



DEBATE PACK

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Fourth Industrial Revolution

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Summary

This pack has been prepared ahead of the debate on **the Fourth Industrial Revolution** to take place in the Commons Chamber on Thursday 8 September 2016.

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The House of Commons Library prepares a briefing in hard copy and/or online for most non-legislative debates in the Chamber and Westminster Hall other than half-hour debates. Debate Packs are produced quickly after the announcement of parliamentary business. They are intended to provide a summary or overview of the issue being debated and identify relevant briefings and useful documents, including press and parliamentary material. More detailed briefing can be prepared for Members on request to the Library.

1. Background

1.1 Defining the Fourth Industrial Revolution

The Fourth Industrial Revolution

The fourth industrial revolution is a vaguely defined term used to refer to a variety of technological changes and innovations that have occurred since the beginning of the 21st century, with potentially dramatic effects on economy and society.

It is characterised by increased automation of working practices, effecting both low and middle skill jobs, greater connectivity, machine learning and developments in new and emerging technologies, occurring at a considerably faster than in preceding industrial revolutions.

The origin of the term “fourth industrial revolution” can be traced to the idea of “Industrie 4.0” first used at the 2011 Hanover Fair and subsequently featured as one of ten “future projects” identified by the German government as part of its [High-Tech Strategy 2020 Action Plan](#), published in March 2012.

More recently, the term has come to be associated with the work of the German engineer, economist and founder of the World Economic Forum, Klaus Schwab through his 2015 book *The Fourth Industrial Revolution*.

In this work, Schwab identifies three distinct preceding industrial revolutions:

- **The First Industrial Revolution** – Spanning from the 1760s to the 1840s and characterised by the use of water and steam power to mechanise production.
- **The Second Industrial Revolution** – Spanning from the 1870s to the 1910s, characterised by the use of electrical power to create mass production.
- **The Third Industrial Revolution** – Beginning in the 1960s, this digital revolution has been characterised by a shift away from mechanical and analogue electronic technologies to digital electronics, as well as further automation of industrial production.

Schwab goes on to describe a fourth industrial revolution, beginning at the turn of the century, driven by automation and connectivity and characterised by “a more ubiquitous and mobile internet, artificial intelligence and machine learning.” Borrowing the title of a work by Erik Brynjolfsson and Andrew McAfee¹, Schwab describes this new era as “the second machine age” though one that will be characterised by the making of “unprecedented things.”²

¹ See Erik Brynjolfsson and Andrew McAfee, *The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies*, W.W. Norton and Company, 2014

² Klaus Schwab, *The Fourth Industrial Revolution*, World Economic Forum, 2016, pg. 7-8

Specific features that define the fourth industrial revolution include:

- The emergence of **“smart manufacturing”** and **“smart factories”** – that is manufacturing processes based around the integration of physical production with digital technologies collecting data on plant operations and the supply chain, which are able to analyse this data and contribute to real-time improvements in production, procurement and supply chain management.
- Tied to this idea is the concept of the **‘Internet of Things’** - in which everyday objects, are connected to the internet, able to identify themselves to other devices to collect and exchange data.
- The replacement and augmentation of certain kinds of labour using **automation technologies**, including robotics and machine learning. This also opens up the possibility of automation of certain kinds of knowledge work.
- Ongoing developments in **new and emerging technologies**, including nanotechnology, 3-D printing, biotechnology, quantum computing and renewable energy and energy storage.
- The rate of change is **considerably faster** than in preceding industrial revolutions.

1.2 Impacts of the Fourth Industrial Revolution

Some theorists and critics of the fourth industrial revolution have identified a number of potential opportunities and risks it presents, including:

- **Potential job losses** as a result of further automation of low-skill jobs, spreading to middle-skill jobs. A 2013 study estimated 47% of jobs in the USA had a high probability of becoming automated, while the World Bank estimates 7.1 million mostly service sector jobs could be lost to “disruptive labour market changes” between 2015 and 2020.³ These jobs losses could potentially lead to **increased levels of inequality**.
- Growth of **new jobs spurred by technological developments**, and potential growth in education and re-education to meet demand.

³ See Carl Benedikt Frey and Michael A. Osborne, [*The Future of Employment: How Susceptible are Jobs to Computerisation?*](#) University of Oxford, 2013 and [*The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*](#), World Bank, January 2016

- Potential **growth of gender inequalities** following increased demand for skills in male dominated employment sectors, including engineering and computer science.
- **Long term gains in productivity and efficiency**, potentially reducing the cost of trade and driving economic growth.
- **Disruption to traditional industries**, combined with the **growth of the “sharing” and “on demand” economies**.
- Increased **technological innovation** combined with the **enhancement of products and services with digital capabilities**, increasing their value, durability and resilience and altering customer expectations.
- The reduction in number of jobs through increased automation **could reduce states’ ability to tax labour income**, potentially resulting in lower tax revenues.
- The fourth industrial revolution maybe **more likely to benefit developed economies**, with developing economies facing challenges following the decline in value of low-skill labour.

2. Press Articles

The following is a small selection of recent press and media articles which may be relevant to this debate. Please note: the Library is not responsible for either the views or accuracy of external content.

[A fourth industrial revolution is powering the rise of smart manufacturing](#)

Lisa De Propris, The Conversation

20 June 2016

[Most UK manufacturers are struggling to recruit skilled workers – report: Business group EEF says skills shortage is putting productivity growth at risk and warns government over lack of support](#)

Katie Allen, The Guardian

29 March 2016

[Rise of the robots threatens the poor](#)

Steve Johnson, Financial Times

26 January 2016

[Fourth Industrial Revolution brings promise and peril for humanity](#)

Larry Elliot, The Guardian

24 January 2016

[Forget the markets -the Fourth Industrial Revolution is here: New technologies are again about to transform how we live, as those gathered in Davos are well aware](#)

Hamish McRae, Independent

23 January 2016

[Davos: Smart machines set to transform society](#)

Murad Ahmed, Financial Times

20 January 2016

[Businesses will wither and die if they ignore the coming technological paradigm shift](#)

Martin Gilbert, City AM

20 January 2016

[Look out, here comes the Fourth Industrial Revolution](#)

Hamish McRae, Independent

19 January 2016

[Come the next industrial revolution, we shall be primed, ready and waiting: Individuals must be equipped to adapt and learn skills that can be applied as their occupations evolve](#)

David Sproul, Daily Telegraph

16 January 2016

[The Fourth Industrial Revolution: What It Means and How to Respond](#)

Klaus Schwab, Foreign Affairs

12 December 2015

[Robot revolution: rise of 'thinking' machines could exacerbate inequality](#)

Heather Stewart, Guardian

9 November 2015

[Same as It Ever Was: Why the Techno-optimists are Wrong](#)

Martin Wolf, Foreign Affairs

July 2015

[The Robots Are Coming: How Technological Breakthroughs Will Transform Everyday Life](#)

Daniela Rus, Foreign Affairs

July/August 2015

[Will Humans Go the Way of Horses? Labor in the Second Machine Age](#)

Erik Brynjolfsson and Andrew McAfee, Foreign Affairs

July/August 2015

3. Parliamentary Material

Debate: The Economy and Work, [HC Deb 26 May 2016, c 732-811](#)

[Automation and the Workforce](#), Parliamentary Office of Science and Technology, 12 August 2016

4. Further Reading

[Will the fourth industrial revolution drive global economies or eliminate millions of jobs?](#), Zurich, January 2016

[How will the Fourth Industrial Revolution affect economic policy?](#), World Economic Forum, January 2016

[What does the “fourth industrial revolution” mean for Britain’s businesses?](#), realbusiness, January 2016

[The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution](#)

World Economic Forum, January 2016

[Extreme automation and connectivity: The global, regional, and investment implications of the Fourth Industrial Revolution](#)

UBS White Paper for the World Economic Forum Annual Meeting, January 2016

[Technology, globalisation and the future of work in Europe: Essays on employment in a digitised economy](#)

Institute for Public Policy Research, March 2015

[Industry 4.0: Challenges and Solutions for the Digital Transformation and Use of Exponential Technologies](#)

Deloitte, 2015

[The Future of Work: Jobs and skills in 2030,](#)

UK Commission for Employment and Skills, February 2014

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