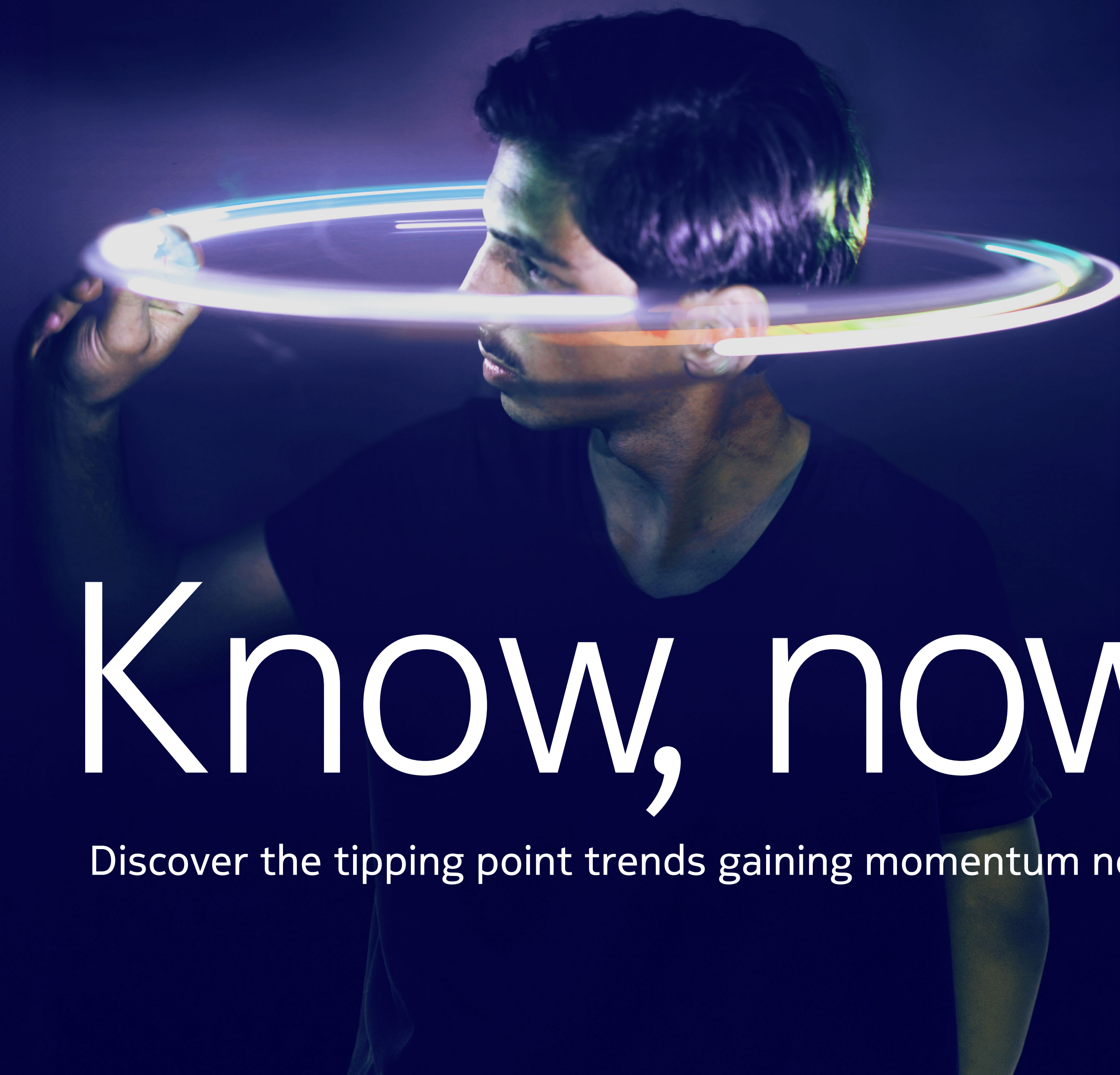




Know, now

Discover the tipping point trends gaining momentum now



Welcome

Sabrina Maniscalco's journey is a testament to the power of slow-burn technology.

A Sicilian living in Finland and a professor of quantum information, computing, and logic at the University of Helsinki, she has spent two decades quietly working in the field of quantum technology amidst the gradual evolution of the industry around her.

Her efforts have culminated in the founding of Algorithmiq, a potentially groundbreaking startup that has received generous funding of €13.7 million and looks set to revolutionize drug discovery.

The convergence of artificial intelligence (AI), cloud, and networking has brought us closer to a tipping point where slow, persistent work like Sabrina's is on the brink of transforming businesses, lives, and even our planet. Her story is a reminder that steady technological progress can suddenly create a lasting impact on the world.

In this latest edition of Know, now, we look at the tipping point trends that Communication Service Providers (CSPs) and enterprises should know about now. This includes how Sabrina's story demonstrates the vast potential of quantum computing for industry, the gradual rise of data democracy, the human-centric value of Industry 5.0, plus the importance of biodiversity for businesses.

In today's rapidly evolving technological landscape, networks are critical in driving transformation across businesses and society. Know, now 5 offers valuable insights into how networks merge various technologies to create momentum for this change.

Nokia Bell Labs has teams of expert researchers investigating the future. Its Tech Strategy 2030 provides a strategic insight into the future.



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The march

of quantum

The exponential age
of problem solving



Algorithmiq, founded by Sabrina Maniscalco, demonstrates how the march of quantum computing is gradually reaching a tipping point.

And the potential is vast. By harnessing the principles of quantum physics, quantum computers boast the promise of solving problems that have plagued science and society for years – accomplishing complex calculations 47 years quicker or 158 million times faster than any supercomputer.

Quantum technology can potentially revolutionize several industries, such as pharmaceuticals, cybersecurity, and logistics. Although it's unlikely that quantum computers will replace classical computers any time soon, it's crucial to combine the strengths of both to unlock quantum's full promise.

With an expected economic impact of almost \$1.3 trillion by 2035, worldwide investments in quantum technology start-ups reached their highest levels in 2022. Corporations such as IBM, Google, Microsoft, and Intel are investing heavily, the Chinese government has developed its own computer called Jiuzhang, while other smaller startups are looking at new approaches to maximize quantum speed.

All this comes with a flip side. Their immense processing power could one day be capable of cracking the widely used RSA encryption scheme, leaving essential data vulnerable.

A true quantum computer is a long way off, but the race is on for interim real-world solutions that will have a tangible impact on our lives and businesses.



Unlocking the power of qubits

If you have many doors but need to find the only one unlocked, a classical computer – using a traditional bit, which can only be a one or a zero – would try each door one at a time until it finds the right one. However, a quantum computer – using qubits that can be a one, a zero, or both simultaneously (superposition) – can try simultaneously, making it possible to conduct multiple calculations quickly.

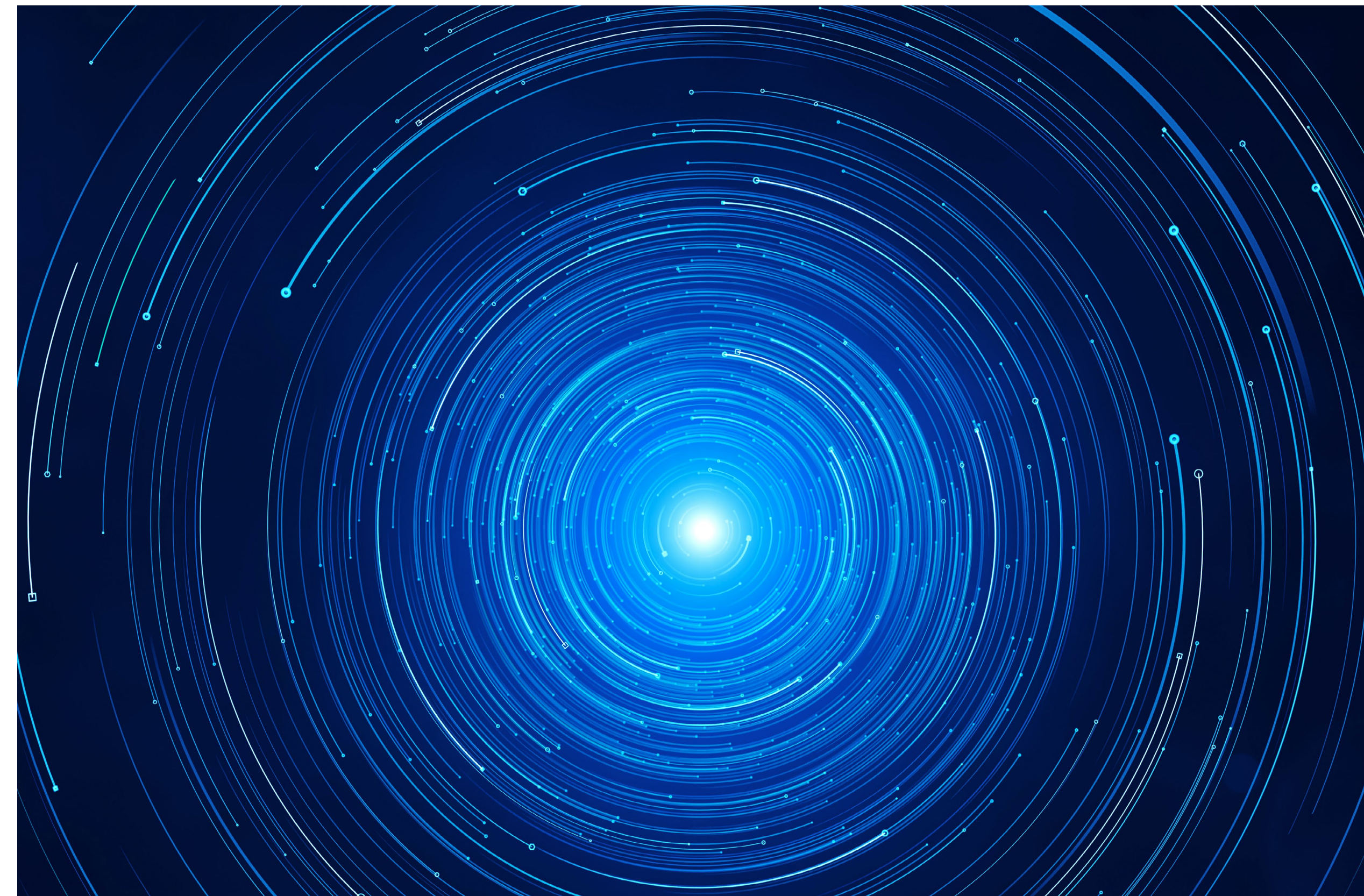


Quantum technology is advancing rapidly, and while it has no practical applications now, it's expected to pretty soon. It will then play a significant role in everyday functions and industries, even if only initially in partnership with classical computers.

Forbes predicts it will transform the pharmaceutical industry – enabling drug and vaccine discovery in days, not years. It could combine with AI and machine learning to transform financial services by better predicting trading signals in global markets, helping investors build resilient portfolios, and assessing environmental risks, which is crucial to sustainable finance decisions.

Logistics and supply chain activities often involve vast amounts of data, making ultra-complex optimization algorithms impractical. Quantum computing could significantly change multiple industries, including healthcare, by improving outcomes via early disease detection, amongst other benefits.

Quantum computing could also seriously threaten our digital lives. A new Deloitte poll reports a significant cyber risk from 'harvest now decrypt later' (HNDL) attacks, in which attackers steal encrypted information and will wait until quantum computing advances make it simpler to crack. This makes it imperative to stay quantum-safe at both the software and the network level.



Big Tech companies dominate

It's essential to recognize the big tech companies in quantum computing, such as Amazon, which enables anyone to run programs on its quantum computer. [IBM](#) has developed a technique to manage the inherent unreliability of quantum processors. It has partnered with [Mercedes-Benz](#) to revolutionize the transportation industry with next-generation batteries, and [Boeing](#) to address one of the significant challenges in aerospace engineering.

[Google](#), meanwhile, has developed a quantum computer that instantly makes calculations that would take the best-existing supercomputers 47 years to achieve. Other big tech players in this field include [Intel](#), [Microsoft](#), and [Toshiba](#) that are all investing heavily in space-age hardware to achieve their specific goals.

Bringing quantum to life

Algorithmiq, launched in 2020 by Sabrina Maniscalco, is one of a handful of startups developing software for the noisy quantum computers we can access today. Algorithmiq – considered the first quantum biotech company – is figuring out sophisticated methods to model noise and mitigate against it so that early-stage devices can be used for experiments.

To begin with, the company is focusing on chemistry simulations – a promising potential use case for quantum computers because they mimic the uncertainty of nature and are essential for drug development and discovery.

Solid backing for Universal Quantum

[Universal Quantum](#) is looking to build a quantum computer with one million qubits, capable of solving complex problems in various fields, from medicine to finance. Unlike many other quantum startups, Universal Quantum uses microwave technology instead of lasers. The startup has received significant investment from notable investors, including Village Global, backed by Bill Gates, Mark Zuckerberg, and Jeff Bezos.

Advancing Personalized Medicine

Fujitsu has collaborated with the Barcelona Supercomputing Center as part of its joint efforts to enhance disease detection rates with IBM. The project aims to use quantum computing to facilitate precision diagnostic medicine by analyzing diverse datasets, encompassing molecular characteristics in the genome and extensive features in X-ray images. [This collaboration](#) will help advance personalized medicine and improve disease detection rates.

Making hacking futile

Quantum computers pose a significant threat as they can hack at breakneck speed and, in the wrong hands, could access sensitive information. While breaking current encryption methods would require significant advances in quantum computing, the issue still needs to be addressed.

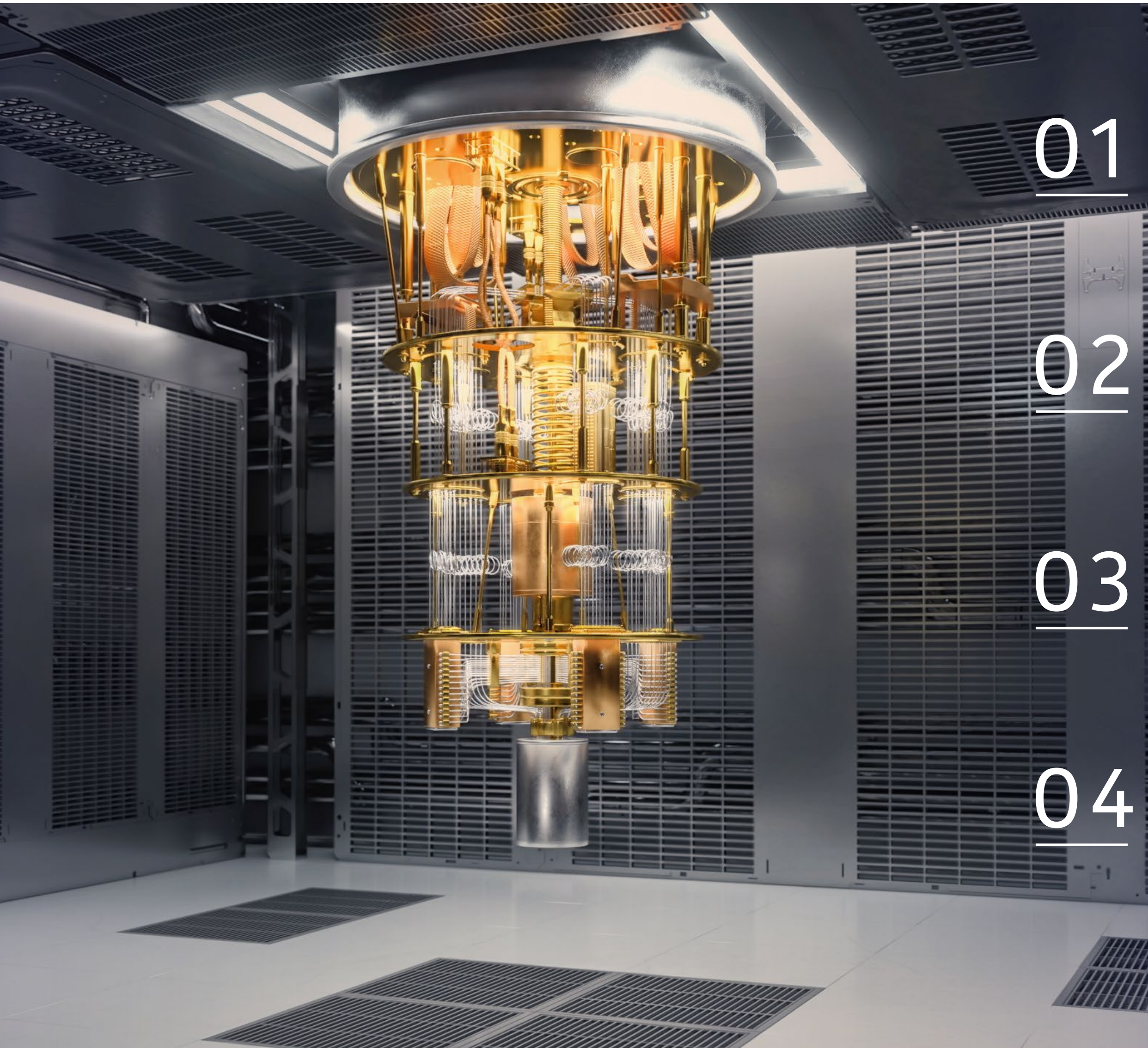
Arqit Quantum has stepped up on the network level by providing an integrated solution for [quantum-safe VPN communications](#). At the same time, Nokia recently announced the completion of [Europe's first live hybrid quantum encryption key trial](#) with Proximus – successfully encrypting and transmitting data between two data centers in Brussels and Mechelen, Belgium.



01

How to be prepared

Do your homework



01

Many cloud computing service providers offer quantum computer access, enabling potential users to experiment with this technology. As personal or mobile quantum computing is unlikely, the cloud may be the primary way for early adopters to experience the technology.

02

Combining classical computing with quantum computing can advance both fields. These two types of computing have their strengths and weaknesses. While classical systems are good at handling data preparation, visualization, and error correction, quantum systems are more effective at complex calculations. Therefore, using classical and quantum systems together can improve overall computing performance.

03

Companies should ensure they are ready for quantum computing, whether to disrupt their industry or protect their data. They can gain a competitive edge in their respective fields by taking this step.

04

Companies must flag sensitive data and establish governance measures, particularly in older systems vulnerable to future attacks.



Data democracy is coming

The internet of value



In the early days, the internet was known as Web 1.0, allowing us to connect with people and information worldwide. With the advent of Web 2.0, we saw a new era of user-generated content and social media, where people could create and share their content, connect with others, and build communities. But this came with the privacy challenges that dominate the news today. And so, the web continues to evolve.

Web 3.0, considered the future of the internet, is promising a more immersive and decentralized blockchain-based online world. Previously, when it came to blockchain applications, there was a tendency to focus on the financial value of cryptocurrencies or nitty-gritty tech details, but the conversation has gradually pivoted towards value.

As a result, blockchain-based applications have been gradually gaining momentum. As these technologies reach a tipping point, the global blockchain technology market is projected to grow to \$469.49 billion by 2030, according to [Fortune Business Insights](#).

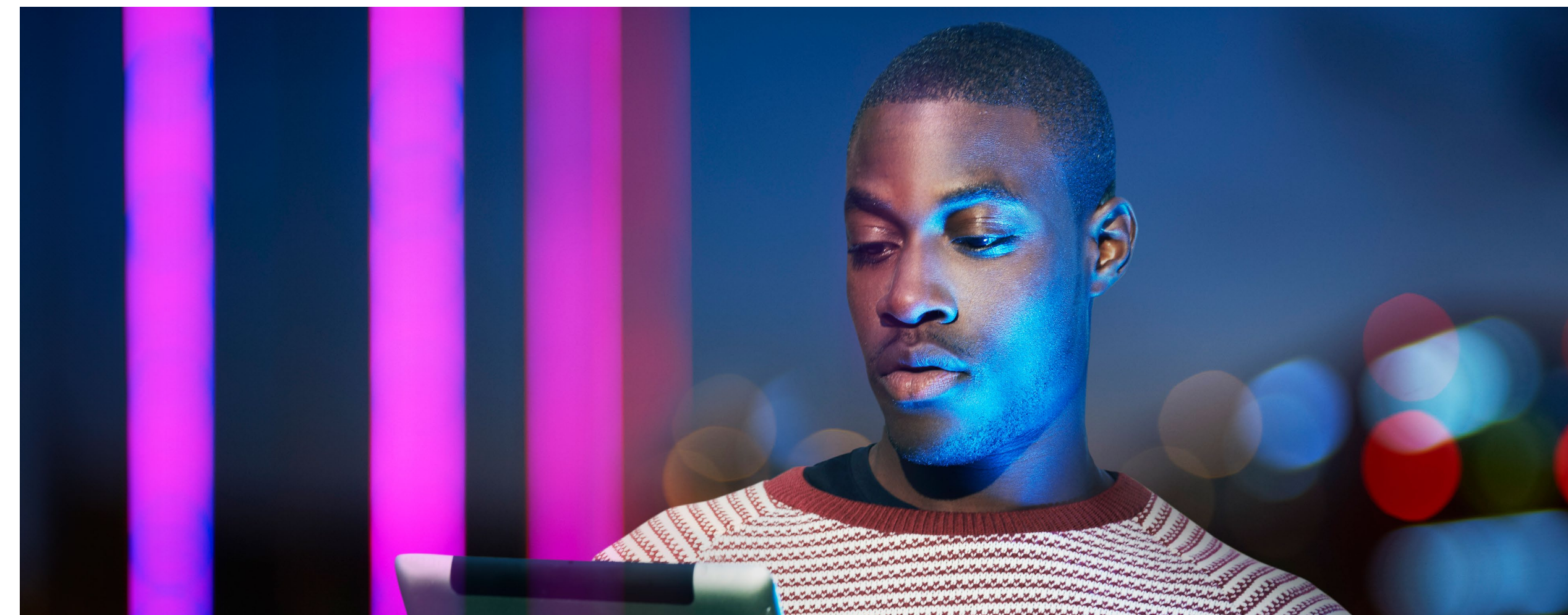
The global blockchain market
is projected to grow to \$469.49
billion by 2030



Today, blockchain applications are widely used across industries in many surprising ways. Smart contracts – which automate simple transactions and cut out the intermediaries – are currently employed in many tangible use cases. For example, Walmart has utilized this to track the sources of products in its supply chain.

Then there is the utility of NFTs (non-fungible tokens) – which can't be traded or changed – and already provide business value in customer retention. Most famously, Starbucks utilized Web 3.0 technology as part of its loyalty program, allowing customers to participate in interactive activities and earn NFTs as incentives.

Ultimately, the evolving Web 3.0 can serve a broader purpose than Web 2.0, including creating an internet of value – where people can transfer assets amongst themselves without needing intermediaries.

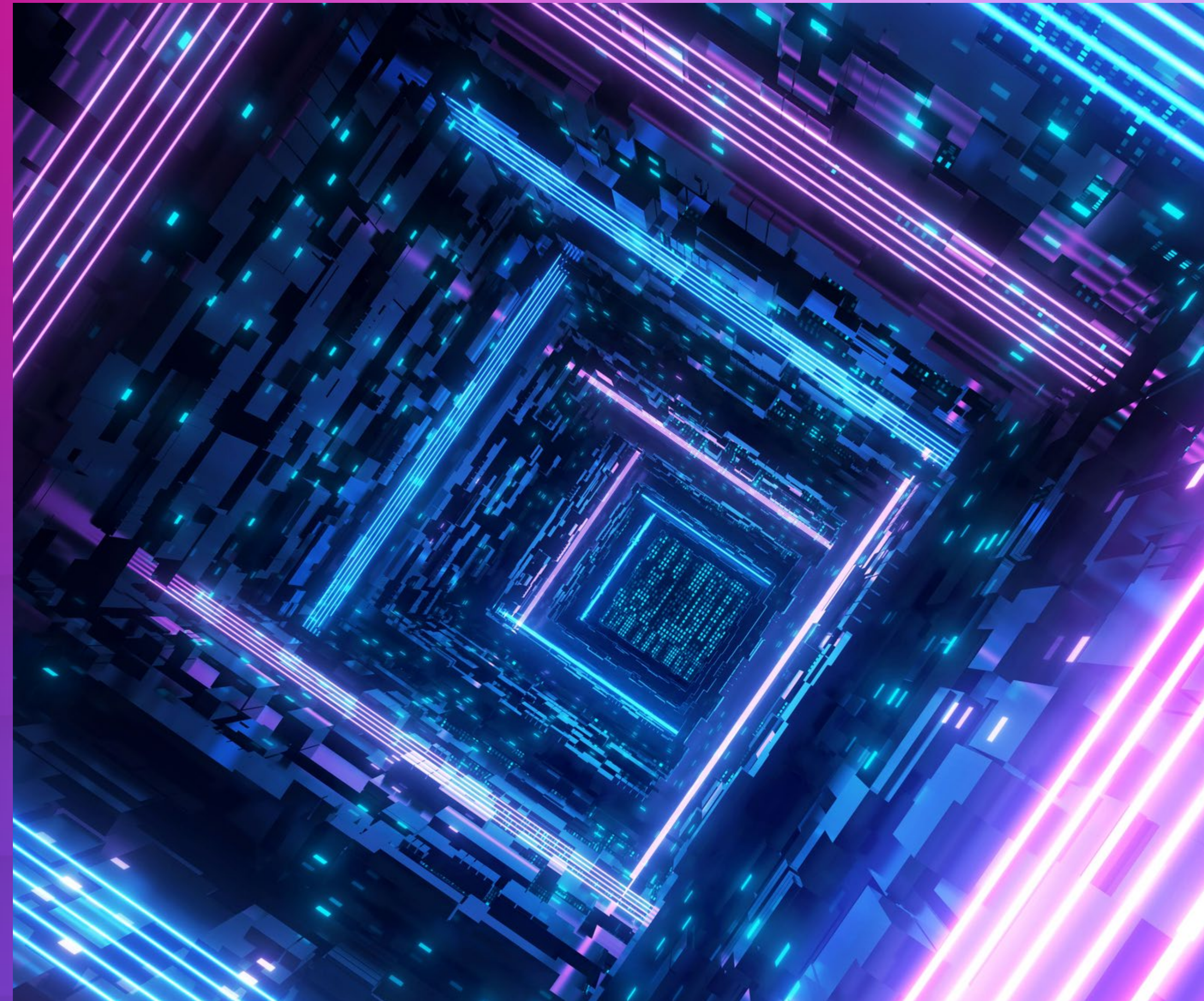
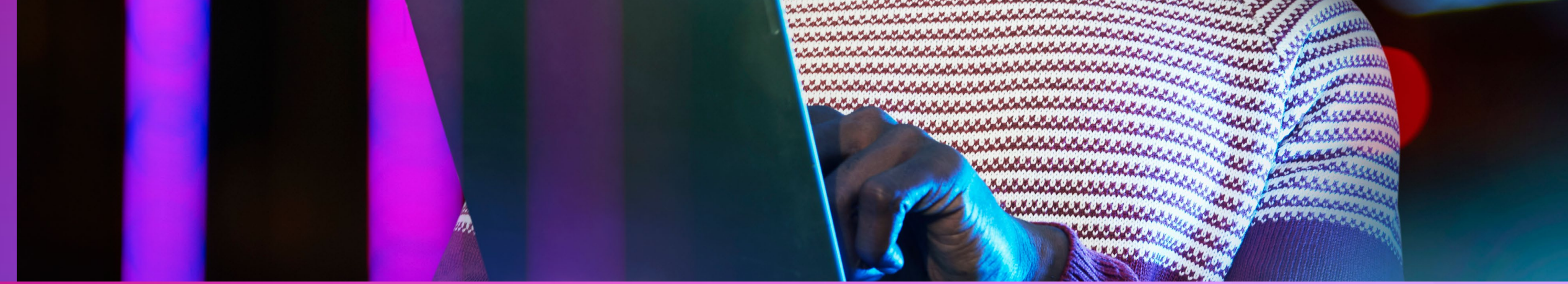


Gavin Wood, one of the founders of the blockchain Ethereum, who first used the term Web 3.0, had a vision of an internet that doesn't require users to hand over personal information to companies to use their services.

The promise is that instead of being at the mercy of major tech companies, consumers have new ways of searching, communicating, banking, and shopping that would safely put the power of the internet back into their hands.

The importance of this for individuals and businesses is hard to underestimate. It changes how companies communicate and interact with their customers and places even greater emphasis on seamless connectivity and automation.

These applications also achieve higher security and interoperability by building decentralized infrastructure, running on distributed blockchain and cloud networks. This creates a safer and more efficient online landscape for businesses, and places the expectation of transformation on them in return.





Keeping Theta firmly on the ground

Theta has developed a decentralized blockchain-based network to enhance the quality of video streaming while maintaining high efficiency and affordability. Theta Labs includes experienced technologists and media executives from Netflix, Amazon, Samsung, Vimeo, and Salesforce, making them the leading blockchain for media and holding over a dozen patents in blockchain, video, streaming, VR, and NFTs.

Sparkling creativity in a virtual world

Decentraland has become popular among users due to its immersive 3D virtual reality platform for content creation and monetization. The platform operates on the Ethereum blockchain and aims to create a network its users own, thus fostering a shared metaverse. Users can purchase virtual plots of land within this digital landscape, ushering in a new era of interactive and creative experiences.

Come in Pokémon, your time is up

Web 3.0 games are the future of blockchain-based games. Axie Infinity is a modern web 3.0 gaming platform that utilizes a play-to-earn model, allowing players to play, earn, and trade game assets such as weapons, skins, vehicles, and collectibles in NFTs. To access the Axie Infinity platform, users must complete a multi-step process, including setting up an account and connecting a wallet.

A gamechanger for the finance industry

Uniswap is a DeFi (Decentralized Finance) exchange protocol on a Web 3.0 network. It provides complete asset ownership to users, enabling developers, traders, and liquidity providers to participate in an open financial marketplace. Version four, the latest iteration, offers a range of new features, optimizations, and opportunities to redefine how we interact with DeFi.



02

How to be prepared

Get ready for the next phase of the internet

01

Identify the technology building blocks and capabilities that can benefit your operations today and in the future with Web 3.0. Consider using blockchain technology for internal and external-facing solutions, including partner roaming and settlement identity services, and provide a more trusted model to on-board 3rd party applications to monetize 5G.

02

By exploring blockchain distributed ledger technology, you can create a transparent platform for sharing data and computing among network entities like cloud servers, edge devices, and base stations. Automating processes and contracts can enhance the efficiency and transparency of your networks while providing a verifiable and immutable record of network activities and performance.

03

Integrating blockchain with AI can maximize network configuration, routing, and resource allocation, optimizing the performance of 5G and 6G networks. This will improve your networks' efficiency and transparency while providing a verifiable and immutable record of network activities and performance.



Get
ready for

Industry
5.0

From welfare to wellbeing



According to [Forbes](#), Industry 5.0 represents a transition from Industry 4.0's emphasis on economic value to societal value. While Industry 4.0 has progressed quickly, Industry 5.0 builds upon its advancements and takes a more human-centric approach, promoting cross-sector collaboration, a circular economy, and a shared vision of leveraging technology for a better future.

As Industry 5.0 develops, it will mean a world where advanced technology helps workers collaborate with machines and where even the most dangerous tasks can be done safely and efficiently through remote-controlled equipment. We are seeing evidence of this in the burgeoning [industrial and enterprise metaverse](#), which is set to continue at pace.

The European Union has already [defined a list of six technologies](#) that will drive its development. These focus on many technologies that are independently ramping up and gaining – like AI, cyber-safe data transmission, real-time simulation, and energy efficiency – but the key area here is human-centric solutions and human-machine interaction, such as collaborative robots (cobots).

The cobot market is expected to be worth \$6.8 billion by 2029

The cobot market, for example, is expected to be [worth \\$6.8 billion by 2029](#), growing at a CAGR of 34.3%. Last year's Know, now report focused solely on humans, but the gradual integration of humans and machines is accelerating in anticipation of [6G in 2030](#). Because in this next generation of the network, new machine interfaces will make it even easier for humans and machines to collaborate.





Industry 5.0 looks to ensure a harmonious work environment where humans and machines collaborate to achieve higher productivity, innovation, and customization.

With its agile and flexible manufacturing processes, Industry 5.0 enables safer, more efficient, and more inclusive workplaces and is critical to meeting ambitious productivity, resilience, and sustainability goals.

Workers will unlock their true potential by being freed from mundane and repetitive tasks. Real-time data analysis will empower

them to make informed decisions and unleash their creativity and critical thinking abilities.

But it's more than that. At its heart it represents a shift in thinking where people and planet come first, and wellbeing takes center stage.

This presents a game-changer for government agencies. It equips frontline workers with the tools to make well-informed decisions in critical situations, ensure public safety, and foster a safer and more secure society.



The world's first cobot could be the world's best

ABB is a global leader in the manufacturing of collaborative robots. They offer a range of single and dual-arm, programmable cobots, including [YuMi](#). Combining people's unique ability to adapt to change with robot's tireless endurance for precise, repetitive tasks, YuMi can automate the assembly of many products on the same line.

ABB's innovative suite of collaborative automation solutions, including ABB's YuMi robots, empowers people and robots to work together safely and more closely than ever before.

Clarify will bring your data to life

Clarify's next-generation SaaS [time-series data intelligence tool](#) is a game-changer for industrial automation. Its data analysis platform and Industry 5.0-ready features allow organizations to utilize the potential of their industrial data fully. This state-of-the-art technology empowers users to effortlessly navigate and analyze hundreds of data signals simultaneously, unlocking valuable insights.

Harnessing the power of 5G and digital twins

[OMRON, Nokia, and Dassault Systèmes](#) teamed up at Hannover Messe 2023 to advance IoT solutions in industrial settings. The OMRON LD mobile robot benefits from seamless connectivity provided by Nokia's 5G private wireless network technology to perform repetitive tasks.

At the same time, Dassault Systèmes has developed a digital twin of an OMRON autonomous and flexible production solution to illustrate virtual simulation's planning, optimization, and efficiency benefits.



01

Industrial organizations must understand that the technologies of Industries of 4.0 are a stepping-stone to greater collaboration between humans and machines. This may only be early days, but the decisions companies make now could significantly impact their wider future.

02

To ensure the success of Industry 5.0, we need to bring together different stakeholders who interact with the telecoms industry. The goal is to ensure that their specific interests are appropriately considered in standardization and regulation. This involves discussing and evaluating technical, regulatory, and business aspects related to Industry 5.0 to align more closely with the needs of the industry.

03

CSPs have a significant opportunity to facilitate and strengthen the adoption of Industry 5.0 across various organizations. Data connectivity and communication will be critical to the smooth operation of Industry 5.0 technologies, whether enabling digital twins or increasing the effectiveness of cobots.

04

Enterprises must consider various factors beyond network connectivity, such as application design, software engineering, power and battery ecosystems, big data, analytics, and security. Service providers can simplify this process by offering a one-stop solution and building a successful business around Industry 5.0.

05

CSPs can be crucial in delivering digital twin services, including designing, developing, deploying, and integrating them into customers' IT/OT workflows.

06

The convergence of OT and IT systems, digital twins, and cobots will increase the risk of cyber-attacks in Industry 5.0. CSPs can offer cybersecurity services to protect against these threats, ensuring the safety and integrity of critical infrastructure and business operations.



Biodiversity is a necessity

Sustainability relies on tech



Biodiversity refers to the wide range of living organisms that inhabit the Earth. Humans depend on this diversity for their survival, as plants and animals provide us with fresh water, food, and medicine. Different species of plants and animals work together to deliver these essential benefits. Furthermore, plants help to purify the air, regulate temperature, and safeguard against climate change.

According to [The Guardian](#), human activities such as deforestation, pollution, and carbon emissions currently threaten 36 of the world's biodiversity hotspots. With over [half of the world's GDP dependent on nature](#) and the land and the ocean absorbing more than half of all carbon emissions, we must take action to safeguard and preserve our natural resources.

Nations worldwide have pledged to [protect 30% of Earth's land and seas by 2030](#) to halt biodiversity decline. Adopting the [Kunming-Montreal Global Diversity Framework](#) shows how we can work together to conserve ecosystems and species, use resources sustainably, share natural resources more equally, and live in harmony with nature by 2050.

According to the GSMA and Carbon Trust, [mobile networks have a track record of promoting emissions reduction](#), while using [the right tech could lower global emissions by 17%](#). Utilizing advanced connectivity, cloud-based technologies, analytics, and AI could reduce our carbon footprint, conserve energy, and enhance efficiency.

Using the right tech could lower global emissions by 17%



Human activities are causing a significant loss of biodiversity and the degradation of natural ecosystems at an alarming rate. Relentless carbon emissions have pushed the climate crisis into a new cataclysmic phase. As a result, our precious marine, terrestrial, and freshwater ecosystems are experiencing devastating impacts.

Many species work together to provide the food we need to stay healthy. A quarter of modern medicine is made from rainforest plants, with 70% of cancer drugs based on natural products or synthetic materials inspired by nature. Every time a species goes extinct, we lose the chance to discover new medicines that could have been developed from them.

Natural materials used in medicine generate around \$75 billion in sales every year, and that's not even counting the value of other industries that depend on natural ecosystems, like tourism and food. All in all, human activities that rely on nature are worth about \$125 trillion annually.

70% of cancer drugs are based on natural products or synthetic materials inspired by nature

Reducing energy consumption and achieving zero emissions is crucial for a sustainable future. The path to success requires collective efforts from governments, businesses, and individuals. Digital technologies can play a significant role in enabling us to reach these goals. By working together, we can help biodiversity recover.



Capturing the fragility of biodiversity, one photo at a time

Advanced technology is helping to track and protect species on the brink of extinction. [Wildlife Insights](#) uses machine learning to process and analyze images from motion-detector cameras quickly, revealing information about species' condition in near-real time and analyzing photographic evidence about species and how they survive.

Giving reforestation a boost

[AirSeed](#) is an Australian restoration company tackling climate change head-on using drones to enable a new era of [large-scale tree planting](#). Trees can be planted quickly and efficiently in remote and inaccessible locations like Mexico's Yucatan Peninsula. And thanks to satellite-based and on-site sensors, these young forests can be carefully monitored and protected over the long term.

Environmental sensing and analytics can help a world in peril

Dynamic, real-time sensors deployed globally by [Environmental Monitoring](#) from [Nokia Bell Labs](#) offer early detection and continuous AI/ML insights. They track environmental conditions and protect transportation, communications, water, and power/gas services. This is crucial for utilities, emergency services, government agencies, fisheries, timber, and agriculture and is part of the solution to the climate crisis.

Artificial IoT (AIoT) solutions for net-zero carbon targets

[AIoT](#) – Artificial Intelligence combined with the Internet of Things – could be an effective way to achieve zero emissions. It can optimize fleet management, minimize waste in smart farming, and enable smart factories and cities through sensor deployment. Additionally, [digital twins](#) offer virtual operations optimization before application to real-world models.

Alibaba Cloud's [ET City Brain Version 2.0](#) covers all 420 square km of urban areas in the eastern Chinese city of Hangzhou. AI and cloud computing technology can maintain the city's urban transport management to speed up traffic efficiency and lower carbon emissions.



01

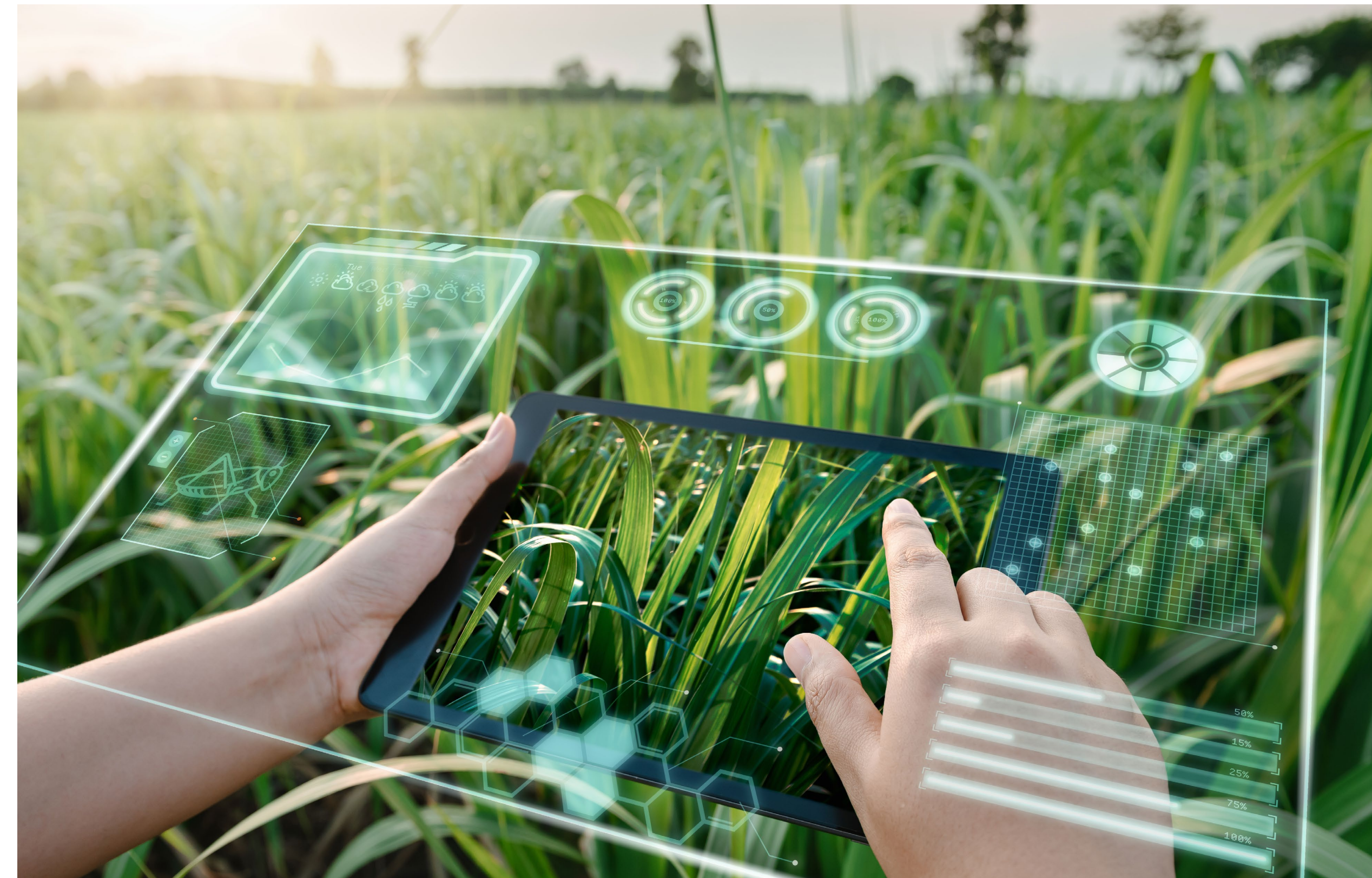
Our research suggests potential productivity and energy savings gains of 10-20% by 2030 with the move towards IoT devices and automation of labor-intensive tasks. Smart factories can reduce CO2 emissions in the manufacturing industry by automating production lines, reducing plastic use, and implementing circular economy practices.

02

Organizations can create a sustainable future using advanced connectivity, edge cloud, analytics, and AI technologies. Digital technologies help reduce energy consumption, carbon emissions, and waste, streamline supply chains, connect the unconnected, and increase inclusivity, improving productivity while addressing environmental and social challenges.

03

Buildings account for nearly one-third of the world's total final energy consumption. With only 20% of buildings expected to be new by 2050, it's critical to prioritize optimizing energy systems in existing structures. Retrofitting older buildings with AI and IoT-based solutions can significantly improve their efficiency.



Tipping point trends

will transform our world

The convergence of a raft of technologies – many of which have loosely been on our radar for a long time – is gradually reaching a tipping point.

This means technologies like quantum computing that have held promise for a long time, and have slowly been making incremental advances, are finally about to reach fruition. Sabrina Maniscalco, who has worked as a quantum academic for decades, is only now bringing to market a startup that many believe will change drug discovery.

The next wave of the decentralized internet – Web 3.0 – relies on blockchain applications that have been around for some time but are only now conjoining with technologies, such as AI, to change the human relationship with

the virtual world. Industry 5.0 builds on the momentum of Industry 4.0 and the industrial metaverse, to put people squarely at the heart of connected industry.

Over in the natural world, protecting biodiversity is everyone's concern – from businesses to consumers – and digital technologies, powered by the network, have a critical role in protecting what we have and driving energy efficiency. And this has never been more important.

This edition of Know, now focuses on the wealth of technologies that are coalescing, amalgamating, and ramping up to show the key trends you must have on your radar over the coming months. We're reaching a tipping point, and being in the know is the key to being prepared.



Four takeaways

you need to Know, now

Technology develops slowly and then moves quickly. These are the top trends CSPs and enterprises should stay abreast of right now or risk getting left behind.



01

‘Interim’ quantum computing could impact your businesses very soon – we’re a long way from the true fruition of quantum computing, but two things are clear right now. Firstly, many companies will be able to tap the potential of superfast computing shortly. Secondly, business assets can be hacked now to decrypt later – so it’s important to stay quantum-safe.

03

The next wave of industry is more human-centric – Industry 4.0 was often seen as the smart use of technology. Industry 5.0 takes that a step further by helping humans and machines to work together smarter. This will become increasingly important as 6G develops.

02

Data decentralization changes online experiences – as Web 3.0 technologies also become more commonplace, they will have a direct impact on data ownership and the way businesses interact with customers.

04

Protecting biodiversity is more than an ESG tickbox – having more living organisms on the planet will lead to a safer and healthier environment. Technology can play a role in this, and companies that prioritize the betterment of the world are likely to be the most successful.





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Disclaimer: This report was correct at the time of publication,
but things change quickly in a fast-paced technological landscape.

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.

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