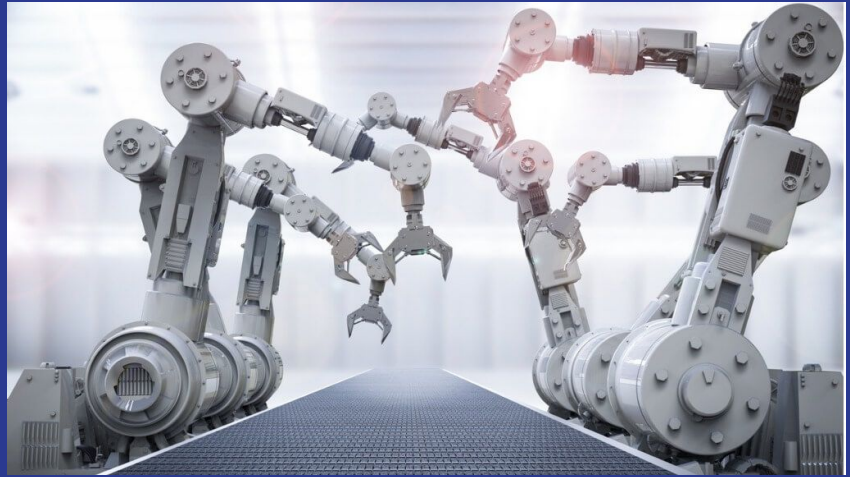


Why Are There Still So Many Jobs? The History and Future of Workplace Automation.



Peter Raich

Big Question

How will the emergence of greatly improved computing power, artificial intelligence, and robotics raise the possibility of replacing labor? Will it be on a scale not previously observed?

Technological Progression

- Labor lost to more efficient machines is only part of the problem.
- We could be heading in a direction where automation may prevent the economy from creating new jobs.
- In the past, loss of factory jobs due to innovation was typically countered by an increase in the service industries or office jobs, however automation is beginning to eliminate office jobs too.

- Autor highlights, there has never been a better time to be a worker with special skills or the right education, because people can use technology to create and capture value. Contradictory, there has never been a worse time to be a worker with only ordinary skills and abilities because computers, robots and other digital technologies are acquiring these skills and abilities at an extraordinary rate

(widening income disparities)

Wage Polarization After WWII

- Technological innovation and consumer affluence increasing during and after WWII led to a higher demand for manufactured goods and leisure complements. Simultaneously growth took place in technologically intensive corporations, health care services, and higher education, which also opened many new occupations for professionals, clericals, administrative and sales peoples. Physically demanding, repetitive, dangerous, and cognitively monotonous work was receding, ushered out by extraordinary productivity gains.
- Increased productivity over the past decades has not led to a shortfall in demand for goods and services. Household consumption has largely kept pace with household incomes. Consumption demands have risen along with productivity. In high-income countries it seems consumption and leisure are complements, as a result of increased productivity. This is reflected in the share of the population engaged in paid employment increasing over past decades, despite vast improvements in material standards of living.

Automation

- Automation may contribute to substitution for labor in the short run, and may also contribute to trending wage polarization in the US.
 - 1) Contradictory, automation may also complement labor, raise output in ways that lead to higher demand for labor, and interact with adjustments to labor supply.
 - a) ex.) Bank-teller employment during the introduction of ATM's actually rose modestly. ATM's reduced the cost to operate a bank branch, meaning less tellers in a location is required. This resulted in a 40% increase in the number of urban bank branches. We can see that while automation may temporarily affect labor through substitution, it may also allow for expansion and growth in ways that are better in the long-run.

Job Polarization

Past decade analysis of statistics shows rapid employment growth in high and low education jobs (1979-2012, across ten major occupational groups), with decreasing employment in middle-skill occupations such as sales, office, and administrative workers. (Autor)

Manual (low-end)

- Physically adept
- Performed largely on-site or in person, hard to outsource.
- Fluent communication in spoken language
- Not highly-skilled
- Food preparation, in-person health assistance, protective services etc.
- Low-education, low-wage
- (haircuts, fresh meals, housecleaning, etc)

Growth Occurrent

(middle-skill)

- Mathematical calculations.
- Retrieving, sorting and storing information.
- Repetitive physical operations in unchanging environments.
- Most susceptible group to automation.

Growth non-occurrent

Abstract (high-end)

- Workers with high levels of education and analytical capabilities.
- Characteristics of professional, technical or managerial positions.
- Premium on inductive reasoning, communication ability and expert mastery.
- intuition, creativity, persuasion and problem solving skills associated.
- High-education, high-wage.

Growth Occurrent

O-Ring Principle

Tasks that are not easily substituted by automation are usually complemented by it.

Productivity improvements in one set of tasks almost necessarily increases the economic value of remaining tasks.

Failure in any one step of the process leads the entire production process to fail.



As automation steps in the production process, the value of remaining human tasks in the production process increases.

Environmental Control



- Kiva Systems is a robotic warehousing startup
- Amazon's invest in Kiva Systems in 2012 is an example of exploiting environmental control to extend the reach of automation.
- Highlights current limitations of technology and also demonstrates human ingenuity to surmount obstacles by reengineering the environment.
- Kiva Systems demonstrates an example of robots substituting for manual labor in order to increase efficiency. Amazon creates new jobs by employing humans to build, program and ship the robots to fulfillment centers. The remaining humans working with the robots in the fulfillment centers become more valuable (Humans that have not been substituted). The excess labor can now be relocated to a different Amazon fulfillment center, where they can also work with robots, and now growth and expansion is on a scale that would be impossible otherwise.

(Amazon's largest fulfillment center is 3.6 million square feet (w/80,000 square feet in office space), with the average Amazon fulfillment center being 800,000 square feet. Can you imagine how many employees would be needed to operate one of these facilities efficiently, without the help of automation? All Amazon warehouses are highly automated.)

Brute Force Machine Learning

Author recognizes that brute force machine learning could approach or surpass human capabilities as computing power rises and training databases grow. Others suspect machine learning will only ever get it right on average while miscalculating important and informative information. This is partly because machine learning algorithms have fundamental problems with reasoning about purposiveness particularly, given an arbitrarily large database of images. (chair/table analogy, computer may think a chair is a table, given changing characteristics that computers may not be easily able to distinguish.)

“If you wish to make an apple pie from scratch, you must first invent the universe.”

Conclusion

The authors conclude by stating they think employment polarization will not continue indefinitely. This is because while many middle-skill jobs will become automated, many others require a mixture of tasks from across the skill spectrum. Likely combining routine technical tasks with other sets of nonroutine tasks which workers hold comparative advantages, such as interpersonal interaction, flexibility, adaptability and problem solving. The authors suggest that human capital investment must be at the heart of any long-term strategy for producing skills that are complemented by rather than substituted for by technological change. Universal high school education was implemented into the US as a response to farm employment declining and industry employment rising (children would need additional skills to earn a living). The author finishes by stating no matter how much we output with less and less input, there will always be perceived scarcity and conflict over distribution. This problem will not become any less severe as automation advances.

What to Expect

- Unimagined innovations of the future
 - Introduction of economies of scale
 - Implementation of education that will provide workers with optimal skills
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