Technology Vision 2021

Leaders Wanted

Masters of Change at a Moment of Truth

Voices of **Change**

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

accenture

Foreword

The past year has shown us that technology is a lifeline for economies, governments, companies, and people. It changed the way we see and understand the world.

It also pushed a giant fast-forward button to the future. Amid 2020's challenges, many organizations lacked the digital foundation needed to rapidly pivot, and were confronted with a stark reality: a digital performance gap that widened seemingly overnight. Yet, other leading organizations stepped up to use technology in extraordinary ways to keep their businesses and communities running—at speeds they thought previously impossible.

At Accenture, our cloud capabilities made the difference. They helped us pivot our global workforce to a remote-first approach, keeping our employees safe, productive, and ready to seamlessly serve our clients and partners in industries around the world.

Now, as we start to turn the page from the challenges of 2020, we'll also turn to the power of technology to restore confidence among employees, consumers, partners, and our communities. We can build new ways of working and interacting, add much-needed adaptability and resilience, and create new experiences and ways of doing business. Newly accelerated digital transformations give us the means to serve these needs. But our efforts will be effective only when we work to build and preserve trust at the same time.

We know this is possible because we've seen it. When the "normal" ways of operating were removed from the equation, organizations proved they *could* wield technology to try new things, change with unprecedented speed, and innovate their way forward, responsibly and transparently. We now have a once-in-a-generation opportunity to turn this moment of truth for technology into a moment of trust—embracing the power of exponential technology change to completely reimagine and rebuild the future of business and human experience post Covid.

As you learn about the trends in this year's Technology Vision, think about how you can apply them to reimagine and replatform your business—leading the change that is needed for your organization, for your people, and for our world.

Julie Sweet
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The world is hungry for a new kind of leadership. Amid the challenges of 2020, two truths became evident. More companies than ever have embraced the axiom that every business is a technology business, and they've ignited a new era of exponential transformation as technology continuously reshapes industries and the human experience. Now, as we begin shaping our post-pandemic reality, companies must learn to **master change**.

For years, enterprises have been optimistic in their self-assessments, thinking they're further along in their digital transformations than they really are.

Adaptability, innovation, connectedness—pick a metric and businesses asserted they were leaders in the space, ready for anything. But 2020 and the COVID-19 health and economic crisis cleared their rose-colored glasses, bringing a new reality into sharp focus: Inflexible work arrangements and operations. Fragile supply chains. Untrustworthy information. New customer needs. The pandemic and the resulting disruptions exposed the limitations of long-standing norms for how companies operate and how people live.

Forced to recognize this deepening digital achievement gap, companies began to compress their decade-long transformation agendas into two to three-year plans. Leaders pivoted to focus on building a digital core that would allow them to simultaneously transform multiple parts of their enterprises and their talent. In essence, they began looking at technology as a saving grace in an unpredictable time, allowing them to accelerate their efforts to minimize the disruptions of the pandemic. Amid this chaos, enterprises not only pivoted faster than they believed they could, they started demonstrating the adaptability, innovation, and connectedness that they *thought* they'd already achieved.[1]
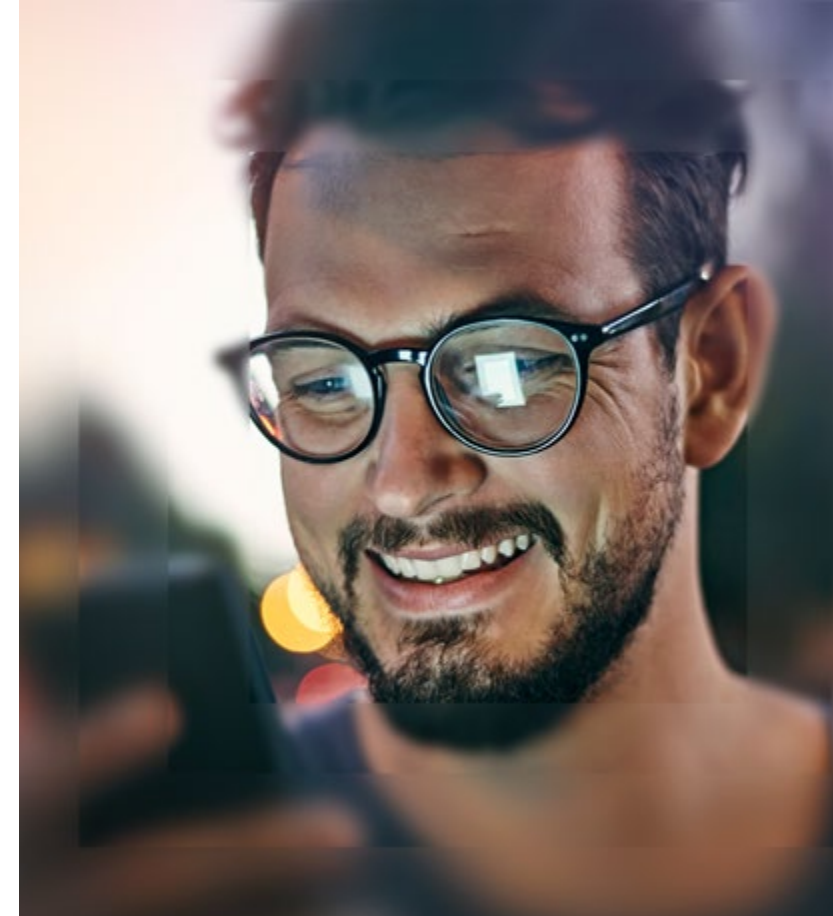
2–3x revenue growth

A recent study revealed that digital leaders (the top 10 percent of companies leading technology innovation) achieve 2–3x revenue growth as compared to their competitors—a widening divide that Accenture calls the "Digital Achievement Gap."

This journey of reinvention, however, has only just begun. The pandemic radically accelerated changes that companies knew were coming but didn't expect to see so soon. Major shifts that were predicted to materialize in years are happening here and now: industry convergence, localized supply chains, mass virtualization, and rapidly and continuously changing customer expectations. But, while immediate changes are clear, there's less clarity than ever into what our long-term future holds.

We're left with a global set of circumstances we've never seen before. On one hand, we have widespread and accelerated digital transformation coupled with the digital building blocks to create almost anything. On the other, we have blank slates in every industry waiting for the next vision of the future to be defined. Combined, it's an opportunity we may never see again in this generation: to actively shape our future almost from the ground up. But this is a challenge that demands a new kind of leadership. Leading in the uncertain future will require companies to become **Masters of Change**.

The single biggest reinvention of industry in living memory has been ignited. People and the world need leaders who will look beyond today's triage effort and start building what comes next. While it will be tempting for companies to retreat to what they know, 2020 brought the need for a different path forward into clear focus. If businesses continue to have a clear-eyed perspective and sharp focus on their expedited digital transformations, reimagining everything from their people, to data, architectures, and ecosystems, they can emerge as leaders.

Leadership Demands Technology Leadership

We always talked about how technology would come to change the world, and now that enterprises across industries have accelerated their digital transformations all at once—it has. The era of the fast follower is effectively over. Perpetual change is here to stay, and leaders must not only embrace it, but catalyze it.

During the pandemic, it became starkly clear that there is no leadership without technology leadership.

Just look at the restaurant industry. As lockdown and shelter-in-place mandates around the world closed traditional dine-in experiences, major chains started to declare bankruptcy.[2] In fact, 60 percent of the restaurants listed as "temporarily closed" on Yelp in July were out of business permanently by September.[3] Six months into the pandemic, the National Restaurant Association reported that nearly three million workers remained unemployed, and the food service industry was on track to lose $240 billion.[4] And yet, through this chaos Starbucks emerged as a leader.

Starbucks had a digital transformation well underway by 2020, and when the pandemic hit, that transformation evolved from a strategic initiative to a vital airbag. The company's mobile app, which allows users to customize orders and pay for drinks with their phones, proved invaluable as contactless transactions rapidly became the norm. By August,

three million new users had downloaded the app, and mobile ordering and drive-thru pick up combined accounted for 90 percent of sales.[5] Starbucks used technology to reinvent its customer experience for a changed world, and when demand surged, it doubled down. The company pushed out a new integrated ticket management system to combine orders from Uber Eats, the Starbucks app, and drive-thru customers into a single workflow for baristas, and introduced a new espresso machine laden with sensors to help staff track how much coffee was being poured and predict necessary maintenance.[6]

Starbucks was prepared to lead when uncertainty hit, but not every company was as fortunate. A year ago, many were content to do 'just enough' to keep pace with their competition. Case in point: Every year Gartner surveys manufacturers on their current and planned levels of cloud deployment across enterprise systems. And every year from 2014 to 2019

enterprises reported deployment levels between 8 and 13 percent and expressed the expectations that they would reach between 30 and 50 percent in three years. Or, as the Gartner analysts put it: "manufacturers had been planning to move to the cloud in three years, for the last five years."[7]

90%

of business and IT executives in our survey agree that to be agile and resilient, their organizations need to fast forward their digital transformation with cloud at its core.

In the last 12 months however, this mindset has started to change. Eighty-two percent of IT executives reported ramping up their use of cloud technologies in direct response to the crisis, and 66 percent of the respondents reported that they will continue to grow their use of cloud for the foreseeable future.[8] Ninety-five percent of companies said they are seeking new ways of engaging customers as a result of COVID-19.[9] From food delivery platforms that kept restaurants connected to customers to the rise of telehealth services and e-commerce, the pandemic opened enterprises' eyes to a new reality. Cloud is now at the core of the company, not just the periphery, and technology is no longer just one vehicle for success— it's the vehicle all possible success depends on.[10]

And what started as an attempt to solve immediate problems during the pandemic has quickly become an opportunity to rapidly re-platform the enterprise, create entirely new kinds of value, and become an industry leader. Ford created 10 interactive augmented reality videos to help customers experience the new electric Mustang Mach-E without needing to go for test drives.[11] Potential customers can explore all the features of the new car using a completely interactive 3D model, while hearing directly from the designers and engineers who were involved in its creation. In another case, D-Wave, one of the leading companies exploring quantum computing, gave free access to its "Leap" quantum cloud platform to anyone working on solutions for COVID-19—an effort that exposed many to the utility of quantum computing.[12] And Neolix, a Beijing-based maker of robo-delivery trucks, reported soaring orders as the pandemic cleared cars off roads and opened customers' eyes to the advantages of driverless delivery.[13] By accelerating their transformations to meet the needs of a world in crisis, these enterprises ignited a new and different future—one predicated on technology.

Rapid digital acceleration during the pandemic has cemented technology as the cornerstone of global leadership. 'Just enough' is not enough now. The gap between digital leaders and laggards grows by the day and committing to a wait-and-see approach will land companies on the wrong side of that gap. Leadership demands that enterprises prioritize technology innovation in response to a radically changing world. Small pilots and incremental scaling are an obsolete luxury, and the friction between research, development, and large-scale deployment must diminish or disappear.

63%

of executives report the pace of digital transformation for their organization is accelerating.

92%

of executives report that their organization is innovating with an urgency and call to action this year.

Leaders Don't Wait for a New Normal, They Build It

As the saying goes: The best way to predict the future is to invent it. Prioritizing technology is essential to ensuring the enterprise doesn't fall behind. However, true leadership will come from companies embracing radically different mindsets and models. The world has been beset by sweeping change and demands leadership that thinks boldly in response.

Thriving in this moment will require ambitious leaders not content to rehabilitate the business to what it was, but willing to upend convention and wield their vision for the future.

From the workforce, to supply chains, to technology, operating, and business models, leaders have spent decades building systems for static purposes, where change happened slowly and expectedly. But today success is coming to those with the audacity to reimagine it all.

In the last year enterprises were forced to confront deep-seated assumptions about how fast the organization can pivot, where or how work gets done, even what they sell and to whom. While some froze, watching their old convictions crumble, others shattered the bureaucracies and assumptions holding them back—becoming the leaders that everyone will follow. The Red Roof hotel chain took reduced demand for travel, but an increase in remote work, as an opportunity to book rooms as daily workspaces.[14] As more companies start to see a return to the office as an option, not an inevitability, Red Roof has positioned itself as a challenger in the coworking market. And as advertising spending globally began to drop, Spotify saw the threat posed to its ad-supported business model.[15] The company quickly took steps to begin buying and developing premium content to drive up paid subscriptions— a strategic shift that moved them from licensing and aggregation to production and trendsetting.

In isolation this looks like enterprises temporarily responding to crisis, but their willingness to challenge the core value proposition of the enterprise is setting a new standard for the future. While many companies are still waiting for the new normal to emerge before them—others are already building it.

Before the pandemic, if you asked an executive how long it would take to deploy a new communications platform across the company, doing it in less than a year would feel like a stretch. But in March 2020 the United Kingdom's National Health Service dispelled perceptions of just how fast technology transformation needs to take. In a matter of weeks, they rolled out Microsoft Teams to 1.2 million employees.[16]

If you had asked a manufacturer what it would take to pivot from producing power and propulsion systems to medical equipment, they likely would have argued it was nearly impossible. But when the UK faced a critical shortage of ventilators, Rolls-Royce demonstrated the true capacity enterprises have for change. The luxury car manufacturer redesigned its entire supply chain to begin producing this desperately needed medical device.[17] Within five weeks, the company had secured the new parts needed from across 100 different suppliers, orchestrated operations across three sites, and production was underway.

When push comes to shove, leaders don't see change as disruption—they embrace it as an opportunity to build something new. But bold actions will fall flat without the technology foundation needed to support their ambition. Enterprises that pair big ideas with powerful technology will turn change-readiness into a competitive competency, not a reluctant accommodation.

For example, as the Geisinger Health System learned more about the COVID-19 pandemic, it prioritized accelerated investments in API modernization and microservices architecture.[18] With the agility and scalability it gained, the company was able to seamlessly move from supporting 27 remote visits a day to more than 1,000; double its remote workforce to 13,000 employees; and build a digital screening system and companion dashboard that allowed administrators to view patient population data in real time, reduce waits and crowding, and ensure safe social distancing protocols.

There is a temporary vacuum as people, employees, customers, and partners all continue to establish a new set of preferences for the next normal. Boundless opportunity lies ahead for the enterprises willing to break from the mentality of "that's how we've always done it" and become part of crafting what comes next. This could be reinventing the customer experience in your industry, reimagining how data flows across the enterprise and its partners, or fostering the advantages of a virtualized workforce— even when social distancing is no longer a necessity.

But the wide-open opportunity also means competition has never been fiercer. Every company, from start-ups to traditional competitors, is facing those same disruptions, and introducing their own vision of the future all at once. It's not enough to keep pace anymore—to lead, enterprises must become pioneers.

83%

of executives agree that their organization's business and technology strategies are becoming inseparable—even indistinguishable.

Broaden the Horizons of Leadership

Technology makes the boldest ambitions achievable, but people are the north star that provide vision and direction. As they pioneer the new normal, enterprises are poised to have an outsized impact on the world around them—and financial success will only be one measure of leadership.

There is a unique moment to rebuild the world better than it was before the pandemic, and realizing that goal will mean expanding our definition of value to include how well people thrive, the impact left on the environment, growing inclusivity, and more.

When technology, ambition, and a commitment to people converge, the impossible becomes attainable. Early in the pandemic it was clear that many workforces were going to be stuck in limbo. Some industries, like airlines and hospitality, suddenly had next to no customers and a surplus of talented employees. Other areas, like technology and customer service, had surging demand and existing staff couldn't keep up. To respond to this imbalance, the chief human resources officers from Accenture, Lincoln Financial Group, ServiceNow, and Verizon jointly created a digital platform to connect workers with new roles.[19] The platform, called People + Work Connect, maps out employees available for work and roles that need to be filled, letting HR professionals from different companies collaboratively fill talent needs across their organizations and keep more people employed.

Even prior the pandemic other leaders have been widening their vision of who their stakeholders are and ingraining those commitments into the fabric of their business. For instance, Danone published its fiscal year-end results with a "carbon-adjusted" evolution to their earning per share to ensure environmental impact was included when assessing the company's profitability.[20] In light of protests that brought awareness to racial inequality, Walmart underwent an audit of its diversity and hiring practice, prioritized relationships with minority-owned suppliers, and committed $100 million to establishing a center for racial equity.[21]

And with their accelerated digital transformations, enterprises can attack some of the deepest-set challenges the world faces. As efforts like sustainability and conscientious consumption become top initiatives, technology offers a foundation from which to achieve those goals.

Imagine buying a coffee and being able to see—and trust—its full production history. You could guarantee that sustainable material was used in the packaging, confirm the absence of allergens, be assured of ethical practices in production, and more. In the past, providing this level of visibility for any and every product would have seemed far-fetched. But emerging technology solutions are making it increasingly feasible, allowing companies to build trust with customers in unprecedented ways.

The circular supply chain, for instance, is a multiparty system (MPS) created in partnership with Mastercard, Amazon Web Services, Everledger, Mercy Corps, and Accenture. The cross-industry initiative combines blockchain-based data sharing, biometric identity verification, supply chain tracking and payment capabilities, to drive more inclusive, equitable and sustainable global supply chains.[22] By addressing problems of provenance, authenticity, and traceability, the system benefits the entire ecosystem and helps to realign incentives.

As companies lean more on the capabilities of technology, they need to recognize more than just the value it provides to the business. To lead with technology, they must measure its impact through a wider lens.

Our Moment is Now: 2021 Technology Trends

Companies are no longer strictly competing for market share; they are competing to build their vision of the future faster than the competition. Success will depend on their ability to accelerate and master change in all parts of their business, which in turn will be a direct function of the technology decisions they make today.

But make no mistake, transforming the enterprise into a technology leader cannot be contained to the oversight of the CIO or CTO alone. To be successful, a digital-first approach must be fostered by the entire C-suite and manifested across all areas of the organization.

Becoming a Master of Change begins with **architecting the future** and recognizing that business and technology strategies are increasingly indistinguishable. Architecture has never mattered more as the technology choices businesses make today will determine what the business can or cannot do long into the future. Competition is becoming a battle of technology stacks—and one size fits none.

As leaders thread technology through all aspects of the business, the valuable troves of data generated are being used to build massive networks of intelligent digital twins. The **Mirrored World** these next-generation twins create is fueling change by unlocking the currently trapped value of data and allowing enterprises to simulate, predict, and automate by seamlessly bridging the divide between digital and physical.

Enterprises must also ensure their people are empowered to become drivers of change—an outcome achievable through **technology democratization**, which is making powerful technology capabilities accessible without the need for specialized skills. Enterprises can ignite grassroots innovation by equipping every employee with the tools and skills to build technology solutions at the point of need.

The enterprise can change from anywhere and everywhere as it equips the workforce to **bring your own environment**. The single biggest workforce shift in living memory is positioning businesses to explore the benefits of a virtualized workforce and expand the boundaries of the enterprise.

Finally, the challenges and opportunities ahead are vast and businesses will not be able to tackle them alone. **Multiparty systems** will help businesses lead by changing the way they partner. From supply chains to digital ecosystems, the pandemic showed just how brittle globe-spanning relationships can be. By rebuilding these partnerships with technology at the center, enterprises are finding ways to adapt together.

A new future is on the horizon—one that's different from what the world expected. As this future takes shape, there will be no room for enterprises that cling to the past. Will you watch the world change around you? Or be the one leading it? People are ready for something new and it's time for enterprises to join them. Let there be change.

LET THERE BE CHANGE

Our five technology trends for 2021

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

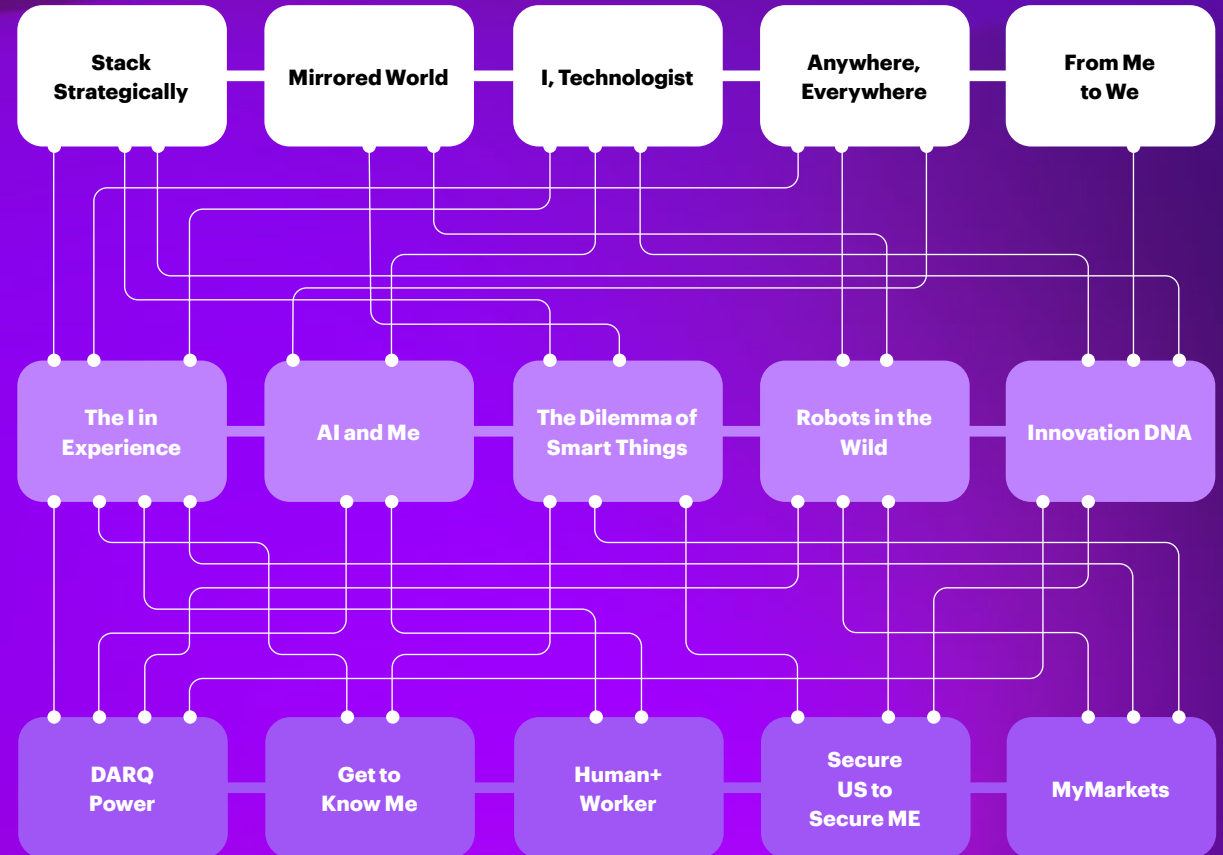### A Multiparty System's Path Through Chaos

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

Completing the picture

Accenture's Technology Vision report comprises a three-year set of technology trends, currently including trends from 2020 and 2019.

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.

2021 Trends

| Stack Strategically | Mirrored World | I, Technologist | Anywhere, Everywhere | From Me to We |

2020 Trends

| The I in Experience | AI and Me | The Dilemma of Smart Things | Robots in the Wild | Innovation DNA |

2019 Trends

| DARQ Power | Get to Know Me | Human+ Worker | Secure US to Secure ME | MyMarkets |

2020 Trends

The I in Experience

Helping people choose their own adventure

Redesign digital experiences with new models that amplify personal agency. Turn passive audiences into active participants by transforming one-way experiences into true collaborations.

AI and Me

Reimagine the business through human and AI collaboration

Take a new approach that uses artificial intelligence to bring out the full power of people. Move beyond deploying AI for automation alone and push into the new frontier of co-creation between people and machines.

The Dilemma of Smart Things

Overcome the "beta burden"

Address the new reality of product ownership in the era of "forever beta." Transform pain points into an opportunity to create an unprecedented level of business–customer partnership.

Robots in the Wild

Growing the enterprise's reach—and responsibility

Build new models of interaction and impact as robotics move beyond the walls of the enterprise. Companies in every industry will unlock new opportunities by introducing robots to the next frontier: the open world.

Innovation DNA

Create an engine for continuous innovation

Tap into the unprecedented scale of disruptive technology available today. Build the capabilities and ecosystem partnerships necessary to assemble the organization's unique innovation DNA.

2019 Trends

DARQ Power

Understanding the DNA of DARQ

New technologies are catalysts for change, offering businesses extraordinary new capabilities. Distributed ledger technology, artificial intelligence, extended reality, and quantum computing will be the next set of new technologies to spark a step change, letting businesses reimagine entire industries.

Get to Know Me

Unlock unique customers and unique opportunities

Technology-driven interactions are creating an expanding technology identity for every consumer. This living foundation of knowledge will be key to not only understanding the next generation of consumers, but also to delivering rich, individualized, experience-based relationships in the post-digital age.

Human+ Worker

Change the workplace or hinder the workforce

Workforces are becoming human+: Each individual is empowered by their skillsets and knowledge plus a new, constantly growing set of capabilities made possible through technology. Now, companies must adapt the technology strategies that successfully created this next-generation workforce to support a new way of working in the post-digital age.

Secure US to Secure ME

Enterprises are not victims, they're vectors

While ecosystem-driven business depends on interconnectedness, those connections increase companies' exposures to risks. Leading businesses are recognizing that just as they already collaborate with entire ecosystems to deliver best-in-class products, services and experiences, it's time security joins that effort as well.

MyMarkets

Meet consumers' needs at the speed of now

Technology is creating a world of intensely customized and on-demand experiences, and companies must reinvent their organizations to find and capture those opportunities as they come. That means viewing each opportunity as if it's an individual market—a momentary market.

Trend 1

Stack Strategically:

Architecting a Better Future

Business strategies and technology strategies are becoming inseparable—even indistinguishable.

Consider Royal Dutch Shell's goal to become a net-zero emissions organization by 2050.[23] The company's "ChargeWorks" program is developing and deploying edge intelligence algorithms to optimize energy consumption at electric vehicle charging stations.[24] A joint effort with Microsoft aims to develop AI solutions to improve operational efficiency and lower company emissions.[25] Investments in quantum computing research are targeting capabilities that will let Shell model chemical processes needed for large-scale capture and storage of solar energy or capture and conversion of carbon dioxide.[26]

These technology investments are driving and defining Shell's future—an effort every enterprise needs to start emulating. Industries are being reshaped by technology, and now industry leadership demands technology leadership. Look at manufacturing, where companies are using predictive analytics and robotics to inch ever closer to delivering highly customized on-demand products. Or the future of food, where we see the promise of

precision agriculture driven by edge intelligence and transparent supply chains built on blockchain. In transportation, autonomous vehicles are no longer a question of "what if?" but "how soon?"

Enterprises have long anticipated this shift—but believed they had more time to prepare. While technology augmented parts of the business, few actually approached their technology and business strategies as one. Now, all of that is changing. In response to the COVID-19 pandemic, companies across the globe made rapid digital transformations, accelerating their journeys to the future. Cloud spending in the first quarter of 2020 was nearly triple that of the previous year, and by November, 70 percent of companies using cloud had plans to increase spending due to the disruption.[27,28] Fetch Robotics, an industrial robotics provider, saw a 63 percent increase in demand.[29] Virtual reality growth prospects surged as the world began to search for new ways to work remotely.[30] Additive manufacturing returned to prominence as new demand for rapid and onshore production suddenly emerged.[31]

These rapid transformations and the sudden influx of new technologies have ignited a new era of business—one where architecture matters more than ever, and industry competition is a battle between technology stacks.

Look at the competition playing out between Sony and Microsoft. For decades, these companies approached the video game market in roughly the same way. They launched consoles around the same time and competed on the relative strength of the hardware and their ability to secure exclusive content deals. But when they started making different technology decisions to drive unique competitive advantage, both technology and business strategies started to diverge.

This year, Microsoft is emphasizing cloud as the underpinning for its latest Xbox gambit, working to make more games accessible on more devices. The company's Game Pass subscription service lets users play a wide variety of cloud-hosted games, and multi-device log-in support means they can

play on phones, tablets, or PCs, rather than be tied to a living room console.[32,33] Conversely, Sony is delivering immersive—and exclusive—experiences with its next-generation hardware. The new PS5 console supports PlayStation VR headsets and 3D spatial audio through its wireless headsets.[34] The system's DualSense controllers feature a unique haptic feedback mechanism through adaptive triggers that provide realistic sensations to match situations in a game—like when shooting an arrow or pulling a rope.[35] Both first- and third-party games will offer exclusive DualSense features that can only be accessed with Sony's PS5 console.

On the surface, Sony and Microsoft are going after the same market, but "under the hood" their strategies are completely different. The discrete advantages of their technology architectures have let them reimagine how they find new customers and what they sell in radically different ways. They are demonstrating that technology is no longer one-size-fits-all, and the technology choices that a company makes can radically alter their value proposition.

What's more, enterprises have more technology choices to make than ever before. From the distribution of cloud deployments, types of AI models, and wide range of edge devices, to the design, or even basic physics, of hardware and computation—each layer of the stack is expanding into new dimensions. The abundance of "as a service" solutions from hyperscalers, improvement in technology standards, and growing cloud foundation throughout the enterprise has made taking advantage of this choice extremely accessible.

This range of options presents both opportunity and risk. Like Shell, Sony, and Microsoft, the opportunity is to custom-tailor every layer of the technology architecture and capture the market with a truly unique approach. The challenge: Most enterprises' technology strategies and architectures aren't designed to take advantage of this abundance of choice.

Enterprises are now at a critical decision point. To become—or remain—industry leaders, they must build competitive technology stacks. At the same time, as they make investments in cloud, data analytics, and emerging technologies like

DARQ (distributed ledger technology (D), artificial intelligence (A), extended reality (R) and quantum computing (Q)), they need to think about the long-term impact these choices may have—either limiting or propelling them in the future. The most dynamic, sustainable, and competitive architectures will be the ones that let businesses tap into the full spectrum of technology capabilities available today, building unique solutions for current markets while maintaining a focus on reusability, repurposing, and the enterprise's evolving goals.

A new era of competition is dawning—one where architecture matters, and leaders will be decided not just on the success of their business plans, but by the ingenuity of their technology choices.

77%

of executives state that their **technology architecture is becoming critical** to the overall success of their organization.

Fortify:

Creating Technical Wealth

To build a competitive technology stack, you first need to invest in a strong foundation. And as 2020 showed, despite the best intentions—most don't have one yet. Enterprises are weighed down by technical debt accumulated as former technology solutions become outdated, need refactoring, or are otherwise holding them back from achieving their current goals. Instead, they need to build technical wealth—establishing a clear path to move away from static, unadaptable legacy systems and develop an adaptive, reusable approach to technology.

At the height of the COVID-19 pandemic, when nearly every organization was rapidly pivoting to meet new needs, multiple U.S. state governments were instead desperately trying to find workers with COBOL expertise to keep their decades-old unemployment systems operational.[36] If COBOL doesn't ring a bell, that's not too surprising; it was designed in 1959. Too often, companies have built rigid solutions for short-term needs only to struggle when they need to be updated or adapted. In the pursuit of building something cutting edge at the time, many businesses inadvertently built systems that were future-resistant, not future-adaptive.

Most have already taken the step toward flipping their approach: cloud transformation. But simply "lifting and shifting" or migrating a handful of enterprise applications won't be enough when companies need to be prepared for change at a moment's notice. Cloud has the potential to transform everything from how businesses operate, to how they partner, compete, and drive value. Truly architecting for change means fundamentally re-thinking how applications are developed and taking full advantage of these opportunities.

The microservices revolution is at the forefront of this. Designing applications at a micro level breaks away from the one-challenge-one-solution paradigm and gives enterprises the flexibility they so desperately need. These composable elements can be swapped in or out independently, scaled, or repurposed over time, creating a system that isn't just minimally viable, but maximally valuable.

Look at the UK Department for Work & Pensions (DWP), which prior to the pandemic had begun a cloud transformation including both microservices and the creation of an API library.[37] During the pandemic, when demand started surging, DWP was able to identify and quickly scale up critical services.[38] What's more, their API library, full of reusable templates and code, allowed developers to rapidly string together new services for citizens to address the unique circumstances they faced. In record time employees were able to create automated systems for uploading medical records, requesting universal benefits checks, and issuing free school meal vouchers.
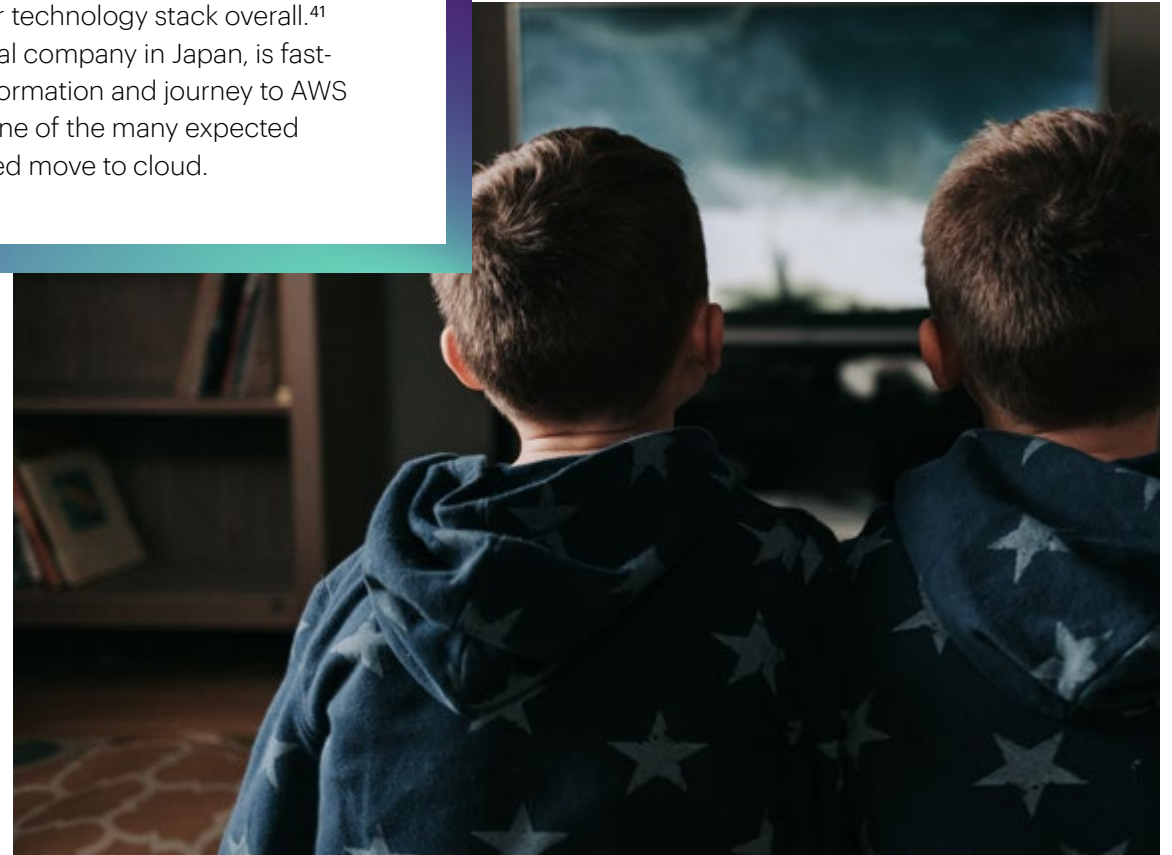
Taking similar steps to redesign and reinforce your technical foundation with modular and adaptable building blocks will help ensure you are well prepared to accommodate change when it happens. And it isn't just about being reactive. Generating technical wealth gives companies greater ability to explore and extend the business in new directions, building new value with relative ease.

Cloud has the potential to transform everything from how businesses operate, to how they partner, compete, and drive value.

In 2019, ITV, a large UK media company, launched an ambitious effort to put their digital transformation to work.[39] The company had migrated from a mixture of legacy systems, on-prem data centers, and aging software running on COBOL to cloud microservices.[40] But, not content with just the efficiency and cost savings of this transformation, ITV also used its newly developed microservices and hyper-automation capabilities to build a new direct-to-consumer video platform, BritBox, in under nine months. By having the foresight to align tech strategy with business strategy, ITV is now distributing its original content to over one million subscribers, and delivering unique consumer engagement experiences, such as interactive competitions and online pay features.

In parallel, it's important to understand how technology is going to impact wider corporate goals. Businesses in every industry are scrutinizing their supply chains, manufacturing, and packaging under a sustainability lens, and the increasingly central role of technology means it should be part of this

reevaluation as well. For instance, using cloud-native architectures and sustainable software engineering can reduce carbon emissions by 5–10 percent each—making a greener technology stack overall.[41] Takeda, a pharmaceutical company in Japan, is fast-tracking its digital transformation and journey to AWS cloud. Sustainability is one of the many expected benefits of its accelerated move to cloud.
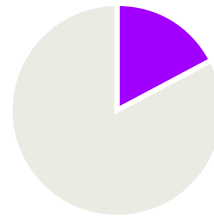
Generating technical wealth gives companies greater ability to explore and extend the business in new directions, building new value with relative ease.
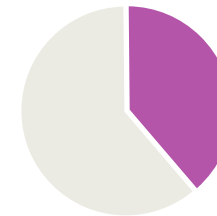
Extend:
Competing Through Tech

With a technology foundation built for change, enterprises will unlock the true value of aligning technology and business strategies: tapping into today's wide range of technology options. The diversity of technology capabilities emerging today is driving unprecedented diversity in business tactics and solutions. Enterprises no longer need to approach problems in the same ways as their competitors, and their unique technology solutions will be their competitive edge.

Please indicate the statement that best reflects the alignment of your organization's technology and business strategy
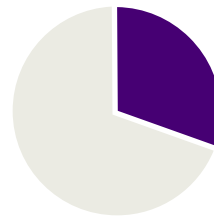
17% Technology goals are somewhat aligned with my organization's overall strategy.
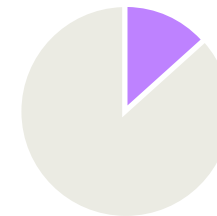
38% Technology goals are aligned with my organization's overall strategy.

30% Technology drives my organization's overall strategy and goals.

13% Visionary technology goals are at the core of my organization's overall strategy including larger societal goals (sustainability, inclusion and diversity, etc).

Just look at Ralph Lauren, which is transforming fashion into a completely personal experience. The company has long had a customization program, but it was largely limited to picking a color or adding embroidery to existing products. In 2020, they pushed past customization and into on-demand manufacturing. Using a digital customization platform, customers could create their own unique jacket style, which would then be cut and sewn directly to their specifications.[42] With no pre-existing inventory, the company is able to reduce waste and better meet customer needs.

The company also introduced a Digital ID program, where products are manufactured with a unique identifier—or "born-digital" as the company calls it.[43] Customers can scan QR codes embedded on the garments and guarantee authenticity of the product, while Ralph Lauren uses the Digital IDs to bring more transparency to the supply chain and create efficiencies. Importantly, the IDs are built on an agile platform so the company can continue to open up new interactions over time, like providing styling tips based on the specific garment.

This means that to stake out a share of tomorrow's market, enterprises today need to explore the possibilities, experimenting with what their particular marriage of technology and business objectives will be. They need to reimagine the future of their products, services, operations, and more through the lens of what technology is making—or will make— possible, and they need to build the right technology stack to bring their preferred future to life.

Bentley is responding to customer demands for sustainability by reinventing its planning and design operations around greener materials. For its first all-electric production model due in 2026, the company is researching and developing a cost-effective "e-axle" that is fully recyclable and eliminates the rare-earth magnets and copper windings used in many current electric cars.[44] In addition to zero emissions from propulsion, Bentley's project could significantly reduce the overall environmental impact of electric cars—helping to achieve a preferred sustainable future for society while positioning Bentley as a leader in that future.

Each of these examples demonstrates the convergence of technology and business strategy within certain technology layers. But to tackle the most ambitious challenges and position the enterprise to be flexible and future-adaptive, businesses also need to think holistically across layers.

NVIDIA demonstrated the value of this approach during the pandemic. As COVID-19 flared around the globe, NVIDIA launched Clara Guardian, a smart hospital solution that enabled hospitals to respond rapidly to an unprecedented time.[45] Installed in over 10,000 hospital rooms, the system made it possible for healthcare workers to address a wide range of newly discovered needs. With Clara Guardian, hospitals could: remotely monitor and detect changes to patient vital signs; enforce the wearing of personal protective equipment (PPE); direct employees and visitors away from high-risk areas of the hospital; have contactless patient interaction by using a voice-powered AI agent; and more.[46,47,48]

This feat would not be possible without innovation and cohesion at every layer of the technology architecture. The system's smart sensors were able to stream data and generate insights about body temperatures, movement, social distancing, and mask detection. Pre-trained data models could use that data to help a diagnosis or predict if a patient was going to go to the ICU. Edge AI chips and GPUs provided much-needed horsepower to the system, while simultaneously supporting intelligent human–computer interactions like voice-powered assistance and dynamic wayfinding. The system allowed hospitals to respond and reorient to ever-changing needs in a time when speed was critical. And it's not just a COVID-19 solution, but one that will grow in value over time as hospitals repurpose parts of the system and uncover new use cases—allowing them to reap benefits long into the future.[49]

The choices enterprises make throughout their technology stack now directly determine the ways in which they do business and how competitive they ultimately are. Organizations that successfully combine their business and technology strategies, and work to find their most valuable combination of technologies across the stack, will be able to develop truly one-of-a-kind offerings with unprecedented agility, capturing new markets no matter how fast the world changes.
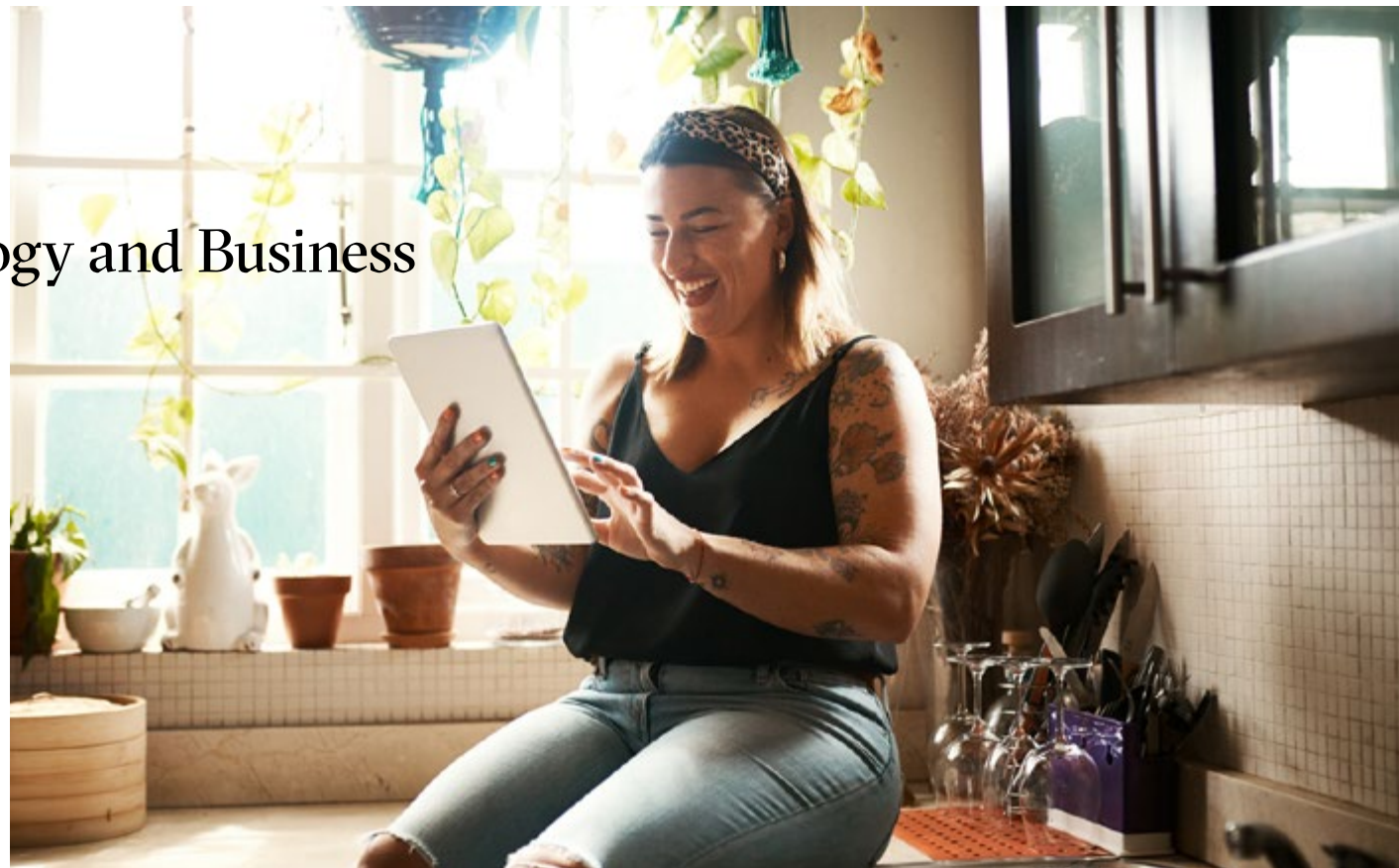

89%

of executives believe that their organization's ability to generate **business value will increasingly be based on the limitations and opportunities** of their technology architecture.

The choices enterprises make throughout their technology stack now directly determine the ways in which they do business and how competitive they ultimately are.

Reinvent:

A New Generation of Technology and Business

As enterprises reimagine the possibilities of technology-powered products and services, they will soon find they are playing a more active role in the relationship between people and technology than they ever have before. The convergence between business and technology means it's highly likely that the first time a customer interacts with a near-human AI agent, puts on a pair of virtual reality goggles, or learns about blockchain, will be linked to a company's cutting-edge offering.

Foremost, this comes with added responsibility. Just as warranties or brand reputation guarantee products and influence purchasing decisions, technology will come under the same scrutiny. Like many financial institutions, Allied Irish Bank (AIB) integrates digitalization for an enhanced customer experience, including using AI as part of its decision-making process.[50] The organization has invested in the skills and capabilities to build decision-making models and wanted to ensure they understood and could implement cutting-edge methods to measure algorithmic bias. To ensure they have both services and technology that customers can trust, AIB partnered with Accenture to build and pilot the use of an algorithmic bias tool. This tool enables the integration of a data-driven assessment of algorithmic fairness into the end-to-end model lifecycle, allowing data-scientists and business users alike to use the tool to evaluate proposed models for any bias or unfairness. It provides the necessary understanding to ensure that the customer is being treated fairly and is at the heart of the bank's decision making.

With the added responsibility also comes new opportunity: the chance to delight a customer or truly shape the way they engage with the digital world. Look at Adidas, which is showing customers how engaging with the digital world can go far beyond a screen. The company has designed a wearable digital platform into one of its lines of soccer cleats and is partnering with the FIFA organization on a unique customer engagement experience that blends real-world interactions with video games.[51] Based on a person's movements while wearing the Adidas shoes, they can improve their FIFA video game avatar and unlock new in-game rewards. The program and partnership have helped both companies reach customers in novel ways while deepening loyalty.

These engagements are poised to emerge everywhere. The wearable that Adidas is using, built by Google's Project Jacquard, is also being used by Levi's and Yves Saint Laurent in their apparel lines. It's an advanced hardware device packed with different types of computing chips and an AI interface that can be inserted into textiles like jackets, backpacks, and more, making it possible for brands to deliver integrated customer experiences to the people wearing the clothes.[52] Google's work to embed intelligent capabilities into everyday items demonstrates how the merging of technology and business will be present in even the simplest experiences.

Other companies are going even further. Microsoft has spent years developing its HoloLens augmented reality device, primarily thinking about use cases where the information of the digital world could be visually mapped and blended onto a user's physical environment. But now with Project Tokyo, the company is using the HoloLens as an agile platform to create offerings that fill new roles in people's lives.[53]

A team at Microsoft has begun to refit the device to help the visually impaired engage with their environment. The team designed several new machine learning models that repurpose the computer vision and hardware acceleration capabilities on the device. One model uses the device's spatial sensing to help users understand the layout of their environment. It detects people's poses and distances, and relates that information to the user through spatially tuned audio cues. Another model repurposes the machine vision capabilities for facial recognition, taking pictures of the environment and scanning faces to provide the wearer with people's names (if the scanned individual has opted in).

The great diversity of technology capabilities available to businesses today is creating limitless possibilities—but also new challenges and new ways competitors can gain the upper hand. As enterprises accelerate their innovation strategies to meet the demands of today's market and future markets, they need to be strategic—the technology choices they make today will have far-reaching impact. Now is the time to migrate to cloud, leverage AI, and take advantage of next-generation infrastructure; the architecture enterprises build today will determine their future.

The great diversity of technology capabilities available to businesses today is creating limitless possibilities.

Decision Points

Is your business prepared to be a technology leader?

- Technology is reshaping industries, an evolution that went into overdrive in 2020. Revisit (or create) your vision for the future of technology in your industry: Identify what has accelerated, what has lagged, and what has changed forever.

- Evaluate current digital transformation efforts against your competitors. Accelerate investments in core technologies like cloud, data analytics, and mobility. Identify new avenues for digitally driven products, services, and customer experiences that leverage growing technology capabilities.

How are you creating a competitive edge with your technology choices?

- Focus on building technical wealth. Reimagine your approach to application development to take advantage of cloud capabilities, microservices, and the flexibility they unlock. Focus on creating reusable components that are maximally valuable, not just minimally viable.

- The future is here already. Begin piloting or scaling efforts and investments in next-generation technologies like distributed ledger, XR, or AI. Leading in cutting-edge technology areas will be the main source of competitive advantage—make sure you have a strategy for them.

How will your relationship with your customer be reshaped by next-generation technology?

- The first time a customer uses a new technology may be through your products or services. Conduct design thinking and strategic foresight exercises to evaluate how the enterprise will be brought closer to the customer in unexpected ways.

- Make trust a core design principle of new technology strategies. Prioritize data privacy, ethical design, and continuous governance as you build. Trust and adoption will go hand in hand for the next generation of products and services.

Trend 2

Mirrored World:

The Power of Massive,
Intelligent, Digital Twins

On its way to the moon in April 1970, NASA's Apollo 13 was severely damaged.

More than 200,000 miles away with no access to the spacecraft, mission controllers needed to diagnose the problem, but neither they nor the astronauts could see the full extent of the situation.[54]

Fortunately, NASA had 15 simulators back in Houston. The models each represented different parts of the spacecraft or aspects of the mission and were controlled by computers that could be networked together to mimic a scenario. By modifying the simulators to replicate what they knew about the situation in space, mission controllers were able to rapidly—and safely—test and refine a plan to bring everyone home.

If this technique sounds familiar, it's because NASA's simulators were a precursor to the digital twins a growing number of enterprises are building today. But where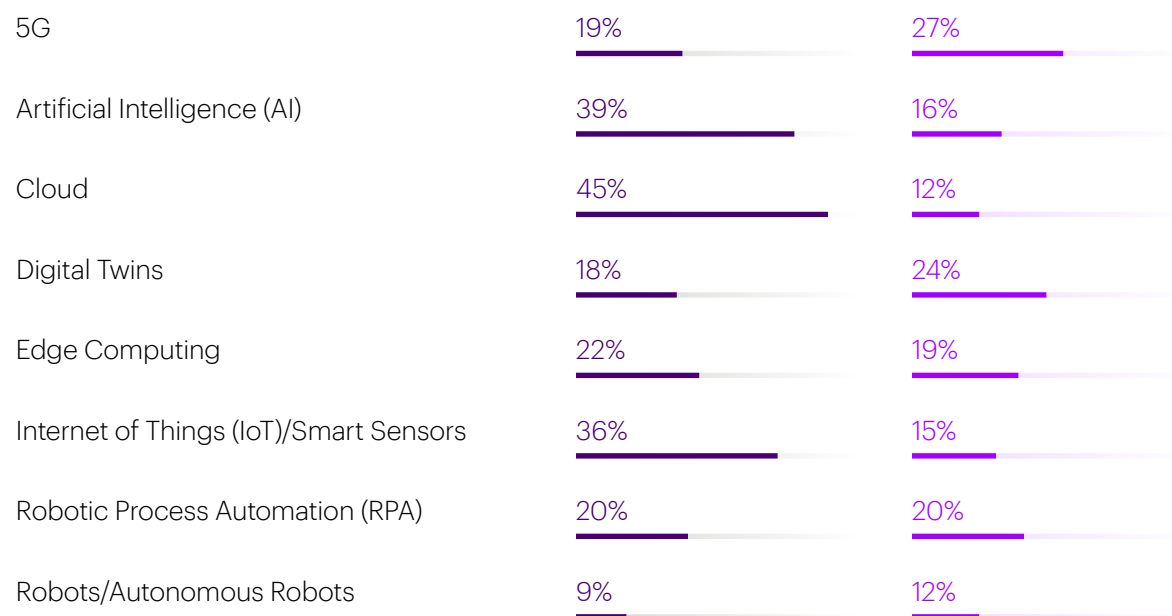 Apollo's simulators were an isolated undertaking by one of the most advanced science agencies of the time and were shut down after the program ended, today's digital twins are being rapidly deployed across many enterprises and industries. Their pervasiveness is driving an irreversible inflection point—the birth of the mirrored world.

When digital twins were initially adopted, they were championed for their ability to monitor, simulate, and streamline the data of discrete devices. But recently, the scale of the models, layering in of AI, and increase in adoption have transformed the equation. Leaders are starting to connect massive networks of *intelligent* twins, linking many twins together to create living models of whole factories, product lifecycles, supply chains, ports, and cities. They are creating unbroken threads of data—fabrics that will soon be essential to every enterprise's digital strategy.

The mirrored world is the amalgamation of these threads; as more enterprises build and connect intelligent twins, bringing more of their organization into digital space, they are opening a cornucopia of new opportunities and ways of doing business. Consider how digital twins already let businesses gather, visualize, and contextualize data from across their physical assets and projects, bridging their physical operations and digital capabilities. AI helps them act on that data, dynamically responding to real-time information, asking "what-if" questions about possible future scenarios, and designing and testing new products in the virtual world long before ever constructing them physically. As enterprises connect more expansive networks of twins and build out the mirrored world, these capabilities will grow exponentially. Leaders will be able to make data and intelligence the primary orchestrators of the business, increasing real-time agility at scale, overhauling their innovation processes, and forming entirely new mirrored-world ecosystems and partnerships.

What technology is your organization scaling up or experimenting with this year?

Technology	Scaling	Experimenting
5G	19%	27%
Artificial Intelligence (AI)	39%	16%
Cloud	45%	12%
Digital Twins	18%	24%
Edge Computing	22%	19%
Internet of Things (IoT)/Smart Sensors	36%	15%
Robotic Process Automation (RPA)	20%	20%
Robots/Autonomous Robots	9%	12%

—— Scaling

Applying technology to change a process (or multiple processes) in a full production system

—— Experimenting

Applying technology to testing within a process (e.g., A/B testing), but not yet changed the process in a full production system

It's a future that's still being built, but today's initiatives signal that it isn't far off. The mirrored world will soon be the foundation on which businesses manage their operations, form and test new strategies, collaborate with partners, and more—it's becoming their new mission control.

Look at Unilever, which is working with Microsoft to develop intelligent twins of its factories.[55] The company's strategy uses data streaming from connected machines to track conditions within the factories, then adds machine learning and AI techniques to test potential operational changes and improve production efficiency and flexibility. Connected devices can send real-time data on production variables like motor speed or temperature to the twin, where algorithms can then map out the best operational conditions. Unilever reports that its pilot twin in Valinhos, Brazil has saved them millions of dollars by cutting energy use and increasing productivity by one to three percent. Importantly, the company isn't stopping there. Unilever aims to have twins for all of its facilities, so that together they will provide a comprehensive, digital representation of the entire supply chain.

Bringing data and intelligence together at this magnitude is what makes building intelligent twins and the mirrored world so critical. They will let enterprises ask and answer big-picture questions: How will it impact my operations if I have to shutter this warehouse? What will happen if this vendor's supply chain fails? How can I update this product to be more sustainable—and is that achievable with my existing vendors?

And the urgent need for visibility and insight at this scale became undeniably clear during the COVID-19 pandemic. From factories that shut down, to supply chains that failed to work around disruptions, to consumer goods companies that couldn't pivot fast enough—many organizations struggled because they couldn't easily answer these big-picture queries. Imagine the difference if more enterprises had faced COVID-19 with intelligent twins for every asset and the power of the mirrored world on hand. Even after the pandemic is over the world will continue to change more rapidly than ever. Developing these capabilities can no longer be put off.

Leaders across industries are now rethinking their five- and 10-year plans in light of the pandemic and unpredictable times ahead, and the mirrored world must be their north star. Intelligent digital twins are driving a step change in how businesses operate, how they collaborate, and how they innovate—and enterprises that get left behind will struggle to participate in the markets and ecosystems of the future. The businesses that start today, building intelligent twins of their assets and piecing together their first mirrored environments, will be the ones that push industries, and the world, toward a more agile and intelligent future.

65%

of executives expect their organization's **investment in intelligent digital twins to increase over the next three years.**

Fortify:

Unleash the Power of Data

To gain the organizational insights and greater agility the mirrored world promises, you first need a strong and comprehensive data foundation for your twins. When intelligent twins are connected in mirror environments, they are a powerful way to turn data into actionable, big-picture insights. But incomplete or incorrect data will lead to false conclusions.

High-quality historic data is critical for intelligent twins—it's what the twin uses to monitor real-time machine performance, build models of customer behavior to help design custom products, and more. But COVID-19 has made historic data increasingly unreliable. Look at how quickly the pandemic transformed consumer behavior on Amazon. Nozzle, an agency that helps Amazon sellers conduct algorithmic advertising, found it took just one week at the end of February for the top 10 Amazon search terms in multiple countries to shift to COVID-19 related products like hand sanitizer, alcohol wipes, and N95 masks.[56] Sudden, widespread changes like this can send machine learning models that have been trained on "normal" behavior off course, impacting supply chains, inventory management, marketing, and more. Going forward, enterprises cannot rely on historic data blindly—they need to check and correct their models as the world changes.

On top of historic data, businesses need a strategy for real-time data collection, or they'll miss out on the real-time analytics intelligent twins can provide. There are two sides to this: investment in sensors and IoT devices to collect data, and the tools to prepare, analyze, and visualize the massive amounts of information gathered. Today, many enterprises are already investing in IoT devices and sensors, but struggle to fully utilize the data these devices generate. New cloud-based services and platforms are being developed to bridge this gap and help enterprises achieve real-time insights. Snowflake, for instance, offers clients data warehousing as a service, which can load continuously generated real-time data, requires no manual effort, and can even digest semi-structured data.[57]

From there, intelligent twins can make real-time data actionable in the moment—making the possibilities of Industry X a tangible reality. Look at Ericsson and Vodafone, which are working with e.GO, an electric vehicle company, to develop a factory of the future.[58] The factory is powered by connected machines and a private 5G network, and each machine gathers and processes data to send to the company's "brain"—its network operations center. This data powers a digital twin of the entire e.GO factory: It knows every component, when that component arrived, and the instructions for how to assemble and disassemble it. New parts can be timed to arrive exactly when they're needed. And the tools used by human workers are connected and smart, automatically adjusting to provide the right torque needed for a particular task based on current data and specifications.

Only 11%

of executives estimate that **100 percent** of the data provided through **IoT devices and/or sensors in their organizations is fully utilized.**

Going even further, companies are starting to explore how multiple intelligent twins, connected in mirror environments, can use real-time data to safely increase autonomy. GEMINA (Generating Electricity Managed by Intelligent Nuclear Assets) is a U.S. Department of Energy program funding research projects that use AI and digital twin technology to increase the flexibility and autonomy of nuclear reactor systems, and reduce operation and maintenance costs.[59]

Two of the projects to receive funding are tied to GE Hitachi's BWRX-300 boiling water reactor design. GE Research intends to move from time-based to condition-based predictive maintenance, which will lead to significant savings. To make this possible, they will develop an array of digital twins for continuous monitoring, diagnostics, prognostics, and early warnings for the reactors. They will also develop a "Humble AI" framework that defaults to a safe operation mode when confronted with situations the algorithm does not recognize. In doing so, the system ensures safe handling of uncertainties and increases the feasibility of more autonomous operations.

And as enterprises continue to deploy intelligent twins and build the mirrored world, they will also need to think about data integration across the multiple twins in a digital thread, or if multiple sub-components all feed a single twin, then data integration between those sub-components. Twins that represent different pieces of the same operation will need to be designed with data synchronization in mind, to maintain an accurate representation of the whole. Twins that represent different stages of a process, or that need to be connected to twins in other systems—for instance, the twin of a solar farm and the twin of a power grid—should have APIs that allow them to interact. And organizations purchasing connected machines or devices from different vendors should ensure that data interoperability challenges will not prevent them from linking these systems.

When built on comprehensive, compatible, and trusted data, intelligent twins and mirrored environments will help enterprises optimize operations, detect and predict anomalies, pivot to prevent unplanned downtime, enable greater autonomy, and dynamically adjust their designs and strategies with every new piece of data they collect or new test that they run. While each of these capabilities can save money and increase efficiency, their true value lies in what they represent together: a new way of understanding the business, and a new way of running it.

Synthetic Data for Product Simulation

Some twins, like simulations of products that have not yet been manufactured, may require yet another type of data. Generated synthetic data can help test variations in product design or test products in different situations, like extreme weather, even before enterprises build their first prototype.

Mackevision, which is part of Accenture Interactive, is working on KI Absicherung, a joint research project with 25 partner organizations, to establish a standard for validating and approving AI functional modules for self-driving vehicles.[60] The consortium is creating reproducible and high-quality synthetic training and test data sets. AI algorithms will be tested and trained for pedestrian recognition in virtual simulation, using the synthetic data.

Extend:

A Risk-Free Playground for Innovation

Intelligent twins have powerful simulation capabilities, and with your data foundation in place they will let you reimagine your innovation process. They are, essentially, a risk-free playground to explore new product ideas, strategize for many possible futures, and explore limitless "what-if" scenarios. Most businesses experimenting with this kind of simulation today are doing so at a smaller scale, but the capabilities they are demonstrating will only become more valuable when enterprises can tap into multiple twins in fully mirrored environments.

For instance, intelligent twins can completely transform product development. They enable AI-driven generative design, where human workers and AI systems iteratively work together, shrinking design and manufacturing timelines significantly. And they allow enterprises to complete more product testing in simulation, meaning they can put off physical manufacturing for much longer, saving time and money, and potentially moving manufacturing closer to the customer.

Big data and software company TIBCO is doing this with Mercedes-AMG Petronas Formula One Team, to improve race performance.[61] Despite limited on-track testing time, their partnership lets the team test a number of vehicle factors—like design, configuration, and aerodynamics—in a digital twin simulation, helping them build the optimal car for various tracks and drivers. Additionally, the simulation can test performance during different scenarios, like weather changes, track heat, accidents, or the appearance of a safety car, helping drivers and teams test and plan how they should react or modify their strategy in response.

And in the future, intelligent twins may play an even bigger role in product development, changing the way enterprises conduct R&D and letting them explore opportunities that wouldn't have been possible before. Look at developments in personalized medicine. Oklahoma State University (OSU) and Ansys explored using the power of digital twins to better target tumors.[62] Respiratory treatments for lung tumors can also damage healthy tissue, so it's important to make sure that as many of the drug particles as possible reach the tumor rather than other areas of the lung. OSU and Ansys developed digital twins of human lungs, then simulated drug delivery for different models of patients with different particle sizes, inhalation rates, and initial

locations. By experimenting with these factors, they found a delivery method that may let doctors increase the accuracy of drug delivery to 90 percent—much higher than the 20 percent common for conventional aerosol methods.

Outside of product innovation, companies are using intelligent twin simulation to explore possible future scenarios and inform their strategies. Some are using simulations to model and predict the increasingly dynamic behavior of bad actors. Facebook, for instance, has created a simulator, called WW, based on the company's real code base. In WW, AI-powered bots mimic both innocent Facebook users as well as bad actors attempting to conduct a range of harmful behavior—like scamming people. Facebook engineers can then implement various strategies to stop or constrain this behavior in the simulator and test the effect on the bots.[63]

And the NFL is partnering with Amazon Web Services to create a "digital athlete" platform, applying AI and machine learning to better inform their player safety and treatment measures.[64] Using historic data on athletes' performance over the years, as well as current data on injuries and environmental information, they are creating simulations of the athletes to virtually model different

scenarios. The NFL hopes that visualizing the way players would respond in these scenarios will help them create a pathway for new, prevention-focused rules.

These capabilities will only become more transformative as enterprises continue to deploy and connect intelligent twins, and the reach of the mirrored world grows. Consider the benefit if a group of twins could simulate not just a single car's reaction to different conditions, but a whole fleet's. Or if product twins could interact with twins of individual people to create more customized experiences. A car manufacturer, for instance, might build an intelligent twin of a car's wheels. If that model can interact with information about the customer—historic preferences or even real-time information from test drives—it can generate custom wheel designs, autonomously ensuring that the wheels meet the designers' requirements, safety regulations, and the individual customer's driving and lifestyle.

From generative design to personalization to security, intelligent twin simulation is about bringing the right data and the right AI models together, and exploring various possibilities, futures, and strategies from the safety of a twin. Soon, the mirrored world will bring this future-focused intelligence and agility to bigger stages, with bigger impact.

Reinvent:

Build the Big Picture

As companies continue to reinvent themselves in the wake of 2020's challenges, truly gaining big picture visibility means going beyond their own four walls. Today's businesses are not self-contained; they rely on partnerships, co-experimentation, and global collaboration, and this must be reflected in the mirrored world. It's not always enough to have a real-time view of what's happening within your own organization. The full picture includes what's happening with the supply chains, delivery partners, and governments that you rely on too.

Already, businesses are pursuing twin-enabled visibility with select partners. Porsche, for instance, has teamed up with material suppliers Borealis, Covestro, and Domo Chemicals, and blockchain provider Circularise, to use digital twins throughout the supply chain to ensure the use of sustainable materials in Porsche cars.[65] By creating digital twins of materials, Circularise built a digital thread across the entire supply chain, enabling material traceability and tracking other sustainability metrics like carbon footprint and water savings. Throughout the supply chain, various parties can update the twins to reflect the manufacturing process and lifecycle of the product, increasing transparency both for Porsche and its customers.

Singapore is demonstrating another way that the mirrored world can increase big-picture visibility. Singapore's National Research Foundation has created Virtual Singapore, a digital twin of the city-state, which uses 3D semantic modeling to combine map and land data with real-time data on climate, traffic, and more.[66] It's intended as a tool for many uses: testing urban designs to increase accessibility in certain areas, simulating emergency evacuations to develop better protocols, and analyzing traffic, transit, and pedestrian movement to make transport as efficient as possible. It's easy to see how other twins of physical objects within the city-state may be integrated. One district has been using the twin to plan and monitor urban development, visualizing how various pedestrian bridge designs could be integrated into a nearby park and using it to monitor the Greenprint Project—a sustainable area outfitted with solar panels and pneumatic waste conveyance systems.

And the Port of Rotterdam offers a glimpse into what mirrored-world ecosystems can achieve when big-picture visibility and intelligence are combined. The Port is the largest in Europe, serves around 30,000 ships per year, and is using an intelligent twin to provide shipping companies with a more efficient, cost-effective, and seamless experience. Partnering with IBM Watson, the Port equipped its expansive dock with sensors that collect comprehensive information about things like air temperature, wind, humidity, and water conditions, and even has "Digital Dolphins": smart quay walls and buoys with sensors.[67] Using AI to analyze all the collected data, the Port is able to predict best times to moor and depart, or calculate how much cargo needs to be unloaded at a deeper part of the Port to allow a ship to continue sailing through.

Additionally, in July 2020 the Port signed a deal with Daewoo Shipbuilding and Marine Engineering (DSME), one of South Korea's largest shipbuilding companies, to build a digital twin interface between smart port and smart ship.[68] It's a signal of things to come. Soon, the organizations building intelligent twins will be able to interact and collaborate within mirror environments in ways that organizations without twins will simply not be able to access.
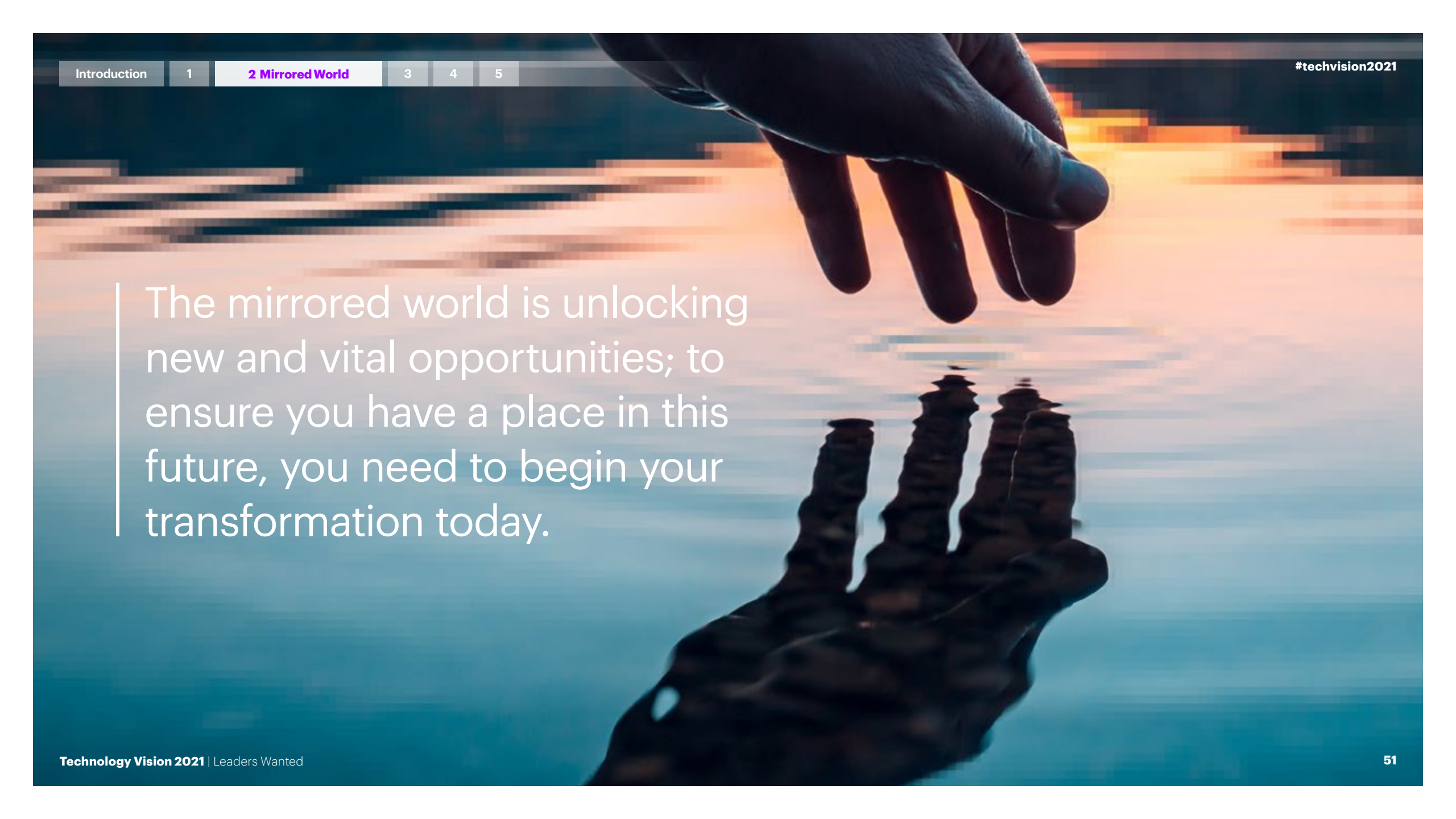
These early examples foreshadow the mirrored world's coming role and if enterprises want to lead in the future, they need to be part of it. As more organizations digitize their physical operations and systems with intelligent twins, they will be able to share designs, information, and insights easily across silos and across ecosystems, virtually test how future products might work together, and conduct business in ways that were not possible before. How will your business evolve when the power of comprehensive visibility, unlimited simulation, and safe experimentation is at your—and your partners'—fingertips?

The mirrored world is unlocking new and vital opportunities; to ensure you have a place in this future, you need to begin your transformation today.

87%

of executives agree **digital twins are becoming essential** to their organization's ability to collaborate in strategic ecosystem partnerships.

The mirrored world is unlocking new and vital opportunities; to ensure you have a place in this future, you need to begin your transformation today.

Decision Points

Is the business prepared for the Mirrored World?

- Audit your data practices. Evaluate what tools and technologies are being used and where data is being warehoused to deconstruct data silos. Identify where COVID-19 may have impacted historic data and its ability to drive accurate insights.

- Prioritize building streaming analytics capabilities. Digital twins will need a healthy data "supply chain" to be effective. Embed sensors in physical products and spaces, and invest in solutions that deliver rapid ingestion, preparation, and analysis of the data generated.

How can digital twins transform your innovation process?

- Develop a list of key use cases for where digital twins will generate the most impact in your enterprise. Reimagine how product development cycles would look with digital twins at the center.

- Integrate intelligence capabilities with digital twin efforts. Pilot generative design or synthetic data solutions to explore how they enhance design, testing, and product development.

How will your enterprise engage wider ecosystems of digital twins?

- Design twins from the outset with the intent to connect them across the business or ecosystem. Make API strategy a priority when developing digital twins. This includes evaluating and including external (or open) sources of data, as well as ensuring construction of an API for the twin itself.

- Have ecosystem-scale thinking lead digital twin strategies. Target large systems as the long-term target digital twins. Think entire offices, supply chains, and more. Use individual twins as a means to gain greater visibility into larger collaborations.

- Short-list potential digital twin-driven partnerships. This could be collaboratively building a new twin or tapping into an already established network of digital twins.

Trend 3

I, Technologist:

The Democratization of Technology

In July 2020, OpenAI asked for help exploring the capabilities of GPT-3, the third generation of the organization's deep learning language model which can generate human-like text.[69]

Using a private beta version of the model, developers got to work, discovering and experimenting with its ability to write short stories, songs, guitar tabs, an article about itself, and even code.

Each new discovery and demonstration sent waves of excitement and awe across tech workers, reporters, and business leaders alike. When one developer testing the model was able to tweak it to produce code, demonstrating that he could create webpage layouts by giving the model written prompts like "the Google logo" or "a blue button that says Subscribe," many wondered if this was an opportunity to make programming more accessible.[70] With the help of a tool like GPT-3, could anyone become a developer?

They weren't far off. An undeniable shift is underway: Powerful technology capabilities are being put into people's hands, usable without highly specialized skills. It's not about a single tool or service, but the culmination of an array of democratizing technologies. Natural language processing, low-code platforms, and robotic process automation (RPA) are just a few of the capabilities and services making technology more accessible. They each have different and unique applications, but all are bringing the innovative power of machines into the hands of people with as little friction as possible.

Democratized technology lets people optimize their work or fix pain points on their own. Without needing to request major IT projects, people can create a custom dashboard for a group's finances, build an app to approve and automatically fulfill purchase orders, and much more. Suddenly, the power to create technology solutions is entering the hands of people all across the enterprise.

This doesn't remove IT from the equation. IT will still be in charge of the big implementations, scaling successful programs, and injecting the most cutting-edge technology into the business. Rather, it frees IT from many burdens that bog down big projects, like not *quite* capturing the users' needs or needing to customize for every user and use case. Instead, IT can focus on large-scale evolutions while the people who are closest to day-to-day business problems can tackle them head-on. Democratized tech tools and capabilities empower people to take action on their business expertise, addressing problems with technology-driven solutions.

This shift could not come at a more critical time for businesses. As companies seek to compress digital transformation into a rapid timeframe and reorient for new circumstances, they can use these tools to empower all members of the enterprise as agents of change.

G&J Pepsi, using Microsoft's Power Apps, demonstrated exactly why this approach is such a game-changer. Power Apps gives users the ability to create new software services easily and rapidly, by stringing together data, applications, and AI with visualizations and icons rather than lines of code.[71,72] G&J Pepsi used this capability to rapidly build and deploy transformative digital applications across inventory and merchandizing.[73] In one case, employees with little to no software development experience created an app that would examine a picture of a shelf to identify the number and type of bottles on it, then automatically order the correct items for restocking based on historic trends.[74] The group created eight applications without a professional developer on staff and saved $500,000 in the first year alone.[75] And this was just one team of seven people; imagine the power of technology democratization when these capabilities are scaled across the entire organization.
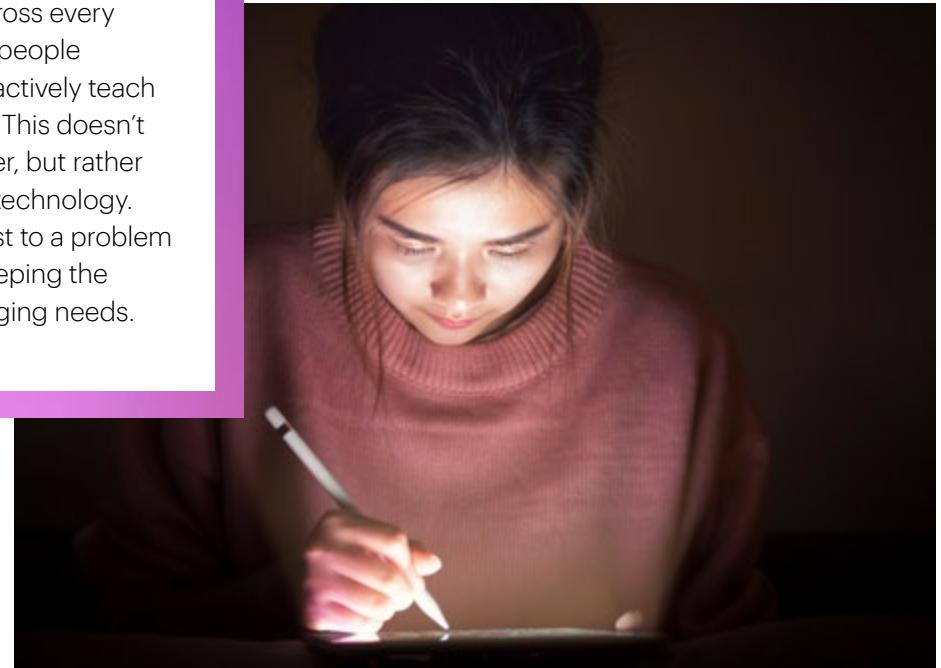
Technology democratization adds a grassroots layer previously missing from enterprise innovation, extending it to the very edges of the business. Too often IT departments or technologists work to uncover the needs of the organization in silos, building or buying a new tool and then rolling it out and training business units on the new technology. With technology democratization, everyone can be an innovator. The tools of democratization are the spark to ignite transformation, and people across the organization will sustain it.

This is every enterprise's opportunity to make their employees a core part of their digital transformation effort. But to do so successfully, leaders will need to extend the innovation imperative across every business unit. It's not just about giving people access to new tools; companies must actively teach their people to think like technologists. This doesn't mean turning everyone into an engineer, but rather enabling them to solve problems with technology. By empowering everyone, those closest to a problem can be the ones to create solutions, keeping the company in lockstep with rapidly changing needs.

88%

of executives believe **technology democratization is becoming critical** in their ability to ignite innovation across their organization.
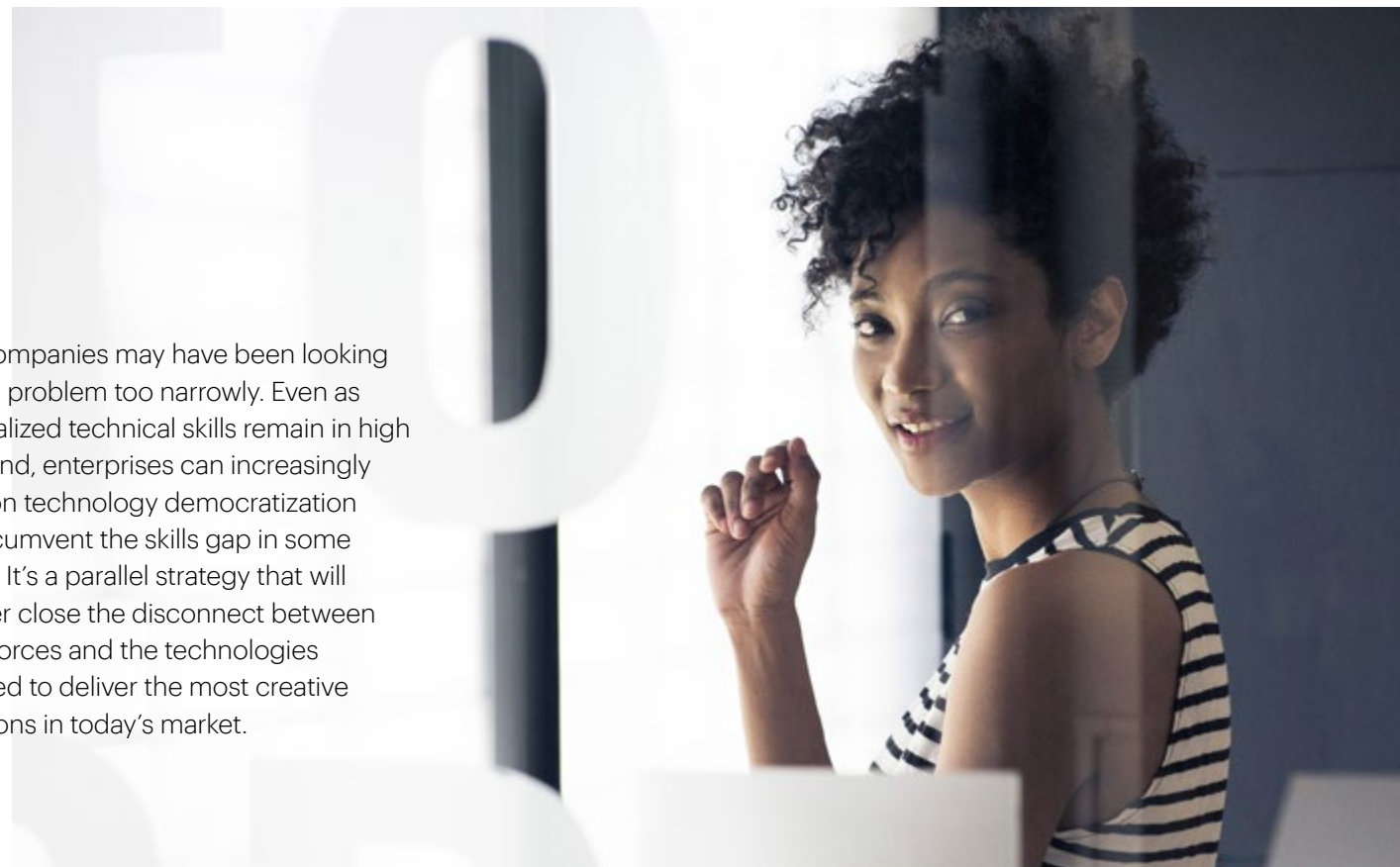
Fortify:

Bypass the Skills Gap

For years, many enterprises have had great ambitions for their digital transformations, but struggled to recruit and keep the highly technical workers needed to bring those plans to life. In 2019 an all-time high of 67 percent of organizations reported facing a skills shortage and falling behind the pace of change.[76] The demand for rapid digitization in response to the COVID-19 pandemic threatens to push those numbers even higher.

But companies may have been looking at this problem too narrowly. Even as specialized technical skills remain in high demand, enterprises can increasingly lean on technology democratization to circumvent the skills gap in some areas. It's a parallel strategy that will further close the disconnect between workforces and the technologies needed to deliver the most creative solutions in today's market.

RPA, for instance, allows people with different types of skill sets to automate repetitive tasks. Pharmaceutical company Takeda is empowering its people to focus on higher-value activities, supporting better patient outcomes by scaling automation throughout the company. To date, Takeda has trained over 1,500 people and democratized the development of over 300 bots.[77]

At LexisNexis Risk Solutions, a project manager used an RPA management tool from UiPath to house and manage automation ideas, reuse bots when possible, and demonstrate ROI to leadership.[78] In one instance, his work uncovered a backlog of records that needed to be cleared and his team used 11 robots to clear 31,000 of them in a single day. These successes have also helped evangelize RPA among other peers, scaling the automation and value creation beyond the project manager and his own team.

These days, speed goes hand in hand with success. Enterprises can't afford to wait and hire someone tomorrow to build the solution they need today. In the first months of the pandemic, healthcare provider Geisinger saw a 50 percent decline in outpatient visits and a sudden surge in in-patient and ICU needs.[79] The

company faced a major challenge trying to get the right healthcare professionals to the right places at the right time, and they sprang to action with democratized tech. By using Quickbase low-code development they were able to build an app to help coordinate and assign the thousands of healthcare workers in their network in just two days.

These democratized technologies may be new ground for many organizations, but there's good news on that front too. With the massive shift to cloud underway, you're headed in the right direction, and may even have access to these tools already. Existing cloud solutions offer a stepping stone into these spaces. Amazon's Honeycode, for instance, is an AWS service that lets people build mobile and web apps without writing a single line of code.[80] Salesforce's Lightning App Builder is a point-and-click tool for creating custom pages on the Salesforce app.[81] For the many organizations migrating their people to Microsoft Teams, Power Apps can be directly embedded.[82] These tools, and many others, offer an incredible opportunity to bridge the gap between complex technology and workers at every level of the organization.

It's easy to see these examples as a story of speed and efficiency alone. But there is a far more profound message underneath. When access to powerful technology capabilities reaches throughout an organization, every employee can be an active and vital part of the digital transformation effort. People can pick and choose for themselves what to automate, allowing them to focus on the things they do—and like doing—best. They can create solutions for customers right at the point of need. They can help to improve both the customer and the employee experience— not by gathering feedback to send to a team of tech experts for consideration, but by putting technology to work themselves.

The fact is, there are no more excuses about lacking the right talent. With the right technologies, in many cases you have the people you need. From startups hoping to quickly establish themselves among more seasoned competitors to legacy organizations working to complete their digital transformations, enterprises can use democratized technology to put the skills gap in the past. Leaders in the future will be the ones who rethink their approach to meeting their skills needs. It's no longer just "who can I hire?" but "how can I empower?"

Extend:

Activate Grassroots Transformation

Businesses are already using the tools of democratization to speed up development and enable greater agility in one-off or limited instances. But the investment needed to fully capitalize on this trend doesn't end with the tools themselves. Activating a grassroots layer to your digital transformation requires investment in your people. You don't need to teach them how to become expert coders, but you do need to train them to *think* like technologists.

For most organizations, this means a two-pronged strategy. At a basic level, employees will need to learn what tools are at their disposal, and how and when to best deploy them. But more importantly, enterprises need to invest in employees' overall technology literacy. You need to help your people understand the logic of machines, the benefits and risks to different decisions, and how to see technology not just as a tool, but as a solution. When the workers closest to customers, clients, or internal problems have the context to identify new opportunities and experiment with solutions, they will be able to deliver more customized responses and offerings, with greater agility than ever.

IOOF, an Australian wealth management firm, has created a training program to familiarize its people with low-code development. The company wanted to explore new digital innovation opportunities but most of their highly skilled developers were busy working on

a multi-year project.[83] So the company's CIO launched a low-code competition, paired developers with less technical colleagues, and gave participants two weeks off to experiment with OutSystems, their low-code platform of choice. Already, the company says this experiment has proven valuable. Employees with outdated skills didn't need to spend years retraining, and the low-code apps they created are fulfilling mission-critical needs. One has evolved into a full-scale production system.

Companies will also need to ensure that training strategies include a focus on security and data governance—staples that are baked into full-scale development projects but could be overlooked by employees experimenting with new tech capabilities. CommScope, a manufacturer of fiber-optic cables, developed a low and no-code program with guardrails in place to help their people avoid accidental security risks.[84] The company launched an internal website

with training courses and materials, information about their security and data policies, and details about how much it could cost to launch and maintain an application after development. Additionally, they provided a database of all the applications developed and a forum where workers going through the program could ask each other, or IT staff, questions.

In some cases, it's possible to build checks and reviews into the democratized technologies themselves. Low-code software company Appian, for instance, offers a "Health Check" feature that helps users determine if their app is following best practices, and identifies risks with scalability or maintenance.[85]

Finally, long-term training initiatives to elevate general technology know-how for all employees are picking up steam. Nationwide announced they would spend $160 million over five years to provide "future capabilities" training for their 28,000 employees in the U.S. and elevate their digital literacy.[86] And Accenture's Technology Quotient (TQ) program is a global learning initiative to help employees across the firm raise their "TQ" through training and competitions. The program helps employees understand and articulate important technology concepts as well as their business value and applications. It covers everything from mature strategies like DevOps and cloud to more cutting-edge technologies like blockchain and AI, and is built for any role or skill level with the intent to have every employee become conversant in technology and see technology as part of the solution to the most pressing client needs.

Programs like these can be scaled across the organization while still offering employees a personalized experience. SkyHive, for instance, is using AI to help enterprises analyze their workforce's current skills and identify new and emerging skills they will need in the future.[87] At the individual level, SkyHive assesses what skills each employee will need to excel in their role and what their personal skill gap is, then connects them with appropriate training.

Thinking like a technologist doesn't just mean understanding the use cases for the tools at hand, but understanding the business and technology context necessary to create the best solutions for a particular problem or need. Quick training programs won't cut it. This requires a true investment in the knowledge and thinking of your people. But done right, it will transform what they—and the business as a whole—can do.

86%

of executives agree their organization must train their people to think like technologists—to use and **customize technology solutions at the individual level, but without highly technical skills.**

90%

of executives agree that for tools of **technology democratization**, organizations need to ensure that **training strategies** include a focus on security and data governance.

Quick training programs won't cut it.
Thinking like a technologist requires
a true investment in the knowledge
and development of your people.

Reinvent:

Power Your New Innovation Engine

The value of technology democratization and wide-scale technology training will only grow over time. As it does, it will challenge the typical notions of who "owns" technology in the company, how technology strategy and planning is done, and the role of IT at large. Right now, while the capabilities of democratized technology continue to grow, leaders have a chance to reimagine the intersection of technology and the organization—and ultimately to reinvent how their IT and non-IT employees work *together*.

Schneider Electric is one company demonstrating a vision of this future. The organization has made RPA a significant part of its digital transformation effort, deploying more than 220 bots as part of the process.[88] But the company had the foresight to realize bots might create silos, break other parts of the system, or fail to meet expectations. To combat this, they established a global RPA team to review use cases submitted by business leaders and act as a backstop to ensure that the use cases are strategic and part of the end-to-end transformation strategy. The group has rejected more bots than they have approved at this point, but the extra process helps to guarantee that approved bots will remain useful for a long time. They've also begun offering training on the best ways to make use of RPA technology, which has significantly increased the percentage of accepted use case proposals.

Leaders in this area are unlocking more freedom and exploration for employees. At Google, employees are able to use new technology tools—even if they aren't yet supported by the organization—if they have a strong business need.[89] This is not free rein to use whatever whenever; teams that adopt new tools must put in the work to support their new technical stack and must be conscientious of potential issues like

difficulty communicating and collaborating between teams. Google recognized the value in providing freedom to the people closest to the work in question, so rather than create policies about what technology *not* to use, they prioritized developing a more inclusive framework for how workers can choose their own technical stack.

Approaches like these are also helping companies overcome the friction that all too often exists between IT and business workers. UnitedHealth Group, like many, has often struggled to align its business and IT sides.[90] When challenges arose with the company's claims-processing applications, UnitedHealth Group turned to low-code from Pegasystems Inc. The company found that low-code provided a useful bridge between business needs and IT support. It created a common and intuitive platform for business stakeholders and developers to work together iteratively, allowing business users to have a hand in shaping solutions and giving developers a better idea of what needed to be built. It empowered the groups to work together more seamlessly and proactively than before.

The pace of transformation will no longer be limited to how quickly IT teams can roll out new solutions, nor will the scope of transformation be limited by non-IT workers' expertise with tech capabilities. Enterprises equipping their people with democratized technology are building the foundation for greater agility now and in the future.

Without taking steps to empower your people in this way, you'll be holding back your own digital transformation. Industries are adapting and transforming around you, and your customers' expectations are evolving accordingly; your organization must evolve in kind.

Customer, client, and business-specific expertise has long been spread across the business, recognized as critical capabilities for the workforce as a whole. Now, with rising demand for robust, rapid responses to changing needs and the realization of truly democratized technology, the time has come for tech literacy and capabilities to join that list. Successful digital transformation will be the first win for companies that get it right, but that's just the start. With every employee empowered to contribute technological solutions to business needs, savvy enterprises will have an innovation advantage for years to come.

Decision Points

Is your enterprise poised to take advantage of technology's growing democratization?

- Pick one area of the enterprise to begin experimenting with technology-democratizing solutions. For instance, give sales development representatives the tools needed to design their own apps, or customer service agents the ability to automate workflows.

- Evaluate your existing access. Many cloud providers are beginning to include robotic process automation or low-code solutions as part of their services. Identify what tools the enterprise may already have access to, or what additional investments need to be made, to power grassroots innovation.

How are you training your workforce to think like technologists?

- Invest in technology literacy and training programs across your organization. Educate employees on the technologies available to them, and how to use them to design solutions. Leverage self-selection and AI to find hidden aptitudes.

- Teach employees the "business of tech" by ensuring plans to adopt democratized technologies are accompanied by training for security, governance, and more. Teach employees to understand the costs of scaling and maintaining solutions, how security gaps create enterprise risk, and how to avoid creating institutional friction like incompatibility and data silos.

How can democratized technologies make IT groups more effective—and vice versa?

- Establish teams to support and guide the use of democratized technologies across your organization. Update IT policies to give employees flexibility to explore the use of new technologies, but have IT play a role in establishing guardrails.

- Bridge the gap. IT will still be leaned on to scale and iterate on innovative solutions. Try using technologies like low-code to bridge the gap between the business and technical sides of your organization during prototyping and design stages.

Trend 4

Anywhere, Everywhere:

Bring Your Own Environment

The year 2020 saw the biggest workforce transformation in living memory.

Leaders made drastic moves to keep business going and employees safe during the pandemic, sending swaths of their people to work from home and doubling down on technology solutions to keep them productive. Billions of people around the world changed behavior overnight. In the U.S. alone, research conducted by Stanford in May found nearly twice as many people working from home than working on-site—accounting for more than two-thirds of economic activity.[91]

Many companies approached these changes as short-term solutions to a temporary problem. But in fact, they're part of a longer-term solution to a number of persistent business challenges. Post-pandemic, no one is going back to work as they remember it. Rather, companies and employees alike are moving into a new future, one where work can be done from anywhere.

What does this mean in practical terms? Think back to the early days of the "bring your own device" (BYOD) movement, where companies allow employees to bring their own preferred laptops or smartphones into the office to perform their work. Employers had to implement new policies and tech solutions for a wide range of devices, enabling that flexibility while mitigating the risk of devices that weren't entirely within their control. But it also gave employees a chance for a better work experience and ultimately saved companies money.[92] Now we've moved beyond BYOD and into BYOE: Employees are bringing entire *environments* to work.

They may be on a company laptop, but that laptop is connected to a personal home network that also hosts smart speakers, security cameras, gaming consoles, and more—the average U.S. household already averages 10 connected devices.[93] The laptop itself is sitting on the dining room table between the day's mail and the kids' homework. And in the middle of all that is the employee themselves—leaning heavily on technology to meet the demands of their job while surrounded by the demands of their life.

It's a shift that companies themselves set in motion with rapid pivots to keep operating during the height of the pandemic. Look at NHS Digital—the IT provider for social and health systems in England—which partnered with Microsoft and Accenture to make Microsoft Teams available to 1,275,000 NHS staff.[94] The platform let doctors conduct virtual appointments, allowed the NHS to host virtual "town hall" events, and made it easier for staff in isolation rooms to communicate and collaborate with colleagues outside.

82%

of executives agree their organization's employees just faced the **largest and fastest human behavioral change** in history due to COVID-19.

But even as organizations around the world embraced these and other pivots to keep moving, they didn't have time to appreciate the larger ramifications of the shift. When people can work via "BYOE," they can do their jobs in different or even brand-new ways that will outlast the pandemic. For instance, at the University of Liverpool, scientists worked with a robot chemist to continue their research during lockdowns.[95] The robot helped them look for new ways to speed up reactions inside solar cells, and could run experiments autonomously, even when researchers were not physically present. The researchers won't stop using these robots just because they can go back into the lab themselves; they'll expand what they can do *with* the robots, like running experiments 24/7 or handling toxic substances that could be dangerous to humans.

After the pandemic BYOE work also won't be limited to employees' homes. It will give people the freedom to seamlessly work from *anywhere*—whether that's their home, the office, the airport, enterprise partners' offices, or somewhere else. In a BYOE model, leaders can rethink the purpose of working at each location, and when it makes sense to be at certain sites or with certain people.

As they move forward into this new future of work, enterprises face two key realities. First, just as most companies didn't have much say in BYOD—people wanted the devices that worked best for them—BYOE is here to stay. Remote employees have spent a year experiencing the flexibility and benefits of working from home; they're increasingly reluctant to return to offices. In May 2020, 30 percent of employees wanted to return, according to Perceptyx, an employee survey and people analytics firm.[96] By the end of June, that percent dropped to just four.

People want the environment that's best for them. For some that will mean going back to the office; for some it will mean going 100 percent remote; and still others will want a mix. But regardless, this new approach is something businesses must accommodate rather than fight.

Second, effective strategies to support this new reality are now critical for enterprise differentiation. Leading businesses were moving toward workforce decentralization before the pandemic, eyeing benefits like the ability to recruit from non-traditional locations or offering their people more flexibility and freedom. The advancement of remote collaboration tools and remote monitoring technologies during the pandemic have only made this approach more effective and more promising. Three years from now, successful organizations will be the ones who resisted the urge to race everyone back to the office in favor of rethinking their workforce model for the evolving world.

Opportunities to lead abound, and they all start with continuing the technology transformation the pandemic kicked into higher gear. Cloud-based platforms and collaboration tools saw explosive growth as more information and office workers started staying home; early in the pandemic, Google Meet saw 30x growth, and was hosting up to 100 million users every day.[97] Organizations that rely on physical operations have moved in this direction too, with IoT devices, AI, and XR offering more granular insight into physical worksites, often helping to reduce the number of people needed on-site at one time.

Looking forward, the virtualization of the workforce offers opportunities to expand on human–machine interaction, boost resiliency, and realize the promise of Industry X to harness the power of constant change. But success in this new future will require more than adopting new digital solutions at scale. To get the best from the BYOE model, enterprises need to think about the entire organization in a new way. They need to toss out convention and reimagine how their workforce model can best support and enable their people, and they also need to reimagine their company culture— how remote employees and on-premises employees collaborate, what work is better done in which locations, and what the purpose of physical offices will become.

The right balance will be different for every organization. Each individual worker will also have their own needs and the technologies enterprises need will vary too. But one thing rings true for all. The next generation of workforce leaders will be the ones that lean into this future, seeing it not as something to be endured but as something that drives value. The strongest organizations will be physically distributed, creatively connected, empowered by technology, and able to innovate from anywhere.

48%

of organizations have invested in cloud-enabled tools and technologies and **47 percent in digital collaboration tools** to support their remote workforce during COVID-19.

Which of the following has your organization invested in specifically to support your remote workforce during COVID-19?

48%
Cloud-enabled Tools and Technologies

47%
Digital Collaboration Tools

41%
Productivity Management Tools

40%
Remote Monitoring Technologies

39%
Home Networking Equipment (Laptops, phones, tablets)

39%
Learning or Training Tools

35%
Well-being Technologies (Meditation or wellness apps)

33%
Automation Tools (Robotic process tools, software testing tools)

The right balance will be different for every organization.

Fortify:

From Patchwork Solutions to Permanent Strategy

Businesses have spent the last 12 months doing half of the BYOE equation. In more roles and industries than anyone thought possible before, people now can work remotely thanks to rapid tech rollouts and expansions of existing solutions. But now that the initial rush to get out of the office is over, it's time for the other half of the equation: ensuring that BYOE work can be done seamlessly and securely.

The first step to completing that equation is gaining new visibility into the employee experience. "Workplace" analytics has a vast new meaning and an important new mandate: to build an understanding of how employees' larger environments are impacting their work. As Microsoft's own workforce shifted to working from home, the company used its Workplace Analytics offering to try to understand how collaboration and work patterns were impacted.[98] The company found that people were working different hours of the day, had an increase in social meetings, and had more manager one-on-ones. The analysis demonstrates just some of the ways company culture and work styles changed over the past year, and that there are new opportunities to meet employee needs in this model.

When every worker was on site, it was easier to spot problems with the employee experience. Often you could see the biggest issues with your own eyes. Now, with BYOE as the new future, employee experience is more important than ever but obscured behind miles of distance, shifted schedules, and disparate time zones. Without an expanded approach to analytics, you won't know where experiences are falling short.

And let's not forget one of the biggest challenges of the BYOE shift for employees and employers alike: security. At the height of the pandemic, many companies had to overlook the security concerns of having employees work from home, because the most pressing need was simply to keep them working at all. Now, companies need to accept that their employees' environments are a permanent part of their own enterprise attack surface and adjust accordingly.
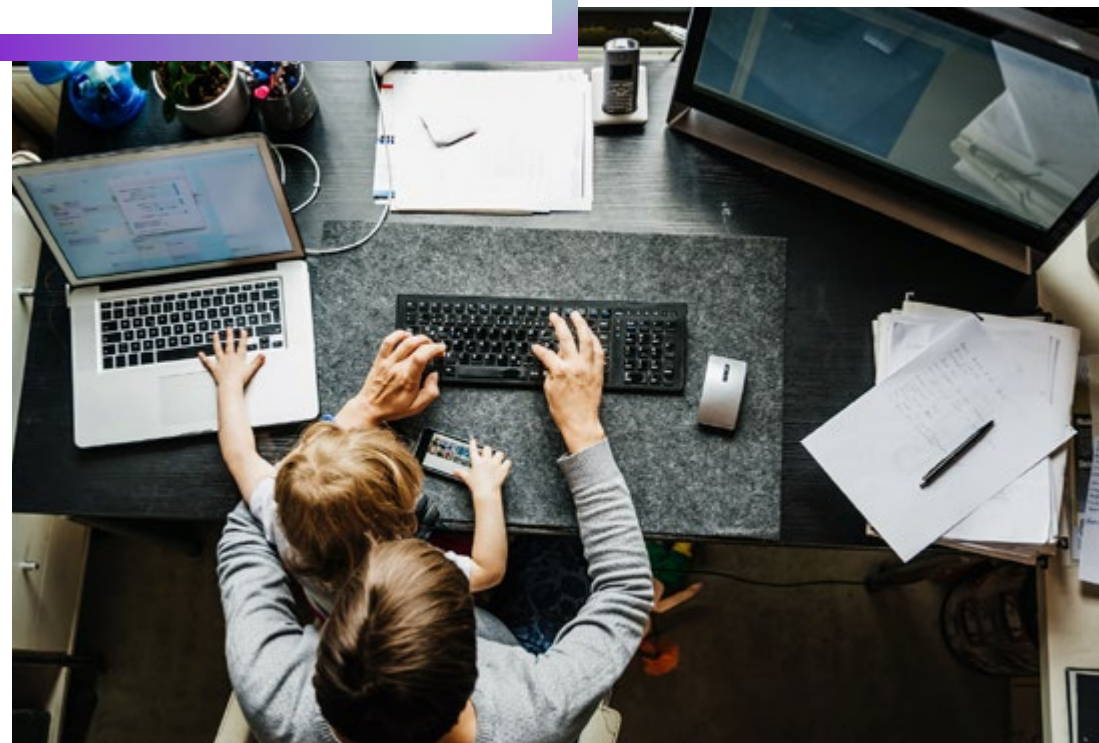
Is that personal laptop someone's using to check their email updated with the latest security patches? Is the home network they're using to access company files safe, or is it driven by an unsecured router with a default administrative password and an easy-to-guess WiFi password? Is the smart baby monitor properly configured, or wide open to the internet and giving bad actors easy access to a microphone to listen in on company calls and presentations?

And don't forget the technologies that are allowing employees to work remotely in the first place, because attackers haven't. Videoconference service Zoom saw its user base double between December 2019 and the end of March 2020, from 100 million to 200 million users.[99] Attackers responded in force; in March, the Anti-Phishing Working Group got eight reports about Zoom phishing attacks. In April they got 1,054. The user base doubled; attacks multiplied by more than a hundred.

Security was a pain point for enterprises long before the company attack surface expanded to include employees' homes and their connected TVs, speakers, smart home devices, and security cameras. That's why approaches like Accenture Labs' CyTwin have rapidly grown in popularity. CyTwin is a digital twin solution that offers companies clear consolidated visibility into their security postures. Much like a roadmap can show you the different routes you can take to reach a destination, CyTwin shows companies the pathways attackers could exploit to penetrate their critical systems. It estimates the impact of potential breaches at scale and helps businesses to prioritize remediation actions that mitigate the biggest risks. This kind of priority-focused analysis is critical at a time when risk is everywhere and the company "footprint" is spreading ever wider.

With the workforce more distributed than ever, companies need to bolster their efforts to keep employees and their interactions with the company safe. The payoff is worth the investment: The enterprise benefits of embracing a BYOE workforce outweigh the challenges. Put yourself in a position to capitalize on those benefits by addressing your BYOE risks and pain points now, so they don't grow alongside your new strategy.

Companies need to accept that employees' environments are becoming a permanent part of the enterprise.

Extend:

New Workspace, New Opportunities

Once you have your full footing with BYOE, there are even more benefits to reap. Few companies have realized it yet, but this new future gives you a chance to really rethink your operating models—even if you traditionally relied on physical work.

Tyson Foods, for instance, is doubling down on robot butchers.[100] Like many industries, meatpacking plants needed an in-person workforce to continue operating throughout the pandemic, and companies spent hundreds of millions on safety equipment like protective gear and thermal scanners. Now, Tyson is looking beyond how to make their previous approaches safe and is turning to a new approach to their business. The company has been investing in more automation for several years and intends to increase this investment going forward. While the robots available today do not yet match human ability, they are able to take on a number of simpler roles, making it possible to have fewer human workers physically on the floor at one time.

When companies go virtual-first, they have new opportunities to integrate emerging technologies into the workforce. Robots, alongside many other innovations, are often presented as a zero-sum option: Either a human has a job or a robot does. But with a virtual-first BYOE strategy, you can have a full warehouse of robots doing the physical work, coupled with offsite employees safely doing the monitoring and strategy. It's not one or the other, but the best of both.

Perhaps more important than any other benefit, a BYOE strategy lets you rethink how you recruit new employees. Almost every major company already runs its business globally, but still sees itself tied to geographies; opening up to the idea of geographically distributed employees, by default, will finally give companies access to a truly global talent pool.

Facebook is transitioning more of its workforce to a remote strategy as a way to expand and diversify its talent pool; in an interview, Mark Zuckerberg cited the ability to recruit people from more locations and the ability to retain people who might have left the company because they wanted to move to a different area.[101]

And shifting to a BYOE strategy may make new approaches to filling roles more attractive. During the pandemic, when many companies were forced to furlough or lay off employees, and others were struggling to fill roles and meet surging demands, the chief human resources officers from Accenture, Lincoln Financial Group, ServiceNow, and Verizon jointly created a platform to connect displaced workers with new roles.[102] The platform, called

People + Work Connect, maps out employees available for work and roles that need to be filled, letting HR professionals from different companies collaboratively fill talent needs across their organizations and keep more people employed. BYOE strategies will make systems like this valuable beyond the pandemic, because organizations will be able to collaboratively fill roles regardless of physical location.

There's also a key opportunity to reimagine the purpose of place. What can work environments be in this new, changing world? Already, a number of businesses are repurposing their existing offices—allowing workers to stay home by default but keeping these spaces available for co-working or team building.
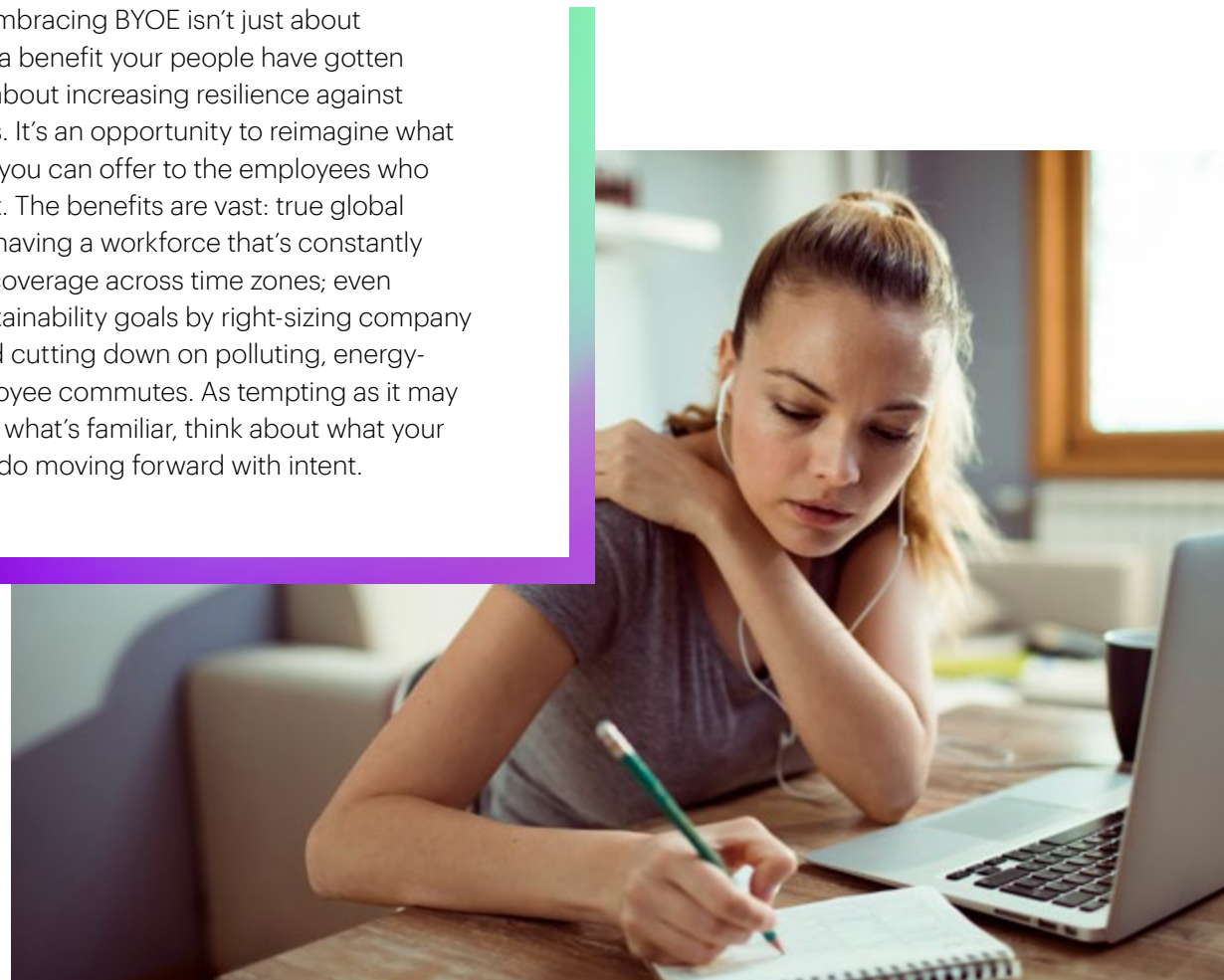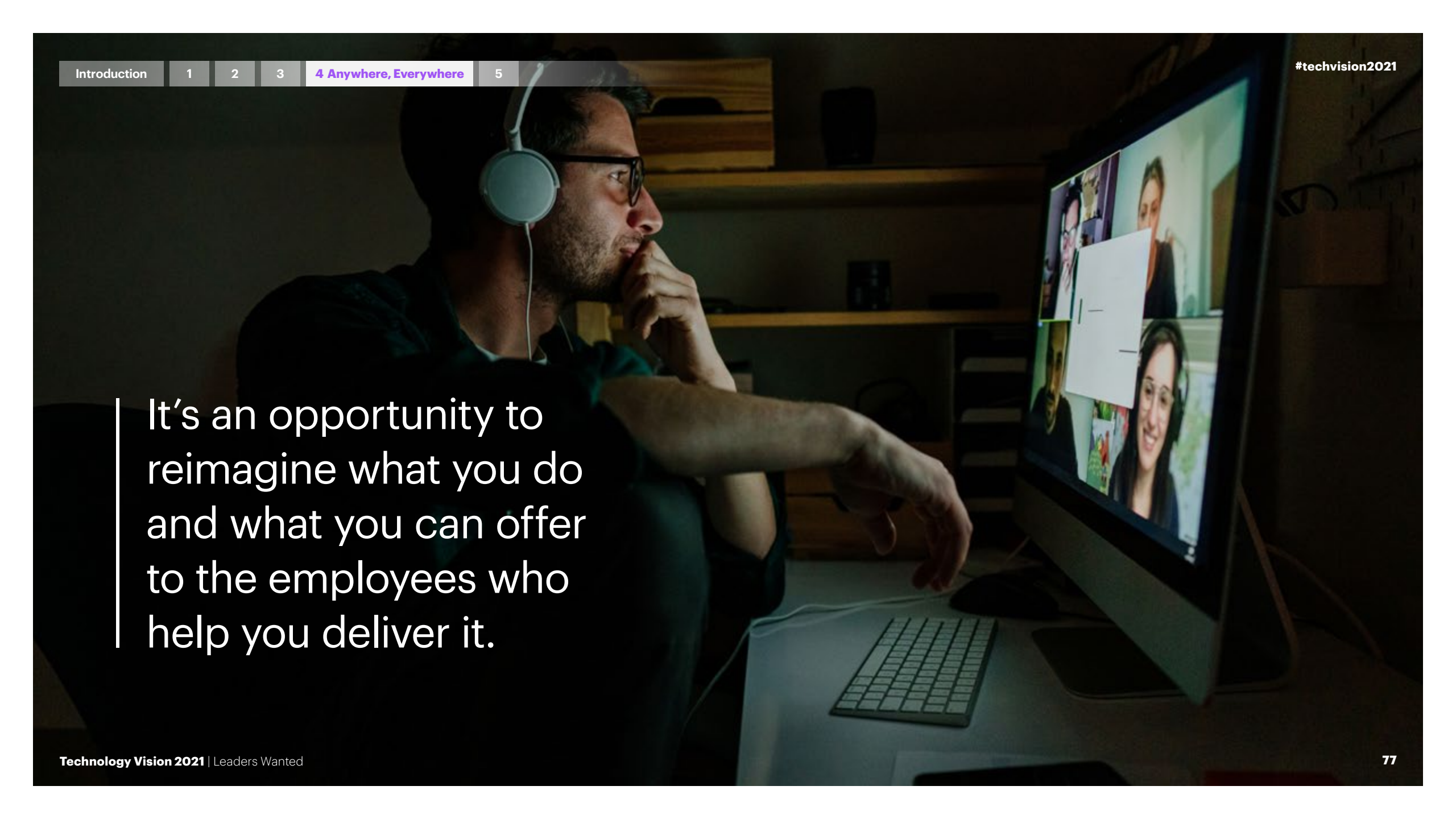
87%

of executives believe the remote workforce **opens up the market** for difficult-to-find talent, and expands the **competition for talent** among organizations.

Fujitsu's new "Work Life Shift" program, for instance, seeks to maximize creativity and efficiency by letting the company's 80,000 workers determine the best work situation for themselves.[103] All employees will be able to work from home permanently and to work flexible hours. But while Fujitsu is halving its total office space in Japan, the company is actually expanding satellite offices in different parts of the country. The new model will let employees choose where they want to work—whether that's their home or one of these smaller offices.

The reimagination of workplaces is also about how far remote employees can reach. Stripe launched a remote engineering hub long before the pandemic began, and now that 22 percent of their engineers are permanently remote, the company says geographic diversity has proven valuable.[104] The Developer Support Engineering team, for instance, is spread across three continents, meaning they can provide more timely support to local users, and can run regional customer events around the world.

In the long run, embracing BYOE isn't just about accommodating a benefit your people have gotten used to, or even about increasing resilience against future disruptions. It's an opportunity to reimagine what you do and what you can offer to the employees who help you deliver it. The benefits are vast: true global access to talent; having a workforce that's constantly "on" by virtue of coverage across time zones; even delivering on sustainability goals by right-sizing company office spaces and cutting down on polluting, energy-consuming employee commutes. As tempting as it may be to pull back to what's familiar, think about what your organization can do moving forward with intent.

It's an opportunity to reimagine what you do and what you can offer to the employees who help you deliver it.

Reinvent:
Embrace the New Work Culture

The last piece of the BYOE puzzle may be the most nebulous: culture.

Returning to the BYOD versus BYOE comparison is the best way to make this challenge plain. Bring your own device, for all the initial difficulties it caused, was limited to tech functionality and security. When we use the word "environment," though, that includes people's *lives*.

A person's environment is more than just devices and WiFi networks. It's kids, pets, the construction happening next door, the sick relatives they're supporting, their stress levels—the humanity of the equation. None of these challenges are new for any of us as people, but "going to work" used to provide some separation that kept them largely out of the employer's purview. No more.

The enterprise must accept that the employee environment is now part of the "workplace," and accommodate for people's needs just as they would for people's technical requirements. This will be a large, slow-to-emerge cultural shift, but there are quick wins to find your footing.

Some of the first steps are simply admitting that the BYOE approach is a work in progress and committing to continued improvement. Microsoft Teams enabled many organizations to quickly transition their people to remote work, and the company continued to roll out new features meant to support a more lasting remote workforce. Features like hand-raising and background noise suppression were created to improve the actual experience of working remotely, beyond just making it technically possible.[105] And in response to research on remote meeting fatigue, Microsoft created Together mode, which mimics the feeling of sitting in a room with colleagues—making it easier to see non-verbal body language and making discussions feel more natural.[106]

Another focus area is the disconnect between in-person and remote workers. Right now, so much is tied to geography, but the future will be all about balance. Workers in different roles will benefit from the best work environment for their particular needs, but without careful implementation it could lead to a divided workforce, where in-office and remote workers struggle to collaborate and become demoralized or feel unsupported. Quora, for instance, is adopting a remote-first approach while also keeping its California headquarters open as a co-working space; to avoid distant workers' voices being minimized in favor of those in physical office spaces, all employees attending meetings will be required to appear on their own video screen.[107]

Organizations are also addressing the tricky new question of how to ingrain their mission and values into new hires who have never experienced their in-person work environment. Verizon, which transitioned 90 percent of its workforce to a work-from-home model in mid-March 2020, was hiring for 950 new home-based customer service roles.[108] Leaning on their experience transitioning existing workers to a remote model at the beginning of the pandemic, the company has redesigned its new hire training programs to be digital, self-guided, and video-based, and to include work-from-home-specific training as well as training from current employees.

And Twitter, which was among the first major organizations to announce permanent remote work, is starting to transform its workforce culture in even more ways.[109] While remote working will help the company meet its goal to hire more diverse employees from all parts of the U.S., leaders have also identified areas where improvement is needed: to avoid meeting fatigue, executives formally cut down on video calls; they have decided to rethink their performance review system to prevent bias against remote workers; and they are looking for ways to recreate "water cooler" connections and social engagement.

Optimizing your organization for a BYOE strategy is a moving target and best practices are still evolving. But one thing is certain: Waiting to act isn't an option. To create an organization that attracts the best talent and keeps employees

engaged, enterprises will need to constantly experiment with new solutions, pursuing and supporting cultural changes like these across the organization.

BYOE is the gateway to working from anywhere, and leaders in the future will be the ones that lean into this opportunity and reimagine their business in this new model. The future of work starts today.

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Decision Points

How is your business making remote work sustainable, seamless, and secure?

- Identify where you made rapid digital transformations and prioritize addressing outstanding security concerns. Cyber attacks are on the rise and the enterprise's attack surface is wider than ever. Commit the necessary resources to security teams to minimize risk to both the business and employee.

- Re-evaluate technology strategy to ensure benefits of remote work are being maximized. Examine VPN needs and access requirements, ensure employees are trained to use the tools they have, and create a pipeline for employees to introduce new collaborative solutions to the organization.

How are your people responding to remote work?

- You are performing a massive workforce experiment—evaluate how it is going. Invest in workplace analytics tools and develop a set of KPIs to build a deeper understanding of how employees are responding to remote work.

- Open the lines of communication. What is working for some teams or individuals may not be the same for others. Survey your people to understand what benefits (or challenges) they are facing with remote work. Ensure any return-to-office strategies account for this sentiment.

- Partner with your workforce to understand the new demands they face as their home becomes their office. Uncover accommodations the enterprise can make as the employee's environment—including their personal life—becomes part of the "workplace" and requires different accommodations.

How are you thinking about the purpose of place moving forward?

- Reimagine how your physical space is utilized. Plan for optimizing offices to account for a growing remote contingent, and how the enterprise can transform these spaces. Explore creating XR capabilities and environments that will foster immersive digital collaboration.

- Revise recruiting and talent strategies to take advantage of talent pools outside your typical geographic markets. For example, think about your recruiting process: resume intake; basic requirements; who candidates interview with (and how). These, and more, will need to be reworked to connect with a wider network.

- Emphasize the culture. Ensure that the informal advantages of workplaces are virtualized as well. Team-building efforts and "water cooler" conversations need to find their digital home as the enterprise builds toward a future with a mix of in-person and remote employees.

Trend 5

From Me to We:

A Multiparty System's
Path Through Chaos

At the height of the COVID-19 pandemic, Singapore introduced a blockchain-based medical record system.[110]

The "Digital Health Passport" let individuals store medical documents in a secure digital wallet. At a time when monitoring the spread of the virus was crucial, the system allowed the government to easily track the levels of infection and eliminated the need for paper records—all while maintaining individuals' privacy. It also gave people verifiable test results and the hospital discharge papers they needed in order to be cleared for work. In other words, it put a clean and trusted bill of health right at everyone's fingertips—and was used more than 1.5 million times in its first four months alone.

This story isn't an isolated one. Even as companies were making drastic cuts and scrambling to keep operating during the height of the pandemic, organizations across industries doubled down on exploration and investment in multiparty systems (MPS). From contact tracing to frictionless payments, applications for technologies that were once considered too complicated, far from maturity, or niche suddenly took center stage. In fact,

despite the economic hardships many companies faced, IDC forecasted blockchain to maintain double-digit year-over-year growth, with worldwide spending reaching $4.3 billion for 2020.[111]

With the benefit of hindsight, the explosion in adoption of multiparty systems isn't all that surprising. COVID-19 made it clear that companies can't navigate through disruption and uncertainty alone. One of the biggest impacts of the pandemic was how it unveiled global enterprise fragility, leaving companies cut off from their partners, scrambling for answers, and needing to build new, trustworthy relationships. For instance, the highly communicable disease demanded that businesses develop deep insight into how people and things were moving, without sacrificing privacy or efficiency—a capability existing systems were not ready to meet. Across many areas, multiparty systems quickly shifted from ambitious undertakings to desperately needed solutions.

Multiparty Systems

Multiparty systems enable a shared data infrastructure between individuals and organizations that drives efficiency and builds new business and revenue models. They include blockchain, distributed ledger, distributed database, tokenization, and a variety of other technologies and capabilities.

25%

of organizations are **scaling up multiparty systems this year.**

With the benefit of hindsight, the explosion in adoption of multiparty systems isn't all that surprising. COVID-19 made it clear that companies can't navigate through disruption and uncertainty alone.

The digital age allowed businesses to expand their reach in unprecedented ways, with the proliferation of data analytics, cloud, and mobility letting companies seamlessly share insights and services. But despite widespread investments in transformation technologies, businesses never really changed the way they partner.

Consider supply chains: Even with the investment in new technology, many still rely on physical paper trails or outdated processes. Companies can find themselves locked into single-partner relationships, where working with their regular supplier or vendor is hyper-efficient but trying to work with anyone new is painstaking and slow. COVID-19 was a grain of sand introduced to the clockwork, and the gears went flying. Last year 94 percent of the Fortune 1000 reported COVID-19 related supply chain disruptions, and 75 percent reported negative or strongly negative impacts to their business.[112] These numbers are a testament to the scale of the pandemic, but also evidence that the power of technology to transform partnerships wasn't being truly maximized.

As companies evolve beyond COVID-19, they must not rebuild the mistakes of the past. Companies are facing an enormous imperative to forge a resilient, adaptable, and trustworthy foundation for their existing *and* future partnerships. There's opportunity here: Disruption has upended our expectations for ecosystems and ambitious enterprises are creating new standards for industry. Coordinated, strategic ecosystem partnerships will set companies up to address today's disruptions and be better prepared to weather new ones, but they'll also enable ways to create new interactions or discover new ways to approach a market. These partnerships will start to blur industry boundaries to solve new problems, like the emerging collaboration between healthcare and travel, or even begin to define new industries entirely.
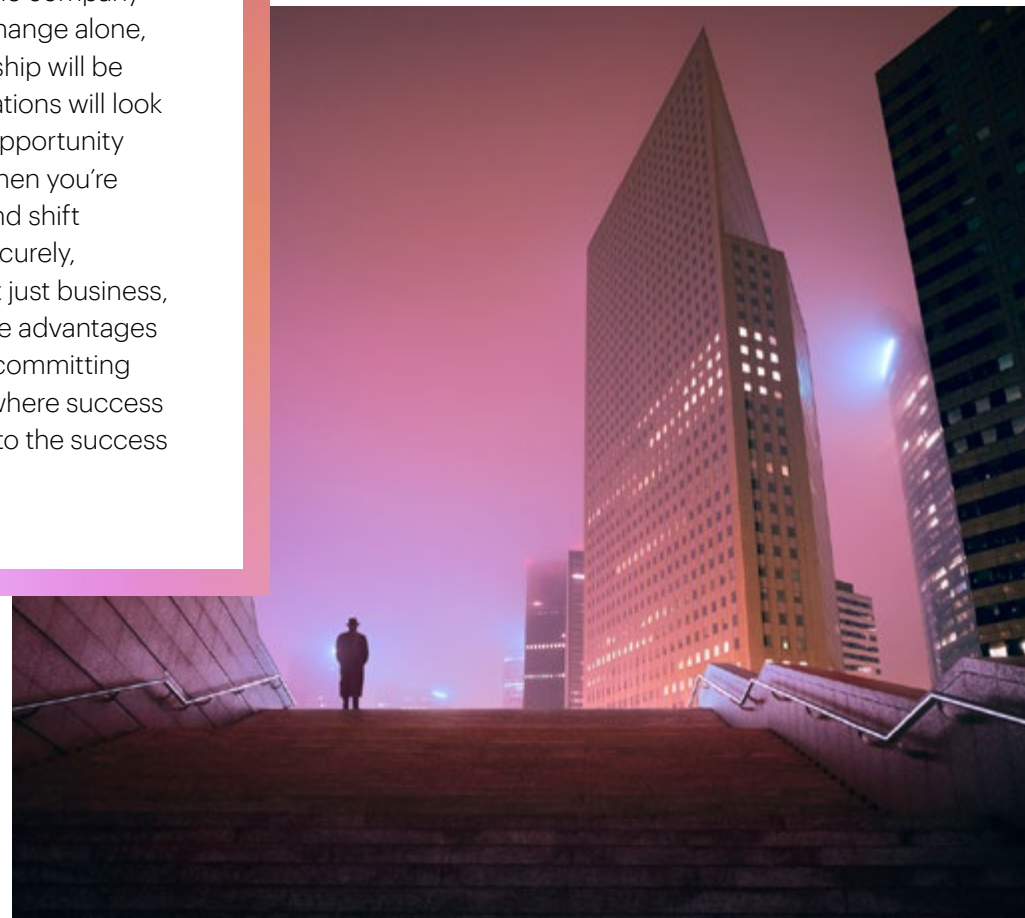
Enterprises aren't all starting entirely from scratch. Previous efforts toward building digital ecosystems allowed *some* companies to successfully navigate the early days of the pandemic. In retail, when brick and mortar stores were forced to shut their doors to customers, sales rerouted through platform-based

ecosystems. According to Adobe, online shopping in April and May of 2020 was $52 billion more than is typically reported during those months, even surpassing the levels of online shopping retailers had seen in the previous November–December holiday season.[113] Globally, internet usage has risen by 30 percent in the last year and tapping into that market has been essential for enterprises' survival.

But even with these technology solutions, enterprises often built pseudo-ecosystems, not fully committing to the ecosystem mindset. Companies looked at them as an appendix to the enterprise—an approach that limited the promise of the underlying technology. While enterprises built efficient solutions within their company, they often generated more friction in working with partners by creating data silos or incompatible standards.

Moving forward, companies need to adopt a broader ecosystem-forward approach: driving the most value for the ecosystem as a *whole*, of which the company is a part. As an example, look to the U.S. healthcare industry, where the costs associated with overwrought administrative complexity are estimated at $265 billion—nearly five times the amount associated with fraud.[114] One study found that investment in creating industry data interoperability could result in administrative cost savings of $30 billion.[115] Another study found that the adoption of blockchain, and the subsequent data exchanges, fraud protection, and ecosystems it would generate, could save the industry between $100–150 billion.[116] But the nature of these solutions is that they must be built by ecosystems and consortiums of collaborators—not independently. This is where enterprises are being pushed out of their comfort zone.

Over the next three years companies will face sudden shifts from evolving customer desires, geo-political forces, and more. No one company will be able to manage this level of change alone, and a trusted foundation for partnership will be critical to survival. But savvy organizations will look beyond mere survival and spot the opportunity to emerge as established leaders. When you're better able to transact, share data, and shift between partners seamlessly and securely, you have an advantage in driving not just business, but industry-level change. Build these advantages on technology and sustain them by committing to a new approach to partnerships, where success for the enterprise is inextricably tied to the success of the ecosystem.
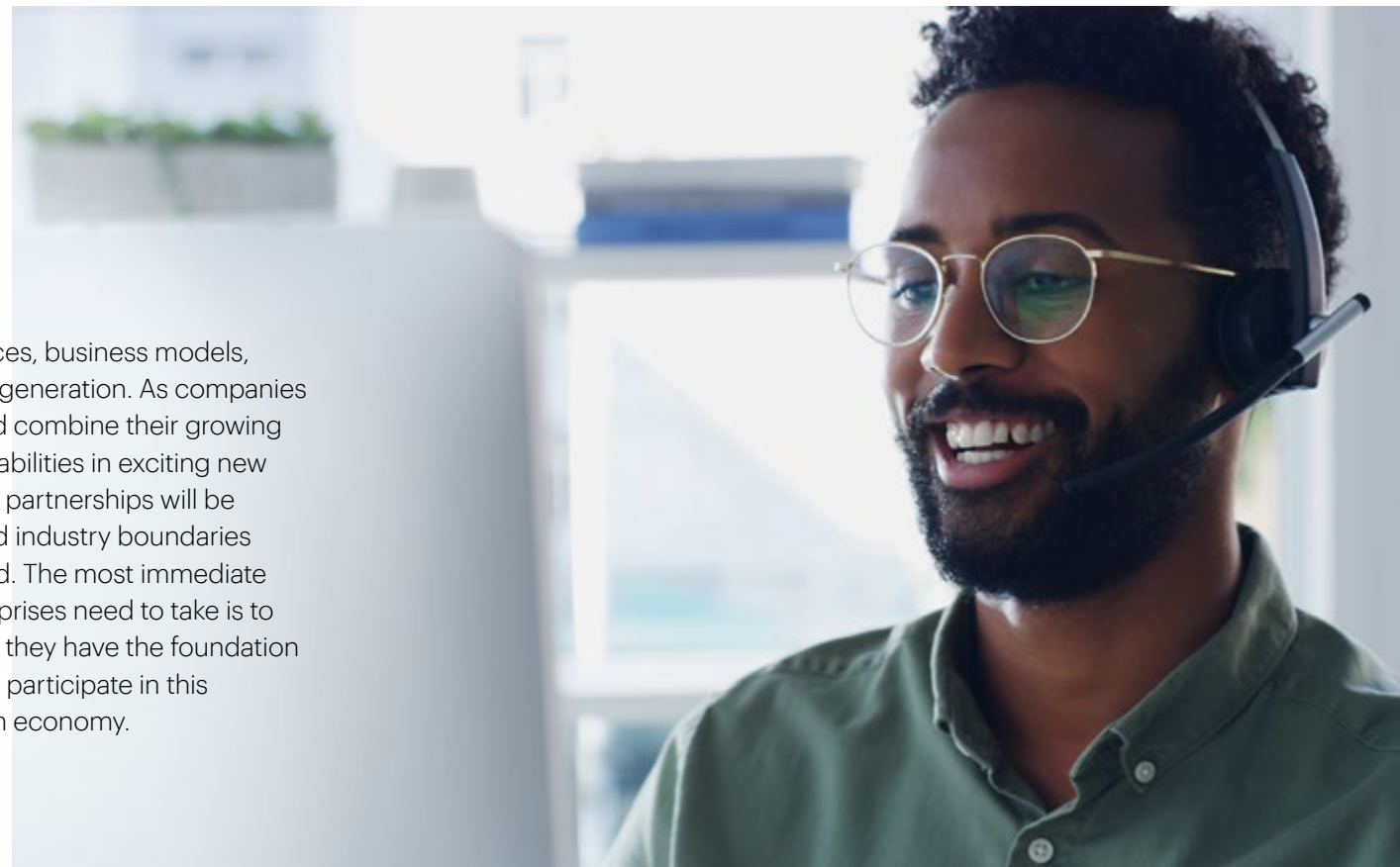
Fortify:

When Clouds Collide

Rapid digitization during the pandemic has paved the way for enterprises to rethink partnerships. Cloud rotations have always been gateways to deep collaboration, and now that every company has accelerated their cloud transformation at once, there is an abundance of potential partners. Simultaneous and accelerated change is creating a network effect that will lead to new services, business models, and value generation. As companies merge and combine their growing cloud capabilities in exciting new ways, new partnerships will be forged and industry boundaries challenged. The most immediate step enterprises need to take is to make sure they have the foundation needed to participate in this ecosystem economy.

Take international bank BBVA, which has long predicted that shopping habits and financial markets were changing forever—and saw that transformation kicked into overdrive by the pandemic. The bank had already developed a leading digital banking platform but wanted to reach new customers in their time of crisis. The bank partnered with Google to develop a new banking product that would be integrated with Google Pay.[117] Similarly, when Goldman Sachs was looking to develop a new consumer-facing product they found a natural partner in Apple.

These collaborations gave tech companies the backing of a financial institution that would help customers grow their purchasing power, while providing the banks with a clear avenue to customers and access to technology expertise for developing cutting-edge front-end applications. Most importantly, co-innovation led to a more successful service and seamless customer experience.

As partners combine their digital efforts, the resulting ecosystems are generating novel solutions—and new expectations for whole industries. Industry-focused clouds, for example, are creating a customized environment for industries with specific requirements and challenges, like regulatory controls, inconsistent network access, data governance needs, and more. But more than just creating an industry standard, this common ground provides a new way for ecosystems to innovate and flourish.

90%

of executives agree that to be **agile and resilient**, their organizations need to fast forward their **digital transformation with cloud at its core.**
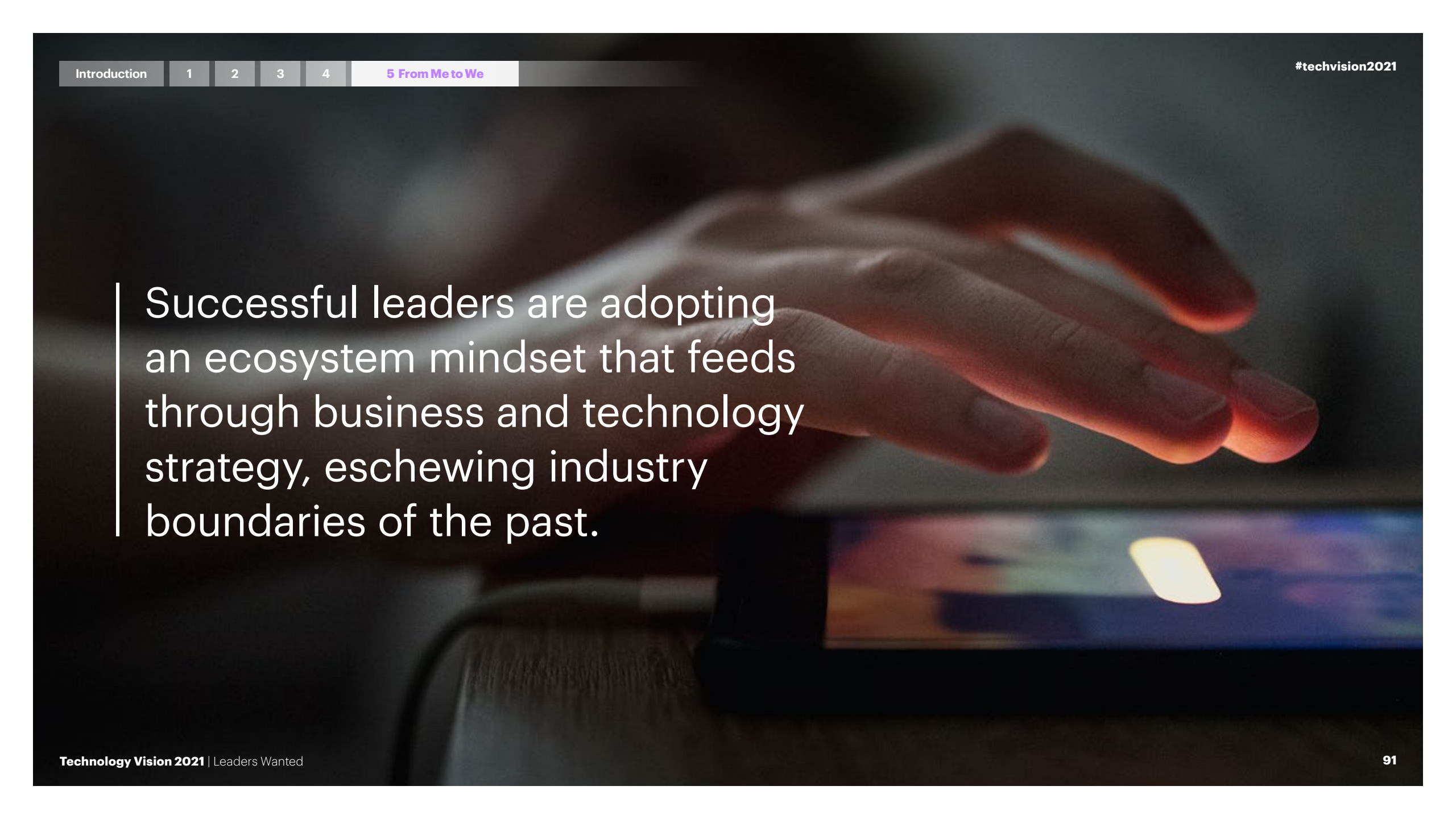
The industry cloud approach delivers exciting ways to create new products—for *shared* customers. For instance, Honeywell partnered with SAP to create a comprehensive building management platform.[118] The effort integrated Honeywell Forge, a platform that leverages OT and industrial IoT data for operational visibility, with SAP Cloud for Real Estate. With this new harmonized data structure, building owners were able to view all operational and business insights through a single dashboard, creating easier pathways toward important goals like reducing carbon footprints, improving tenant experiences, and efficiently managing maintenance requests and leases.

Successful leaders are adopting an ecosystem mindset that feeds through business and technology strategy, eschewing industry boundaries of the past. Ping An, one of the largest insurers in the world, demonstrates how powerful an ecosystem-first approach can be.

The company aggressively pursued digital transformation, and in the process, built five groups of cloud platforms for automotive, personal finance, health, property, and smart cities.[119] Each platform is used to incubate innovative apps or services for customers, and act as a funnel into the broader Ping An business. The ecosystem model allows the company to cross-sell and integrate services between the five areas.[120] Today they have more than 500 million people using their digital products, with a third of their new customers coming from ecosystem engagements.[121] But more importantly, the technology has extended the company's ecosystem to include 618 banks, 84 insurance companies, and 3,000 other financial institutions, driving more than $5 billion in revenue in the first half of 2019 alone. And things didn't slow down in 2020: The COVID-19 pandemic saw 30 new banks seek out partnerships with Ping An in an effort to secure the technology they needed to pivot through the pandemic.[122]

Companies with robust digital presences were able to make the quick moves needed in a time of crisis. The lesson learned for every business leader is that technology-based ecosystems are the foundation for future growth and leadership, and you can't play the game if you don't have the right equipment. Investing in the platforms that will create a launchpad for new partnerships is the most immediate action for enterprises to take—but it's just the first step.

Successful leaders are adopting an ecosystem mindset that feeds through business and technology strategy, eschewing industry boundaries of the past.

Extend:

Transform Partnerships with Multiparty Systems

Cloud is the cost of admission to digital ecosystems, but multiparty systems (MPS) are effecting deeply rooted transformation in the way businesses partner and how industries operate.

It's more than a technology solution. Multiparty systems rebalance cooperation and benefits among participants, forge lines of transparency, and establish trust in ways that other systems are incapable of. As such, building an MPS relies on more than just investing in technology, but supporting the process of establishing a consortium, governing the networks that are built, and more. The power of MPS to transform partnerships is immense, but leaders should focus on this as a business-case and value-driven change—not just a technology-driven one.

For instance, the speed of business is dramatically impaired by the slow pace of transactions, especially when it comes to trade for globe-spanning enterprises. Companies need to share non-uniform data, repeatedly reconcile accounts, and even transpose paper documentation. Multiparty systems offer solutions to these persistent problems. TradeIX's Marco Polo is a platform for payables financing, receivables discounting, and payment commitment, built on R3 Corda distributed ledger technology.[123] Partners install and integrate the network into ERP systems and gain access to an interoperable and collaborative environment where they can move capital and conduct business operations seamlessly with partners across the network. The ecosystem already hosts 30 banks, lenders, and technology providers, and can help improve trade processing speeds by three to four times, increase working capital and liquidity by 20 percent, and decrease data entry and reconciliation by 80 percent.[124]

In this particular case, efficiency stands out as a key benefit—and a valuable one. But these systems can be pushed even further. By guaranteeing a trusted and secure common environment, they generate equitable relationships amongst partners and lines of sight into previously masked areas of the value chain. This trust can immensely improve customer confidence (a pressing need in light of the anxieties created by the pandemic)—and create an environment that catalyzes innovation for all participants.

90%

of executives state that multiparty systems will enable their **ecosystems to forge a more resilient and adaptable foundation** to create new value with their organization's partners.

Look at retail, where the intangible costs of a product are masked from the consumer by the intricacies of the supply chain. This could include the environmental impact of the coffee they buy; child labor being used in the production of textiles; or intermediaries who capture an excess amount at the expense of farmers or workers producing original material. But now consumers are becoming more aware of the interactions throughout the ecosystem and are demanding accountability. Multiparty systems are making this possible.

Mastercard, Amazon Web Services, Everledger, Mercy Corps, and Accenture introduced a circular supply chain capability as a multiparty solution that combines identity verification, payment capabilities, resource planning, and secure data sharing to provide benefits to everyone in the ecosystem.[125] Within the system, data is securely recorded providing provenance and transaction history for the flow of goods. Customers are able to seamlessly

send gratuities directly to product producers, and biometric capabilities help certify identities and ensure payments reach the right individuals. Manufacturers and distributors that sit in the center of the supply chain are able to watch the flow of goods and better optimize, price, and prepare for unexpected upstream and downstream shifts.

Of course, these systems are not being built in a vacuum. Success will still be tied to how well enterprises integrate and govern them alongside the rest of the business. Solutions to this challenge are already emerging. Many distributed ledger platforms share language runtimes such as Ethereum's Virtual Machine (EVM) or Digital Asset's Modeling Language (DAML), enabling the portability of shared business logic across ecosystems. And this portability has been extending into full transaction interoperability across ecosystems through emerging projects such as Hyperledger Cactus and Digital Asset Canton frameworks.

The seamless transfer of data between the business and ecosystems it participates in is key to driving the most value out of partnerships, and how well those systems are architected will determine if the ecosystem reaches its full potential. Even the most advanced multiparty systems can be rendered ancillary by rigid architectures that keep data self-contained. Even worse, with bad data, it's stretching the old axiom of "garbage in, garbage out" to "garbage in, garbage forever."

The seamless transfer of data
between the business and
ecosystems it participates
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value out of partnership.

Reinvent:

A New Perspective on Value

As enterprises begin to set ground rules for the post-pandemic world, partnerships are taking center stage. Businesses are finding immense financial opportunity in constructing new ecosystem-based business models, but in the process their efforts are also driving a reinvention of basic components of society's fabric. Just as multiparty systems drive benefit for everyone in the ecosystem, it's important that enterprises embarking on these undertakings do it with a wider perspective of what value means.

To see how partnerships are shaping the world, look at one area where MPS is having extraordinary impact: money. The earliest public application of blockchain technology, Bitcoin, had proponents heralding the end of fiat currency as we know it. Intrinsic shortcomings, like lengthy wait times for transaction confirmations and the inability to take action when something went wrong, indicated Bitcoin was never going to fully meet that expectation. But as the excitement (and in some cases fear) over Bitcoin settled down, governments and banks all over the world began to realize that money was in need of a digital overhaul.

The world relies on central banks for monetary policy and influencing the supply of money. This was traditionally done through interest rates and minting, but now central banks are looking to establish "Central Bank Digital Currencies" (CBDCs) that are better equipped for the modern era. In October 2020 it was announced that the International Monetary Fund (IMF) was working with members from each nation in the Group of 20 to establish a set of standards for CBDCs.[126] While there is no single solution yet, early efforts are already underway. Accenture has been working with central banks across the globe as they explore their digital programs and it is likely we will see the first CBDCs come to fruition in the next 12–24 months.[127] The Bank of International Settlements (BIS) reported that 80 percent of central banks are engaged in investigating CBDCs. For instance, The Digital Dollar Project is advancing a collaborative framework for developing a CBDC in the United States, and the central bank in Sweden, the Riksbank, is piloting the e-krona to test its viability.[128, 129]

CBDC efforts worldwide demonstrate why businesses need to have multiparty systems at the forefront of their innovation agenda—and also why leaders need to take a considered approach with their efforts. These technologies are poised to become the center of commerce, supply chains, and all other transactions between partners and customers, driving powerful new ecosystems that span every geography and industry. People are at the center of all of these ecosystems, and the technology needs to support their ambitions—not overshadow them.

The World Economic Forum recognized the transformative capabilities of MPS and, along with Accenture, established a set of guidelines called the Presidio Principles to help guide experimentation with this powerful technology.[130] The guidelines span four categories and include the principles that every participant should have rights to information about the system; that individuals should be able to own and manage their data, and have their data protected in accordance with recognized technical security standards; and that participants should have the information they need in order to pursue effective recourse. The goal of these principles is to ensure that multiparty systems are providing for a more equitable and inclusive future. But enterprises can also use these rights to identify areas ripe for development and where MPS efforts could have the biggest impact.

There are ambitious ecosystem efforts underway right now, many spawned by the challenges of COVID-19 but designed to far outlast its impacts. At their zenith they will transform the world. If you've hesitated to explore a full ecosystem approach, now is the time to recognize the opportunity; if you've already been exploring, it's time to move beyond small-scale implementation and become a leading partner in shaping tomorrow's industries.

Decision Points

How are digitally led partnerships driving value for your enterprise?

- 2020 saw a surge of companies moving to digital platforms for shopping, work, and more. Review what platforms your business—or customers—leaned on most in the last year.

- Take advantage of industry-focused cloud solutions and have a strategy for using these solutions to enhance ecosystem collaboration. Find partners with a shared set of customers and explore collaborating to build unique digital products.

Is your business ready to participate in multiparty systems?

- Multiparty systems are steadily growing in adoption. Designate a team to scan prominent MPS emerging in your industry, their current and long-term impacts, and the enterprise's relative preparedness to engage them. Make understanding the technology, identifying technical partners and providers, and addressing skills gaps a priority.

- MPS is more than technology—it reshapes business practices and models. Determine if MPS is the right solution by evaluating the business case that will drive your participation. This could include areas where transactional data has yet to be digitized or complex networks that would benefit from a common and trusted platform.

Which business relationships will be transformed by the growth of multiparty systems?

- Think beyond the walls of the enterprise. Interview strategic partners to understand their exposure to multiparty systems. Consider running strategic foresight exercises with these partners to evaluate the need and impact of a multiparty system.

- Consider joining industry consortiums or establishing a working group of inter-enterprise partners. Create the process for assessing the value of any MPS strategy against the benefit to all participants, not just the enterprise in isolation.

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. These trends have significant impact across industries and are actionable for businesses today.

Accenture Labs and Accenture Research collaborate on the annual research process, which includes:

- 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 nearly 100 Accenture business leaders from across the organization.

- A global survey of business and IT executives to understand their perspectives on the adoption and impact of technologies in their organizations. Survey responses help to identify the technology strategies and priority investments of companies from across industries and geographies.

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.
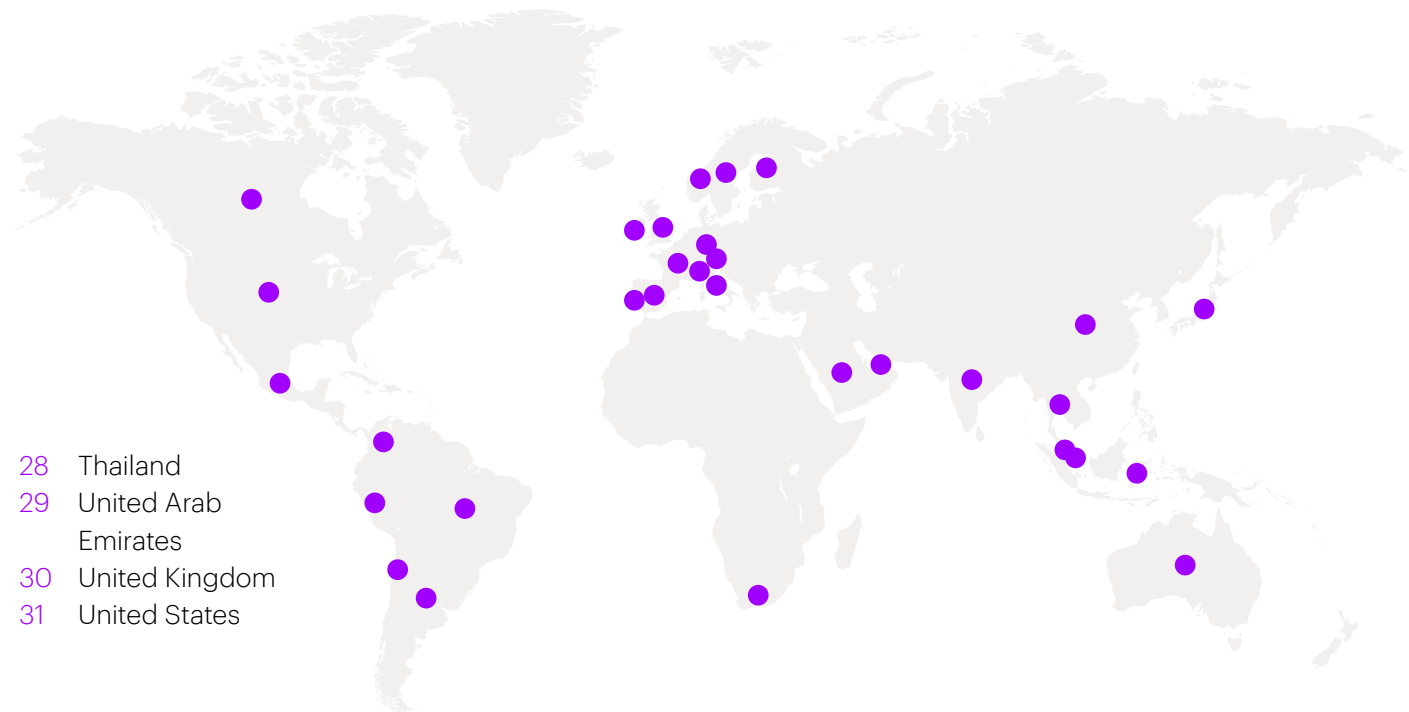
Survey demographics

Business survey

Accenture Research conducted a global survey of 6,241 business and IT executives to capture insights into the adoption and use of emerging technologies. The survey, fielded from December 2020 through January 2021, helped identify the key issues and priorities for technology adoption and investment. Respondents were C-level executives and directors at companies across 31 countries and 14 industries.

31 Countries

1	Argentina	10	France	19	Norway	28	Thailand
2	Australia	11	Germany	20	Peru	29	United Arab Emirates
3	Austria	12	India	21	Portugal		
4	Brazil	13	Indonesia	22	Saudi Arabia	30	United Kingdom
5	Canada	14	Ireland	23	Singapore	31	United States
6	Chile	15	Italy	24	South Africa		
7	China	16	Japan	25	Spain		
8	Colombia	17	Malaysia	26	Sweden		
9	Finland	18	Mexico	27	Switzerland		

14 Industries

2%
Aerospace and Defense

2%
Automotive

11%
Banking

9%
Communications

10%
Consumer Goods and Services

6%
Health

9%
Industrial Equipment

9%
Insurance

20%
Public Service

10%
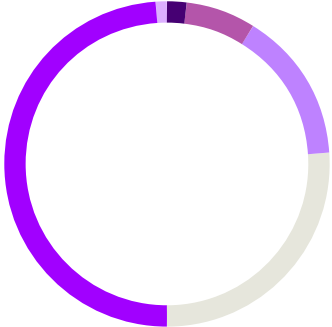Retail

1%
Semiconductors

3%
Software and Platforms

7%
Utilities

1%
Other

Revenues

- 2% $50 billion or more
- 7% $20–$49.9 billion
- 15% $10–$19.9 billion
- 26% $5–$9.9 billion
- 49% $1–$4.9 billion
- 1% Less than $1 billion

Roles

52%
Business Executives

48%
IT Executives

Business Executives		IT Executives	
7%	Chief Executive Officer	3%	Chief Security Officer
5%	Chief Digital Officer	5%	Chief Strategy Officer
9%	Chief Finance Officer	2%	Chief Supply Chain Officer
4%	Chief Human Resources Officer	13%	Chief Technology Officer
10%	Chief Information Officer	10%	Director, IT
2%	Chief Information Security Officer	1%	Director, Line of Business (Non IT-related)
5%	Chief Innovation Officer	3%	Director of Business Function (Non IT-related)
7%	Chief Marketing Officer	6%	Director of Technology
8%	Chief Operating Officer		
1%	Chief Purchasing Officer		

References

Introduction

1 Wilson, H. J. (2019, October 25). Why You Should Mind the Innovation Achievement Gap. Accenture: https://www.accenture.com/us-en/blogs/accenture-research/innovation-achievement-gap

2 Valinsky, J. (2020, December 13). The 30 Retailers and Restaurant Chains That Filed For Bankruptcy in 2020. CNN Business: https://www.cnn.com/2020/12/12/business/retailers-restaurants-bankrupt-2020/index.html

3 Increased Consumer Interest in May Correlates with COVID-19 Hot Spots in June, According to the Yelp Economic Average. (2020). Yelp: https://www.yelpeconomicaverage.com/yea-q2-2020.html

4 Sietsema, T. (2020, October 6). 'The Goal is to Make It Through This'. The Washington Post: https://www.washingtonpost.com/magazine/2020/10/06/weather-pandemic-restaurants-reinvent-themselves-again-again/

5 Lauchlan, S. (2020, July 29). Brewing Resilience—How Early Digital Vision is Paying Off For Starbucks. Diginomica: https://diginomica.com/brewing-resilience-how-early-digital-vision-paying-starbucks

6 Wilson, M. (2020, June 6). Starbucks Is About To Look A Lot Different—And COVID-19 Is Only Part Of The Reason Why. Fast Company: https://www.fastcompany.com/90514230/starbucks-is-about-to-look-a-lot-different-and-covid-19-is-only-part-of-the-reason-why

7 Franzosa, R. (2020, August 24). Manufacturing Operations Finally Turns To The Cloud. Gartner: https://www.scmworld.com/manufacturing-operations-finally-turns-cloud/

8 Donnelly, C. (2020, June 18). Coronavirus: Enterprise Cloud Adoption Accelerates In Face of Covid-19, Says Research. Computer Weekly: https://www.computerweekly.com/news/252484865/Coronavirus-Enterprise-cloud-adoption-accelerates-in-face-of-Covid-19-says-research

9 COVID-19 Digital Engagement Report. (2020). Twilio: https://www.twilio.com/covid-19-digital-engagement-report

10 Accenture Cloud First Launches With $3 Billion Investment To Accelerate Clients' Move to Cloud and Digital Transformation. (2020, September 17). Accenture: https://newsroom.accenture.com/news/accenture-cloud-first-launches-with-3-billion-investment-to-accelerate-clients-move-to-cloud-and-digital-transformation.htm

11 Cole, C. (2020, September 29). Ford Is Using Augmented Reality To Help Sell Its New Mach-E Electric SUV. CNET: https://www.cnet.com/roadshow/news/ford-mustang-mach-e-augmented-reality/

12 D-Wave Provides Free Quantum Cloud Access For Global Response To COVID-19. (2020, March 31). D-Wave: https://www.dwavesys.com/press-releases/d-wave-provides-free-quantum-cloud-access-global-response-covid-19

13 Ross, P. (2020, March 17). Is Coronavirus Speeding the Adoption of Driverless Technology? Institute of Electrical and Electronics Engineers: https://spectrum.ieee.org/cars-that-think/transportation/self-driving/will-coronavirus-speed-adoption-of-driverless-technology

14 Anas, B. (2020, March 31). The Clever Way This Hotel Chain Plans To Stay Open During The Coronavirus Closures. Forbes: https://www.forbes.com/sites/brittanyanas/2020/03/31/the-clever-way-this-hotel-chain-plans-to-stay-open-during-the-coronavirus-closures/amp/

15 Guillén, M. (2020, July 7). How Businesses Have Successfully Pivoted During The Pandemic. Harvard Business Review: https://hbr.org/2020/07/how-businesses-have-successfully-pivoted-during-the-pandemic

16 Hughes, O. (2020, April 7). Microsoft And NHS Digital To Provide New Clinical Capabilities Through Teams. Digital Health: https://www.digitalhealth.net/2020/04/microsoft-and-nhs-digital-to-provide-new-clinical-capabilities-through-teams/

17 Designed, Supplied, Delivered: Coordinating Production of Medical Ventilators for the UK. (2020). Accenture: https://www.accenture.com/_acnmedia/PDF-126/Accenture-RollsRoyce-ACN-Ventilator-ChallengeUK-CaseStudy.pdf

18 Geisinger's Digital Strategy to Combat COVID-19 and Accelerate Enterprise Transformation. (2020, July 14). Healthcare IT News: https://www.healthcareitnews.com/blog/leveraging-digital-strategy-combat-covid-19-and-accelerate-enterprise-transformation

19 Peart, N. (2020, December 9). Four HR Officers Create A Solution To Connect People To Work. Forbes: https://www.forbes.com/sites/nataliapeart/2020/12/09/four-hr-officers-create-a-solution-to-connect-people-to-work/?sh=514492096278

20 Danone Full Year Results 2019. (2020). Danone: https://www.danone.com/content/dam/danone-corp/danone-com/medias/medias-en/2020/corporatepressreleases/danone_full_year_2019_results.pdf

21 McMillon, D. (2020, June 12). Advancing Our Work on Racial Equity. Walmart: https://corporate.walmart.com/newsroom/2020/06/12/advancing-our-work-on-racial-equity

22 Accenture Circular Supply Chain. (2019). Accenture: https://www.accenture.com/_acnmedia/PDF-95/Accenture-Circular-Supply-Chain.pdf#zoom=50

Trend 1: Stack Strategically

23 Our Climate Ambition (n.d.). Shell: https://www.shell.com/energy-and-innovation/the-energy-future/shells-ambition-to-be-a-net-zero-emissions-energy-business.html

24 Sebregts, Y. (2020, September 2). Three Ways to Thrive Through the Digital and Energy Transitions. Shell: https://www.shell.com/energy-and-innovation/digitalisation/news-room/three-ways-to-thrive-through-the-digital-and-energy-transitions.html

25 Tough, J. (2020, October 7). Microsoft: The Surprise Energy Wildcatter. Forbes: https://www.forbes.com/sites/johntough/2020/10/07/microsoft-the-surprise-energy-wildcatter/

26 Shell Works with Leiden and VU Researchers on Quantum Computer Algorithms for Chemistry. (2020, May 26). Universiteit Leiden: https://www.universiteitleiden.nl/en/news/2020/05/shell-works-with-leiden-physicists-on-quantum-computer-algorithms-for-chemistry

27 The Cloud Imperative for the Software and Platforms Industry. (2020). Accenture: https://www.accenture.com/_acnmedia/PDF-139/Accenture-The-Cloud-Imperative-Software-Platforms-Industry.pdf

28 Ramel, D. (2020, November 17). COVID-19 Fuels Cloud Spending Boom. Virtualization & Cloud Review: https://virtualizationreview.com/articles/2020/11/17/cloud-spending.aspx

29 24 Industries & Technologies That Will Shape The Post-Virus World. (n.d.). CB Insights: https://www.cbinsights.com/research/report/industries-tech-shaping-world-post-covid/#industrial

30 Augmented Reality and Virtual Reality Market with COVID-19 Impact Analysis by Offering, Device Type, Application, and Geography – Global Forecast to 2025. (n.d.). Markets and Markets: https://www.marketsandmarkets.com/Market-Reports/augmented-reality-virtual-reality-market-1185.html

31 Spiegel, R. (2020, August 6). Additive Manufacturing Growth and the Impact of COVID. Design News: https://www.designnews.com/3dp/additive-manufacturing-growth-and-impact-covid

32 Strategy Analytics: Sony and Xbox Games Strategies Diverge As Cloud Streaming Shapes Future Platforms. (2020, October 5). Business Wire: https://www.businesswire.com/news/home/20201005005824/en/Strategy-Analytics-Sony-and-Xbox-Games-Strategies-Diverge-As-Cloud-Streaming-Shapes-Future-Platforms

33 Venkatesh, A. (2020, August 17). Microsoft to Reportedly Add Multi-device Login Support for Xbox Live. Neowin: https://www.neowin.net/news/microsoft-to-reportedly-add-multi-device-login-support-for-xbox-live/

34 Stein, S. (2020, June 12). Why The PlayStation 5 Hasn't Shown Off VR… Yet. CNET: https://www.cnet.com/news/why-the-playstation-5-hasnt-shown-off-vr-yet/

35 Warren, T. (2020, November 3). The PS5's New Controller is Amazing – Here's How it Works. The Verge: https://www.theverge.com/2020/11/3/21547303/sony-ps5-dualsense-adaptive-triggers-haptics-teardown-features

36 Shein, E. (2020, April 10). COBOL Programmers Are In Demand To Fight The Coronavirus Pandemic. Tech Republic: https://www.techrepublic.com/article/cobol-programmers-are-in-demand-to-fight-the-coronavirus-pandemic/

37 Trendall, S. (2020, July 28). Inside DWP's Digital Coronavirus Response – APIs, Reuse and Micro-services. PublicTechnology.net: https://publictechnology.net/articles/features/inside-dwp%E2%80%99s-digital-coronavirus-response-%E2%80%93-apis-reuse-and-micro-services

38 Harrison-Adcock, K. (2020, August 4). How Microservices Empowered the UK's DWP to Pivot During COVID-19. Programmable Web: https://www.programmableweb.com/news/how-microservices-empowered-uks-dwp-to-pivot-during-covid-19/elsewhere-web/2020/08/04

39 Tucker, M. (2020, June 17). How We Built BritBox in 9 Months. Medium: https://medium.com/itv-technology/how-we-built-britbox-in-9-months-3c7e4966b7d1

40 Currie, A. (2018, April 16). ITV – A Cloud Strategy With 50 Years of Legacy. Container Solutions: https://blog.container-solutions.com/itv-a-cloud-strategy-with-50-years-of-legacy

41 The Green Behind the Cloud. (2020, September 22). Accenture: https://www.accenture.com/us-en/insights/strategy/green-behind-cloud

42 DeAcetis, J. (2020, October 22). Ralph Lauren Introduces the Latest in On Demand Manufacturing: The Custom Packable Jacket. Forbes: https://www.forbes.com/sites/josephdeacetis/2020/10/22/ralph-lauren-introduces-the-latest-in-on-demand-manufacturing-the-custom-packable-jacket/?sh=7f0d606989e2

43 Ralph Lauren Corporation Unveils Digital Product Identities to Tens Of Millions Of Products. (2019, November 1). https://corporate.ralphlauren.com/pr_191101_DigitalProductID.html

44 Edelstein, S. (2020, August 13). First Electric Bentley Due in 2026 Will Say No To Rare-Earth Magnets. Green Car Reports: https://www.greencarreports.com/news/1129225_first-electric-bentley-due-in-2026-will-say-no-to-rare-earth-magnets

45 Johnson, K. (2020, May 14). Nvidia Launches Clara Guardian to Power Smart Hospitals with Surveillance, Sensors, and Edge AI. Venture Beat: https://venturebeat.com/2020/05/14/nvidia-launches-clara-guardian-to-power-smart-hospitals-with-surveillance-sensors-and-edge-ai/

46 Nvidia Clara Guardian. (2021). Nvidia: https://www.nvidia.com/en-us/healthcare/clara-guardian/

47 Goswami, A. (2020, September 17). Ouva's Hospital Intelligence Platform Uses NVIDIA Clara Guardian Framework to Monitor Patients in a Contact Free Environment. MarkTechPost: https://www.marktechpost.com/2020/09/17/ouvas-hospital-intelligence-platform-uses-nvidia-clara-guardian-framework-to-monitor-patients-in-a-contact-free-environment/

48 Diycam Brings AI to the Edge of Healthcare with NVIDIA Clara Guardian. (2020, May 27). Times of India: https://timesofindia.indiatimes.com/business/india-business/diycam-brings-ai-to-the-edge-of-healthcare-with-nvidia-clara-guardian/articleshow/76035783.cms

49 Johnson, K. (2020, May 14). Nvidia Launches Clara Guardian to Power Smart Hospitals with Surveillance, Sensors, and Edge AI. Venture Beat: https://venturebeat.com/2020/05/14/nvidia-launches-clara-guardian-to-power-smart-hospitals-with-surveillance-sensors-and-edge-ai/

50 Fairness You Can Bank On. (n.d.). Accenture: https://www.accenture.com/us-en/case-studies/applied-intelligence/banking-aib?src=SOMS

51 Peters, J. (2020, March 10). Google, Adidas, and EA Team Up on a New Smart Insole That Tracks Soccer Kicks for FIFA Mobile Rewards. The Verge: https://www.theverge.com/2020/3/10/21168731/google-adidas-ea-smart-insole-jacquard-wearable-fifa-mobile-gmr-soccer

52 Google Jacquard. (n.d.). Jacquard: https://atap.google.com/jacquard/

53 Roach, J. (n.d.). Using AI, People Who Are Blind Are Able To Find Familiar Faces In A Room. Microsoft: https://news.microsoft.com/innovation-stories/project-tokyo/

Trend 2: Mirrored World

54 Ferguson, S. (2020, April 14). Apollo 13: The First Digital Twin. Siemens Blog: https://blogs.sw.siemens.com/simcenter/apollo-13-the-first-digital-twin/

55 Sokolowsky, J. (2019, July 15). Now It's Personal: Unilever's Digital Journey Leads to Real Results for Consumers and Employees. Microsoft: https://news.microsoft.com/transform/now-its-personal-unilevers-digital-journey-leads-to-real-results-for-consumers-and-employees/

56 Heaven, W.D. (2020, May 11). Our weird behavior during the pandemic is messing with AI models. MIT Technology Review: https://www.technologyreview.com/2020/05/11/1001563/covid-pandemic-broken-ai-machine-learning-amazon-retail-fraud-humans-in-the-loop/

57 Snowflake The Data Cloud. (2020). Snowflake: https://www.snowflake.com/

58 Rose, D. (2019, June 26). Factory of the future shows mobile model for small manufacturers. Vodafone.com: https://www.vodafone.com/perspectives/blog/factory-of-the-future

59 Patel, S. (2020, May 14). Advanced Nuclear Reactor Designs to Get Digital Twins. Power Magazine: https://www.powermag.com/advanced-nuclear-reactor-designs-to-get-digital-twins/

60 Joint research project KI Absicherung. (2020, July 13). Mackevision.com: https://www.mackevision.com/ki_absicherung/

61 Victory Fueled by Data. (n.d.). Tibco: https://www.tibco.com/formula-one-competitive-advantage

62 Feng, Y. (n.d.). Targeting a Tumor. Ansys: https://www.ansys.com/about-ansys/advantage-magazine/volume-xii-issue-2-2018/targeting-a-tumor

63 Ahlgren, J., Berezin, M., et al. (2020, April 29). WES: Agent-based User Interaction Simulation on Real Infrastructure. Facebook: https://research.fb.com/wp-content/uploads/2020/04/WES-Agent-based-User-Interaction-Simulation-on-Real-Infrastructure.pdf

64 Eide, N. (2019, December 6). NFL, AWS to use player digital twins to model scenarios and combat injury. CIO Dive: https://www.ciodive.com/news/NFL-AWS-AI-ML-safety/568619/

65 Moore, S. (2020, November 10). Porsche in Joint Effort for Plastics Traceability. Plastics Today: https://www.plasticstoday.com/sustainability/porsche-joint-effort-plastics-traceability

66 Liceras, P. (2019, May 20). Singapore experiments with its digital twin to improve city life. Tomorrow.Mag: https://www.smartcitylab.com/blog/digital-transformation/singapore-experiments-with-its-digital-twin-to-improve-city-life/

67 Boyles, R. (2019, August 29). How the Port of Rotterdam is using IBM digital twin technology to transform itself from the biggest to the smartest. IBM: https://www.ibm.com/blogs/internet-of-things/iot-digital-twin-rotterdam/

68 Port Technology International Team. (2020, July 23). Port of Rotterdam and DSME to develop interface between smart ships and ports. Port Technology: https://www.porttechnology.org/news/port-of-rotterdam-and-dsme-to-develop-interface-between-smart-ships-and-ports/

Trend 3: I, Technologist

69 Heaven, W.D. (2020, July 20). OpenAI's new language generator GPT-3 is shockingly good—and completely mindless. MIT Technology Review: https://www.technologyreview.com/2020/07/20/1005454/openai-machine-learning-language-generator-gpt-3-nlp/

70 Chan, R. (2020, September 7). A developer used a tool from the AI company Elon Musk cofounded to create an app that lets you build websites simply by describing how they work. Business Insider: https://www.businessinsider.com/developer-sharif-shameem-openai-gpt-3-debuild-2020-9

71 Build the right app for the job. (2020). Microsoft Power Apps: https://powerapps.microsoft.com/en-us/build-powerapps/

72 Take care of what's important. Automate the rest. (2020). Microsoft Power Automate: https://flow.microsoft.com/en-us/

73 Hachman, M. (2019, June 10). Microsoft adds AI capabilities to PowerApps and Flow to automate business tasks. PCWorld: https://www.pcworld.com/article/3401459/microsoft-adds-ai-capabilities-to-powerapps-and-flow-to-automate-business-tasks.html

74 Demo: Empowering citizen developers with AI Builder at Microsoft Inspire 2019. (2019, July 17). YouTube: https://www.youtube.com/watch?v=IA8aRy_WM4s

75 Transforming in-store merchandizing and auditing to achieve targeted business goals. (2018, June 22). Microsoft Customer Stories: https://customers.microsoft.com/en-us/story/gj-pepsi-consumer-goods-powerapps

76 Ellis, A., and Bates, S. (2019). A Changing Perspective. Harvey Nash/KPMG: https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/07/harvey-nash-kpmg-cio-survey-2019.PDF

77 Takeda (2021)

78 Why LexisNexis is "In Awe" of Automation Hub and Task Capture. (2020). UiPath: https://www.uipath.com/resources/customer-success-stories/lexisnexis-risk-solutions-rpa?utm_source=GoogleSearch&utm_medium=cpc&utm_term=uipathe&utm_content=449355758531&utm_campaign=AR20GMQ

79 Torres, R. (2020, June 18). Low code helped put out COVID-19 fires. How can leaders sustain momentum? CIO Dive: https://www.ciodive.com/news/low-code-implementation-coronavirus-2020/580024/

80 Barr, J. (2020, June 24). Introducing Amazon Honeycode – Build Web & Mobile Apps Without Writing Code. AWS: https://aws.amazon.com/blogs/aws/introducing-amazon-honeycode-build-web-mobile-apps-without-writing-code/

81 Condon, S. (2020, May 7). Salesforce rolls out new low-code features for Lightning App Builder. ZDNet: https://www.zdnet.com/article/salesforce-rolls-out-new-low-code-features-for-lightning-app-builder/

82 Add an app to Microsoft Teams. (2020, September 15). Microsoft Power Apps: https://docs.microsoft.com/en-us/powerapps/user/open-app-embedded-in-teams

83 IOOF Gives Developers a New Lease on Life With OutSystems. (n.d.). OutSystems: https://www.outsystems.com/case-studies/it-modernization-wealth-management/

84 Renner, K. (2020, September 1). How to build a citizen developer program. CIO Dive: https://www.ciodive.com/news/citizen-developer-low-no-code-CIO/584290/

85 Bridgwater, A. (2019, December 3). Appian 'Smartens' Up The Low-Code AI-Factor. Forbes: https://www.forbes.com/sites/adrianbridgwater/2019/12/03/appian-smartens-up-the-low-code-ai-factor/#56d8b21b3ce1

86 Golden, R. (2020, January 21). Nationwide announces $160M employee digital literacy training. HR Dive: https://www.hrdive.com/news/nationwide-announces-160m-employee-digital-literacy-training/570786/

87 Transform your workforce with the most advanced reskilling technology. (2020). SkyHive: https://www.skyhive.io/en-ca/enterprise

88 Moore, J. (2019, August 19). RPA journey: Schneider Electric's global plan taps Blue Prism, UiPath. TechTarget: https://searchcio.techtarget.com/feature/RPA-journey-Schneider-Electrics-global-plan-taps-Blue-Prism-UiPath

89 DevOps tech: Empowering teams to choose tools. (2020, November 16). Google Cloud: https://cloud.google.com/solutions/devops/devops-tech-teams-empowered-to-choose-tools

90 Bloomberg, J. (2019, November 15). Has low-code programming arrived? These five companies think so. SiliconANGLE: https://siliconangle.com/2019/11/15/low-code-programming-arrived-five-companies-think/

Trend 4: Anywhere, Everywhere

91 Bloom, N. (2020, June). How working from home works out. Stanford: Institute for Economic Policy Research: https://siepr.stanford.edu/research/publications/how-working-home-works-out

92 Bullock, L. (2019, January 21). The Future of BYOD: Statistics, Predictions And Best Practices To Prep For The Future. Forbes: https://www.forbes.com/sites/lilachbullock/2019/01/21/the-future-of-byod-statistics-predictions-and-best-practices-to-prep-for-the-future/

93 Holst, A. (2020, March). Average number of connected devices residents have access to in U.S. households in 2020, by device. Statista: https://www.statista.com/statistics/1107206/average-number-of-connected-devices-us-house/

94 Hughes, O. (2020, April 7). Microsoft and NHS Digital to provide new clinical capabilities through Teams. Digital Health: https://www.digitalhealth.net/2020/04/microsoft-and-nhs-digital-to-provide-new-clinical-capabilities-through-teams/

95 Gill, V. (2020, July 6). Robotic scientists will 'speed up discovery'. BBC News: https://www.bbc.com/news/science-environment-53029854

96 Wells, B. (2020, July 15). As Employees Become More Productive Working From Home, They Are Less Likely To Want To Return To The Physical Workplace After COVID-19. Perceptyx: https://blog.perceptyx.com/employees-become-more-productive-working-from-home

97 Barrett, B. (2020, August 11). How Google Meet Weathered the Work-From-Home Explosion. Wired: https://www.wired.com/story/how-google-meet-weathered-work-from-home-explosion/

98 Singer-Velush, N., Sherman, K., et al. (n.d.). Microsoft analyzed data on its newly remote workforce. Microsoft 365: https://insights.office.com/workplace-analytics/microsoft-analyzed-data-on-its-newly-remote-workforce/

99 Phishing Activity Trends Report, 1st Quarter 2020. (2020). APWG: https://docs.apwg.org/reports/apwg_trends_report_q1_2020.pdf

100 Bunge, J., and Newman, J. (2020, July 9). Tyson Turns to Robot Butchers, Spurred by Coronavirus Outbreaks. The Wall Street Journal: https://www.wsj.com/articles/meatpackers-covid-safety-automation-robots-coronavirus-11594303535

101 Bond, S. (2020, May 21). Facebook Expects Half Its Employees To Work Remotely Permanently. NPR: https://www.npr.org/sections/coronavirus-live-updates/2020/05/21/860382831/facebook-expects-half-its-employees-to-work-remotely-forever

102 Peart, N. (2020, December 9). Four HR Officers Create A Solution To Connect People To Work. Forbes: https://www.forbes.com/sites/nataliapeart/2020/12/09/four-hr-officers-create-a-solution-to-connect-people-to-work/?sh=514492096278

103 Fujitsu Embarks towards 'New Normal', Redefining Working Styles for its Japan Offices. (2020, July 6). Fujitsu Limited: https://www.fujitsu.com/global/about/resources/news/press-releases/2020/0706-01.html

104 Shirley, J. (2020, May 28). Stripe's remote engineering hub, one year in. Stripe Blog: https://stripe.com/blog/remote-hub-one-year

105 Spataro, J. (2020, April 9). Remote work trend report: meetings. Microsoft 365: https://www.microsoft.com/en-us/microsoft-365/blog/2020/04/09/remote-work-trend-report-meetings/

106 Spataro, J. (2020, July 8). The future of work—the good, the challenging & the unknown. Microsoft 365: https://www.microsoft.com/en-us/microsoft-365/blog/2020/07/08/future-work-good-challenging-unknown/

107 D'Angelo, A. (2020, June 25). Remote First at Quora. The Quora Blog: https://www.quora.com/q/quora/Remote-First-at-Quora

108 Robuck, M. (2020, September 4). Verizon takes Covid WFH lessons into next stage of hiring 950 new employees. Fierce Telecom: https://www.fiercetelecom.com/telecom/verizon-takes-covid-wfh-home-lessons-into-next-stage-hiring-950-new-employees

109 Dwoskin, E. (2020, October 1). Americans might never come back to the office, and Twitter is leading the charge. The Washington Post: https://www.washingtonpost.com/technology/2020/10/01/twitter-work-from-home/?arc404=true

Trend 5: From Me to We

110 Yu, E. (2020, September 30). Singapore touts blockchain use in COVID-19 data management. ZDNet: https://www.zdnet.com/article/singapore-touts-blockchain-use-in-covid-19-data-management/

111 Soohoo, S. (2020, April). How Will COVID-19 Impact Industry Technology Spend on Blockchain? IDC: https://www.idc.com/getdoc.jsp?containerId=US46229520

112 Supply chain disruption. (2020). Accenture: https://www.accenture.com/us-en/insights/consulting/coronavirus-supply-chain-disruption

113 Adobe Digital Economy Index. (2020, August). Adobe Analytics: https://www.adobe.com/experience-cloud/digital-insights/digital-economy-index.html

114 Shrank, W.H., Rogstad, T.L., et al. (2019, October 7). Waste in the US Health Care System. JAMA Network: https://jamanetwork.com/journals/jama/article-abstract/2752664

115 Huynh, K., and Dzabic, N. (2020, August 25). Industry Voices—Interoperability can cut health costs by $30B. But this needs to happen first. Fierce Healthcare: https://www.fiercehealthcare.com/tech/industry-voices-interoperability-can-reduce-healthcare-costs-by-30b-here-s-how

116 Carfagno, J. (2019, August 2). Blockchain Can Save Healthcare Industry up to $150 Billion Annually by 2025, Report Says. DocWire News: https://www.docwirenews.com/docwire-pick/blockchain-can-save-healthcare-industry-up-to-150-billion-annually-by-2025-report-says/

117 Groenfeldt, T. (2020, August 14). Google – BBVA Partnership Marks A Tipping Point For Big Tech In Banking. Forbes: https://www.forbes.com/sites/tomgroenfeldt/2020/08/14/google-bbva-partnership-marks-a-tipping-point-for-big-tech-in-banking/#52d5dfa51933

118 Honeywell and SAP Partner to Improve Building Performance with Integrated, Cloud-Based Business and Operational Technology Data. (2020, June 11). SAP News: https://news.sap.com/2020/06/honeywell-and-sap-partner-to-improve-building-performance-with-cloud-based-technology/

119 Bloomberg Markets. (2019, December 2). China's Insurance Giant Is Morphing Into a Tech Company. Bloomberg: https://www.bloomberg.com/news/articles/2019-12-02/ping-an-co-ceos-talk-about-the-chinese-insurer-s-move-into-tech

120 Yiu, E. (2020, February 20). Ping An Insurance eyes more technology investment to spur cross-selling, counter coronavirus impact. South China Morning Post: https://www.scmp.com/business/banking-finance/article/3051638/ping-insurance-eyes-more-technology-investment-spur-cross

121 Bloomberg Markets. (2019, December 2). China's Insurance Giant Is Morphing Into a Tech Company. Bloomberg: https://www.bloomberg.com/news/articles/2019-12-02/ping-an-co-ceos-talk-about-the-chinese-insurer-s-move-into-tech

122 Huang, E. (2020, February 21). Ping An says the coronavirus will impact China's economy but has also been 'helpful' for its business. CNBC: https://www.cnbc.com/2020/02/21/ping-an-on-coronavirus-impact-on-china-economy-and-business.html

123 Cutlan, M., and Sanghvi, P. (2020, June 4). Trading in the new with multiparty systems. Accenture: https://www.accenture.com/us-en/blogs/blockchain-mps/trading-in-the-new-with-multiparty-systems#:~:text=The%20rapid%20innovations%20in%20multiparty,world%20with%20their%20digital%20transformations

124 Accenture TradeIX Alliance. (n.d.). Accenture: https://www.accenture.com/us-en/services/blockchain/marcopolo-alliance

125 Treat, D., and Leong, C. (2019). Imagine…A new generation of fairer trade now. Accenture: https://www.accenture.com/_acnmedia/PDF-95/Accenture-Circular-Supply-Chain.pdf#zoom=50

126 Regulation, Supervision and Oversight of "Global Stablecoin" Arrangements. (2020, October 13). Financial Stability Board: https://www.fsb.org/2020/10/regulation-supervision-and-oversight-of-global-stablecoin-arrangements/

127 Central Bank Digital Currencies: Foundational Principles and Core Features. (October 2020). Bank For International Settlements: https://www.bis.org/publ/othp33.pdf

128 Digital Dollar Project. (2020). The Digital Dollar Project: https://www.digitaldollarproject.org/

129 Orcutt, M. (2020, February 20). Sweden is now testing its digital version of cash, the e-krona. MIT Technology Review: https://www.technologyreview.com/2020/02/20/906146/sweden-riksbank-ekrona-blockchain/

130 Presidio Principles: Foundational Values for a Decentralized Future. (n.d.). World Economic Forum: https://www.weforum.org/communities/presidio-principles

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