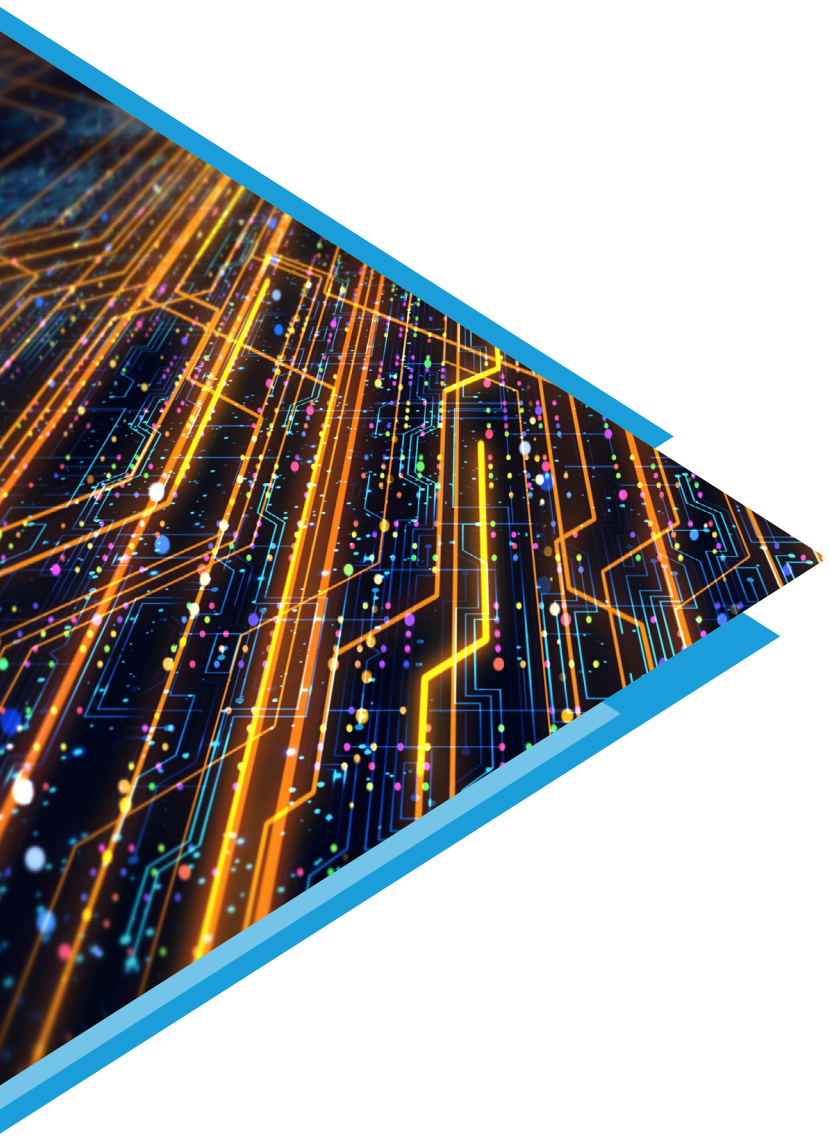

An investment perspective:

COVID-19 'MASSIVELY ACCELERATES' TAKE-UP OF AI

The pandemic has forced companies to rethink their approach to intelligent automation, speeding the spread of AI-based technologies from the tech and internet sectors through the rest of the economy. Early adopters stand to gain huge competitive advantages, according to David M. Egan, Senior Analyst, Semiconductors and Head of Thought Leadership, Research, at Columbia Threadneedle Investments.

QUICK READ

- **In healthcare and elsewhere, AI-related technologies have received a "battlefield promotion" as the crisis forced the pace of innovation and adoption.**
- **Companies that move fastest to adopt technology innovations such as AI and intelligent automation open up a productivity and growth advantage over those that move more slowly, which quickly becomes unassailable.**
- **It is reminiscent of the 1990's, when early adopters that installed industrial robots thrived, expanding their headcount by more than 50% over the following 18 years as their increased productivity delivered gains in market share. By contrast, non-adopters cut jobs by 20%[1].**

[1] Source: Robots and firms; VOX CEPR Policy Portal; 01 July, 2019. https://voxeu.org/article/robots-and-firms.

David M. Egan, CFA®
Senior Analyst, Semiconductors and Head of Thought Leadership, Research

Even before the Covid-19 pandemic struck in early 2020, artificial intelligence (AI) and related computing techniques were already spreading beyond their heartland in tech and internet companies to other industrial sectors. The Covid-19 crisis, however, has prompted a "massive acceleration" of the trend towards intelligent automation, says David M. Egan, Senior Analyst, Semiconductors, at Columbia Threadneedle Investments.

In some cases, this is directly related to the fight against the virus. Egan cites examples including Royal Bolton Hospital in the north of England, which fast-tracked the introduction of an AI-based system to triage the huge flow of patients presenting with suspected Covid-19. The algorithm read chest X-rays for signs of Covid-related lung infection, allowing medics to identify those patients most in need. Similarly, researchers seeking possible drug therapies as the crisis escalated relied on very computationally-intensive parallel processing techniques that are fundamental to AI. This allowed them to scan the massive body of published research and identify promising candidates.

Covid-19 hands AI a 'battlefield promotion'

Egan says that in healthcare and elsewhere, AI-related technologies have received a "battlefield promotion" as the crisis forced the pace of innovation and adoption, sweeping aside doubts over whether the time was right to start experimenting with new techniques. In sectors ranging from logistics to financial services and facilities management, companies are accelerating their take-up of intelligent automation.

The immediate impetus may be to combat the effects of the Covid-19 pandemic on their business operations, but these are investments they would have made eventually in any case – the arrival of Covid-19 simply pushed them to the top of the agenda. As a result, the adoption of technology, AI and data science will become ever more pervasive as companies that did not previously prioritise the 'digital revolution' rethink its potential impact on their businesses.

In examples such as hospitals tackling Covid-19, AI tools that prove their worth after being fast-tracked into service under crisis conditions for one purpose, will spread through the organisation as the crisis passes and further use cases are identified, says Egan. "Are you going to throw them away? No, you're going to say 'Oh, I tried this thing and it worked really well. Let's see what else we can

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> This is an existential question of whether companies want to prosper and succeed or fail.

use it for.'" Healthcare has been a direct beneficiary of AI's accelerated adoption, but Egan says he is also seeing a surge of interest in robotics among companies that need to respond to the productivity hit caused by social distancing requirements in warehouses. "We're only now getting to the point where we can start doing pick and place, so the robot can look using sensors and pick things up and move them into another place autonomously," he says.

As before, robots were starting to be used to pick and move packages around warehouses before the crisis, but Covid-19 is speeding up adoption significantly. Although this automation trend is not yet showing the same momentum in factories, where the more complex production stage poses greater challenges, for the handling of finished products the shift is now well under way.

Accelerated uptake brings unassailable advantages

Our experience from previous technology adoption waves demonstrates the effects that an accelerated uptake of AI and related technologies is likely to have.

Data from Spain compiled by *Encuesta sobre Estrategias Empresariales*, an annual survey covering 1,900 manufacturers, showed the commanding competitive edge that early adopters of traditional industrial robots gained. Those that installed robots between 1990 and 1998 thrived, expanding their headcount by more than 50% over the following 18 years, from 1998 to 2016, as their increased productivity delivered gains in market share. By contrast, non-adopters cut jobs by 20%.[1]

"This is an existential question of whether companies want to prosper and succeed or fail," says Egan. He points to research by Accenture consultants Paul Daughtery and James Wilson, published in *MIT Sloan Management Review*, who studied 8,300 companies across 20 industries[2]. Daughtery and Wilson report: "We found that the top 10% of these companies, in terms of their levels of technology adoption, technology penetration and organisational change are achieving levels of revenue growth that are double those of the bottom 25% and grow revenues more than 50% faster than the middle 20% of the companies... At critical stages of systems evolution, the 10% of companies that lead the way boldly choose the most challenging, but most rewarding, of the technology options typically available. In contrast, laggards

[1] Robots and firms; VOX CEPR Policy Portal; 01 July, 2019. https://voxeu.org/article/robots-and-firms.
[2] https://sloanreview.mit.edu/article/how-leading-organizations-are-getting-the-most-value-from-it/ The slide deck explaining their research sets out a framework explaining how companies can move up the tech adoption curve. Egan believes this framework is also relevant for investors in evaluating companies. See: https://www.accenture.com/_acnmedia/Thought-Leadership-Assets/PDF-2/Accenture-Legacy-or-Legend-PDF-Report.pdf

fail to achieve full value from their investments in new technology because they make defensible but suboptimal decisions that inhibit their ability to share and scale technology-driven innovation across business units and processes."

Egan observes: "That growth advantage compounds every year – it's a devastating conclusion because the compounding curve is exponential. People don't think in exponentials very well, so they don't understand the magnitude of the difference. They don't get that there is something fundamentally different going on here, which is that those big tech companies, which they say are overvalued, can scale their businesses to a level that we've never seen before and they can do it with incredibly high margins and free cash flow."

He points out that, as of December 2020, the five largest US technology companies (Alphabet, Amazon, Apple, Facebook and Microsoft) account for 18.8% of the market capitalisation of the Russell 1000 index. During 2020 just two sectors – information technology and healthcare – accounted for 28% of revenues in the Russell 1000, 32% of EBITDA, 55% of free cash flow and 41% of the index's market capitalisation, he says.

His conclusion is stark: companies that move fastest to adopt technology innovations such as AI and intelligent automation open up a productivity and growth advantage over those that move more slowly, which quickly becomes unassailable.

The effects of this trend are already obvious in the US tech sector but as AI-related technologies spread further into a wider range of industries – for example, to automated loan decisioning in financial services – he expects a similar divergence in growth rates and profitability between the leaders and the rest. The effect of the Covid-19 pandemic has been to accelerate adoption of these technologies and therefore increase the pressure on investors to identify those companies that are best positioned to benefit.

"The laggards who think they're trying things out – they're going to have problems. It may not be tomorrow, but it will be in five, 10 or 20 years because they're going to be so far behind. The scale that you're getting from using technology and AI allows a massive shift in what goes on in the economy.

"The tech intensity of the world economy is growing and computational approaches will take a higher share of

> "Big tech companies can scale their businesses to a level that we've never seen before."

> "Autonomous vehicles, if we ever get them, are the ultimate example of edge computing."

economic output." he says. "Over time, the companies that are more open to trying these things are more likely to gain control of the economy than others."

The tool makers for AI

This raises the obvious question of how best to invest in this trend. The technology and internet sectors remain the obvious focuses for investors, but Egan also highlights opportunities among the tool makers for AI.

The same visual sensors used in Amazon Go's stores instead of checkouts, for instance, are used in automated vehicles and robots. The companies making these sensors stand to do well. Similarly, NVIDIA designs the graphical processing units (GPUs) for machine learning that Audi, Mercedes and Toyota are experimenting with in self-driving vehicles and healthcare companies use for purposes such as early detection of cancer. Based in Santa Clara, California, NVIDIA is the market leader in GPUs, which in effect are the brain of AI solutions.

Having designed the GPUs, NVIDIA also has NVIDIA Drive, a platform that enables car manufacturers to create their own algorithms for automated vehicles. In healthcare, its platform allows radiologists to build a data set and create algorithms that make predictions about the kind of surgery people need. AI is perfectly suited to making early and better diagnosis of disease, as there is a huge amount of data available.

However, complexities around handling data, such as confidential health information, are spurring innovation in other areas, he says.

In cases where data has to be processed locally rather than sent to the cloud for regulatory reasons, or because the latency involved in sending data to the cloud is too great, the processing will have to be carried out locally – at the edge, in the jargon. "Autonomous vehicles, if we ever get them, are the ultimate example of edge computing," he says. "You cannot guarantee that the vehicle will always have connectivity to a centralised cloud, so you're going to need edge computing there."

He says a range of service providers are trying to come up with an outsourced, cloud-type service that is available remotely, at the edge, for users such as hospitals handling confidential patient data. Innovations in this area are likely to open a further growth area for tool makers.

The pandemic brings data challenges for AI

While the Covid-19 pandemic has accelerated adoption of AI-related technologies across numerous sectors, its arrival has also highlighted the technology's limitations. AI operates by making predictions based on the patterns it detects within historical data sets. If patterns of human behaviour and demand for products and services change in fundamental ways, as they have done since the onset of global lockdowns, then historical data will no longer be relevant and predictions made using AI systems relying on historic data will no longer apply.

"That's what the pandemic is like for systems making supply chain predictions about how much you need here or there. Now your supply chain system is getting what looks like an anomalous set of data and it doesn't know how to react to it, because it's never seen this before." This is the point at which automated systems have to be augmented by human intelligence that is able to make judgements based on more than historical data.

Although the crisis may challenge existing AI systems in the short term, as they struggle to interpret data patterns they have never seen before, ultimately Covid-19 will widen the range of information that can be used to train AI systems and will accelerate their spread into all corners of the economy.

David M. Egan, CFA® biography

David Egan is a senior analyst in central research at Columbia Threadneedle Investments and is responsible for the semiconductor vertical. In addition, he leads the team's thought leadership effort.

Egan joined Columbia Threadneedle Investments in 2008. Previously, he was a research analyst at Lehman Brothers, where he covered semiconductor equipment. Prior to that, he worked at various internet and technology startups, including Lycos, in the San Francisco, California Bay area. Egan began his career doing actuarial work at the pension and benefits consulting firm Watson Wyatt.

Egan has been a member of the investment community since 2004. He received a BA from Duke University, a master's degree in Finance from CEMA University in Buenos Aires, Argentina and an MBA from the University of California at Berkeley. In addition, he holds the Chartered Financial Analyst® designation.

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