

The shape of things to come?

Once viewed as little more than science-fiction fantasy, artificial intelligence (AI) now holds the potential to reshape the relationship between humans and machines and drive a new wave of economic growth over the next two decades. Here, we assess the financial and social benefits AI could bring to the global economy and wider investment community.

The development of AI – computer systems that can think intelligently and learn as humans do – continues to generate global excitement and controversy, dividing public opinion. Some fear the development of intelligent machines poses a greater threat than climate change to humanity.¹ Others remain optimistic AI can bring huge benefits including the scope to boost productivity, revolutionise the workplace and unleash a new wave of global economic growth.

While AI seems revolutionary, so-called narrow or weak AI – involving non-sentient artificial intelligence systems focusing on single dedicated tasks – has existed for well over a decade. In 1997, Deep Blue, a chess-playing computer designed by IBM, famously beat then world

champion Garry Kasparov.² More recently, IBM's supercomputer Watson 'won' the US TV quiz show Jeopardy! and has since been used to support fields as diverse as healthcare and dress design.³

As AI makes early strides into the home and workplace, global consulting firm Accenture has said it believes the technology has the potential to double annual economic growth rates across major economies including the US, Germany and Japan by 2035, adding an estimated US\$814bn to the UK economy alone.⁴ The firm also predicts the impact of AI technologies and its integration with the 'internet of things' could boost business productivity by as much as 40% and fundamentally change the way work is done.

¹ *The Guardian*. Artificial intelligence: 'We're like children playing with a bomb'. 12 June 2016.

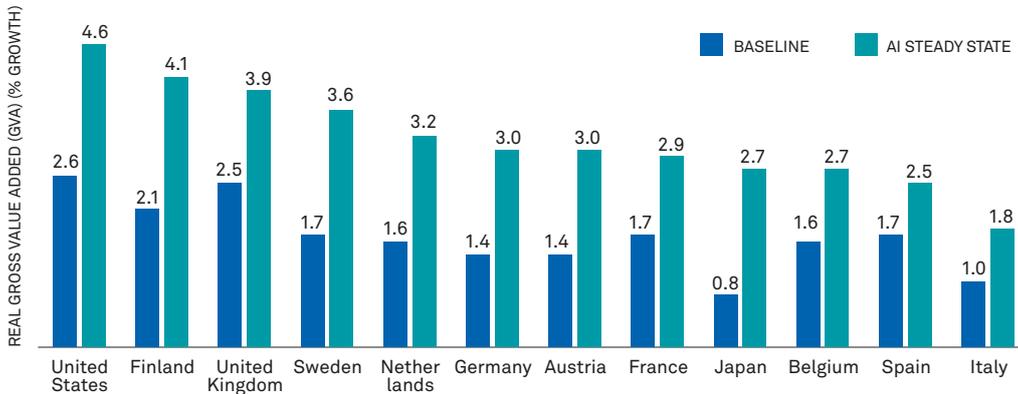
² *BBC*. Artificial Intelligence dictionary: How to speak AI. 13 September 2015.

³ *MIT Technology Review*. IBM's Watson is everywhere – but what is it? 27 October 2016.

⁴ *Accenture*. Why artificial intelligence is the future of growth. 28 September 2016.



The potential economic impact of AI*



Smart homes and even smart cities are starting to develop with huge implications for sectors such as healthcare and transport. The way we live and work could see fundamental change

Source: Accenture and Frontier Economics as at 28 September 2016.
 *Reflective of the growth rates Accenture/Frontier Economics analysed.

The global investment management community is also keeping a close watch on developments in this field. Commenting on the potential for AI and current market growth forecasts, Robert Kluchko, a senior quantitative analyst and portfolio manager of thematic technology strategies at US-based asset manager The Boston Company Asset Management (TBCAM)⁵, says: “We believe AI is a game changer. When you consider some of the related innovation taking place in areas such as so-called deep learning, predictive analytics, ‘big data’, the internet of things and even virtual and augmented reality, you begin to realise the huge economic and social potential it carries.”

Market breakthrough

Kluchko points to the swift adoption of smartphones and, more recently, wearable technologies as evidence technological barriers are disintegrating as innovation reshapes the everyday life of millions worldwide and opens new channels for AI integration.

“The development and speed of technological change are now moving forward exponentially and change that would once have taken over a century can be completed in a fraction of that time. Connectivity across networks and devices is improving at a rapid rate, and with underlying technologies becoming cheaper, its popularity is increasing. Smart homes and even smart cities are starting to develop with huge implications for sectors such as healthcare and transport. The way we live and work could see fundamental change,” he adds.

At a household level, Amazon’s Alexa and the 2017 launch of Google Home⁶ – MAI speakers able to control home appliances and respond to commands – in the UK are just two indications of the likely shape of things to come for AI applications in domestic life.

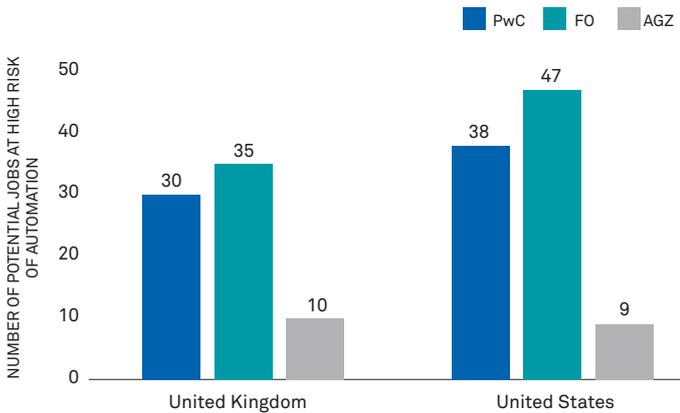
In industry, pioneering car manufacturer Tesla already applies AI to support the predictive and self-driving features of some of its latest models,⁷ despite previous warnings by founder Elon Musk that the technology was probably humanity’s “biggest existential threat.”⁸ In February, US car giant Ford Motor also announced plans to invest US\$1bn over five years in Argo AI, an artificial intelligence start-up focused on developing autonomous vehicle technology.⁹

Hopes and fears

Where there are opportunities, however, there are often also threats, adds Kluchko. Some fear a more widespread application of AI could replace human employees, creating damaging new levels of unemployment. A 2017 report by consulting firm PwC¹⁰ found that up to 30% of jobs in the UK alone were under threat from AI and that, in some sectors, up to half the jobs could disappear.¹¹ Advocates of AI insist it can bring genuine advantages, boosting productivity and replacing routine, monotonous manual jobs with machines, while freeing up workers for more sophisticated, creative and higher-skilled tasks.

⁵ Investment Managers are appointed by BNY Mellon Investment Management EMEA Limited (BNYMIM EMEA) or affiliated fund operating companies to undertake portfolio management activities in relation to contracts for products and services entered into by clients with BNYMIM EMEA or the BNY Mellon funds.
⁶ Telegraph. Google Home: AI speaker to launch in the UK next week. 28 March 2017.
⁷ Forbes. Powerful Examples Of Artificial Intelligence In Use Today. 10 January 2017.
⁸ The Guardian. Elon Musk: artificial intelligence is our biggest existential threat. 27 October 2014.
⁹ Telegraph. How Ford will create a new generation of driverless cars. 27 February 2017.
¹⁰ PwC. Consumer spending prospects and the impact of automation on jobs. 23 March 2017.
¹¹ BBC. Robots to affect up to 30% of UK jobs, says PwC. 24 March 2017.

What proportion of UK/US jobs is potentially at high risk of automation?



Source: PwC analysis; FO; AGZ as at 24 March 2017.

The likelihood of automation from robotics and AI appears highest in sectors such as transport, manufacturing, medical diagnostics, wholesale and retail and lower in jobs requiring more empathy, interaction and human skills such as education, health and social work and arts and entertainment.

Across the AI universe, computing strength, reach and capacity are expanding rapidly. According to Accenture, global data has seen compound annual growth of more than 50% since 2010 as more devices around us have become connected.¹² Against this backdrop, some analysts predict AI could soon align with other related developments such as robotics, spawning a connective revolution in the machines and systems we use and the way we interact with them.

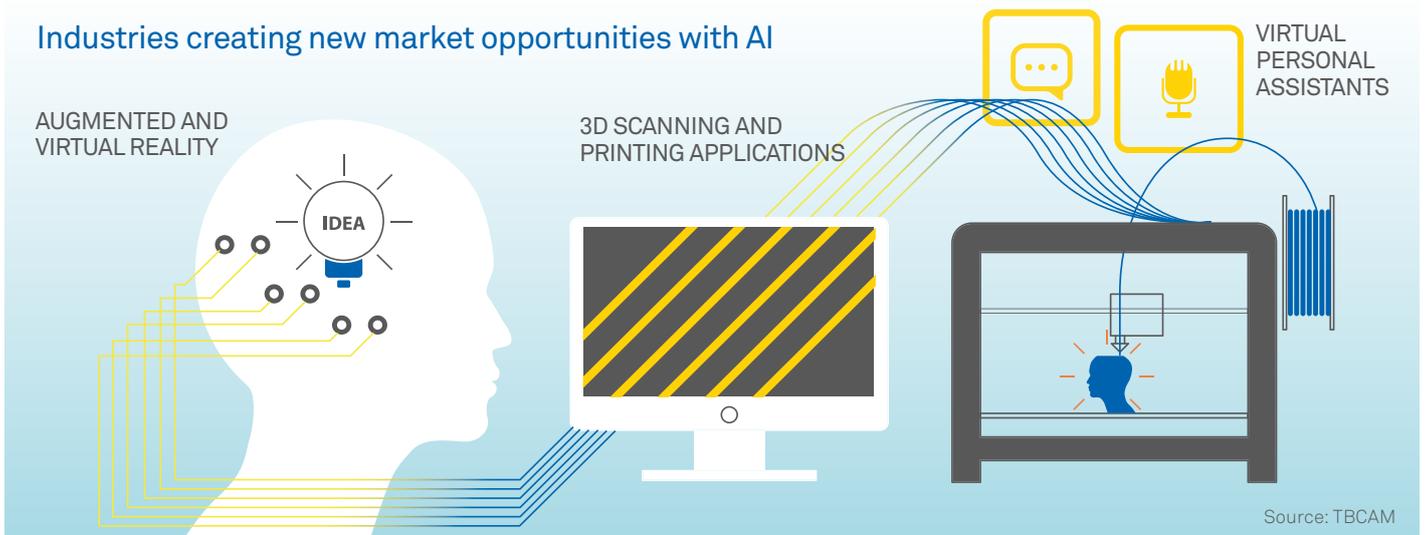
Bridging new frontiers

Kluchko believes AI could, over time, also lead to the creation of entirely new markets that wouldn't previously have been feasible. From a social and employment perspective, the potentially transformative powers of automation and AI are so great they have also prompted some policymakers to consider devising forms of universal basic income or even a 'robot tax' to support those whose jobs have been automated.¹³ From a policy perspective, AI holds potential for governments to develop new digital infrastructure and skills and is winning growing support from policymakers across developed nations. February saw the British government pledge £17.3m for AI and robotics research to be carried out by UK universities as part of its wider digital strategy.¹⁴

In March, the Canadian Government separately announced funding of a Pan-Canadian AI Strategy¹⁵ for research and talent that will cement Canada's position as a world leader in the field. The C\$125m strategy is designed to attract and retain top academic talent in Canada, increase the number of post-graduate trainees and researchers studying AI and promote collaboration between Canada's main centres of expertise in Montreal, Toronto-Waterloo and Edmonton.

The US government also remains supportive of developments in AI and last year published a major report *Preparing for the Future of Artificial Intelligence*, which included recommendations for specific further actions. A companion *National Artificial Intelligence Research and Development Strategic Plan* was also released, laying out a strategic plan for federally funded research and development in AI.¹⁶

Industries creating new market opportunities with AI



Source: TBCAM

¹² Accenture. Why artificial intelligence is the future of growth. 28 September 2016

¹³ The Guardian. Robots could displace 10m British workers. 24 March 2017.

¹⁴ BBC. UK robotics research gets £17.3m pledge. 26 February 2017.

¹⁵ Canadian Institute for Advanced Research (CIFAR) news release. Canada funds \$125 million Pan-Canadian Artificial Intelligence Strategy. 22 March 2017. 20 May 2016.

¹⁶ The White House. The Administration's Report on the Future of Artificial Intelligence. October 12 2016.

Investment potential

While accurately valuing potential investment opportunities in the AI space can prove somewhat challenging, investment interest in the sector – and in companies which utilise AI – is growing among both institutional investors and venture capitalists with some even seeking ways to apply AI to their investment management techniques and strategies.¹⁷ According to figures from software and data analysis specialist CB Insights, global artificial intelligence equity funding surpassed US\$6.6bn across 1,241 deals from 2011 to the first quarter of 2016.¹⁸

For its part, TBCAM has identified an AI investment universe of about US\$14 trillion in size, including 750 stocks, mainly comprised of US companies. TBCAM, as well as other analysts, anticipate exponential growth in the market. Kluchko points to the potential for increased AI application in areas such as retail, transportation, healthcare, manufacturing and agriculture, with the development and adoption of so-called natural language processing or conversational user interfaces and its inclusion in everyday items such as smartphones and other devices as a likely driver of future market growth.

Much will ultimately depend on how humanity manages the development and implementation of AI. While doubts persist about its potential dangers, AI developers could find themselves increasingly walking a tightrope between implementing its benefits while straddling and addressing any moral and ethical concerns, adds Kluchko.

“We are going to places we haven’t gone before, and in doing so, unanswered questions come into play on ethical dimensions – how much free will AI embodies in machines and what this is used for. These are topics that will come up more and more as AI becomes a part of our daily lives. The hope is we can exploit the potential benefits of AI and harness it in a way that fosters not only greater prosperity but also helps us to enjoy a better quality of life,” he concludes.

WHAT IS ARTIFICIAL INTELLIGENCE TECHNOLOGY?

While exact definitions of AI Technology vary widely, TBCAM defines it as technology that can*

- ANALYSE DATA**
Integrating new information from its environment via:
 - DEEP LEARNING
 - IMAGE RECOGNITION
 - MACHINE LEARNING (DATA MINING)
 - NATURAL LANGUAGE GENERATION OR PROCESSING
 - REASONING OR EVIDENCE BASED
- OFFER PREDICTIVE INSIGHTS**
and make decisions
- ADVISE ON WHICH ACTION TO BE TAKEN**
and implement those decisions in a way that is trusted

*Or companies which support the benefits from this technology.
Source: TBCAM

¹⁷ Fortune. Robots Are Replacing Humans at All These Wall Street Firms.30 March 2017.
¹⁸ CNBC. Here are the best stock plays for artificial intelligence bulls. 03 November 2016.

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