

AT THE

Future's Edge

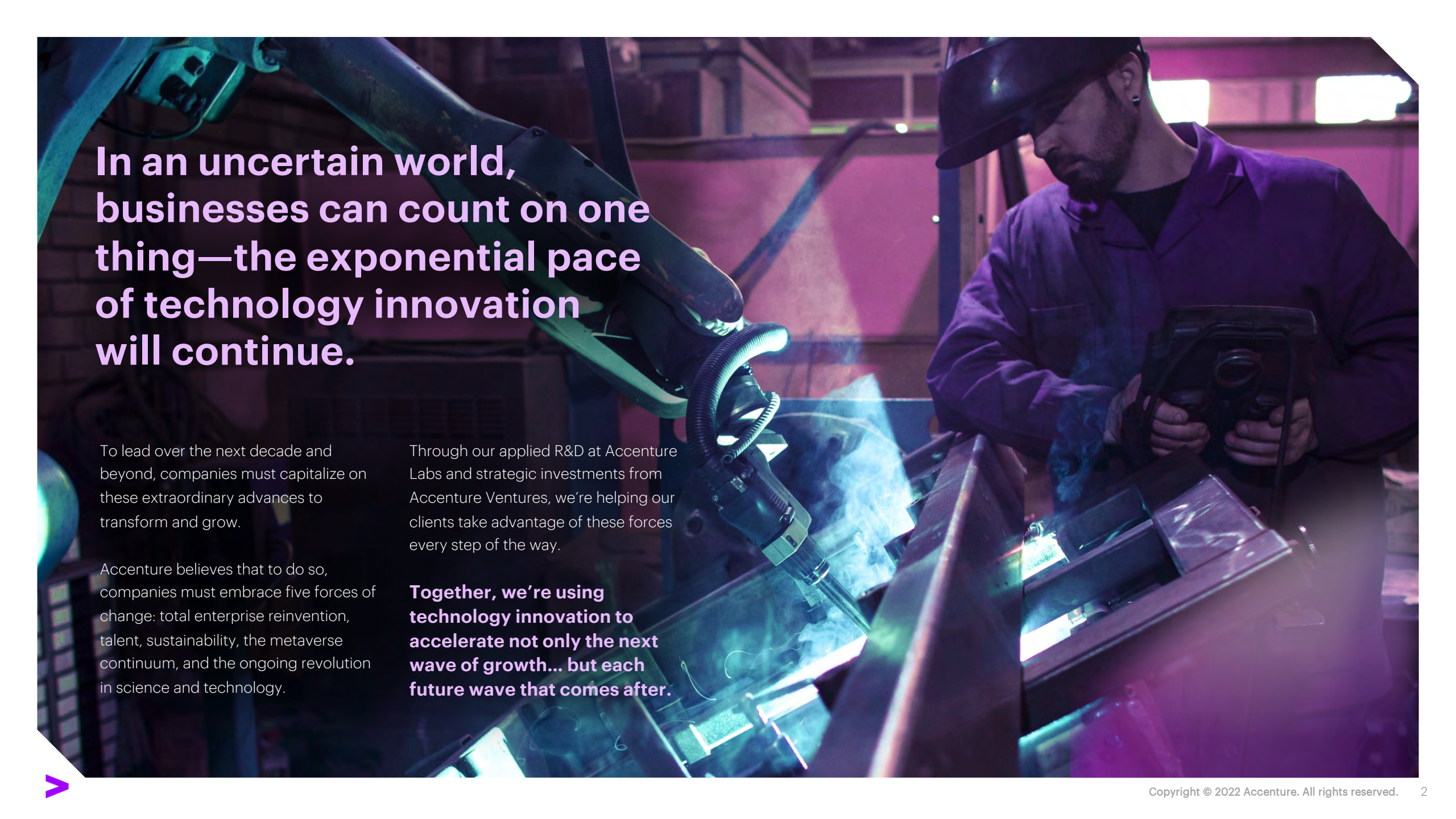
accenture

Innovation Stories from

Accenture Labs

Accenture Ventures



A worker in a hard hat and safety glasses is operating a robotic arm in a factory setting. The worker is wearing a blue long-sleeved shirt and is looking down at a control panel. The robotic arm is blue and is positioned over a workbench. The background is a dimly lit industrial environment with various pipes and structures.

In an uncertain world, businesses can count on one thing—the exponential pace of technology innovation will continue.

To lead over the next decade and beyond, companies must capitalize on these extraordinary advances to transform and grow.

Accenture believes that to do so, companies must embrace five forces of change: total enterprise reinvention, talent, sustainability, the metaverse continuum, and the ongoing revolution in science and technology.

Through our applied R&D at Accenture Labs and strategic investments from Accenture Ventures, we're helping our clients take advantage of these forces every step of the way.

Together, we're using technology innovation to accelerate not only the next wave of growth... but each future wave that comes after.

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WELCOME
TO THE

Future's Edge

We're excited to share examples of cross-industry innovations that we've been advancing with our clients and research partners through Accenture Labs and Accenture Ventures.

This year, our innovation stories are grounded in five forces of change that are shaping business growth. We've helped clients harness those forces and accelerate innovations in areas like Industry X, digital twins, robotics, smart materials, energy efficiency, quantum computing, advanced AI, and much more.

Given increased interest in the business community, the metaverse has been a major focus of our recent work. Our teams have helped clients explore, understand, and crack the most promising use cases in a wide range of industries. This is something we've been working on for 15 years, during which time Accenture registered over 600 patents related to metaverse continuum technologies.

As we look ahead, we see many more exciting opportunities to push the boundaries of the possible, especially in space and science technology.

Already, we've invested in exciting, young companies that are opening up the unique R&D environment of orbit. This includes satellite mapping companies that promise to transform the way we track and measure the sustainability of the planet.

These stories are just a taste of the broad range of innovations we're driving forward to the future's edge. We're excited to keep partnering with our clients and research partners as we continue to look for ways to outmaneuver uncertainty by turning cutting-edge technology innovation into practical business applications.

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Prepare for Liftoff

—
Embracing the
Five Forces of Change

Today's exponential pace of technology innovation means companies face one of the most exciting periods of positive change and progress since the Industrial Revolution. **To capture the vast opportunities for growth, we believe business leaders must embrace five forces of change.**

Every part of every business is being transformed by new technologies, new uses of data and AI, new ways of working, and new opportunities for growth. This is driving dramatic changes in how organizations operate—and what they can accomplish for their customers.

Total FORCE 1 Enterprise Reinvention





Smart manufacturing with digital twin

Manufacturers often need to react quickly in uncertain business environments, making complex production decisions with potentially significant consequences for profitability, productivity, and sustainability. We've been working with Cognite, Microsoft and Cosmo Tech to show how **contextualized data as a faithful digital twin, simulation /optimization, and AI can help companies make better split-second decisions when unexpected events occur**. Our cloud-based solution combines a digital twin of a production line with simulation and

scenario planning capabilities: what-if simulations and how-to optimizations. The simulation also allows the generation of synthetic data to train AI models through reinforcement learning. It's designed to master data lifecycle (data from the past, present, and future), helping manufacturers understand the impact of each potential option—on everything from profitability and productivity to costs and carbon emissions—and optimize their operations in near real time.

Honing the hydrogen supply chain with AI

Hydrogen has a potentially key role to play in the energy transition. But the technology's viability rests on the ability of its supply chain to scale up to meet growing demand. We helped one leading supplier of hydrogen tanks increase manufacturing efficiency by rethinking quality control with artificial intelligence.

Our solution overcomes one of the big practical challenges associated with automated defect detection—finding enough “bad” outcomes to train the AI algorithms effectively. By reframing the approach, we developed an AI solution able to rival human inspectors—and scale up far more effectively.

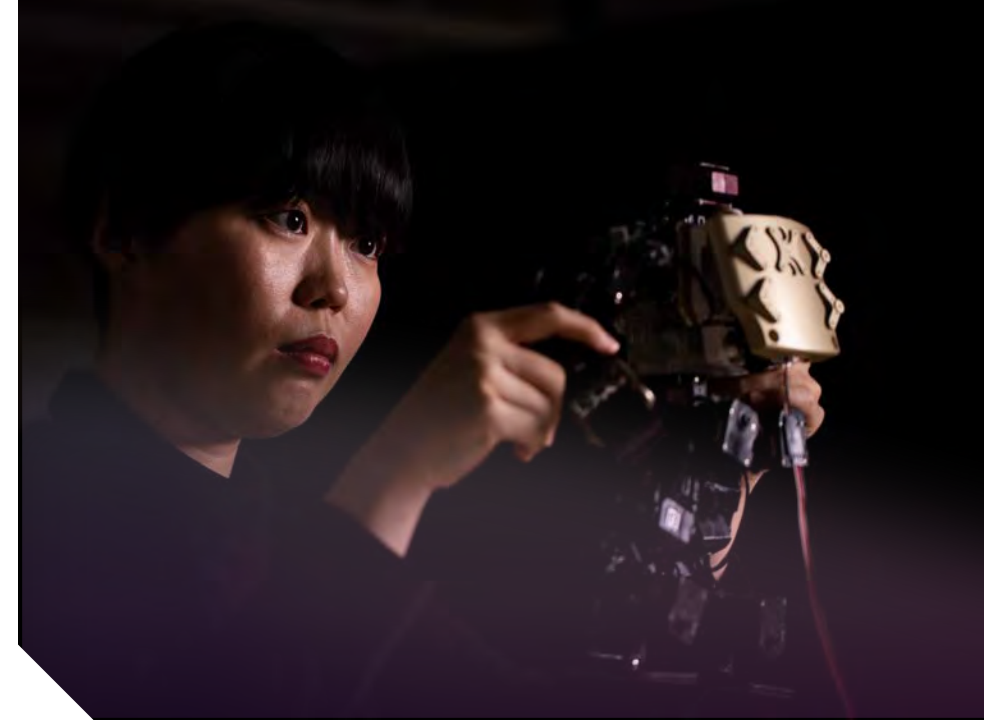
Preserving data privacy

Creating synthetic data can be a highly effective way of generating insights from a dataset without compromising its privacy. Accenture worked with [Veritas](#), an industry consortium established by the Monetary Authority of Singapore (MAS), to co-create a framework and methodologies that enable financial services institutions to evaluate their AI and data analytics solutions against the principles of fairness, ethics, accountability and transparency (FEAT). Veritas wanted to illustrate the framework with [use cases](#) using real data, but in a way that protected the privacy of the individuals involved. For the fairness framework use case, Accenture not only helped synthesize a privacy-preserving version of the original data, but also used our new Automated Privacy & Value Assessment Tool (APAT) to illustrate how anonymization had impacted both the privacy and usefulness of the data.

Making machine learning trustworthy on the edge

As Internet of Things matures, more machine learning algorithms are being pushed onto connected endpoint devices to benefit from lower latency and avoid bandwidth limitations. But the constraints of edge hardware often mean machine learning (ML) models must be compressed for this to work, potentially impacting their security and resilience. And with ML increasingly used in smart cities, smart energy grids, and other critical infrastructure, the impact of security breaches can be extremely serious.

We've been collaborating with university partners to ensure machine learning can stay trustworthy on the edge. Our Model Compression Defense solution is designed to preserve not only performance but also security and resilience during the model compression process.



This helps ensure ML models can withstand a variety of AI and privacy attacks despite the hardware constraints of edge environments.

Transforming healthcare through collaborative data-sharing

Collaboration and data-sharing among hospitals could lead to rapid healthcare innovation and unlock previously unknown insights into diagnoses and treatments—but privacy concerns have prevented broad data analysis. We invested in data privacy solution provider TripleBlind and their unique Blind Learning approach that enables AI model training across partners, with data that can't be moved or re-identified. By using larger and more diverse datasets—while preserving data privacy and ensuring compliance—healthcare organizations can develop more accurate algorithms for diagnostics



and collaborate to develop, test, and deploy AI solutions for targeted treatments. This approach has been implemented at hospital partners across the globe, driving faster and easier data collaboration that respects privacy regulations and may ultimately lead to accelerated medical discovery and better patient outcomes.

By using larger and more diverse datasets—while preserving data privacy and ensuring compliance—healthcare organizations can develop more accurate algorithms for diagnostics and collaborate to develop, test, and deploy AI solutions for targeted treatments.



Talent

FORCE 2

Embracing the
Five Forces of Change

The future is people powered

Leading companies are unlocking the potential of their employees, recruiting from more diverse pools of talent, and partnering with other organizations to access new capabilities. The goal is to be a talent creator—not just a talent consumer—using the power of technology to help people unleash their natural skills and creativity.

Sharpening up soft skills with AI

Soft skills are a vital part of building a successful career. But, unlike hard skills, these intrinsically human qualities can be notoriously hard to pin down and quantify. Now, advances in AI offer a solution. We've been working with one multinational company to use AI to better categorize, discover, manage, and identify training needs relating to soft skills.

This included creating a holistic taxonomy of skills, as well as using natural language processing to build individual skills profiles for each employee.

This tool will help the company better understand its overall skills profile, as well as match its people with activities more effectively and identify key training and coaching needs.



Upskilling workforces at scale in the metaverse

Metaverse environments are ideal spaces for onboarding, training and reskilling the workforce, allowing people to familiarize themselves with workplace environments and/or develop core skills through highly realistic, infinitely repeatable exercises. Through Accenture Ventures, we made two key investments in VR-based training companies. Strivr provides a leading at-scale enterprise VR platform for companies to elevate workforce performance through immersive experience. Talespin's

platform provides the foundation for the immersive learning ecosystem, offering an end-to-end solution for creating, distributing and measuring the impact of immersive learning content. With the World Economic Forum reporting that over a billion workers may need reskilling by 2030,¹ metaverse continuum training platforms like these will be crucial in meeting a pressing enterprise need, while also delivering data-driven talent insights to enhance employee engagement and retention.

Bringing robots into the remote work era with XR

Hybrid working and remote working lets people work in ways that suit them. It also allows organizations to tap into a more geographically diverse talent pool. But some activities—like operating on-site robots—have traditionally been difficult to perform remotely. We've been working with ETH Zurich Labs on a solution: a two-way digital twin—combining an XR interface and hand-tracking—capable of translating human

gestures into robot movements. This innovative proof of concept allows human workers to easily control robots in real time without needing to be physically present. It has many potential use cases, not only for adapting workplaces for hybrid working, but also in using robots in hard-to-access locations and reducing the need to travel to remote sites.



Future plans include building complete digital twins of plants and machines that workers will be able to operate remotely through an immersive experience using XR technologies.

Embracing the
Five Forces of Change

Every business that wants to thrive must now be an environmentally and socially sustainable business. Calls for action are growing on all sides—from consumers, employees, business partners, regulators and investors—as the world faces an increasing array of economic, humanitarian and environmental crises.



Sustainability

FORCE 3



Getting ahead of wildfires with smart probes

Almost 100 million acres of US land have been ravaged by wildfire over the past 70 years. And more than half of that has occurred in the last 20. Early detection is critical for reducing the risk to lives and livelihoods. We worked with CSAA Insurance Group to develop an innovative solution. The result is an IoT-enabled prototype smart probe that can be strategically placed around high-risk properties. Solar-powered sensors transmit early-warning data via the

cloud, giving homeowners the opportunity to take proactive steps to mitigate fire damage. The probe even releases a fire retardant on first contact with flames, providing a first line of defense against ground fires. We're now exploring opportunities to scale the solution, in collaboration with insurance ecosystem partners, to help increase community wildfire preparedness.

Demonstrating global leadership in green software



The world is becoming increasingly dependent on software, and advanced technologies such as artificial intelligence, quantum computing, blockchain, and the metaverse require massive amounts of computing power.

The computing demand of AI, for example, is now doubling every 3.4 months, according to one study. Software itself is becoming an environmental problem because of its growing energy demands and the resulting carbon emissions.

Embedding green software practices when designing, developing, and deploying applications to minimize technology's carbon footprint is an integral part of a sustainable technology strategy.

In the past year alone, we rolled out four innovative sustainable tech tools used in over 100 projects—including a groundbreaking Sustainable IT Advisor—and filed more than 10 sustainability-related patents.

These solutions helped our clients unlock 35 to 65 percent carbon reduction potential over five years. And, as a founding member of the [Green Software Foundation](#), we've led the drive to set global standards and spur action.

Accenture developed a green software framework, tools and best practices, and trained more than 70,000 of our developers in sustainable software engineering practices





Drive up sustainability in the cloud

Accurately analyzing the total carbon footprint of the IT environment is a key step in reducing enterprise CO₂ emissions. But this is hard to do in practice and remains a persistent challenge in many organizations.

We helped one multinational automotive manufacturer plan a more sustainable future by understanding its IT carbon footprint in depth.

Examining infrastructure across four business units and more than ten countries—including ~490,000 devices and servers—we leveraged our Sustainable IT Advisor to identify key emissions hotspots and decarbonization levers. These included moving to cloud infrastructure, switching to more energy-efficient end-user devices, and adopting green software practices. In total, a ~60 percent reduction in IT carbon emissions was identified.

Less than 1% of garments produced today are recycled into new clothing.



Moving the needle on fashion sustainability

Making fashion more sustainable is a tough nut to crack. An example? Less than 1 percent of garments produced today are recycled into new clothing, according to the Ellen MacArthur Foundation.² To help step up progress, we developed an intelligent assistant that optimizes the layout of patterns for cutting. It means manufacturers can cut

down on fabric wastage, as well as materials costs and CO₂ emissions. In fact, we envision a whole suite of intelligent assistants to support greater sustainability throughout the entire fashion lifecycle—including consumer assistants for upcycling and reselling old garments and advice on extending their usable life.

Saving the planet one satellite at a time

Accenture Ventures has strategic relationships with several space-technology companies that have the potential to make a dramatic difference in various commercial, humanitarian and environmental sustainability applications. One of the latest companies to join Accenture Ventures' Project Spotlight investment program—space data company [Pixxel](#)—is building a planetary 'health monitor' using a constellation of hyperspectral earth imaging satellites as well as analytical tools to mine insights from that data. Pixxel's satellites can capture

images at hundreds of wavelengths in the electromagnetic spectrum and reveal key data about the health of our planet that is invisible to other satellites. The company's planned constellation of hyperspectral satellites will reshape how businesses across agriculture, defense, mining, environmental, and other critical industries make decisions on a global level to reduce their environmental impact.





Embracing the
Five Forces of Change

Over the next decade, virtual digital spaces and Web3 technologies will allow people to connect, interact, work, buy, sell, share, explore, and understand in more immersive, safer, and more effective ways.

Metaverse Continuum

FORCE 4

The [Metaverse Continuum](#)—a spectrum of digitally enhanced worlds, realities and business models—will transform how businesses interact with customers, how work is done, what products and services companies offer, how they make and distribute them, and how they operate their organizations. For 22 years, the annual **Accenture Technology Vision**

report has identified the latest technology trends that will have the greatest impact on companies, government agencies and other organizations in the future. In [this year's report](#), we share our perspective of the Metaverse Continuum and how forward-looking companies can embrace and shape the future. While we're still in the early days of the metaverse, it will advance very quickly.

Virtually every aspect of business is changing

A woman with curly hair is shown from the chest up, looking towards the right. She is wearing a light-colored, textured top. Overlaid on her and the background is a semi-transparent, glowing purple wireframe grid that appears to be a digital or virtual environment. The background is a solid purple color.

If companies don't act now, they'll find themselves operating in worlds designed by, and for, someone else.

Seeing sports in a new light



Sports broadcasters know that immersive technology offers powerful possibilities for storytelling—and a new way to let fans get right to the heart of the action.

It's one reason **ESPN** set up ESPN Edge, a new innovation center for imagining, incubating and scaling up game-changing sports experiences. In collaboration with industry and technology leaders, we're helping ESPN with their ESPN Edge Innovation Center to give fans digital immersive experiences. We're using 5G, augmented and virtual reality and mobile edge computing technology to test new ways to watch and consume sports.

Immersive metaverse experiences, powered by multisensory simulation and AI, will shape the next generation of human-centered products and experiences. By employing virtual multisensory capabilities, we developed prototypes that could transform the way companies engage with consumers to create personalized products—from fragrances and fashion to architecture and interior design. Through a combination of generative AI design, intelligent


spatial collaboration and physics simulation, companies can enable customization—whether for a home or a fragrance—by letting customers touch, smell and change the product in the metaverse before the physical item is produced. Conversational AI assistants guide them through the experience, with helpful interactions that reinforce personalization and increase customer satisfaction.



Reinventing product customization in the multisensory metaverse

These innovations are opening the door for a new era of product design, allowing customers to design products and monetize their creations, including the use of NFTs (non-fungible tokens).

Putting Data at Your Service



Traditional approaches to personal data management are often fragmented and difficult for enterprises to manage.

They also frequently leave consumers resentful that their data is used to benefit everyone but themselves. More open and collaborative approaches are needed, especially as companies start to develop their metaverse strategies in which data interoperability and consumer collaboration will be key (with digital avatars and assets needing to move seamlessly between platforms). We invested in data technology startup Inrupt, co-founded by world wide web inventor Sir Tim

Berners-Lee, which is focused on enabling organizations to connect data to the people they are trying to serve and engaging consumers in the product personalization process. The company's Enterprise Solid Server platform enables personal data vaults that allow individuals to decide which data to share across different applications and services. This will help build a connected digital economy where consumers and businesses can thrive safely and transparently.

New forms of technology innovation—in everything from new digital solutions to radically enhanced computing technologies and from synthetic biology and smart materials to space technology—are stretching the imagination and pushing the boundaries of what companies can achieve.

Ongoing Tech Revolution

FORCE 5



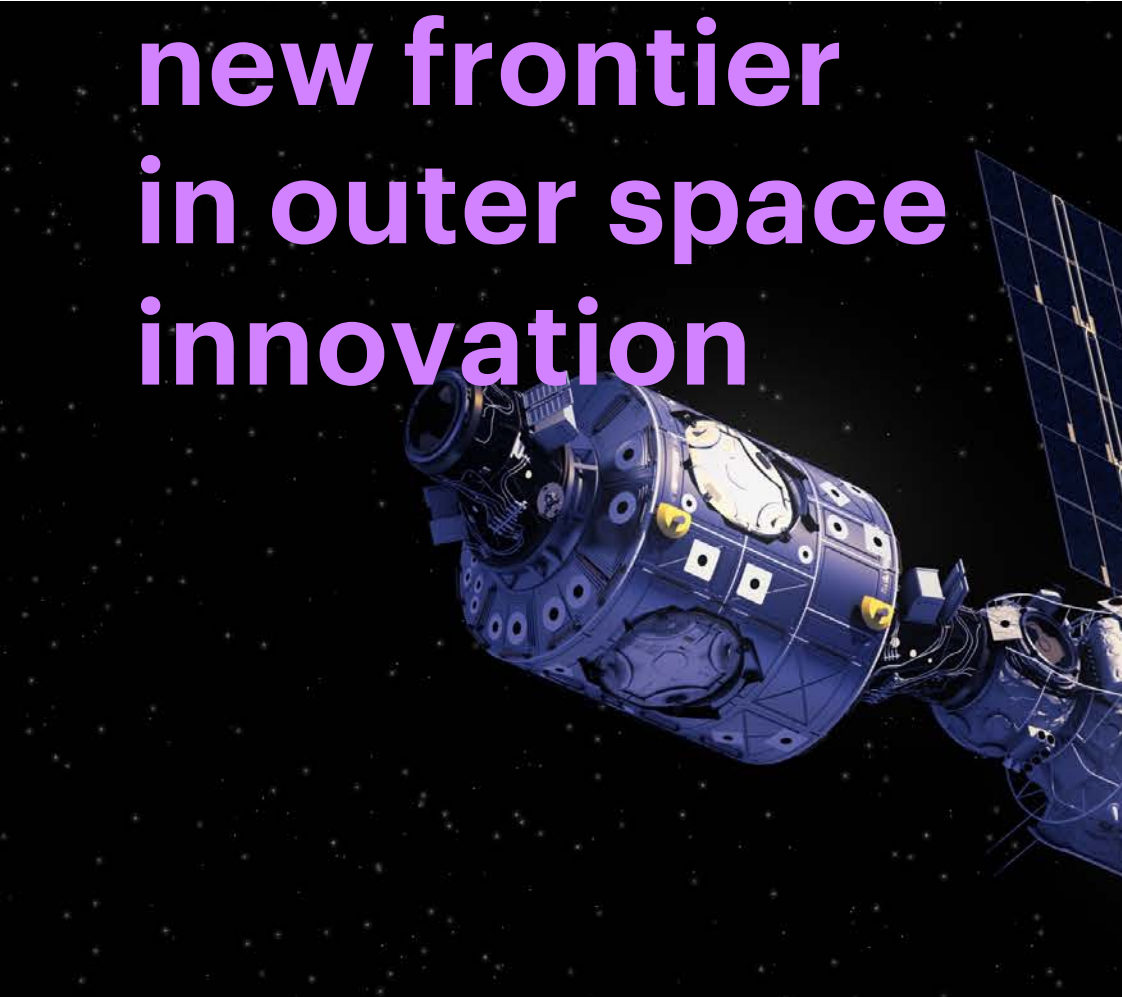
Smart materials deliver functionality plus luxury

To stay ahead of the curve in the luxury car market, leading automotive supplier FORVIA partnered with Accenture to create a seamless, pressure-sensitive dashboard interface that can fit behind any interior finish—in this case a wood veneer. Blending luxury with utility, this innovative smart materials solution adds more functionality to a vehicle dashboard without compromising the high-end minimalist aesthetic.



This innovation has led to a jointly filed patent and is part of a five-year collaboration between Accenture and FORVIA to design the future of transportation and accelerate innovation for mobility services.

Exploring a new frontier in outer space innovation



Space offers a unique opportunity for running experiments in a low-gravity R&D environment. And thanks to today's burgeoning space sector, companies have a once-in-a-generation chance to leverage it. It's why Accenture Ventures made a strategic investment in Titan Space Technologies. The company's advanced AI platform offers real-time monitoring and analytics across multiple modalities created specifically to accelerate the next generation of space experimentation-driven applications that can benefit life here on Earth and beyond. Some of these areas include adaptive immune response, carbon capture technologies, biomedical engineering and more.

In 2022, Titan successfully deployed its first suite of machine learning models on HPE's Spaceborne Computer-2, aboard the International Space Station.



Breaking new ground in human health

We continue to explore and accelerate a wide range of life sciences and healthcare innovations with our clients.

Recently, we developed a Future of Health 2030 framework setting out a vision of what healthcare will look like for patients and citizens by the end of the decade—from personalized biology to synthetic care to precision medicine and beyond. The framework is designed to help healthcare and life sciences companies plan their future innovation strategies, including over 100 signals to track, and explain the technology building blocks we've developed to help accelerate the journey.

One area where we've already proved value is using in-silico biotechnology for life sciences and health research—specifically, applying deep learning on knowledge graphs of 'Omics' data (such as genomics), patient records, and other real-world data to quickly create and validate hypotheses.

We've already used this approach to identify previously unknown genetic risk factors relating to blood clotting in COVID-19 patients, which are now being used as targets for developing a drug to combat this condition. And, as part of the European H2020 project [CLARIFY](#), we used the approach to develop a solution to predict the recurrence of lung cancer. Early results at Puerta de Hierro Majadahonda University Hospital in Madrid indicate it outperforms conventional methods while also helping clinicians understand and explain the solution's predictions to patients.

Accenture Ventures has made a key investment in Good Chemistry Company, a startup using quantum chemistry, machine learning and quantum computing to accelerate new materials design.



A quantum fast-track to chemistry innovation

Next-generation computing paradigms like quantum promise breakthrough advances in computational chemistry, drug discovery, and advanced materials science. Good Chemistry Company is already working with advanced materials enterprises to experiment with these technologies in materials innovation and run complex chemistry simulations at a speed and level of accuracy that would have previously been impossible.

The Good Chemistry Company's platform, QEMIST Cloud, combines cloud, AI, and quantum computing to generate high-accuracy chemistry data at scale and continuously learn from that data. This enables companies to anticipate the properties of molecules and chemical reactions at an unprecedented scale and accuracy, before they are built in the lab.

A close-up, artistic photograph of a person's eye. The eye is looking slightly to the right. A digital screen is reflected in the pupil, showing some data or code. The overall color palette is blue and purple, with a soft, ethereal glow.

Planning for post- quantum security

With quantum computing threatening to break many of the cryptographic algorithms currently used both to authenticate and to secure communications and data across the internet, the race is on to develop post-quantum cryptography (PQC).

For enterprises, one immediate priority is to identify which of their solutions are potentially vulnerable. And to build a strategy that will enable them to migrate to PQC solutions before it's too late.

Our Cyber Labs, Quantum and Security teams have been working hard to shape a future PQC vision for our clients, including initial planning and workshops with various leading global companies and governments.

We're developing techniques to lengthen the useful life of existing cryptographic methods in the field while working on quantum-enabled security and methods that are quantum proof.

Our Mission

Accenture Labs

Shaping the future with breakthrough technologies through applied R&D

We incubate and prototype new ideas and concepts that we expect to have a significant strategic near-term impact on our clients' businesses.

Our dedicated team of technologists and researchers work with leaders across the company and with our business partners to invest in, develop and deliver breakthrough ideas and solutions that help organizations create new sources of business advantage.

Accenture Labs are located in seven key research hubs spanning the world, from San Francisco, California to Shenzhen, China. These Labs are complemented by our growing number of Nano Labs which extend our reach to numerous locations in Asia, Europe and the Americas.

Labs also collaborate extensively with Accenture's network of nearly 400 innovation centers, studios and centers of excellence in 92 cities and 35 countries. This collaboration is key in delivering highly scalable cutting-edge research, insights and solutions for our clients, taking innovation into the heart of where they operate, work and live.

Innovation in numbers

— Over the past 12 months:

269 filed or issued patents

679 innovation workshops

13 Project Spotlight Investments

106 Proofs of Concept delivered

51 University research collaborations

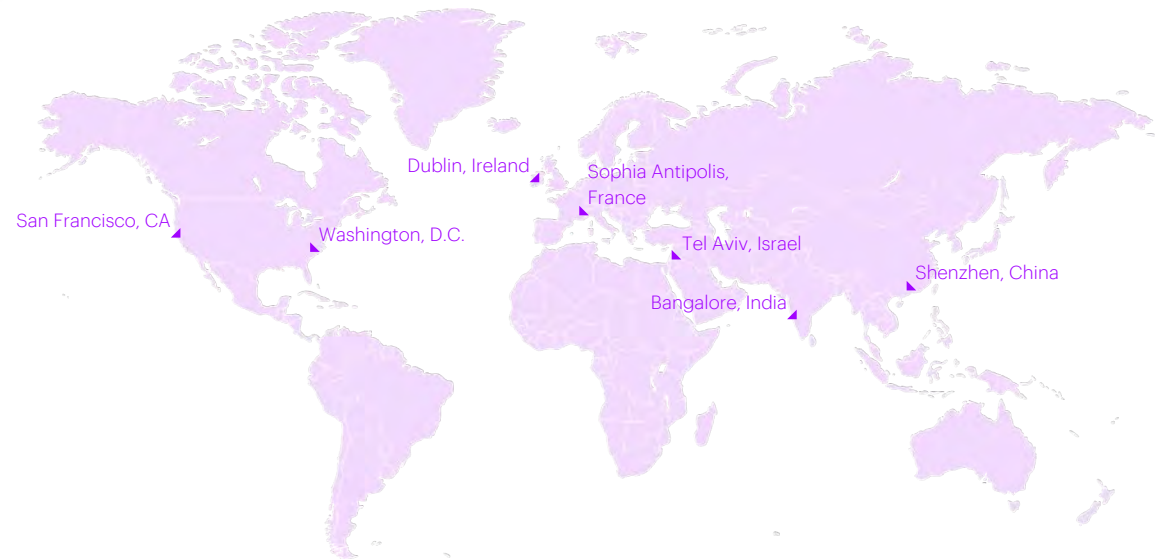
148 business & research publications

Building the future

Accenture Labs

Our **7 Accenture Labs** are innovation engines where we harness the most promising breakthrough technologies and trends to shape our clients' future together.

For more information, please visit [accenture.com/labs](https://www.accenture.com/labs)



Cross-group initiatives

Data cooperative Trustworthy AI Industry X Talent

Artificial intelligence

- AI reasoning & inference
- Conversational systems
- Visual narrative understanding
- Trustworthy AI
- Computational creativity
- Data privacy
- Workforce enablement & well-being

Digital experiences

- Future of product development
- Future of work experiences
- Future of consumer experiences
- Neurotech and the multisensory metaverse

Security

- Cyber digital twin
- Intelligent data mesh
- Knowledge graph studio
- Post-Quantum security
- Trustworthy AI

Systems & platforms

- Digital twin
- Accelerated AI
- Robotics
- Trusted distributed computing
- Quantum
- Data mesh
- 5G

Future technologies

- Smart and sustainable materials
- Neuromorphic computing
- Emerging energy solutions
- Biocomputing & biotechnology

Application engineering

- Sustainable software engineering
- SE for the cloud continuum
- Emerging areas in software engineering

Move your business to the future's edge

01

Discover what's next with the Technology Vision.

Every year, Accenture Labs identifies the technology trends that will shape the way business is done over the next three years and beyond. For more information, please visit:

[accenture.com/techvision](https://www.accenture.com/techvision)

02

Get involved in a Labs Innovation Workshop.

Labs offer dedicated workshop programs where you can discover the potential of emerging technologies, discuss your challenges with our researchers, co-create disruptive use cases, and identify opportunities for future collaboration.

03

Kick-start a co-research program.

Our co-research initiatives are long-term engagements during which our research teams work directly with your business to tackle a strategic challenge in your industry.

04

Engage with the Shaping the Future program.

The Accenture Labs Shaping the Future program gets you thinking about how products and services in your industry will evolve and can be shaped over a ten-year-plus horizon.



Accenture Ventures identifies and invests in start-ups that will change and shape the future of client businesses.

Project Spotlight is an immersive engagement and investment program targeting emerging technology software start-ups to help fill strategic innovation gaps for the Global 2000. Beyond capital investments, the Accenture Ventures Project Spotlight program offers unprecedented access to Accenture's technology domain expertise and its clients, as well as enabling start-ups to co-innovate with Accenture to adapt and scale their solutions faster.

For more information, please visit [accenture.com/ventures](https://www.accenture.com/ventures)



Accenture is a global professional services company with leading capabilities in digital, cloud and security. Combining unmatched experience and specialized skills across more than 40 industries, we offer Strategy and Consulting, Technology and Operations services, and Accenture Song — all powered by the world’s largest network of Advanced Technology and Intelligent Operations centers. Our 710,000 people deliver on the promise of technology and human ingenuity every day, serving clients in more than 120 countries. We embrace the power of change to create value and shared success for our clients, people, shareholders, partners and communities.

Visit us at [accenture.com](https://www.accenture.com)

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1 World Economic Forum. Jan 22, 2020. "We need a global reskilling revolution – here's why."

<https://www.weforum.org/agenda/2020/01/reskilling-revolution-jobs-future-skills/>

2 Ellen Macarthur Foundation. 2017. "A New Textiles Economy: Redesigning Fashion's Future."

<https://ellenmacarthurfoundation.org/a-new-textiles-economy>