

# Automation: this time could be different

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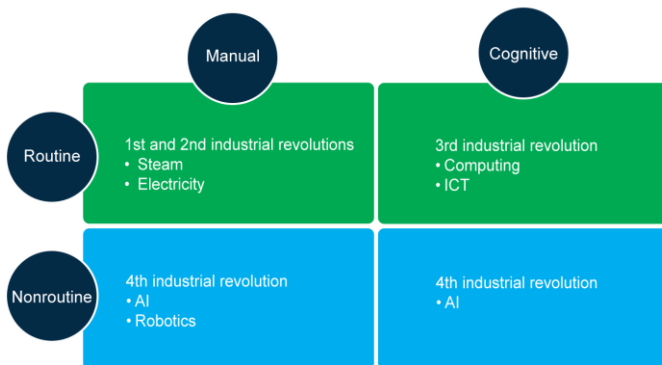


- Emerging technologies, particularly AI and robotics, have the potential to carry out a wide range of non-routine tasks that have historically been the preserve of human labour
- Previous industrial revolutions did not result in mass lay-offs since the automation of some roles was offset by the creation of others
- The current wave of technological innovation has a far more radical potential, and could displace all categories of human labour
- However if emerging technologies result in higher wages, they may lead to workers choosing to reduce their working hours — in other words, a voluntary reduction in labour supply

## Technological innovation and labour demand

To date, waves of innovation have produced technologies capable of carrying out routine tasks. The first and second industrial revolutions (steam, electricity etc.) automated routine manual tasks, while the third industrial revolution (computing) has diminished demand for human labour in routine cognitive roles. As the framework below shows, nonroutine roles have not been seriously challenged by previous industrial revolutions.

### A framework for the labour market impacts of automation



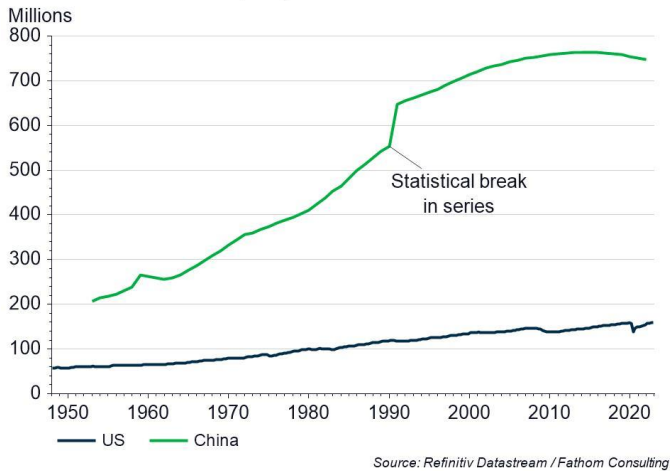
Source: Autor et al. (2003) / Fathom Consulting

*Previous industrial revolutions have automated some routine manual and cognitive roles – but new roles have also been created by new technologies*

Historically, automation has displaced labour in certain tasks and occupations, but new technologies have also created new roles for labour (particularly in nonroutine roles), and high levels of involuntary unemployment have been avoided. The chart below shows that the general upward trend in employment has continued, despite these waves of innovation.



## China and US employment

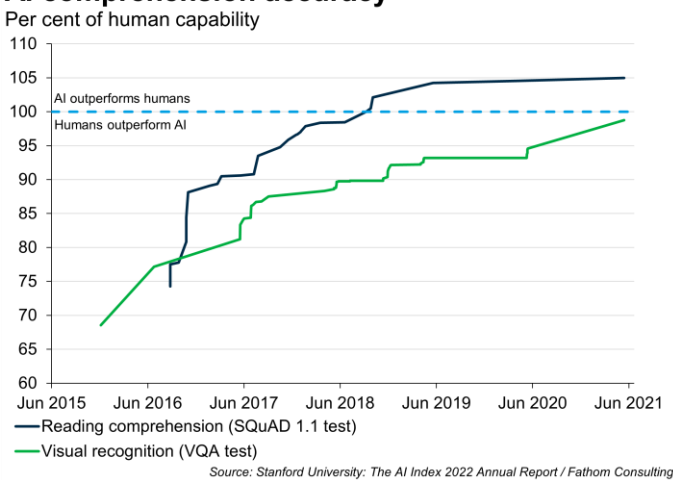


## Labour demand in the fourth industrial revolution

The fourth industrial revolution could break this trend. Emerging technologies such as artificial intelligence (AI) and robotics have the potential to carry out nonroutine tasks, and their capabilities are advancing at an astonishing rate. Though AI lacks the general intelligence of humans, it has already surpassed the abilities of human cognition in many focused applications.

*The technologies of the fourth industrial revolution could automate nonroutine tasks — for the first time, mass layoffs may be a consequence of technological innovation*

## AI comprehension accuracy



If progress in AI is coupled with advances in industrial robotics, employment in manual nonroutine roles could be seriously challenged. However, we expect this to take longer to occur, as the automation of these roles may be more challenging due to the existence of both Moravec's paradox (tasks that demand sensor-motor skills also require vast computational resources) and Polanyi's paradox ("There are many tasks which people understand intuitively



how to perform, but cannot elicit the rules or procedures they follow”).<sup>1</sup> However, as the quality of AI improves, the odds of these barriers being overcome is increasing.

We are in the foothills of a fourth industrial revolution, powered by AI. For the first time, all categories of labour are at risk of automation. In other words, there may soon be nowhere left for labour to seek new tasks, as it has in response to previous waves of innovation. The consequence could be unprecedented mass unemployment.

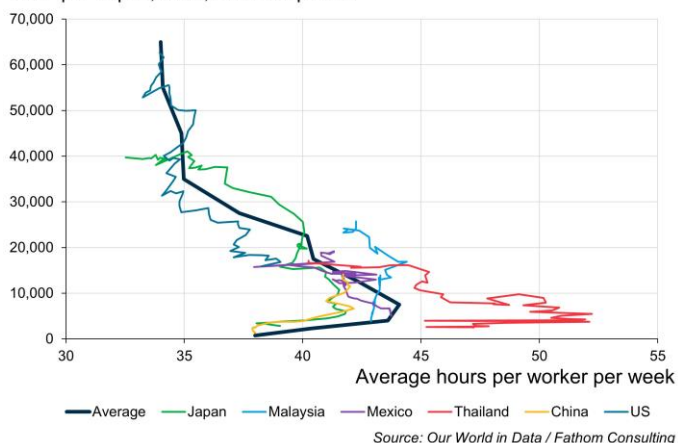
### Technological innovation and labour supply

Technological innovations often support human workers and make them more productive. This increases their value to firms and raises the wages they can command. Higher wages can, in turn, increase the incentive to work — but only to a point. Once wage rates reach a certain level, individuals have enough money and often opt for less work and more leisure time. The result is a backward-bending labour supply curve. As the chart below shows, this backward-bending behaviour seems to occur when national incomes approach \$10,000 per capita. The US and other advanced economies are already there. If the technologies of the fourth industrial revolution increase wages accrued by human labour, they will likely contribute to this trend of falling working hours.

*Workers may voluntarily reduce the numbers of hours they work, if wages reach a point at which the incentive to work declines*

### Backward-bending labour supply curves

GDP per capita, USD, constant prices



### Two approaches to the fourth industrial revolution

One way or another, emerging technologies are likely to lead to a reduction in human labour. This can happen either as a reduction in demand for labour due to automation (resulting in an involuntary rise in unemployment), or as a fall in the supply of labour brought about by workers opting to reduce their hours of work.

How different countries navigate the fourth industrial revolution will be shaped by the policies they adopt and the technologies they promote. The next note in this series will consider how

*The fourth industrial revolution could reduce the role of labour in the economy, either due to a reduction in labour demand or a reduction in labour supply*

1. Lane, M. and A. Saint-Martin (2021), "The impact of Artificial Intelligence on the labour market: What do we know so far?", *OECD Social, Employment and Migration Working Papers*, No. 256, OECD Publishing, Paris, <https://doi.org/10.1787/7c895724-en>. [25]



the macroeconomic outcomes of the fourth industrial revolution will depend upon whether countries:

- Invest in the development of labour-replacing technologies that consequently reduce the demand for human labour; or
- Invest in the development of labour-supporting technologies, that raise labour productivity and real wages but which are also likely to reduce labour supply

The latter is good from a social perspective, as it is driven by the preferences of workers; the former is likely to cause social and political difficulties. Despite this, Fathom's view is that we should not ban investment in labour-replacing technologies altogether. The next note in this series will explain why not.

## *Welcome to the machine*

*A comparative assessment of the USA and China to 2035, focusing on the role of technology in the economy*

This note is the fourth in a series highlighting the findings of *Welcome to the Machine*, Fathom's recent report on techno-economic competition between the United States and China to 2035.

[Read more from this series or read the report in full](#)

### Further Reading

[Measuring the AI sector](#)

[Automation could offset China's demographic problem](#)

[Introducing 'Welcome to the machine'](#)

[The changing China consensus](#)



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