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INTO THE NEW

## The Post-Digital Era is Upon Us

# ARE YOU READY FOR WHAT'S NEXT?

Accenture Technology Vision 2019

# FOREWORD

## As every business does indeed become a digital business... what is next?

Persistent change, challenged assumptions, and disruption are now the norm, rather than the exception, in business and society. And these indicators will only accelerate and multiply as we progress into the future. The lightning-speed of change, driven by technology, is taking us from the digital age toward a new reality, one we call the *post-digital* world.

The Accenture Technology Vision 2019 lays out the inarguably bold and complex path that businesses will encounter in the coming years, as digital continues to take hold and the next wave of powerful technologies ushers in a new era.

First let's look at what is happening today to see where we are headed: everything is becoming digital. Organizations are making enormous strides and realizing the benefits of new digital business models and processes. We see examples of this everywhere—in how people shop, work, learn, communicate, decide, respond and even elect leaders.

Now enterprises are at a crucial turning point. Digital is indeed important, but now it is simply the price of admission for doing business, especially as technologies have swiftly evolved people's expectations and behaviors. The next epic disruption is coming, and our Tech Vision provides a glimpse of this future, along with insights on how to steer your organization toward continued success.

Here is the good news: the post-digital era offers tremendous opportunities and value for business if enterprises proceed responsibly and strengthen trust. The power of cloud and artificial intelligence will continue to advance. When combined with technologies such as distributed ledger, extended reality, and quantum computing, they will reshape not only the business sphere, but also the relationships with individuals—customers, employees and ecosystem partners—that are critical to future growth.

As you explore Accenture Technology Vision 2019, think ahead to this new reality with us, and decide how your organization will get ready for what the post-digital world will bring.

Thank you,

**Paul Daugherty,**
Chief Technology &
Innovation Officer

**Marc Carrel-Billiard,**
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# CONTENTS

**Introduction** . . . . . 4

**Trend 1: DARQ Power:**
Understanding the DNA of DARQ . . . . . 16

**Trend 2: Get to Know Me:**
Unlock unique consumers and unique opportunities . . . . . 29

**Trend 3: Human+ Worker:**
Change the workplace or hinder the workforce . . . . . 44

**Trend 4: Secure US to Secure ME:**
Enterprises are not victims, they're vectors . . . . . 59

**Trend 5: MyMarkets:**
Meet consumers' needs at the speed of now . . . . . 73

**Research Methodology** . . . . . 87

**Survey Demographics** . . . . . 88

**References** . . . . . 89

# The Post-Digital Era is Upon Us. ARE YOU READY FOR WHAT'S NEXT?

**Companies are taking their first steps in a new world—one that tailors itself to fit every moment. It's a world where products, services, and even people's surroundings are customized, and where businesses cater to the individual in every aspect of their lives, shaping the very realities they live in.**

Japan's biggest e-commerce company, Zozotown, is delivering "custom fast fashion." Its skintight spandex Zozosuits pair with the company's app to take customers' exact measurements; custom-tailored pieces from Zozotown's in-house clothing line in some cases could arrive in as few as 10 days.[1]

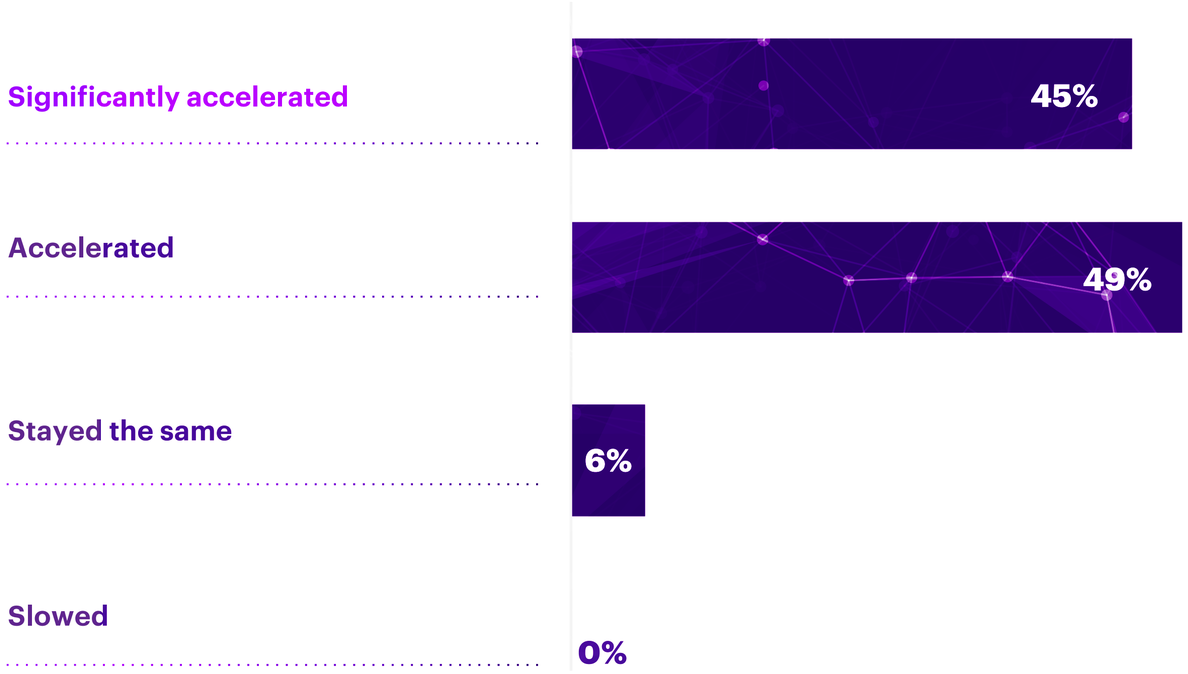
Gillette is catering to individual preferences in health and beauty, partnering with 3D printing startup Formlabs to offer customized razor designs.[2] Consumers create their personalized product through the company's website; the digitally-personalized design is then physically printed and assembled, to be shipped directly to their door.

And customizing for the individual doesn't necessarily require Zozosuits or direct design input. Sam's Club developed an app that uses machine learning and data about customers' past purchases to auto-fill their shopping lists, and plans to add a navigation feature, which will show optimized routes through the store to each item on that list.[3,4] Virgin Hotels greets its guests with a cocktail of their choice and a minibar stocked with their favorites, thanks to a digital platform the company uses in place of a rewards program.[5]

Companies like these are figuring out how they can shape the world around people and pick the right moments to offer their products and services. Looking at these companies individually, there is a story of hyper-personalization and on-demand digital services. But the collective enterprise efforts reveal a fundamental shift in how people will experience the world for generations to come. Soon, each individual will have their own reality, and every moment will represent an opportunity for companies to play a role in shaping it.

What is enabling—and driving—this reality-shaping shift? The emergence of a post-digital world. We as a society are nearing a turning point in digital enterprise, where more businesses will have completed their digital transformations than not. Digital-era technology, which began as a differentiating advantage years ago, is now expected from every business. But its *impact* is still changing

**According to our Technology Vision 2019 survey of 6,672 business and IT executives, 45 percent report the pace of innovation in their organizations has significantly accelerated over the past three years due to emerging technologies.**



the relationship between businesses and society, and the expectations of individual people.

Digital-born companies and those completing their transformations have showered consumers with digital products and services. Facebook, Twitter, Snapchat, and a constant rotation of new social media brands have become go-to destinations for finding and sharing information. Smart home devices enable contextual interactions between the digital and physical world (Hey Google, remind me to talk to the accounting staff when I get to the office), direct requests for physical products and services (Alexa, order more dish soap), and even digitally driven social interactions from wherever people choose (Siri, call Mom with FaceTime).

The digital saturation of reality has granted companies with exceptional capabilities. They can understand their customers with a new depth of granularity. They have more channels than ever to reach those consumers. And with every company finally converging on the same digital footing, there are more digital ecosystems and more potential partners to help companies create holistic experiences.

But as we move collectively into the post-digital era, these capabilities and advantages are now available to *every* organization. Digital itself is no longer differentiating. With every business heavily investing in digital technologies, how will leaders set themselves apart?

As the playing field evens out, companies will need to acknowledge a shift in their reality too—around the level of expectations they face from digitally mature customers, employees, and business partners. Businesses have used technology-driven mass customization to get more granular with consumers through a top-down approach: selling two different options, then 10 different options, then 100 different options. Companies' success with this approach has fostered the illusion that they can meet any need, no matter how personal or custom. Now, to meet expectations in the post-digital world, they need to turn that illusion into reality. That means understanding people at a holistic level and recognizing that their outlooks and needs change at a moment's notice.

In the post-digital world, every moment will represent a potential new market of one. It's where demand is communicated instantly and gratification is expected immediately. What's more, both are constantly changing, creating an infinite and never-ending stream of opportunities to be met through business-to-business (B2B) and business-to-consumer (B2C) engagement, as well as in the public sector. The post-digital world is one where technology is the fabric of reality, and companies can use it to meet people wherever they are, at any moment in time—if they rise to the challenge.

# A PARALLEL TRANSFORMATION

Companies have not been alone on their journey to digital transformation. People have been on a parallel path, incorporating new technologies at an increasingly rapid rate. When mobile phones were first introduced, they took 12 years to reach 50 million users; the internet took just seven to get to the same point.[6] Looking at purely digital technologies, the rates become frantic: Facebook reached 50 million users in four years; WeChat, one year. Pokémon GO, the augmented-reality gaming app from Niantic? Nineteen days.

People are adopting new technology both quickly and completely, and whether they're customers, employees, or even threat actors, they are beginning to outpace enterprises in their digital transformations. They are more knowledgeable about technology itself and how companies use it, and are becoming selective and demanding of what they adopt, challenging companies to work with them or adapt to them in different ways.

**Post-digital consumers** are enjoying the results of technology saturation. In a world of unprecedented technology choice, people have strong sentiments about which technologies they will or won't adopt to get the experiences they want. Companies must pay close attention not only to the choices themselves, but also to the powerful new insights those choices can provide about their customers—and about new market opportunities.

**Post-digital workers** are incorporating technology to complete tasks in new ways, in new types of jobs, but they are still being hired, trained, and managed in pre-digital ways. With the war for talent continuing to rage, companies must adapt their technology strategies to close the divide between themselves and their digitally mature workforce.

**Post-digital threat actors** have nearly unlimited points of entry to enterprise. With a global army of connected devices ready to be pressed into service, and an attack surface that includes not only the target company but every partner and vendor in the company's ecosystem, they have the clear advantage. Businesses must respond to this post-digital threat with a collaborative approach, recognizing that they are not just potential victims, but someone else's vector.

**Post-digital markets** are made up of consumers, business partners, and governments alike enjoying the spoils of the digital revolution. Fully on-demand or fully customized products are now the standard in practically every industry, and sooner than later, customers will expect every organization to achieve both.

This is not to say digital is old or over. Far from it. Companies have used the power of digital transformation to shape themselves, to shape customers and employees, and then to shape people's expectations. What's left is using their ongoing digital efforts to shape the market. Companies face a world of renewed expectations and core digital technologies are more critical than ever. But the time for pilots and experimentation is long past, and leaders must begin to strategize for what's next.

# GETTING TO THE NEW "MOMENT"

Realistically, the world is not yet at the point of everything being instantaneous. But post-digital companies are already playing a different game. Companies still completing their digital transformations are looking for a specific edge, whether it's innovative service, higher efficiency, or more personalization. Post-digital companies are looking for much more. They are out to bypass the competition by changing the way the market itself works. From one market to many custom markets—on-demand, in the moment.

Industry lines are no longer a boundary to growth, and the disruption that came in waves as technology matured in the digital era is now ever-present. Any company can compete with any other or carve out a new market. Take Amazon partnering with Berkshire Hathaway, an insurance and holding company, and JPMorgan Chase, a global financial services firm, to tackle challenges in healthcare spending. The three have pooled their resources in a joint effort that has companies in entirely different industries preparing for foundational disruption.

Look at JD.com, an e-retail platform and one of the fastest-growing companies in China. JD is radically differentiating itself with its "Toplife" platform—a service that helps third parties sell through JD by setting up customized stores for unique shopping experiences.[7] Not only do these third parties benefit from the e-retail personalization, they also have access to JD's supply chain with cutting-edge robotics and drone delivery that can reach rural areas. And through a partnership with Walmart, a physical store in Shenzhen will offer more than 8,000 products available in person or delivered from the store in under 30 minutes.[8] By offering unprecedented customization and speed, JD is enabling other companies to capture moments, and in doing so creating a new market for itself.

It won't be long before the standout examples of today are the norm. Companies are already investigating the next generation of technologies such as artificial intelligence (AI), distributed ledgers like blockchain, extended reality, and quantum computing. The message is clear: "keeping up with the digitals" won't cut it for what's coming next.

Business leaders looking to do more than just complete their transformations must set new goals in their sights, including:

- *Move your focus to the end.* As companies begin to understand instant demand and supply options expand, they will have more opportunities than they can pursue. Success will mean carefully choosing the specific opportunities companies want to target—and just as important, the ones not to target—then working backward to determine how they will get there.

- *Define what it means for your business to be post-digital as the world moves into a new phase of cooperation*. As companies settle on their new goals and the pathways they will take to reach them, they must also determine which ecosystem partners they need and where their own place in the ecosystem should be.

- *Master SMAC as a core competency and a foundation to rotate to what's next*. When it comes to enterprise-level technology strategies, companies can never stop moving. Social, mobile, analytics, and cloud (SMAC) combined to drive the biggest enterprise and market transformations since the dawn of the industrial era. At this point, the failure to complete a mastery of SMAC will leave businesses unable to serve even the most basic demands of a post-digital world. But success will unlock boundless future opportunity. **D**istributed ledger technology, **A**rtificial intelligence, extended **R**eality, and **Q**uantum computing (DARQ) are already having an impact in disparate areas of enterprise. DARQ technologies will drive the post-digital wave, but catching that wave will only be possible with the firm foundation of SMAC. Looking even further down the road? DARQ technologies will enable innovation in such core aspects of the business that *they* will be foundational for whatever comes after that.

As companies move to meet these goals, they must also accept a new level of responsibility. As businesses use technologies to reach further into people's lives, shaping the very fabric of reality, they must address the privacy, safety, ethics, and governance questions that come along with that level of access.

Look at drone usage, which companies are incorporating for everything from agricultural services to public safety, utility monitoring, and product delivery. They're even changing what's possible in healthcare, with Switzerland's postal service provider using drones to move time-sensitive lab samples between hospitals and bypass the delays of ground transport.[9] But this does raise issues of patient safety, privacy, and data protection that the involved organizations must address, as well as navigating potentially restricted airspace. AirMap, which operates an airspace management system for the low altitudes at which drones fly, partnered with Microsoft Azure to create a platform that gives state and local authorities authorization, enforcement, and restriction abilities for drone operation in their areas.[10] The platform also lets companies incorporate security and compliance checkpoints into drone-related workflows.

By positioning themselves as the curators of reality, companies already have a new level of obligation to society. But being able to deliver for specific and constantly changing moments creates challenging additional questions for businesses that are used to one market of many and long-static circumstances. With limitless opportunities, how do you measure the potential impact of products and services on society? How do you avoid crossing ethical boundaries where there are different lines for every reality and moment? And how does a company responsibly pick the opportunities to target in the first place? When you reach the point of being able to deliver nearly anything instantly, it is critical to remember that "can" doesn't always mean "should."

It's every company's responsibility to understand the impact of its moments at scale.

# 2019 TECH TRENDS

**This year's Accenture Technology Vision highlights five emerging trends that will shape businesses over the next three years. In each trend, you will see how digital saturation is raising expectations, abilities, and risk across industries, and how businesses are seeking new ways to differentiate themselves as the world moves into the post-digital era.**

TREND 1

## 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.

TREND 2

## 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.

TREND 3

## 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.

TREND 4

## 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.

TREND 5

## 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.

# THE POST-DIGITAL FUTURE

**Just as people no longer say they live in the "age of electricity," the days of calling something digital to insinuate that it is new and innovative are numbered.**

The word is already passé in the consumer space. Soon, it will be the same for enterprise. There is no need to say you are a "digital business." If you're still in business, investing in digital is understood.

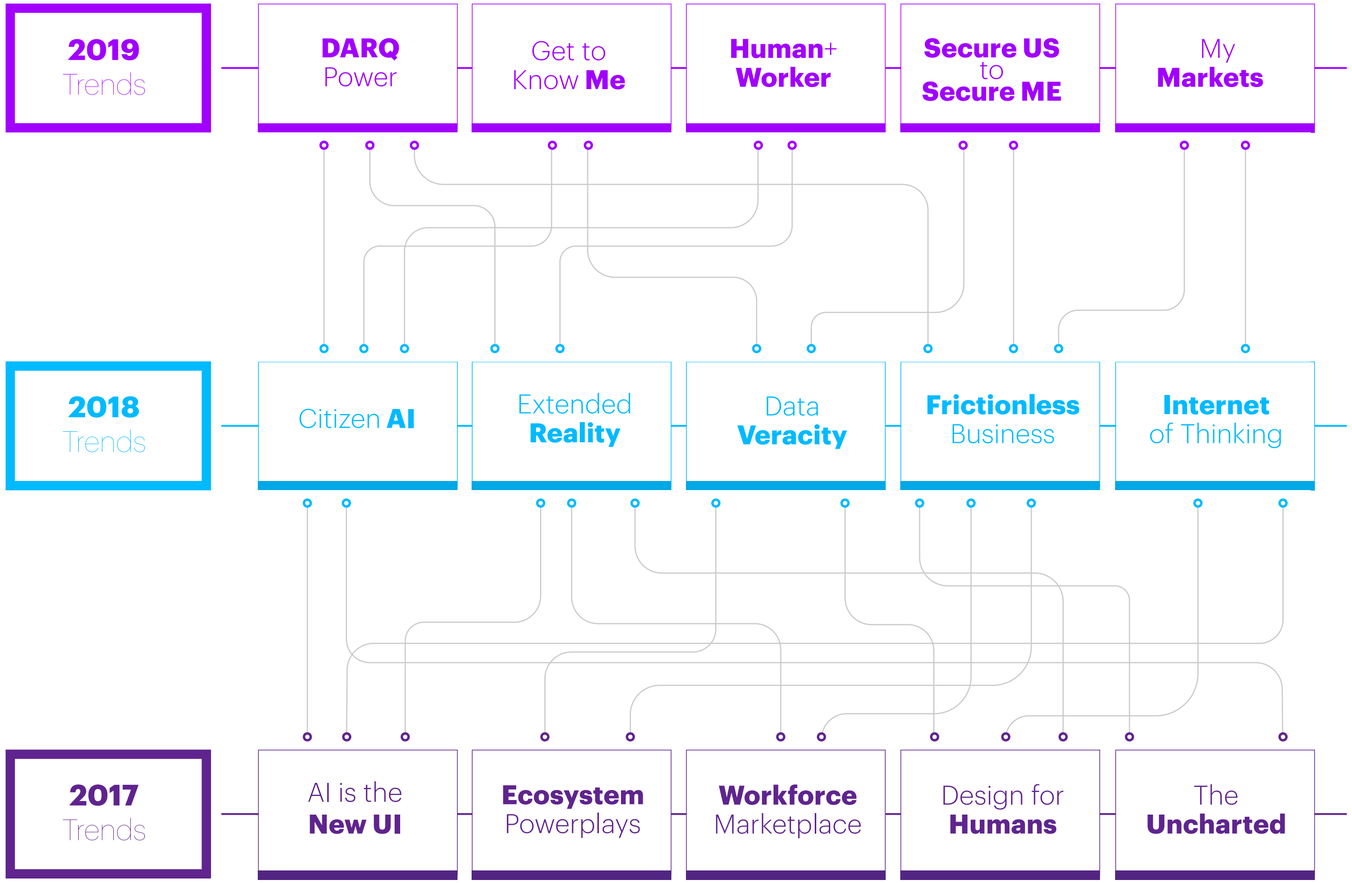
What does "post-digital" mean for companies? Doubling down on completing their digital transformations to get the most value from those investments—and at the same time, turning a strategic eye toward what's next. By moving the company's focus to targets of opportunity, finding a place among the ecosystems of the post-digital era, and mastering digital investments with an eye toward the post-digital future, leaders will position themselves for success for years to come. Your digitized organization will be the foundation from which you drive all future innovation.

It's a tall order; thanks to the power of digital now and post-digital next, the next era will be one of massive customer, employee, and societal expectations. Fortunately, it's an era of equally tremendous possibility: to deliver for any moment in any reality.

# COMPLETING THE PICTURE

**The current three-year set of technology trends relating to Accenture's Technology Vision includes our reports from 2018 and 2017.**

Accenture's Technology Vision comprises a three-year set of technology trends, and it's important to recognize that this year's trends are part of a bigger picture. As companies continue to grow as digital businesses, they will need to keep up with the latest technologies, as well as continue to master those that have been maturing. These technologies will collectively inform how enterprises build the next generation of business and create paths toward future growth.



# 2018 Trends

Trend 1

## CITIZEN AI

**Raising AI to Benefit Business and Society**

As artificial intelligence grows in its capabilities—and its impact on people's lives—businesses must move to "raise" their AIs to act as responsible, productive members of society.

Trend 2

## EXTENDED REALITY

**The End of Distance**

Virtual and augmented reality technologies are removing the distance to people, information, and experiences, transforming the ways people live and work.

Trend 3

## DATA VERACITY

**The Importance of Trust**

By transforming themselves to run on data, businesses have created a new kind of vulnerability: inaccurate, manipulated, and biased data that leads to corrupted business insights, and skewed decisions with a major impact on society.

Trend 4

## FRICTIONLESS BUSINESS

**Built to Partner at Scale**

Businesses depend on technology-based partnerships for growth, but their own legacy systems aren't designed to support partnerships at scale. To fully power the connected Intelligent Enterprise, companies must first rearchitect themselves.

Trend 5

## INTERNET OF THINKING

**Creating Intelligent Distributed Systems**

Businesses are making big bets on intelligent environments via robotics, AI and immersive experiences. But to bring these intelligent environments to life, they must extend their infrastructures into the dynamic, real-world environments they want to reach.

# 2017 Trends

Trend 1

## AI IS THE NEW UI

**Experience Above All**

Artificial intelligence (AI) is about to become your company's digital spokesperson. Moving beyond a backend tool for the enterprise, AI is taking on more sophisticated roles within technology interfaces. From autonomous driving vehicles that use computer vision, to live translations made possible by artificial neural networks, AI is making every interface both simple and smart—and setting a high bar for how future interactions will work. It will act as the face of a company's digital brand and a key differentiator—and become a core competency demanding of C-level investment and strategy.

Trend 2

## ECOSYSTEM POWER PLAYS

**Beyond Platforms**

Companies are increasingly integrating their core business functionalities with third parties and their platforms. But rather than treat them like partnerships of old, forward-thinking leaders leverage these relationships to build their role in new digital ecosystems—instrumental to unlocking their next waves of strategic growth. As they do, they're designing future value chains that will transform their businesses, products, and even the market itself.

Trend 3

## WORKFORCE MARKETPLACE

**Invent Your Future**

The future of work has already arrived, and digital leaders are fundamentally reinventing their workforces. Driven by a surge of on-demand labor platforms and online work management solutions, legacy models and hierarchies are being dissolved and replaced with open talent marketplaces. This resulting on-demand enterprise will be key to the rapid innovation and organizational changes that companies need to transform themselves into truly digital businesses.

Trend 4

## DESIGN FOR HUMANS

**Inspiring New Behaviors**

What if technology adapted to you? The new frontier of digital experiences is technology designed specifically  for individual human behavior. This shift is transforming traditional personalized relationships into something much more valuable: partnerships. Business leaders recognize that as technology shrinks the gap between effective human and machine cooperation, accounting for unique human behavior expands not only the quality of experience, but also the effectiveness of technology solutions.

Trend 5

## THE UNCHARTED

**Invent New Industries, Set New Standards**

Businesses are not just creating new products and services; they are shaping new digital industries. To fulfill their digital ambitions, companies must take on a leadership role to help shape the new rules of the game. Those who take the lead will find a place at or near the center of their new ecosystem, while those that don't risk being left behind. From technology standards to ethical norms to government mandates, in an ecosystem-driven digital economy, one thing is clear: a wide scope of rules still needs to be defined.

# TREND 1
# DARQ POWER

## Understanding the DNA of DARQ

**Imagine movies in the future. Audiences will live inside of stories, fully immersed in fictional worlds through virtual reality (VR). Human-like artificial intelligence characters will respond, anticipate, and react to each audience member's choices, and payments and access will be facilitated seamlessly by distributed ledger technology.**

Watching a fixed story on a screen will be a relic of the past. In its place: create-your-own TV packages or multi-player, interactive movies at home. No more traveling to a theater to watch a movie; instead, people will "travel" into the movie itself as participants.

This may seem farfetched or at least far off, but companies are already building these kinds of interactions in the entertainment industry and beyond. Supermassive Games released a VR experience for "The Inpatient," letting players participate in the game in true first person.[1] Google is rolling out Duplex, a natural language voice assistant so human-like it's hard to recognize as AI, to help people accomplish daily tasks.[2] Choon, a blockchain-based music streaming platform, is attempting to democratize and streamline artist royalties.[3]

And while the full maturity and widespread adoption of quantum computing may still be years away, companies are beginning to explore this technology now. Leaders in quantum hardware are connecting their quantum computers to the cloud, allowing companies and individuals to experiment with the possibilities of this revolutionary new approach to solving exponentially complex problems.

The world is moving into a post-digital era. Companies are setting their sights beyond their organization's digital transformation, moving toward shaping how governments, business partners, employees and individuals interact with the world through technology. Future-minded leaders know that they will need not only every digital tool in their current arsenal to succeed, they'll also need new ones. The next set of technologies every company will need to master? **D**istributed Ledger Technology (DLT), **A**rtificial Intelligence (AI), Extended **R**eality (XR) and **Q**uantum Computing.

## The next set of technologies every company will need to master:

Distributed Ledger Technology (DLT)

Artificial Intelligence (AI)

Extended Reality (XR)

Quantum Computing

In other words, "DARQ" matters.

New technologies are catalysts for change, offering extraordinary new business capabilities when applied appropriately. Individually, each of these four technologies represent opportunities for businesses to differentiate their products and services. Collectively, they will open unimagined new pathways into the future. AI already plays a critical role in optimizing processes and influencing strategic decision-making. Extended reality, an immersive technology, creates entirely new ways for people to experience and engage with the world around them.

Distributed ledgers will expand networks by eliminating the need for trusted third parties. And quantum technology will usher in novel ways to approach and solve the hardest computational problems.

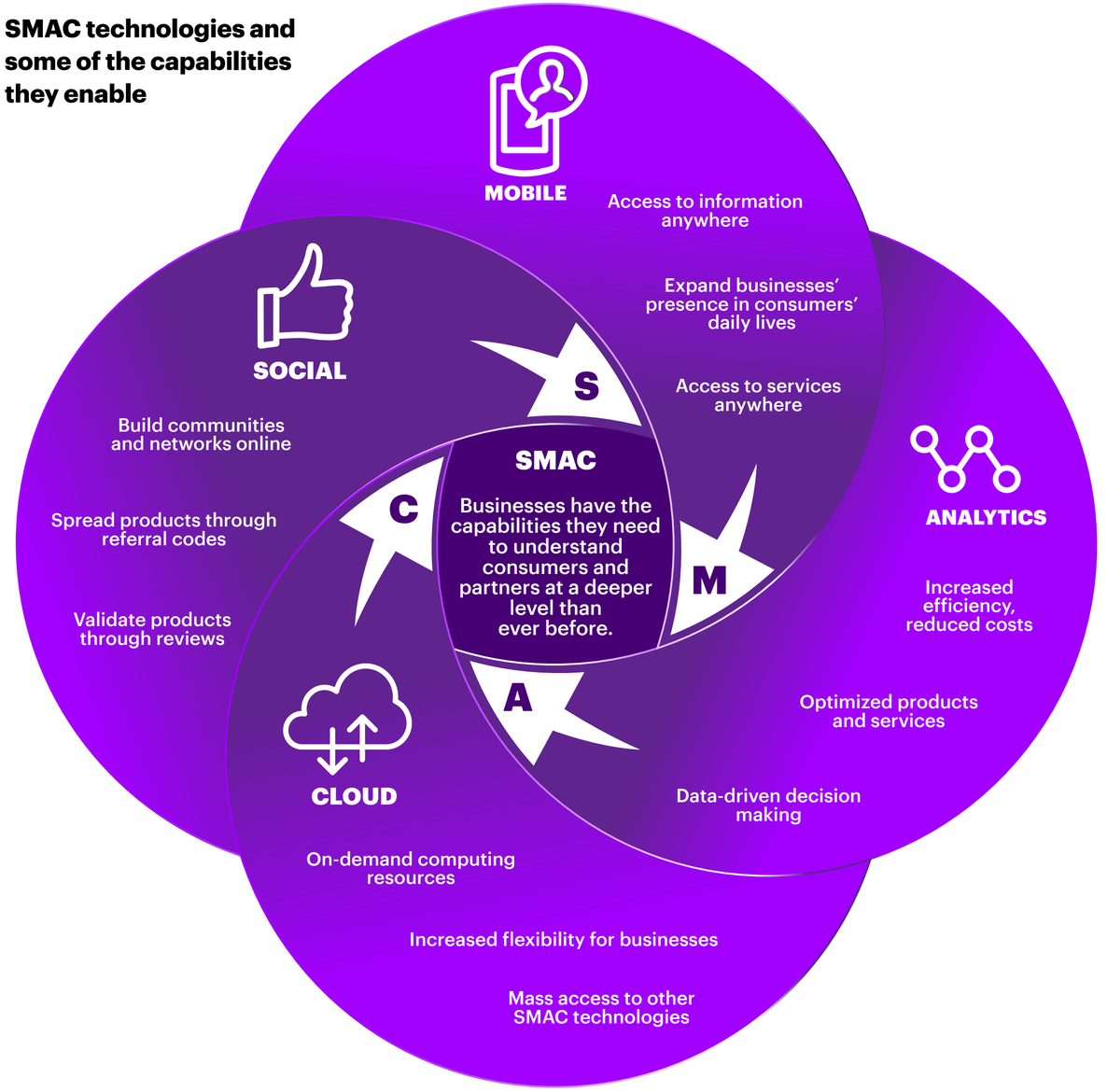
When sets of technologies like these converge over a short period of time, they can spark a step change, letting businesses reimagine entire industries. DARQ will be the next set to do this, but not the first.

During the digital revolution, social, mobile, analytics, and cloud (SMAC) combined to enable one such step change. These technologies let businesses understand their partners and consumers at unprecedented depth, and together, SMAC helped companies create major differentiators. Now, investing in digital is a core expectation of being in business, and ambitious companies are looking at DARQ technologies for the next source of differentiation and disruption. As these technologies reach maturity and converge, they will let businesses expand upon their digital capabilities to build intelligent and highly customized, in-the-moment experiences that help shape their customers', business partners' and employees' very lives.

**Leaders will be the ones best prepared to capitalize on the value of DARQ technologies as they progressively reach maturity.**

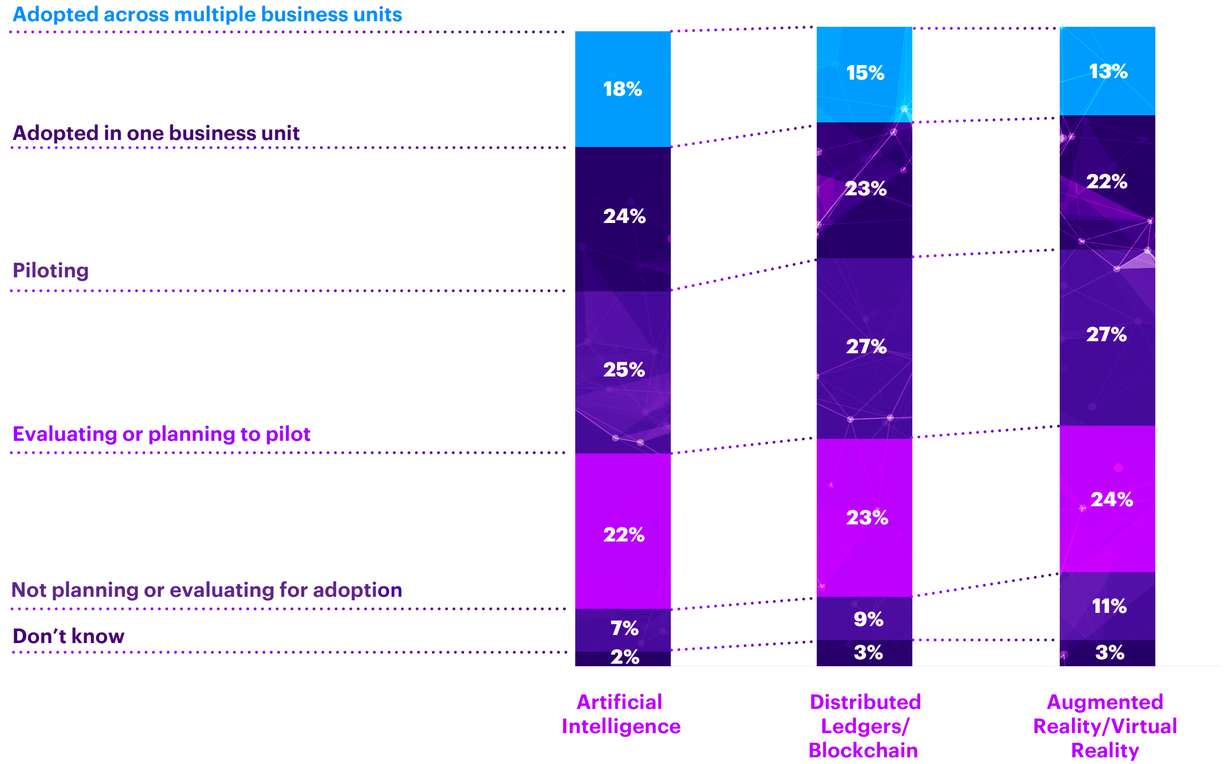
Success in the future starts now. As they mature, DARQ technologies will offer businesses huge opportunity. But there is risk in waiting to make a move. Many ignored SMAC for too long and later struggled to keep up with digital-first businesses. To avoid this mistake with DARQ, companies must begin exploring new capabilities as they arise, experimenting with combinatorial effects, and using their digital foundations to launch meaningful and effective pilots. Leaders will be the ones best prepared to capitalize on the value of DARQ technologies as they progressively reach maturity. At this stage, every advantage counts.

**SMAC technologies and some of the capabilities they enable**



# EXPLORING THE DARQ

**Across the DARQ technologies, investments and adoption are rising steadily. VR and AR saw a 12 percent increase in investment between 2016 and 2017, reaching $3 billion that year; in the first three months of 2018, companies invested $750 million in AR/VR startups.[4] Distributed ledger investments are exploding, with blockchain and cryptocurrency-focused startups alone collecting almost $3.9 billion in investments in the first three quarters of 2018—nearly three times the total for all of 2017.[5]**




Please indicate your organization's stage of adoption for each of the following emerging technologies today.

Eighty-nine percent of businesses are already experimenting with one or more DARQ technologies, expecting them to be key differentiators. Each technology is at a different point on the adoption curve, but the first wave of companies using DARQ technologies to drive differentiation is already here.

The Symphony Post-Acute Network incorporated AI and machine learning to improve care for its 80,000 patients, using a cloud-based AI engine to drive predictions and recommendations based on its existing patient data.[6] The resulting insights led to a drop in readmission rates from 21 percent to less than 19—a huge reduction in a key success metric in healthcare, at a cost savings of more than $13,000 per patient. Similar AI-driven results can be found across industries, with 80 percent of companies reporting that AI is in production in their organization in some form.[7]

Others are already creating new value with distributed ledger technology. A consortium including AB InBev, APL, and Kuehne + Nagel developed a blockchain solution to save hundreds of millions of dollars for the freight and logistics industry.[8] The approach reduces the need for data entry related to transport documentation by up to 80 percent while streamlining required cargo checks and customs compliance.

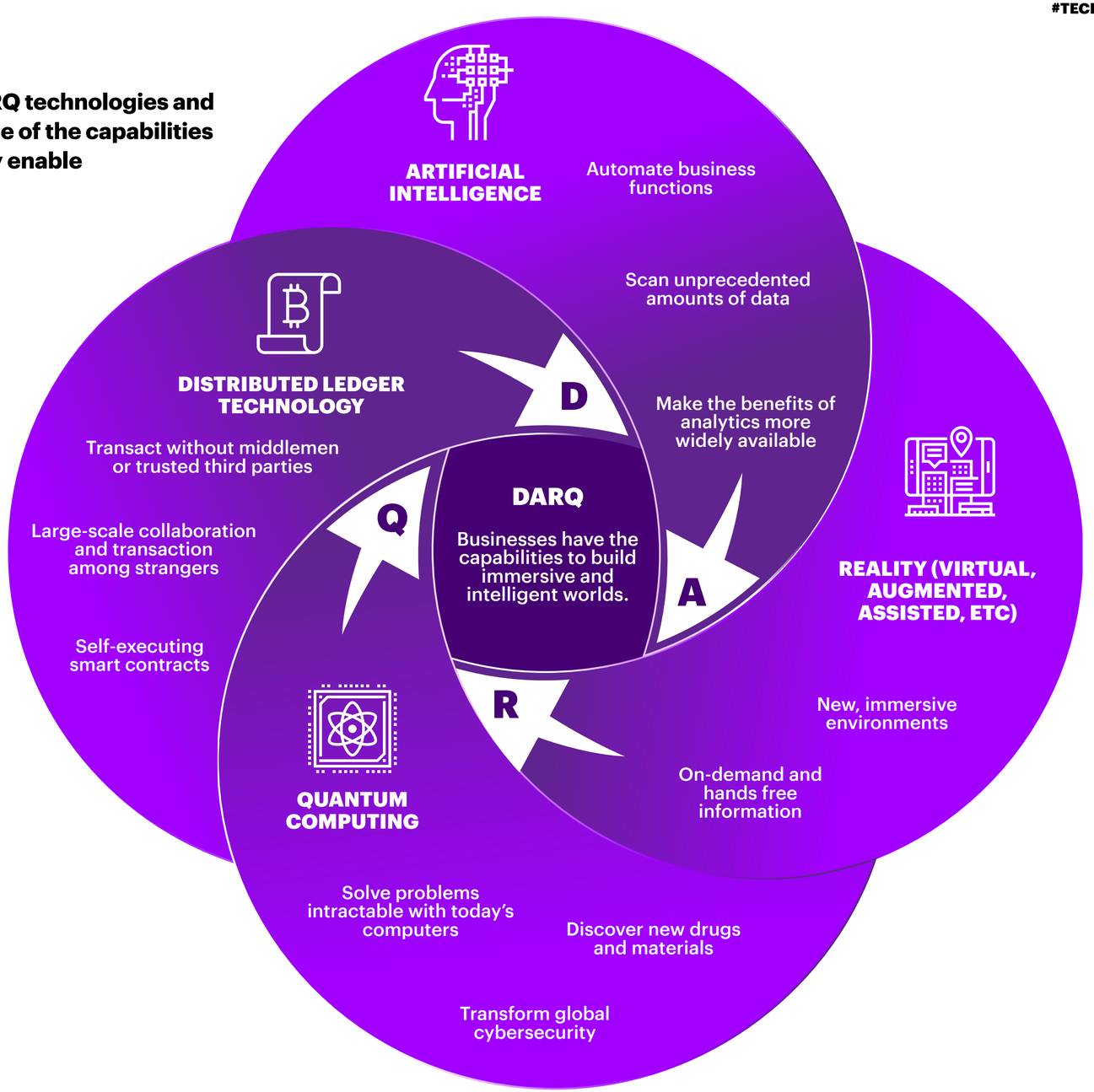
And while quantum computing is the furthest from full maturity and impractical as a current investment for most companies, advances in quantum research are bringing costs down significantly. The number of qubits (the quantum equivalent of a bit in a traditional computer) in leading chips is accelerating: it took 19 years to get from a chip with two qubits to a chip with 17, which IBM achieved in 2017; later that year, IBM bested its own record with 50 qubits, and by 2018, Google had unveiled a chip with 72.[9,10] In concert with these advances, Microsoft, Rigetti Computing, 1QBit, and other leaders in quantum research are increasingly

making their quantum systems available for experimentation via APIs and software development kits (SDKs, or QDKs).[11] These offerings give companies a way to develop and test quantum solutions for specific enterprise use cases today.

Volkswagen has used quantum computing to test traffic flow optimization, as well as to simulate the chemical structure of batteries, hoping to accelerate battery development.[12,13] The company teamed with Nvidia to add AI capabilities to future models.[14] Volkswagen is also testing distributed ledgers with an eye to protecting cars from hackers, facilitating automatic payments at gas stations, creating tamper-proof odometers, and more.[15] And the carmaker provides step-by-step augmented reality instructions to help service employees repair vehicles.[16]

Companies like Volkswagen with early-stage tests and pilots are gaining expertise, forming key partnerships, and building up DARQ capabilities. As the technologies mature, this experience will provide the tools to weave together solutions creatively and strategically—to solve new kinds of problems or attack existing problems in new ways.

**DARQ technologies and some of the capabilities they enable**



# GAINING COMBINATORIAL EFFECTS

**As businesses explore new capabilities, some of the DARQ technologies will be more immediately relevant than others. When asked to rank the technologies, forty-one percent of business and IT leaders report that AI will have the greatest impact on their organizations over the next three years, while 19 percent say their greatest impact during the same timeframe will come from distributed ledgers. But to use the technologies to their greatest potential—now and when all four have matured—businesses need to think about the value in combining them.**

All four DARQ technologies are, or will be, powerful on their own. But as they advance, they will push each other forward further. Already, early pairings reveal game-changing combinatorial effects.

The blend of AI and XR, for instance, is helping to solve one of the biggest barriers to widespread impact for immersive experiences: VR sickness. Businesses have identified numerous potential applications of XR—like virtual training, "hands-on" education, or even realistic online shopping—but have been stymied by the symptoms of motion sickness that many VR users experience.[17] To address this, LG Display is partnering with Sogang University in South Korea, where researchers are using a deep

learning AI algorithm to lower latency and motion blur. The solution shortens the time lag between when a person moves and when the display image updates to reflect that movement.[18]

Many leaders are also exploring quantum computing in conjunction with AI. Google AI has a quantum research effort aimed at developing quantum processors and algorithms to accelerate machine learning computing tasks.[19,20] Similarly, IBM released QISKit AQUA Artificial Intelligence, a set of tools and algorithms allowing developers to access and run AI experiments on IBM Q quantum computers.[21]

Even before these DARQ technologies have reached full maturity, businesses can see the value to come—and these examples offer just a glimpse of what leaders have planned. Microsoft and Adents, a supply tracking solutions provider, are already integrating distributed ledgers and AI. The companies teamed up to develop a blockchain and AI-based product tracking platform, called Adents NovaTrack. The blockchain-as-a-service approach offers greater traceability, transparency, and security throughout supply chains, guarding against counterfeit items. Microsoft's machine learning and business intelligence services then help transform the collected data into actionable business insights. [22]

In the future, XR and quantum computing capabilities could be added to platforms like Adents NovaTrack, further transforming industries. With hands-free augmented reality instructions, warehouse employees could reduce shipping mistakes significantly, while quantum computers could optimize complex vehicle routing, helping dispatchers coordinate multiple vehicles with warehouse locations and rapidly add new destinations.

To take advantage of the transformational new capabilities that DARQ technologies will offer, businesses must explore the possibilities now all along the spectrum. From the growing pervasiveness of AI in enterprise today to the long-range potential of quantum computing in the future, businesses should continue experimenting with and applying these technologies to transform their businesses.

The one certainty is that all four of these technologies will offer powerful new capabilities to enterprise—and will amplify the impact of the others. Leaders in the DARQ-driven future will be prepared to combine and exploit those competencies as the technologies reach enterprise-level maturity.

# REALIZING NEW VALUE FROM EXISTING INVESTMENTS

As DARQ technologies reach maturity, they will amplify the reach and capabilities of the business, creating new value from existing SMAC investments.

Consider how distributed ledgers will work with social platforms. Social media created huge and powerful ecosystems and networks of people, but serious pain points like fake news and inadequate data privacy protections have emerged. Now, distributed ledgers can give people more agency, helping them verify information and control their data.[23] Skycoin BBS, for instance, is a distributed social platform with no central server or central authority, so people can retain their privacy.[24] Taking the lead on integrating distributed ledger capabilities into social platforms has given businesses a new way to gain value and distinguish themselves from competitors.

Early progress with XR is also closely tied to a major digital technology—mobile. For XR to shape and augment the world at any given time, businesses must navigate network connectivity, application development, and processing power. Those with successful mobile practices or products will be better prepared for this wave. Already, many VR headsets rely on mobile phones: the Samsung Gear VR is powered by Android Galaxy phones, and though early complaints about mobile VR centered around battery life and storage, the company has improved those features and, therefore, the Gear VR experience with each new model.[25]

While quantum computers will be necessary to power next-generation technologies, they remain too fragile and expensive for every company to have one. But several leaders in quantum computing have already released software platforms that enable connections to their quantum computers via the cloud. Rigetti gives businesses access to 8-qubit and 19-qubit quantum machines as part of its hybrid Quantum Cloud Services platform.[26] Alibaba's cloud service subsidiary, Aliyun, and the Chinese Academy of Sciences launched a joint 11-qubit quantum computing service, which they encouraged researchers to use to run algorithms and conduct early quantum experiments.[27]

Strong digital foundations in SMAC will let businesses explore DARQ technologies in their early stages—a must if companies want to stay ahead of competitors. Later, when DARQ technologies reach full maturity, they will amplify the value of earlier technology investments, extending the business into the future.

# DRIVING THE POST-DIGITAL FUTURE

**Even before DARQ technologies have reached full maturity, it's clear that they are poised to become the foundation for next-generation products and services. Already AI and XR offer major competitive advantage in multiple areas, and distributed ledgers and quantum computing are expected to drive new innovations in the coming years. When all four technologies are viable at scale, their impact will grow significantly—once again giving companies the opportunity to transform their business models and full industries from the ground up.**

Leaders looking for a head start on the future must consider the revolutionary successes of SMAC technologies and strive to replicate their impact. Studying how the most successful companies used new capabilities to transform their industries in the past will provide guidance as businesses explore new competencies through DARQ, and a strong digital foundation will help them pilot those capabilities while DARQ technologies are still in early stages.

DARQ will enable the post-digital era of business and technology, and those looking to lead in that era must start now. For some, this means launching pilots. For others, it means looking into startups and building relationships or making acquisitions. The companies that recognize the opportunity—and begin to explore possibilities and investments with strategic focus—will be leaders in a brand-new competitive landscape.

# DECISION POINTS

## 1 Is your digital foundation ready for DARQ?

- Early stage DARQ pilots will heavily rely on SMAC practices. Prioritize the completion of ongoing digital transformation efforts.
- Consider where businesses in your industry stumbled with SMAC adoption at the beginning of the digital revolution, and what pitfalls were difficult or impossible to recover from. This will help you build roadmaps for the growth of DARQ technologies, and ultimately determine the optimal time to involve your business in each one.

## 2 Determine how your organization will access the DARQ technologies that are relevant for your business, keeping in mind their different levels of maturity.

- Decide whether you will buy or build your own AI tools, taking AI training and security requirements into account.
- Explore different XR use cases in the enterprise. Depending on how you expect to use XR throughout your business, decide whether you should begin building an in-house team to design XR experiences, or establish vendor contracts.
- Begin identifying the best use cases for distributed ledger technology in your industry. Will you use it internally or to pivot quickly between many business partnerships?
- Establish relationships with leading quantum cloud vendors and explore new quantum computing capabilities as they are made available.

# DECISION POINTS

## 3 How are you adding DARQ skills to your current workforce?

- Approach hiring, training, and employee retention with DARQ in mind. As the technologies become more pervasive, expertise will be increasingly in-demand. As recruiting DARQ talent becomes more competitive, consider training programs to reskill your current employees and incentivize them to stay.

## 4 How can you use DARQ to shape the future of your industry?

- DARQ technologies have the potential to transform whole industries from the ground up. Start a future-looking program dedicated to scenario planning. Task  the team with exploring different possible futures for your organization, driven by the industry-level impact of DARQ.
- Steer your industry toward your company's preferred future with strategic combinations of DARQ technologies. Evaluate each combination, taking into account what can be implemented today and what capabilities they will enable as they mature. Use this information as you build your overall DARQ strategy.

# TREND 2
# GET TO KNOW ME

## Unlock unique consumers and unique opportunities

**Globally, 1.7 billion adults are "unbanked," with no bank account or access to formal finance.[1] They frequently end up in a financial catch-22: without any financial history, they can't qualify for a loan. Without any loans, they have no financial history.**

But lending platform SlicePay has found a way to serve unbanked students in India. SlicePay runs "credit" checks by examining applicants' use of technology. How often they post photos of themselves on vacation or check into restaurants on social media may seem like unorthodox measures of financial viability, but they offer useful insight into spending patterns.[2] Combined with other tech-derived metrics, SlicePay uses these insights to build applicant profiles that replace traditional financial histories.

Another company, Capital Float, operates similarly. If someone applies for a loan for a technology-related endeavor, like buying a car to become a driver for a rideshare app or signing up as an ecommerce seller, one of the data points Capital Float will check is the software update status of their mobile phone. It helps the company evaluate the applicant's technology savvy, to determine how likely they are to be successful in technology-related work.

SlicePay, Capital Float, and others have spotted the emergence and growing importance of technology identities. The sets of technologies people choose to use are now so integrated into their lives that they have become a part of consumers' identities, and leaders are using those identities to create a new generation of offerings. In SlicePay's case, its new technology "credit check" lets the company serve a previously untapped market of customers.

These technology identities are part of an emerging enterprise feedback loop, one that first began to show its potential with the personalization efforts of the digital era. Through digital technologies, companies gained new, direct touchpoints with customers. They used the resulting "snapshots" of insight into customer needs and goals to deliver personalized products and services, which, in turn, gave companies even more insight into their customers.

Now, that technology-driven feedback loop is about to kick into overdrive. As the world moves into the post-digital era, companies are beginning to build new products and services that shift the one-off, transactional exchanges between businesses and consumers to an ongoing, customized relationship. They are moving beyond personalized products to individualized experiences, creating a one-to-one relationship with each customer where technology plays the starring and ever-present role.

**Technology identities are driven by digital demographics, which reflect consumers' choices across a variety of devices and services.**

**83%**

**of business and IT executives agree that digital demographics give their organizations a new way to identify market opportunities for unmet customer needs.**

The transactional interactions of the digital era offered snapshots of customers at a single point in time. Now, experiences are beginning to deliver a living, more holistic, and ongoing view of customers' digital activities, technology capabilities, and preferences—in addition to their personal needs and goals. It's the enterprise feedback loop of the post-digital era: the more experiences companies deliver, the richer the technology identities that are created. The richer the technology identity, the more powerful the experience a company can create.

The shift toward technology-driven experiences has already begun in earnest. Ikea built an augmented reality app that allows customers to browse the company's catalog and place 3D renderings of furniture directly in their physical environment.[3] Instead of having the customer get home and build a piece, only to then realize it was not quite what they had hoped, the app revolutionizes the shopping experience. People can now make purchasing decisions by using their very own home as the backdrop of the catalog—and, thanks to Ikea's purchase of labor platform TaskRabbit, customers can also seamlessly recruit help to assemble the new piece in place.[4]

Other companies have followed suit, replacing dry, often frustrating transactions with new technology-driven efforts that bring experience to the forefront of the relationship. Look closely at those interactions: technology is an inextricable component of the experience, just as it is in daily life. And with every step in those experiences, consumers are leaving behind footprints of their technology identity. It's creating a living foundation of knowledge for business, as customers use technology to interact with them—and other companies they do business with—across multiple points in time.

The key opportunity for enterprise? Become each individual customer's ongoing, trusted partner. Companies will achieve this by understanding the technology people use and how they use it, creating the insights needed to integrate seamlessly into the person's life.

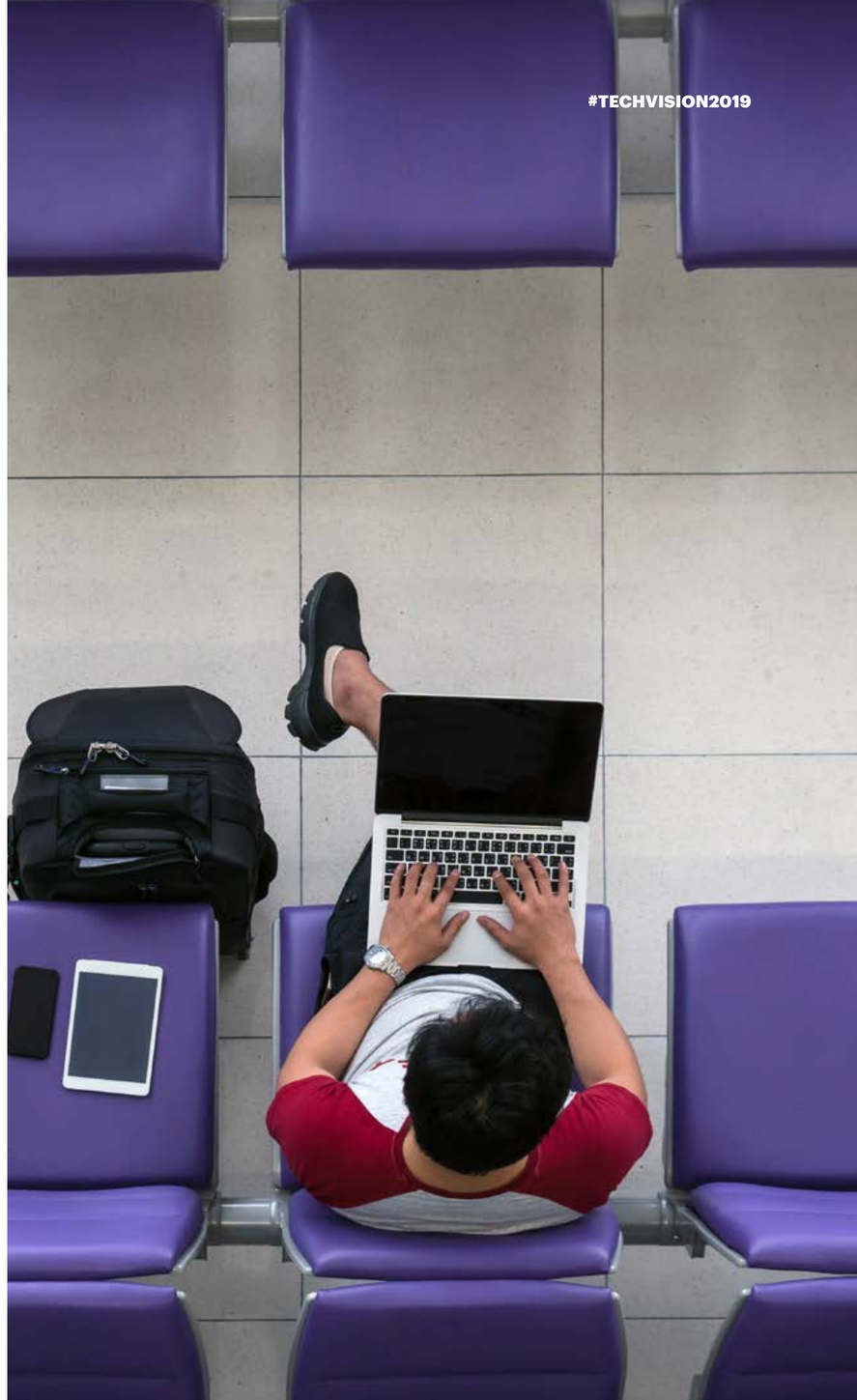
B2B organizations have already started to adopt this thinking. Companies like Datanyze and the HG Data app on Salesforce AppExchange will mine websites to identify what technology stack a target company is using, or if they have recently changed providers.[5,6] Vendors can then leverage that information to generate leads and refine sales pitches that both meet the target company's specific needs and fit within its existing sets of technology products and services.

For B2C companies, the logic is the same. If consumer-facing businesses are betting big on experiences fundamentally driven by technology, they will need to better understand how that experience fits into the technology that already exists in a customer's daily life.

The technology that consumers have integrated into their lives may not be as clearly defined as an enterprise technology stack, but it is just as critical. People entrust digital services to pay bills, shop, catch up with friends, get the news, control the lights in their homes, work, and entertain themselves; even social movements like #MeToo are inherently born through technology. More than half of the global population are internet users, and in the US, consumers across generations already spend more than three hours per day on their mobile devices.[7,8,9] Even when it is operating silently in the background, technology has come to dominate the way people engage with the world.

Success for companies, then, is about seamlessly integrating into each individual's technology choices—drawing insights not only from which technologies a person has adopted, but also how they're used. Look at the difference in the ways people use voice technology: among US adults, 70 percent use voice services to play music, 31 percent use them for smart home commands, and just 17 percent use them for food delivery or takeout.[10]

Technology identities not only reflect overall consumer identities, they also define new aspects of people's lives in an era where everything is digital. Companies that disregard technology identities will inevitably create offerings out of sync with what their customers are able or willing to use. But those that successfully grasp technology identities will achieve a living, individualized view of each consumer—one that's needed to deliver rich, continuous, experience-based relationships in the post-digital age.



# USING TECHNOLOGY TO GROW THE MARKET OF ONE

**The innovative technologies and strategies that companies use to interact and engage with their customers are in constant flux. Walmart redesigned the technology backend of its website to distinguish between items people buy for themselves and those they buy as gifts, with an eye toward driving better-targeted recommendations.[11] Alibaba's "FashionAI" incorporates machine learning into a physical store experience, giving individual customers real-time suggestions and tips as they try on different styles based on the items they've already chosen.[12]**

**41%**

**of executives strongly agree that understanding consumers' behaviors around technology will be critical for their organization to increase customer loyalty.**

At first blush, these feel like very different strategies for customer profiling and improving customer experiences—but each is actually a stepping stone to the same ultimate goal: the market of one.

Savvy businesses are taking their first steps with technology identities to personalize their existing product and service offerings. It's a smart move; there is still value to be gained from personalization-driven customer loyalty. But this is just the beginning of what is becoming possible today. Leaders can push even further to craft new individualized, experiential business models entirely around the technology identities of their customers.

North American life insurance company John Hancock has found technology identities to be so valuable that it has done away with the traditional life insurance model. Now, the company offers interactive life insurance policies that incorporate clients' fitness and health data through wearable devices. John Hancock's "Vitality" program policyholders qualify for discounts when they hit certain exercise targets and can get personalized premiums and rewards for their activity.[13,14] The results speak for themselves: the average customer with a traditional insurance plan engages with their life insurance company one to two times per year. The new Vitality policyholders engage with John Hancock more than 500 times per year.[15]

Technology is letting businesses maintain ongoing, experience-driven relationships with individual consumers in ways that were impossible before. But with these technology-enabled possibilities comes new ambiguity and complexity, along with key challenges that companies must address. Among them: recognizing that there are times when consumers want more technology in their lives, but also times when they do not want it in their lives at all. To successfully establish and maintain ongoing, intensely individualized relationships with consumers, companies must understand that dynamic. In essence, businesses must earn and retain consumers' trust by weighing their needs against the company's opportunities—and that will require a non-stop balancing act.

# UNDERSTAND CHOICE TO BUILD TRUST

**With every future offering poised to be individualized for the market of one, companies must master the granular understanding that technology identities make possible. It's the difference between creating a tailored, seamless experience that neatly integrates into a specific customer's life, or losing a consumer's trust and a potentially lifelong relationship by creating an experience that is out of sync with their needs and expectations.**

Mastering the use of technology identities begins with understanding their key value: they rely on the power of consumer choice. No one chooses their age, ethnicity, or other characteristics commonly used to categorize people into demographic buckets. But having a Facebook account or a smart home device is a choice. Which brand of smartphone a person carries, or if they carry one at all, is a choice. Whether or not to turn on location tracking, use a wearable fitness device, or let an insurance company monitor driving activity in exchange for a discount—all of these are choices, driven by convenience, accessibility or the trust a person has in a particular company. Choices around technology

create many consumer variables that businesses must both understand and address.

The most obvious example relates to the question of individualization and privacy. As companies move toward serving the market of one, they must toe the line between "useful" and "creepy"—and bear in mind that the line will vary for each person.

Going beyond the red line for an individual customer could mean all is lost. Case in point: one in five consumers report that they would switch to another brand if a personalization experience was too creepy, and one in five also said they would talk about the creepy personalization with others.[16] Yet at the same time, nearly half of consumers say they have purchased a product they weren't planning on buying after receiving a personalized recommendation from a company.[17]

The key takeaway: tailoring offerings to the individual also means figuring out just how much tailoring to do in the first place. Individual lines will range from "all personalization is creepy to me" through to "personalization is incredibly useful and I don't find it creepy at all," plus everything in between—and the line will vary for each different offering.

Businesses must also remember that they are not the only company that individuals have technology-driven relationships with—and those other relationships may affect the lines they draw for *your* company.

Thanks to ecosystem connections, companies can access information about a person's technological footprint even if that person has never interacted with them. Kinsa's connected thermometers let customers track their fevers via a smartphone app; Clorox paid to license the information, using it to direct ads to US ZIP codes where people had more fevers (and potentially more need for disinfecting wipes).[18] No personally identifying information was ever shared. Still, customers who end up seeing ads for disinfecting wipes not long after their child had a fever might wonder if their new connected thermometer is being too "chatty" about their household's health.

Fortunately for businesses, the very technologies that make individualized experiences possible can also help companies determine consumers' preferences for how tailored those experiences should be.

Businesses are already collecting the information they need to build this level of understanding, whether it is for marketing purposes, figuring out how best to communicate with a particular customer, or for providing support. Now, they must combine the data and use it in new ways to calculate the "creepiness quotient" in advance. Coupled with transparency about the insights being drawn from their interactions, companies can use this understanding to build and maintain trust with customers as offerings get more and more individualized.

# WHERE'S THE LINE?



## Persona 1

### "I am concerned about my privacy and prefer very little personalization"

- ✗ Personalized playlists help me expand my musical horizons
- ✗ My navigation app works with my calendar and the location services on my phone to suggest departure times
- ✗ My fitness-tracking app only knows my location when the app is open
- ✗ I'm letting this online retailer know this item is a gift
- ✓ **I like it when sites help me understand why I see certain ads**
- ✓ **I actively manage the kinds of notifications I receive**

## Persona 2

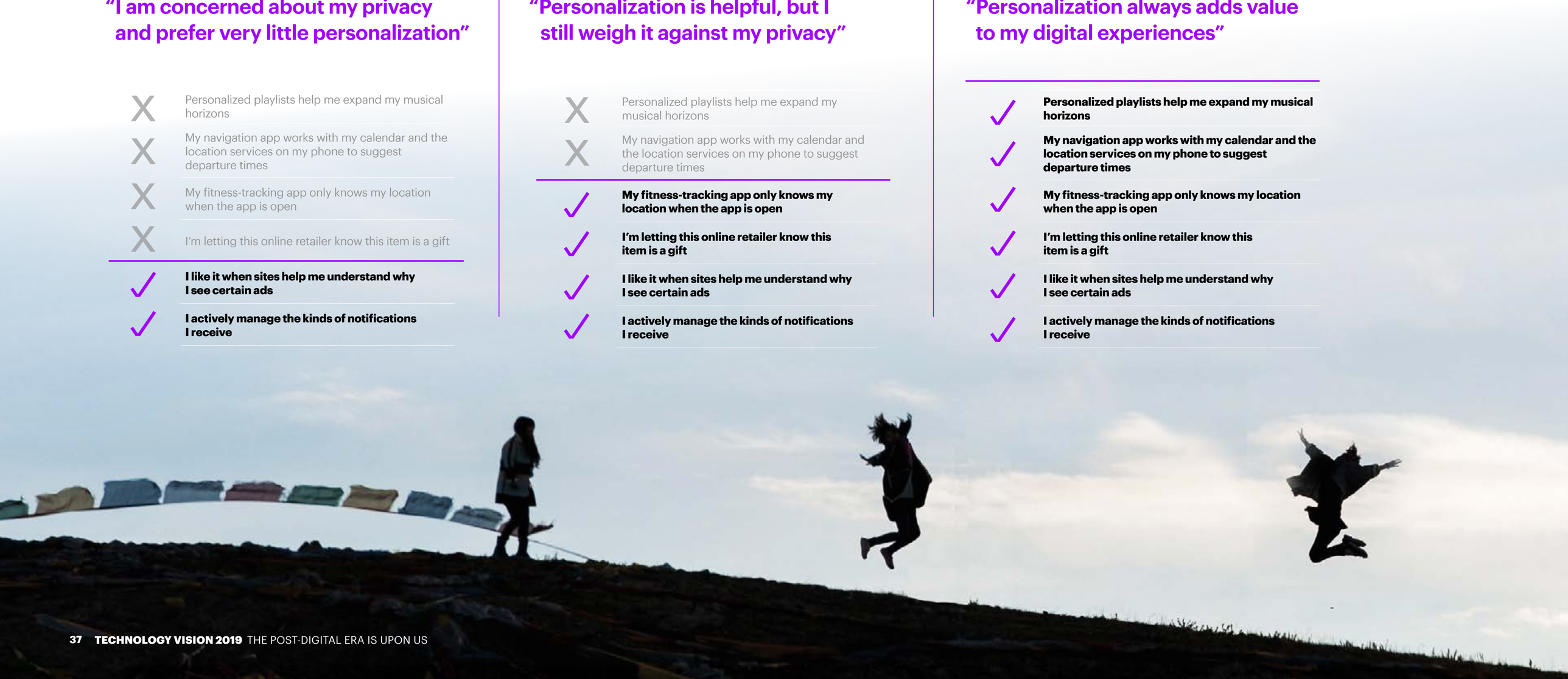
### "Personalization is helpful, but I still weigh it against my privacy"

- ✗ Personalized playlists help me expand my musical horizons
- ✗ My navigation app works with my calendar and the location services on my phone to suggest departure times
- ✓ **My fitness-tracking app only knows my location when the app is open**
- ✓ **I'm letting this online retailer know this item is a gift**
- ✓ **I like it when sites help me understand why I see certain ads**
- ✓ **I actively manage the kinds of notifications I receive**

## Persona 3

### "Personalization always adds value to my digital experiences"

- ✓ **Personalized playlists help me expand my musical horizons**
- ✓ **My navigation app works with my calendar and the location services on my phone to suggest departure times**
- ✓ **My fitness-tracking app only knows my location when the app is open**
- ✓ **I'm letting this online retailer know this item is a gift**
- ✓ **I like it when sites help me understand why I see certain ads**
- ✓ **I actively manage the kinds of notifications I receive**



# UNDERSTANDING THE LIMITS

Technology choices have created a wide spectrum of attitudes around technology, and the European Union's General Data Protection Regulation (GDPR) along with the chaos that surrounded its passage showed just how little attention companies have paid to these differing attitudes in the past. The regulation stunned business leaders and set off a mass scramble to try to understand the scope of its potential effects for individual companies. Even after a two-year delay in enforcement, more than 60 percent of companies said they didn't expect to be fully compliant when the law went into effect in May 2018.[19]

The honeymoon of unlimited technological access is over. Businesses need to understand how much technology people want to use, how much access they want to allow into their lives, and how much individualization they want companies to create *without* stepping over the line.

# UNDERSTANDING THE CHOICES AVAILABLE

The struggle between privacy and individualization is the most pressing piece of the growing consumer technological identity, but it is far from the only one. As businesses look to deliver rich, technology-driven individualized experiences, they must understand the complexities around the technology each consumer has access to in the first place.

From toll tags to baby monitors to smart meters, various technologies from different companies pervade people's everyday lives. Increasingly, those experiences are delivered through other companies' devices and ecosystems: app-based interactions are distributed via Android or iOS; voice-driven services are accessed through a preferred digital assistant; smart appliance purchases depend on compatibility with a consumer's existing smart home management system. Individual customers will be involved in many different ecosystems, and to deliver experiences that fit seamlessly into their lives, companies must navigate all of those relationships.

In the short term, this means that companies may need to maintain more digital channels to support the many combinations of ecosystems found in their customers' technology identities. Domino's Pizza, a digital leader, demonstrates this by supporting orders through the traditional avenues like a webpage and smartphone apps, but also expanding its capabilities to support ordering through Amazon Alexa, Google Assistant, Slack, Twitter, Ford's SYNC connected car platform, and many more.[20]

In the long run, the expanding choices of technology ecosystems and services will affect product strategy. Like Domino's, some companies will go after every ecosystem; Philip's Hue, iRobot's Roombas, and Belkin's Wemo devices all work in concert with a range of digital assistants, maximizing their reach. Others may follow Samsung's Family Hub refrigerator strategy instead: eschewing the horizontal approach, Samsung introduced its own smart assistant, Bixby, as an inextricable part of the refrigerator itself.[21]

Whether companies opt to compete within multiple ecosystems, or forge and focus on their own, is an increasingly critical question for future strategies.

Beyond ecosystems, the direct availability of specific technologies is the other side of the access equation. Just look at the reach of mobile networks. Despite being nearly 10 years into the 4G rollout (and with the 5G standard completed in 2018) consumers in just five countries have access to an 4G connection more than 90 percent of the time.[22] If a consumer in an area without 4G coverage isn't using a smartphone, it may not be a strict "choice." Companies will have to deal with a spectrum of access levels as they attempt to reach a global market with technology-driven experiences.

Connectivity might seem too "nuts and bolts" for business strategy, but it can have a serious impact. Take Netflix. Initially serving the US market, the service was built on the pretext of ubiquitous high-

speed streaming. However, when the company decided to take the product global, it quickly realized that some of its most avid customers did not have the same bandwidth access. Customers in India often experienced lag and buffering, so Netflix introduced a download feature, initially only available in markets where connectivity was not a given. With this approach, customers could store videos on their devices when they had service, and watch them uninterrupted at a later time.[23] Similarly, since Indian customers were primarily mobile users, Netflix invested heavily in mobile video encoding to guarantee the same experience to all customers—no matter their technology context.

Similarly, SoftBank, Synchronoss Technologies, and TBCASoft realized that existing banking apps demanded high-speed wireless access, which meant the companies weren't giving all banking customers the consistent access to mobile payments that they wanted.[24] To solve this, they built a solution based on technologies both new and old. By building a blockchain platform to create transparent accounting across mobile carriers, the three companies were able to develop a proof of concept that allows payments using SMS or RCS—two text messaging standards that operate reliably on 3G networks. The solution extends connected banking experiences to customers without high-speed wireless availability.

Businesses need to understand consumers' full technology context if they want to deliver rich, seamless experiences in the post-digital age—including the issues of access that affect consumer choice. This might mean making sure products work in multiple areas, all with different levels of technology access. Or it might mean serving more people in the same area by supporting many different digital ecosystems. Either way, it starts with a clear and constantly updating picture of the technologies that consumers are willing to and *can* incorporate into their lives.

# EARNING TRUST ONE CONSUMER AT A TIME

**When companies began their digital transformations, technology was the means through which they developed and connected with new customer bases. Those connections gave them snapshots of consumer needs, preferences, and goals—and helped drive the first efforts toward personalization in the digital era.**

Now, with technology ubiquitous in consumers' lives and companies shifting from individual transactions to experience-driven relationships, the opportunity is much greater. Businesses can use technology identities to build individualized, seamlessly integrated experiences for the market of one.

But this opportunity creates great responsibility. Integrating experiences into customers' lives requires an ongoing, intimate level of understanding; such insights rely on a strong foundation of trust, which companies must maintain through every consumer interaction. Those that take on this challenge today will achieve the new level of continuous insight and understanding needed to lead in the post-digital world.

# DECISION POINTS

## 1 How is technology an inextricable component of your customers' identities?

- Identify the consumer technology choices that are most relevant to your business and develop a plan to both capture and build on these data points to deliver individualized experiences.

## 2 Is your company using customer technology histories to build and evolve your understanding of individual customers?

- Ensure that your business is prepared to understand how technologies are used across a variety of contexts, not just *which* technologies are used. This will help your business create an individualized view of consumers—necessary to build a deep, on-going relationship with them.
- With every new product you build or service you explore, pay close attention to everything from consumers' basic network connectivity to the technology ecosystems they choose to participate in, and how these variables will affect your offering's reach and impact. Increasingly, business decisions will be driven by levels of consumer access to technology.

# DECISION POINTS

**3**

## How is your business determining the limits of personalization?

- Build a plan to combine your existing customer knowledge (from marketing, support, and other teams) with data gleaned from technology identities, to determine the relevant “creepiness quotients” for your customers.

# TREND 3
# HUMAN+ WORKER

## Change the workplace or hinder the workforce

**Businesses have not been going through their digital transformations alone. Today's workers are equipped and empowered by technology, incorporating it to perform existing roles in new ways and to adapt for new roles that did not exist in the pre-digital era. With every company making major investments in technology, a renewed focus on the workforce will decide the winners from the losers in the post-digital age: across industries, it's the workforce that will bring the promise of those investments to life.**

Oil and gas drillers at Conoco use a data visualization tool based on a gaming engine to troubleshoot malfunctions nearly a mile underground in real time.[1] In Siemens's "Click2Make" automated factory project, an artificial intelligence (AI) reasoning tool uses the known capabilities of both human and robot workers to assign tasks, enabling people to work seamlessly with machines.[2] In China, e-commerce giant JD offers three-month-long drone classes to train employees for jobs as delivery drone pilots, a job that simply did not exist before the digital revolution.[3]

Across industries and organizations, workers are incorporating technology to build on their own inherent skills and experience. The workforce is becoming "human+": each individual is empowered by their skillsets and knowledge *plus* a new, constantly growing set of capabilities made possible through technology.

But as the line between employees and the technology they use blurs, a new divide is emerging. The workforce is evolving at a rapid pace, incorporating new technology-driven abilities and skills to deliver value for the company—while the enterprise itself is still optimized for the workforce of the past, leaving a disconnect that reaches throughout the organization. Companies have inadvertently created a new digital divide between themselves and the workforce that has helped them to grow.

Leaders are endeavoring to close the gap, adapting the technology strategies that successfully created this next-generation workforce to incorporate their new enterprise needs.

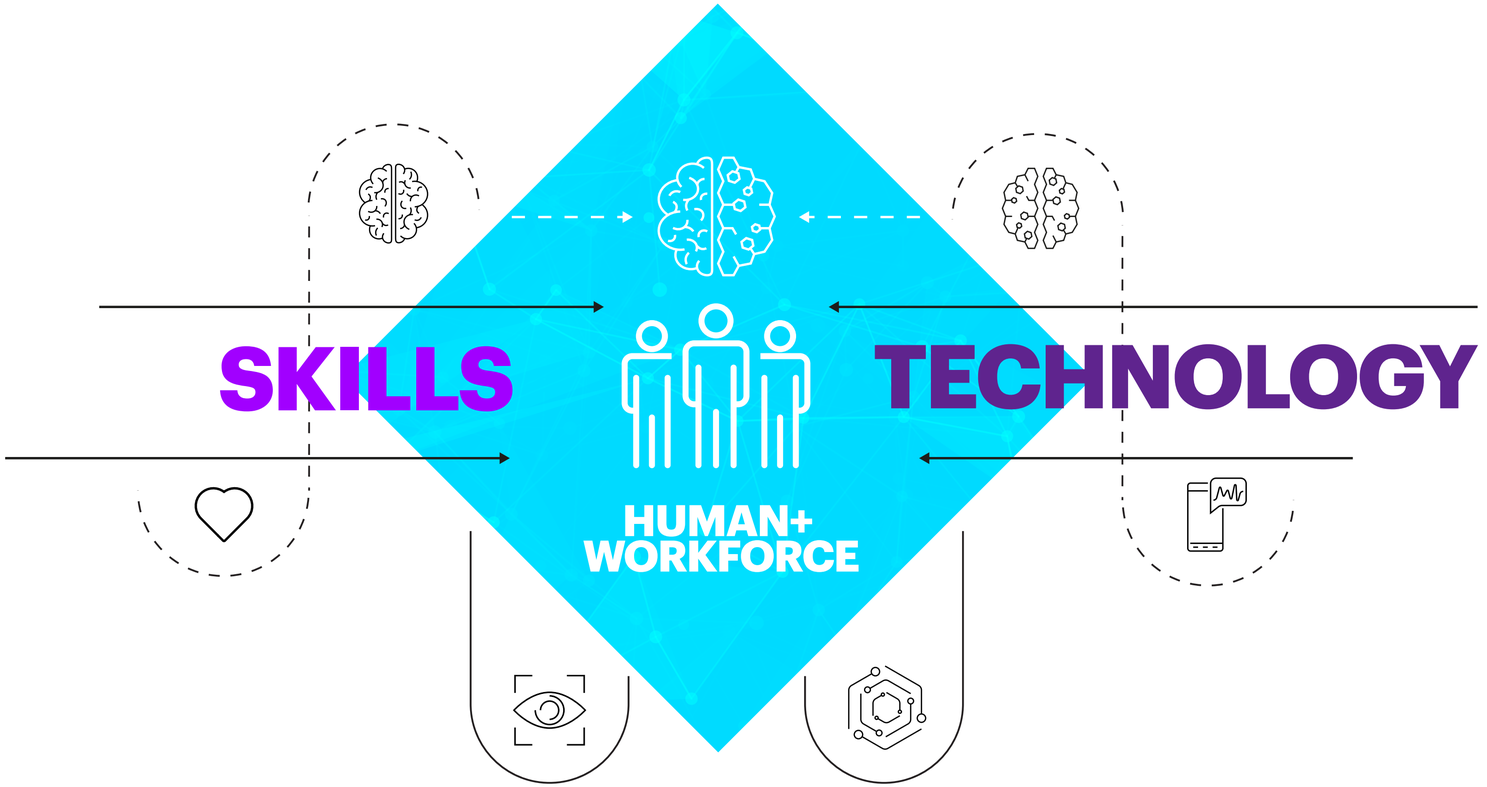
At Swisscom, employees were struggling to collaborate across siloed teams and distributed knowledge. With the breadth and depth of experience at Switzerland's leading telecom provider, someone within its 21,000-person

workforce would certainly have the answer a colleague needed to solve a problem—but finding the right person to ask was a frequent challenge.

Now, Swisscom's workers can pose questions via "Ask the Brain," an AI-powered solution from Starmind that identifies the relevant experts and automatically shares the inquiry.[4] More than half of questions are answered in less than two hours, and the knowledge of each employee is easily accessible to everyone else. People save the time they would have spent searching out the right expert, and instead spend that time putting the answers to use.

By incorporating its workers' needs into its technology strategy, Swisscom has taken a step toward unleashing the full potential of a next-generation workforce—one currently constrained by the very foundations on which it was built.

This challenge is not limited to a small subset of workers, nor is it restricted to knowledge workers alone. In every industry, technology is changing the way work is done. Workers in Amazon warehouses shifted into roles as robotics operators and technology overseers.[5] At Baker Hughes, field technicians wear augmented reality headsets to access both digital overlays of information and live expertise from off-site engineers in order to fix malfunctioning turbines.[6]



As companies continue to innovate and push into new areas of the market, they will necessarily create new jobs and new roles immersed in technology. Not only is every job today becoming a human+ role, but every new role that is created in the future will be human+ from the start.

In concert with this human+ shift, people are moving more rapidly between companies. The median years of tenure with a US wage or salary worker's current employer dropped from 4.6 in 2012 to 4.2 in 2016.[7] Among those between the ages of 25 and 34, the median tenure with one company is now less than *three* years.

Technology innovation combined with increasing employee velocity has created an ever-expanding number of potential paths for workers to explore. But that also means an increasing number of career paths for businesses to identify, manage, and support—and so far, companies have not kept up. Talent-finding strategies are out of sync with the capabilities of human+ workers, and investments in learning and reskilling are far short of where they need to be for the high rate of employee transitions to different roles or companies. Knowledge management and access strategies haven't kept pace either: more information is available than ever for both workers and organizations, but it has become harder to find as people move fluidly between roles.

The bottom line for companies? Adapt the technology strategies that successfully created this next-generation worker to empower them even further. Through AI, extended reality (XR) and sentiment analysis, companies can propel their workforce forward, blazing a trail for the company's continued growth.

The human+ worker will build the pathway to the next big wave of innovation. How will your technology strategy empower them to get you there?

# OPTIMIZING THE WORKFORCE MIX

**The speed and constantly changing nature of human+ career journeys are making it harder for companies to add specific skills to their workforce through traditional hiring approaches. Top candidates are off the job market within 10 days, and a slow hiring process can lead to a new employee whose primary skills are no longer a good match by the time a role is filled.[8]**

And, of course, with the rapid pace of technological change, it is a challenge to know which skills to target in the first place. Companies' needed technology skills are in constant flux, yet most still approach talent-finding as they did in the era of stable career paths. But savvy businesses are finding new ways to balance their workforce mix, both externally and internally.

Outwardly, companies are rethinking the way they hire, using technology to assess candidates based on capabilities and potential—an approach that is better suited to the adaptability of the human+ worker. Leaders are already using this as an advantage, moving away from solely reactive skills-based hiring and looking toward an optimized mix of people.

Unilever has revamped its entry-level hiring process with this in mind. Interested candidates begin with a screening process that includes a series of short games, designed to assess a person's potential fit based on traits like memory, acceptance of risk, and whether the person is more likely to read contextual or emotional cues.[9] An AI-based tool reviews the results, eschewing traditional résumé-based evaluation in favor of optimizing for potential. There's no "wrong" result; the trait profiles help Unilever better match candidates to open roles.

Following an initial effort in North America, Unilever saw its applications-to-jobs numbers double within the first 90 days, and the average time to hire a candidate drop from four months to four weeks. It also saw higher acceptance rates for offers and a major increase in diversity among new joiners. After one year, the number of universities represented among entry-level Unilever hires increased from 840 to 2,600. The company later expanded the hiring approach and program to 68 countries.

Tech-driven solutions also allow for increasingly powerful passive recruitment. Cloudflare and Medium have adopted this approach with Aevy, which offers an AI tool that crawls the web to identify good candidates for developer positions, analyzing people's work and interactions on GitHub, Stack Overflow, and other respected code repositories and developer forums.[10] Aevy bases its recommendations not only on the code that developers write, but also on variables like passion, teamwork, and the effort they put into staying current with their skills.

In the war for talent, leaders are recognizing that the most important thing about employees is not where they come from, but how far they can go.

Internally, companies can adapt their technology strategies to seek out the untapped talent in their internal human+ workers as well. Businesses have long sought to hire and promote from within, both to maintain institutional knowledge and to avoid the time and expense of an external search. But the methods used for internal sourcing pre-date the technology innovations that have made today's workforce so mobile and capable in the first place.

Instead, organizations are turning to new solutions that can draw upon a wealth of workforce data streams, not just self-reported skills and experience. As part of its talent transformation, Accenture debuted its "specialization at scale" program: with 469,000 employees, the company needed a robust and agile way to ensure that the right team, with the right skills, is ready at the right time to spark innovation. Rather than having employees self-report on skills, artificial intelligence infers an employee's skills and specializations. In pilot programs, employees confirmed that this new analytics engine identified their specializations correctly 93 percent of the time.[11]

In such programs, transparency is key. Accenture employees receive information about how their specialization was derived, how the algorithms work and how to immediately update their specialization if they disagree. Areas of specialization, learning opportunities and advancement are also part of ongoing, real-time conversations that people have with career counselors, helping them to remain relevant.

Used responsibly, workforce data can unlock people's potential and drive greater value for individuals and the business.[12]

By adapting their technology strategies, companies can identify strong internal candidates for open roles, and later, match employees with the training needed to prepare for a role switch. Most importantly, leaders can begin to offer employees a consistent experience from the time they join the company all the way through their career—knowing individual workers' skillsets and goals, while helping them to better connect with internal opportunities and resources.

To learn more about using workforce data responsibly to elevate trust and unlock value, see Accenture's report "Decoding Organizational DNA: Trust, Data and Unlocking Value in the Digital Workplace." www.accenture.com/workforcedata

# APPLYING TECHNOLOGY TO COMPENSATION AND SALARY NEGOTIATION

As organizations evolve their strategies for recruitment and hiring, they must also review their approach to compensation. Even as work becomes more democratized and career journeys more fluid, challenges like gender pay gaps persist. Numerous studies demonstrate that these pay gaps begin before a candidate even interviews for a job, with gender bias in job postings. AI-driven tools can help identify and correct biases related to gender, race, disabilities or age, beginning to even the playing field.

The mobility of human+ workers requires a new approach to salary negotiation throughout career journeys as well. Before the digital revolution, workers might only change jobs a few times in a career and were less likely to cross between industries or areas of expertise. That stability and familiarity with a specific area would give them a reasonable idea of fair compensation for their current skills and potential.

Now, with workers constantly evolving their skills and moving rapidly between roles, ensuring that compensation is fair and consistently negotiated is essential. Companies can offer tech-driven pay equity awareness, comparing proposed wages against industry averages, so that both applicants and hiring managers have visibility into any potential discrepancies.

# TRAINING AND ENGAGEMENT

In an era of high employee velocity and constantly shifting skills needs, training and continuous learning are more important than ever. Seventy-eight percent of business and IT executives agree that increasing employee velocity has increased the need for reskilling in their organization. To lead in the human+ era, companies must invest in their workforces through learning and reskilling strategies that prepare employees for changing roles.

The good news? Human+ workers are willing and able to learn and adopt new tools quickly. The bad: typical organizational training approaches limit resources to employees who have been approved for certain learning opportunities to fill a specific enterprise need. Even with workers overwhelmingly reporting that they require new job skills to remain relevant, just 30 percent of non-freelancers report participating in skills-related training in the past six months.[13] Compare that with more than 40 percent of millennials who rank learning and development second only to salary as the most important benefit in deciding where to work, and companies are headed for trouble.[14]

Rather than limiting their powerful human+ workers to only the skills they need today, leaders are investing in learning platforms and strategies that better prepare workers—and the company—for tomorrow. PayPal partnered with Udemy to offer on-demand, self-directed video learning to its employees.[15] Not only does the partnership offer immediate learning opportunities, it also provides PayPal with better insight into the skills its workers want to target and how best to meet those needs. As employees browse through and engage with Udemy's curated videos, PayPal gets in-depth, backend analytics about which topics get the most interest and which materials are most successful.

Going into 2018, Telenor Group wanted to foster a culture of continuous learning and skills transformation. Employees were challenged to devote 40 working hours to self-learning during the year, splitting their time between the company's digital learning portal—which features courses from providers like LinkedIn and Coursera—and other opportunities including classroom courses and on-the-job training. At the end of the year, the company found that employees had not only met the challenge but far exceeded it, nearly doubling the time spent on online courses alone. They've renewed the challenge for 2019.[16]

By incorporating training and learning needs into their technology strategies, leading businesses are matching human+ capabilities and potential with both current *and* future enterprise skills needs. What's more, this approach drives engagement, ensuring that people have continuous access to opportunities for learning and growth. Companies should pay special attention to immersive learning, where extended reality (XR) technologies are creating myriad new opportunities, and artificial intelligence enables new levels of personalization.

This XR approach can also bridge the gap between the company and the human+ worker in terms of day-to-day management and engagement strategies. Augmented and virtual reality have made remote work possible in positions like design and analysis; BMW is now using VR during the development stages of new vehicles, such that workers can design new cars from anywhere.[17] Companies can use these technologies to provide connected face-to-face time for their increasingly distributed workforces, improving human touchpoints.

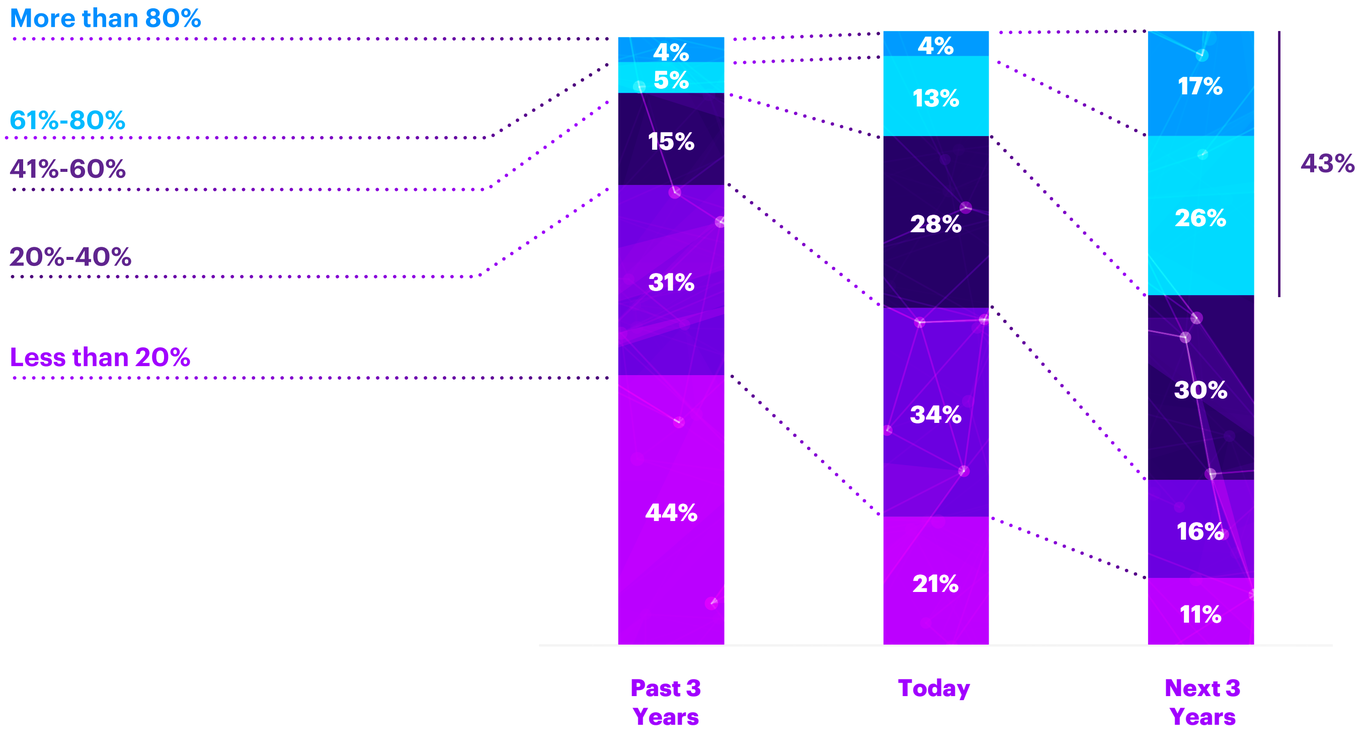
Another option to pinpoint areas where employee engagement is needed is to use machine learning solutions that provide a more frequent and granular read on employee satisfaction. Traditional methods for measuring engagement are based on roles that progress slowly over time; a once-a-year survey can't capture the real-time insights required to power a digitally mature workforce.

FICO, a credit scoring service, found that annual surveys and the added delays of waiting for results left the company with obsolete employee engagement data. The business switched to smaller, ongoing "pulse surveys" to gauge satisfaction—automated and analyzed with AI to provide fluid insights.[18] Using this approach, FICO saw an 11 percent increase in worker engagement and a reduction in unwanted attrition for five consecutive quarters.

Companies can also adapt a technology strategy used for customer engagement to fit workforce needs: passive and real-time measures of engagement via sentiment analysis. Applying machine learning to email or chat content makes it possible for the business to more quickly act on employee pain points or frustrations, without having to wait for the next survey or active measure of engagement.[19,20] (Companies must use care to be transparent, however, about information collected in this way, given the level of in-depth monitoring required to generate useful insights.)

By gathering workforce engagement data at a speed that matches the rate of employee velocity, companies can better manage attrition and identify opportunities to engage their workforce. Once again, some of the innovative technologies that have helped to evolve the nature of work itself can also be used to power it.

## 43 percent of business and IT executives report more than 60 percent of their workforce will move into new roles within three years requiring substantial reskilling within their organizations due to the impact of technology.




Percentage of workforce that global business and IT executives report have moved or will move into new roles requiring substantial reskilling within their organizations due to the impact of technology.

# ENABLING FLUID KNOWLEDGE FLOW

**As human+ workers continue to move more rapidly throughout and across organizations, companies must address the reality of increasingly distributed knowledge. Both the workforce and the organization as a whole rely on quick access to information to be agile and efficient. But current knowledge management strategies rely on workers themselves to act as stable sources of institutional and industry knowledge—and the high velocity of the human+ worker defies that approach.**

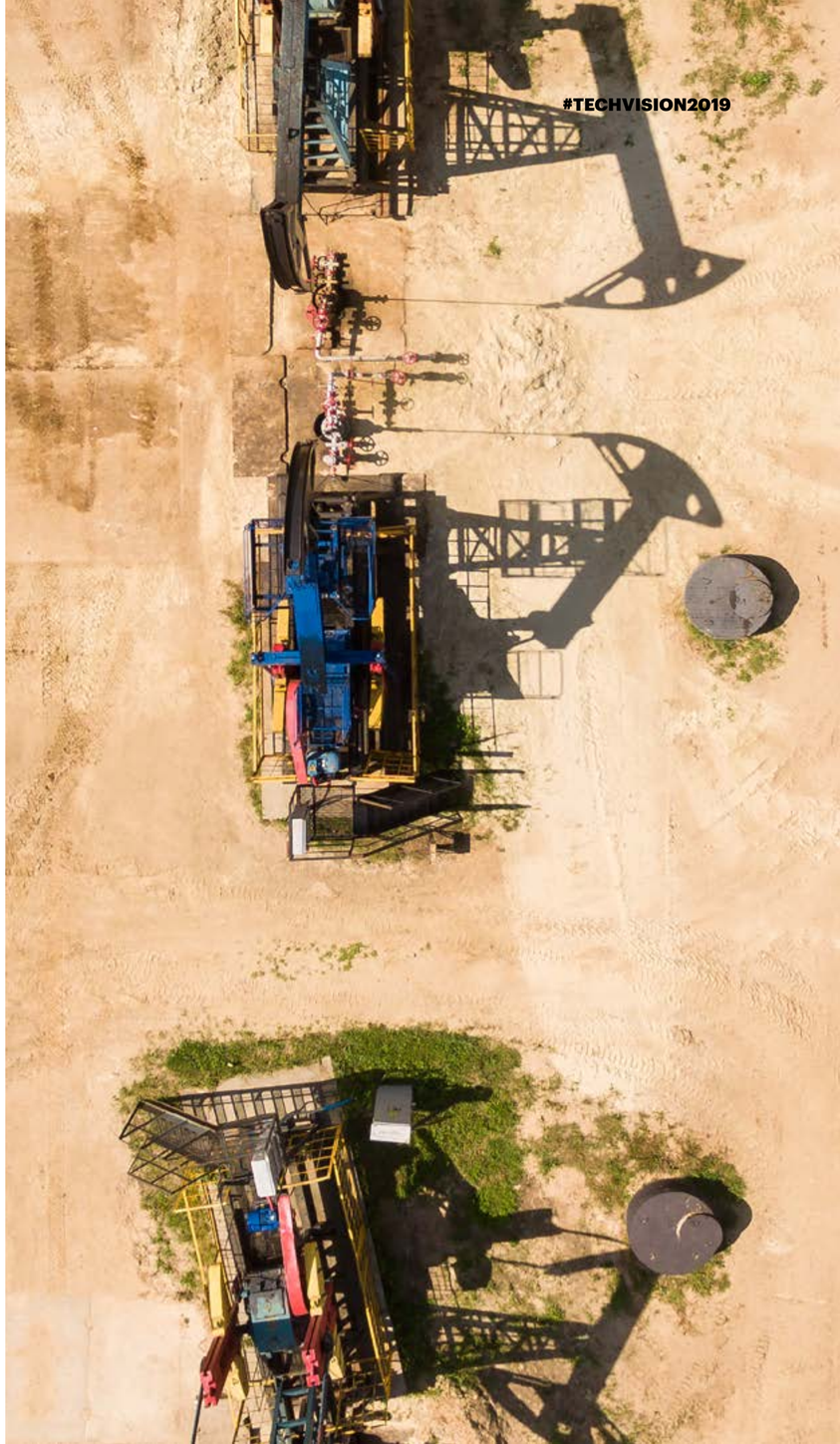
It is time for technology strategies that bring knowledge management into the human+ era. With the right approach, companies can redefine the phrase "institutional knowledge," making it a true responsibility of the organization itself.

A major oil and gas company was losing critical industry knowledge as its corrosion engineers reached retirement. Even in the case of planned departures, with time available to capture the necessary knowledge, the company struggled to record and disseminate the workers' insights. In response, the organization adopted a knowledge platform with natural language processing capabilities, indexing unstructured data sources like refinery incident reports to collect knowledge and insights from workers.[21] The platform aggregates the information into a single location, making it available to all of the company's corrosion engineers.

Another leading oil and gas company has gone a step further, incorporating knowledge graphs to gather dynamic information about oil well design and operation. Developed by Accenture Labs, the system automatically scans data and extracts information on components, the supply chain, compliance questions, and the company's workers. The knowledge graph models a human expert's knowledge, which the system automatically updates through a combination of AI and natural language processing.

The company's knowledge graph approach allows the AI system to reason about expected performance or understand how and why components fail. The system not only captures current knowledge but gives workers a powerful way to examine larger insights. The company itself is becoming a learning organization through its technology.

In conjunction with expert-finding solutions like Swisscom's "Ask the Brain," companies can incorporate these new approaches to organizational knowledge to get back in sync with the capabilities of their human+ workers. Enabling employees to query quickly both their colleagues and the company's technologies not only *empowers* the human+ worker, it adds yet another piece to the plus.



# EQUALIZING THE INVESTMENT

**Becoming human+ has expanded the capabilities of the workforce beyond what companies could have imagined just a few decades ago. It is one of the biggest wins from the era of digital transformation: organizations can draw on a workforce with a constantly evolving set of capabilities, comprised of employees who can more readily adapt to new roles and needs. But supporting and engaging that workforce requires companies to commit to a level of workforce investment that's on par with the one in technology.**

New investments in training and reskilling will better prepare workers for changing roles. Innovations in AI and XR, coupled with integrated learning platforms, will empower workers to participate in self-directed learning, while also giving businesses better insight into the needs and goals of their workforce. Along with new approaches to talent-finding and knowledge management, these changes will let companies capture the full potential of their human+ workers.

Through the innovative technologies they've used to drive new products and services, companies will find new heights of success: empowering the human+ worker will drive the organization into the post-digital era.

# DECISION POINTS

## 1 What areas of your business have the biggest digital divide between the company and your human+ workforce?

- Identify business practices that are still optimized for pre-digital workers. These could include your knowledge management strategies, employee learning opportunities, or talent-finding and hiring practices. Make a priority list based on areas where the divide is creating the largest pain points and missed opportunities. These may include attrition, difficulty meeting talent goals, or low employee engagement.
- Select one or more areas for pilot programs that explore how AI, sentiment analysis, and extended reality can help close these gaps. For those already completing pilot programs, select a key focus area in which to industrialize successful efforts.

## 2 With in-demand technology skills constantly changing, is your approach to talent-finding and acquisition ready for the post-digital era?

- Review your current approach to talent forecasting. Identify areas of the business where talent gaps have persisted or grown. For the areas with the largest talent gaps, rethink hiring methods. Select one or more areas for pilot programs that focus on employees who will grow with the company, even as roles change. Rather than “reactive” and skills-based hiring, look for ways to assess candidates by their capabilities and potential.
- Identify areas of the business where AI tools can assist in finding talent. These tools can offer value for both internal and external talent-finding; you may wish to begin by prioritizing one of these for initial experiments and pilots.

# DECISION POINTS

## 3 How are you industrializing workers' transitions between roles, and enabling them with the skills they need to succeed?

- Does your company keep track of the roles employees are working toward in their career?
- Critically examine your company culture as it relates to training. Does it encourage self-directed learning? Do company processes and policies back this up? (For example, are workers allotted time for training/learning, or are they expected to pursue learning on their own time?)
- Create a training plan that supports frequent transitions between roles. This should include both open access to on-demand training and (where applicable) opportunities for XR-driven experiential learning.
- Regularly evaluate your training practices by surveying employee opinion: do employees feel that they have the resources and support needed to learn new skills? Look for ways to use machine learning solutions to gauge employee sentiment on an ongoing basis. Create an open dialogue to ensure transparency about what is collected and how it's being used.

## 4 Can your knowledge management strategy withstand high employee turnover?

- Consider how much your company's store of institutional and industry knowledge relies on individual workers. If high employee velocity could mean losing valuable information, it's time to revamp your company's approach to knowledge management.
- Explore platforms that use natural language processing to collect and store information from workers, and knowledge graph solutions that can gather information in a way that models a human expert's knowledge and share it back.

TREND 4

# SECURE US TO SECURE ME

## Enterprises are not victims, they're vectors

**In October 2018, JPMorgan Chase, Mastercard, Fidelity, and other global payment firms participated in the first joint cybersecurity exercise meant to test operational preparedness during simultaneous attacks of payment systems.[1] Through the process, the companies found they have very different approaches on how to respond to threats, when to engage law enforcement, and even hold varying definitions of what constitutes a breach. Critically, though, the exercise allowed the firms to uncover ways they could better coordinate responses and dramatically improved their ability to respond to threats.**

This cooperative effort is just one example of how companies are evolving to become more resilient against the new reality of cyberthreats. Today's ecosystem-dependent business world amplifies exponentially the impact of cyberattacks: incidents that cripple one enterprise can grow rapidly and expand to threaten a company's ecosystem, industry, and beyond. Interconnectedness increases companies' exposure to risks, and leading businesses are recognizing that while they already collaborate to deliver best-in-class products, services, and experiences, it is high time security joins that effort as well.

The level of risk has been rising for some time. Enterprises have been building vast interconnected ecosystems, but only 29 percent of business and IT executives report that they know that their ecosystem partners are working diligently, like they are, to be compliant and resilient with regard to security. Here, "weakest link" takes on a new importance: liability. Now these linkages are being exploited by attackers—both criminal and state actors alike—to catastrophic effect.

In connected ecosystems, such attacks can reach unprecedented scale. The WannaCry cryptoworm did not stop at ransoming the data of individual businesses, but exploited an operating system vulnerability to spread across the globe, infecting 300,000 computers spanning 150 countries in a matter of days.[2,3,4] The Mirai malware was used to hijack more than 100,000 Internet of Things (IoT) devices and launch an attack on a domain registration services provider in 2016; since then, even though its original developers were caught, new variants have emerged.[5] One such variant, Satori, spread to 100,000 home routers in 12 hours.[6]

Threat actors also exploit ecosystems that were designed to amplify the reach of information, such as social networks. And it has been done to great success: researchers from MIT found that attackers have been able to spread fake news faster than real news, with the top one percent of fake news stories reaching 1,500 people six times faster than real stories.[7]

But scale is not the only way digital ecosystems are amplifying cyberattacks. With the business world dependent on ecosystem connections, even the smallest disruption to one service can cascade to have a massive business impact on other partners. And while risk management activities are largely focused on a company's internal operations, attackers are looking at the whole house of cards.

For example, for more than five years, a group of hackers stole insider information about publicly traded companies—not by attacking the companies themselves, but by targeting the newswire agencies that get early access to press releases from the world's largest businesses. Unscrupulous stock traders created "shopping lists" of companies whose press releases the hackers would target and gave the hackers a cut of the ill-gotten profits from trading off the stolen information.[8]

And as more of the physical world is controlled by digital devices, the risk and potentially dangerous impact grows. Researchers at Ben Gurion University demonstrated that attackers could drain a city's water tower without a direct attack on its critical infrastructure—by instead exploiting vulnerable IoT irrigation systems, forcing them to overdraw from city reserves.[9]

These examples reflect the harsh new reality of business: as companies find rich opportunity in working with whole ecosystems, they are simultaneously extending, and absorbing, the risk and vulnerabilities of those partners as well. Threat actors see ecosystems as an ever-widening attack surface, while most businesses still look at cybersecurity as strictly an individual effort. To respond to this dichotomy, organizations need to amend their approach, incorporating security into the collaborative strategies they have used to create powerful and innovative products and services. They must include growing ecosystem dependencies as part of their own security posture and make security a cardinal component of how they build partnerships. Both are a must for security in a post-digital world.

Doing so means shifting away from the "my company first" mindset and recognizing that today's emerging threats demand a cooperative effort. Enterprises will need to expand the horizons of their risk assessment and threat modeling to account for a much wider threat landscape. They must spread and share responsibility for security, starting in their own organization—and begin building security partnerships that reflect the ecosystems in which they participate. Security in an ecosystem-driven world is no longer about protecting the organization—it is about protecting everyone.

# REFRAMING RISK AROUND THE ECOSYSTEM

**If enterprises hope to collaborate on security across their ecosystem, the first step is reframing their understanding of threats and the subsequent risk those threats pose. In a recent Accenture survey, 71 percent of IT and business executives felt that cyberattacks were a "black box" and did not know how they would affect the organization.[10] If leaders cannot assess the impact of an attack on their own organization, how will they understand the risk posed to their ecosystem partners—or the risks they are accepting through those partnerships?**

Addressing this knowledge gap is paramount. Leaders must develop an organizational competency for evaluating the cyberthreats they and their ecosystem face. The most resilient companies will be those that best understand, prioritize, and remediate not only the threats they face, but also those challenging their ecosystem, while recognizing the business impacts those vulnerabilities pose to partners.

One way enterprise leaders can better understand the risk they and their ecosystems face is by expanding their approach to threat modeling. Many companies practice threat modeling today, mapping out potential threat actors, vulnerabilities, and vectors of attack, then linking those to the business risk each possibility presents. Yet few, if any, are modeling through the lens of their entire ecosystem.

Consider how Strava, a fitness app, had to suspend services after it was discovered that the app's anonymized activity map was inadvertently uncovering classified US military sites as soldiers tracked their workouts.[11] The data did not present significant risk to Strava or any privacy risk to individuals, as it was aggregated and not personally identifying. But it was this very aggregation, coupled with free access to the information, that generated substantial risk for a subset of the company's customer base—and, in fact, for a large group of *non*-Strava users as well.

Threat modeling across an entire ecosystem lets organizations put themselves in someone else's shoes, whether that is an attacker or a partner. Doing so improves both threat intelligence and understanding of risk exposure—and strengthens their resilience. It enables companies to identify critical dependencies that demand immediate hardening, or vulnerabilities that represent potential damage to a partner.

Enterprises can learn lessons from the newly established New York City Cyber Command, a government agency tasked with defending the city's information infrastructure. The group worked with researchers from Wake Forest University and the University of Maryland to establish a threat modeling procedure for the unit. Within 30 days, the participants developed 147 unique mitigation strategies, more than 60 percent of which were new to the agency. Within four months, the agency implemented these strategies to prevent more than 500 unique intrusion attempts, thwart privileged account hijackings, and close web server vulnerabilities.[12]

Threat modeling will help companies expose and understand immediate enterprise and ecosystem risk. But businesses do not stand still—and neither does risk. Ecosystem partners are changing constantly, bringing with them new business ambitions, priorities, and operational maturity—yet assessing security risks is a step that is frequently bypassed when these business relationships change or grow. Only 38 percent of businesses report including the chief information security officer (CISO) when considering new business opportunities.[13] Even among those that do, most evaluations are only done annually; and few have any mechanism for integrating new partners' controls and alerting into the company's enterprise management.

To address these problems, companies are building new organizational mechanisms to ensure security is a dedicated part of any corporate strategy. GE has CISOs assigned to specific regions and business units, to help inform decision-making at a more granular level.[14] And AT&T established its Security Advisory Council, a board of cross-functional business and security leaders who meet regularly to discuss the most pressing issues facing the organization.[15]

In ecosystem-driven business, enterprises must understand the challenges faced by every participating company. Reframing risk to account for ecosystem relationships and proactively making security a part of business discussions will help companies begin to view their own business the way attackers do, leading to better preparation overall. But reconsidering what constitutes risks for the ecosystem is just the beginning. Security and IT operations teams can spend days fighting the wrong fires if they do not understand the business impact.

# DISTRIBUTING RESPONSIBILITY: SECURITY FROM THE INSIDE OUT

**It is no secret that security professionals are overworked. Today, most security teams only look at five percent of the alert flags they receive.[16,17] This isn't just a threat to the organization, but to the ecosystem as well. Businesses are already facing more vulnerabilities than they know what to do with; additional ecosystem challenges will only further burden security practitioners, inevitably leading to mistakes and oversights.**

To combat this ever-growing challenge, businesses will need to spread responsibility for and ownership of security throughout their organization, giving security teams the agility to address the biggest challenges. By being more strategic with how they position security internally, companies can make it a business enabler rather than a catch-all.

Take Xero, an accounting software company. Xero handles sensitive data from banks around the world, including Wells Fargo, HSBC, Barclays, and more.[18] To provide better security for itself and its clients, the company's security teams operate as service providers.[19] The groups maintain incident response teams that are always on call, ready to spring into action to address the most serious issues.[20] When not faced with immediate threats, the team helps develop cybersecurity guidelines for individual departments, allowing them to innovate unencumbered, but with appropriate safeguards in place.[21]

Ensuring that security is integrated into each part of the business is especially critical with emerging technology. As IT groups began eschewing the traditional waterfall approach, they turned to DevOps, the agile approach to code development where design, analysis, and testing are continuous processes. But DevOps without the right security tooling can result in bad code much faster. And while 27 percent of companies today test or analyze for security requirements throughout the entire development process, 59 percent of organizations still believe security inhibits DevOps agility.[22]

Embracing DevSecOps should be a priority for any company operating in an ecosystem-driven enterprise. The technology products and applications businesses build to enable partnerships can introduce a significant amount of risk. Addressing security early in the development lifecycle is 30 times cheaper than doing so in production and integrating security teams into DevOps teams allows for continuous improvements to security—transparently.[23] The approach gives developers the early feedback they need to be better stewards of good code.

# THE EXPANDING SECURITY TOOLBOX

A shortage of security skills has been a long-present challenge for businesses. But new tools are helping developers automate processes and allow testing to happen seamlessly. IBM built the Application Security Open Source Analyzer, a tool that allows developers to scan code automatically and identify open source packages containing vulnerabilities, while also providing remediation instructions.[24]

Similarly, after Amazon Web Services recognized that misconfigurations of Amazon Simple Storage Service (S3) buckets were the culprit behind a large number of data breaches, it released two new tools: Zelkova and Tiros.[25,26] These tools analyze security configurations, providing automated feedback to administrators on the risk of different set-ups for cloud-based applications.[27]

# BUILDING A MORE RESILIENT FUTURE

**In concert with their technology efforts, companies must also evolve their approach to governance as ecosystem-driven business expands. Ecosystems are inherently in flux; companies never know who they will be partnering with tomorrow—or whose vulnerabilities will be putting them at risk.**

To manage their risk in this ever-changing environment, companies will have to create governance models and policies specifically with these challenges in mind. One-off measures that are negotiated each time a new partner is introduced are inadequate; comprehensive models and policies must ensure that the partners and third parties joining the company's ecosystems adhere to the same standard of security—or higher—that they set for themselves.

To begin creating ecosystem-level standards and governance, enterprises should look not just to their partners, but also their broader industry to collaborate. Other companies, even competitors, are likely to be facing the same challenges, and have opportunities to build solutions that make it safer for every company to conduct business. Take the Vendor Security Alliance, a non-profit organization that will assess, qualify, and audit technology vendors based on a standardized set of security principles.[28] The founding partners of this organization were major technology companies like Uber, Square, Palantir, and others that all recognized they are drawing from the same well of vendors. Rather than each company needing to audit individually or blindly trust their vendors, the non-profit created

**87%**

**of business and IT executives believe that to be truly resilient, organizations must rethink their approach to security in a way that defends not just themselves, but their ecosystems.**

a rigid, consistent set of standards along with an auditing body to ensure a better foundation of security for the entire ecosystem.

It's a creative solution to a pressing challenge all businesses face as they work with an increasing number of partners. Across industries, just 39 percent of companies believe that the data exchanged with strategic partners or third parties are protected adequately by their cybersecurity strategy.[29] Companies must assess third parties not only on the merits of their business contributions, but also on their compliance with security policies and laws in an increasingly complex regulatory environment.

Siemens is helping move its entire ecosystem and industry players toward this reality with a Charter of Trust initiative that the company established in 2018.[30] Partners signing the charter agree to make commitments to a number of cybersecurity tenets. These include baking security into the design of products and technologies, collaboratively innovating on cybersecurity measures, providing transparency on incidents to all participants, and more. Ecosystem partners and competitors alike have already signed the agreement, including enterprises such as AES, Airbus, Deutsche Telekom, and Daimler.[31]

Beyond industry, enterprises must work more closely with governments as well. Governments have valuable cross-sector insight and enterprises are becoming the new front lines where both criminal and state-level attacks occur. Consider attacks like those faced by Sony Pictures, or more recently the NotPetya attacks that impacted Maersk and FedEx—all of which involved malware attributed to state-level actors.[32,33] Threats that seem criminal may be state-level in nature, underscoring the importance of businesses and governments addressing cybersecurity collaboratively.

Fortunately, there are already efforts underway to build these relationships. The US Department of Homeland Security set up the National Risk Management Center, a hub dedicated to creating cross-sector coordination in risk management strategies and improving crisis response for threats to critical infrastructure. The effort is aimed at ensuring that in the moment of a cyberattack, all parties involved know their role and the necessary actions to effectively respond to the threat.[34] Similarly, the European Union established the Cyber Rapid Response Force, a set of teams that pull in experts from across industries and borders to counter attacks that threaten both public and private sectors.[35]

Even without direct partners in mind, there are still ways to collaborate. Netflix is among those leading the open-source security charge, sharing internally developed security tools with the world since 2014.[36] The company's free software releases include tools for penetration testing, application-specific distributed denial of service (DDoS) simulation, end-user vulnerability remediation, and more.[37] Rather than keep these tools to itself, Netflix understood that a safer internet is a better place to do business.

As companies pursue and complete their digital journeys, they will find themselves operating in new and different ecosystems to chase innovative opportunities—and that means a constantly expanding attack surface for threats and vulnerabilities. If companies are going to join in the pursuit of shared business outcomes, they need to coordinate their efforts for resilience as well.

# A UNITED FRONT

**Cyberattacks are changing, and the implications for businesses are vast. It is time to bring the ecosystem into the security fold. Limiting a company's security efforts to only its own infrastructure is akin to barricading the door of a home under construction before all of the walls have been built.**

By widening their perspective, leaders will gain a better understanding of their real attack surface, and better prepare themselves for the ecosystem-driven threats that will only grow in the post-digital world. In the process, they'll differentiate themselves as trustworthy defenders, becoming more attractive partners for other businesses, governments, and consumers alike.

# DECISION POINTS

## 1 How has your company's exposure to risk changed in light of the push toward ecosystem-driven business?

- Look beyond your company's own infrastructure to identify areas where ecosystem connections could expose you to new vulnerabilities. Conversely, consider areas where your connections to other companies have changed *those* companies' exposure to risk.
- Develop a security strategy to continuously assess and address these vulnerabilities while ensuring the appropriate groups inside your organization are aware of these threats.

## 2 Is your company considering the security implications of business-driven ecosystem moves?

- As you look to form new business partnerships, position security as a cardinal component of those relationships. Take steps to ensure that ecosystem partners can meet your company's standards around security and are actively auditing their own practices.

# DECISION POINTS

## 3 How is your business reconsidering the relationship between DevOps and security?

- If you are not already integrating security teams into your DevOps teams, explore ways to support such integrations and enable continuous improvements to security.

## 4 How could your business participate in security alliances and other ecosystem ventures around cybersecurity standards and governance models?

- Seek out industry partners as well as competitors to find common goals for addressing security challenges. Perform a security audit of your vendors and provide relevant findings to ecosystem or industry partners who are also using those vendors' services. If applicable, open source the security tools your business has developed to get input from a larger community and make these protections more broadly available to others.

# TREND 5
# MY MARKETS

## Meet consumers' needs at the speed of now

**With companies, workforces, consumers, and industries now inextricably connected, being digital is no longer enough for a business to differentiate itself. But it does give organizations a foothold for their next big opportunity: capturing moments.**

Paper Boat, a beverage brand operating in India, uses hyper-customization as a key driver of market growth. Its main product is buttermilk soft drinks, but unlike other beverage companies that work hard to drive consistency, the drink tastes different depending on where it is sold.[1] Paper Boat infuses regional flavors like curry leaves, green chili, or ginger that better reflect local tastes—even going so far as to use localized mango varietals to ensure customers in every region are delighted. No opportunity is too small or too fleeting; the company also completes small runs of seasonal beverages to celebrate regional holidays. One such drink —Panakam—is sold for only three days a year.

**85 percent**

**of executives agree the integration of customization and real/near time delivery is the next big wave of competitive advantage.**

Technology is at the backbone of how Paper Boat executes these granular strategies. The company solicits localized feedback from customers by surveying them on WhatsApp, using the aggregated data to continuously gain new insight with a proprietary analytics platform. Its factory, fully equipped with Internet of Things (IoT) sensors, is extremely flexible: changing recipes takes at most two to three minutes, is transacted through computers, and even factors in external variables like weather and air pressure to ensure the finished beverage tastes exactly as intended.

A company like Paper Boat offers a glimpse of how leaders will capture the opportunity of individual moments. As people's lives become more and more personalized through technology, creating a world with a multiverse of realities and moments, companies must reinvent their organizations to capture those opportunities as they come. That means viewing each moment as if it is an individual market—a momentary market.

With direct digital access to customers and increasingly powerful analytics capabilities, companies can understand their current and potential markets better than ever before. And with sophisticated backend technology that can reorient the business quickly, they can deliver for those markets faster than ever before. Put those capabilities together and every moment is a chance to deliver a new product or service designed not just for a specific customer, but for their needs at a specific point in time.

Mastering momentary markets will be both an art and a science. Delivering for *every* moment is impractical and unnecessary; the art lies in picking the right opportunities to be both effective and welcomed by consumers. The science is in building a company that can create context-aware, customized products and services on demand.

Leading businesses are already preparing for a future of living in the moment, on both sides of the equation.

Take General Motors. The company installed a 3D printer in one of its manufacturing plants, allowing assembly line workers to print replacements for broken tools on-site the moment they need them.[2] This lowered the cost for replacing tools significantly—one commonly-used tool cost $3,000 to buy but just $3 to 3D print—and kept lines moving.

For consumers, Zume Pizza rises to moments of opportunity through an app that forwards custom orders directly to an assembly line of pizza-making robots.[3] The machines roll dough, add sauce, and cook the pie, letting the company deliver just what the customer wants up to 20 minutes faster than competitors.

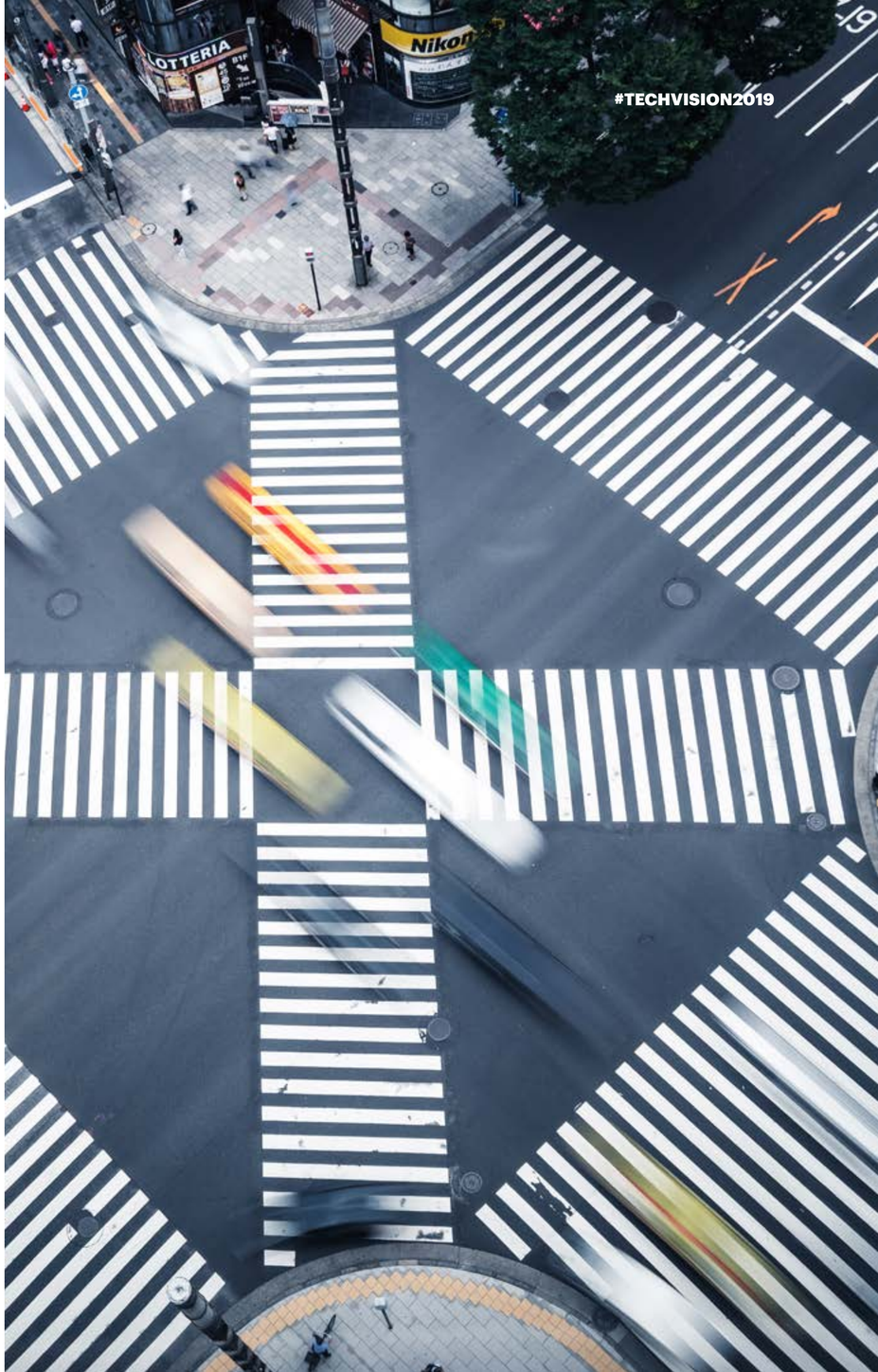
These pushes toward momentary markets are the natural evolution of a digitally maturing world. When businesses and consumers increasingly turned to online interactions, on-demand services and customizable products became cheaper and easier to execute. Netflix and Spotify brought entertainment out of stores and directly into people's homes; Google and Facebook introduced targeted and personalized advertising; Salesforce, Amazon, Microsoft, Google, and others offered customizable software and on-demand storage and compute power.

Exposed to this level of convenience, immediacy, and intimacy, it is no surprise that people now expect this level of service from every company. Searches for "same-day shipping" have grown 120 percent since 2015, and there are high expectations around personalization as well, with 71 percent of consumers expressing frustration when shopping experiences are impersonal.[4,5] B2B expectations have also grown: in a recent study by Salesforce, business partners overwhelmingly said that understanding their needs and the way they use products and services is key to winning their business.[6]

Miss the moment, and there is no second chance. When unsatisfied, 76 percent of customers believe it is easier than ever to simply take their business elsewhere. But opportunity awaits the businesses that are prepared to capture the moments when they come.

Companies that weave a technology strategy to meet and even exceed these growing customer expectations will find themselves far ahead of the competition—and ready for a post-digital future. Their ability to remain continuously relevant—a living business in the face of constantly changing customer, partner, or employee needs—will set them apart in a way that was not possible before.[7]

Many have already invested in the tools it will take: AI will help predict trends and preferences; digital twins and agile manufacturing will provide granular context and the capacity to rapidly prototype, experiment, and deliver. Your competition may be well on its way to unlocking momentary markets. Are you?



# FINDING THE MOMENTS

**Before companies can deliver for a given moment, they have to know that the opportunity exists. That means identifying customer needs before their competitors do—and potentially before customers themselves do.**

Companies already do demand planning and forecasting on a large scale. But with momentary markets, forecasts and predictive models won't be limited to long-range planning or major trends; they will be used for everything to anticipate key opportunities.

In the short term, there are still gains to be made by improving existing forecasting techniques. Take grocery stores, where forecasting errors range from 40-60 percent and lead to spoiled goods and unsold stock.[8] In an effort to curb those errors, Walmart is deploying robots in some stores to traverse aisles and record stock information.[9] But given the amount of data enterprises have access to today, their anticipation of future needs is not as good as it can be—and certainly not good enough for the markets of tomorrow.

To anticipate moments of opportunity, companies must dramatically improve the granularity of their forecasting, and the first step is turning to AI.

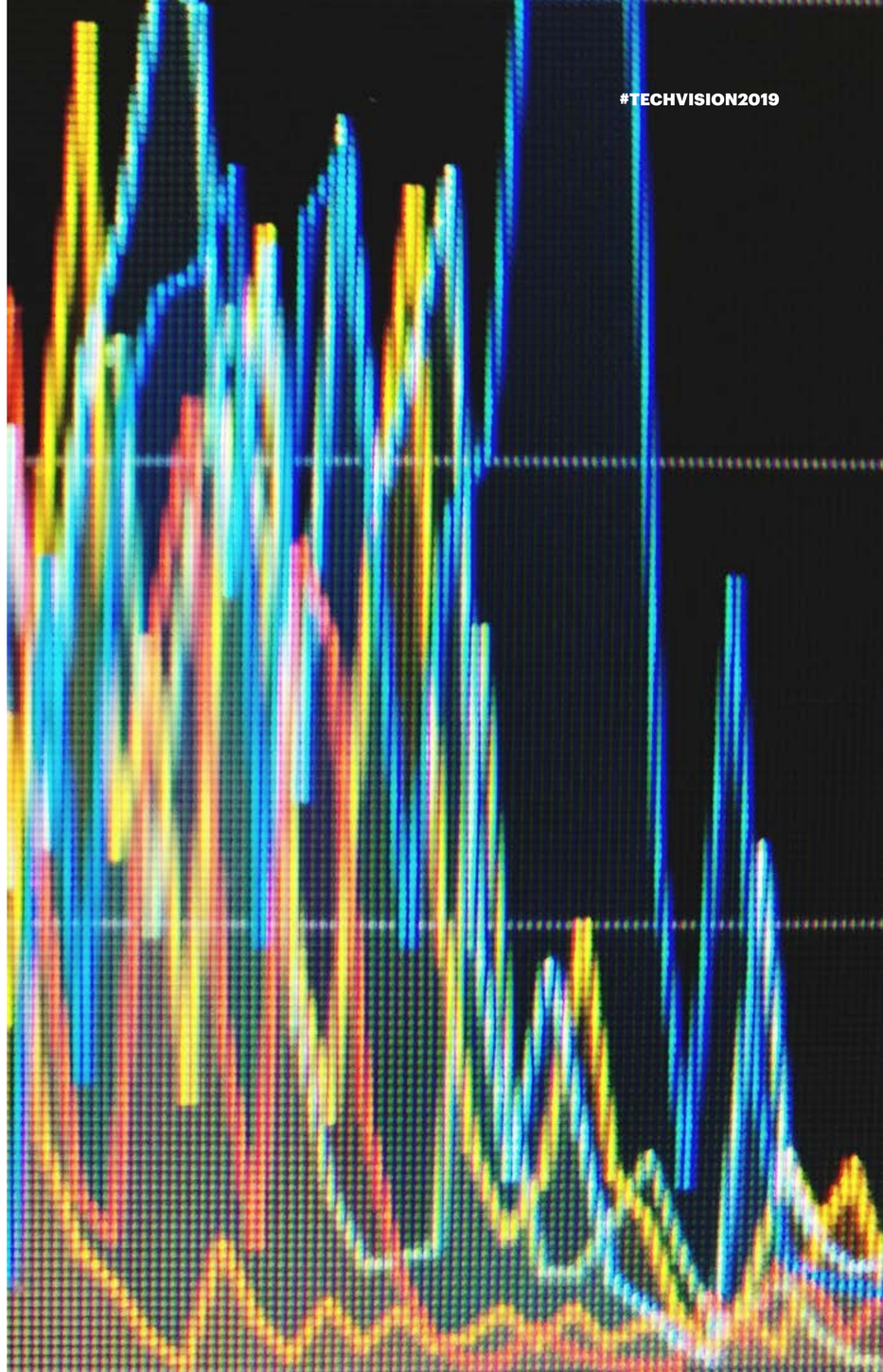
It is not a question of collecting more data; companies already have information about supply chains, customer sentiment, stock, transit times, and even the weather. The challenge? No team can tackle this deluge of information alone.

The German pharmaceutical company Merck KGaA deployed sensors on factory machines and in warehouses throughout its supply chain, providing a real-time view of operations down to the individual stock-keeping unit (SKU).[10] Using this data, and other data from its ERP software, the company applied machine learning techniques and generated demand models that outperformed its previous models 80 percent of the time.

And AI-based forecasting is not limited to future demand. Improving the granularity of forecasting lets businesses capitalize on immediate moments, too. Infinera, a telecom equipment provider, used to take up to 36 hours to provide accurate quotes on prices and inventory availability. The delay gave customers the opportunity to find competing quotes, lose interest, or otherwise move on from Infinera's business. By using an AI platform to integrate inventory, scheduling, and pricing data, the company created dynamic real-time insight into order availability. Now its sales teams can quote prices instantly with more accurate delivery windows, improving customer conversion and satisfaction.[11,12]

With granular demand forecasting in place to anticipate and capture opportune moments, companies can optimize their existing business and product models. Looking further, the next phase of projection is getting ahead of larger trends, to see where the business needs to be in the future.

Google already has a "trend spotting" division dedicated to exactly this. The internet giant leverages its search data to identify trends before they emerge and shares findings with different industries.[13] In another case, to identify the most fashion-forward of the crowd, New Balance filmed people as they walked in the city during New York City's fashion week; the company used Google's TensorFlow machine learning framework to analyze outfits and find the individuals with the most exceptional style.[14] Thus far, these types of pilots are still limited in scale, but are poised to influence rapidly businesses' operating models and strategic planning.



# ADAPT TO THE MOMENT

**Identifying moments of opportunity is just the first step. The other piece of the puzzle is being able to compete for those moments when they come.**

To do that, businesses must deliver precisely *what* people want with increasingly specific personalization for the circumstances of the moment. Leaders are already going far beyond basic customization, individually tailoring products and services to the needs at hand.

Look at the retail industry where people expect their digital presence to follow them into the physical store. Sam's Club, the warehouse club owned by Walmart, first introduced a "Scan & Go" app two years ago, letting customers scan items as they place them in a cart and bypass the traditional checkout line. Now Sam's Club has adapted the app to drive an interactive shopping experience, incorporating a customer's past purchase data and machine learning to create smart shopping lists.[15] Moving forward, the company is looking to combine this tailored experience with beacon technology to suggest optimal routes through the store.

Other individualization happens even closer to home. Lifebeam's Vi, described as the first "personal personal trainer," delivers customized coaching in real time. Based on an athlete's individual goals and in-the-moment metrics like heart rate and

cadence, Vi can play music at a beat that matches the step rate a runner should try to hit, or advise her to take shorter steps to reduce the strain on her knees.[16] Some companies have even achieved customization of physical products in the consumer's hands—or their ears. After customers first put on Revols earphones, they use a paired app to trigger an in-the-ear molding process.[17] The earphones transform from an initial gel-like state into a permanent, personalized shape for the listener in 60 seconds.

With expectations around personalization growing and new moments of opportunity appearing every day, companies must build the agility to adapt for individual moments at scale. That begins with agile manufacturing methodology.

Bosch Rexroth has already started introducing these capabilities in more than 100 factories. The company's automatic production assistants are single-arm robots that can manage complex tasks like assembling and welding. The robots are also highly reconfigurable. When product demands on its Homburg factory changed, the existing line was modified over a single weekend.[18] Simultaneously, Bosch Rexroth is working to enable flexibility and adaptability for its human employees. Workstations called "ActiveAssist" are equipped with cameras, projectors, and touch screens to display context-relevant information for each employee, providing specific instructions, visual cues, and error correction during the assembly process of an individual part.[19]

These are early efforts in an ongoing transformation. With an additional suite of technology—including sensors, IoT gateways, and data platforms—Bosch Rexroth is building its vision of the "factory of the future," where the entire assembly line will support product-oriented design, customization, and dynamically scalable product runs to react in a moment to shifting customer needs. Agile manufacturing lets companies deliver highly personalized products and services before the moment of opportunity is gone.

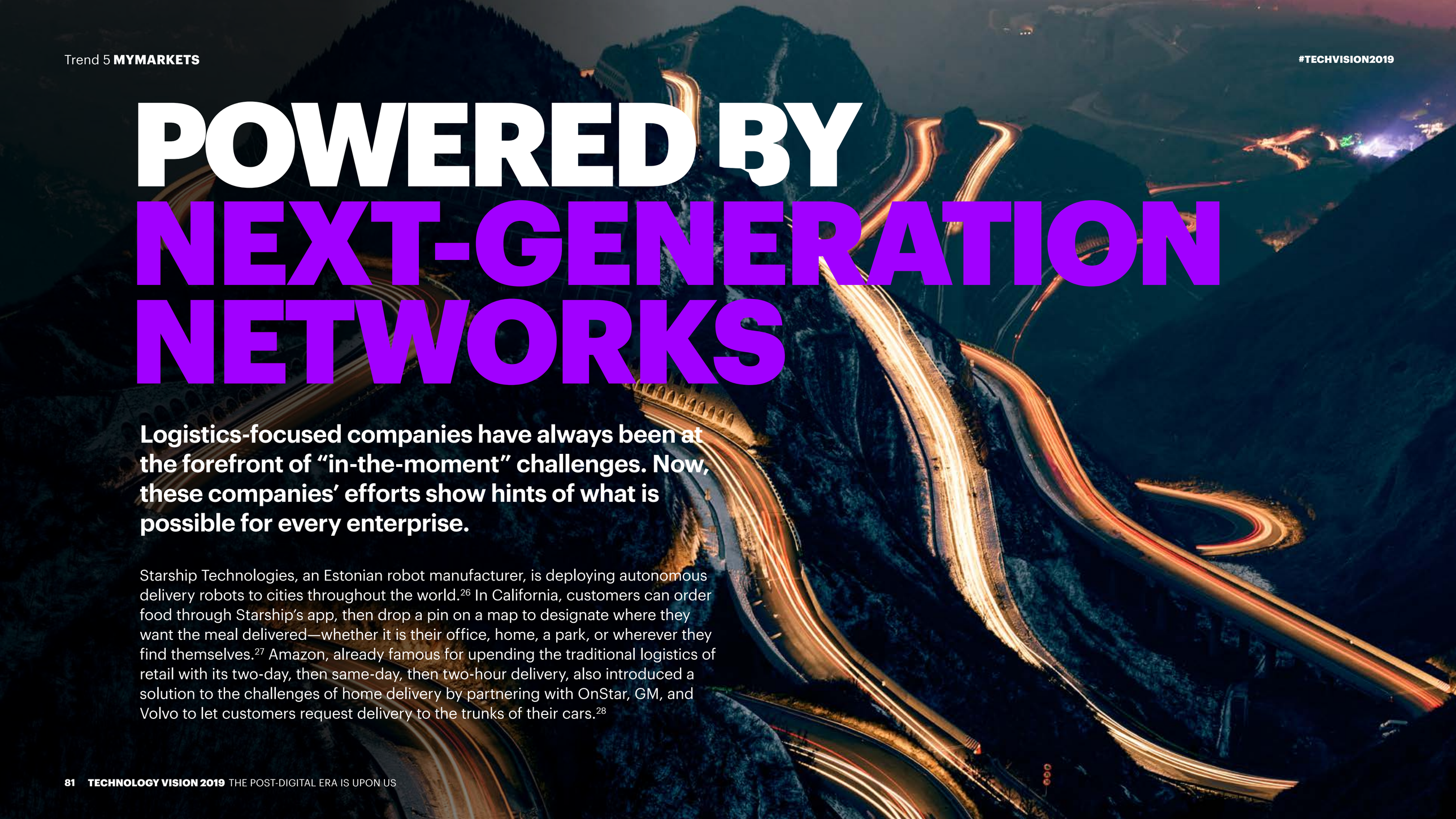
Underpinning this and other transitions to capture momentary markets are the insights made possible through digital twins. These are digital models of equipment, machines and a variety of other items that exist—or could exist—in the physical world, built on real-time sensor data and contextual information like service schedules, operating runtimes, and weather data.[20,21] By adopting digital twins, companies can retain a granular digital model of their products, operations, and more. These twins can be used to monitor, analyze, and simulate plans or potential actions.

It is easy to see the value of digital twins in manufacturing. But they will be key for any enterprise looking to serve momentary markets, by enabling greater flexibility and adaptability. The Port of Rotterdam, one of the largest shipping destinations in Europe, is building a comprehensive digital twin for the entire harbor. Port operators will have real-time knowledge of the location of every ship and cargo container at a given moment. By sharing this information with partners, the organization will be able to save shipping operators an estimated $80,000 every time they dock. In the long run, Rotterdam could be among the first ports to serve completely autonomous ships—a reality it expects by 2025.[22,23]

In the healthcare field, Heidelberg University Hospital in Germany is working with Siemens to introduce digital twins to patient care. In one instance, a cardiologist used a digital model of a patient's heart to test the efficacy of different placements of a pacemaker's electrodes.[24,25] This is just the beginning of "in-the-moment" personalization in healthcare, where experts hope to use technology to create whole "living" models of individual patients. These digital twins could help medical personnel evaluate the potential outcomes of different treatments for individual patients.

As companies expand their use of digital twins across the value chain, they will improve their ability to respond to momentary opportunities at scale. Eventually, the level of insights that these approaches enable will also drive the company's ability to see those moments coming—bringing the momentary market approach full circle.

# POWERED BY NEXT-GENERATION NETWORKS



**Logistics-focused companies have always been at the forefront of "in-the-moment" challenges. Now, these companies' efforts show hints of what is possible for every enterprise.**

Starship Technologies, an Estonian robot manufacturer, is deploying autonomous delivery robots to cities throughout the world.[26] In California, customers can order food through Starship's app, then drop a pin on a map to designate where they want the meal delivered—whether it is their office, home, a park, or wherever they find themselves.[27] Amazon, already famous for upending the traditional logistics of retail with its two-day, then same-day, then two-hour delivery, also introduced a solution to the challenges of home delivery by partnering with OnStar, GM, and Volvo to let customers request delivery to the trunks of their cars.[28]

These leaders show how the new momentary world will be built: on the burgeoning IoT market. By 2020, there will be 31 billion connected devices in the world, and that number will more than double to 75 billion by 2025.[29] Each device is a new channel, a new source of data, and a new way to identify and reach a momentary market.

The catalyst that will boost IoT to its long-awaited full potential is the 5G network. Sixty-two percent of business and IT executives believe 5G will have a significant impact on their industries within the next three years. The standard was completed in June 2018, with mobile providers expected to rapidly grow their networks in 2019 and 2020.[30,31,32] The speed, reach, and decreased latency of 5G will put long-standing concerns around connectivity and bandwidth for IoT devices to rest.

Far beyond the controlled factory, office, or home environments that IoT devices are largely confined to today, 5G will provide the basis for a truly intelligent network of cars, robots, drones, and more—all of which will be able to communicate and react in real time, wherever people need them.

Research correlates higher levels of data traffic across geographic locations with a boost in GDP.[33] Now, mobile data traffic is expected to increase nearly eight times by 2024, at which point 5G networks will carry more data than the combined traffic of 4G, 3G, and 2G networks today.[34] In the face of this explosion of data, companies must anticipate and capture the value from individual moments of opportunity. With 5G making pervasive, real-time intelligence a possibility everywhere, companies will have the technological capabilities to spot moments of opportunity before they come—and capture them before they go.

# LIVING (BUSINESS) FOR THE MOMENT

With every business embracing the importance of digital transformation, companies need to look toward their next opportunity for differentiation—momentary markets. Internally, this means preparing the organization to be a truly agile company with the capabilities to identify opportunities and deliver exactly what customers want. But as businesses move in this direction, they must also work to understand where they fit into customers' lives.

That granularity of understanding will allow companies to meet people in their moment of need in a post-digital world—to in fact become a different business to every single customer. It is all about choosing the right moments. How will your company choose them?

# DECISION POINTS

## 1 How is your company moving closer to delivering on-demand experiences?

- Identify the forecast areas your business could improve with the help of AI. This first step will help your business adopt more granular forecasting techniques that are better suited for on-demand and momentary markets.

## 2 How is your business uncovering discrete moments of opportunity?

- Businesses need the technology tools to capture, understand, and respond to consumer moments as they're happening. Begin by evaluating the ways you currently solicit feedback from individual consumers and determine the effectiveness of each for driving product development. Explore ways of bringing these insights to more groups within your organization.

# DECISION POINTS

## 3 How can your business prepare today to deliver for the momentary markets of tomorrow?

- As your business explores IoT applications, consider how the data generated by sensors could help build digital twins of your assets and facilities. With these models on hand, use them to monitor, analyze, and simulate device or facility performance. As your understanding of these tools grow, adapt them for consumer-focused digital twins to inform more personalized offerings.
- Examine your current product and service development approaches and identify areas that may prevent your business from being able to quickly respond to moments of opportunity. Look for areas to incorporate agile development and manufacturing approaches.

# ABOUT THE TECHNOLOGY VISION

About the Technology Vision

# RESEARCH METHODOLOGY

**Every year, the Technology Vision team partners with Accenture Research to pinpoint the emerging IT developments 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.**

The research process begins by gathering 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.

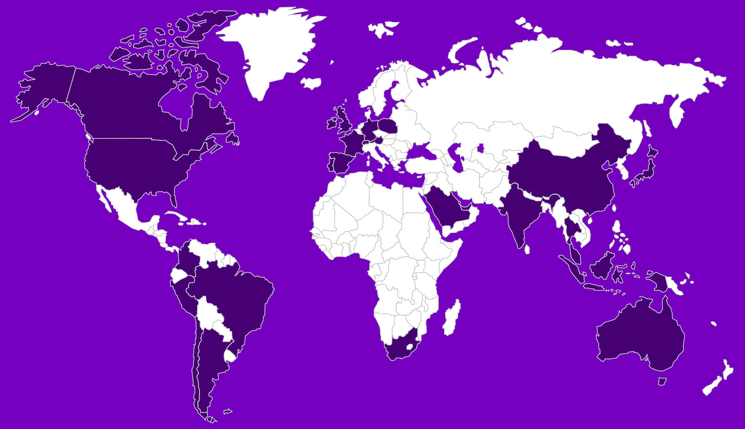
Each year, the research process also includes a global survey of thousands of business and IT executives from around the world, to understand their perspectives on the impact of technology in business. Survey responses help to identify the technology strategies and priority investments of companies from across industries and geographies.

As a shortlist of themes emerges from the research process, the Technology Vision team reconvenes its advisory board. The board's workshop, a series of 'deep-dive' sessions with Accenture leadership and external subject-matter experts, validates and further refines the themes.

These processes weigh the themes 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

Accenture Research conducted a global survey of 6,672 business and IT executives to capture insights into the adoption of emerging technologies. The survey, fielded from October through December 2018, helped identify the key issues and priorities for technology adoption and investment. Respondents were C-level executives and directors at companies across 27 countries and 20 industries, with the majority having annual revenues greater than US$6 billion.



## 27 Countries:

(Respondent Location)

1. Argentina
2. Australia
3. Austria
4. Brazil
5. Canada
6. Chile
7. China
8. Columbia
9. France
10. Germany
11. India
12. Indonesia
13. Ireland
14. Japan
15. Malaysia
16. Peru
17. Poland
18. Portugal
19. Saudi Arabia
20. Singapore
21. South Africa
22. Spain
23. Switzerland
24. Thailand
25. UAE
26. UK
27. United States

## 20 Industries:

1. Aerospace and Defense
2. Automotive
3. Banking
4. Consumer Goods and Services
5. Chemicals
6. Communications
7. Energy
8. Healthcare
9. Industrial Equipment
10. Insurance
11. Life Sciences
12. Media
13. Metals and Mining
14. Public Service
15. Retail
16. Semiconductors
17. Software and Platforms
18. Transportation
19. Travel
20. Utilities

## Revenues (USD):

1. $50 billion or more
2. $20-$49.9 billion
3. $10-$19.9 billion
4. $6-$9.9 billion
5. $1-$5.9 billion
6. $250-$999 million

## Roles:

(50% Business Executives/50% IT Executives, Director Level and Above)

- Chief Information Officer
- Chief Mobility Officer
- Chief Technology Officer
- Chief Marketing Officer
- Chief Finance Officer
- Chief Operating Officer
- Chief Security Officer
- Chief Information Security Officer
- Chief Strategy Officer
- Director of Technology
- Director, IT
- Director of Business Function (Non IT-related)
- Director, Line of Business (Non IT-related)

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