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SPECIAL REPORT

# Future of AI

The emergence of artificial intelligence is having an increasing impact on all facets of life and business. This report looks at how AI is being used to create new jobs and impact lives as well as investigate the impact on employment for the immediate future.

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# AI is accelerating the energy transition, say industry leaders

*The technology is transforming all areas of the sector, with new roles generated and more traditional, lower-skilled jobs at possible risk*

Nicholas Fearn

Energy companies are increasingly leveraging artificial intelligence technology to improve the efficiency and sustainability of their operations. And it is already transforming critical functions: from lowering carbon emissions to mitigating cyber attacks and predicting mechanical failures.

In the process, the technology is generating new job opportunities for AI ethics specialists, software developers and data engineers across the sector. However, experts warn that AI could also displace more traditional energy jobs.

## Use cases: emissions monitoring, infrastructure routing, supply management, cyber defence

With energy-related carbon dioxide emissions reaching 37.4bn tonnes for the first time last year — an increase of 410 mn tonnes, or 1.1 per cent, on 2022 levels — many companies are exploring ways in which AI can help reduce their carbon footprint.

Shell, for example, has developed an AI tool for monitoring methane emissions. This "uses wind and concentration data to help us understand the origin and quantity released", explains Dan Jeavons, vice-president of computational science and digital innovation at the oil and gas company.

AI will optimise the efficiency of energy systems by "reducing the amount of power needed to be generated", he adds. It could also create "entirely new low carbon-footprint energy systems" and enable suppliers to monitor greenhouse gas sinks.

Gert Vermeiren, European managing director of environment, water and energy at global infrastructure consulting firm Aecom, says AI will improve the cost-effectiveness and accuracy of energy infrastructure. Engineers, for instance, working on pipelines and power lines could use AI to "generate a viable route shortlist in seconds" instead of several days.

In addition, AI offers operations engineers "a more strategic, whole-grid view of supply", allowing them to analyse energy generation and usage patterns to "plan supply more efficiently" and balance the "use of different sources of low carbon generation in a dynamic environment". He adds: "For the customer, this means supply is much more reliable."

> **The technology is transforming all areas of the sector, with new roles generated and more traditional, lower-skilled jobs at possible risk.**

Energy asset managers can benefit from AI tools, making it possible to predict system failures and inspect and repair them accordingly. "This not only addresses productivity gains but safety as well," says Vermeiren.

Scotland-based provider SSE has found AI-powered energy forecasting to be extremely useful. It is using technology to "forecast energy usage at the distribution system operator level" and analyse "future energy demand at a local level", notes SSE Energy Solutions digital services director Eunice Mabey. It gives businesses "greater accuracy and certainty on their future energy demand and cost while enabling energy flexibility".

The company is also using AI for optimising large energy generation systems in the healthcare and academic sectors. "It [AI] analyses past energy performance and operation to produce optimised running schedules to lower energy costs and carbon emissions," Mabey explains.

Mona Schroedel, a managing associate at UK law firm Freeths, says AI-powered algorithms could streamline energy trading research — by "surveying enormous swaths of information and detecting patterns and anomalies". She suggests the technology could help energy companies monitor and detect cyber security threats, as well, which are increasing in scale and sophistication.

Amanda Ahl, grids and utilities associate at the energy transition research body Bloomberg NEF, expects AI to "play a larger role in grid design and planning". Ahl says this "accounted for 7 percent of AI activities in the power sector in 2023".

## Jobs created: systems modellers, ethics officers, cyber security experts

As energy companies continue integrating AI into day-to-day operations, many will require staff with the data science and AI development skills to create "the next generation of predictive models", according to Dr Augustine Ikpehai, senior lecturer in electrical and electronic systems at Sheffield Hallam University.

Muhammad Wakil Shahzad, assistant professor in Northumbria University's mechanical and construction engineering department, agrees that system modeller engineers will be in demand. Companies will need people who can apply AI and computational modelling to "simulate and optimise complex energy and end-use systems", he says, as well as data analysts who can "extract insights to optimise energy production, distribution and consumption".

But, to ensure AI algorithms are not used for the wrong reasons, energy companies must appoint AI ethics officers, too, argues Derreck Van Gelderen, AI energy lead at management consultancy PA Consulting. He says their job will be to ensure "AI systems are designed and used in a fair, transparent and responsible manner".

Cyber security professionals will also play a bigger role in keeping future energy infrastructure safe from rising online threats, according to Kumar Parakala, president of digital transformation specialists GHD Digital: "As bad actors become more sophisticated in their attacks on critical infrastructure, including the energy sector, the demand for cyber security skills will increase in a bid to be one step ahead in knowledge, skills and approach."

## Jobs lost: inspection and maintenance staff

While the rise of AI-powered energy systems and infrastructure will generate new jobs, this could come at the cost of more traditional roles. Ikpehai expects AI to displace low-skilled energy jobs, in particular.

Energy companies could, for example, use drones and computer vision systems for manually inspecting transmission lines and pipes. However, humans will still need to check and review the results generated by such systems, he adds.

Traditional inspection and maintenance roles that expose people to hazardous working environments should be automated, says Van Gelderen. He points out that the Sellafield nuclear waste management plant in Cumbria is using an AI-powered robot to keep its operators "out of harm's way".

But it is likely the petroleum sector will suffer most from AI-related job losses, says Parakala. In this area, mechanical work is "being replaced by robotics and AI automation".

More generally, AI will automate repetitive maintenance tasks in areas such as energy plant operations and tasks conducted by junior supervisors, according to Tom Fairbairn, distinguished engineer at real-time data platform Solace. But, he adds, energy workers affected by these job losses could upskill in areas "where human judgement, creativity, and problem-solving skills are irreplaceable".

# Academics express confidence that they and AI can work together

*An effect of the new technology 'doesn't have to be the removal' of teachers from the classroom*

Javier Espinoza

Artificial intelligence may not be about to replace teachers and college professors altogether, but it is augmenting the way the education sector engages with learning.

Robert Seamans, professor of Management and Organisations at NYU Stern School of Business, expects he and his peers will be helped to become better at what they already do by AI tools such as ChatGPT, rather than having their roles taken over.

They will certainly be "faster, and I hope it means that's better," explains Seamans — and he is well placed to judge, having co-authored research into the professions most vulnerable to the rapid growth of AI.

This research found that eight out of the top 10 occupations exposed to AI are in the education sector: mainly teachers of various subjects, including sociology and political science. However, that does not necessarily mean they will be replaced, Seamans stresses, only that the way they carry out their work will be affected in a range of ways.

The study does recognise the potential for job losses and the role of government in managing the disruption, but also points to the technology's potential. A workforce trained in AI will help both companies and workers themselves as they "take advantage of the new tools", the research concluded.

In education, the implications include a change in the way those in academia deliver content and engage with their students, with more access being via tools such as ChatGPT, and administrative automated tasks.

## Use cases: learning chatbots and writing prompts

David Veredas is professor at Vlerick Business School in Brussels. He sees AI as a "facilitator" to educators and their students in the same way that other tools such as Google and Wikipedia have done so until now. "First we had the whiteboard, then we had slides, and now we have artificial intelligence," Veredas says. "We can do many more things, like using virtual reality to enhance the learning experience."

Others see the potential of AI as an enhancer in the classroom. Greg Benson, professor of computer science at the University of San Francisco, has recently launched Gemini Cafe, an informal forum where students share views about the potential of generative AI. "I feel like I am a kid in a candy store right now," he says. "There is so much changing."

Benson says intelligent chatbots have emerged as part of his university's early thinking of AI tools that can aid learning. "They won't give you the answer but they will help you reason through the problems you're working on," he says.

However, he is concerned about plagiarism as a result of the use of language models. "Cheating is not a new problem but we have made it explicit that you cannot turn in generative AI-produced work," he explains.

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> **An effect of the new technology 'doesn't have to be the removal' of teachers from the classroom.**

Seamans has started using ChatGPT to help speed up his writing process. He says writing "comes a little bit quicker because I stick some initial thoughts into ChatGPT, and I start to get a structure or a framework". He adds: "I never use most of what it gives me because it's not in my words. [But] it sparks this creative process…it gives me something to react to."

In this way, AI is likely to make some tasks easier to perform, rather than making roles redundant. As well as assisting in drafting initial research ideas, it can help structure academic papers, or provide a platform for brainstorming. This would speed up the academic workflow but not replace the creative or intellectual input of the teachers. "It doesn't have to be the removal of a professor in front of the class," stresses Seamans.

## Jobs enhanced: lecturers and classroom teachers

Benson points to experimental tools developed by large tech firms that will act as virtual assistants, not necessarily replacing one but creating a new AI function. He highlights Google's NotebookLM, which helps find trends from uploaded documents. "You can ask it to summarise. You can ask it to produce stuff. That's one example where you could imagine a lecturer putting in their notes, to make it available to their students now. Is that a new position or is it an augmentation of my current role?"

It helps with students' thinking process, too. "If you're taking an ancient Chinese history class, and you get all your lecture notes and you can put them in [NotebookLM]. This application would automatically generate a list of questions and answers from those notes, then create flashcards for them. So then you could study from that material."

Veredas is optimistic about his profession surviving and thriving despite the advent of AI. He stresses the irreplaceable core of learning that involves interaction, discussion and critical thinking, which AI cannot easily replicate.

He says: "AI may flip the classroom. We can allow students to learn the basic concepts at home with AI and then we can go deeper into the discussion in class. But it remains to be seen. We need to be open to new technology and embrace it whenever it's useful for learning."

**First we had the whiteboard, then we had slides, and now we have artificial intelligence.**

# Financial services counting on AI for a productivity boost

*AI set to take on customer help, pricing and transaction monitoring — leaving some workers to find alternative roles*

Siddharth Venkataramakrishnan

Finance has always been a sector that has thrived on innovation, and artificial intelligence offers further opportunity to shake up the industry. Armed with cutting-edge technology, companies hope to explore new ways of working, and boost productivity.

## Use cases: customer help, pricing, cyber defence, crime detection

"There are a number of areas of finance where we are seeing AI starting to have an influence," says Peter Weston, associate director for financial services at recruiter Harvey Nash. "For instance, in investment banking and investment management, we have seen a change within IT where AI is being used increasingly as the first line of support for help desk functions."

At the same time, insurers are turning to the technology to help with underwriting and pricing premium quotes. Last year, UK insurer Hiscox unveiled its own AI model, which it built in collaboration with Google, a move hailed as the first in the London insurance market.

"This is really having an impact, as cutting seconds off the time it takes to respond to a query can make the difference between securing a deal or not," says Weston.

Michael Conway, partner and AI transformation lead at IBM Consulting in the UK & Ireland, says a number of factors are driving the change. Among the most important is that customers want a high-end digital experience when handling finance.

"Changing customer expectations, competitive disruption, the emergence of business ecosystems and platforms, cyber security threats, operational resilience, and regulatory actions are all accelerating the pace of transformation in financial services — and quickening the adoption of AI," Conway says.

Employee efficiency and productivity are key areas, he adds, with virtual assistants going from novelties and useful accessories to potentially transformative tools.

"Any complex workflow, from financial crimes detection and evaluating regulatory compliance to payments processing, can benefit from a virtual assistant that generates actionable outcomes to assist a human agent," he says.

Data from Nash Squared, owners of Harvey Nash, reveals that a majority of companies plan to use the technology. In a survey of financial services firms last year, more than 60 per cent said they were actively considering, piloting or implementing AI. Levels of take-up varied by task: ranging from 70 per cent for creating or testing code to 46 per cent for creating graphics or images.

"Many technology leaders view this as just the beginning of a journey whose final destination is not yet clear," says Weston. "While AI could prove truly transformative, that may not be in the way — or ways — people are currently expecting."

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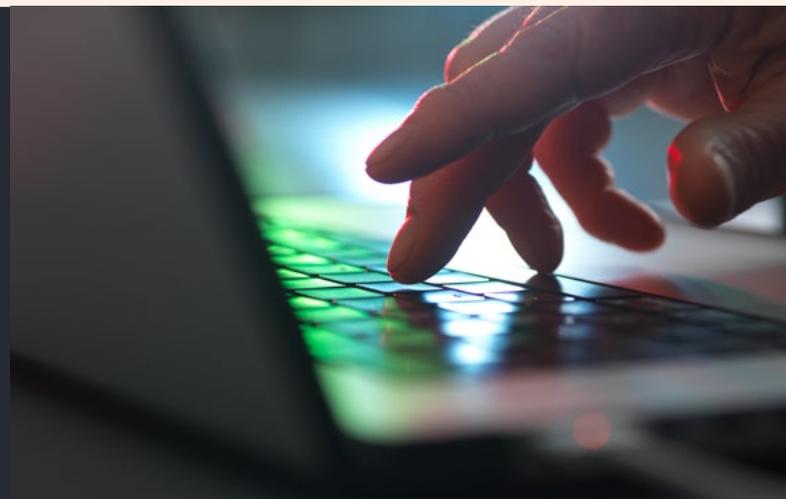
## Jobs created: prompt engineers, transaction monitors, cyber experts, ethicists

Although there has been significant focus on where jobs will be lost, Conway is confident that AI will augment human roles, rather than fully replace them, with new jobs opening up to help push the technology.

"We expect that financial institutions will bolster their technology teams to include generative AI experts, including prompt engineers," he says. These teams will "train staff across a range of functions, to become familiar with generative AI as it will be used to enhance their day-to-day productivity".

Akeesh Khokhar, a senior consultant in Harvey Nash's financial services and banking division, is similarly sanguine that AI will support rather than threaten human workers. He points to the use of co-pilot systems to help reduce mundane tasks in financial services as in other areas.

Among the specialised examples is Lucy, a co-pilot developed by Icelandic anti-money laundering fintech Lucinity. It helps staff in financial institutions who are looking for potentially suspicious transactions to reduce the time they spend on each case.

Cyber security would benefit from AI, he says, with analysts and engineers increasingly turning to high-tech systems to help keep networks secure, as criminals and other nefarious actors look to use artificially intelligent systems.

"Those cyber security professionals specialising in AI will also be responsible for detecting and mitigating AI-related security threats, such as adversarial attacks and data breaches, to safeguard sensitive financial information and maintain trust in banking services," he predicts.

Khokhar singles out AI ethicists as another growth area, a job speciality that has been a facet of Big Tech companies for years. It is now spreading as more advanced AI embeds across industries.

"As AI becomes more integrated into banking, there will be a need for professionals who understand the ethical implications and regulatory requirements surrounding AI usage," says Khokhar. "These individuals will ensure that AI systems are deployed responsibly and comply with relevant regulations, such as data protection and privacy laws."

## Jobs lost: help desk and support roles, coders

At the same time, Weston is clear that some changes are happening that could affect technology roles, with IT team sizes shrinking because of increased automation. Help desk and support roles are most at risk, although that could give these workers a chance to upskill and specialise.

"We anticipate that specialist coders and programmers will also come under threat," he adds. "It will become increasingly important to have a wide skill set that enables coders to understand broad logic and utilise AI from this."

But the extent of its use remains unclear, as governments around the world race to bring in new legislation to oversee the technology. Issues range from how much energy Ai servers might use to how it combat its use by scammers.

In the UK, the government is taking a "pro-innovation" approach, with the stated aim of making the country more competitive. In a paper released in February, it called on regulators to publish their planned approach to AI by the end of April, with the Financial Conduct Authority among the bodies involved.

"Whatever the variation in individual views, there is a common belief in the industry that regulation and security need to be fully in place before real change can occur," says Weston.
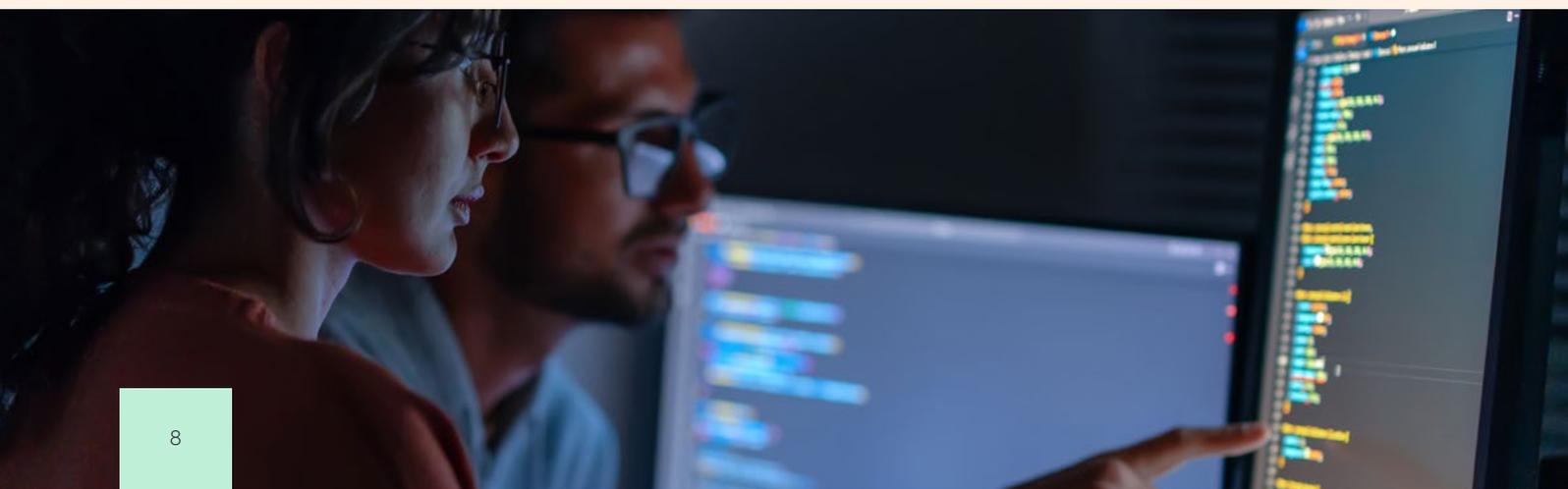
# Healthcare professionals demonstrate immunity to AI

*Transformative changes are still 10 to 15 years away, experts predict*

Andrew Jack

When Robert Wachter, chair of the Department of Medicine at the University of California, San Francisco, reflects on the extent to which healthcare jobs will be disrupted by artificial intelligence, he recalls an apocalyptic speech given by the British-Canadian computer scientist Geoffrey Hinton.

Hinton sent shockwaves through specialist medical education with his warning in 2016: "We should stop training radiologists now. It's just completely obvious that, within five years, deep learning is going to do better."

The technology seemed so good that it would soon replace humans. But the reality has been rather different. Beyond a few applications — for example, in mammography and colonoscopy — evidence of AI's superiority over doctors remains thin. Human intervention is still essential.

"Eight years out, we can't hire enough radiologists, there's so much demand," points out Wachter, who is also a director of the Josiah Macy Foundation, which focuses on medical education. "AI is not perfect; and, in malpractice, you want to sue a human."

AI has the potential to significantly transform employment in many aspects of healthcare — from basic research to clinical care, patient monitoring and medical administration. But Wachter's comments are a reminder that its impact in transforming human roles and the timescales for such changes to take effect remain far from certain.

"I'm most impressed by our ignorance on AI," says Wachter. "It has speeded up mammography, but there are lots of areas where it is not quite as good. Diagnosis is not just looking at digital dots but understanding and placing them in the clinical context. The number of scans is growing faster than AI is advancing."

## Use cases: drug development, compound identification, coding, data analysis

AI — and notably generative AI — offers considerable potential for improving treatments. Some breakthroughs have already been felt. In drug development, there has been much buzz around the identification of compounds such as treatments for antibiotic resistance. In 2021, a first practical example emerged of AI identifying a drug that has been put into practice: baricitinib, an existing treatment for rheumatoid arthritis, was shown to be a way to treat complications of Covid-19.

Overall, consultants McKinsey estimated in a report in January that AI could generate $60bn-$110bn a year for the pharmaceutical and medical-product industries by identifying compounds for possible new drugs, speeding their development and approval, and improving the way they are marketed.

McKinsey showed that since ChatGPT's release in late 2022, the number of AI-related job listings has quadrupled. The number of positions offered grew by 43 per cent annually across the top 10 pharmaceutical companies alone since 2018.

The consultancy highlighted AI's capabilities, including knowledge extraction, content and compound generation, customer engagement, and coding and software generation. McKinsey attributes these strengths to "gen AI's truly multimodal nature: foundational models are built not just

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> **AI is not perfect; and, in malpractice, you want to sue a human.**

on language but also on images, omics [data analysis of an entire biological system], patient information, and other types of data".

A report by the Brookings Institution pointed to AI's roles in functions including post-treatment monitoring and follow-up, and in routine information gathering, particularly through the collection of information via chatbots by "engaging with patients in understandable language, resolving uncertainties, and summarising data for healthcare providers".

## Jobs enhanced: face-to-face consultations

Eric Topol, executive vice-president at Scripps Research, says: "AI is hugely transformational but these things always take longer than you might project." Yet he already sees some applications elsewhere in his own medical practice.

These include note-taking in consultations — freeing doctors from their keyboards to spend more time and eye contact with patients. "That gives the physician the ability to get rid of all notes, tackle [their own] memory issues that are often a problem."

Future doctors and other healthcare workers should not despair about their own displacement or redundancy. As

a recent Pew Research survey highlighted, 60 per cent of Americans would be uncomfortable with their doctors or other providers relying on AI for their healthcare.

"We'll always have human oversight — you are always going to want to talk to an experienced, empathetic physician," says Topol. "Doctors, since before Hippocrates, ruled the roost and tended to be control freaks. The digital era has propelled the patient into a power position…we're going to see that trend of democratisation get into high gear."

He also sees technology driving changes to human medical recruitment, and training. "We were picking brainiacs to be physicians. We need people with deep empathy." But he adds that far greater education is needed around AI. "It requires a reboot of our curriculum. There is no medical school in this country that has fully incorporated AI."

Wachter adds: "I do believe that AI will be transformative, but healthcare is so stressed, [cash-]strapped and expensive that for the next 10 or 15 years it is unlikely whole medical groups will get fired. So much is wasteful, there is so much friction. Healthcare and education are the two fields that have been slowest for AI. There are no unemployed doctors or nurses."

# Media groups look to AI tools to cut costs and complement storytelling

*Technology is shaking up the industry but is unlikely to replace roles where nuance is needed*

**Hannah Murphy**

Could this article one day be written by a "robo-journalist", edited by an AI assistant, and distributed by algorithms alone?

Rapidly evolving artificial intelligence (AI) is unlikely to fully replace traditional media roles but it is fast shaking up the industry. It is set to have a profound impact on the responsibilities and processes of journalists, broadcasters, creatives and advertisers, bringing much-desired speed and efficiency.

It is also becoming available just as media companies, particularly news outlets, are being forced to tighten their belts and enact waves of lay-offs as the rise of digital advertising groups such as Meta and Google have been one of the factors in a global decline in revenues at newspaper groups.

Many appear to see the technology as a solution: media groups have been ramping up their investment in AI even as they have been forced to make those cost cuts. Games company Blizzard Entertainment, entertainment group Walt Disney, and news organisation the New York Times are all putting money into it. In 2022, the global market for AI in media and entertainment was estimated at nearly $15bn and was projected to grow at a compound annual growth rate of 18.4 per cent between 2023 and 2030, according to Grand View Research.

"Whilst we've had AI explosions and 'winters' before, this time is different," says Michelle Sally, partner at UK law firm TLT.

"In a competitive industry, with various outlets — including [social media platform owners] Meta and ByteDance — changing how we consume news, media companies are utilising AI tools to stand out and remain relevant in an ever-changing market."

## Use cases and jobs lost: journalism, film, gaming

In news media, the main use cases for AI include the generation of text and images, as well as editing and AI-assisted research.

Experts suggest it will be most commonly deployed to optimise production processes and take on laborious tasks — for example, identifying the main points of an article to write a headline or using speech-to-text technology to save time in providing on-screen captions or translations.

"Jobs that are more likely to be replaced or negatively impacted include editing and copywriting jobs, as generative AI is already relatively strong in these domains," suggests Ravit Dotan, an AI ethics adviser and researcher.

Meanwhile, developments in generative AI and increasingly powerful large language models (LLMs) — which, among other things, can generate text from huge sets of data — mean that some media outlets have explored AI-powered news generation and distribution. Such "automated journalism" has the potential to disrupt the traditional journalist role.

"AI is already being widely used when it comes to article writing," says Oliver Lock, associate at London lawyers Farrer & Co. He points to articles published by Sports Illustrated. In instances where structured data is available — for example, with sports statistics or financial results — AI can easily transform this into a news narrative, says Danielle Chazen of AI-based video and audio transcribers Verbit.

However, where on-the-ground newsgathering or more complex and nuanced storytelling is required, AI is an imperfect solution — an aid to existing roles, rather than a replacement. Rajvinder Jagdev, partner at specialist IP litigation firm Powell Gilbert LLP, cites a segment broadcast recently by Sky News, where a reporter tried using a generative AI tool to plan, script, and create a TV news slot: the quality was subpar and needed a team of human journalists to finalise the work.

Jagdev believes that "in the short-to-medium term, AI tools are likely to be used to complement existing workflows rather than to work independently as 'robo-journalists — but this may be where things end up in the future."

In filmmaking, gaming and advertising, generative AI is increasingly present in creative processes. It is also increasingly used to improve the customer experience, making personalised news recommendations or, in advertising, helping to show ads at the right time to the right user.

Meta and Google already offer tools that can help marketers generate and better target ads at social media users in real time. There are fears that this could reduce or eliminate the need for advertising creatives, as well as agency staffers who advise on how to place ads effectively.

"Imagine a level of personalisation similar to TikTok but extended across a wider range of verticals and industries," says Joel Hellermark, founder and chief executive of AI co-pilot and learning platform Sana.

## Challenges and jobs created: fact checkers and ethics managers

But the implementation of AI in media still faces many challenges. Generative AI technology remains prone to "hallucinations": namely, generating inaccurate or false information. Usage of outdated or biased data banks for training LLMs can deepen the potential for misinformation. AI tools might also be wielded in a deliberately malicious way to create deepfake videos of people, or to manipulate opinion.

"If the problem of inaccuracy persists, there may be an increased demand for fact-checkers, and their work may be more challenging and important than ever as the internet gets flooded with more and more AI-generated false information," says Dotan. "Companies and governments should require media outlets to mark their content in a way that readers can confirm what truly comes from them," she adds.

Some argue that tie-ups with news organisations themselves could help solve the problem. "From a social interest perspective, it could make sense for LLMs to arrive at some kind of agreement with large media publishers that would allow the software companies to use trusted content to train their systems," says Lock. He notes that Le Monde and Prisa Media have struck one such deal with OpenAI, while the New York Times is suing the AI group to prevent it from training its LLMs on the newspaper's data.

Generative AI's evolution, meanwhile, raises authorship questions — and corresponding concerns about copyright protection and intellectual property ownership of AI-generated content. "As AI tools become more sophisticated and are able to generate content without any prompting, what happens then?" says Jagdev. "Is the author the person who first initialised the AI tool, or perhaps the creator of the AI tool — for example OpenAI, Microsoft, Google — or perhaps even the AI tool itself?"

Such grey areas may give rise to new roles, for instance, ethics managers, responsible for ensuring that AI-generated content adheres to ethical norms, says Hellermark.

Rafi Azim-Khan, head of digital law, Europe, at lawyers Crowell & Moring says AI represents an "existential threat" to the media sector. However, he adds, "it is fair to say, it will be an opportunity for those who adapt well to it and use it as a positive tool, and a threat to those who do not adapt, who are perpetrators or victims of its misuse, or who ignore the new powerful laws and sanctions being introduced".

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**Is the author the person who first initialised the AI tool, or perhaps the creator of the AI tool — for example OpenAI, Microsoft, Google — or perhaps even the AI tool itself?**

# 'Humanoid' robot wave signals change on the production line

*AI training for manufacturing workers could minimise job losses*

Nick Huber

From steam engines to conveyor-belt assembly lines and robots on the factory floor, the manufacturing industry has long been a pioneer of new technologies. Artificial intelligence now looks set to become the next and, perhaps, biggest leap forward. But what will it mean for jobs over the next decade?

## Use cases: controlling plants, recommending equipment fixes, designing products, assembling parts

Manufacturing is already highly automated, with sensors, software and computer networks monitoring the output, data, pressure and temperature of factory machines and industrial processes. Such connectivity has become essential on sites that are sometimes square miles wide.

"In a refinery or petrochemical plant, there can be thousands — if not tens of thousands — of instruments, equipment and valves [needed] to, for instance, manage 250,000 to 500,000 barrels of oil per day and process that into gasoline," points out Jason Urso, chief technology officer in the software division of Honeywell, a US industrial conglomerate.

Within 10 years, more than 80 per cent of manufacturing facilities could be using AI to help run these "control systems" and fix problems with them, he forecasts. If, for example, a machine emits an unusual sound, a factory worker can ask the AI software to analyse that sound, summarise the problems associated with it and recommend remedial action, Urso says.

Some manufacturers already invest in this type of AI. United States Steel Corporation, for example, has said it will use generative AI software from Google to guide its workers through truck repairs and ordering parts.

AI is also playing a bigger role in product design. For example, AI-powered software can help automotive engineers make multiple three-dimensional vehicle designs in minutes instead of days, says Stephen Hooper, vice-president of software development, design and manufacturing at US software supplier Autodesk.

"You [can] build 3D [computer designs] of styling for new vehicles in a fraction of the [current] time," he notes. "You can control characteristics like the wheelbase, the vehicle type…and [the AI] will derive hundreds, if not thousands, of alternatives".

Hyundai has used Autodesk software to help design parts for a prototype car, the wheels of which can transform into four legs to walk and climb — making it a potential rescue vehicle.
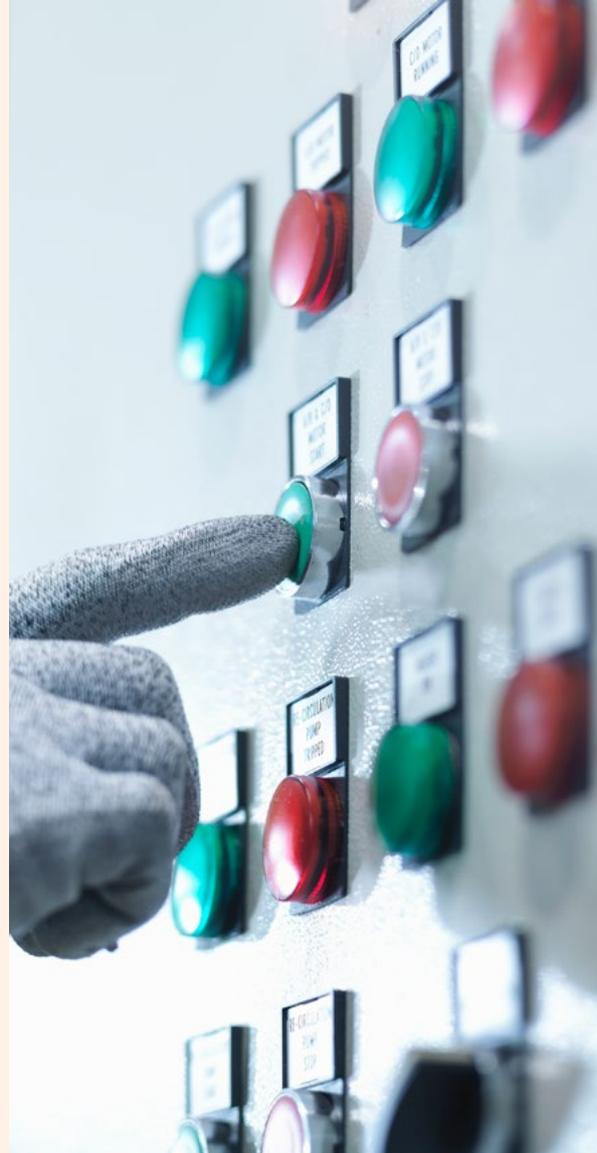
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> in the short-to-medium term, AI tools are likely to be used to complement existing workflows rather than to work independently as 'robo-journalists — but this may be where things end up in the future.

In factories, robots have long been used to assemble parts but the next generation will be AI-powered "humanoid" robots, working alongside humans. These will have sufficient dexterity and learning capabilities to handle processes such as picking and sorting items into categories, experts say.

Early versions could be operating within the next five years, predicts Geordie Rose, co-founder and chief executive of Canadian start-up, Sanctuary AI, which is aiming to create the world's first robots with "humanlike intelligence". Its latest Phoenix model is 5ft 7in tall, weighs 70kg, and can walk at up to 5km/h. It is operated by humans but, Rose forecasts, will eventually mimic human memory, sight, sound and touch.

Demand for such humanoid manufacturing robots is going to be "significant", according to a recent Goldman Sachs research note — particularly in electric vehicle assembly.

"The central premise of this approach is that you can build a machine that's humanlike in the way that it understands the world and acts on it," explains Rose. However, building a machine that can react like a human "is obviously a lot harder than [building] a machine that…can do a couple of things that people can do".

Sanctuary's robot can already sort mechanical parts as fast as a human, but even Rose acknowledges further improvement is needed. "The question is, how long it will take [for our robots] to go from the lab to being on the factory floor," he says. "And that's a very difficult question to answer."

Eventually, robots equipped with artificial general intelligence (AGI) — the same level of intelligence as a human — will be capable of designing and making things, Rose predicts. "You could ask a sufficiently powerful AGI [robot] to design a new battery and then manufacture it."

## Jobs lost: production-line workers, quality-control assessors, and machine operators

Adding AI to manufacturing robots — which do not demand pay rises or go on strike — has the potential to make millions of traditional manufacturing roles redundant.

Pascual Restrepo, associate professor at Boston University and an expert on industrial robots, points out that non-AI robots have already replaced between 6mn and 9mn manufacturing jobs, globally, since the 1980s. About 500,000 of these were in the US alone.

Now, most experts predict AI will lead to more jobs cuts in manufacturing. When technology leaders around the world were surveyed last year by recruitment company Nash Squared, they estimated that 14 per cent of jobs in manufacturing and automotive industries will be lost due to "automation" technologies, including AI, over the following five years.

Production-line workers, quality-control assessors and machine operators seem most at risk of being replaced by AI. Gabriele Eder, head of

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**Demand for such humanoid manufacturing robots is going to be "significant"**

manufacturing, industrial and automotive at Google Cloud, Germany, suggests that, in these areas, AI-powered machines and equipment can "often operate with greater precision and consistency than human operators" — requiring less human intervention in manufacturing processes.

"Our members are very much worrying [about AI taking their jobs]," says Kan Matsuzaki, assistant general secretary at IndustriALL, an international union representing more than 50mn workers in mining, energy and manufacturing. He adds, however, that his members acknowledge the possibility of AI bringing benefits, such as improving safety in manufacturing.

Training manufacturing workers in applying alongside AI could help them adapt and minimise job losses, but opportunities may be limited. "When you reach like 55 years old…can those workers be retrained to become [an] AI machine…specialist, for example?" says Matsuzaki "[It] is very difficult to do that."

## New jobs: machine monitors, robot programmers, digital champions, forensic AI scientists

However, some experts predict that AI will create more new jobs in manufacturing than it eliminates. They note that manufacturing companies are keen to hire, rather than fire, workers — but are hampered by a global shortage of people with manufacturing skills.

New AI-related manufacturing jobs will include running AI machines, monitoring their performance, programming robots, and working in "cross disciplinary teams" with equal expertise in data science and manufacturing, experts predict. At the same time, old jobs will change and become more tech-focused, rather than being replaced by AI, says Marie El Hoyek, an expert in AI and industrials at consultants McKinsey.

"Some of the manufacturing roles will need to evolve," she says. "I imagine [in the future] you would need digital champions who are core manufacturing people but know how to translate their needs and their work into digital language to the digital team and say 'this is what I need you to resolve'."

AI will increase demand for "forensic AI scientists", typically from a technology background, who analyse the performance of AI systems, says Cedrik Neike, chief executive of digital industries at German technology company Siemens. "[We] need to have experts which [understand] where things go wrong to fine tune them," he says.

How widely these AI systems are deployed remains open for negotiation, though. "The ultimate question is, who will benefit from this AI?" says Matsuzaki. "If you introduce AI and automation robot[s] in manufacturing workplaces…you can reduce your number of workers, which means the productivity will gain [and] profit will gain…But there's nothing for the workers."

# What does AI mean for a responsible business?

*How to navigate the opportunities and challenges posed by a technology few can afford to ignore*

Sarah Murray

It was what many called an iPhone moment: the launch in late 2022 of OpenAI's ChatGPT, an artificial intelligence tool with a humanlike ability to create content, answer personalised queries and even tell jokes. And it captured the public imagination. Suddenly, a foundation model — a machine learning model trained on massive data sets — thrust AI into the limelight.

But soon this latest chapter in AI's story was generating something else: concerns about its ability to spread misinformation and "hallucinate" by producing false facts. In the hands of business, many critics said, AI technologies would precipitate everything from data breaches to bias in hiring and widespread job losses.

"That breakthrough in the foundation model has got the attention," says Alexandra Reeve Givens, chief executive of the Center for Democracy & Technology, a Washington and Brussels-based digital rights advocacy group. "But we also have to focus on the wide range of use cases that businesses across the economy are grappling with."

The message for the corporate sector is clear: that any company claiming to be responsible must implement AI technologies without creating threats to society — or risks to the business itself, and the people who depend on it. Companies appear to be getting the message. In our survey of FT Moral Money readers, 52 per cent saw loss of consumer trust as the biggest risk arising from irresponsible use of AI, while 43 per cent cited legal challenges.

"CEOs have to ensure AI is trustworthy," says Ken Chenault, former chief executive of American Express and co-chair of the Data & Trust Alliance, a non-profit consortium of large corporations that is developing standards and guidelines for responsible use of data and AI.

"AI and machine learning models are fundamentally different from previous information technologies," says Chenault. "This is a technology that continuously learns and evolves, but the underlying premises must be constantly tested and monitored."

Some have warned that inappropriate use of AI technologies could prevent companies from meeting their promises around social and environmental challenges — not least because of AI's hefty carbon footprint, which arises from the energy consumed in training chatbots or producing content.

A 2020 analysis conducted by the journal Nature found that high energy use, along with a lack of transparency and poor safety and ethical standards, could cause AI to erect obstacles to meeting 59 of the 169 targets in the UN's Sustainable Development Goals.

> **This is a technology that continuously learns and evolves, but the underlying premises must be constantly tested and monitored.**

However, the Nature research also brought positive news: that AI could help progress towards 134 of the SDG targets by enabling innovations in areas from sustainable food production to better access to health, clean water and renewable energy.

With its ability to analyse millions of data points at speed and to identify patterns that humans would miss, AI can certainly help to drive positive impact.

For example, by creating "digital twins", it can analyse data from sensors, along with historical and real-time data, to find energy and other efficiencies in building systems. It also offers speed in the development of everything from life-saving drugs to alternative materials for electric vehicle batteries that could reduce reliance on scarce resources such as lithium.

Some see AI as supercharging progress on climate goals through everything from enhancing electric grid efficiency to applying analytics to satellite imagery to map deforestation and carbon emissions in real time.

"It's a very big deal," says Mike Jackson, managing partner at San Francisco-based Earthshot Ventures, which invests in climate tech start-ups. "Things are going to change much faster than people realise — and that's going to be a significant boon for the climate."

With AI holding both promise and peril, the challenge for companies across all sectors will be to temper the instinct to race ahead with appropriate caution. Businesses will need to commit to thorough testing of AI models, and introduce policies and procedures to address risks of accidental harm, increased inequity and something every organisation fears: loss of control.

## Executives agree that businesses must start taking AI risks more seriously

Responses to the statement: 'Businesses are not taking the ethical impacts of AI technology on society seriously enough' (%)
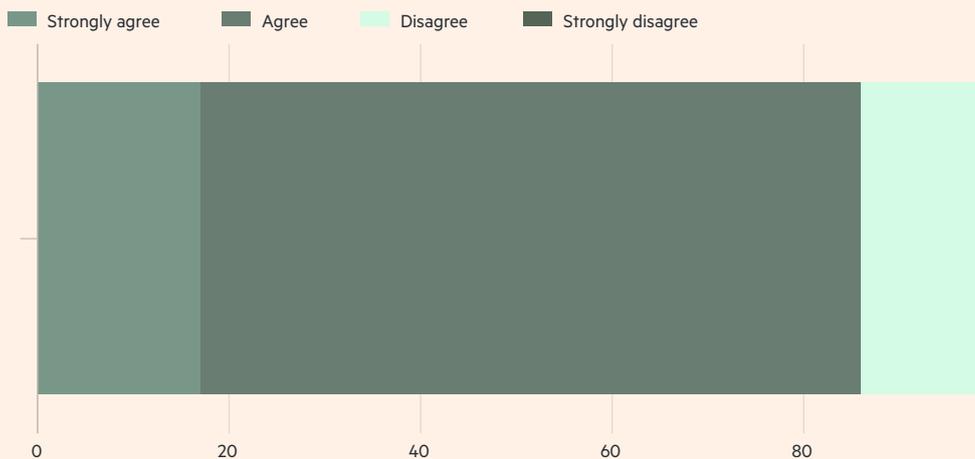


Source: Gartner
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## Handle with care

In 2023, New York lawyer Steven Schwartz was ridiculed in court when it emerged that his brief included fake citations and opinions generated by ChatGPT. For Schwartz, the revelations were deeply embarrassing. But they also raised awareness of the fact that AI programs can make glaring errors, something that is worrying when considering their possible use in industries such as nuclear power or aviation, where mistakes can be fatal.

Even where physical safety is not at risk, AI can introduce bias into decisions such as who to hire, who to arrest or who to lend to. In healthcare, concerns range from data breaches

to relying on models trained on data sets that ignore marginalised communities.

For companies, among the biggest risks of getting it wrong is losing public trust. When KPMG polled 1,000 US consumers on generative AI, 78 per cent agreed on the responsibility of organisations to develop and use the technology ethically — but only 48 per cent were confident they would do so.

"You're going in with a level of scepticism," says Carl Carande, US head of advisory at KPMG. "That's where the frameworks and safeguards are critical."

Approaches to AI governance will vary by sector and

company size, but Carande sees certain principles as essential, including safety, security, transparency, accountability and data privacy. "That's consistent regardless of whatever sector you're in," he says.

In practical terms, a responsible approach to AI means not only creating the right frameworks and guidelines but also ensuring that data structures are secure, and that employees are given sufficient training in how to use data appropriately.

But responsible AI does not always mean reinventing the wheel. The UN Guiding Principles on Business and Human Rights provide a ready-made means of assessing AI's impact on individuals and communities, says Dunstan Allison-Hope, who leads the advisory group BSR's work on technology and human rights.

"There's been all kinds of efforts to create guidelines, policies and codes around artificial intelligence, and they're good," he says. "But we suggest companies go back to the international human rights instruments and use them as a template."

Some have not yet implemented any governance structures at all. While 30 per cent of FT Moral Money readers said their organisations had introduced enterprise-wide guidelines on the ethical use of AI, 35 per cent said their organisations had not introduced any such measures.

Reid Blackman, founder and CEO of Virtue, an AI ethics consultancy, sees no excuse for inaction. A rigorous approach to AI does require companies to make change,

which takes time and effort, he says. "But it's not expensive relative to everything else on their budget."

While some might turn to the services of consultancies like Virtue or products such as watsonx.governance, IBM's generative AI toolkit, another option is to build internal capabilities. This was the approach at Walmart, which has a dedicated digital citizenship team of lawyers, compliance professionals, policy experts and technologists. "Given our scale, we often build things ourselves because the bespoke model is the only one that's going to work for our volume of decision making," says Nuala O'Connor, who leads the team.

Whether turning to internal or external resources, there is one element of a responsible approach to AI that so many agree on it has its own acronym: HITL, or human in the loop — the idea that human supervision must be present at every stage in the development and implementation of AI models.

"Let's not give up on human expertise and the ability to judge things," says Ivan Pollard, who as head of marketing and communications at The Conference Board leads the think-tank's development of online guidance on responsible AI.

For Walmart, putting humans front and centre also means treating AI systems used for, say, managing trucks and pallets differently from AI programs that can affect the rights and opportunities of employees. "Those tools have to go through a higher order of review process," says O'Connor.

## Many companies have been slow to develop internal AI rules

'Is your company planning to enact rules or guidelines regarding the ethical and responsible use of AI?' (% of responses)



Legend:
- Already have policy in place
- Yes, but no timeline in place
- Yes, in the next 12 months
- No, we have no plans
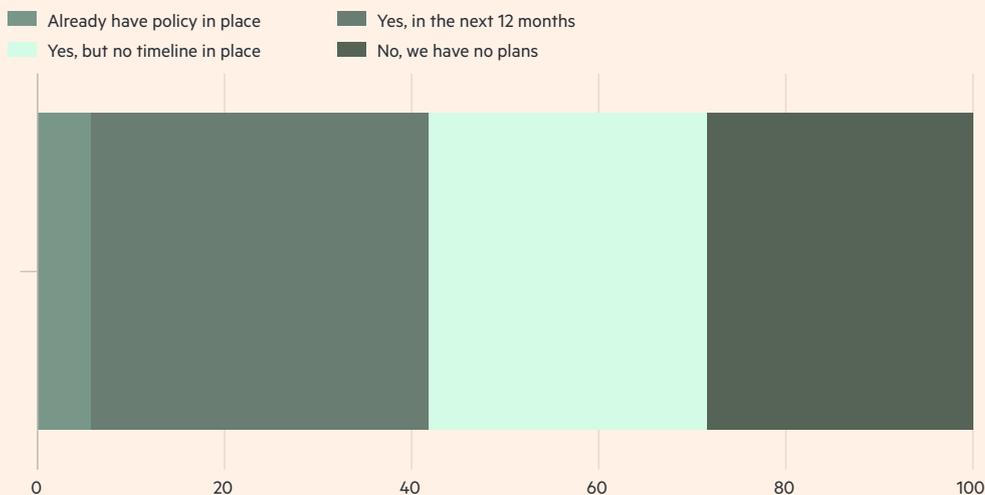
Source: Conversica
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## A vendor in the loop

If companies are still grappling with how to manage AI responsibly, their efforts must extend beyond their own four walls. "The vast majority of companies won't develop their own AI," says Chenault. "So they need to ensure they have the right governance and controls in procurement."

Without these controls, the exposure is both legal and reputational, says Reeve Givens from the Center for Democracy & Technology. "This is a hugely important piece of the AI governance puzzle — and not enough people are thinking about it," she says. "Because it's the downstream customers that will have the most at stake if something goes wrong."

Not all organisations appear to be aware of this. When ranking the risks posed by the adoption of AI and big data, only 11 per cent of the 976 institutional investors polled in a 2022 CFA Institute survey highlighted reliance on third-party vendors.

It was for this reason that one of the first publications of the Data & Trust Alliance was a guide to evaluating the ability of human resources vendors to mitigate bias in algorithmic systems.

The evaluation includes questions on the data that vendors use to train their models and steps taken to detect and mitigate bias, as well as measures vendors have put in place to ensure their systems perform as intended — and what documentation is available to verify this.

The alliance focused on HR vendors for the guidance because many companies' first foray into AI is for recruitment purposes. "But those guidelines could be adopted for other tech vendors," says JoAnn Stonier, a member of the Data & Trust Alliance leadership council and chief data officer at Mastercard, which helped develop the guidelines.

"When we're using third-party vendors, we interrogate them heavily," she says. "Because we're ultimately responsible for the outcome of their solutions."

To make things even more complicated, because AI technologies learn and evolve, vendors cannot know what will happen to their models when trained on the data sets of their clients.

This means that vendor-customer partnerships need to be far more collaborative and long-lasting than in the past. "That will change the supply chain relationship," says Reeve Givens. "They have a shared responsibility to get this right."

## IT professionals think health is the key area for AI ethics

'Which of these areas do you think should take priority in establishing ethical standards for AI' (% responses)



Legend: ■ %

| Category | % |
| --- | --- |
| Health and care | ~24 |
| Defence | ~16 |
| Criminal justice | ~13 |
| Banking & financial services | ~13 |
| Education & skills | ~12 |
| Creative industries & intellectual property | ~10 |
| Environment & sustainability | ~3 |
| Transport | ~1 |
| Other | ~8 |
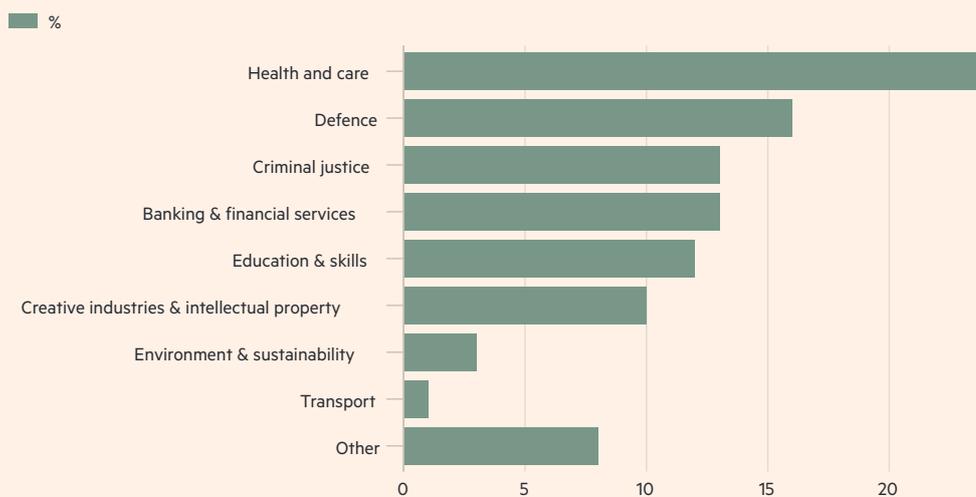
Source: BCS, The Chartered Institute for IT
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## Watchful eyes

Companies may be trying to demonstrate that they can be responsible stewards of AI technologies. But governments are not leaving it to chance. In fact, for once policymakers seem to be acting relatively swiftly to bring order to an emerging technology.

First out of the regulatory gate was the EU, which in December agreed on its wide-ranging Artificial Intelligence Act, which many see as the world's toughest rules on AI.

While the UK's version is still a work in progress, the AI Safety Summit, convened by Prime Minister Rishi Sunak in November, sent a signal that regulating the technology would be taken seriously.

A month earlier, US President Joe Biden sent a similar message in an executive order directing government agencies to ensure AI is safe, secure and trustworthy. "To realise the promise of AI and avoid the risk, we need to govern this technology, there's no way around it," Biden said at the time.

The desire to create safeguards around AI technologies has even prompted a rare moment of collaboration between the US and China. In January, Arati Prabhakar, director of the White House Office of Science and Technology Policy, told the Financial Times that the two countries had agreed to work together on mitigating the risks.

"All around the world we're seeing policymakers feel the need to respond," says Reeve Givens. "I haven't seen a moment that is as concentrated as this AI policy moment."

However, she also points to gaps, particularly on standards. "We can't expect the average manager of a factory or supermarket chain to run a deep analysis on how an AI system is working," she says. "So what is the approach to certification? That's a massive global conversation that needs to happen."

Debates continue over whether new regulations are either appropriately tough or risk stifling innovation. Meanwhile, it appears that they have not yet had much impact on corporate behaviour, at least among FT Moral Money readers, 92 per cent of whom said they had not had to change their use of AI to meet emerging regulations or standards.

Yet there are signs that, having failed to act to prevent the worst effects of social media, policymakers are determined not to let the same thing happen with AI.

"If we let this horse get out of the barn, it will be even more difficult to contain than social media," Richard Blumenthal, the Democratic senator from Connecticut, said in his opening remarks at a December hearing on AI legislation.

## Transparency is investors' top AI concern

'What risks or governance issues, if any, does your organisation face in adopting AI and/or big data?' (% responses)

**■ %**

| Category | Value |
|---|---|
| Transparency of algorithms | ~64 |
| Intellectual property protection | ~63 |
| Operational risks | ~49 |
| Compliance risks | ~38 |
| Data protection & privacy | ~36 |
| Reliance on third-party vendors | ~11 |
| No risks in these areas | ~1 |

Source: Survey of 976 institutional investors conducted by Coalition Greenwich for the 2022 CFA Institute Investor Trust Study
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## Investing with an AI lens

Regulators are not alone in keeping a watchful eye on how companies use AI. Investors are also starting to ask tough questions. For asset managers and asset owners, responsible AI is partly about building internal governance systems. But it also means finding out whether the companies in their portfolios are using AI responsibly — particularly when investors are applying environmental, social and governance criteria to those portfolios.

"In pretty much every ESG conversation I have, AI is a topic," says Caroline Conway, an ESG analyst at Wellington Management. "And mostly what I'm trying to get at is governance — how well the company is doing at managing the risk, pursuing the potential benefits and thinking about the trade-off between benefit and risk at a high level."

Yet if FT Moral Money readers are anything to go by, it is early days for investors: only 19 per cent who identified as corporate executives said investors were asking their company about the use of AI. And 63 per cent of investors in the same survey said AI use did not affect decisions on whether or not to invest in companies.

The responses are perhaps unsurprising given the difficulties investors face in assessing the risks AI poses to portfolios. "They are seeking basic understanding of how it can be used, which few of them and us truly have, to be honest," one reader told us.

To help investors navigate this new risk landscape, a group of asset managers has formed Investors for a Sustainable Digital Economy, an initiative to pool resources and generate research on digital best practices in asset management. Members include Sands Capital, Baillie Gifford, and Zouk Capital and asset owners such as the Church Commissioners for England.

Karin Riechenberg, director of stewardship at Sands Capital, suggests investors start by identifying high-risk sectors, which range from technology, healthcare, financial services to hiring and defence. Then, she says, they should identify high-risk use cases — those where AI will have a significant impact on aspects of people's lives, such as credit scores, safety features in self-driving cars, chatbots and surveillance and hiring technologies.

"It's important to look at each company individually and ask what AI tools they are using, what they are intended for and who might be affected by them and how," she says.

## Serving people and planet

If AI technologies are helping to measure social and environmental impact, they are also enabling innovators to create businesses that drive positive change in everything from healthcare to clean technology.

"We see it as a really amazing tool for engineers," says Jackson of Earthshot Ventures. "It allows us to tease out correlations, to run through millions of simulations much faster and to model things in software before building them in hardware or biology."

Given these capabilities, it is no surprise that AI technologies are permeating the portfolios of impact-focused venture capitalists and accelerators.

Jackson says AI is being used by almost every company in its portfolio and is at the core of the strategy for at least one-third. The same is true of the portfolio companies at Hawaii-based Elemental Excelerator, says Dawn Lippert, its founder and CEO.

Jackson points to Mitra Chem, which is using machine learning to speed up the development of the iron-based cathode materials needed in energy storage and transport electrification. The company says its technology and processes cut lab-to-market time by about 90 per cent.

Also in the portfolio is California-based KoBold Metals, backed by Bill Gates and Jeff Bezos. The company uses AI to scrape the world's geological data (even including old hand-painted maps on linen) and deploys algorithms to find deposits of minerals such as lithium, nickel, copper and cobalt.

"To facilitate the transition to electric vehicles, we're going to need to find a lot more of these resources," explains Jackson. "Through that ingestion of a tremendous amount of data, AI is helping predict where these resources might be."

Decarbonising the economy also involves making better use of existing resources — something AI technologies are particularly good at.

The technologies can be used to optimise energy use in buildings or adjust traffic lights to keep cars on the move rather than idling. "AI technologies find those marginal gains — and they find so many of them that the cumulative value is massive," says Solitaire Townsend, co-founder of sustainability consultancy Futerra.

AI can also help keep valuable resources in circulation for longer. For example, San Francisco-based Glacier, one of Elemental's portfolio companies, is using AI technologies to bring greater efficiency and precision to waste sorting, a job for which it is hard to find human workers.

Equipped with computer vision and AI, its robots can identify and remove more than 30 recyclable materials from general waste at 45 picks per minute, a speed far greater than even legions of human workers could achieve. "Recycled aluminium, for instance, generates about 95 cent per cent fewer emissions than new aluminium," says Lippert, who is also founding partner at Earthshot Ventures. "So it has a huge climate impact."

By enabling new efficiencies, AI is also spawning a generation of young businesses that aim to expand access to essential services. At 25madison, a New York-based venture capital firm, the portfolio includes companies in the healthcare sector that are using AI to drive operational efficiency.

They include Midi, a virtual clinic specialising in perimenopause and menopause that uses AI to manage patient records and billing. The start-up aims to fill the large gap in access that women have to this kind of care, explains Jaja Liao, a principal at 25m Ventures, a fund at 25madison that invests in early-stage companies.

She says AI relieves specialists of time-consuming administrative tasks allowing them to spend more time with patients. "That's how they make care more equitable."

As these and other companies are demonstrating, AI technologies can be used for good. But as is the case with KoBold Metals, now valued at $1.15bn, using AI to benefit people and the planet can also create highly successful businesses.

## Moving fast and slow

AI may be ushering in an exciting new era in technological innovation and potential solutions to social and environmental challenges. But as the University of Oxford's Colin Mayer points out, it is also a gold rush with similarities to previous booms.

"At the moment it's clear the motive is to become as profitable as possible," says Mayer, who has spent many years exploring the purpose of business. "The only way to solve this is to align the interests of companies with what we as humans and societies want."

But with corporate leaders anxious to seize opportunities ahead of the competition, is this alignment possible? "There's pressure to get it done first," says The Conference Board's Pollard. "But with that comes risk — the risk of doing the wrong thing with the wrong tool in the wrong way."

And while many organisations have appointed chief ethics officers to maintain ethical behaviour and regulatory compliance, they may need to go further. One solution, says Virtue's Blackman, is to put someone in charge of responsible approaches to AI. "If you're the chief innovation officer, you want to move fast, but if you're the chief ethics officer, you don't want to break things — so there's tension," he says. "Someone with a dedicated role doesn't have that conflict of interest."

And while large, well-established companies may need to do some organisational retrofitting to put appropriate guardrails around their use of AI, young companies have an opportunity to get it right from the start.

This is something Responsible Innovation Labs, a coalition of founders and investors, is promoting among the next generation of high-growth tech companies. "Responsible AI should be an essential mindset and operating norm in the earliest stage of company building," says Gaurab Bansal, executive director of the San Francisco-based non-profit.

For Bansal, the right approach is to assess the potential impact of products and technologies on customers and society more broadly. "We think responsible innovation is about designing and accounting for that," he says. "It's not about putting your head in the sand or worrying about it some other time."

Unfortunately, as sluggish progress on meeting climate goals has shown, putting its head in the sand is something business does all too well. The question is whether it will take the same approach with AI. Or can capitalism harness AI for good and use awareness of its risks to prioritise long-term thinking over short-term gain?

So far, the jury is out. Yet there is a sense that, at this early stage of what is expected to be the next great tech revolution, this is a moment when it is still possible to get the governance right.

"We'll constantly have to tweak it," says Riechenberg at Sands Capital. "But if we start doing that now, we have the potential to make the most of this technology — to control it and not be controlled by it."

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