

Think _
Feel..._
Do...



The Future Disruption Essay Series

Contents

Foreword

Quantum

Artificial Intelligence

Robotics

Digital Twins

Software

Cybersecurity

Renewable Energy

Green Tech

Space Tech

Biotech

Contact

1

3

9

15

23

29

35

41

47

53

59

65

Introducing

The Future Disruption Essay Series

The world is going through an accelerated pace of change, innovation, and disruption. We are witnessing what sometimes feels like constant and fairly fundamental shifts in how we live and work, driven by technologies once confined to science fiction. And communicating those innovations has become more and more complex.

That’s why, to celebrate TFD’s 10-year anniversary, we wanted to spotlight ten dynamic and disruptive technology areas, turning our lens toward some of the innovations that will shape the next decade. It’s the Think part of Think, Feel, Do - constantly challenging ourselves, passionate about tech, and wanting to understand more to communicate tech in an accessible way.

With this in mind, we are thrilled to announce the release of The Future Disruption, a series of essays about the technological innovations that will define humanity’s next chapter: digital twins, robotics, cybersecurity, space tech, green tech, software, quantum, AI, renewable energy, and biotech.

We wanted to provide a clearer understanding and deeper engagement with these complex topics. We hope this sparks meaningful conversations, provides fresh insights, and inspires your own innovation journey.

A lot of insights from brilliant experts have gone into each essay. We connected with some of the brightest minds working at the frontier of technology innovation, offering you a unique view of what the future might look like in deep tech.

We are particularly excited to have collaborated with Jane Wakefield, freelancer and former BBC tech journalist.

We embarked on this project with Jane, whose extensive expertise and background in technology journalism made her the ideal partner. Her ability to translate complex technical concepts into accessible and engaging narratives has been invaluable in each of the interviews and in shaping this series.

The journey of innovation is a continuous one, and we believe that sparking conversations and challenging conventional wisdom are vital to progress. We invite you to share your thoughts, challenge perspectives, and contribute to the ongoing dialogue about the future of disruptive technologies and their applications.

We are incredibly proud of this essay series. I hope you enjoy reading it as much as we loved developing it.

Thank you for coming on this journey with us.

Here’s to the next 10 years of innovation.



Stephanie Forrest,
CEO and Founder, TFD

Quantum 01

How close are we to a quantum future?

The promise of quantum computing is huge. Such machines could, in the words of physicist and cosmologist Stephen Hawking, “tackle the last frontier of complexity”.

That could mean a solution for some of the biggest challenges facing the world, from climate change to personalised medicine and more efficient ways to grow food and provide energy.

But how far away are we from that being a reality? Every week seems to bring a quantum announcement from either Google, IBM, or Amazon about how powerful their machines are getting in the race towards quantum supremacy, but what does this really mean?

The truth is that, for many, quantum remains a complete mystery. A technology they may have heard of but almost certainly would not be able to explain.

To help unpick what quantum is and where it is going, we spoke to **Ilyas Khan**, Founder and Chief Product Officer of **Quantinuum**, the world's largest integrated quantum company.

A quantum computer is built not from bits that make up digital code but by harnessing the principles of quantum mechanics and the strange properties of sub-atomic and atomic particles.

“A quantum computer is computing in a natural way. All of the machines that we use right now are contrived. They are based on ‘first-order logic,’ which doesn’t exist in nature,” Khan told TFD.

Or, as Google’s head of quantum puts it, quantum is “the operating system of nature”.

While binary code stores information as either a one or a zero, sub-atomic particles can do either or both. This translates into machines capable of doing calculations that would take a classical machine many millions of years in mere minutes.

And right now, we are at a major tipping point, Khan told TFD.



Ilyas Khan,
Founder & Chief Product Officer,
Quantinuum

“If somebody somewhere can generate a topological qubit at scale, then that is game over for everyone.”

Transforming Biology

“For a quantum computer to have an impact, it has to be incapable of being simulated classically,” he said.

In early 2025, Quantinuum announced that data generated from quantum computers can now **be used to train AI systems**, while US start-up D-Wave Quantum demonstrated how its new quantum machine can **outperform one of the world’s most powerful supercomputers**.

“A quantum computer on its own will be useful in high-energy particle physics and condensed matter, which are the building blocks for many, many things we do,” said Khan.

But the real breakthrough will come when AI and quantum can be combined, he explained.

“A large language model with a quantum computer will have an enormous impact on the things that matter, such as biology, gene therapy, drug delivery and material discovery. There’s nothing bigger than biology. If we could live longer with dignity, if we could treat disease at the source rather than symptoms, if your medicine was different from mine. Then that affects society at a fundamental level.”

He envisages data centres that have both a supercomputer and a quantum machine using powerful AI working side by side, and he predicts this will be a reality in less than two years.

What a quantum computer will not do is replace the desktop machines that we all use in our daily lives because, as Khan puts it, “they are perfectly good for Zoom and YouTube and Excel spreadsheets and email and many, many other things”.

Size Matters, but What You Do with It Matters More

Google, IBM, Amazon, Microsoft, and a range of start-ups are all engaged in a race to build the most powerful quantum computer. In December 2024, Google unveiled a quantum chip called Willow, which it said **could solve a problem in five minutes that would take the world’s fastest supercomputer ten septillion years**. But that does not mean it is ready for the commercial world.

While the big tech firms may boast about developing machines with more and more qubits, the key to commercial success will only come when those qubits can be controlled and are error-free.

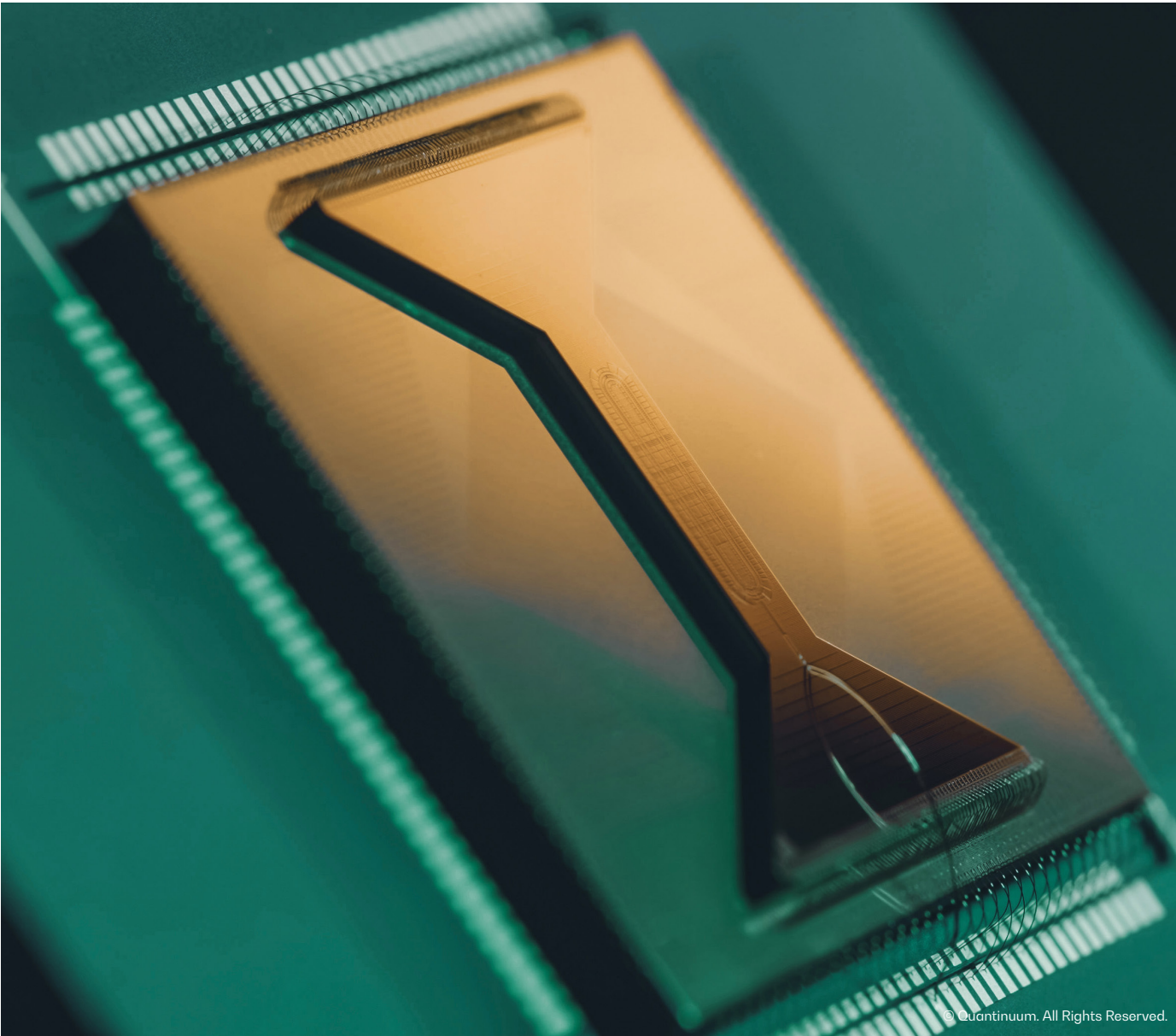
“There are many different methods of generating a qubit and manipulating it. It could be an atom, it could be an electron, it could be a photon,” said Khan.

“The announcements you will have seen from Microsoft, Google and more recently AWS, say ‘If we were to have a qubit, here’s how we would control it.’”

Noise from the environment is “the biggest enemy of a qubit”, said Khan. But there could be one breakthrough in the next decade that could solve this specific problem and turn the industry on its head: a topological qubit.

“If somebody somewhere can generate a topological qubit at scale, then that is game over for everyone,” he said.

“A topological qubit is born deaf. It is impervious to noise. If you collected 100 quantum computing experts and forced them to go through an honesty machine, everyone would agree that a topological qubit is perfect. The challenge is that it is very hard to create.”



Switching to Quantum

Despite the challenges associated with the technology, huge progress has already been made.

“90% of quantum machines are outside of the lab and within commercial organisations. Four years ago, we could not have said that, but it is certainly the case now,” he told TFD.

The appetite for investors has also grown. What used to be the preserve of government and university funding is now seeing much more private capital flow in.

All of which means that the big tech firms may need to reassess where they are putting their money, thinks Khan.

“When we listen to Sam Altman and Elon Musk, they point to the things that AI will impact, and it ends up making our climate and our planet better and making us healthier. And those can’t be done with classical computers,” he said.

“They’re investing so much in AI that they will get to the point at which they will have to switch to quantum.”

“Pharmaceuticals will be at the forefront, and then energy companies would be next, and then finance. These are the three areas where there is strong consensus that quantum will be almost existentially important to them.”

A New Era of Security

One of the biggest concerns about quantum is how it will affect the security of computer systems and critical infrastructure because a quantum machine would be able to break traditional encryption methods that currently keep much of our digital world safe.

Already, start-ups specialising in cybersecurity have begun integrating quantum-safe algorithms into their existing platforms, and back in 2022, the US National Institute of Standards and Technology (NIST) began standardising post-quantum cryptographic algorithms.

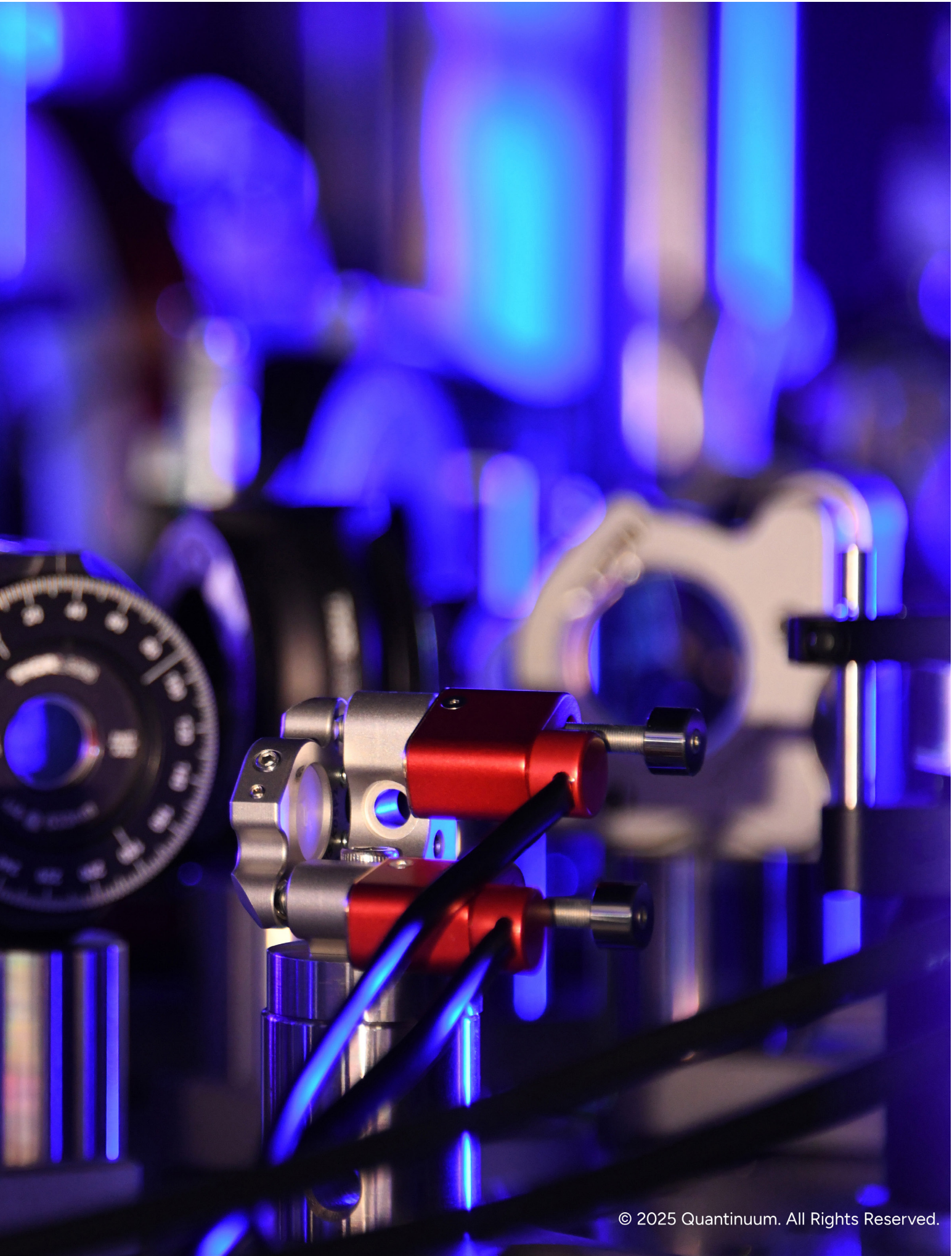
Businesses are being urged to assess their encrypted assets and consider how to make them quantum-safe.

Khan sees no reason to panic.

“There will be algorithmic methodologies that are impervious to a quantum machine, although I pause on that because how many times have we heard that new code is impervious and five years later someone cracks it? So I think that cycle will continue. But I am less worried about it, and I think we have enough time to be able to prepare ourselves.”

Plus, he said, the bigger picture for quantum outweighs any near-term fears.

“I actually think that this is overblown. In 100 years’ time, no one is going to say a quantum machine could break RSA-2048 (an infamous cryptographic algorithm), but they will say – oh wow, we are able to edit and manipulate our genetic code so we can solve oncologies or senility.”



© 2025 Quantinuum. All Rights Reserved.

An Industry in Preparation

In the near term, the quantum industry is in preparation mode.

“The analogy I always use is that of the mobile telephone. The car phone made a sudden appearance, and it was pretty much overnight in late 1988, early 1989. You could go along and have it installed in your car. But the fact of the matter is, however, that for a couple of years prior to that, the relay signals, the transmission towers, the handsets, the mechanics, the battery, someone somewhere was developing and making them. Suddenly, within a year, you had this industry which didn’t exist before.”

When the quantum industry is ready for that leap, where does he see it impacting first?

“Pharmaceuticals will be at the forefront, and then energy companies would be next, and then finance. These are the three areas where there is strong consensus that quantum will be almost existentially important to them.”

Explore TFD’s Quantum Collective and discover valuable insights for quantum communications.

Artificial Intelligence

02

Where will AI take us next?

Whatever the next ten years bring in the world of tech, artificial intelligence (AI) will likely be at the heart.

According to **Microsoft**, 75% of workers who share information as part of their job are now using AI to help them. Consultancy **Deloitte's consumer trend research** found that more than 18 million people in the UK alone have used a large language model such as ChatGPT or Gemini.

From healthcare to government, finance to fishing, AI is changing the way society is shaped. Few companies will get far without adding an AI component to what they are offering.

Trying to understand how AI will change in the next decade could be considered a fool's errand, given the leaps the tech has taken since ChatGPT burst onto the scene in 2022. Large language models (LLMs) are changing the way we interact with content. AI in healthcare is speeding up drug discovery. AI vision enables self-driving cars, interprets geospatial data from satellites, and allows farmers to predict what crops will fail. And these are just some of the many use cases that exist today, while hundreds more are yet to emerge.

With the advent of AI being driven by businesses and consumers alike, to understand what the next ten years could look like, we sat down with **Daniel Verten**, Head of Strategy at **Synthesia**. One of the UK's leading AI start-ups with a valuation of over \$2.1bn, Synthesia turns text into AI-generated videos in over 140 languages, and has been adopted by major global organisations including Reuters, Zoom, and Heineken. In addition to his role at Synthesia, Verten serves as a member of the World Economic Forum's AI Governance Alliance, which is committed to fostering inclusive, ethical and sustainable AI, giving him an important perspective on the technology's potential and the hurdles that must be overcome.

For Verten, AI video has almost limitless potential.

"The interesting thing about turning video production into a software-only process is that it allows you to create new formats and experiences that previously were not possible. AI is driving a fundamental shift in how we produce and consume video," he told TFD.

Clients ranging from big corporations to smaller businesses use Synthesia to create video content and avatars for use in a range of scenarios: training videos, chatbots, product demos or ads. For example, PepsiCo created an avatar of footballer Lionel Messi and used it to send personalised messages to fans in up to 10 languages.



Daniel Verten,
Head of Strategy, Synthesia

“The interesting thing about turning video production into a software-only process is that it allows you to create new formats and experiences that previously were not possible. AI is driving a fundamental shift in how we produce and consume video.”

Creating Hollywood-quality Content on Your Laptop

When it comes to how AI video will develop in the next ten years, Verten acknowledges the speed of change.

“I’ll be very honest, I have no idea because we haven’t invented it yet.”

He does, however, have one bold prediction.

“Just as the internet went from being static web pages to a full multimedia experience, so too will AI video. I’d say that on a five-year horizon, anyone with a laptop and their imagination will be able to create Hollywood-grade content on their laptop from their work desk.”

And if that sounds disruptive, then he is drawing reassurance from the past.

“It’s useful for us to study history and look at previous platform shifts. The first digital cameras were invented in 1975, but it took 14 years for the first commercially available digital camera to hit the market. While most people think that new technologies replace old ones, that’s not actually the case. What really happened is the per-minute cost of analogue film fell to about \$5, and that allowed the market to expand exponentially because all of a sudden more people were able to afford a camera.

“The same thing is happening with AI video – instead of a few select people with access to expensive filming equipment being the only ones able to create high-quality content, I believe AI will democratise content creation, not replace it.”

Post-truth Era

This is the optimist’s view, but many more are pessimistic about where the new age of AI-based content creation will take society. Already, deepfakes have been used to scam people, create pornography (including images of child abuse), and disrupt democracy.

One new trend is the stream of so-called “AI slop” that is filling social media channels. Some are clearly fake videos, such as whales flying through space. Others are more ambiguous, like a polar bear being hauled onto a fishing boat. Comments below such videos suggest that, as a society, we are already facing a new digital divide – between those who believe what they see and those who are starting to view all content with a critical eye.

“Education will be key,” said Verten, as we enter what some have called the post-truth era.

“At the start of the conflict in Ukraine, someone created a deepfake of President Zelensky and hacked broadcast TV stations and distributed the video on those channels. But it was actually debunked by the public in five minutes, and President Zelensky shot a video of himself and put it out, saying the other one was not me. With proper digital literacy and public education, many of the risks can be mitigated.”

He does think it is important that people play around with the tools.

“I think as long as it is harmless, I actually see it as a good thing. Because one of the novel things about generative AI is that you can get started right away and experiment with it. And that helps educate the public on some of these new technologies in a playful way,” he said.





Consent, Control and Collaboration

Deepfakes for more nefarious purposes will need tough regulation, and already we are seeing nations outlawing the making of deepfake pornography or images of child abuse, he said.

Ethics has always been a watchword in the world of AI, although finding international agreement on what that means, and making sure the tech giants have appropriate guardrails, is less easy to enforce.

There have been disturbing reports of AI chatbots calmly telling a man the best method by which he could kill himself, just one of many shocking examples of how AI may be running wild.

Verten thinks that AI systems, whether developed by big tech companies or start-ups, need ethical principles at their heart, and in the case of Synthesia, this is a simple mantra: consent, control, and collaboration. Consent means no AI avatar is created without the consent of the person whose likeness is being used. Control means that no one can create a video that is against the firm's terms of service, and collaboration sees the firm partnering with governments and organisations

such as the World Economic Forum to “help build a healthier media ecosystem”.

In a world where our images could become like a form of currency, Verten thinks that change is afoot.

“I do believe that we will have to bring regulation into this new age and give people protection and agency over their likeness.”

Some of the technical solutions being mooted are more sensible than others, and he is not a fan of the move to digitally fingerprint all AI-generated content.

“I think that is a ludicrous exercise. What we should do is exactly the opposite and start to tag trusted sources, such as the BBC, with a cryptographic signature.

BBC Verify uses this already, so I can be 100% sure that the content came from the BBC and was not generated by someone else.”

In future, Verten thinks that all politicians and business leaders will get their own cryptographic signature to validate content they are sharing.

Will AI Outperform Humans?

One of the biggest worries around AI, as it increasingly makes work more efficient, is how quickly it will render human workers redundant. Again, the world is firmly divided between those who see the age of AI leading to mass job losses and those who see it working in harmony with humans for many decades to come.

A report from The Institute for Public Policy Research predicted that eight million UK jobs alone could be lost to artificial intelligence in a “jobs apocalypse”, while Bill Gates said that advances in AI mean that we will no longer need humans “for most things”.

Verten takes a more optimistic view.

“60% of the jobs that we do today did not exist in 1940. It’s always easier for us to think about the jobs that might get disrupted. It might be a bit of a cliché, but you’re not going to be losing your job to AI, you are going to be disrupted by another human who knows how to use these AI tools.”

One big question being asked currently is how advanced those AI tools will get, and there are mutterings that the leaps Generative AI has made in the last three years may soon hit a wall.

Verten doesn’t agree.

“Once Apple sold iPhones to a billion people, the improvements became incremental, but we are very, very far from that in AI. So I think that we are very far from the point where it starts to plateau.”

Creative Potential

The billion-dollar question in the AI world is when and if we will get to a point of Artificial General Intelligence (AGI) where an AI is as intelligent as a human, and able to multitask in the way people do. This has been the holy grail for AI for many decades. Google DeepMind CEO, Demis Hassabis, said such a system could exist by 2030.

Verten prefers not to speculate on this but is characteristically optimistic about the future of AI-generated video.

“What I’m super excited by, and one of the reasons that I get out of bed in the morning, is the new formats and creativity that AI video will unleash. Similarly to when we got smartphones, people started to experiment with all sorts of weird and fun ways to express themselves. Seeing that creative energy and being able to enable creativity for so many more people, I find it magical and really, really exciting in the next few years.”

Curious about TFD’s work in AI tech? [Learn more about our AI Collective](#)



“Instead of a few select people with access to expensive filming equipment being the only ones able to create high-quality content, I believe AI will democratise content creation, not replace it.”

Robotics

03

Robots are coming – progress or peril?

Robots have fascinated humans throughout history. Back in the 18th century, the “Automaton” attracted huge crowds at exhibitions across Europe as it seemed to outwit human chess players. It was later exposed as a hoax – a person was moving the pieces beneath the table.

Even in modern day, things aren’t always what they seem. In 2021, Elon Musk showed off his new Tesla robot, which turned out to be a man in a robot suit. Subsequent demos of the Tesla Optimus in 2024 turned out to be remotely operated.

But among the flashy faux demos, there have been some incredible breakthroughs. Millions of people have watched videos of Boston Dynamics’ Atlas robot jumping on tables and performing backflips, while a video from Chinese robotics firm, Unitree, showed a humanoid robot demonstrating Kung Fu skills.

Robots are already standard in factories, warehouses, and even hospitals. But what industries will be disrupted next? Will we see them in our homes? And what are the obstacles that we need to clear for us to benefit from, and live in harmony with, these intriguing machines?

In this essay, TFD spoke to **Mike Lawton**, Co-Founder and Director of **Oxford Dynamics**, an AI and robotics company, about how he sees the future playing out.

The industry has come a long way in a short time, he told TFD.

“We have been working seriously in robotics for about 70 years, and of course, part of that time has been without advanced electronics. Now, we have some absolutely phenomenal computing power. We have a much better understanding of control loop algorithms (the feedback systems that allow robots to adjust their actions in real time based on sensor input). We have pretty much overcome the mechanics of getting robots to move in exquisitely elegant ways,” he said.

The real challenge over the next decade will be working out “how we get them to behave properly and reliably in a very controlled way”.

This means learning to navigate unstructured environments like homes, which might have objects in unexpected places.

It will also require a programming challenge to make sure that robot brains, powered by AI, really know their limits.

Currently, robots are trained on deterministic models, which produce consistent, predictable outcomes. This is in stark contrast to current generative AI models.

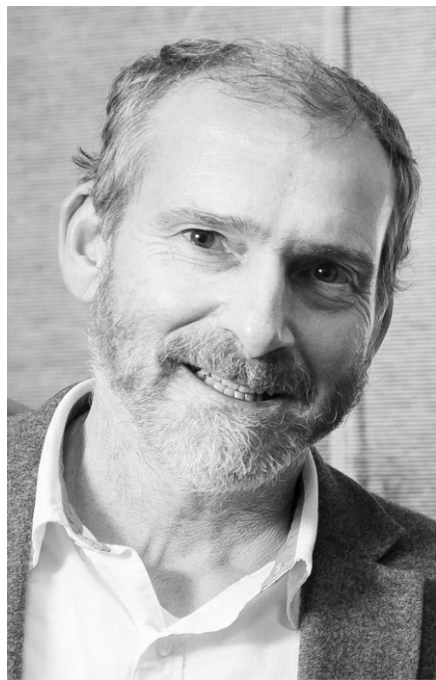
“The Kung Fu robot uses quite a bit of AI, but as we’ve all seen, if you play around with ChatGPT, it isn’t deterministic, it is probabilistic. We can estimate the probability of getting an answer, so there’s always a percentage of uncertainty in what might happen. So when you type a question into ChatGPT, you might not get the answer you were hoping for. Imagine that in robotics. You’ve got a robot standing next to you in a kitchen with a large kitchen knife. If that is running on a probabilistic engine, that robot may, on some occasion, unintentionally cut you with that knife.”

Nobody wants to perpetuate the stereotype of the killer robot. But, if the industry can get it right, robots may help solve one of society’s most pressing problems: how we care for our ageing population.

“Our demographic globally is getting much, much older. In the West, we tend to live more solitary lives than we do in other nations, and the evidence shows we would much prefer to stay in our own homes than go into formal care. There’s a problem that needs to be solved. And I think we will certainly see the emergence of home assistance robotics, starting in a pretty crude way with AI-enabled home assistance for elderly care,” he said.

Unlike the robots in factories, warehouses and hospitals, care robots are likely to take a more human form. Partly because a human-like presence will be more reassuring for an elderly person, but also for practical reasons.

“We are the sum of our lived experiences, both good and bad. Do we really want a robot to get temperamental because it’s grumpy? We probably want the better qualities of what we define as human characteristics.”



Mike Lawton,
Co-founder & Director,
Oxford Dynamics

Moody Robots?

“It makes a lot of sense to have a humanoid form factor for a robot in a domestic environment. We’ve designed our houses and everything we use in them around the human body. For a machine to be truly useful, I think robots in the domestic environment are probably going to have to have that human form factor, but with greater degrees of freedom, like the ability to swivel 360 degrees at its hip joint to give it greater utility and assistance to a human.”

Getting the robots to safely move around our homes will just be the start of the tick list for people programming these machines. They will also have to grapple with some pretty complex ethical questions, thinks Lawton.

“Imagine this scenario: the robot detects a house fire and can only save one person, its elderly primary carer, or the grandchild who’s visiting, who has her whole life ahead of her. So, who does it choose?”

“It’s an almost impossible problem to try and resolve, but we’re going to have to try and resolve it when we’re putting machines in these situations. And who gets to decide? I don’t know how we solve that problem. Do we look at prevailing law? Do we look at case histories from trials and try to embed that in our software? Our laws and values are different from those in the Middle East, Pakistan, or India. What does that mean for selling internationally – does the software need to be redefined when it goes to different territories? It’s an immensely knotty problem.”

And we probably don’t want our robots to replicate all human behaviour either, as we learned from Marvin, the depressed, pessimistic, cynical android from The Hitchhiker’s Guide to the Galaxy.

“We are the sum of our lived experiences, both good and bad. Do we really want a robot to get temperamental because it’s grumpy? We probably want the better qualities of what we define as human characteristics. But then the question is, who gets to choose? There’s a lot of work we need to do in social science and psychology about picking the properties we want in a robot.”

What is clear is that we need to hardwire into robots something similar to the fictional laws devised by Isaac Asimov. The first of these states that robots may not injure or allow a human to come to harm.

Giving Robots a Brain

In the next few years, Lawton predicts we will see robots move into what he calls “semi-structured environments”. Unlike highly controlled and predictable factory floors, these include more variability, such as deep-sea exploration and environmental monitoring of forests.

His firm has just developed such a robot called Strider. It has been designed for use by the UK’s Department for Environment, Food, and Rural Affairs in cases of chemical, biological, or radiological attacks.

“Strider can go into a semi-structured environment and map it to quite exquisite detail using Lidar and camera systems. The operator can be a mile away, and Strider can recover a whole range of things from the environment. It can take fluid samples, and it can spray a decontaminant. It can do all this for about nine hours continuously beyond line of sight, under a whole range of conditions,” he explained.



Oxford Dynamics has also developed an AI platform called AVIS (A Very Intelligent System), which aims to bring human-like cognitive understanding of complex data sets and make them easier to interact with. The platform has been used by the British Army, with analysts saying that it can do in 40 seconds what it takes a human eight hours to achieve.

“Ultimately, we want to converge the technologies and put a variant of AVIS inside Strider, so we can have a natural language conversation with a complex machine and achieve predictable results,” he said.

“Everything is About Cost and Functionality”

This combination of AI and robotics is the long-term goal for many robotic start-ups, and it is an area that is starting to see a lot of interest from investors. But making robots is an expensive and time-consuming business, and we have seen some spectacular failures. For example, Pepper, a cute little humanoid robot that made headlines a few years ago. Pepper was lauded as a robot guide for stations, shopping malls, and events, but it was decommissioned in 2021 due to weak take-up.

Lawton has some advice for start-ups.

“We primarily positioned ourselves as an AI and robotics company, and we tend to lead on the AI aspect. This is because investors much prefer software companies, as the time to develop software is a lot quicker and cheaper than building expensive machines.

“If you really want to go down the robotics path as a start-up entrepreneur, you have got to be absolutely laser-focused on the problem you are trying to solve. Every man and his dog is trying to be the first to produce that human-shaped robot, so forget that – billions of dollars have already been invested by your competitors. What is the niche problem you’re solving? Everything is about cost and functionality.”

Areas he sees that robotics could address in the more immediate future include security and farming.

“Imagine having a robot patrolling an industrial estate with an advanced machine vision system, an ability to take much more natural thought processes and be able to report back in human language what it can see.”

“And in farming, why are we sending a bloke on a quad bike and some dogs to herd cattle when that could potentially be done by an AI-driven robot?” he said.

For some of the more delicate farming jobs, such as fruit picking, there is more work

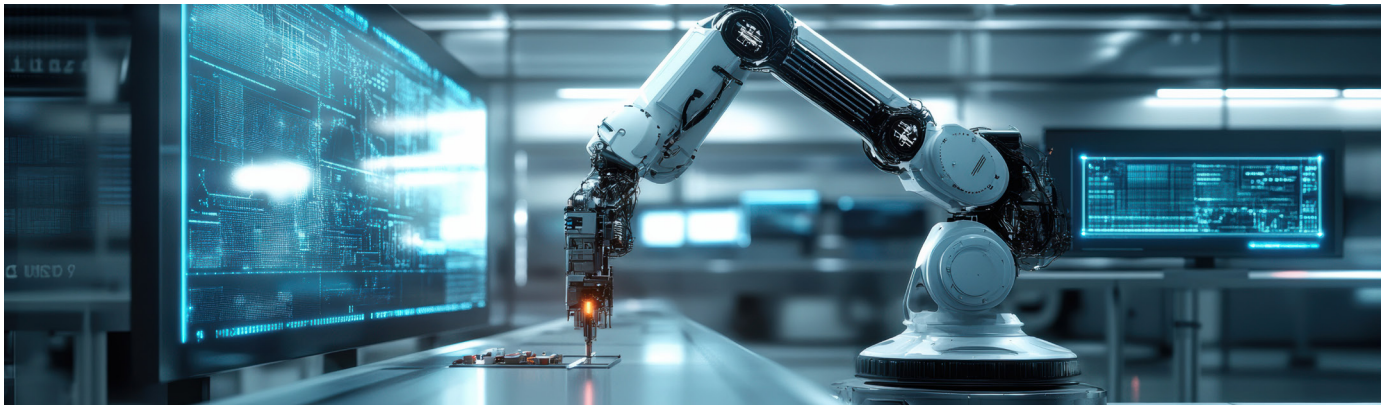


“If you really want to go down the robotics path as a start-up entrepreneur, you have got to be absolutely laser-focused on the problem you are trying to solve.”

to be done on replicating the complexity of human touch, he added.

“Today, the materials are rigid, and they are not particularly good at working delicately, such as picking soft fruit. If I hand you a plastic coffee cup, the calculations that your brain is doing are actually quite complex: you want to grip that cup, but you don’t want to crush it, so you grip it with just enough force. And as humans, we can walk and talk and drink coffee from a cup.”

“There’s no way that you could hand a robot that hasn’t been exquisitely programmed, a plastic cup of coffee without a disaster on your hands.”



Sex Sells

Providing robots with human-like skin and features has already been cracked by those making sex robots. These bots, which have rudimentary movements and some AI capability, are already being sold around the world.

It may seem distasteful to many, but it is a part of the industry that shouldn't be dismissed, thinks Lawton.

"Sex sells. The biggest driver of the internet was the pornography industry. It drove the need for high-speed video and a whole bunch of other things. And now the sex robot industry is driving things such as tactile skin and solving that uncanny valley challenge," he said.

"Uncanny valley" refers to the phenomenon where humans are repulsed by seeing versions of themselves in machine form. Making robots look human works up to a point, but cross the line and they quickly become creepy.

A study by Brookings found that just 16 percent of people said they felt comfortable with robots, and there will be much work to do in the next decade to increase public confidence.

For now, we remain fascinated, but wary, of the potential of robots. In future, we may come to rely on them.

Looking for a robotics PR agency? [Explore how to build trust in robotics with PR and comms.](#)

Digital Twins

04

Digital twins could save cities – and maybe your life

Digital twins are a 3D replica of an object, a process, or even a person, and have the potential to change both our physical environment and the way we live. The technology can help transform cities, give robots sight, and maybe even offer to solve the greatest of human questions: how to live longer.

To probe what possibilities the technology holds in the next decade, we spoke to **Burkhard Boeckem**, the Chief Technology Officer for **Hexagon AB**, a firm which develops the sensors, software, and platforms that power digital twins and unlock their insights.

Lots of cities have twins – usually a town of similar size in another country that allows citizens and officials to experience another culture and learn new ways of doing things. But far fewer have a doppelgänger – an exact replica of themselves – in the digital sphere.

So-called digital twins are being built not just of cities, but across a range of industries and sectors to help answer questions about supply chains, improve efficiencies, and allow manufacturers to make things better and more quickly.

The technology is possible as the physical and digital worlds become ever more connected via sensors. Combining this with improved computing power, better 3D modelling tech, and smart algorithms means the data being fed into the digital twin can offer insights about how to do things better in the real world.

Hexagon has worked with the Austrian city of Klagenfurt to help create its digital twin.

“They used our AI-enabled technologies to build a digital twin of the old city to find the best places to put solar panels, and in three years, they executed on this. They also thought about where the best place was for putting new green spaces and have increased those by 4%,” explained Boeckem.

In future, he thinks more and more cities will build digital twins, because the changing climate will force them to rethink their urban spaces.

“What if you don’t do it? What if there were a single mistake that you could avoid if you had seen it in the digital world? For example, we live in times of climate change, where looking at weather scenarios helps you understand and plan for future climate impacts. Digital twins are the ideal sandbox for this; they let you simulate effects and changes, then derive their impact in the digital world before you deploy them into the real world.”



Burkhard Boeckem,
Chief Technology Officer, Hexagon AB

“Digital twins are the ideal sandbox; they let you simulate effects and changes, then derive their impact in the digital world before you deploy them into the real world.”

“We see spatial intelligence as very crucial going forward, that combination of digital twins, AI, and the perception of 3D spaces. It gives you a new form to interact and understand physical spaces.”

Digital Stadiums

Building digital replicas of our living spaces could fundamentally alter the way cities are built in the future, he believes.

The design parameters will become different, and cities will be much more friendly to live in. “I think we will see the style of buildings change, whether residential houses, offices, or industrial facilities, they will be built much more sustainably.”

And it is not just him who thinks so. Policy-makers are increasingly waking up to the benefits of digital twins. The European Commission has set aside 1.2 billion euros for digital twin projects that can improve the management and sustainability of the urban environment, while the US Department of Transport has used digital twins to predict the structural integrity of bridges, tunnels and highways.

The construction industry is also turning to digital twins to create models that are changing our built environment, with much more building happening in factories rather than construction sites. Prefabricated parts are already common for home building and will start being used for bigger projects, such as new stadiums or train stations, thinks Boeckem.

Hexagon is currently working across more than 27 industries, including automotive, aerospace, and mining.

“A mine is an ever-changing ecosystem which requires a lot of equipment – trucks, excavators, and conveyor belts to be built. And as you take the material out of the earth, it changes. By using a digital twin, you can mine for 30 or 50 years or even longer,” he said.

Meanwhile, in manufacturing, digital twins are giving industries a much better picture of what they are building.

“If you have a virtual replica of your production line, you can optimise the processes and manage the whole supply chain. You can simulate in manufacturing and design the complete product life cycle, and the digital twin can help reduce carbon footprints or increase efficiency and productivity,” said Boeckem.

For example, Jaguar Land Rover needed to renovate its older manufacturing sites in the UK and Slovakia to meet modern safety standards, fit new equipment, and minimise downtime. Hexagon helped them create highly detailed digital twins of each facility, accurate down to the millimetre, providing an exact replica of the existing buildings so that they could plan changes virtually and spot problems early. The result? Fewer surprises during renovations, smoother installations, and faster project timelines.

Digital twins are also taking product design to new heights. They are already helping to design “the perfect car” and in future will allow manufacturers to be even more experimental and bold. Jetpack, anyone? Or how about a flying car?

“Absolutely possible, because you don’t need to build prototypes. It means you can iterate faster and have many more scenarios. The second part will be down to adoption in society, but I’m quite stunned of late by how fast things can be adopted,” said Boeckem.



How Will I Age? Ask My Digital Twin

Some futurists believe that, in the next decade, humans may even have their own digital twin: a replica of ourselves which we can update with all the data we have from social media, on our smartwatches, and even the information in our work calendars. Our digital doppelgänger could take our place, attending meetings on our behalf or even providing our doctors with our latest health data.

Boeckem thinks this scenario is a little far-fetched, but says there are already plenty of examples of digital twins being used in the medical world.

“Dermatologists use AI and a copy of your face to get a prognosis of the likelihood that you might get skin cancer. And in future, we could ask the digital twin about ‘how will this person age?’ Longevity is a big trend that will also be a touchpoint for digital twins,” he said.

Metaverse Revival?

Some have already achieved a kind of immortality via the avatars we use on gaming platforms or social media. While avatars and digital twins are not the same thing, both conjure up images of the metaverse, a much-hyped concept just a few years ago. Meta (which believed in the metaverse so much it changed its name) told us we would all be living, working and playing in the metaverse. But since ChatGPT burst onto the scene in November 2022, it has taken something of a backseat to AI.

Boeckem thinks digital twins can revive the metaverse, but its reincarnation might not happen in the way envisaged by Mark Zuckerberg and others.

“For me there are two definitions of the metaverse: the consumer version which is more about entertainment and retail, where you might have an avatar that can meet your friends in a virtual bar; and then you have the industrial metaverse, which is a combination of digital twins, simulations and AI, where you can test what-if scenarios and trial processes before you deploy them. And I think we are already in that metaverse, whether we want it or not.”

What he is most excited about for the next decade, though, is technology that will give those digital creations awareness of the real world: so-called “spatial intelligence.”

“We see spatial intelligence as very crucial going forward, that combination of digital twins, AI, and the perception of 3D spaces. It gives you a new form to interact and understand physical spaces,” he said.

“For example, in an automotive plant, you would be able to query a spatial model and tell it that you want six production lines and the output should be this many cars. And then you ask your AI to give you a layout of this. The more information you feed into the system, the more iterations and layout proposals you will get. AI and digital twins will mean you can build better and faster and with less waste, and that has huge potential. Then we will see quite drastic changes.”

All-seeing Robots

Spatial intelligence would also speed up the move to human-level AI.

Demis Hassabis, the CEO of Google DeepMind, has predicted Artificial General Intelligence by 2030, but for some, this will only come with the integration of spatial intelligence.

“In 2022, we had the big breakthrough with language, and then came visuals and videos, and then multi-modal models. I think adding spatial intelligence is the logical next step,” said Boeckem.

And this will have a powerful impact on another key area of technology: robotics.

“I think that in the future, and not so far ahead, you will need a digital twin for training a robot. We will make the digital twin of the environment where the robot will be deployed and then use techniques, such as reinforcement learning, to train it. The robot has never seen the actual physical world where it will be deployed, but because it has been trained using the digital twin, it will know directions. And, in cases where the physical world changes around them, these changes can be transmitted to the robot so it can adapt in real time.”

He predicts that such all-seeing robots could be built at scale in the next decade.

Niantic, the company behind the augmented reality game Pokémon Go, thinks spatial intelligence will become the world’s next search engine. Late last year, it announced that it was building a geospatial AI model based on player data.

Boeckem agrees that, in the next decade, demand for 3D data will increase “whether that is of your sneaker, your street, or the wider environment”.

“The big question is whether the training data is as easy to find as it was for the large language models, because the world is not completely machine-readable yet. It seems likely that the next ten years will see us building a repository of digitally mapped physical spaces.”

Discover how TFD and Hexagon are working together to bring these ideas to life.

Software

05



Rethinking the cost of open-source software

“If I have seen further than others, it is by standing on the shoulders of giants.”

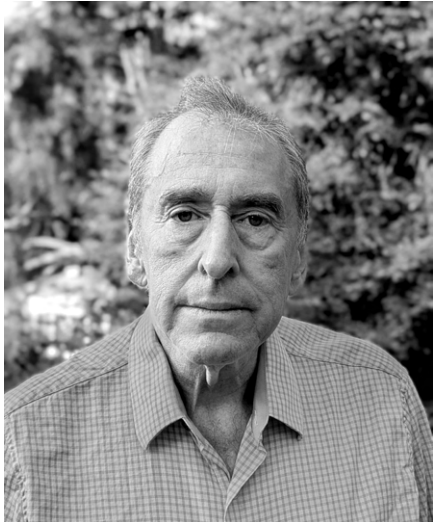
Isaac Newton’s phrase is often used in conjunction with Open Source Software (OSS) – software that developers make available for others to use, modify, and distribute. Since it gained momentum in 1983, it’s become the foundation of our digital economy, **comprising 70-90%** of any modern application. Not only is it pervasive in our digital lives and at the core of many of the companies that provide our digital services, but it still has huge relevance. Some of the big generative AI models have been built using open-source models.

However, prolific and critical open-source vulnerabilities and attacks, including the “catastrophic” **Log4J** and the Equifax breach, which resulted in the records of over **147 million people** being exposed, have fueled questions about its security. In parallel, OSS’s viability has become increasingly called into question. Developers are commonly uncompensated for their contributions to open source, while large corporations have profited from their work, creating an inequality at the heart of the movement.

As one of the founders of the Open Source movement and the creator of the Open Source Definition, the set of legal requirements for Open Source licensing which still stand today, **Bruce Perens** has unique insight into this landscape.

One of his proudest moments, he tells TFD, was getting Linux on the Space Shuttle – proof that OSS could do mission-critical work. But despite the success of the movement he helped create, he has questions about whether it has fulfilled the potential and the promise the early OSS pioneers hoped for.

In conversation with TFD, Perens shares what he sees coming in the next decade for software. He discusses whether the price paid for sharing was too great and offers a new future vision of how we can use open source more fairly in the next decade. And he looks at how AI will disrupt the software industry, the new issues it will bring, but also the hope it offers in helping solve some of the biggest challenges the human race faces.



Bruce Perens,
Founder, Open Source Definition

When the World Wide Web was merely a twinkle in Sir Tim Berners-Lee’s eyes, there was already a philosophy that would guide it. And that philosophy was based on the academic principles of shared knowledge.

Software was not seen as a commodity and early developers worked in collaboration, making their source code available for others to learn from and improve in the great tradition of scientific discovery.

Fast forward 40 years and software is now the engine that powers our digital lives. And open source software has played a powerful role in that.

“Every company uses open source. All the devices around you use open source. It’s in your phone; it’s probably controlling the traffic lights when you walk down the street. It’s used in air traffic control when you take a flight,” said Perens.

Recent research from GitHub, the Linux Foundation, and the Laboratory for Innovation Science at Harvard suggests that organisations now invest around **\$7.7 billion in the ecosystem each year.**

Enhancing Democracy

But that doesn’t necessarily equal success, he argues.

“It’s everywhere, it is used for everything, and yet still today we have 66% of developers that are not compensated in any way for its creation,” he told TFD.

And it is not just the monetary problem that Perens worries about.

“The creators of the internet, and all the open source developers, thought what we were doing would enhance democracy. But we didn’t have this flow of intellectual capital that we expected to happen. I think part of the problem was that we were all scientists and technologists, and we thought that if you connected all of us, great things would happen. And we did not really consider who the real users would be, and what would happen with them.

“I feel we have actually failed to help people because our software is used to monitor them, surveil them, and even exploit them. We could provide them with software that respects their freedom, and we’re not doing so.”

There was, he said, a disconnect between what the open source community wanted and how society responded.

“We started sharing, and most people took it as a gift. But that isn’t sharing. It requires some give and take.”

He now preaches a new philosophy and a solution called Post Open, which attempts to shore up the gaps the current licensing of software leaves open. It is based on the idea that large companies pay fairly for the software they use.

AI’s binary dilemma

But, in the age of AI, will it even be down to humans to code our future?

Google’s CEO, Sundar Pichai, has said that **more than a quarter of new code for Google’s products is generated by AI** and such tools are becoming more popular and ubiquitous. For any youngster considering a career in programming, it poses a problem: why bother if AI will replace you?

When it comes to how AI will play out, Perens has a developer’s binary approach to how the future may unfold.

“Software is the creation of a system that performs a job with a very large number of logical decisions that a human being currently makes. Software at scale, something like a web browser, has so many lines of code that no human being can actually understand all of it. If AI becomes capable of that, then AI is capable of performing all jobs; writing novels, being the CEO. If that actually happens, I think we have been replaced,” he said.

But getting there will require AI to make some bigger leaps than the ones seen since ChatGPT burst onto the scene in November 2022. He questions if we are about to enter a new AI winter, a period of time when no great steps forward are made in the development of the tech.

“Will we hit a boundary? Right now, the large language models have tremendous weaknesses and are prone to hallucinations. We have had 50 years of thinking we would have strong AI, something that thinks the way we do, and it didn’t come. And now we’ve seen this tremendous jump, but will it go further?”



Even if AI becomes smart enough to take on coding jobs, history tells us that humans are eminently adaptable in the face of new technology.

“When automation came to factories, there was a lot of anxiety about it and the creation of the Luddite movement, but it became part of everyone’s life and did not obsolete us,” said Perens.

And he sees huge potential for AI-driven software in one key area that the early web pioneers are also keen to influence.

“At the beginning of the web, we talked about it being a tremendous boost for education, but we’ve also seen these negative impacts on society. I think we will see a revolution in education in the era of AI, where education becomes more personal and more individual.”

“I feel we have actually failed to help people because our software is used to monitor them, surveil them, and even exploit them. We could provide them with software that respects their freedom, and we’re not doing so.”

“I actually see security getting better. One of the reasons for that is that we are abandoning computer languages like C++ and Java in favour of things like Rust, which very deliberately shuts out an entire class of bugs that exist in older languages.”

Genetic Code

When it comes to how software may develop in the next decade, he believes it has a huge role to play in helping to solve some of the biggest challenges we face.

“If we look at genetic code, it’s very much like a computer program and thus something that we can understand in a computer science way. Ultimately, cancer is an error in the program, a bug in your genetic code and computational biology can help solve these problems.”

Businesses may be looking for more prosaic bugs to be solved in the short term, as software has become synonymous with hacking.

Software bugs have led to thousands of data breaches over the last few decades and wiped billions off our economies.

Post-truth Era

But in the future, Perens sees improvements.

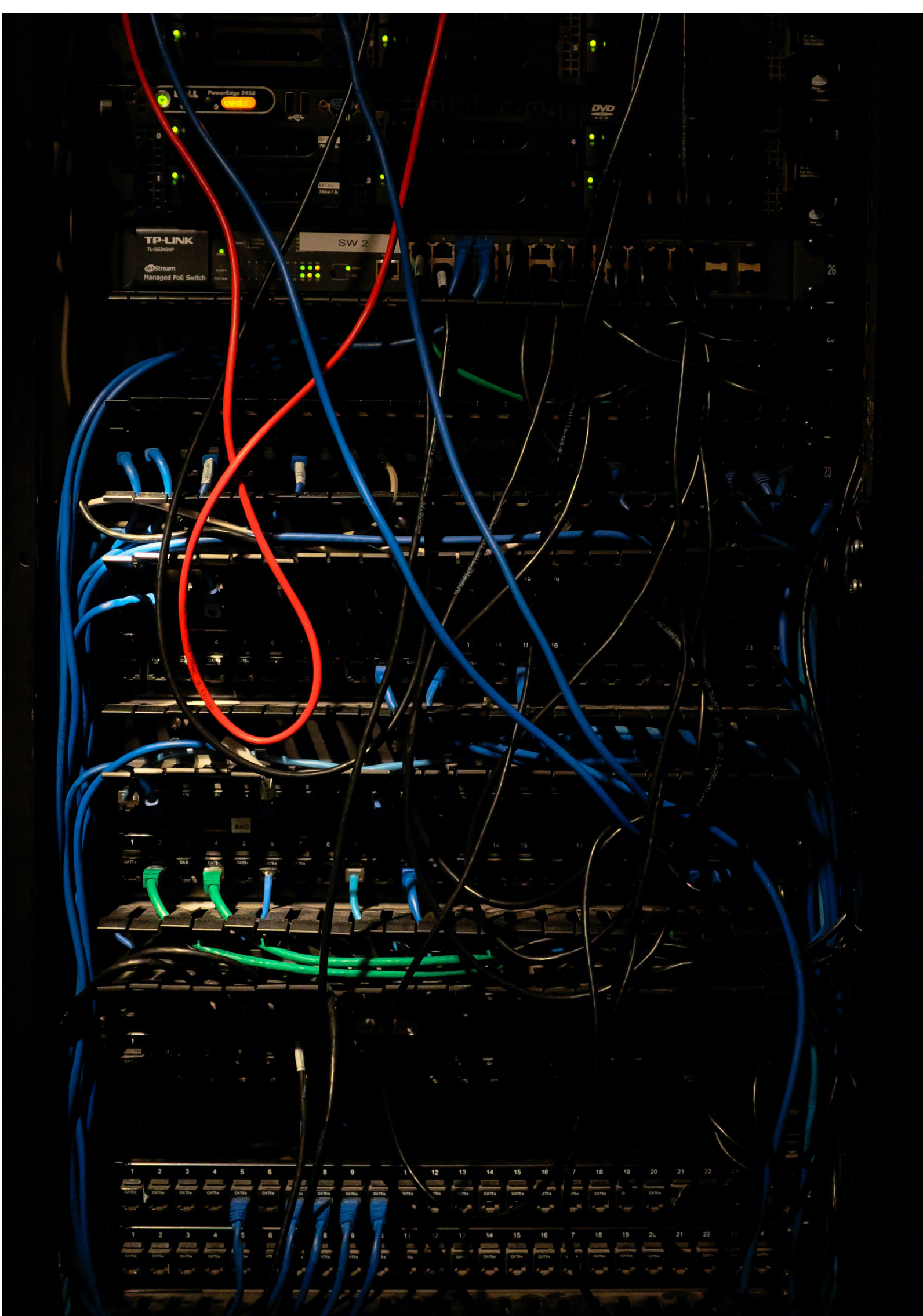
“I actually see security getting better. One of the reasons for that is that we are abandoning computer languages like C++ and Java in favour of things like Rust, which very deliberately shuts out an entire class of bugs that exist in older languages. We will continue to see the evolution of computer languages that will help programmers create fewer bugs.”

Whatever the next decade holds, Perens remains hopeful that those tenets of shared scientific knowledge that began the software movement will propel it forward too, but there will be big barriers to overcome first, though.

The internet may have enabled shared knowledge on scales never seen before, but that has brought with it a new philosophical problem – the daily bombardment of information we can all access so readily has led to misinformation.

“The biggest problem that we have in society today is that we are living in the post-truth era, the era in which simple lies are more compelling than complex truths. Guiding society past that is the biggest challenge we now face, and I don’t have the first idea how to solve it.”

[Explore how we uncovered the real impact of the CrowdStrike outage.](#)



Cybersecurity

06

Are we leaving small businesses behind in the cybersecurity arms race?

Cybersecurity affects us all – nations, businesses, and individuals. AI threatens to change the nature of the digital threats we face as a society, from the scams that are taking over our inboxes and threatening to drain our bank accounts, to providing new vectors for nation-state hackers to disrupt our lives.

For businesses, AI represents both an opportunity and a threat. Hackers will use AI tools to create new malware or launch more sophisticated phishing attacks to gain entry to business systems. But the tools also mean IT departments can be better armed to protect themselves. However, for third and public sector organisations with fewer resources at their disposal, the threats posed by AI-driven attacks become particularly acute.

In conversation with **Stephanie Itimi**, Director of Information Protection and Compliance at **Age UK** and Chair of **Seidea CIC**, a career development platform designed to connect Black, Asian and Minority Ethnic talent with inclusive employers in the cybersecurity field, we talk about the things that keep her awake at night.

During her career, Stephanie played a pivotal role with the BBC World Service team in launching the first public health information service on WhatsApp, which combated Ebola disinformation in West Africa and reached over 16,000 users, and contributed to the World Economic Forum Cybersecurity Outlook 2025 Report. This background has given her extensive insight into the global cybersecurity landscape, and she shared her thoughts on how the next decade may play out when it comes to cybersecurity, and how the good guys can ensure that their tools are better than the bad guys.

In the last few years, a disturbing new scam has emerged that threatens both businesses and individuals. Voice cloning – where a small three second clip of a person's voice is stolen from social media and cloned to make loved ones or colleagues believe they are talking to someone they know.

The CEO of **WPP**, the world's biggest advertising agency, had his voice cloned to solicit money and private company information from colleagues last year. Meanwhile, in a horrific case in the US, a mother believed she was listening to her teenage daughter begging for her life in a kidnapping attempt, and nearly handed over \$50,000 before she realised it was an AI scam.

For Itimi, voice cloning is what most worries her when it comes to the future of cybersecurity.

"In the next decade, we'll see an increasing blurring of the lines between what is real and what isn't. While deepfakes are already a significant concern, I believe the most frightening development will be voice cloning. It's the hardest to detect and, as a result, poses an even greater risk to personal security and trust."

Itimi believes it will usher in a new relationship between individuals and social media because everything we put on it, from videos to pictures, could be ammunition for criminals in the age of AI.

"I've used ChatGPT, and it's been able to pull up virtually every piece of information about me available online. Everything from my social media profiles to public records. Now, imagine how easily that wealth of personal data could be exploited in a social engineering attack, where criminals use it to manipulate or deceive individuals into divulging even more sensitive information?"

It means consumers really need to start protecting their data, whether that be by using a data broker or just getting more savvy about things they can do themselves.

"For example, on ChatGPT, you can turn off your memory to stop your data from being entered into the system."

She also advised that people check the number if a loved one calls you asking for money or claiming to be in distress. Other security experts go even further, suggesting we all need a safe word for phone calls with family, friends, or even with our bosses.



Attacks Every 14 Seconds

Worldwide cybercrime costs are estimated to hit \$10.5 trillion annually by 2025, and that isn't a figure that is likely to go down in the next decade.

Itimi is concerned about how small businesses and charities, which often lack the resources of larger organisations, will afford the increasingly sophisticated defences they need.

She thinks that inevitably, cybersecurity is going to become an even greater arms race between criminals and defenders. And one that hinges on who wields the most powerful AI tools.

For criminals and scammers, AI will mean that they can scale up their attacks. A GenAI program can write a thousand convincing, personalised phishing emails in seconds, for instance. It is estimated that there is an attack on a business every 14 seconds.

But it isn't entirely bleak. AI tools can also be utilised by businesses to test the robustness of their systems and improve their security, said Itimi.

"In the past, it would have cost a lot of money to replicate cybersecurity attacks. AI now allows us to do twice as much for a fraction of the price, and you can be a bit more experimental with the scenarios that you are testing out, too," she told TFD.

Human error is often a company's biggest weakness, as many attacks begin when an employee unwittingly clicks on a phishing email. As AI makes these scams even more convincing, businesses will need to devote a portion of their security budget to training their staff, teaching them how to recognise and avoid increasingly sophisticated threats over the next decade.



Stephanie Itimi,
Director of Information
Protection and Compliance, Age
UK & Chair of Seidea, CIC

Need For DEI

The use of shadow AI, where employees are using tools that haven't been endorsed by the company, will also be cracked down on, she thinks.

She has three key recommendations for businesses that may not have huge budgets but want to future-proof themselves.

"Start with the Cyber Essentials, but if you are a small business and you can't even afford that, at least you should be focusing on the NIST (National Institute of Standards and Technology) frameworks and have a roadmap for the next five or 10 years. And when it comes to AI, you want to start having those conversations within your organisation and have an AI policy," she said.

Cyber Essentials is a UK scheme, but its common-sense advice applies globally.

Much of Itimi's work is focused on diversity, which remains a problem within cybersecurity and the wider tech industry.

The UK government estimates that **30% of cyber firms faced a skills shortage in 2024**, while the World Economic Forum states that worldwide there is a **shortage of four million cyber-security workers**.

Itimi finds Meta and Amazon's decision to pull back on diversity programmes extremely concerning as we seek more cyber experts in the coming decade.

"I worry that other companies will follow suit and we might see a regression in all aspects, whether it be gender, neurodiversity, or ethnicity."

She warned that DEI should be viewed as a strategic priority rather than just a marketing initiative.

"What does that signal to those in communities that don't normally have access to those industries? Because even in cybersecurity, we live in a global world, the attacks are coming from global sources, and we need a global workforce to be able to understand the minds of hackers who might come from anywhere in the world."

"It is a necessity in the world that we live in," she said.

“It may deter malicious actors, but what happens to the businesses or individuals whose data is leaked or sold? If you block one thing, malicious actors will always find another way.”



Ransomware Regulation?

Another key discussion point on the global cybersecurity agenda is the surging threat of ransomware, and whether government intervention can stem the tidal wave of attacks.

According to security firm Veeam, the average organisation will experience **around two ransomware attacks each year**. Such attacks, where hackers gain entry to a company’s system, freeze data and demand a ransom to unlock it, also come with a threat to release sensitive data on the dark web.

Tragically, a huge **84% of businesses opt to pay the ransom** according to Cybereason, exposing them to further risk. 78% of those who paid the fine were subject to a second attack, while, according to Veeam’s annual threat report, nearly a third of those who paid were not able to recover their data.

The UK government is currently considering instigating a ban on paying ransoms, but it is not a policy Itimi thinks can work.

“It may deter malicious actors, but what happens to the businesses or individuals whose data is leaked or sold? If you block one thing, malicious actors will always find another way.”

While ransomware will remain a common way for hackers to attack businesses, much of the future of cyber may be fought out at the national level.

Itimi predicts a rise in infrastructure attacks from nation-state hackers looking to cause societal disruption.

“Targeting critical infrastructure can have far-reaching consequences, disrupting entire economies. Without energy, how do you power essential services, turn on the lights, or even heat homes? The impact goes beyond inconvenience; it can bring daily life to a standstill.”

Attacks such as those as the Colonial Oil pipeline, or the breach of the SCADA systems of the Bowman Dam in New York, could become regular occurrences in the next decade, she thinks.

As cybercrime evolves beyond financial gain into a form of cyber warfare, she thinks it is essential for businesses and governments to collaborate in strengthening their defences and preparing for future threats.

Ready to elevate your cybersecurity PR?
[Explore our services.](#)



Renewable Energy

07

Here comes the Sun — rethinking how we power the world

When it comes to climate change, energy lies at the heart of the challenge.

While fossil fuels account for more than 75% of global greenhouse emissions, renewable energy sources emit no pollutants during operation and are available in abundance.

The need to harness these sources gets ever more urgent each year. Science backed by the United Nations suggests that emissions need to be reduced by almost half by 2030 and to net zero by 2050 if we are to limit global warming to 1.5°C above pre-industrial levels.

But new challenges emerge all the time. Data centres, which keep the digital world whirring and increasingly power AI systems, are becoming more energy-intensive. The International Energy Agency (IEA) predicts that **data centre electricity consumption will grow by around 15% per year**, and will make up just under 3% of global electricity consumption by 2030.

To explore what the future of energy may look like, we spoke to a company that is already innovating. **GRYD** is offering the UK's first solar subscription model, where homeowners gain access to solar power through a fixed monthly fee, including installation and maintenance. We spoke to CEO and Co-Founder **Mohamed Gaafar** about what his company is doing and if he sees a bright future for solar and renewables.

Putting solar panels on your roof seems like an easy win. It allows you to be part of the push to sustainability while also avoiding the energy price hikes we have seen in recent years. However, many are put off by the up-front costs and concerns that they won't stay in the property long enough to recoup costs (estimated to be around 8 to 12 years).

"It just doesn't make economic sense for most people," admits Gaafar.

And even on new builds, where it seems like a no-brainer to install solar panels, the picture is depressing.

"I live in an area where there are a decent number of new builds, and it is soul-destroying when I go past and see three or maybe four solar panels being installed. It is really frustrating because we know three or four panels are not enough to meet homeowners' energy demand," he told TFD.

GRYD is working to turn the traditional model of solar on its head.

"We fund, manage and operate smart solar and battery systems for new homes at zero cost to the developers and the homeowners. What we are saying is, we'll own it, we'll provide those benefits and share them across multiple homeowners and tenants," he said.

It seems like a win-win, and Gaafar firmly believes that generating and storing solar "behind the meter" is the direction of travel for the energy industry. Improvements in battery tech will mean that being entirely off-grid will become viable, even during a depressingly grey English winter.

While solar subscription is a relatively new idea in the UK, in the US it has already been accumulating fans and, in August last year, US firm Sunrun became **the first solar subscription business to reach one million customers**.



Mohamed Gaafar,
CEO and Co-Founder, GRYD

Virtual Networks

“The move toward decentralised energy is quite literally rewiring the way that we use energy and how it works,” said Gaafar.

We may not have the luxury of waiting for these upgrades if we want to hit our net-zero targets on time. “We’ve waited decades for utility-scale solar, and if we’re waiting decades more for the grid to be upgraded, well, there is no benefit.”

That’s part of why distributed solar is starting to look like a more resilient option.

Gaafar envisions a future where we increasingly rely on energy created at our homes, rather than in big power plants miles away. Smart tech can then balance energy to create a flexible and democratised energy network, essentially bypassing some of the grid’s limitations.

“Currently, we have devices that connect to a home, and then those homes connect to a network. But imagine if those networks no longer have to be physically based. The idea of a virtual power plant where homes can connect with each other and trade energy between them is starting to take shape. It will open up a lot of possibilities for the future of energy.”

Though the road to this future isn’t without its own challenges, such as how to store unused power.

“When we’ve got a surplus of solar and the grid risks getting saturated, we need storage.”

This is something Australia is rushing to figure out right now – it has a profusion of sun and now generates over 10% of its electricity via rooftop solar alone. It is an issue that needs to be addressed urgently.

Though the price of solar and battery tech will continue to come down, he predicts the capacity of hardware will increase. This means that consumers can “fit larger, more robust systems and more self-sufficient ones”, shifting more of their energy demand off the grid and increasingly mitigating their exposure to wholesale price swings.

He thinks we will see some big innovations in battery tech, something he describes as “a key tool in the clean energy transition”.

“In the near future, no home will be without battery storage. We’re already seeing them become a critical technology to insulate homes from regular, sustained power outages in places like Texas. Continued innovations in the technology will deliver sleeker, more compact and denser battery storage architectures that can help people to meet their own energy needs and keep their homes running cheaper, for longer,” added Gaafar.

People also continue to innovate on the ‘form’ factor for rooftop solar, be it solar roof tiles or hybrid systems that allow panels to slip in and out behind the roof structure, which could improve efficiency. It will be interesting if we reach a point where solar roof tiles are cheaper than regular roof tiles, which would greatly increase deployment.

Global Supply Chain

Another key discussion point on the global cybersecurity While pretty much every country has a clean energy push, none can compete with what is happening in China. Its pivot to green, coupled with unparalleled manufacturing capacity, has put it at the heart of the global clean energy supply chain. It now produces an estimated **80% of the world’s solar panels** and a large number of wind turbines. It also dominates global lithium-ion battery production, which is essential for EVs.

All of which presents some geo-political problems.

“It’s a massive challenge. It’s really hard to come to terms with the scale at which China is not only manufacturing these things but also deploying and installing them.” Gaafar noted that, in 2024, China added **more solar than the US did in its entire history**. “If something were to happen involving China, the impact on the global supply chain for solar and batteries would be felt worldwide.”

China’s dominance means it is more important than ever that Western countries devise clear and impactful clean energy strategies for the next 10 years.

“Particularly in the current political climate, many are seeing the crucial need to reduce their reliance on China and improve the resilience of their supply chains. It will require significant investment to move manufacturing onshore, given the amount of control China currently yields, but the need for it is paramount if these countries want to establish their renewables resilience.”

Europe Rising?

One way the UK has responded is with the Future Home Standard (FHS), which is due to come into force this year. It aims to ensure that new homes built in England will produce 75-80% fewer carbon emissions than those built under current building regulations. This is expected to mandate on-site renewables such as solar, heat pumps or zero-carbon

heating and hot water. Other suggestions include: waste water heat recovery systems, reduced heat waste, and better insulation.

Gaafar described the FHS as an important piece of legislation to ensure homes built now are fit for the future and one that could put the UK “back on the map as a leader within the climate space”.

Leadership is much needed as the US pedals back on the Inflation Reduction Act, widely regarded as a flagship climate change initiative, providing tax incentives for a range of clean energy projects.

“It was an incredibly progressive piece of legislation for incentivising and really moving the needle on the clean energy transition,” explained Gaafar.

Trump’s decisions to freeze funding for clean energy projects previously supported by the Inflation Reduction Act and abandon the Paris Climate Agreement are, he says, “disappointing and massively challenging.”

“The optimistic view is that someone else emerges as the new leader in this space to show what the benefits are from taking charge of this.”

One benefit that Europe may see in the next four years of Trump’s government is more investment in its own clean energy projects.

“The Inflation Reduction Act created such a great incentive that it was hard for European start-ups to compete. And now investors we’ve spoken to say there could be more of a shift back towards Europe.”

“If the energy demand of data centres continues to increase as expected, they are likely to only use renewables, such as solar or wind, as supplementary energy sources.”

AI Demands

One of the biggest challenges facing countries over the next decade is how they balance the need for advancements in AI technologies with energy needs. Some predict its energy demand will nearly double by 2030, leading to vocal concerns that the grid will not cope.

Like Texas, which is facing soaring electricity costs due to crypto mining facilities and AI-driven data centres.

All eyes are on the big tech firms that run the data centres and the AI systems that are hungrily eating up energy. Some, including Amazon, advocate for the need for nuclear power plants. Google has pledged to build wind and solar farms next to all its future data centres, while Sam Altman, CEO of OpenAI, has **expressed doubts that renewables will be enough.**

Perhaps surprisingly, Gaafar agrees with Altman.

“Having solar panels on top of a data centre doesn’t do enough, which is why you have companies such as OpenAI investing in nuclear fusion, because the intensity and the scale of energy required is so significant that it’s going to need a whole suite of technologies,” he said.

“If the energy demand of data centres continues to increase as expected, they are likely to only use renewables, such as solar or wind, as supplementary energy sources. However, we are beginning to see data centres explore interesting applications of grid-scale batteries coupled with onsite renewables generation. Whilst they may not be a silver bullet given the immense amount of energy these centres need, they are readily applicable as opposed to developing solutions like nuclear fusion.”

Flying Close to the Sun

Could it be that the solution lies in Space?

Space Solar is one of many companies trying to harness limitless clean power from the Sun via huge solar arrays. In April last year, the firm claimed a breakthrough with a 360° power transmission system that could wirelessly beam energy back to Earth regardless of orientation.

It is an area Gaafar is both excited and sceptical about.

“There’s a serious amount of investment going into it, and it is interesting. It’s a cool idea and could have a really big impact, but it is likely to be 15 years or more into the future and may never exist at all. We need a mix of people working on moonshots and people working on real tech that already exists,” he said.

Describing himself as an “idealistic pragmatist”, he thinks that we will need a huge variety of clean tech options in the next decade.

Personally, though, he is walking on the sunny side of the street.

“Off-grid solar is one of the cheapest forms of energy. I’m very much on the side of finding ways to harness it in smart and clever ways. That ultimately will be the best way for us to meet our energy needs.”

We love technology. **Find out how we can help people fall in love with yours.**



Green Tech

08

Can green innovation and protectionism work hand in hand?

Technology promises to help solve some of the biggest challenges we face as a society. Many would argue that there is none greater than climate change. From the devastating forest fires that destroyed whole neighbourhoods in LA in early 2025, to floods in Valencia, landslides in the Philippines, and droughts in southern Africa, a warming world is risking lives and fundamentally changing how we live.

There is plenty of innovation out there: new materials are replacing plastics, and robots are monitoring forest fires and ocean pollution. But how do we turn this wave of ingenuity into real change before it's too late?

As global policymakers grapple with green policies, businesses look to reach carbon-neutral goals, and consumers attempt to live more sustainably, we ask what role technology can play in providing a solution to the crisis.

We spoke to **Puja Balachander**, a green tech founder and director of venture at **Carbon13**, which builds and accelerates businesses addressing the climate crisis.

TFD began by asking her what she thought would be the key technologies to effect change in the next decade.

For her, it is not so much about what those technologies are, but how easy and quickly they can be adopted.

"What makes a technology adoptable is by comparing it to the status quo of whatever industry they are disrupting and asking 'how is this technology enabling the solution to be the same or cheaper than the status quo and can it be dropped into existing processes?'" she said.



Puja Balachander,
Founder and Director of Venture, Carbon13

“What makes a technology adoptable is by comparing it to the status quo of whatever industry they are disrupting and asking ‘how is this technology enabling the solution to be the same or cheaper than the status quo and can it be dropped into existing processes?’”

Start Small

She used the example of **Fermtech**, a start-up in the Carbon13 portfolio, which ferments spent grain to produce a sustainable cocoa alternative.

“It’s the same cost, if not cheaper, than current protein ingredients, and it’s exactly the same process to integrate it into formulations,” she said.

Another firm that went through their venture program has developed a robotic arm that can segregate different types of plastic in a cheaper way than traditional methods.

“It’s a super simple solution. The standard is to use a vacuum to suck up specific things, but the company found that using a robotic arm to mechanically grab waste is an inexpensive way of solving the problem.”

The biggest challenge for green tech start-ups is getting a foothold in markets, and she has some good tips for those attempting to shake up traditional industries in the next decade.

“Turning innovation into success in the next few years will be about approaching the right scale of player, at the right time,” she said. One of the key roles for investors will be helping green tech start-ups find what she called “that early beachhead market”; someone willing to “take a green premium, change some of their processes and get you to the point of validation so you can graduate to the next level.”

In the built environment, for example, there is what she describes as “an insane certification process”, a Kafkaesque nightmare for companies such as **Carbon Cell**, which has created a green alternative to polystyrene.

So, while the firm’s end goal is to use the material as an alternative to polystyrene in insulation panels, it has first looked to the packaging market to prove the material’s worth and kickstart a supply chain.

Another key tip for burgeoning green tech entrepreneurs is to start small.

“We had a company, called **Cocoon Carbon**, that takes steel slag and processes it into a cement-like material that can be used to decarbonise concrete. They had to prove that steel companies would send them their waste products. They started with a desktop prototype, so they just needed small samples of steel slag, and they messaged a bunch of manufacturers to get these samples and were able to show that they could do it at this super small scale.”



Can Protectionism Boost Green Tech?

She remains optimistic about how green tech companies can grow in the next decade, partly because there are now “more playbooks” on how to do it, and more venture capitalists will be looking to invest.

When it comes to government input, there is a lot of concern that President Trump’s decision to withdraw from the Paris Climate agreement, which aims to limit global temperature increase to below 2°C above pre-industrial levels, could have major consequences in the US and beyond.

Balachander wonders if the pledge to rebuild American industry might end up favouring green policies, for instance, if the US decides to invest in battery factories in order to stimulate local manufacturing.

“Maybe there is something to be said for an overlap in green innovation and protectionist policies, and maybe that would actually work out in our favour,” she said.

And there is good reason for the US to do so.

One country that has been making huge strides in terms of green policy is China. According to the World Economic Forum, it has increased spending on green companies by nearly **70% from 2018-2013**. It is building a new generation of energy infrastructure faster than anywhere else in the world, has put millions of EVs on the road, and is the world’s largest solar market by capacity.

It is also leading the world when it comes to battery tech, said Balachander.

“China is super-protectionist and has effectively subsidised building their battery supply chain before there was any demand for the end product. In the process, it created an incredibly cheap and profitable battery industry, and everyone has no choice but to use their supply chain because it’s so cost-competitive. US tariffs might be changing this, but the fact remains there are few viable alternatives that can meet the scale required.”

As well as investing in green infrastructure, it is also important that governments offer incentives to consumers, as the UK has done with electric vehicles and solar panels.

AI Saviour?

So far into Trump’s administration, it has seemed that where the government leads, tech firms will follow, for instance, in abandoning DEI policies.

Balachander thinks that the US is less likely to pull back on sustainability, partly because of local manufacturing and clean jobs interest – many of the jobs and tax incentives in the Inflation Reduction Act (IRA), for example, are in Republican states, but also because their biggest cash cow right now is AI.

AI has already proved the benefits it can bring to the climate crisis, from modelling weather patterns to improving the efficiency of the energy grid. However, it is a double-edged sword because the infrastructure needed to run AI is incredibly energy and resource-hungry.

“Big tech firms are going to need more of those data centres, and there’s not enough grid capacity, so they need it to be decentralised. It’s easier to do that with renewables. Firms are not going to be pulling back on things that make business sense.”

In December, Google announced that it was partnering with a climate investor and a clean energy developer to build renewable power and storage co-located with data centres. There could be more such announcements in the coming years, she thinks.

AI has great potential to help society in the battle against climate change, but it will not be our sole saviour, thinks Balachander.

“Just as the internet wasn’t our saviour either. But every climate tech company needs to be using AI. It can speed things up pretty significantly in any situation where there are lots of variables in a complex system. As will quantum.”

Circular Economy

The final piece of the puzzle, as we look to make real change in the coming decade, is consumers themselves.

In 2023, shocking pictures of a mountain of clothes in the Atacama desert, which had become visible from Space, went viral, perfectly illustrating how we need to change fast fashion and the throw-away culture and move to something more circular.

Again, Balachander is a pragmatist.

Alongside policies such as Europe’s Right to Repair bill, which will force manufacturers to provide spare parts for electronics and white goods, she thinks there will need to be lasting incentives for consumers to change their buying behaviours.

“You can’t just hope that consumers have a moral epiphany and are willing to do the inconvenient thing out of some higher sense of purpose. Almost no one has lasting behaviour change unless you’ve changed the incentives really significantly,” she said.

She is starting to see palpable change.

“Everyone I know buys on Depop or Vinted (online marketplaces for second-hand fashion) because you can get designer stuff cheaply. It’s not because people are trying to be super sustainable. I buy all my electronics second-hand because it is so much cheaper. And companies are seeing that and want a cut of the second-hand market, so they are starting to bring that into their supply chains.

“The less you put on consumers, and the more you just make it ‘the easy choice,’ that’s the way that behaviour change happens.”

How do you drive the debate about your technology being a game changer for sustainability? **[Read this case study to find out more.](#)**

Space Tech

09

Space has a dark side – will we use it for good or bad?

It's hard to believe that there hasn't been a person on the moon since 1971.

It may have taken more than 50 years, but NASA's Artemis program is looking to repeat the feat of Neil Armstrong, Buzz Aldrin, and others with a new moon mission in the near future (and this time, hopefully, female astronauts will moonwalk alongside men). But ever political, lunar exploration is no longer a two-horse race between the US and Russia. Hot on their heels for lunar exploration are countries such as China and India.

Meanwhile, two of the world's most powerful men, Elon Musk and Jeff Bezos, are engaged in their own space race.

We talked to **Shahida Barick**, a space specialist with over 25 years' experience in the industry, who previously served as Senior Operations Consultant for Europe's navigation programme, Galileo, at the European Space Agency (ESA), Deputy Operations Director for the British military communications satellites Skynet 5B and 5C at Airbus, and European Space Business Lead for L3Harris Technologies, to understand what will shape space in the next decade. Now an independent consultant, Barick discussed how this race may play out, and what the commercialisation of the night skies really means. She talks about the benefits that the satellite industry can bring, how it is already helping to run our digital lives, and offering insights against threats such as global warming and food shortages.

In conversation with TFD, she also has a warning. Space, rather like the moon, has a dark side and can be used for bad as well as good.

For those who know of the sci-fi series Star Trek, space is and always will be known as the "final frontier". In terms of exploration, we have come a long way since the TV series aired in the 1960s, and we have a lot further to go in the next 10 years, thinks Barick.

Satellites now fill our skies; in low Earth orbit are satellites such as Starlink, making their way like a train around the night sky, providing 4.6 million customers with internet access. In this same orbit is the International Space Station, while in mid and high Earth orbit are satellites that enable GPS and others that observe weather patterns.

Our lives are becoming increasingly dependent on them, Barick told TFD.

"We can't really use our mobile phones without PNT (Positioning, Navigation, and Timing). Banking cannot survive without satellites, and our defence capabilities on land, air, and sea are dependent on satellite connectivity and data. Without satellites, our world would absolutely come crumbling down," she said.



Shahida Barick,
Space Specialist

“The majority of space debris was created by three nations – the US, Russia, and China – and so it is incumbent upon those governments to work in partnership to support research and development to clear it up.”

Transforming Farming

In the next decade, as global warming increasingly threatens our security on Earth, we will rely on them even more, she predicted.

“Observation satellites will play a greater role in enabling global monitoring of things like deforestation, pollution levels, the status of the ice caps, and sea levels. Climate technology is arguably the most important thing we are doing in space today.”

She predicts that in the next decade these satellites will transform the farming and fishing industries, as well as leading to a proliferation of firms that are harnessing satellite data and extrapolating information from them for a range of industries and organisations.

The International Space Station may not yet travel to other galaxies as the Starship Enterprise did, but it is doing crucial work as it orbits the Earth many times each day. And the experiments being performed by the astronauts on board are already helping communities back on Earth.

“We are constantly looking at earthly problems, in terms of drought, clean water, or bacterial disease. What we are unable to do on Earth, we can do in space because the conditions are completely different with zero gravity,” said Barick.

“One example among many is about how they are monitoring how algae, bacteria, and other chemicals interact in order to understand the process of creating never-ending supplies of oxygen, water, and food. And here on Earth, they are using that knowledge to grow algae and bacteria to create food for villages in Congo.”

Digital Divide

It is estimated that one-third of the global population (some 2.6 billion people) still do not have internet access, and innovative satellite systems such as Elon Musk’s Starlink and Jeff Bezos’s Project Kuiper will play a crucial role in closing that digital divide in the next 10 years, she predicts.

But it comes at a price. Of the estimated 10,000 active satellites in orbit currently, most belong to Elon Musk, and that is a fact that Barick finds more than a little worrisome.

“Starlink has changed the technological landscape completely, but the likes of Elon Musk and Jeff Bezos are very powerful individuals, and when we have oligarchs in control of the powerful technology that has the capability to change people’s lives, then we are in very dangerous territory.

“I would say regulation, regulation, regulation. And I would recommend that the government really look into their supply chain model. If we diversify the supply chain, we curtail the amount of power and access Elon Musk and Jeff Bezos have to government contracts.”

The satellites that are now crowding our skies need a method of getting into space in the first place, and here too, Musk and Bezos have led the innovation, with SpaceX and its much-praised reusable rockets winning the race, but Bezos’s Blue Origin snapping closely at his heels with similar technology.





My Rocket is Bigger Than Yours

Reusable rockets mean costs come down considerably, said Barick.

“It means you can put more in space and then we can do more on Earth because of the data that will afford us. So, technologically, SpaceX and Blue Origin are marvellous, but the geopolitics around it is somewhat destabilising given the nature of the characters who are leading these organisations,” she said.

The huge increase in space activity will lead to an increase in space junk, an issue that is concerning many and one that needs to be addressed, said Barick.

“The majority of space debris was created by three nations – the US, Russia, and China – and so it is incumbent upon those governments to work in partnership to support research and development to clear it up,” she said.

“We have two companies here in the UK who are designing innovative technologies. One to grab debris, another to push it into the atmosphere so that it burns up, and we have data centres that allow us to monitor far more precisely how many pieces of debris we have. One of the best things we can do

is regulate how we use space better, and then we will have a higher chance of preventing new debris fields.”

Star Wars

And on that question of using space better, Barick has a grim warning. Space may become not just the final frontier for exploration but also for war in the next decade.

“We are used to thinking of space in the context of Star Trek or perhaps Star Wars, and folks going into space to better humanity’s understanding of other planets. And that is true, but the flip side is that we can also use it to help monitor what’s going on,” she added.

Many nations now have spy satellites in orbit, which allow them to watch what their rivals are doing in both peacetime and during war. The US and China have satellites in the skies above the Indian Ocean, for example.

Even Trump’s bizarre claim on Greenland may become a battle that is fought in the skies.

“The climate crisis has led to the Arctic ice melting, which has opened up sea lanes in the high North and enabled the movement of Russian and Chinese vessels who are beginning to use Arctic sea lanes for both commercial and military reasons,” explained Barick.

“What gives us a forensic level of detail into what is going on there are surveillance satellites in the high north, and they need to relay the data to ground stations based in places like Greenland.”

While the next ten years will see changes in geopolitics on Earth, they will also bring much innovation in space, she thinks.

Trip to Mars?

“Space companies are beginning to integrate AI and machine learning onto their systems because it allows for better decision-making and better autonomous operations. It introduces efficiency and greater safety that can lead to higher profit margins and cost benefits.”

She also sees a move away from the traditional large geo-stationary satellites that can cost many multiples of millions towards proliferated satellite constellations such as Starlink.

“The benefits are lower cost, rapid deployment, higher mission flexibility, and when used in large formations, they can foster greater resilience to threats. An example of this architecture can be seen with the work the US Space Force has undertaken in procuring missile warnings with missile defence satellites in both low Earth and mid Earth orbits.”

Of all the plans for the next decade in space, Musk’s desire to colonise Mars is perhaps one of the most ambitious and intriguing.

And while it may resonate perfectly with the Starship Enterprise’s mission “to boldly go where no man has gone before”, is it realistic or even desirable?

“No,” said Barick decisively. “I have no desire to spend two years in close proximity to a handful of people, to visit a planet we should not exploit.

“We can do incredible things in space, but it is also a place where we can potentially do bad things, and we should be amplifying the message around space as a place for good.”

Discover how TFD is telling space tech stories.

“We can do incredible things in space, but it is also a place where we can potentially do bad things, and we should be amplifying the message around space as a place for good.”

Biotech 10

Decoding life itself

The convergence of technology and biology could help solve some of the world's biggest challenges, from finding cures for diseases to providing new ways to feed an ever-growing population.

Major breakthroughs are already happening, such as DeepMind's AlphaFold, an AI program which utilises artificial intelligence to analyse and understand proteins.

The work was recently recognised with a Nobel Prize, shared with researchers behind similar advances, and has been touted as a game-changer for drug discovery.

But that is just the beginning of the alliance between technology and biology, think **Glen Gowers** and **Oliver Vince**, co-founders of Basecamp Research.

Their firm is generating a dataset of biodiversity, and they believe we are at an inflection point in biotech, one that will lead us down some interesting paths in the next decade.

Gowers talked to TFD about how he sees the future playing out.

When Darwin set sail on HMS Beagle back in 1831, little did he know that the observations he would make on that journey would go on to form an entirely new theory of how life on Earth had evolved.

Now, nearly 200 years later, a similar voyage is taking place. But this next phase of our understanding of biology will happen in the digital rather than the physical realm.

It will be computers, not humans, that are best placed to decode DNA and make connections between how molecules,

proteins and cells interact. And the work these powerful computers and AI models do will help solve a range of problems, from developing new ways to manufacture foods, to creating more sustainable material designs, to discovering new medicines and deepening our understanding of diseases.

It could also put us firmly on the path to personalised medicine, thinks Gowers.

"A patient could walk into a hospital room, and we could instantly diagnose them, design a drug, and work out how to produce that drug. We're very far away from that reality, but it is not inconceivable. Just as in architecture, you don't build loads and loads of tiny physical models and then hope the whole thing doesn't fall down when you build the real thing. We can do the design on a computer now and have very high confidence that the building will stand up. That's where we think we can get to with biology," he said.



Glen Gowers,
Co-founder, Basecamp Research

“We packed a lab into a nine-litre box and we put it in the back of a sledge and we lived up an ice cap in Iceland for a month.”

Internet of Biology

For AI models to make sense of the building blocks of life, they will need access to a whole new database. Much of the publicly available Sequence Read Archive (SRA) data – around 70% – currently comes from just five species, according to Gowers.

“That’s the equivalent of training ChatGPT on five books,” he told TFD.

To increase the information available will require a physical journey much like the one made by HMS Beagle, although, unlike Darwin’s journey, it will be collecting the unseen organisms that form the basis of life in animals, trees, and plants.

So far, Basecamp Research has collected DNA samples from around the world – from forests, rubbish dumps, and rivers. It has visited some of the most inaccessible places on Earth, including Antarctica, volcanoes, and deep-sea shipwrecks. It has done this in partnership with more than 27 countries and a range of organisations, such as the Scripps Institution of Oceanography.

And to persuade communities to take part, it has developed a unique economic model that means all the collected data is traceable back to its source, and all the communities involved in the data collection receive royalties.

“Data collection has sort of ground to a halt because people aren’t seeing these economic upsides to developing this sort of data. We are going to continuously pay back based on every piece of revenue from every use of this data. We’ve already shown that we can scale our data to an order of magnitude larger than all public data sets because incentives are aligned,” explained Gowers.

“We think we’ve done about 60% of the global biomes,” he added.

Labs in Iceland

Taking the tools of the natural world and digitising them is no easy task and while it helps that DNA sequencing has dropped hugely in price, there are other changes that need to happen, thinks Gowers.

The big genome centres are currently located in cities such as London, Boston, and Beijing.

“But most biodiversity is not in London or Boston or China, it’s in environments that don’t have genome sequencing facilities,” said Gowers.

Basecamp Research has become the first company to do fully off-grid DNA sequencing.

“We packed a lab into a nine-litre box and we put it in the back of a sledge and we lived up an ice cap in Iceland for a month. We were doing all this DNA sequencing, and it was solar-powered and infrastructure-free,” said Gowers.

While Basecamp Research’s labs are still built on the same principles of low-infrastructure requirements, they have scaled significantly in throughput and the consistency of data generated. Today, their work could end up helping identify gene editing proteins for rare diseases and cancer, or proteins that will degrade plastic faster and better.



Change in Pharma?

So what will the next decade look like for the wider biotech industry?

Investment potential is huge, but currently, Gowers feels venture capital is going into ‘quick win’ firms that might not work out in the long term.

“There are a lot of companies being set up at the moment where a new AI model gets applied to a public data set and the model is one that is also used in other fields. Putting these two things together is new, but it’s not long-term defensible.

“So, what I think we’ll see in the VC world is initial excitement in these types of companies, but less and less investment over time. Instead, the companies that are really thinking about how to build on top of a novel data set will be the most successful long term.”

The next decade will see significant steps towards a new era in biology, he thinks.

“Even small changes in how accurately we can understand biology will make huge differences in how many drugs can get to clinic or how many crops can get through trials,” he said.

“As the data sets get larger and models scale and get more intelligent, they can start to predict this more and more complex behaviour.”

AI is on the cusp not only of changing the way drugs are discovered and manufactured, but perhaps who makes them, too.

“Will the same 20 pharma companies still be the same top 20 in future? Probably not unless they can make the transition really quickly. The winners are the ones that can make that shift to becoming AI-native.”

Societal Rethink

Regulation of the food and drug industries may also need a shake-up.

“We are talking about producing the same types of products that are being approved today, but we are just saying we can do more and faster. So, potentially, that is a resourcing question for regulatory agencies. If a pharma company could develop 1000 drugs simultaneously, is the agency able to approve that many at the same time? Or, if you can accurately predict how a crop is going to behave, and are able to run trials that last days as opposed to years, is an agency set up to do that?”

Life science research does not happen in a bubble, and current political instability around the world is having an inevitable knock-on effect, most notably President Trump cutting funding to some of the top US universities.

Gowers remains optimistic that the research happening in places such as Harvard and MIT will survive the current political turmoil, but he warns that the West has a rival knocking at its door.

“Biotech and life sciences in China are booming, and the advances there are absolutely remarkable. The IP being generated, the speed at which they are doing it, and the amount of funding and support available from the government are also remarkable.”

If governments around the world really want to take advantage of the discoveries biotech will offer, there may need to be a radical shift in thinking, particularly when it comes to democratising healthcare. Al won’t make this change happen, he said.

“That’s a question of whether we, as a society, choose to make these drugs priced appropriately and available to everyone.”



www.wearetfld.com

Contact us

www.wearetfld.com

info@wearetfld.com

020 7846 7859