Technology Vision 2023

When Atoms meet Bits

The foundations of our new reality

Voices of Change

From insights to action, the path to extraordinary value starts here.

accenture

Foreword

Businesses must embrace the foundations of our new reality

While standing at the edge of the next great technological era, enterprises must navigate economic and geopolitical uncertainty. The natural inclination of many organizations is to pull back. We have a different perspective. Now more than ever is the time for leaders to lean into strategies powered by technology to create differentiation. In fact, 10 years ago we predicted every business is a digital business, and this could not be more accurate today.

We've talked about the five key forces of change that companies must harness over the next decade, including the need for total enterprise reinvention. Cloud, AI, and the metaverse, in particular, have accelerated to such degrees that they dramatically speed up change, bend the innovation curve and create more and more value for every business and organization.

Yet our research shows that only 8% of companies are adopting a strategy of total enterprise reinvention. These are the Reinventors, and we believe every company must aspire to be one. Among that backdrop, our Technology Vision provides insights to enable leaders and their organizations to act now to embrace technology and use the foundations of a new reality as a path towards reinvention.

With this vision, we examine our movement between two types of worlds, physical and digital. Over the years, enterprises and individuals have taken many steps to create their presence in the digital space, consciously moving back and forth between physical reality and the digital ones they created. We believe the time has come to change that. The next wave of business transformation will erase the demarcation between those worlds to fuse them into a new reality.

The goal is not incremental improvement, but a step change towards total reinvention. Not everyone may be ready for this change, but leaders must prepare now for the future where the movement between worlds is seamless and often simultaneous.

We look forward to sharing our latest Technology Vision and building the foundations of a new reality with you.

Technology is the answer. The time is now.

Julie Sweet
Chief Executive Officer

Paul Daugherty
Group Chief Executive -
Technology & Chief Technology Officer

When Atoms meet Bits: The foundations of our new reality

We live in two parallel realities, one of atoms and one of bits.

When we shop, we either go into a store or pull up a webpage. We work in person or remote. We collaborate with people and computers, but usually not at the same time. We live our lives split between the digital and the physical, and, frankly, moving across these separate realities is exhausting and inefficient. Transitioning between them can be challenging, confusing, or impossible, and while it can be easier to focus on just one or the other, doing so is fundamentally limiting.

So, it's time to change that. The next wave of business transformation will shift from creating isolated digital capabilities to creating the foundations of a new reality—a shared reality that seamlessly converges the physical lives we've been leading with the digital ones we've been rapidly expanding. The goal is not incremental improvement, but a step change. An online store here or a smarter object there may have been good enough in the past, but we are now realizing that the true value of combining digital and physical together goes much further. Look at generative AI. Interest in generative AI is surging, with new tools capturing the world's attention faster than any other recent technology. But how people are using them right now—to create digital images and content—is just the beginning. We can already see that this technology is poised to shape the future of science, enterprise data, how we design and manufacture products, and so much more.

Is it challenging? Yes. But even at a time when the world faces an uncertain economic climate and is still in the shadow of recovery from COVID-19, we are seeing enterprises make some of their most ambitious bets yet. They are fueling a new wave of digital-physical convergence that's pushing us closer to a seamlessly shared reality—leveraging the best of atoms and bits to drive novel possibilties.

In healthcare, this shared reality is pushing us towards personalized care. With funding from the European Union, a consortium of hospitals, researchers, and startups have joined the Neurotwin project, an effort to build digital twins of individual human brains.[1,2] Each twin would be used to help healthcare providers understand and predict triggers for neurological diseases and improve preventative interventions. The project is set to launch two studies on individuals suffering from Alzheimer's and epilepsy in 2023.[3]

Even problems as big as sustainability are being re-examined through the lens of what we can do when we combine physical sciences and digital technology. In 2022, AB InBev expanded production facilities for its barley upcycling company, EverGrain, which uses technology and science to find new applications for byproducts of the beer-making process.[4,5] The company created a new barley milk-based coffee drink with Airship Coffee, is developing snacks with barley-based ingredients with Post Holdings, and even developed barley straw-based packaging for Corona, turning a traditionally discarded byproduct into paper board boxes that take 90% less water to fabricate.[6,7,8]

But not everyone is ready for this step change. For many years the guiding pillar of enterprise innovation has been taking processes, even whole parts of the organization, and digitizing them—from how the factory floor is run, to loyalty programs, advertising, supply chains, and recently the entire workforce. For people, the story has been no different. People have spent years building a digital life: from how we do our banking, to establishing ourselves on social media, to choosing streaming over cable—which the relative majority of TV watchers did for the first time this past summer.[9]

96%

of executives agree that the convergence of digital and physical worlds over the next decade will transform their industry.

Given how disconnected and disjointed our digital and physical worlds can feel, it's no wonder that the next decade of innovative efforts is starting to be defined by how we fuse the two together.

While we have built a rich and meaningful digital world, we haven't really reconciled it with the physical one. Challenges with digital identity and data interoperability leave people overwhelmed with technology and exposed to new dimensions of fraud and risk. Many enterprises watched their entire workforce go digital and are now suffering attrition as they struggle to figure out how to hybridize a remote workforce. We haven't even really accounted for the direct impact our digital efforts have had on the physical world, like how an estimated five billion mobile phones will be thrown out in 2022 alone, or how for all of cloud computing's efficiency benefits, it has surpassed commercial airlines in its contributions to global CO_2 emissions.[10,11]

Given how disconnected and disjointed our digital and physical worlds can feel, it's no wonder that the next decade of innovative efforts is starting to be defined by how we fuse the two together. The foundations of this new reality are already being put in place, so the time to make your own mark is *now*.

Last year, in Accenture's 2022 Technology Vision, we called out the Metaverse Continuum as the next big step after digital transformation. Though some may see the metaverse as the culmination of the last wave of digital disruption, it's better viewed as the beginning of the next. The metaverse is a watershed moment for the convergence of atoms and bits, accelerating the path to a singular shared reality. Across the metaverse continuum we are making the digital world behave more like how we experience the physical, and conversely we are using metaverse technologies to reimagine what we do in the physical world. It is the nexus between digital and physical—which is why some of the most powerful ways we have seen the metaverse used are ways in which we fuse the two.

For example, the very first 3D-printed steel bridge in the world was built in Amsterdam and was designed with this kind of digital-physical hybridization in mind.[12] Not only was the bridge created with 3D-printing and robotic arms, but it was also designed specifically to coexist with a digital twin. It was embedded with a cutting-edge sensor network that now feeds a digital twin with real-time data on vibration, strain, weather conditions, and more. The twin can predict how the bridge will behave, such

that maintenance needs can be quickly resolved and engineers can better understand how 3D-printed steel might be used in future projects.

Other companies are endeavoring to thread digital back into physical. Google has been slowly integrating a new wayfinding feature into Google Maps called Live View. It creates an overlay of details about, or directions around, users' environments via geolocators and smartphone cameras.[13] And Snap has been expanding its AR technology far beyond filters, partnering with companies like Amazon, Puma, and Ralph Lauren to integrate 3D product modeling and augmented reality try-on features into the shopping experience.[14,15] This blurring of the digital-physical boundary is now exposing new modes of commerce: the company is rolling out a new "Dress Up" feature where users can discover, try on, and shop for new products directly in the app, and the company reported 250 million people had used its AR shopping lenses over five billion times in just one year alone.

While the budding metaverse continuum is the most attention-grabbing frontier on the path to our new reality, it's hardly the only one. OpenAI open-sourced one of the most powerful Automatic Speech Recognition (ASR) neural networks, called Whisper, which was trained on nearly 700,000 hours of speech-related data and approaches human-like levels of accuracy.[16] ASR and natural language processing are fusing the digital and physical by doing away with today's abstractions like keyboards and gestures and allowing people to engage the digital world in one of the most human ways possible: speech.

Or consider the growing trend of cobots (collaborative robots), a market that is set to expand to $16.3 billion by 2028.[17] These machines let the power of machine intelligence and automation bleed into the physical world, allowing people to work more naturally and unearth new efficiencies. In one example, Moxi, a cobot designed for hospitals, was able to save healthcare workers at one hospital 3,200 hours by taking care of routine tasks like deliveries and allowing the staff to spend more time giving care to patients.[18]

> ... what becomes clear is that merging digital and physical is the path to truly new possibilities.

We've arrived at an exciting frontier of technology innovation for businesses, one where we're not just digitizing but starting to put that digital foundation to work. Fusing digital and physical is not only generating new products and services, it's the force behind a new era of scientific research. Leaders are creating the next set of tools and disruptions poised to rewrite how the world works. And what's become clear is that when atoms and bits collide, truly new possibilities emerge.

2023 Technology Vision:

The foundations of our new reality

The convergence of our parallel realities will evolve over the next ten years. Enterprises will first find opportunity from it in specific, narrower circumstances. It might begin as a digital twin for a single bridge, a robotics deployment in a hospital, or pairing a product designer with generative AI. But as these innovations proliferate, we will see them grow into entirely new physical environments, new ways of working in the metaverse, and more. Ultimately, the fusion of atoms and bits will disrupt the fabric of our worlds, where materials and living things are interlaced with technology and technology's capabilities expand exponentially—leading us to a new frontier.

This year's 2023 Technology Vision explores the technology trends driving this new reality, and the steps enterprises will need to take to thrive in it. We chart the path that begins with blurring physical and digital, continues through the intractable problems companies are starting to be able to solve, and concludes with the science technology revolution that's bringing true novelty to businesses and the world.

In **digital identity** we discuss how identity is the quiet catalyst of this next generation of innovation. Our biggest technological ambitions are being held back by old models of identity. The physical-digital convergence will only be sparked when people and things have identity that can traverse both sides. And emerging forms of digital ID are finally breaking down the walls that divide enterprises and people's physical and digital lives, sparking a torrent of change.

Your data, my data, our data explores how transparency will be a precious resource for enterprises looking to lead these changes. Supply and demand for data among all enterprise stakeholders is dramatically increasing. Enterprises will need to rethink their data collection and architecture design to begin exposing the data that matters. Leaders have an unprecedented opportunity to build trust with partners and customers by proactively becoming more transparent—or risk having someone else do it for them.

But the task of building this new reality won't just be for humans. **Generalizing AI** explores how a new category of AI—spurred on by foundation models and large language models—is becoming table stakes for any business operating in tomorrow's market. With the sheer volume of data and insights needed to drive solutions for the problems enterprises face, business leaders will need to lean on the full capabilities that generative AI and the next generation of AI advances provide.

And finally, **our forever frontier** gives enterprises a window into what lies farther down the line: the science technology revolution. It explores how the feedback loop between science and technology is getting faster, with each accelerating the advancement of the other, in ways that begin to unlock the world's grand challenges.

Bringing Atoms and Bits together:

From IT and OT to ST

Igniting a science technology revolution is the inevitable result of enterprises bringing atoms and bits together. As our digital and physical realities converge into one shared reality, physical science and digital technology are increasingly used to amplify one another, fundamentally reshaping the world around us. Companies already have a technology strategy that encompasses managing their information (IT) and controlling their physical systems (OT). To fully unlock the opportunity of our new reality, enterprises need to extend that strategy to a third dimension—Science Tech (ST).

Take AlphaFold, a recent innovation out of DeepMind. While other efforts like AlphaGo and AlphaStar explored AI's ability to win different types of games, AlphaFold turned to a far more practical and significant application: protein folding.[19] Proteins are the building blocks of biology, and their unique three-dimensional structures determine what function they will perform. So, for instance, if a pharmaceutical company were developing a new drug, understanding various protein shapes would be critical to understanding how the drug will interact with the person it is being administered to. The problem is, historically, these are extremely labor intensive to study, or computationally intensive to simulate. But in the summer of 2022, DeepMind publicly released a database of 200 million different protein structures —which covers nearly every protein known to human beings—now available to all companies and researchers around the world.[20]

The takeaway goes beyond protein folding. AlphaFold unlocked a grand challenge, and for enterprise leaders in all industries, that signals a brand-new world of *possibility*. The field of biology has always been limited by the time it took to perform operations related to protein folding—a restriction eliminated by AlphaFold. In the short time since its creation, AlphaFold has become a critical tool in the field of biology, accelerating activities like drug discovery and the study of novel bacteria and plant structures, and deepening our understanding of deadly diseases.[21] This is the true power of bringing science and technology together, not just efficiency or even acceleration—but how it completely reframes the horizon of possibility, shattering what were once considered insurmountable constraints.

Leaders need to reorient around this mindset shift. It is subtle, but profound. When enterprises approach digital *transformation*, it is often inward looking. It is about disrupting the enterprise, its partnerships, and its relationship to the market, and even demonstrating new models to the market that force others to react. The focus is on gaining advantage in the competitive landscape. But enterprises that look to science technology are going one step beyond: They aren't getting a leg up in the same competition, they are redefining the rules of the game.

As our digital and physical realities converge into one shared reality, physical science and digital technology are increasingly used to amplify one another, fundamentally reshaping the world around us.

Computational chemistry researchers at the University of New Mexico used high performance computing to accomplish in just four years research that would have taken 7,257 years on a single laptop.[22] Solugen, a biotech startup, used science and technology to develop a new method of fabricating industrial chemicals out of sugar instead of fossil fuels, and is already partnering with water treatment providers.[23] And Nokia is partnering with AST SpaceMobile to enable direct-to-cell phone connectivity from space to rural or otherwise underserved communities.[24]

This is the next generation of technology disruption—not just digitizing the present but accelerating towards a previously unimaginable future. The path forward will be challenging. There is no one clearly defined technology to invest in. Though there are some likely contributors like quantum computing, artificial intelligence, and extended reality, the point is that this generation of disruption is no longer about devising a technology strategy alone, it is about designing an innovation strategy that targets digital-physical convergence. The companies that succeed will find themselves at the center of the science technology revolution, and for better or worse, enterprises aren't hurting for areas to make their play.

This is the next generation of technology disruption – not just digitizing the present but accelerating towards a previously unimaginable future.

Grand Challenges:

Taking action in our new shared reality

Becoming a leader in building a shared reality and investing in the science and technology tools to get ahead of disruption are no small tasks. Understandably, every enterprise leader might wonder what the imperative is. Why try to get ahead, and why do we need to start now?

Think about some of the biggest challenges facing enterprises today: a global labor realignment; supply chain disruptions; misinformation; mounting pressure from customers and governments for more sustainable solutions; a growing cyberthreat landscape. These problems are top of mind for every executive, but importantly, they are fundamentally different from the problems of the past. These are massively interlocked problems, with numerous dimensions and a multitude of different partners and stakeholders at play.

Port delays and labor shortages across the food service industry are impacting the bottom line for food suppliers.[25,26] 52% of companies have supply chain partners that have been impacted by ransomware.[27] And enterprises are poised to feel the impacts of climate change, even if they are managing to avoid them today. In August 2022, for instance, companies in China's Sichuan province were forced to shut down factories making solar panels, cement, and more, after a worsening drought caused hydropower reservoirs to run low.[28] Is it conceivable that any enterprise could solve even one of these alone? Of course not.

This is the urgency. The problems enterprises are most affected by today are ones they are not yet equipped to solve. Yesterday's strategies and technologies are proving to not be enough to overcome the grand challenges enterprises are starting to stare down. Building a shared reality of atoms and bits is the necessary path to start tackling new problems in new ways. Technology has always risen to meet the needs of the time, and now the challenges we face are bigger than any one company alone. It's time to start forging the tools to fix them, together.

Think about sustainability. Environmental impact is one of the most pressing grand challenges that companies and the world face today, and increasingly more companies are eager to be part of the solution. Though despite their eagerness, many risk still missing their targets.[29] When shared solutions are built, however, the future starts to become much more attainable. Take Mango Materials. The renewable bioproducts startup collaborated with researchers around the world to

83%

of executives believe science tech capabilities could help address societal grand challenges of health-related issues and diseases, while 75% believe science tech capabilities could also help address poverty/inequality.

develop a bacteria-produced bioplastic designed to decompose in the ocean.[30] So far, five oceanographic equipment manufacturing partners have committed to replacing all their traditional plastic with this new degradable bioplastic once it's ready, with commercialization and other product applications being explored as the collaboration evolves.[31]

Or look at the grand challenge of delivering better healthcare. When it comes to using data to improve treatment, hospitals are typically limited to their own datasets for patient privacy reasons. But in a recent study published in *Nature Medicine*, 20 hospitals from around the world participated in training a federated learning model called EXAM, which predicted future oxygen requirements of COVID-19 patients.[32] The model leveraged data, including patient vital signs, laboratory data, and chest X-rays, from all of the participating hospitals—but each hospital trained their own copy of the AI model and periodically shared updates with a centralized server, which then aggregated them to train the global model. In this case, the hospitals created a shared reality that they couldn't have before, using federated learning to safely share digital data on physical information to improve AI predictions.

Foundations for a new reality

Mounting challenges on the global stage are forcing enterprises to reorient their business objectives and imagine how they can best contribute to solving these collective problems. Some of today's problems might have been considered unsolvable before—but as the convergence of atoms and bits continues to grow, the bounds of possibility expand. Digital identity gives us a foundation to traverse digital and physical worlds; transparency builds the trust and unlocks the data insights necessary to expose and tackle collective problems; generalizing AI provides us with the machine power to aid us in doing so; and our forever frontier is rapidly expanding as we bring physical sciences and information technology closer together. These foundations of our new reality are the path to taking action.

The world is watching.
What will you do next?

Our Four Technology Trends for 2023

Digital identity

ID for everyone and everything

Digital identity is quietly becoming the key to enterprises' technology aspirations, and efforts to reimagine it are underway—not just for people but for all things.

Your data, my data, our data

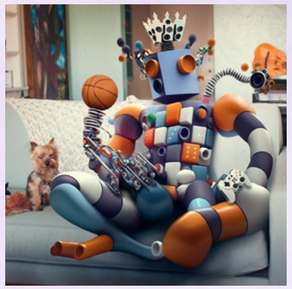
Why transparency will become your most precious resource

Data ecosystems are being reshaped by radical transparency as enterprises leverage their troves of data to offer unprecedented insight into their business.

Generalizing AI

The radical edges—and possibilities—of intelligence

Foundation models are driving one of the biggest step changes in AI history. Now, enterprise leaders can shift from building their own AI to building *with* AI.



Our forever frontier

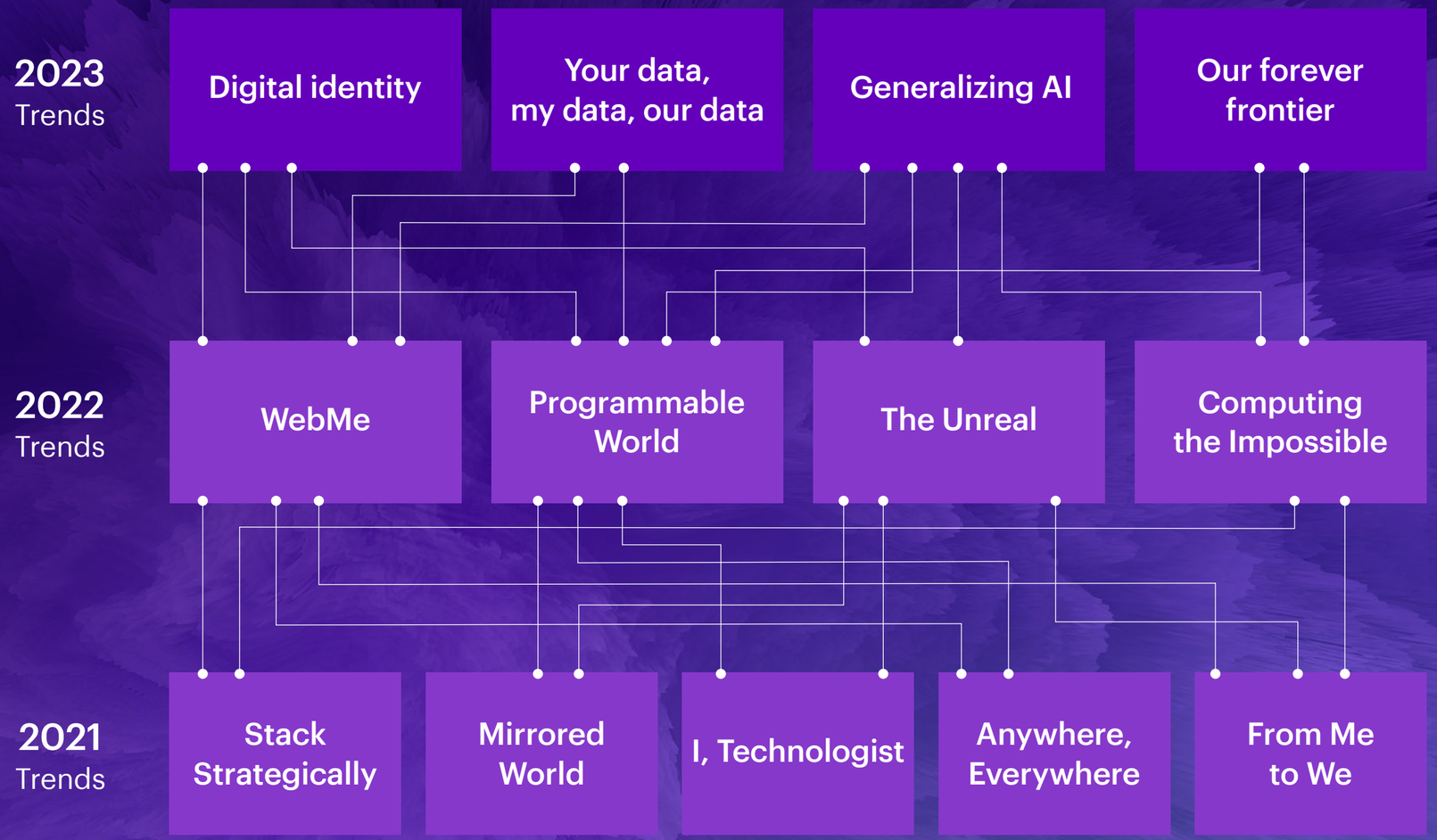
The big bang of computing and science

After decades of hyper focus on digital technology, science is leaping back to the top of enterprises' agendas.

Completing the picture

Accenture's Technology Vision report comprises a three-year set of technology trends, currently including trends from 2021 and 2022.

It's important to recognize that each year's trends are part of a bigger picture. Tracking how they evolve over time offers a glimpse into how they may continue to grow in the future.



2022 Trends

WebMe

Putting the Me in Metaverse

The internet is being reimagined as metaverse and Web3 efforts transform the underpinning and operation of the virtual world.

Programmable World

Our Planet, Personalized

Control, customization, and automation are being enmeshed into the world around us, making the physical as programmable as the digital.

The Unreal

Making Synthetic, Authentic

As AI-generated data and synthetic content convincingly mimic what is "real," authenticity is the new north star.

Computing the Impossible

New Machines, New Possibilities

A new generation of computers are solving some of the world's most intractable problems, leading to one of the biggest technological disruptions of our time.

2021 Trends

Stack Strategically

Architecting a Better Future

A new era of industry competition is dawning – one where companies compete on their architecture.

Mirrored World

The Power of Massive, Intelligent, Digital Twins

Growing investments in data, AI, and digital twin technologies are giving rise to a new generation of business and intelligence: the mirrored world.

I, Technologist

The Democratization of Technology

Natural language processing, low-code platforms, robotic process automation, and more are democratizing technology, putting powerful capabilities into the hands of people all across the business.

Anywhere, Everywhere

Bring Your Own Environment

It's time for enterprises to transform remote work from an accommodation, to an advantage.

From Me to We

A Multiparty System's Path Through Chaos

The global disruption of COVID-19 ignited a scramble for enterprises to reimagine their partnerships – and multiparty systems gained newfound attention.

About the Technology Vision

For more than 20 years, Accenture has developed the Technology Vision report as a systematic review across the enterprise landscape to identify emerging technology trends that will have the greatest impact on companies, government agencies, and other organizations in the coming years. This year the trends look a decade into the future, while remaining relevant across industries and actionable for businesses today.

Accenture Labs and Accenture Research collaborate on the annual research process, which this year included:

- Input from the Technology Vision External Advisory Board, a group of more than two dozen experienced individuals from the public and private sectors, academia, venture capital, and entrepreneurial companies. In addition, the Technology Vision team conducts interviews with technology luminaries and industry experts, as well as many Accenture business leaders from across the organization.

- Accenture conducted a survey of 4,777 C-level executives and directors across 25 industries to understand their perspectives and use of emerging technologies across their organizations. The surveys were fielded from December 2022 through January 2023 across 34 countries.

- Experiential research and data science to analyze technology developments and advancements.

As a shortlist of themes emerges from the research process, the Technology Vision team works to validate and refine the set of trends. The themes are weighed for their relevance to real-world business challenges. The Technology Vision team seeks ideas that transcend the well-known drivers of technological change, concentrating instead on the themes that will soon start to appear on the C-level agendas of most enterprises.

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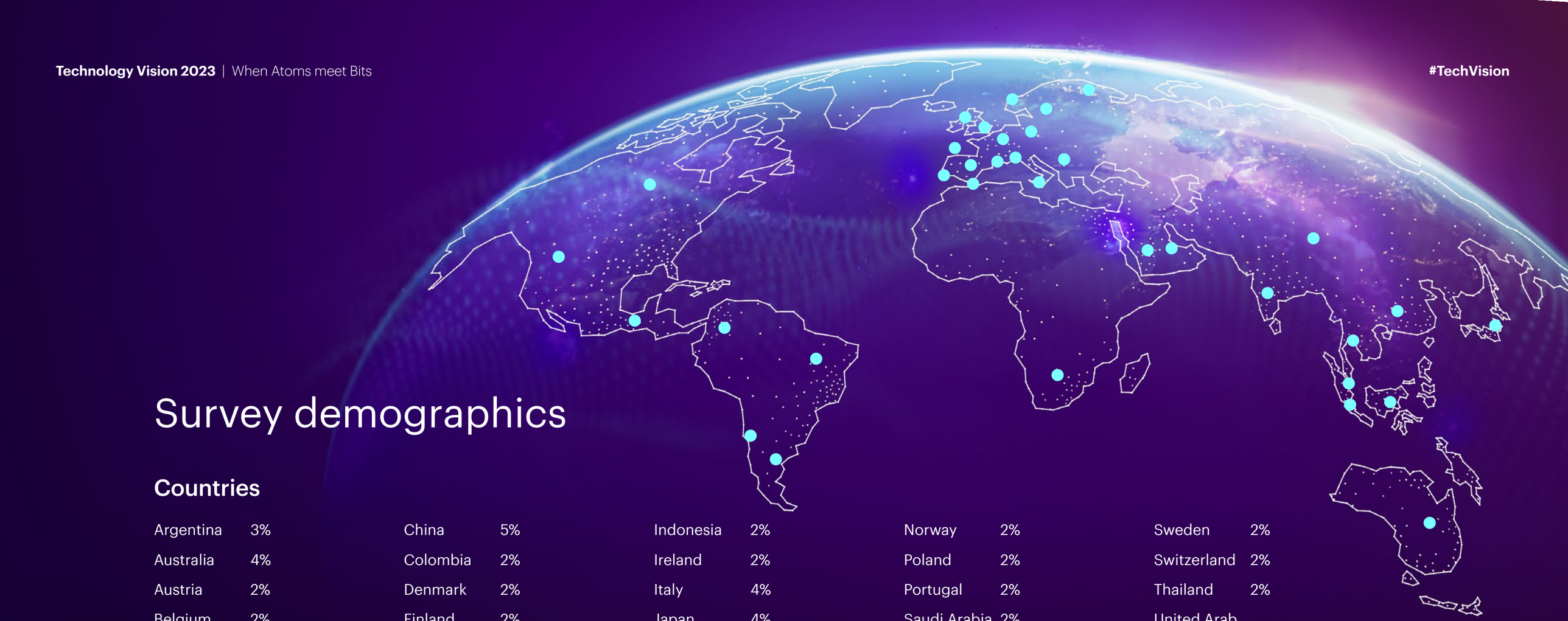


Survey demographics

Countries

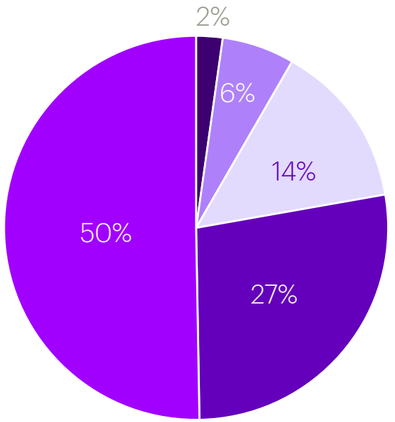
Argentina	3%
Australia	4%
Austria	2%
Belgium	2%
Brazil	4%
Canada	5%
Chile	2%
China	5%
Colombia	2%
Denmark	2%
Finland	2%
France	3%
Germany	4%
India	4%
Indonesia	2%
Ireland	2%
Italy	4%
Japan	4%
Malaysia	2%
Mexico	2%
Netherlands	2%
Norway	2%
Poland	2%
Portugal	2%
Saudi Arabia	2%
Singapore	2%
South Africa	3%
Spain	4%
Sweden	2%
Switzerland	2%
Thailand	2%
United Arab Emirates	2%
United Kingdom	4%
United States	16%

Industries

Aerospace and Defense	1%
Automotive	5%
Banking	6%
Biopharma	1%
Capital Markets	3%
Central Government (CA)	1%
Chemicals	5%
Communications	4%
Consumer Goods and Services	6%
Energy	4%
Federal Government (US)	4%
Healthcare Payor (US)	2%
Health Provider	6%
High Tech	4%
Higher Education (US)	4%
Industrial Goods and Equipment	6%
Insurance	6%
Media and Entertainment	2%
MedTech	1%
Natural Resources	4%
Public Service	6%
Retail	6%
Software and Platforms	4%
Travel	3%
Utilities	4%

Revenue (USD)

$50 billion or more	2%
$20 to $49.9 billion	6%
$10 to $19.9 billion	14%
$5 to $9.9 billion	27%
$1 to $4.9 billion	50%



Roles

Chief Digital Officer	1%
Chief Executive Officer	5%
Chief Finance Officer	10%
Chief Human Resources Officer	12%
Chief Information Officer	5%
Chief Information Security Officer	8%
Chief Innovation Officer	2%
Chief Marketing Officer	13%
Chief Operating Officer	9%
Chief Purchasing Officer	1%
Chief Risk Officer	2%
Chief Security Officer	4%
Chief Strategy Officer	4%
Chief Supply Chain Officer	2%
Chief Sustainability Officer	2%
Chief Technology Officer	4%
Chief Transformation Officer	1%
Director of Business Function	6%
Director of Technology	8%

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