The Future of Work and Jobs

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“UCI is No. 1 UC choice for California’s college-bound high school graduates.”
What does the Future Hold?
How will this Pattern Evolve in the Coming Decades?
US Manufacturing: Large Growth in Output at Much Lower Employment

Automation + Globalization
Personal Computers, Spreadsheet Software, and Routine Work

The Spreadsheet Apocalypse, Revisited

Jobs in bookkeeping plummeted after the introduction of spreadsheet software, but jobs in accounting and analysis took off.

1979: Release of VisiCalc
1983: Release of Lotus 1-2-3
1987: Release of Microsoft Excel for Windows

- Management analysts & financial managers
- Accountants and auditors
- Bookkeepers, accounting and auditing clerks

Think

United States employment, by type of work, m

- Non-routine cognitive
- Routine cognitive
- Routine manual
- Non-routine manual

Sources: US Population Survey, Federal Reserve Bank of St. Louis

Notes: There is no data for 1982. Changes in occupational definitions in 1983, 2000 and 2011 mean that data is not strictly comparable across time. There was no category for management analysts or financial managers prior to 1983.
Source: Bureau of Labor Statistics
Majority of Jobs Losses and Gains Come from Existing Companies

**Figure 8. Jobs Created by Establishment Openings**
Percentage of new jobs

**Figure 9. Jobs Lost Due to Establishment Closings**
Percentage of jobs lost

Automation and Work

- Displacement of jobs
- Changes in the composition of tasks in jobs
- New tasks, jobs, work, economic sectors
- Worker productivity
- Economy and society
Levels of Analysis and Action

• Individual

• Firm

• Community and Region

• Government

• Civil Society

• Global Community
Innovation and Productivity Growth

Peak Innovation
Total factor productivity measures innovation. It peaked in the 1940s and was strong through 1970. Each bar shows a 10-year average prior to the year shown (2014 bar is for 2001-2014).

Source: MIT Technology Review
TFP Growth Slowdown has Material Impact

“Productivity isn't everything, but, in the long run, it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.”

Paul Krugman
Automation has Potential to Boost Productivity and Growth

Automation of existing activities could increase productivity at magnitudes similar to other major technologies

<table>
<thead>
<tr>
<th>Productivity growth</th>
<th>Earliest scenario</th>
<th>Latest scenario</th>
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</thead>
<tbody>
<tr>
<td>Compound annual growth rate %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automation (2015–30)</td>
<td>2.2</td>
<td></td>
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<tr>
<td>Automation (2015–65)</td>
<td></td>
<td>1.4</td>
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<tr>
<td>Steam engine (1850–1910)</td>
<td>0.3</td>
<td>0.8</td>
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<tr>
<td>Robots (1993–2007)</td>
<td></td>
<td>0.4</td>
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<td>IT (1995–2005)</td>
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“In order to make the most of the potential offered by automation and, at the same time, manage its consequences on companies, national economies, and workers around the world, policy makers, business leaders, and men and women everywhere will need to think through the implications that these new technologies will bring and prepare for significant changes.”

McKinsey Global Institute, 2017
Geographic Stratification of Benefits from Innovation

Rise of superstar cities

Concentration of venture capital

Benefits from agglomeration

Will these trends get even more extreme with the acceleration of ML and AI?
“In Davos, executives tend to speak about automation as a natural phenomenon over which they have no control, like hurricanes or heat waves. They claim that if they don’t automate jobs as quickly as possible, their competitors will.”
Socially Responsible Automation*

**Business Goals**
- Drive cost efficiency
- Increase productivity, quality, accuracy
- Enhance worker performance, skills, quality
- Create new revenue streams & Good jobs

**Stakeholder Values**
- **Stockholder**: Profit
- **Society**: Employment, Prosperity, Opportunity
- **Employee**: Safety, Autonomy, Achievement
- **Customer**: Superior Offering, Service

*Socially Responsible Automation, Sampath and Khargonekar, NAE Prism, 2019*
Role of Universities and Industry

• How can new automation, machine learning and artificial intelligence technologies be developed to enhance human flourishing? Intelligence and Human Augmentation rather than Artificial Intelligence should be the goal.

• How should educational programs change to ensure graduates can adapt to the evolving changes in work and jobs?

• What new educational programs are needed? Worker reskilling is likely to be a major need.

• How can industry adopt “socially responsible automation”? Are there better alternatives?
THANK YOU!

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