**Opening text**

First technologists issued scary dystopian alarms about the power of automation, including artificial intelligence (AI), to destroy jobs. Then came a correction of sorts, with a wave of reassurances that tended to minimize alarm. Now, the discourse appears to be arriving at a more complicated story that suggests that while the robots are coming they will bring neither an apocalypse nor utopia, but instead both benefits and stress alike. All of which underscores how mixed, contested, and uncertain the impacts of automation and related technologies will be on our economy in the coming years.

In order to fill in some of the blanks and provide an overview of automation trends both in the recent past and the near future, the analysis presented here develops both backward- and forward-looking analyses of the observed and projected impacts of automation on job growth and change over the years 1980 to 2016 and 2016 to 2030.

The report focuses on areas of potential occupational stress rather than on net employment impacts. Special attention is applied to digging beneath national top-line statistics to explore industry, geographical, and demographic variations. Finally, the report concludes by suggesting a comprehensive response framework and recommendations for national and state-local policymakers.

**Automation framework summary sentence**

Automation exists to substitute work undertaken by humans with work done by machines, with the aim of increasing quality and quantity of output at a reduced cost. The concept of automation, and the use of task-based models to analyze it, leads to some general rules that seem to govern the interaction of machines and workers.

**Intro text 1**

The concept of automation, and the use of task-based models to analyze it, leads to some general rules that seem to govern the interaction of machines and workers. To start with, here are six basic tendencies in the workings of automation and its interplay with human labor that help in assessment:

[2 rows of 3 each]

**Automation substitutes for labor.** If a machine can do a task currently done by humans, it will do it with greater precision, speed, and at a lower cost—but there are limitations to substitution.

**Machines substitute for tasks, not jobs.** A job is a collection of tasks, and even under the most aggressive scenarios, it is unlikely that machines will substitute for *all* tasks in any one occupation.

**Automation also complements labor.** Workplace activity that isn’t taken over by automation is complemented by it—making remaining human tasks *more* valuable.

**Automation can increase demand, creating jobs.** Automation-driven cost and quality improvements can increase demand to a degree that offsets any would-be job losses.

**Capital and labor augmentation spurs innovation.** When machines handle routine, time-consuming activities, human capacity is freed-up to create new products and new tasks.

**Tech possibility is not the same as tech reality.** There are many reasons why technological adoption falls short of potential, so it is a mistake to equate technological *potential* with likely projected outcomes.

In terms of determining the net impact of automation on employment and wages, MIT economist David Autor provides a simplified framework. In it, he highlights three primary dynamics:

[1 row of 3]

**What technology doesn’t replace, it complements.** Workers who supply tasks that are substituted by machines are more likely to benefit from automation than are workers who supply tasks that machines can complete.

**Wages will be determined by the ease with which roles in demand can be filled.** Wage gains for the remaining tasks completed by humans will be larger when the barriers to entry (e.g. education, training, certification) are higher.

**The size of industries—and the number of jobs in them—will be determined by the complex interaction of consumers’ responses to automation-driven price, quality improvements, and how consumption responds to automation-driven wealth changes.** Automation drives cost and quality improvements for products, as well as productivity and wealth increases for workers, which can mitigate some labor displacement.

**Findings: Section Header**

The report’s findings estimate the susceptibility of different jobs, places, and demographic groups to disruption from workplace automation.

**Occupations**

The measure of estimated automation potential provided to us via data from the McKinsey Global Institute reflects the percentage of tasks in a given occupation that could be automated using currently available technologies. We observe that while almost no occupation will be unaffected by technological change in the AI era, the most vulnerable jobs are those in office administration, production, transportation, and food preparation services. All of these either involve routine physical labor or information collection and processing activities.

“High risk” jobs with over 70 percent of tasks potentially automatable represent only a quarter of all jobs, however. The remaining, more secure jobs include a broader array of occupations ranging from professional and technical roles with high educational requirements to low paying personal care and domestic service work characterized by non-routine or abstract activities and social and emotional intelligence.

[See p. 25 for box and whisker plot as basis for interactive. Other options: pie chart on p. 26, line chart on p. 27]

**Geography**

While automation will take place everywhere, its inroads will be felt differently across places, varying with local industry, task, and skill mix. Overall, smaller, more rural communities seem significantly more exposed to the automation of current-task content than larger ones. This relationship holds when comparing metropolitan to rural areas as well as among metros of different sizes. Among the country’s 100 largest metros, though, workers’ education attainment will prove to be decisive.

[See map from Water Workforce report. Only top 100 metros. Same bivariate scheme—bubble size for employment, bubble shade for average automation potential—but with tooltip that names each metro and shows average and low/medium/high job shares]

**Demography**

The sharp segmentation of the labor market by educational attainment, gender, age, and racial-ethnic identity ensures that some demographic groups are likely to bear more of the burden of adjusting to the AI-era than will others. The probable divides are clear: Men, younger and less educated workers, and underrepresented groups all appear likely to face significantly more acute challenges from automation in coming years.

[Array of four static bar charts showing average automation potential by demographic category]

**Strategies for adjusting**

[For suggested formatting, recommend Water Workforce Playbook section of the [Water Workforce Interactive](https://www.brookings.edu/research/water-workforce/)]

Five major agendas require attention to mitigate coming stresses as the nation moves into the AI period of automation.

*Row 1:*

**Embrace growth and technology**

* Run a full-employment economy, both nationally and regionally
* Embrace transformative technology to power growth

*Row 2:*

**Promote a constant learning mindset**

* + Invest in reskilling incumbent workers
  + Expand accelerated learning and certifications
  + Make skill development more financially accessible
  + Align and expand traditional education
  + Foster uniquely human qualities

**Facilitate smoother adjustment**

* Create a *Universal Adjustment Benefi*t to support all displaced workers
* Maximize hiring through a subsidized employment program

*Row 3:*

**Reduce hardships for workers who are struggling**

* Reform and expand income supports for workers in low-paying jobs
* Reduce financial volatility for workers in low-wage jobs

**Mitigate harsh local impacts**

* Future-proof vulnerable regional economies
* Expand support for community adjustment