consist of activities that are 100% automatable

About 60% of occupations have at least 30% of their activities that are automatable

“Pessimistic” re automation potential?

• Incomplete on the face of it
  o Many jobs have declined or disappeared without being automated
  o These include occupations likely “below median” on McKinsey’s automation susceptibility scale
    ▪ Horseshoe makers
    ▪ Pulp & paper workers
    ▪ Investigative journalists
    ▪ Professional photographers

• Overlooked: Impacts of business innovation and changes to core technology, with impact across a sector’s ecosystem
Alternative model: Core ecosystem technology (CET) assessment
A new model: Core ecosystem technology (CET) labour market impact assessment

• Employment impact (technology + business innovation) =
  o Sum of labour...
    ▪ Substitution
    ▪ Obsolescence
    ▪ Impact of technology change
    ▪ Offshoring/outsourcing
    ▪ Economic viability

• Above functions
  o Distinct
  o Ecosystem, task & role specific
    o May overlap in a specific task/role case

• CET analysis is complicated:
  o Requires identification & analysis of entire ecosystems
  o Non-substitution effects vary considerably and are sector ecosystem specific
Hypothetical example: vehicle automation

• **Mobility users (labour substitution)**
  - Transport truck drivers 261,775
  - Taxi, limo drivers 48,545
  - Delivery & courier drivers 90,075
  - Mail, postal, courier workers 92,825
  **493,220**

• **Complementary sectors (labour obsolescence)**
  - Auto dealers & distributors 195,160
  - Auto rental & leasing 16,600
  - Gas stations 52,300
  - Auto service & body shop 166,100
  - Insurance agents & brokers (x.25) 16,550
  - Police officers (x.25) 20,000
  **496,710**

• **Competitors (economic unviability)**
  - Public transit, hotels, airlines ???

• **Mobility tech providers (core technology change)**
  - Auto manufacturing 125,000
Automation of ad-taking & placement

THE COLLAPSE OF NEWSPAPER CLASSIFIEDS
Total print classified advertising revenue, Canadian daily newspapers, 1995-2015 ($millions)

Source: ThinkTV (TVB Canada)

Source: The Shattered Mirror, Public Policy Forum
The Canadian Media Guild has tracked layoffs and buyouts for the past few decades. When non-news companies are excluded, the total is in the order of 12,000 positions lost, more than 1,000 of them in the last year alone. Unifor’s 46 media bargaining units had 1,583 members in 2010 but only 1,125 by early 2016. The CWA estimates it had about 400 editorial members in 2016, a decline of about one-third from 2010 and more than two-thirds since the early 1990s.

<table>
<thead>
<tr>
<th>Pulp &amp; Paper Manufacturing</th>
<th>2000</th>
<th>2013</th>
<th>Change</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>115,700</td>
<td>62,692</td>
<td>-53,008</td>
<td>-46%</td>
</tr>
<tr>
<td>Wages &amp; salaries</td>
<td>$5,221,169,000</td>
<td>$3,235,468,000</td>
<td>-1,985,701,000</td>
<td>-38%</td>
</tr>
<tr>
<td>Income/employee</td>
<td>$45,126.78</td>
<td>$51,608.95</td>
<td>6,482</td>
<td>14%</td>
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Table displays, in millions of tonnes, the production volume of newsprint, printing and writing paper, and wood pulp for each year between 2005 and 2015.

<table>
<thead>
<tr>
<th>Year</th>
<th>Newsprint</th>
<th>Printing and writing paper</th>
<th>Wood pulp</th>
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<tr>
<td>2005</td>
<td>7.77</td>
<td>6.71</td>
<td>25.31</td>
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<tr>
<td>2006</td>
<td>7.12</td>
<td>6.11</td>
<td>23.44</td>
</tr>
<tr>
<td>2007</td>
<td>6.64</td>
<td>5.95</td>
<td>22.11</td>
</tr>
<tr>
<td>2008</td>
<td>5.99</td>
<td>5.27</td>
<td>20.37</td>
</tr>
<tr>
<td>2009</td>
<td>4.38</td>
<td>4.43</td>
<td>17.10</td>
</tr>
<tr>
<td>2010</td>
<td>4.64</td>
<td>4.07</td>
<td>18.54</td>
</tr>
<tr>
<td>2011</td>
<td>4.38</td>
<td>3.77</td>
<td>18.34</td>
</tr>
<tr>
<td>2012</td>
<td>3.87</td>
<td>3.31</td>
<td>17.15</td>
</tr>
<tr>
<td>2013</td>
<td>3.97</td>
<td>3.47</td>
<td>17.25</td>
</tr>
<tr>
<td>2014</td>
<td>4.01</td>
<td>3.26</td>
<td>17.25</td>
</tr>
<tr>
<td>2015</td>
<td>3.50</td>
<td>3.04</td>
<td>16.84</td>
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Pulp & Paper Manufacturing

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Employees in select photography subsectors
United States 1998-2014

Number of employees:
1998  252,648
2014  97,471

Net decline: 155,177
% Change: -61.4%
## Select photography subsector job losses

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<tr>
<td>Photofinishing labs</td>
<td>57,140</td>
<td>6,884</td>
<td>50,256</td>
<td>-88.0%</td>
</tr>
<tr>
<td>Photographic film, paper &amp; chemical mfg</td>
<td>36,942</td>
<td>10,992</td>
<td>25,950</td>
<td>-70.2%</td>
</tr>
<tr>
<td>Photographic/copying equipment mfg</td>
<td>24,566</td>
<td>5,130</td>
<td>19,436</td>
<td>-79.1%</td>
</tr>
<tr>
<td>Photo portrait studios</td>
<td>62,811</td>
<td>44,571</td>
<td>18,240</td>
<td>-29.0%</td>
</tr>
<tr>
<td>Electric lamp bulb &amp; part mfg, including photo</td>
<td>16,156</td>
<td>4,626</td>
<td>11,530</td>
<td>-71.4%</td>
</tr>
<tr>
<td>1 hour photofinishing services</td>
<td>15,102</td>
<td>774</td>
<td>14,328</td>
<td>-94.9%</td>
</tr>
<tr>
<td>Photographic equipment &amp; supplies whsle</td>
<td>21,787</td>
<td>13,638</td>
<td>8,149</td>
<td>-37.4%</td>
</tr>
<tr>
<td>Commercial photography</td>
<td>18,144</td>
<td>10,856</td>
<td>7,288</td>
<td>-40.2%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>252,648</strong></td>
<td><strong>97,471</strong></td>
<td><strong>155,177</strong></td>
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Methodological considerations
What do these ecosystems have in common?

- Mobility: *pilot* shift from human to automated pilot
- Newspapers: *ad placement* shift from human to automated
- Photography: *image capture* shift from analog to digital
- Another example: shipping container (ie not just digital technologies!)
  - Shipping: *packing organization* shift from ad hoc to standardized
- Common feature: shift in a core ecosystem technology (CET)
  - CETs are rare and special
  - Business web/ecosystem analysis required
Factors of labour market change, e.g. self-driving cars

- **Labour substitution.** Significant labour substitution for Canada’s 500,000 professional drivers (light & heavy freight, taxi/limo, transit) and operators of mobile services (e.g., street cleaning and garbage collection). New jobs may arise for vehicle cleaners & travel assistants (e.g., for elderly & disabled passengers).

- **Core technologies.** Shift from steel to ICT & lightweight bodies could reduce labour demand and facilitate offshoring. Electric vehicles will need less routine maintenance (no oil changes!). Demand for oil and gasoline will decline. Labour demand – up for information technologists, down for upstream/downstream oil sector employees and car mechanics.

- **Transaction costs & disintermediation.** Mobility services that use their own fleets will deal directly with consumers. They will disintermediate car dealers, automotive lending and leasing services, insurance, etc. In the process, they will reduce transaction costs for consumers.

- **Positive/negative externalities.** A positive externality of automation will be improved safety and traffic self-management. This will reduce the need for jobs in auto body shops, policing, and accident-related medical services. It will also reduce availability of organ transplants.

- **Economic viability.** As private ownership declines, the traditional automotive aftermarket will be challenged. On the other hand, a new mobility app aftermarket could arise.

- **Ripple effects.** Victims of job losses have less to spend, affecting employment and incomes across a variety of sectors. This applies to both commercial (fewer truck drivers mean less spending at truck stops) and consumer outlays.
A new model: Core ecosystem technology (CET) labour market impact assessment

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The future of work

• Where do jobs come from?
  o Subsistence → industrial economy
  o 4 industrial revolutions
    ▪ Steam/cotton/agriculture
    ▪ Electricity, engine, mass production, plumbing, medicine, etc.
    ▪ Electronics, ICT
    ▪ AI, machine learning – decline of work?

• Canada – grounds for optimism
  o Small population
  o Educated
  o Demographics
  o Export oriented
  o Public policy