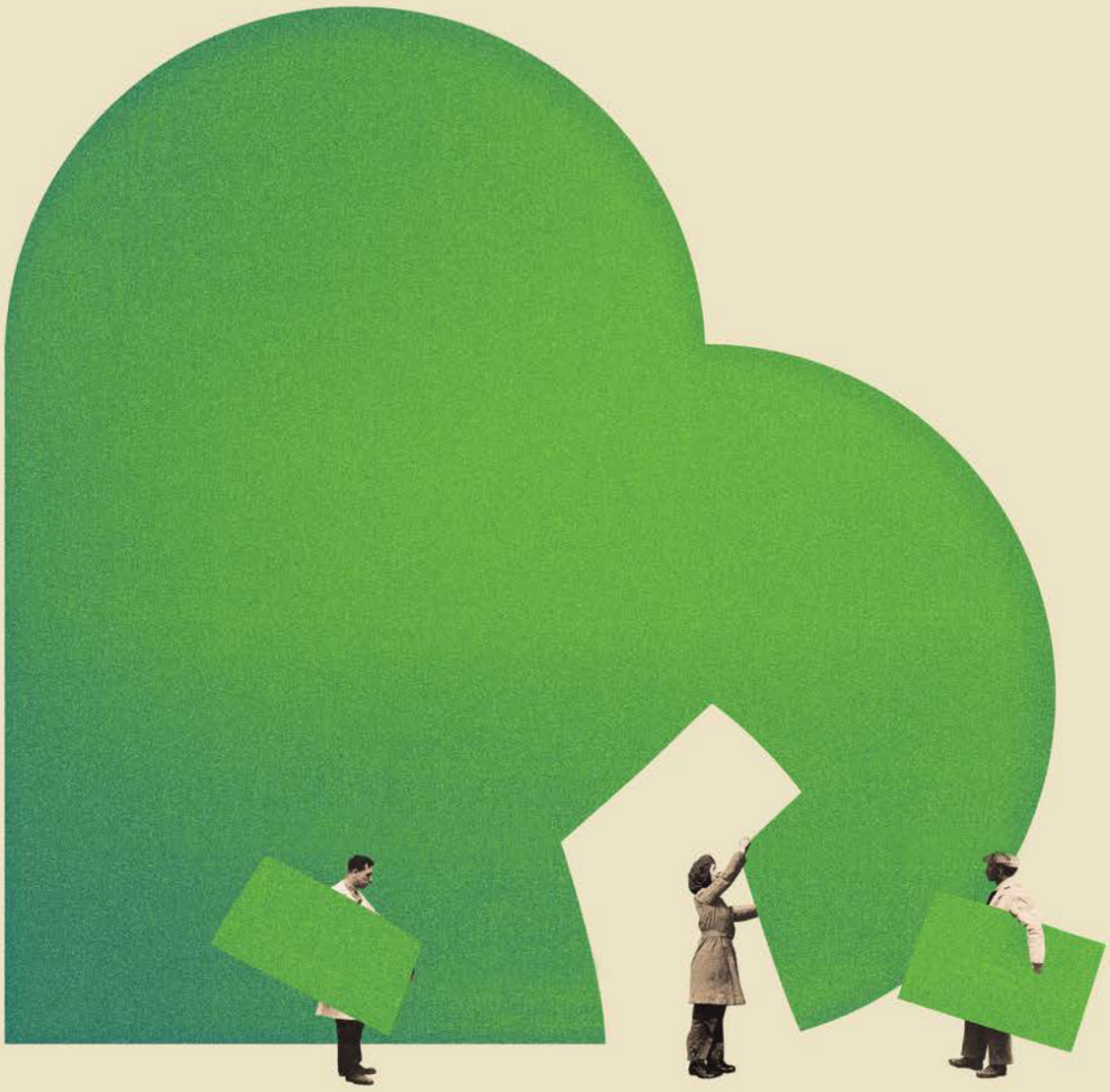

Prioritizing health

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Masthead

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Prioritizing health

Health is top of mind right now, and in many forms. We're increasingly focused on the health of individuals—our family members', our teammates', and our own physical and mental well-being. We're also focused on the health of the collective—organizational health, as supply chain and logistics issues continue to plague companies across the globe, consumer behavior remains altered by the pandemic, and organizations' sustained success grows more uncertain in the continually disrupted business environment; industry and sector health, as new entrants and cross-industry players shake the status quo, and pressure mounts for self-regulation on issues such as data privacy and protection; and societal and environmental health, as public health concerns and climate change realities become increasingly impactful external drivers of change within organizations.

Health is a work in progress—and, for many, it's priority No. 1. Recent global events have posed real and tangible threats to personal and collective health, but they've also made us more aware of the opportunities afforded by achieving an improved state of well-being. This issue offers research and insights into how organizations can work on thriving and prospering at all levels.

Cheers to your good health.

Best,

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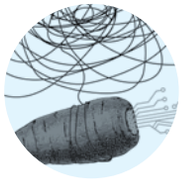
Artists

Mark Conlan

Mark Conlan is an Irish artist based in Melbourne. His characteristic whimsical style is accentuated by his bold use of color in full spectrum and limited palettes. Conlan's ability to distill a concept down to its visual essence has afforded him the privilege of working with some of the world's most recognizable brands.

Maarten Léon

Maarten Léon is a collage artist from Amsterdam. His work has been described as minimalistic surrealism. Vintage ads and photos are mixed together to create familiar yet alienating, new contexts, which are surreal and often playfully absurd.



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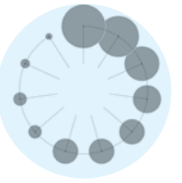

Molly Woodworth

Molly Woodworth is a senior data visualization designer at Deloitte. She believes the display of data itself creates beautiful art and challenges herself to further expand the stories that live between the lines in her infographics. Woodworth is a Virginia transplant to the Seattle area and her roots have grown deep enough that she'll never go back.

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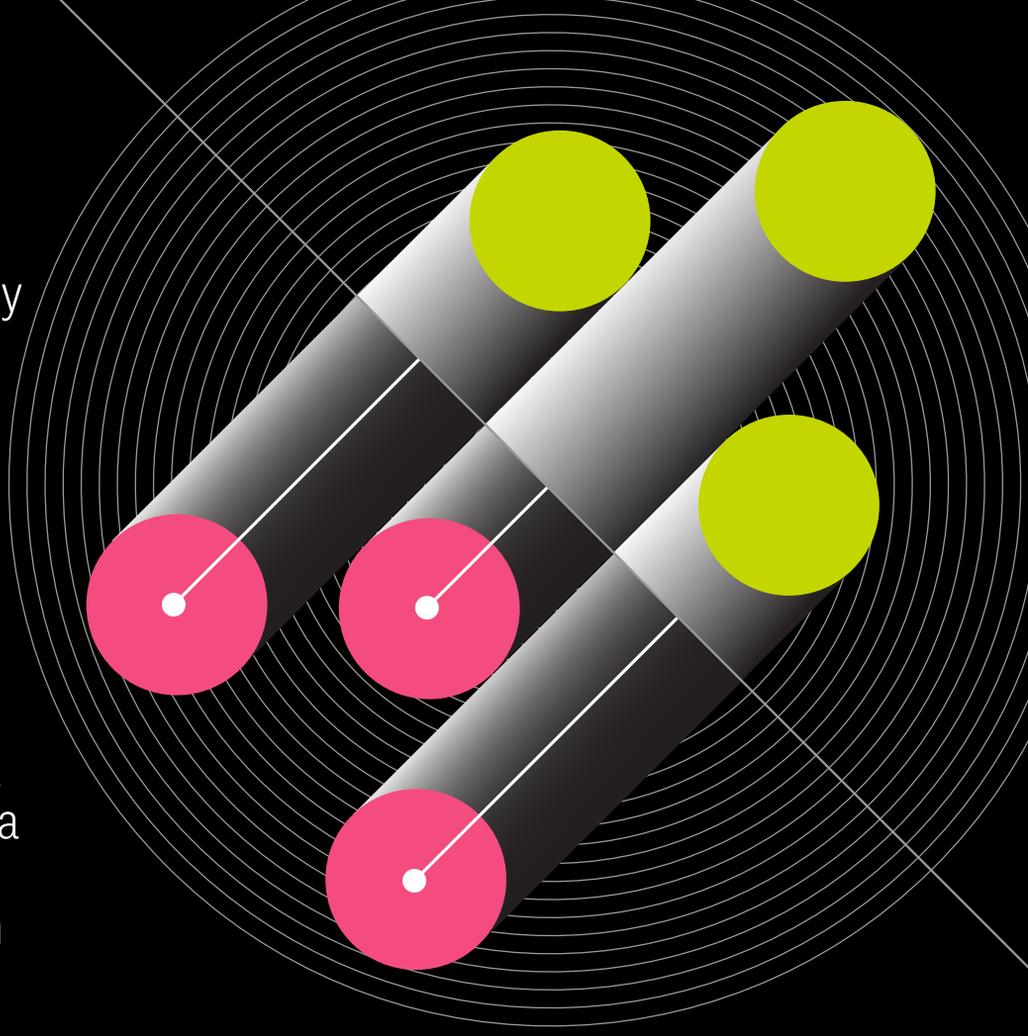

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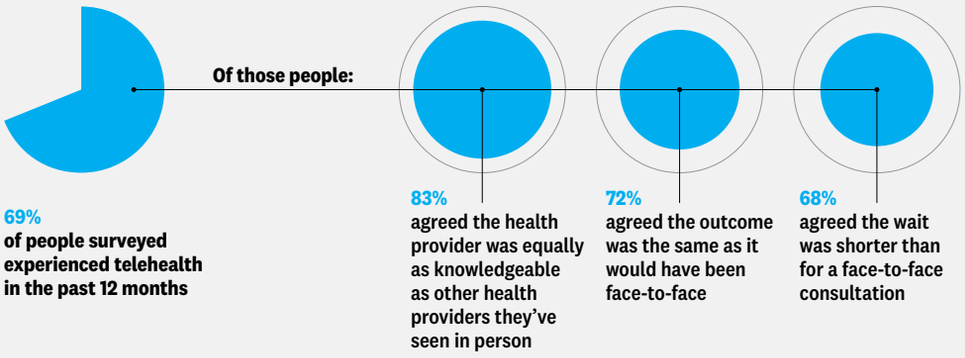
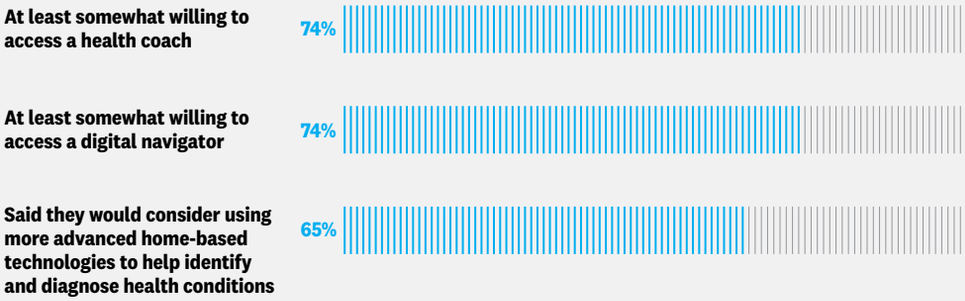
The future of digital health requires bridging the digital divide

As digital technology continues to reshape health care, Deloitte Australia's research finds the risk of a digital divide is real

Experiences with telehealth are positive

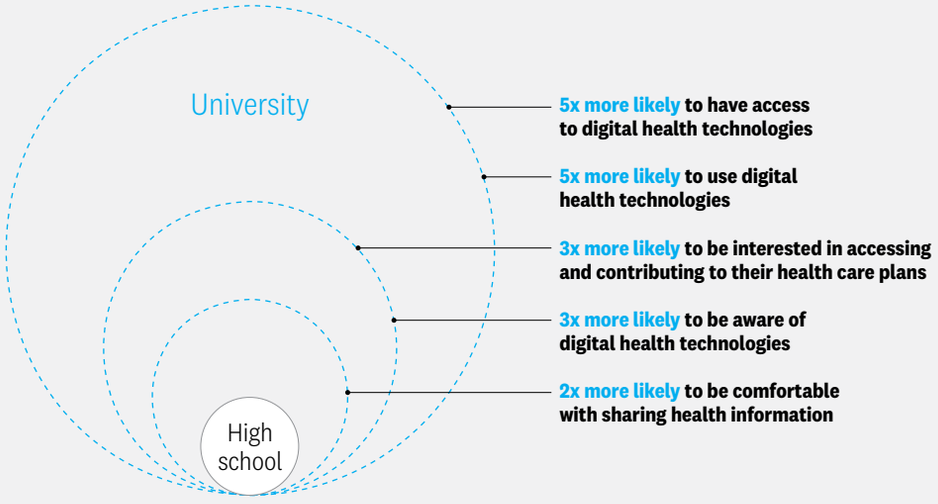


Willingness to use technology to improve access to care is high



Risks of a digital divide

Compared to those with at most a high school education, those with at least a university education were:



Source: Deloitte Australia's Reimagining Health Care Consumer Survey.

Digital health might be improving health care access for some patients, but it's also revealing just how wide health care's digital divide is—and what it will take to bridge it.

According to Deloitte Australia's Reimagining Health Care Consumer Survey—conducted by the Sydney-based Digital Health Cooperative Research Centre for Deloitte in partnership with the Consumers Health Forum of Australia and Curtin University in Perth—of the nearly 70% of Australians who experienced telehealth over the last 12 months, more than 80% felt their virtual physician or provider was just as knowledgeable as physicians and providers they've seen in person. The survey, which polled 1,826 Australian consumers, found that more than 70% of respondents said the outcome of the virtual visit was the same as it would have been from an in-person visit. And 65% would consider using more advanced technologies at home for diagnostic purposes.

However, the survey also highlights risks of digital exclusion. Those with a high school education or lower were five times less likely to have access to digital health technologies than those with a university education or higher. The same cohort also was five times less willing to use digital health technologies.

The digitization of health care—such as leveraging existing investments in digital health infrastructure like telehealth and e-prescription services, while increasing the use of health data sharing and digital health monitoring technology—can help address systemic challenges, helping to shore up at-home and preventative care, reduce chronic disease rates, and decrease the administrative burden on health care workers. But if not properly managed, the digital divide could be perpetuated, including for individuals who experience the poorest health outcomes.

The challenge lies in ensuring that digital health technology is used to make health care access more equitable—not to create a new digital barrier. To ensure equitable treatment and access, health care leaders need to digitize with purpose, serve the needs of individuals, and deliver improved outcomes and value for all.

For more insights, visit deloitte.com/au/healthreimagined

Infographics by Molly Woodworth

Where global execs stand on making health equity a business priority

A lack of metrics and evidence of a bottom-line impact could be holding many organizations back, leaders say

Achieving health equity as a business outcome requires organizations to address it like any other business goal: They need to understand the problem, identify solutions, and measure the impact. But for some business leaders, therein lies the challenge.

Deloitte collaborated with the World Economic Forum to conduct a targeted global survey of 42 C-suite executives from across industries on the opportunities and barriers leaders face when embedding health equity into their environmental, social, and governance (ESG) strategies. The survey found that more business leaders are considering making health equity—an outcome in which every individual has the opportunity to achieve an overall state of well-being within our society, from clinical, physical, and mental health, to social, emotional, and spiritual health—a priority.[1] But only about half of the surveyed business leaders identified health equity as a "very high priority" for their respective organizations.

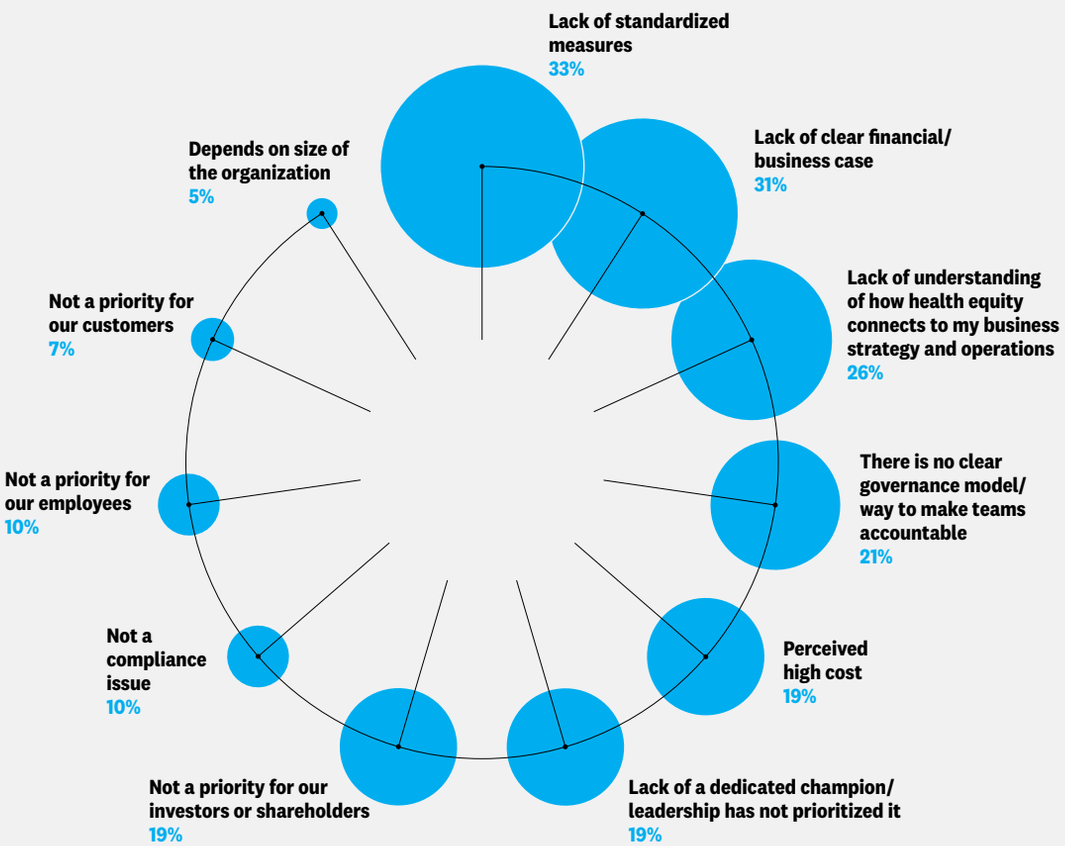
The top two challenges holding many back are a lack of standardized measures (which 33% of respondents ranked as a key issue) and a lack of a clear financial business case (indicated by 31% of respondents). And more than one-quarter of survey respondents said that they don't understand how health equity connects to their business strategy and operations.

Deloitte research shows that addressing health inequities can help organizations accomplish core business goals such as improving workforce productivity, increasing market opportunities, fueling economic growth, and improving competitive advantage.[2] Several standards-setting organizations have already begun to embed health equity and reporting standards into ESG frameworks, which can create a shared language and approach for business leaders to assess, measure, and act on health equity.

Research and analysis by the Deloitte Center for Health Solutions and the Deloitte Health Equity Institute

For more insights, visit weforum.org and search for "Investing in health equity."

Top barriers to integrating health equity into ESG, business strategy, and operations



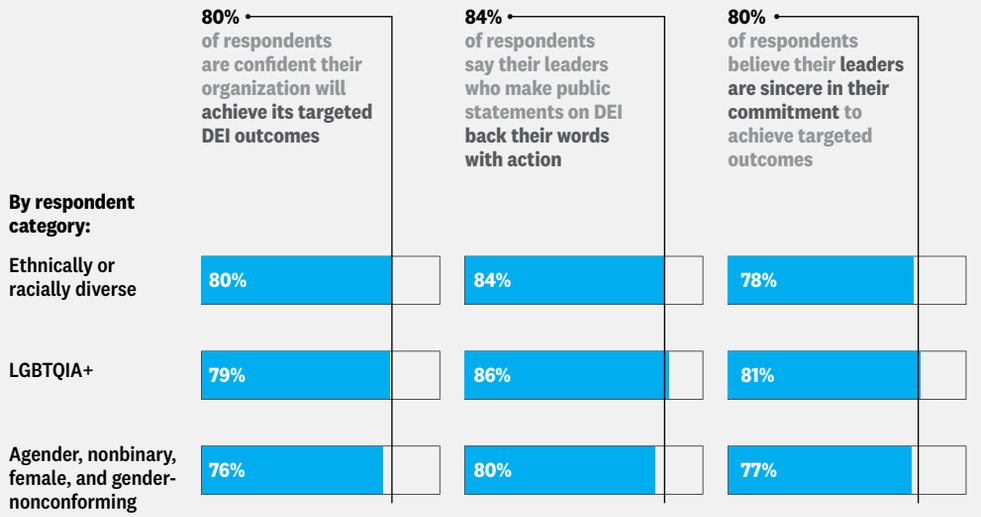
Source: Global Health Equity Network survey of cross-industry CxOs, 2022.

Infographics by Molly Woodworth

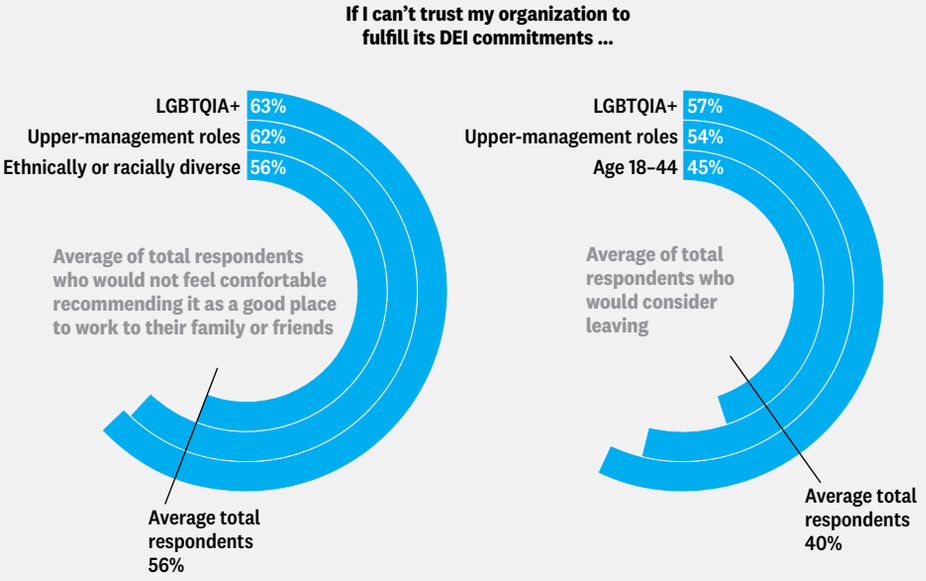
The potential impact of a broken DEI promise

Most employees trust their employers to honor their diversity, equity, and inclusion commitments. Deloitte research shows what could happen if that trust is broken.

Workers trust their leaders' commitment to diversity, equity, and inclusion



Losing worker trust in DEI commitments can have serious consequences



Source: Deloitte DEI and Trust survey, 2021.

Over the last few years, many organizations have made public commitments to address societal disparity and injustice, in part by establishing or expanding diversity, equity, and inclusion (DEI) initiatives. But do workers really trust their organizations' commitments?

Several studies have noted workers' concerns: Some believe that their employers haven't set the bar high enough.[1] Others note that their employers had made promises they weren't keeping.[2] As a result, an organization could develop a reputation for performative activism: the perception that it's involved in activism primarily to enhance its public image without genuine commitment to see it through.[3]

How do the workers whom these DEI programs primarily target feel about these efforts? In 2021, Deloitte surveyed 1,543 workers, mainly respondents who identified as Black, Hispanic/Latinx, Asian, female, and LGBTQIA+.

The overall news is encouraging. Workers, including those who self-identified as members of diverse populations, by and large do trust their leaders' commitment to DEI and ability to execute a successful DEI program.[4] Significantly, these results are consistent across demographic groups.

But our research also shows that it would be a mistake for organizations to take this trust for granted, and what could happen if that trust is broken. Even the most well-intentioned leaders can fall prey to the pressure of short-term business imperatives, which can push them to deprioritize DEI commitments.[5] Losing the trust workers have in organizations' DEI programs can have significant consequences, particularly from a talent perspective.

As organizations begin to understand the potential damage caused by failing to meet DEI commitments, they can develop strategies to combat this risk—helping to create long-lasting, successful DEI programs and build trust within their workforce.

Research and analysis by the Deloitte Center for Integrated Research

Learn more at www.deloitte.com/insights/DEI-trust

Health and sustainability are on everyone's mind, but are they also on their plates?

Deloitte Netherlands examined shifting European consumption patterns in healthy and sustainable eating

What does a global pandemic do to our attitude toward food? Perhaps unsurprisingly, we're far more conscious of health—our own and the planet's.

Through a consumer survey about health and sustainability in grocery shopping, which was fielded in 15 European countries and involved more than 17,000 participants, Deloitte Netherlands examined the balancing act European consumers face between health, sustainability, and price when making food purchases. The results suggest that over the last 12 months, a big shift has taken place in European consumers' attitudes to what they eat and drink, where their food comes from, and how it's packaged and delivered.

Almost two-thirds of respondents to the survey have developed an interest in learning more about the relationship between what they eat and how they feel—and acting on those lessons. Fifty-nine percent of respondents say they eat more vegetables than before, 54% eat more fruit, and 45% say they have reduced their consumption of meat. Healthy, organic food is in favor, while the bottle is not: 48% of respondents say they're drinking less alcohol.

Moreover, 43% say they're ordering less food online—with both the packaging and the transport involved being factors in their decision-making. Overall, European consumers who participated in the survey demonstrate environmental awareness in their food shopping behaviors: 60% of respondents are making an effort to eat locally produced food, and 79% now reuse their shopping bags to reduce plastic waste.

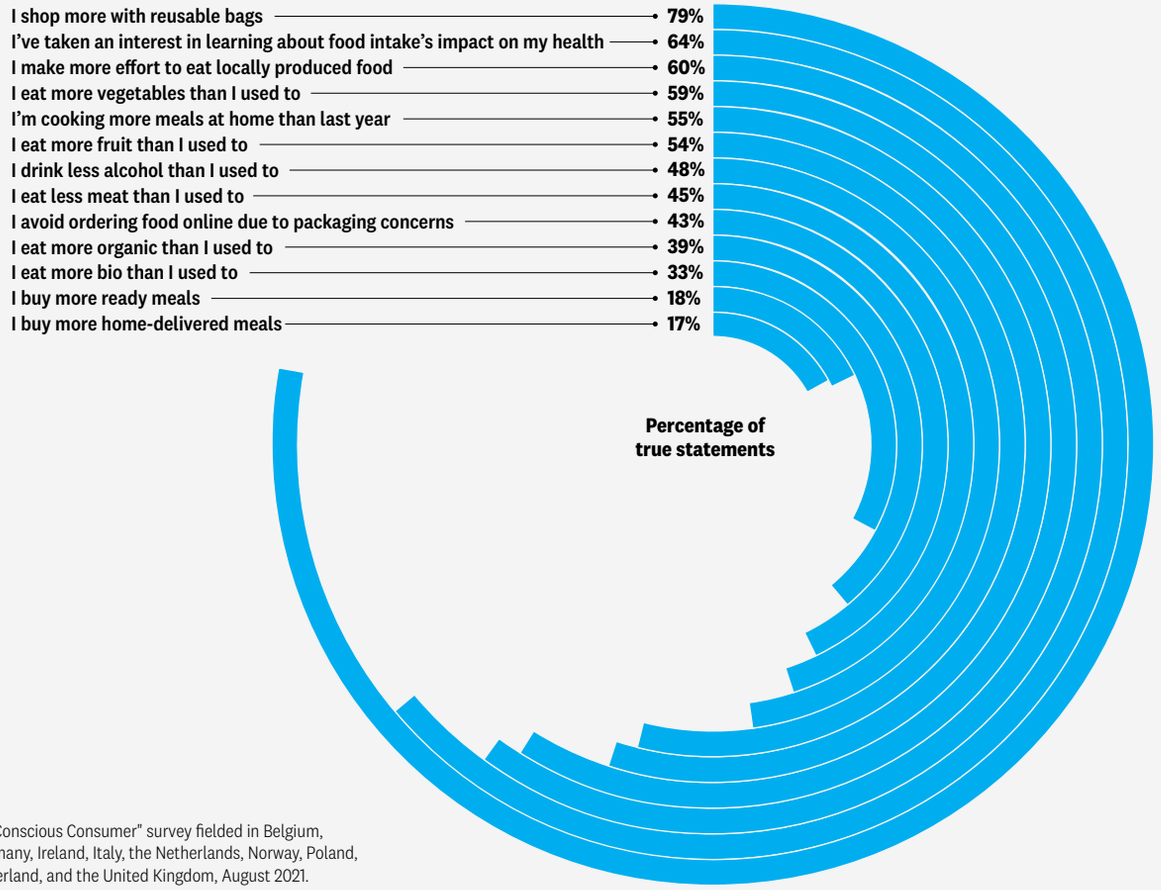
Higher costs are less of a deterrent than expected: When European consumers have to choose, an average of 60% prefer health over affordability, with 74% reporting that they'd be prepared to pay at least 5% more for food that is produced locally. Seventy-two percent of respondents would agree to pay more for foods that are sustainably sourced or fair trade if they're available in their local shop.

The survey showed that European consumers are increasingly expecting action from grocers and regulators in this regard. Over 40% think that unhealthy, unsustainable food should be taxed more. Seniors (those age 60 to 75) are most inclined to think unhealthy and unsustainable food should be taxed higher: About 50% of them want that and about 60% want clear warning labels on foods that are unhealthy and unsustainable, just as there are for cigarettes.

Food products that are healthy for people and the environment are increasingly valued by European consumers. There are clear implications for food production and trade. International producers may need to consider how they can reduce their shipping, packaging, and carbon footprint.

For more insights from the survey, visit www.deloitte.nl/health-sustainability-food

Behavior in the last 12 months



Source: Deloitte Netherlands "Conscious Consumer" survey fielded in Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and the United Kingdom, August 2021.

Infographics by Molly Woodworth

Reevaluating—and revaluing—consumers' priorities

Globally, consumers appear to be prioritizing their time differently. Employers and brands should take note.

The pandemic prompted consumers around the world to contemplate how they're spending their time, and to reprioritize what warrants its investment. This could have significant implications on organizations across industries.

According to data from Deloitte's Global State of the Consumer Tracker—an online panel survey fielded monthly to approximately 23,000 adults across 23 countries—most respondents believe they've become more focused on personal change and well-being in the past year. These factors might also be helping to tip the scales of work/life balance. Compared to one year ago, the percentage of consumers who believe they're now finding more time to enjoy today (34%) significantly outnumbers those who feel they're working harder to get ahead (22%).

And the changes aren't just limited to what consumers want to do with their time, but also the purpose it serves. Those who believe they're pursuing more purposeful goals outnumber those more focused on earning.

Organizations are facing market forces they can't ignore, from the ongoing imperative to address the root causes of our climate change crises to the groundswell of activity to advance social justice to the accelerated expectations from government and investors around environmental, social, and governance issues. To attract and retain both customers and employees in this increasingly time-conscious and purpose-driven era, organizations should consider rethinking customer engagement and talent strategies. They should also define their purpose and ensure that their activities and internal processes are consistent with their stated positions and values.

If time is what customers and employees value most, how can you demonstrate that your organization is worth their investment?

Research and analysis by the Deloitte Consumer Industry Center

Learn more at www.deloitte.com/insights/value-of-time

Top five countries where respondents shared how they feel about well-being, inward focus, and purpose compared to a year ago

Notes: N = 21,034 adults (18+ years); data represents percent of respondents who feel a "strong" or "very strong" change compared to 12 months ago. Respondents who feel little to no change are excluded.
Source: Deloitte Global State of the Consumer Tracker.

Addressing the link between financial, physical, and emotional health

One-third of "underbanked" US consumers we surveyed say their physical well-being has been affected by the state of their finances

According to the American Psychological Association's Stress in America survey, 65% of Americans are worried about money, the highest level since 2015.[1] Financial stress is known to affect physical and emotional health,[2] particularly among the financially vulnerable, many of whom are not fully engaged in the financial ecosystem.

Even though the United States has a large and sophisticated banking system, more than 33 million adults remain "underbanked":[3] consumers who do have a bank account but rely more on alternate financial services providers.[4] And many underbanked customers still prefer alternate financial providers to traditional banks even though they can be quite expensive.

Millions of Americans rely on payday loans, for example, to deal with short-term financial challenges.[5] But fewer than half of US states have imposed rate caps, and loan rates in uncapped states can exceed 600%.[6] According to the Financial Health Network, financially vulnerable households (including both unbanked and underbanked) spent US$24 billion in 2020 on interest and fees for "single payment credit" products such as payday loans.[7]

The plight of the underbanked isn't new. Banks and regulators have tried to reduce the share of unbanked and underbanked customers for decades, but more progress is needed. Since financial health and physical and emotional health are closely linked, the banking and health care industries could band together and rethink how they serve the underbanked segments.

This relationship can be even more striking during times of economic uncertainty. Consider this: In a 2021 Deloitte survey, 34% of underbanked consumers say the COVID-19 pandemic negatively impacted their financial well-being, compared with only 17% of the banked respondents. And more than one-third of underbanked respondents say their physical well-being has been impacted by the state of their finances, compared with only 20% of the banked. The underbanked respondents are also much more likely to borrow when they're emotionally stressed.

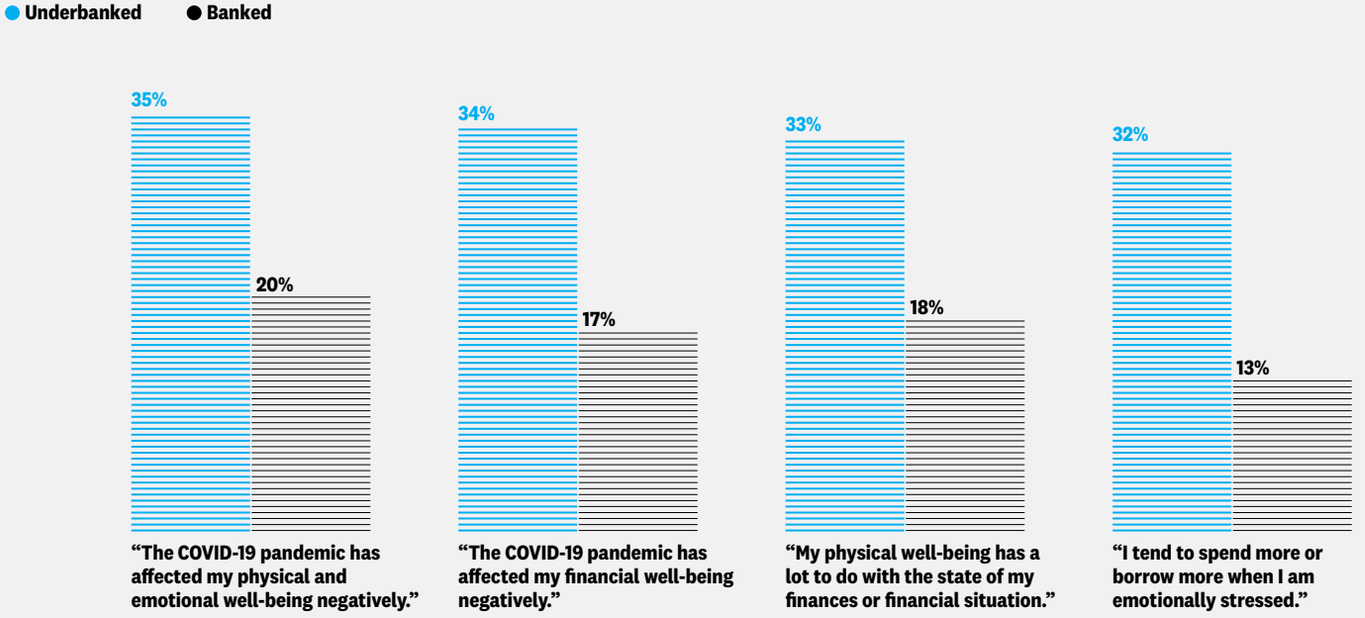
Financial inclusion took on greater urgency over the past two years, with many banks and financial technology firms implementing new programs. UnionDigital, for example, aims to tap underbanked segments using state-of-the-art infrastructure to onboard them.[8] Similarly, Tala, a fintech operating in developing countries such as Kenya and Mexico, is using cell phone data to underwrite loans.[9] Such targeted strategies that cater to the unique needs of these segments may help build trust and improve the underbanked's engagement with the banking system.

Banks also could partner with health care providers to design and offer inclusive credit and payment solutions to economically vulnerable individuals needing assistance. Measures like this could reduce stress and improve the health of underbanked individuals.

Research and analysis by the Deloitte Center for Financial Services

Learn more at www.deloitte.com/insights/underbanked

Financial well-being is closely tied to physical and emotional well-being



Note: Respondents who "strongly agree" or "agree" with the particular statement.
Source: Deloitte Center for Financial Services' Digital Banking Consumer Survey, 2021.

Infographics by Molly Woodworth

Financial executives in energy and industrials need to be front and center for the energy transition

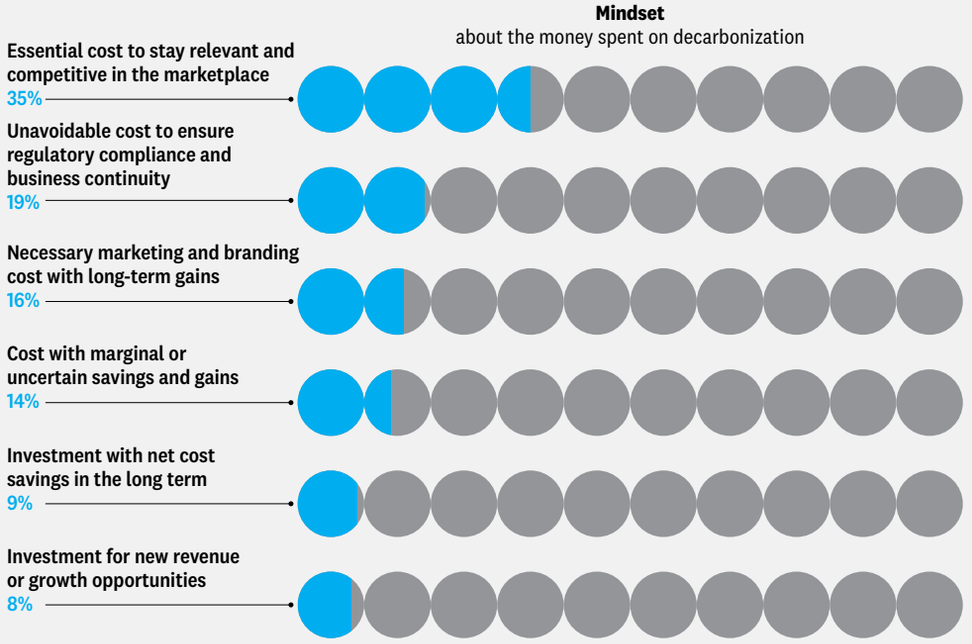
Organizations where the role of the financial executive is at the decision-making level are 82% more likely to have a comprehensive climate action plan

As the 2050 deadline to achieve net-zero emissions looms on the not-so-distant horizon, the onus to cut emissions is highest on the energy and manufacturing industries—and any progress they make could set the direction for other industries. But Deloitte research shows that key financial decision-makers aren't always at the table and some C-suites' decarbonization objectives might not yet be aligned.

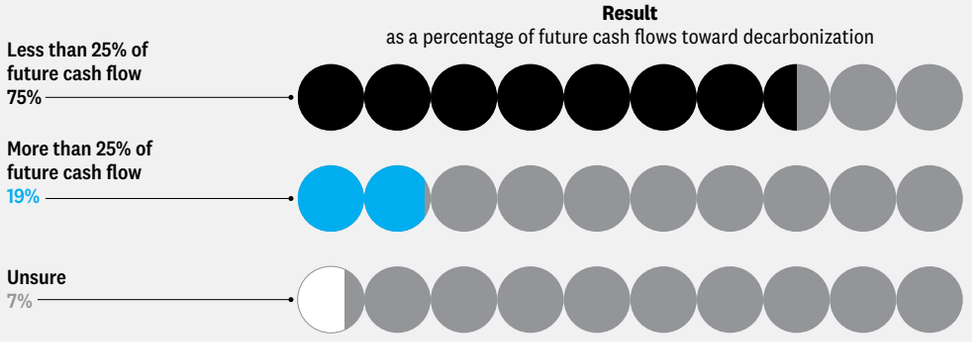
In Deloitte's survey of 140 US financial executives in energy and manufacturing companies, 73% responded that their organizations have a decarbonization strategy in place. Many CFOs report that their organizations are making slow progress toward their decarbonization goals largely because of a lack of clear and consistent environmental, social, and governance reporting guidelines. But dig a little deeper and other challenges emerge.

For one, only 17% of surveyed finance executives see the money spent on decarbonization as a net cost savings or a profitable growth opportunity. The majority (83%) view green investments as a cost that's essential to remain competitive in the marketplace and ensure regulatory compliance, and that's necessary for branding or marketing purposes.

Perception and commitment of respondents toward decarbonization investment



Planned percentage of cash flows directed toward decarbonization investments



One in three financial executives surveyed are looking for financial and tax incentives to safeguard their decarbonization investment

Source: Deloitte Center for Energy and Industrials survey, August 2021.

About three-fourths of the surveyed respondents plan to spend less than 25% of their future cash flow on green initiatives over the next three years. One in three financial executives are banking on financial incentives, including grants, credits, and R&D support, to fund their decarbonization strategy.

Given the fact that CFOs hold the purse strings and have a considerable say in their companies' expenditures, they are key to driving successful decarbonization strategies. Indeed, the survey found that organizations where financial executives participate in decarbonization decision-making are committing the most money to low-carbon investments and are 82% more likely to have a comprehensive decarbonization strategy.

The transition to net-zero emissions provides a significant opportunity for CFOs to lead in the world's biggest business and financial transformation.

Research and analysis by the Deloitte Center for Energy and Industrials

Learn more at www.deloitte.com/insights/cfo-energy-transition

Board leadership and the fight against climate change

Deloitte research shows that many barriers to effective board stewardship of climate initiatives come from within their own organizations

Many board audit committees—and, by extension, the boards themselves—haven't yet sufficiently placed climate change initiatives at the core of their agendas, according to recent Deloitte research. Among the more than 350 board audit committee members in 40 countries surveyed in Q4 2021 by the Deloitte Global Boardroom Program, nearly 60% say they don't regularly discuss climate change during meetings. And nearly half say they lack the basic literacy in climate issues they need to make informed decisions.

Close to two-thirds (65%) of respondents say overseeing climate change initiatives is challenging because their organization lacks "a clear and agreed-upon carbon reduction strategy," as well as "an action plan with milestones and a way to hold management accountable for it."

Alarmingly, the survey finds that the "systemic threat barely features on audit committee meeting agendas, and there seems to be little appreciation of the impact climate change will have on the company's business model and long-term strategy," Kerrie Waring, CEO of the International Corporate Governance Network, told Deloitte in an interview.

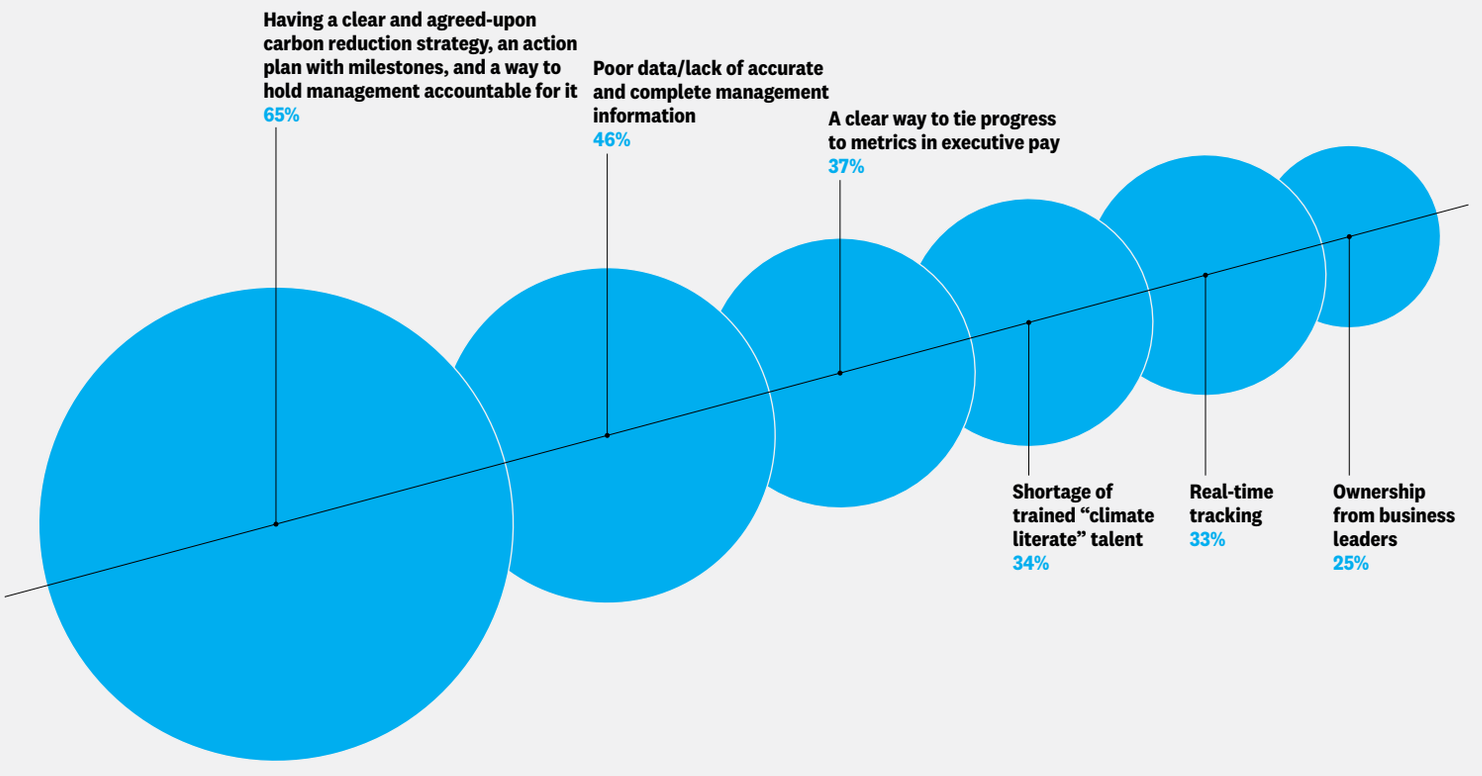
One reason for the climate literacy challenge among boards may be a paucity of information—an issue that's being most acutely felt in the Americas. Fewer than half (46%) of respondents in the Americas say the audit committee "has the information, capabilities, and mandate to fulfill its regulatory responsibilities in relation to climate risks and carbon reduction targets."

However real and credible these obstacles are, what's manifestly clearer is that no board or audit committee can afford to use them as reasons for inaction or to wait to see how things unfold over time. Change isn't coming; it's already upon us.

Research and analysis by the Deloitte Global Boardroom Program

For more information, visit www.deloitte.com/insights/board-climate-change

Q: "What is the biggest challenge in overseeing climate change in relation to your organization?"
Select all that apply



Source: Deloitte Global Boardroom Program survey, Sept. 2021.

Infographics by Molly Woodworth

Climate change breeds climate anxiety

Deloitte research gauges people's concerns about the health of our planet—and who feels compelled to act

The deteriorating health of the earth's natural systems due to climate change poses direct risks to human health, including the medical conditions faced by those living with poorer air quality and other environmental impacts, the physical risks involved for those who experience an extreme weather event firsthand, and the effects of climate-related stress on individuals' mental health. In fact, climate change has been named the "greatest threat" to public health by global medical journals.[1] Global Deloitte research offers evidence of the toll climate change is taking on people's well-being, and how some think governments and organizations should respond.

To gain insight into people's mindsets and intentions regarding climate change, Deloitte has created the Sustainable Actions Index, built from a survey of 23,000 consumers across 23 countries. In the April 2022 survey, 46% of respondents said they had experienced a climate-related extreme weather event in the last six months, and 47% said they had "felt worried or anxious about climate change in the last month."[2]

Moreover, 71% of respondents said they believe climate change is an emergency. Among all respondents, almost two-thirds wanted government to take more steps to address climate change, and nearly half said they supported new regulations, even if it cost them personally.[3]

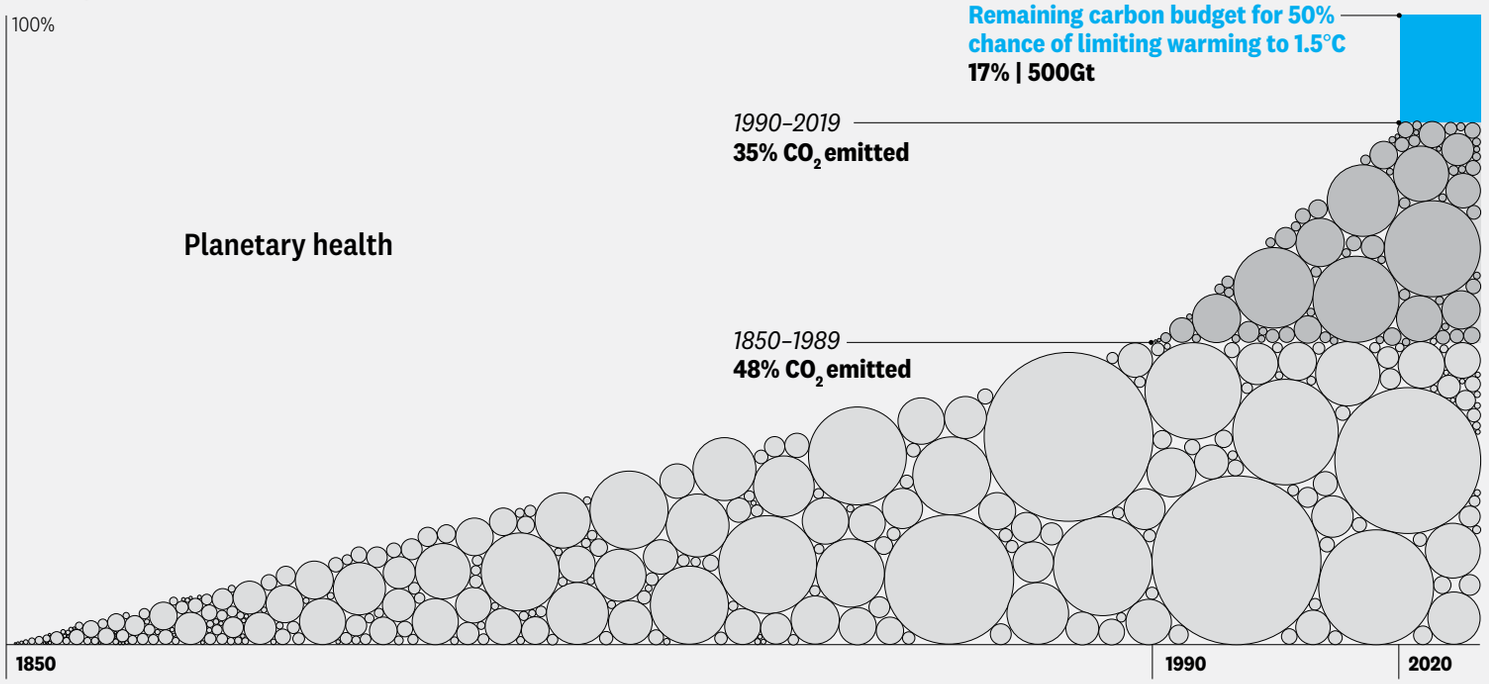
Addressing climate change demands system-level transformations spanning energy, mobility, food, industry, and government—and individual attitudes and behaviors have an important role to play. Shifting societal norms and actions can feed into the efforts of companies and governments, ideally creating positive-feedback loops that can lead to tipping points when adoption rapidly accelerates.

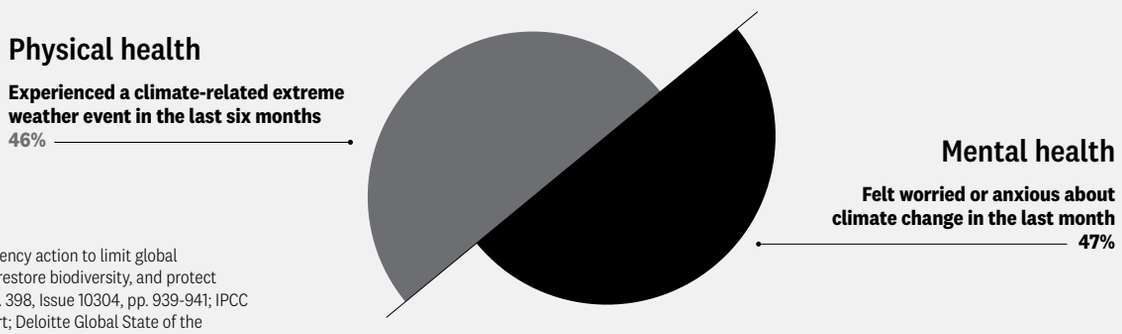
Research and analysis by the Deloitte Center for Integrated Research

Learn more at www.deloitte.com/insights/climate-anxiety

Climate change: The "greatest threat" to global public health

Planetary health and human health are inextricable



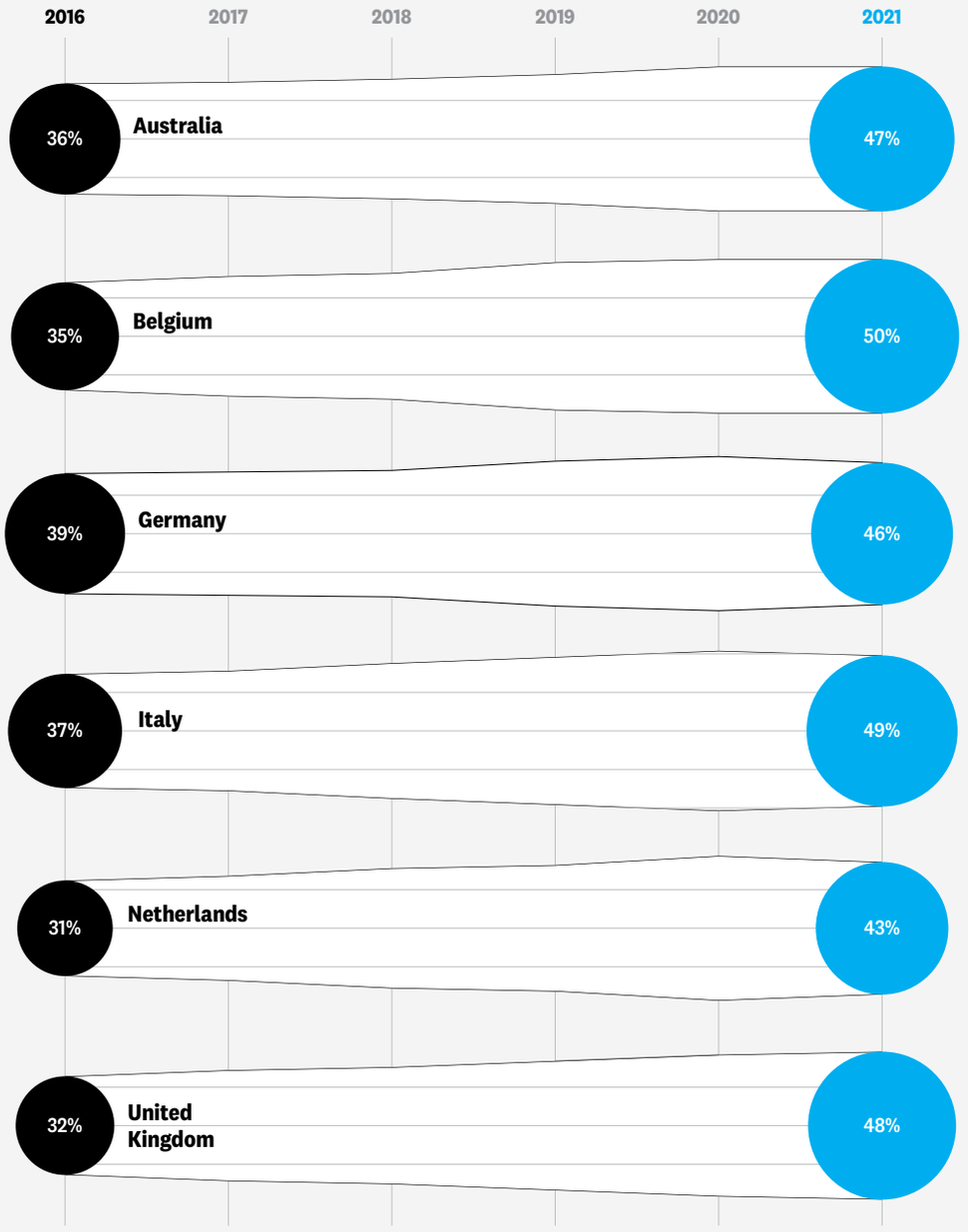


Sources: "Call for emergency action to limit global temperature increases, restore biodiversity, and protect health," *The Lancet*, Vol. 398, Issue 10304, pp. 939-941; IPCC Sixth Assessment Report; Deloitte Global State of the Consumer Tracker, April 2022. N = 23,000.

Making smartphones live longer—and greener

Consumers are holding onto their smartphones for longer, which spells good things for the environment

Consumers are keeping their smartphones for longer
(Proportion of smartphones bought more than 18 months ago, 2016–2021)



Source: Deloitte Digital Consumer Trends, May–June 2016, May–June 2017, June 2018, May–June 2019, May 2020, June–August 2021.

Smartphones, the world's most popular consumer electronic devices, are projected to generate 146 million tons of CO2 or equivalent emissions (CO2e) in 2022[1] from the manufacture, shipping, and first-year usage of all of the new smartphones forecast to be shipped this year.

But Deloitte research shows that many people are starting to keep their smartphones for longer, which would lessen their environmental impact. In a series of global Deloitte surveys between 2016 and 2021, the proportion of respondents who had bought their smartphones in the prior 18 months steadily decreased in several developed markets, including Australia, Belgium, Germany, Italy, the Netherlands, and the United Kingdom.

The trend leveled off or reversed in those markets in 2021, which we attribute to the pandemic prompting increased spending on devices, leading to forced savings on services. But we expect the overall trend to continue. Smartphones are getting tougher and therefore remaining functional longer, reducing the need for unplanned replacement: Screens can now cope with multiple short drops, and flagship-model smartphones are becoming more resistant to water damage every year. Software support for smartphones is also being offered for longer, with vendors creating or sourcing specific versions of operating systems for older phones.

Longer smartphone lifetimes could drive vendors to adjust their business models to grow revenue from sources other than device sales, such as media services, online storage, sales of complementary hardware with lower emissions per unit than smartphones, and commissions on insurance premiums[2] and financial products related to smartphone purchases or leases. These changes would reshape the smartphone industry, but they would make it greener—and every little bit counts.

Research and analysis by the Deloitte Center for Technology, Media, and Telecommunications

Learn more at www.deloitte.com/insights/smartphones

Infographics by Molly Woodworth

Data-protection tech that helps AI fulfill its potential

Some of the world's largest organizations are piloting privacy and security technology to enable AI's success

As demand for and applications of artificial intelligence increase across industries, regulations are keeping pace. New global regulations on AI come out monthly, and enforcement of the European Union's General Data Protection Regulation may be ratcheting up to a new level. Both vendors and users are likely to experience growing constraints on their use of AI—unless data-protection technologies can help organizations comply.

Two such technologies are worth noting now: homomorphic encryption (HE), which allows machine learning to use data while it is encrypted, and federated learning (FL), which distributes machine learning to local or edge devices rather than keeping all the data in the same place where one hack could expose it all.

At least 19 pilots, products, and proofs of concept for HE and FL combined have been publicly announced so far. Some of the world's largest organizations are behind them, including Apple, Google, Microsoft, Nvidia, IBM, and the National Health Service in the United Kingdom; users and investors include Intel, Oracle, Mastercard, and Scotiabank.[1] Further, Deloitte research is aware of multiple additional organizations that are using these technologies but have not yet publicly disclosed it.

The industries involved in these early projects are also among the largest, led by health and social care.[2] Deloitte research estimates that the combined market for HE and FL could top US$500 million by 2025.[3]

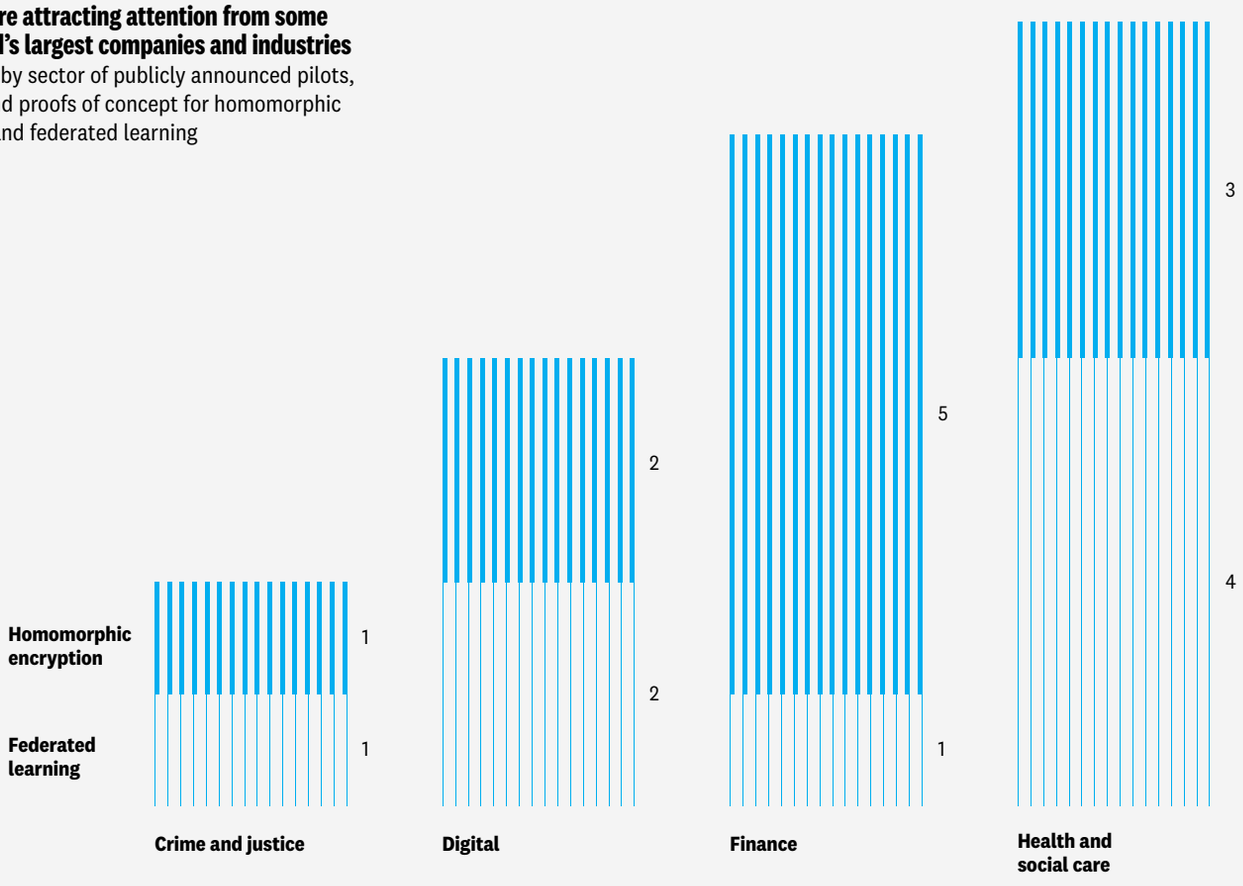
What would more private and secure AI mean from a strategic, operational, and competitive standpoint? To understand this, leaders should keep abreast of the technology's progress and monitor how peers, competitors, and ecosystem partners are investing in and experimenting with it. By helping to protect the data that lies at the heart of AI, organizations can expand AI to more and more powerful uses.

Research and analysis by the Deloitte Center for Technology, Media, and Telecommunications

Learn more at www.deloitte.com/insights/data-protection

HE and FL are attracting attention from some of the world's largest companies and industries

Distribution by sector of publicly announced pilots, products, and proofs of concept for homomorphic encryption and federated learning

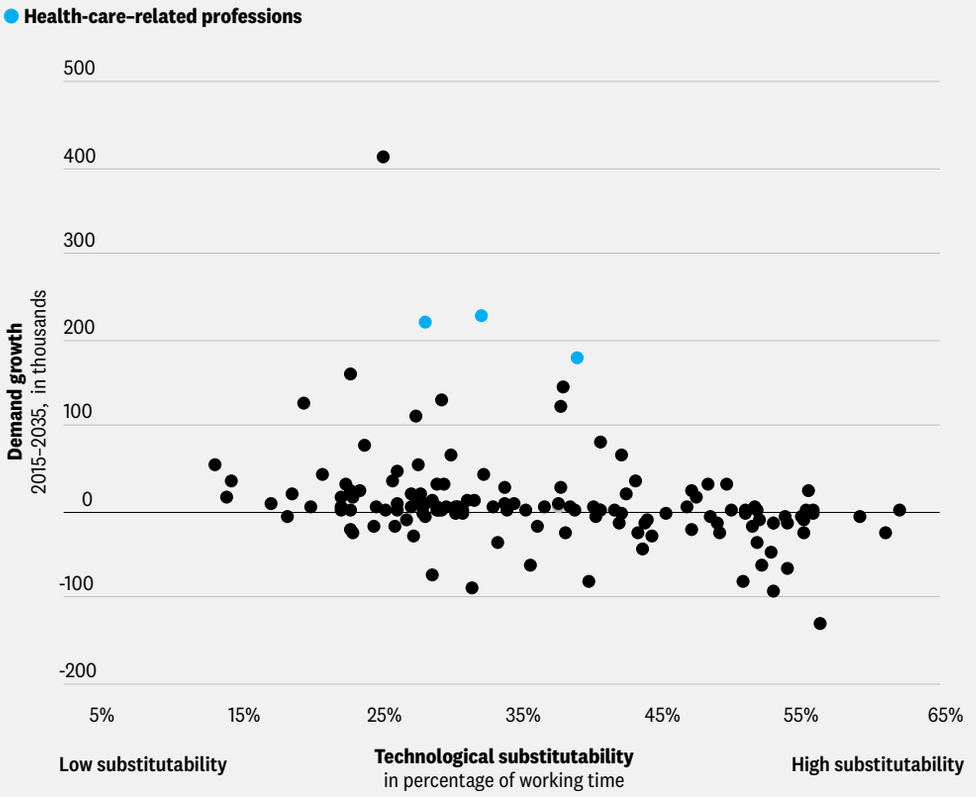


Source: Deloitte analysis of data from the Centre for Data Ethics and Innovation's "Repository of use cases," accessed September 30, 2021.

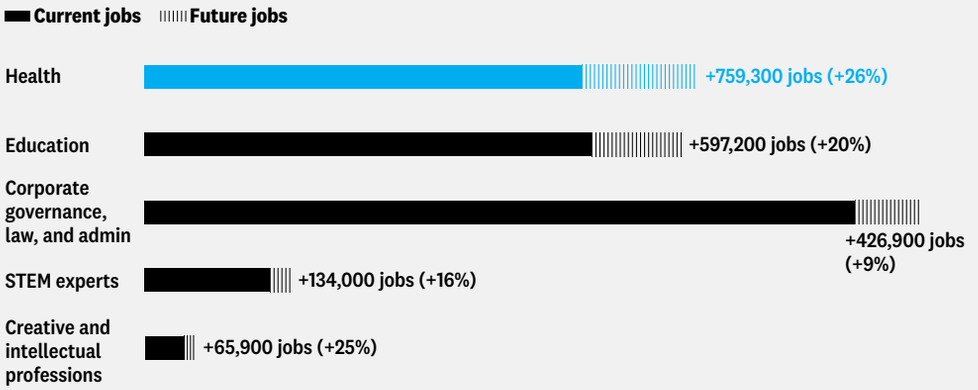
Automation won't end the labor shortage

The health sector exemplifies how demand will grow in the professions for which technology can't substitute, according to research by Deloitte Germany

Substitutability of working time



Expected demand for occupations by 2035



Source: Deloitte analysis.

A good deal of the discussion around the future of work focuses on automation, including the hope that automation could compensate for declining workforces that will characterize many labor markets around the world in the coming years. However, according to a recent study by Deloitte Germany on the impact of technological change on the German labor market by 2035, automation can't fill the labor shortages in some of the sectors projected to experience the most significant increases in demand.[1]

Analyzing the effects of six technologies—machine learning, computer vision, robotics, robotic process automation, natural language processing, and data analytics—across more than 1,000 occupations, Deloitte found that, on average, around one-third of working time can be replaced.[2] But this doesn't mean that a third of the workforce will find itself unemployed. The research shows that activities that are hard to replace are related to interaction, communication, and empathy—which is good news for lawyers, teachers, and health care providers.

Moreover, demographic trends such as aging populations in many labor markets are increasing demand for human-intensive services such as health care. Comparing demand trends for particular professions to the "substitutability" of technology automating certain tasks and roles helps paint a picture of the future work landscape. Demand for jobs such as health care will grow, while they're hard to replace by technology. On the other hand, there are jobs that are easy to automate that will experience less demand. Overall, we estimate that, despite automation, the labor market in Germany will grow by 1.3 million jobs by 2035.[3]

While workforces get reskilled and upskilled to work in increasingly digitized roles, automation won't solve the labor shortage—so companies need to redesign jobs to optimize human-oriented activities and consider how automation might fill these gaps.

For more insights on work and talent, visit www.deloitte.com/insights/human-capital-trends

Infographics by Molly Woodworth

2

The new supply chain equilibrium

In the wake of COVID-19 and widening geopolitical risks, companies around the world are optimizing their supply chains for resilience and efficiency. To really thrive, you also need to focus on agility.

By **Paul Delesalle, Jim Kilpatrick,** *and* **Adam Mussomeli**

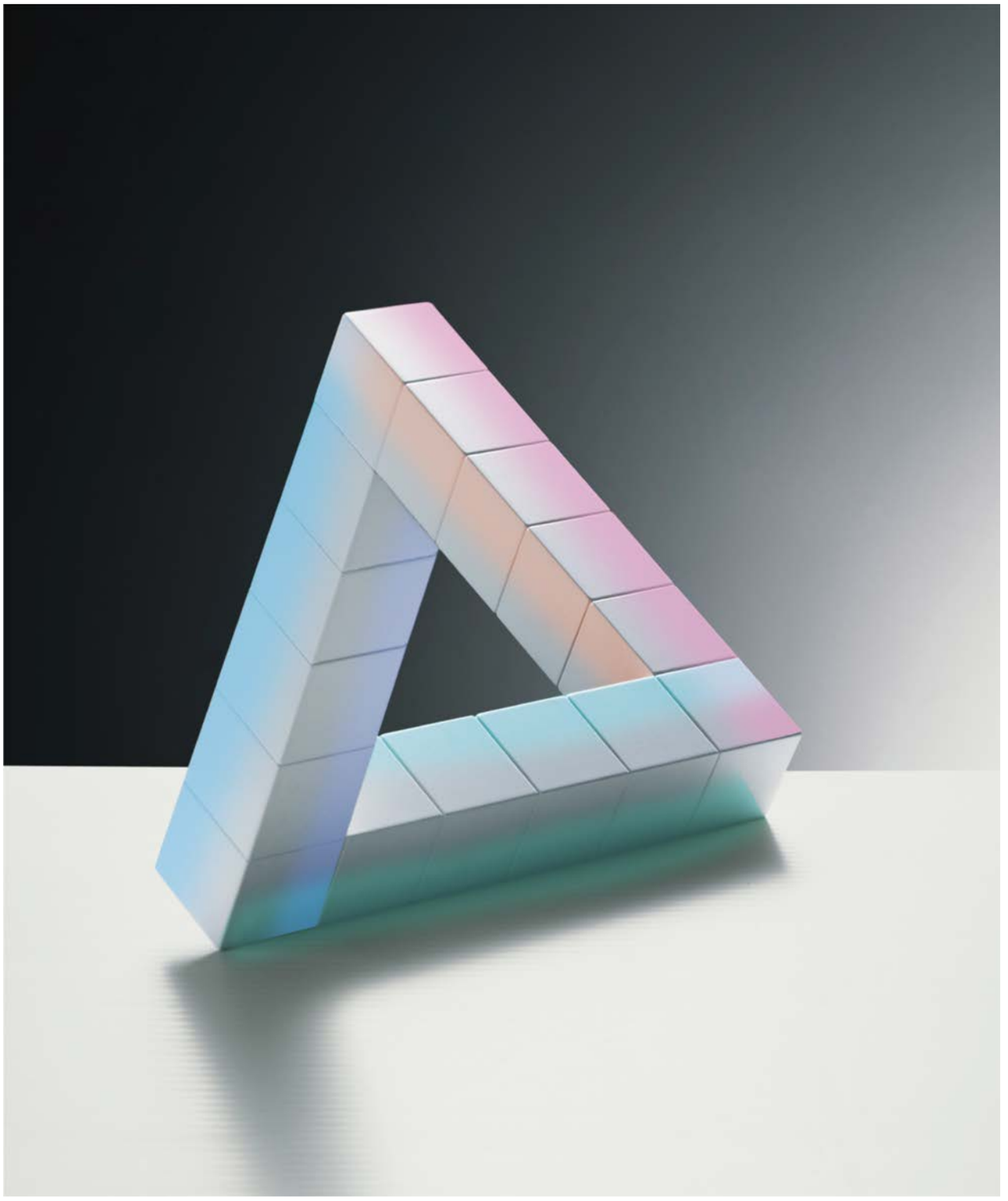


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Illustration by Matt Lennert Source Getty Images/Ray Massey

The COVID-19 pandemic exposed serious vulnerabilities in today's highly efficient global supply chains. As COVID-19 transitions to an endemic state, the world braces for still more shocks and inflationary pressures driven by sanctions on Russia and uncertainty throughout Eastern Europe. Clogged ports and empty store shelves around the world speak to the additional work companies have to do to make their supply chains more resilient, even as they face pressure to hold down costs. These measures are important and necessary, but we believe they miss another crucial element in supply chain management: agility.

Disruption and massive, rapid change are the new normal, but the response from supply chains has been largely defensive to date, as managers enact measures to guard against supply shortages. Agility, which most supply chain officers would nod to as a nice-to-have attribute, is harder to quantify and can feel less urgent in the face of a crisis. As a result, most supply chain leaders have focused on improving the more tangible elements of supply chain performance where metrics and performance expectations—elements such as cost, service, quality, inventory, and asset performance—are much better defined.

However, the fact that agility is less tangible doesn't make it less important. The ability to save money or weather a crisis, while necessary, is insufficient. In the long run, agility can make the difference between operations that thrive and those that merely survive. Among other benefits, agility provides better and more timely data, and improved visibility; the ability to execute faster than the competition; and integrated and collaborative relationships with key supply chain partners.

The agile supply chain is important for two reasons. First, we live in an age of disruption. Capabilities that improve supply chain agility can also help improve its resilience. As new forces continue to roil the world's sources of supply, from increasingly severe and frequent natural disasters to geopolitical upheavals, supply chains will need to build in the capacity to reconfigure much more rapidly to keep goods flowing. This is a level of agility that, before the pandemic, was considered less important than maintaining a simpler, more cost-efficient chain from source to customer. Historical approaches to improve resilience typically relied on incremental inventory, incremental capacity, or incremental suppliers. However, these "physical" approaches to resilience all have a financial overhead that's difficult to justify when supply chain performance is primarily evaluated on efficiency. In the future, digital approaches and new, agile capabilities will enable improved resilience, with less financial burden.

Second, supply chain managers often operate much closer to markets, and with a higher degree of granularity, than managers in other parts of the organization. They have access to market signals that others don't, such as a potential competitor supply issue, so they can identify new opportunities and help mobilize the organization to take advantage of these. This advantage gets compounded when organizations can respond more quickly and precisely than their competitors.

To build in agility, supply chain leaders need to play offense as well as they play defense. This is a fundamental shift in mindset for a world in which the supply chain is more complex, organic, and changeable, and more deeply embedded in corporate strategy as one of the capabilities that you need to win.

What makes a supply chain agile?

The capabilities, key performance metrics, and performance expectations related to agility are not as standardized or well-defined as they are for supply chain efficiency. And the focus on agility will vary based on a company's overall strategy and the design of the supply chain to support that strategy. However, in our experience, agility can be built in four areas:

- **Demand sensing:** The capability to sense and respond to changes in demand is a good start. However, the agile supply chain goes a step further and anticipates changes, smoothly reconfiguring the production and distribution network, and pivoting to robust sources of supply as new demands and opportunities for profitable growth come into view. In an agile supply chain, managers track metrics that include the average number of days between sensing demand for a new product and getting it to the market, as well as the overall number of products introduced based on the proactive sensing of new customer preferences.
- **Collaborative relationships:** Supply chain managers who excel in this area, in effect, become information hubs, taking in data and observations from multiple sources to

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understand opportunities and risks. They excel at collaborating with their key supply chain partners to respond in an orchestrated manner to these opportunities. They collaborate with key customers, exchanging marketplace information and aligning demand forecasts and product flows. They also have two-way information exchanges with a greater percentage of tier 1 suppliers, sharing inventory, production schedule, and capacity information to better optimize the end-to-end supply chain response versus just a single company's piece of it.

- **Process integration:** Agile supply chain organizations break down traditional functional barriers and focus on optimizing end-to-end processes. This fundamentally changes the speed at which an organization can respond to change. Process cycle times that were traditionally measured in months will be executed in weeks. Weekly processes will become daily processes. And the boundaries between planning and execution will blur.

  For some organizations, the ability to respond quickly may lead to a greater degree of vertical integration and direct control over a higher percentage of nodes across the end-to-end supply chain, including manufacturing plants, supply locations, and customer access points. Tesla, for example, is more vertically integrated than many other automotive original equipment manufacturers. As such, it neatly sidestepped the supply crisis in computer chips by using its own in-house software engineers to write code for alternative chips. While other carmakers were forced to shut down assembly lines as they waited for chips, Tesla increased production of its all-electric vehicles in 2021 by an estimated 80%.[1]
- **Information integration:** Rapidly advancing technologies, such as cloud computing, 5G, the industrial Internet of Things, and artificial intelligence, are driving the digitization of supply chains, increasingly leveraging information over assets. Organizations seeking to increase their agility quotient often run aground because of an inability to easily and quickly share information across the organization.

  This same constraint is even more challenging when sharing information across entities in the extended supply chain. That's why agile supply chains monitor the timeliness of information and the percentage of data where they have real-time—or, even better, right-time—visibility and access. They also focus on the richness and integrity of this information as agile supply chain excellence is driven by accurate data and enriched signals.

A tripolar strategy

The need for agility to achieve supply chain excellence doesn't mean supply chain managers can lessen their focus on resilience or efficiency. As chief supply chain officers frequently tell us, the pressure to keep costs down hasn't abated. And the inflationary headwinds in wages, transportation, and many key commodities are strong as the world emerges from the COVID-19 pandemic and global supply chains resynchronize. The equation to optimize supply chain design has become a lot more complex. Supply chain executives need to find a new equilibrium that properly balances these three imperatives. If that isn't daunting enough, supply chains also need to serve the broader goals of the organization, reaching new levels of customer service, and meeting ever more stringent decarbonization and broader environmental, social, and governance goals.

Complicating things further, the right balance will vary based on your position and role within an industry supply chain, your specific strategy, and how the supply chain contributes to your competitive advantage, and even over time as internal priorities evolve and the external environment changes. Some supply chain improvement initiatives can move the needle on more than one dimension. For example, investments in building smarter and more digital factories and distribution centers can have a positive impact on all three dimensions (see figure).

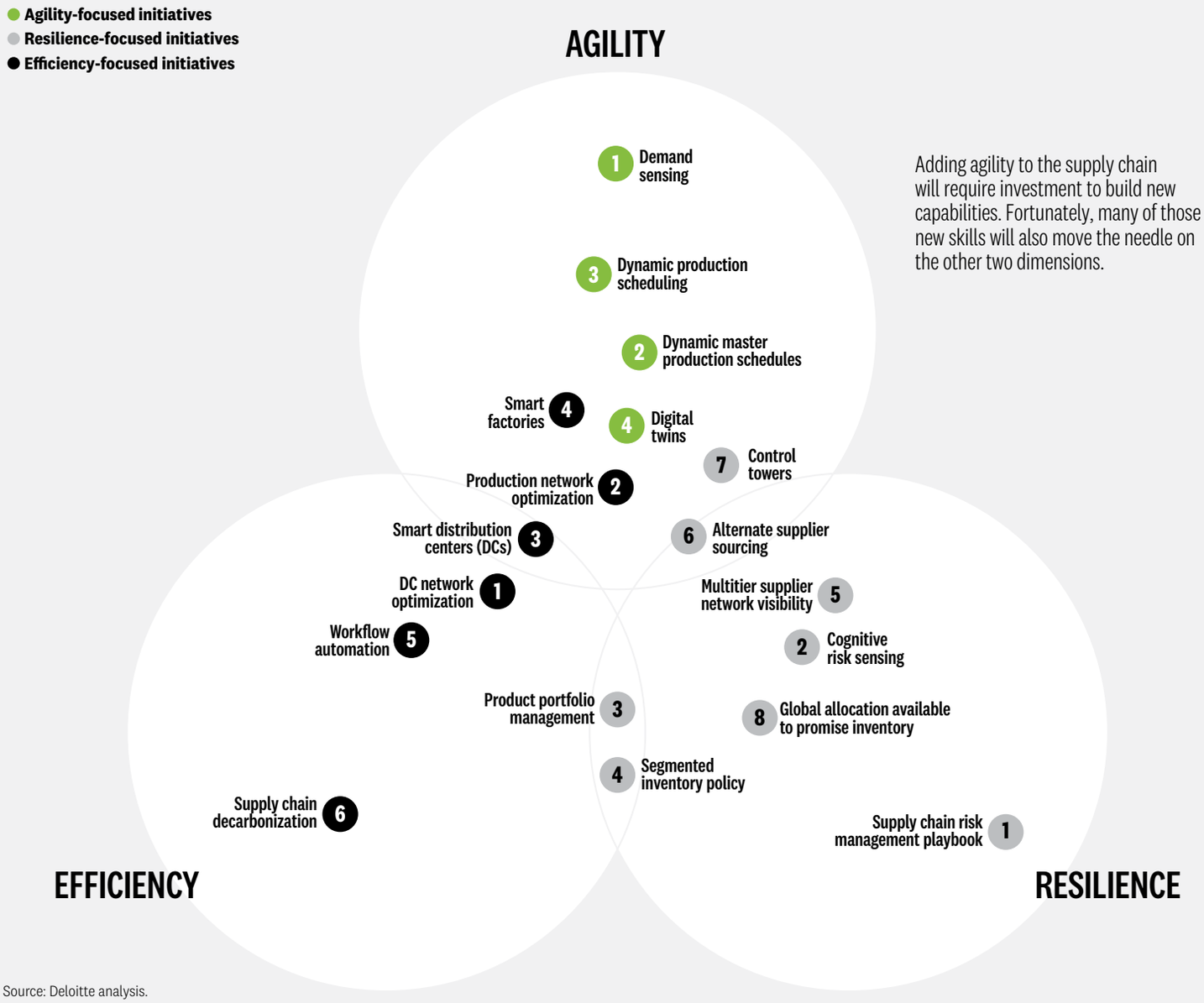
However, many initiatives that respond to a particular imperative may add challenges to the other two, making the strategy truly multidimensional. For instance, if you can source from Asia

YOUR SUPPLY CHAIN MADE AGILE

Here's what the competitive advantage of increased agility actually looks like. Imagine if you had the tools and capabilities to do the following:

- Anticipate a shortage of a critical component or commodity, and move more quickly than your competition to secure supply
- See upstream issues across your multitier supplier network and collaborate with your direct suppliers on alternate supply strategies, preventing the upstream issues from impacting you
- Rapidly reconfigure your production and distribution network to keep goods flowing when global logistics infrastructure hits bottlenecks
- Sense and respond to shifts in demand and changes to consumer preferences or, better still, anticipate them based on enriched digital signals from the marketplace and proactively adjust supply chain execution
- Bring new products to market in weeks when it takes your competition months

A new tripolar strategy



Adding agility to the supply chain will require investment to build new capabilities. Fortunately, many of those new skills will also move the needle on the other two dimensions.

Source: Deloitte analysis.

at a 25% discount on the total cost of ownership of locally sourced products, it strengthens supply chain efficiency. But if the lead time is more than 100 days, that could weaken resilience and agility. The problem could be even worse if the product moves by only one logistics mode (such as ocean freight) and there are unforeseen cost or capacity issues that impact profitability and customer service. Each initiative also needs to be evaluated for its effect on customer service and sustainability.

But the opportunity is worth the effort. Tripolar supply chains that can execute against these three imperatives successfully can go from a corporate expense to a source of competitive advantage and a driver of profitable growth.

A supply chain for a new era

In the postpandemic world, the most successful supply chains will find a balance among these three imperatives: agility, efficiency, and resilience. While costs remain a concern, the past two years have exposed the vulnerabilities in overindexing on efficiency, as well as the risk to efficiency when building resilience becomes paramount.

Agility allows organizations to anticipate supply chain issues, adapt to new ways of working, and proactively respond, thereby offering the potential to build substantial competitive advantage. For today's supply chain managers, it's time to play offense.

Collaborative advantage: Activating the power of many

As economic and societal forces continually reshape the business environment, we're entering an age of profound discontinuity. Here we explore two meaningful opportunities to reframe your strategy for success in the next decade.

By **Eamonn Kelly** *and* **Jason Girzadas**

Illustration by Matt Lennert Source: Getty Images/Artur Debat

In recent years, the world has witnessed extraordinary and foundational shifts: increasingly vivid manifestations of climate change, as scientific theory has been steadily affirmed by newly lived reality; rising inequality, accompanied by a resurgence in populism and nationalism, and a trend toward increasingly autocratic leadership; increased polarization and a decline of trust across many societies; new and impactful civic movements challenging old injustices; millions of human lives lost, and almost all lives disrupted by a severe global pandemic; and the steady demise of the post–World War II world order, now tragically accelerating as the horrors of war return once again to Europe.

Today, as we hope that COVID-19 will soon transition to a manageable endemic status, many business leaders are preparing for a return to something resembling "business as usual." But we should also prepare for continued seismic change ahead, as the world—and the business environment—moves through inevitable further surprises. We believe that over the next decade, business leaders will experience several major discontinuities—shifts that fundamentally undermine and sometimes reverse long-standing "truths" and orthodoxies that have held powerful sway and shaped our thinking, choices, and strategies for decades.

Some of these are already in plain sight. First, from the mid-1990s, a widespread belief took hold that the sole purpose and responsibility of a corporation was to maximize short-term shareholder value. This notion became almost unchallengeable, profoundly informing the priorities and behaviors of most businesses. Today, mounting evidence of the increasingly severe costs of economic and social externalities has dramatically undermined this conviction, and more and more business leaders are publicly embracing a far more balanced model of stakeholder capitalism that includes the needs and interests of customers, employees, suppliers, communities, and our shared natural environment. Even some of the institutions that, in the past, most relentlessly advocated for the primacy of shareholder value now instead exhort leaders to adopt an authentic environmental, social, and governance agenda as a central business driver.

Similarly, for several decades, economic globalization has been a powerful, continuous, and largely uncontested force that spread progress, growth, and prosperity, and generated remarkable, new opportunities for many businesses. A rapidly growing global middle class created new customers, while increasingly educated and skilled workforces provided wage-arbitrage opportunities. Widespread deregulation, the convergence of standards, and the reduction of trade barriers also contributed substantially to a relatively benign international business environment. Now, geopolitical turmoil, increased government intervention, the disruption of supply chains from various sources, and growing protectionist instincts in many parts of the world are putting significant stress on this very system, in which most of us have honed our leadership skills and business strategies.

These discontinuities will undoubtedly require leaders to innovate radically—in new ways and with new mindsets. Fortunately, continued advances in technology will provide significant, new opportunities and capabilities. In fact, developments over the next decade will likely astonish. Paradoxically, the inevitable end of Moore's Law as it hits its physical limits is driving critical, new investments in new materials such as graphene, expected to displace silicon, while advances in chip specialization, design, and architecture are steadily securing significant performance gains. Quantum computing, biological computing, and artificial neural networks are already emerging, and software continues to "eat the world." Together, these technologies are reinventing even our thousand-year–old model of scientific discovery, with the exponential growth of digitized data and increasingly powerful learning algorithms enabling the automated discovery of correlation and causation. The possibilities and capabilities that new science and technology will generate over the next decade quite literally defy human imagination today.

Absolutely critically but perhaps less visibly, *how* we will innovate to create value and secure sustainable growth will also change very substantially. Two key "softer" shifts are underway today that will help redefine most business and organizational models in the years ahead. We believe most business leaders should commit to more deeply exploring and activating both.

From "the theory of the firm" to "the theory of the ecosystem"

Adam Smith first observed the key role of the division of labor in driving productivity and growth. Technological progress and the increased specialization of work resulted in the growing complexity of economies in meeting human and societal needs. Similarly, Ronald Coase, in his seminal 1937 essay, "The nature of the firm," introduced microeconomics and the essential role of firms (primarily, the management of transaction and coordination costs).[1] Both were theories that helped shape business as we know it today. But more than 80 years later, these traditional views of industry structure and the role of individual firms might be less useful in understanding and leading the value-creation systems that now reshape the economy.

Advances in digitization, datafication, connectivity, and specialization are steadily dissolving old structures and blurring old boundaries by enabling cross-industry and cross-firm collaboration and cocreation. Previously distinct industries are converging to form dynamic, human-centric ecosystems that address fundamental human and societal needs and wants in newly possible—and typically more effective, precise, accessible, and sustainable—ways.

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Within these ecosystems, individual businesses—alongside government, academic and philanthropic actors, and consumers—collaborate, compete, and evolve together, with diminishing transaction and coordination challenges, and growing levels of interdependence and vital shared interests. Consider health and wellness: Physical and mental well-being are fundamental human needs, and have been the focus of discovery, innovation, and huge investment for centuries. But for too many in the United States and around the world, health care is inaccessible, either demanding a disproportionate share of their income or simply positioned beyond their reach.

The COVID-19 pandemic has accelerated the emergence of the new ecosystem that will transform this critical part of our societies and economies. Telemedicine usage soared, while tech and data companies rapidly developed and activated new track-and-trace systems. Pharma and biotech companies forged new collaborations, while blending and integrating vaccine manufacture and distribution capabilities. Governments, foundations, civic institutions, public health agencies, pharmacies, and citizens funded, mobilized, and staffed mass vaccination programs. Media companies raised awareness and information.

Globally, around 12 billion vaccine doses have been administered from a standing start in 18 months, with many millions being injected every day.[2] There's no denying the appalling inequity in the timing of the rollout process, and that mistakes have been made and lessons learned. But the sheer scale, speed, and effectiveness of this massively complex undertaking have provided testament to the growing capabilities and power of multiactor collaboration, which will only grow and strengthen over time.

As a result, highly autonomous and fully vertically integrated organizations could be fading into history. Over the coming decade, the concept of a "self-contained firm" as a useful unit of value creation likely will decline even further.

While every business will continue to need its own strategy and vision to inform its own choices and priorities, these increasingly need to be anchored to the ecosystems within which the business operates. By focusing on collective strategies, we can more effectively integrate our capabilities in alliances for mutual benefit. This will not be simple. Strategy in a fast-changing world is already hard enough; collaborating with multiple entities to create shared ecosystem–wide strategies might feel a little like learning to play three-dimensional chess. New strategic tools and methods will be required, and new relationship norms must evolve.

The rise of networked power

Greatly amplified capabilities for connection and collaboration are not only transforming our economy through the growth of ecosystems but also greatly strengthening networked models of power. This matters profoundly. Power—who has it, how they get and use it, the rules they set with it, how they treat those who don't have it, and the checks and balances they face if they abuse it—has always critically defined our societies, economies, and lives. Throughout history, the default modality of power has been consistently hierarchical and centralized, and operated primarily through command-and-control systems. The powerful institutions that have ordered our societies have been built primarily upon these defaults.

Yet very different power modalities have also helped shape human life—and frequently driven change. Networked, decentralized, autonomous, and collaborative models of power have frequently emerged as strong but temporary forces, often to tackle the abuse of traditional power and drive change and reform. Movements such as #MeToo and Black Lives Matter in the United States have triggered foundational societal changes that have impacted the behaviors and priorities of many major businesses. Greta Thunberg, lacking any formal authority or even organization, has catalyzed millions of youth activists in response to climate change.[3]

The default toward traditional hierarchical power models is simple to explain: They're effective in getting things done and are stable and enduring. But they also tend to lack speed, flexibility, agility, responsiveness, and adaptability—all important qualities in times of significant change. This explains why, over the last few decades, most large organizations have launched initiatives aimed at decentralizing, delayering, empowering, or dissolving silos. The sheer strength of the default power systems explains why these efforts have often resulted in new layers, different silos, and recentralizing systems. But over the coming decade, the conditions are in place for the defaults to be reset, at societal, economic, and organizational levels.

Twenty-five years ago, many expected that the internet would catalyze massive decentralization and shift power toward networks and away from formal institutions. Some of the more utopian aspirations of the 1990s have certainly not been realized—and the pace of change has, perhaps, been slower than some expected. But there should be no mistaking the significant impact of the internet on shifting power and influence. Platforms such as eBay, Etsy, and Shopify have enabled new levels of distributed economic activity, with tens of millions of active participants. Open-source intelligence tools and platforms are becoming stronger and, along with a variety of citizen-led investigative organizations, are playing a major role today in tackling disinformation.[4]

Power is already shifting dramatically, but even greater change lies ahead. Trust in many old, centralized institutions is declining rapidly, eroding their authority and gatekeeping roles. Exponentially growing volumes of digitized data are becoming more openly available to more people. Gen Z, the first generation of digital natives, has reached adulthood with deep personal convictions regarding the need for social and environmental change. Web 3.0 and crypto networks are laying the foundations and establishing the capabilities for a decentralized digital economy.

The macro challenges and opportunities that lie ahead of us all demand multidimensional, multiactor collaborations that defy centralized coordination and control. Business (and other) leaders can, of course, choose to resist the rise of networked power models, but the costs, in terms of slow innovation and weaker collaboration, could prove to be high.

Bold action will be required from business leaders as we endeavor to forge a shared future that's productive and sustainable, meritocratic and equitable, profitable and purposeful, logical and human-centric, and competitive but also deeply collaborative. Those who activate and amplify their agency by adopting new mindsets and innovating new tools and approaches to unleash the growing power of ecosystems, while blending hierarchical with networked power, will have disproportionate impact and will better secure their own sustained growth.

For more insights, visit www.deloitte.com/us/ageofdiscontinuity

Why reporting workplace well-being metrics is a good idea

People want to improve well-being at work, but first they need to know where it stands. Transparency through public disclosure is a good place to start.

By **Colleen Bordeaux, Jen Fisher,** *and* **Anh Nguyen Phillips**

Getty Images/skynesher

Spurred by lingering fallout from the pandemic, financial pressures, and other factors, stress in the workplace continues to rise. A 2022 Deloitte cross-industry study confirms the scope of the problem: Only 59% of surveyed employees said that their well-being was good or excellent, and the most-cited factors acting against well-being across both employees and C-suite executives were a heavy workload or a stressful job (30%) and not having enough time because of long work hours (27%).

This could spell trouble for employers. When worker well-being (defined holistically to include physical, mental, financial, and social aspects) suffers, productivity often declines and health care costs frequently rise. Presenteeism, which costs US employers US$150 billion a year in lost productivity,[1] can escalate. And that's not all. Some four million workers have been voluntarily leaving their jobs each month in the United States alone—a ballooning exodus that has been termed the "Great

Resignation"—and a lack of well-being is a leading suspect.[2] A Randstad study found that 56% of employees age 18–24 say they would quit a job that prevented them from enjoying their lives; 38% of those 55–67 agreed.[3]

The upside of well-being is just as compelling. People want to work for organizations where workers thrive. Fifty-nine percent of employees in the Deloitte study said they would seriously consider taking a job with a company that offers better well-being benefits than their current employer. High employee well-being can make an organization more attractive to customers and investors as well.

The challenge, though, is that it's hard to know whether worker well-being—*actual* well-being, not just employers' investment in it—is high or low. While some organizations track program and benefit usage or survey employees about their stress levels, these typical metrics don't get to the heart of what's essential to any organization where workers thrive: a culture that supports well-being. Today, people learn about how a particular organization's workers experience well-being largely through word of mouth—Glassdoor, Vault, conversations with friends and family. But this information is often subjective, influenced by factors such as recent workplace events, listener expectations, and even a person's mood.

But what if organizations publicly reported metrics on their workforce's well-being? The desire for this is evident, as are the potential benefits. In the Deloitte survey, 55% of the employees and 77% of the C-suite executives believed that companies should be required to publicly report workforce well-being metrics. What's more, a majority of both employees and C-suite executives said they would trust their company more if it publicly reported on well-being, and that they would be more likely to take a job with a company that did so.

Publicly disclosing metrics on worker well-being may seem radical, but it has a precedent: the evolution of environmental, social, and governance (ESG) reporting. As ESG has become more of a priority among customers, investors, and workers, companies responded by creating and publicly disclosing ESG metrics. These metrics eventually became so important that regulators in many geographies, including the United States, the European Union, South Africa, Australia, and China, now mandate their disclosure.[4] Governing bodies have also been working to standardize ESG metrics and reporting frameworks, which would allow stakeholders to reliably compare organizations' ESG performance.

The same could happen with well-being as public interest grows. Well-being touches every worker and their families, and many want something done about it. Recent media coverage has put well-being squarely in the public eye, elevating it as an important societal concern. The Great Resignation has sent employers scrambling to use every available lever, well-being prime among them, to attract and retain workers. For all these reasons, organizations have much to gain from metrics that can help them better understand worker well-being and communicate about it to their stakeholders.

Well-being metrics don't have to be "squishy" or based wholly on self-reporting, though self-reported data would likely be a crucial input. Along with gauging workforce sentiment with surveys and interviews, organizations can measure observable proxies that assess well-being in an empirical way. For example, organizations could track the percentage of workers who use their entire time-off benefit, the amount of overtime people put in, or the volume of work-related emails sent on weekends. Attrition rates could shed light on the quality of workers' relationships with their supervisors. Organizations operating in company-provided facilities can use frameworks such as the WELL Building Standard to gauge workers' likely physical well-being at work.[5] They could also analyze insurance claims to understand whether workers are seeking more or less medical attention over time. Combining metrics like these with explorations of workers' lived experience would likely help leaders develop a nuanced, actionable understanding of well-being across the organization.

Organizations can benefit from sharing well-being metrics internally as well as externally. People at all levels want to feel they can be open about their well-being, especially as it relates to their work. Transparency among the C-suite is especially important. In the 2022 Deloitte study, 72% of the workers at organizations whose executives were transparent about well-being rated their own well-being as above average, compared with just 57% of workers at organizations with less-transparent executives.

It remains to be seen if well-being reporting will follow in ESG's footsteps. But the growing recognition of well-being's importance may mean that the process is already underway. Reporting on well-being could be the next evolution in disclosure—with the prospect of benefiting workers, employers, and society as a whole.

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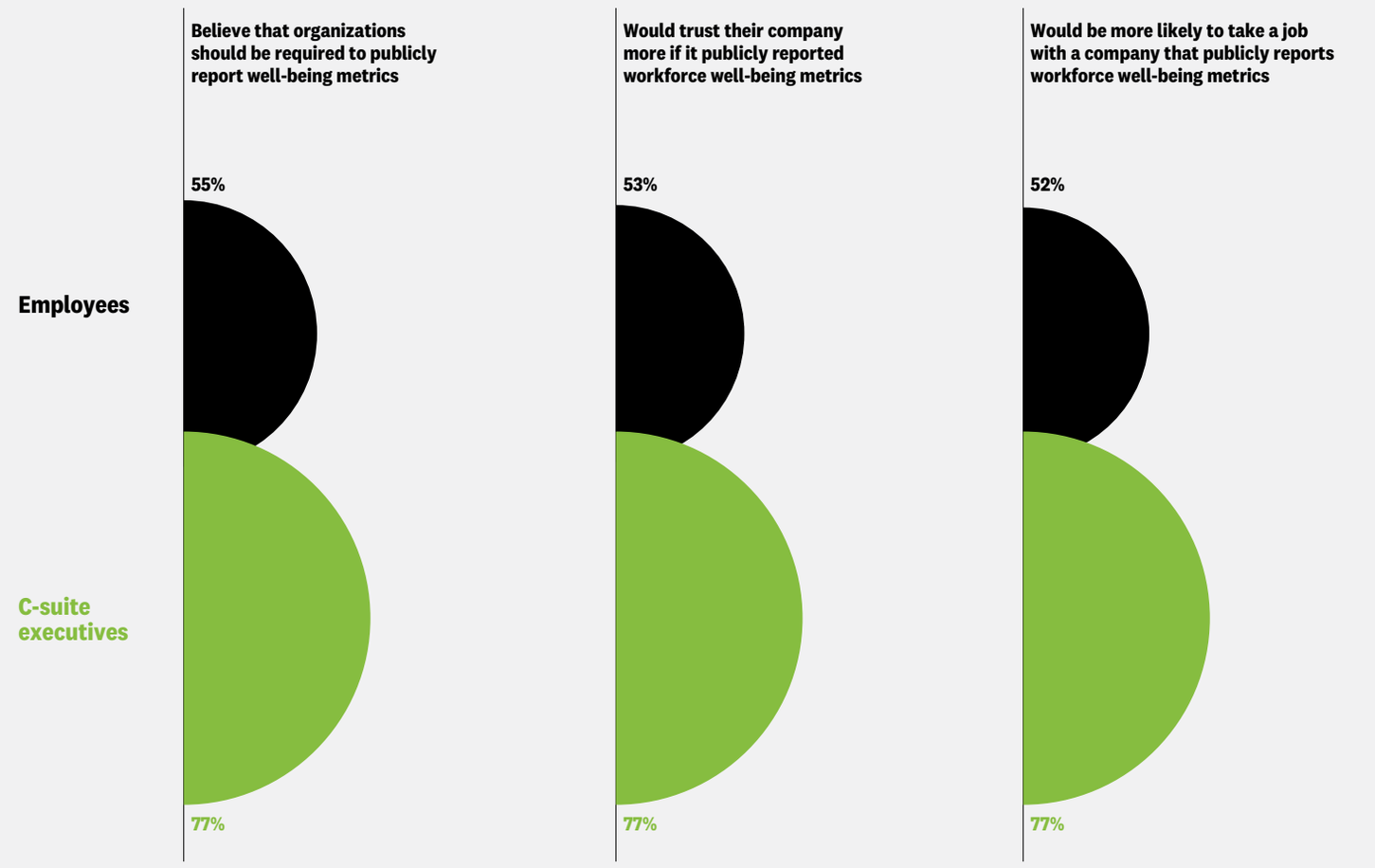
72% of the workers at organizations whose executives were transparent about well-being rated their own well-being as above average, compared with just 57% of workers at organizations with less-transparent executives.

Most employees and C-suite executives we surveyed favor publicly reporting well-being metrics



Source: Deloitte employer and C-suite well-being survey, 2022.

Employee health contributes to organizational health

The commitment to employee health and well-being should start in the C-suite

By **Dr. Jay Bhatt**

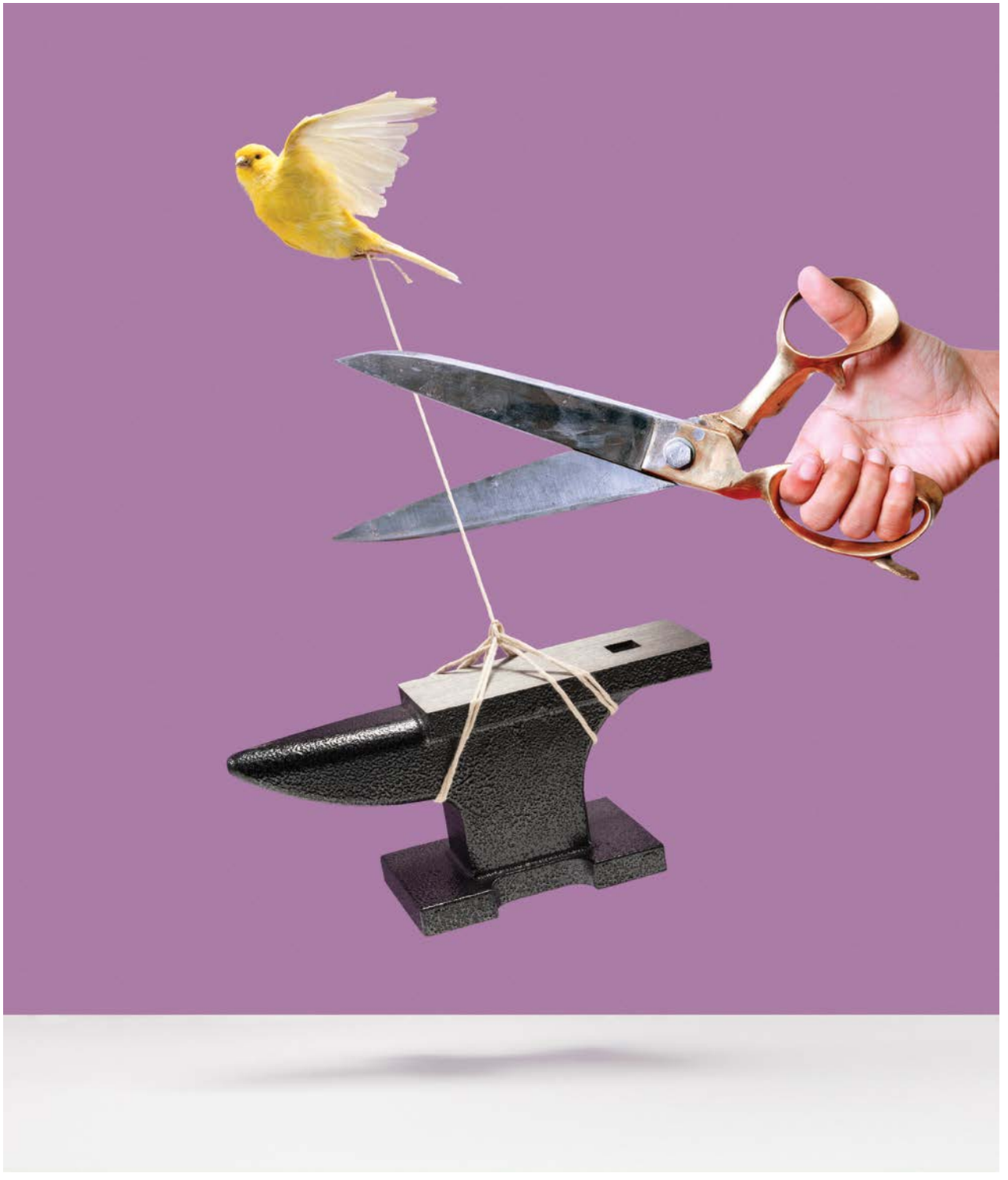


Illustration by Matt Lennert Sources: Getty Images/PM Images, Adobe Stock/Paul Prescott

We've all seen the headlines: Job satisfaction and employee productivity levels are plummeting while cases of burnout and absenteeism are skyrocketing.[1] Employee mental health is declining, and work/life integration is far from balanced. With 4.5 million Americans walking away from their jobs in March alone, the so-called Great Resignation isn't showing signs of slowing.[2] In many ways, the COVID-19 pandemic sounded an alarm on employee health and well-being, and it's time we heed the warning.

Issues of this magnitude generally go straight to the top. According to the winter 2022 edition of the *Fortune*/Deloitte CEO survey—which gathered the perspectives of 175 leading CEOs representing more than 15 industries—nearly 50% of chief executives identified talent-related issues such as "finding/keeping the best people" and "responding to new work paradigms" as some of the biggest challenges their organizations face.[3] When asked to describe 2022 in one word, an equal number of CEOs said "hopeful" and "uncertain."

To counterbalance the uncertainty, business leaders should shore up their strategic priorities, and improving employee health and well-being ought to top the list. After all, the health of your organization sits squarely on the health and well-being of its biggest asset: your employees.

Match benefits to employees' (true) needs so they can bring their best selves to work

Expanding workplace benefits and programs to meet the needs of today's employees can give many organizations a competitive edge. And the list of how to stand out is long, from personalizing wellness programs and improving work culture to helping employees succeed at healthy work/life integration. However, it's not enough to offer great benefits: You should help your employees navigate them. In fact, according to an Employee Benefit Resource Institute survey, just 34% of employees understand their benefits "very well."[4]

The trouble is that there's a disconnect between how employers and employees assess employee well-being—and what can be done to improve it, according to a recent survey of 2,100 employees and C-level executives conducted by Deloitte's CEO Program in collaboration with research firm Workplace Intelligence.[5] For example, while nearly nine out of 10 executives view their employees' physical well-being as "good" or "excellent," just two-thirds of employees have a similar view. Leaders should consider revamping offerings to meet employees' preferences and listening to their changing needs to uncover ways to help them thrive.

Here's how many of today's leaders are bringing a new lens to employee well-being: Employers are going the extra mile by supporting employees who take time off to get preventive and routine screenings or participate in a clinical trial.[6] They're creating inclusive environments and helping employees feel valued and celebrated.[7] And they're thinking of new services for employees who have limited access to safe housing, transportation, and child care services.[8]

How can employers help increase their employees' financial security—which research has shown can directly impact employee well-being—beyond their standard compensation and benefits packages?[9] Consider looking at your employee communications around retirement savings, for example: Some employees might not be contributing to the 401(k) because they can't afford to, while others might not understand how to access the benefit.[10]

It's also about making a commitment to diversity, equity, and inclusion. Many employers are learning that small language tweaks can help make their benefits and programs more inclusive across the board.[11] For example, parental leave language can be inclusive of same-sex and nonbiological parents by using gender-neutral phrases such as "primary caregiver" and "secondary caregiver."

Support your employees on the road to better health—and reap the returns

Healthy employees typically have a better quality of life overall: reduced risk of illness, disease, and injury; lower stress levels; and improved mindset. But it's not a one-way street: Healthy employees can reward their employers with more productivity, fewer sick days, and more organizational and community engagement.[12] So how can employers infuse more opportunities to boost wellness?

In general, if you look at data about employees who use wellness programs, they're healthier overall than the employees who don't participate.[13] And when employers explore why employees aren't engaging, they may find it's a child care issue, or maybe the program is prohibitive because it requires travel across town. For employers, the trick is to start by solving the common problems likely standing in the way of better employee health—and build from there.

It's important that employers address all facets of their employees' well-being. That might mean instituting recognition programs, mental health days, and community volunteer activities; or helping to ensure that employees have a sustainable work/life integration by offering hybrid work environments (when appropriate), health coaching, and onsite trails for lunchtime walks. With the rise in remote workers, employers might find value in establishing rewards programs for gym visits or participating in an online cycle class to help offsite employees create healthy habits.

With many of the pandemic's workplace impacts likely here to stay, it's time to put employee health and well-being at the top of the C-suite's strategic agenda. What might you do differently with your strategies, policies, and programs if employees' health and well-being were primary decision-making criteria? Do you have the data and analytics to identify gaps and opportunities to improve employee health and well-being? Have you sought employees' input on what's working and what isn't to overcome barriers to better health and help boost morale?

The organizations that figure out how to address the physical, mental, spiritual, and emotional needs of their employees—alongside their commitment to health equity and sustainability—could see higher workforce retention rates, better employee health outcomes, and a boost in productivity.[14] But the biggest rewards come from the potential to put your employees, their families, and their communities on a path to better health.

Access more insights on health equity at www.deloitte.com/insights/health-care-equity-steps

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Smart cities, smarter public health

According to Deloitte research, lessons learned from the pandemic are accelerating the evolution of urban environments across the globe for the betterment of residents' health and well-being

By **Miguel Eiras Antunes** *and* **Dr. Stephanie Allen**

Illustration by Matt Lennert Source: Getty Images/BardoczPeter

Many lasting evolutions in urban spaces have happened in moments of great disruption. The Lisbon earthquake of 1755 prompted the creation of guidelines for seismic construction.[1] The cholera outbreak in London in 1848 gave rise to the first health law in the United Kingdom.[2] The Chicago fire of 1871 brought new building laws leading to more fireproof—and, ultimately, taller—structures.[3] The COVID-19 pandemic could have a lasting impact, too, having accelerated the shift toward greener, more digital, and more inclusive cities across the globe.

Over the course of the last two years, we interviewed mayors, city officials, urban planners, academics, and citizens in cities around the world to identify the trends that are making urban living more sustainable, affordable, and human. One theme that emerged was cities' increasingly important role in ensuring the health and well-being of their residents.[4]

Data-enabled wellness

Cities currently represent just 3% of the world's territory but harbor 55% of the world's population. By 2050, it's estimated that 70% of the world's population will live in urban centers.[5]

At an economic level, cities generate around 80% of the global GDP,[6] and are responsible for 80% of energy consumption and more than 70% of carbon emissions and global waste.[7]

When it comes to the health of both people and the planet, cities play a crucial role. By concentrating people and resources in one place, the urban environment creates health hazards as well as opportunities to improve health. For example, 90% of COVID-19 cases around the world occurred in cities,[8] and yet the access and quality of health care is significantly higher in urban centers as compared with rural and remote populations often having poorer health outcomes.

Our global experience of the pandemic showed how interconnected we are as individuals and that our individual health and well-being are shaped by the health and well-being of the communities in which we live, work, and play, and yet our health systems have often been designed around the need of individuals. One of the trends that we believe will become increasingly common in cities is the rise of so-called smart health communities—reimagining public health, integrating well-being into urban design from the outset, and proactively addressing the drivers of health: the social, environmental, and economic factors that contribute to health outcomes.[9]

A data-enabled, digitally connected "smart city" can make health care smarter when systems and data are integrated and interoperable across core health and other services, including public safety, the quality of housing, environmental health, social services, emergency services, and transportation. This can help to enable a real-time response to health crises, address inequities, and support the interconnected health and well-being goals of communities across the globe.[10] A smart city can also better ensure health equity by enabling health care access for more and nurturing the social, economic, and environmental factors that contribute to all residents' overall well-being, encompassing clinical, mental, social, emotional, physical, and spiritual health.[11] For this promise to be realized, health literacy, health system navigation, and access to data are crucial factors to be addressed.

Digitalization has been a crucial lever in cities' response to the pandemic, with tools monitoring contagion risk and ensuring that residents respect confinement and social distancing guidelines, while also enabling services to continue and economic activity to be carried out virtually.[12] The pandemic has turbocharged digital transformation efforts in many cities and paved the way for the next generation of digital-ready cities. Out of necessity, many cities around the world rushed to implement unified digital platforms and develop ways to communicate and engage with citizens. They are making large investments in technologies and platforms to drive a personalized experience, with particular care around digital identity, cybersecurity, and privacy. For example, 83% of cities have made large technology investments to improve remote diagnosis and treatment, and telehealth services. This shows a clear shift in cities' priorities regarding digital health service delivery.[13]

A great example is Cascais, Portugal. The COVID-19 pandemic meant the local government was confronted by new and unprecedented challenges. In the battle to protect its citizens while continuing to provide services and maintain economic activity, Cascais leaders acknowledged the need for integrated management of the health threat, so they deployed a COVID-19 war room. This enabled city leaders to obtain a holistic, real-time view of the pandemic's impact on the local population and manage the entire COVID-19 response process on one platform, maximizing the efficiency of their health and emergency resources, securing citizen engagement, and shoring up residents' morale and sense of security.[14]

We see this trend being applied in cities all over the world. For instance, Chicago has established a highly interconnected health and wellness ecosystem, and Louisville, Kentucky, is prioritizing the development of smart health communities with a focus on the optimal use of technology to facilitate data collection and drive informed interventions.[15]

As Jeff Merritt, head of urban transformation at the World Economic Forum, told us, "It took a pandemic for us to dive in and realize the capabilities of our technology—to prove that we can seamlessly convene individuals across the world and enable productive dialogues, to demonstrate that we can connect with medical professionals from our home without sacrificing quality or privacy."

Cityscapes are going green

Of course, implementing digital technologies and even improving access to traditional health care aren't the only ways cities can foster public health. Cities planned and designed for people, with "green streets" and public spaces as centers of social life, play a major role in creating a healthy environment.

Cities around the world are recognizing that a green approach to urban planning has the potential to lower urban temperatures, mitigate air pollution, and build natural environmental resilience. This focus on green spaces enhances populations' quality of life, enriches physical and mental health, improves resilience and equality as part of an adaptation strategy, and reduces emissions, helping to meet the sustainability and climate goals of the Paris Agreement.[16] We already see great examples of this planning in cities like Freetown, Singapore, Lisbon, and Shiraz.[17]

Improving mobility is a significant factor in going green. The concept of the 15-minute city was developed primarily to reduce carbon emissions by decreasing the use of cars and motorized commuting time. It's a decentralized urban planning model in which each local neighborhood contains all the basic social functions needed for living and working. Innovative urban mobility and planning solutions can help create a convenient, connected, and more sustainable future, contributing to stronger social networks and the quality of living, and reducing congestion, air pollution, and accidents, thereby saving lives.

For example, Saudi Arabia is building a futuristic, mega-city called NEOM or "New Future," in desert bordering the Red Sea. Covering a total area of 26,500 kilometers/10,200 square miles, NEOM will incorporate smart city technologies. The state has pledged at least US$500 billion for the project and is soliciting further investment. All essential daily services—schools, medical clinics, recreational facilities, and green spaces—will be within a five-minute walk. Ultra-high-speed transit and autonomous mobility solutions will make travel easier and give residents more time to devote to their health and well-being. The LINE, a 170-kilometer belt of hyperconnected, AI-enabled communities, without cars and roads, powered by 100% clean energy, and built around nature will provide pollution-free, healthier, and more sustainable environments for residents.[18]

The pandemic highlighted how cities are community-minded by necessity. The inherent interconnectedness that can make them vulnerable to public health events and other disruptions can also make them more resilient. Some cities were able to respond to COVID-19 better than others because they had focused, in prior years, on building resilience and had the physical and digital systems in place. Our research revealed that city leaders the world over are now applying important lessons learned since 2020 to increase digital transformation in community care, remove barriers to care, and improve health equity.

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Thinking about investing in the metaverse? Let history be your guide

To plan how and when to jump into the metaverse, consider your use of existing web technologies

By **Mike Bechtel** *and* **Nelson Launer**

Illustration by Matt Lennert Source: Adobe Stock/Aboltin

You've heard enough about the metaverse to know what it is and how important it could become, but how and when do you plan your business's first move?[1]

When we consider the metaverse not as an unprecedented revolution but instead as an evolution of the web, we can hypothesize that companies' present web strategies—their use of both Web 1.0 sites and Web 2.0 platforms—can be used as predictors of their future metaverse use. These use archetypes fall into three primary categories.

Promoters: Advertising existing offerings

Even though Web 2.0 is nearly 20 years old, most companies' core offerings still exist outside the internet. Consider that e-commerce sales in 2021 accounted for only about 13% of total sales in the United States.[2] However, it's still the rule, not the exception, that companies maintain an online presence, even if it's one with limited functionality and flexibility. From plumbers to professional services firms, most businesses are expected to have basic web pages with information about their offerings.

Similarly, some companies will probably use the metaverse as a simple brochure for their products and services. For example, they might purchase ads in a virtual reality storefront or an augmented-reality–enabled billboard. Although they'll have a metaverse presence for the sake of promotion, their core business models probably won't change materially. If you've used Web 1.0 sites and Web 2.0 platforms for business promotion only, that's probably how you'll use the metaverse.

For these organizations, there's less urgency to take immediate action. Companies in this group have the luxury of avoiding risk and uncertainty by waiting to see how the metaverse unfolds. They might delay investing until one or more metaverse platforms begin to command significant market share.

Plussers: Augmenting existing offerings

For others, the metaverse could provide an opportunity to "plus" today's offerings in richer, more engaging, and more brand-enhancing ways. Consider the decrease in in-person retail sales during the COVID-19 pandemic.[3] A few consumer brands began experimenting with metaverse storefronts,[4] allowing consumers to recreate aspects of the in-person experience, yet they still depend on traditional e-commerce platforms to drive sales.

A portfolio of traditional web and emergent metaverse properties can work together to help these companies diversify their sales channels. Sales and business operations likely stand to be substantially altered but not completely metaverse-dependent.

Companies that already use social media to engage customers while relying on an e-commerce site as their primary go-to-market strategy are probably plussers and will likely approach the metaverse in a similar manner. They will have more urgency to act than businesses in the first group, but they still have the flexibility to wait and see how the metaverse unfolds.

Consider the enthusiastic dawn of Web 2.0, when some restaurants tried their hand at rich online experiences. As it turned out, restaurant-goers of that time only wanted hours of operation, a digital menu, and a to-go order form. Later, as technology and customer expectations evolved, restaurants successfully leveraged third-party platforms to "plus" their core businesses with to-go orders and meal deliveries. In that vein, as customer expectations become clearer, plussers will continue to cook up new ways to leverage the maturing metaverse to augment and enrich their core offerings.

Pioneers: Architecting new offerings

Pioneers see the metaverse as a newly open frontier to be settled. These are the risk takers, innovators, and builders who are already pouring billions of dollars into key foundational metaverse technologies, platforms, products, services, content, and other enabling components. Their first-mover inclination is in service of their goal: sustainable competitive advantage.

Businesses in this group could face a high degree of risk. According to one study, the yearly failure rate for dot-com companies averaged 14%, peaking at about 20%.[5] But the same study showed that dot-com firms' failure rates were on par historically with those from other emerging industries, suggesting that some risk is necessary to reap the rewards of being a successful first mover.

Bloomberg Intelligence expects the global metaverse revenue opportunity to approach US$800 billion by 2024.[6] Competition for a piece of this pie is expected to be fierce,[7] so start-ups and incumbents that are comfortable with the risk should probably already be making investment moves.

In determining your organization's metaverse strategy, consider how your customers might be interacting online in 20 years. How might this consumer behavior intersect with your future business models and capabilities? By evaluating how your company evolved through the Web 1.0 and Web 2.0 eras, you may yield a pragmatic indicator as to when to consider ramping up your investment strategy.

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The importance of sharing success—and stress—metrics

Research from Deloitte Africa highlights how, to survive and thrive through future disruptions, C-suites and their key stakeholders need a shared view of the threat and how their organizations are positioned to manage it

By **Jo-Anne Mitchell-Marais** *and* **Gregor Adrian Böttcher**

Illustration by Matt Lennert. Source: Adobe Stock/Wirestock Creators

Author, commentator, and policy analyst Michele Wucker coined the term "gray rhinos" for high-impact risks people should see coming but invariably ignore until it's too late, like reacting to a rhino aiming its horn in their direction and preparing to charge. In her 2016 book *The Gray Rhino: How to Recognize and Act on the Obvious Dangers We Ignore*, she cautioned that "the frequency of pandemics warns of a much bigger global health threat to come: It's not a matter of if but when."[1]

As the world recovers from the last crisis, and with the next one already happening, it's apparent that more gray rhinos will come. These risks will become more frequent and arrive simultaneously—a "crash" of gray rhinos. For companies, this means operating in a highly uncertain environment, which requires resilience and an honest assessment of where their risks lie.

There's seemingly endless information out there about how companies can ready themselves for the next crisis or disruption, but our 2022 Deloitte Africa Restructuring Survey revealed one particularly important insight that we think is worth adding to the mix: While preparing for the next gray rhino, C-suite leaders should ensure that they're looking through the same pair of binoculars as their key stakeholders and collaborators, including their lenders.[2]

Track the indicators that matter

In a world of frequent disruptions and consistent uncertainty, new winners and losers will emerge across regions, countries, and sectors. Inflation and the threats of recession are altering consumer behavior yet again, as the global economy experiences the reverberating impact of Russia's invasion of Ukraine. Companies that were reaping the rewards of pent-up demand just months ago may show signs of stress later this year. In this environment, where winners can become losers alarmingly quickly, the proactive tracking of indicators of financial stress is critically important for boards, management teams, lenders, and other financial stakeholders.

As the COVID-19 pandemic demonstrated, in the face of a crisis, organizations need a liquidity buffer—sufficient cash runway to implement the operational and financial rightsizing required to survive and thrive. According to our study—which included a survey of 111 restructuring professionals and C-suite executives fielded in January and February 2022 in Kenya, Nigeria, and South Africa—declining operational or free cash flow is the top-ranked indicator of an organization's financial stress. Eighty-five percent of respondents across Africa included this in their top five, and the remaining top metrics were trading- or cash-flow–related.

Many professionals won't be surprised by this finding. Cash is the lifeblood of business, and close cash flow tracking and management are critically important as signs of stress appear. However, while survey respondents across geographies and roles broadly agree on which are the most important indicators of financial stress, views diverge on how often these are tracked by management teams.

C-suite respondents to our survey believe that they regularly track revenue, profitability, cash flow, and working capital but acknowledge that debt ratios are less of a priority. Lenders' perception, however, is almost diametrically opposed: They believe that companies track cash flow and balance sheet metrics less often than headline-making revenue and share price indicators (see figure).

Our survey data indicates a misalignment between the information that lenders and other restructuring professionals would like to see measured and the actual information tracked and provided to stakeholders. This could affect companies' ability to secure emergency funding: Lenders across Africa rank the availability of reliable information as one of the highest barriers to decision-making, second only to the banks' reputational risks.

Adopt a herd—or crash—mentality

So how can management teams better prepare their companies for future crises and disruptions? Don't lose sight of your stakeholders' priorities and perspectives. While C-suite respondents in our survey ranked actions within their control—diversification, establishing crisis committees, and appointing advisors—the highest,[3] lenders recommend that clients engage with their bankers first and as early as possible to ensure emergency funding lines are available.

Halting a crash of gray rhinos may well seem impossible, but by communicating early and encouraging proactive steps to manage risk, the worst of the charge may be avoided.

To access the research report, visit www2.deloitte.com/2022DeloitteRestructuringSurvey.html

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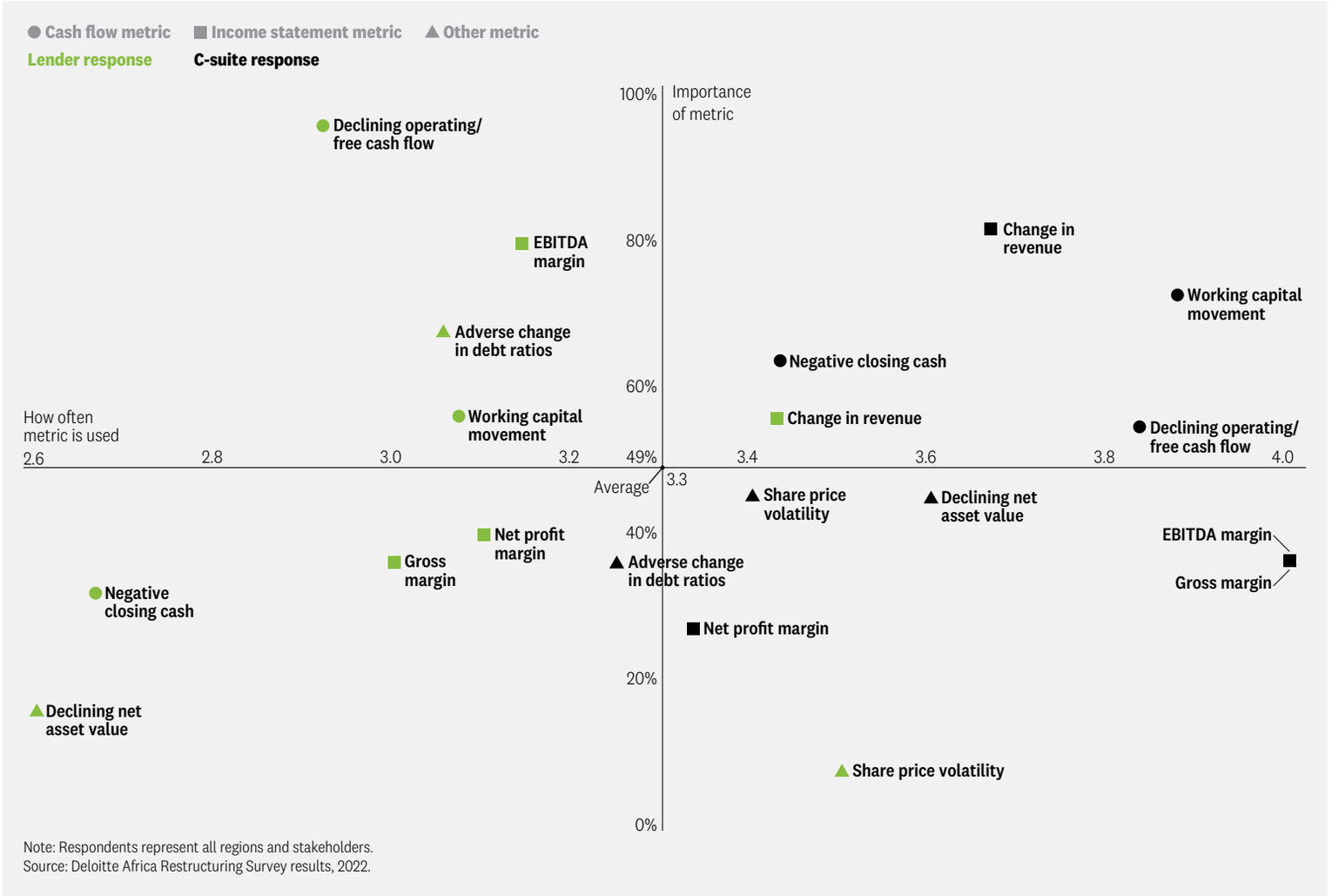
Q: "What are the most effective measures of financial stress and how often are these tracked by companies?"



Note: Respondents represent all regions and stakeholders.
Source: Deloitte Africa Restructuring Survey results, 2022.

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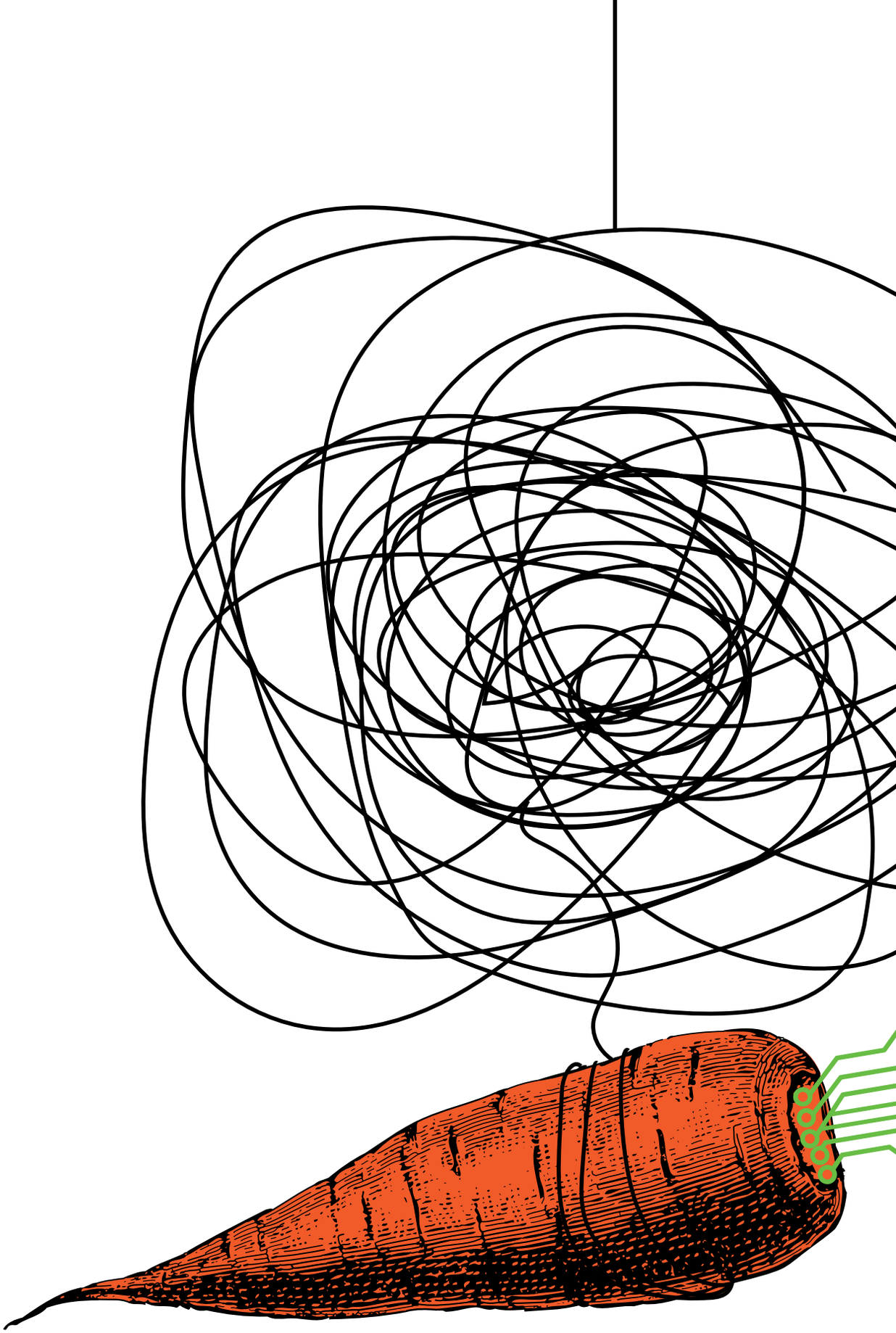
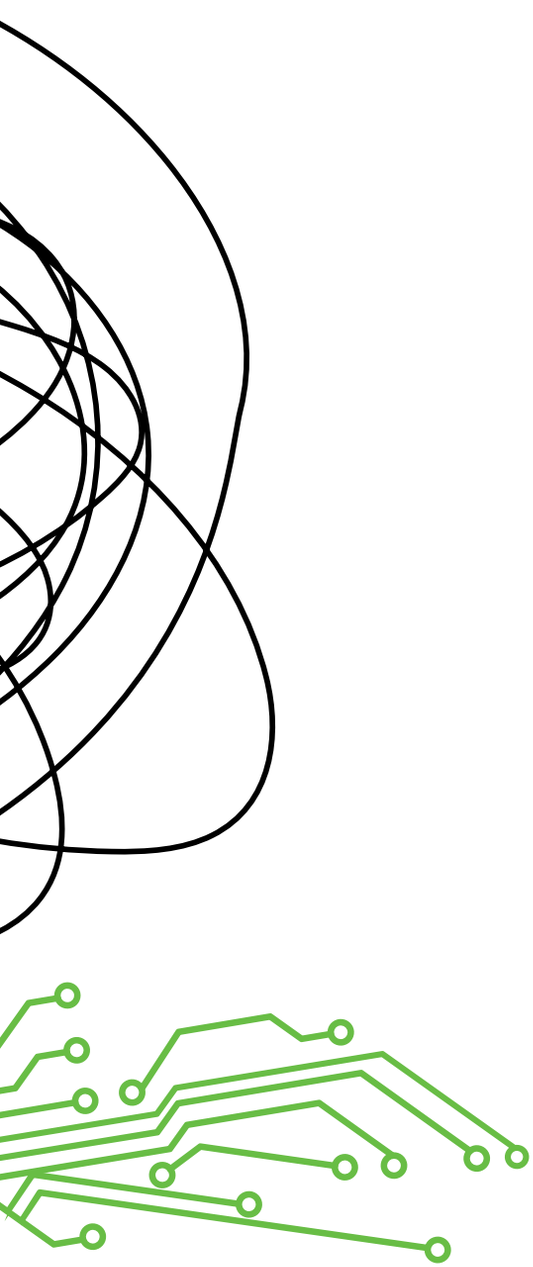




Incentives are key to breaking the cycle of cyberattacks on critical infrastructure

As cybersecurity threats increase across the globe, maintaining the health of organizations', industries', and nations' critical infrastructure takes more—and better—collaboration

By **Joe Mariani, Tim Li, Chris Weggeman,** *and* **Pankaj Kamleshkumar Kishnani** *Illustrations by* **Sonya Vasilieff**

A marshmallow. That may be the secret to improving the cybersecurity of critical infrastructure.

Maybe you've heard of the famous marshmallow experiment conducted by Walter Mischel at Stanford University in which children were offered a marshmallow but promised two if they could resist eating the first one for a given period. There also were follow-on experiments that looked at how cooperation and social pressure changed children's behavior in the experiment. Researchers presented children with the marshmallow task but told them that getting two marshmallows was dependent on another child also not eating their marshmallow. Ironically, kids who were dependent on others were more likely to wait for the reward than those who were solo, indicating that working together was more effective than going it alone.[1] The incentives toward collaboration and social connection worked against the incentive toward short-sighted self-interest.

The same themes resonate when discussing the cybersecurity of critical infrastructure. Officially, critical infrastructure can be any of 16 sectors, ranging from the expected, such as nuclear and chemical, to the perhaps more unexpected, such as agriculture and railcar manufacture. But the proper functioning of these sectors doesn't stop at just the companies involved.

There are many critical functions that require the support of a wide range of stakeholders, from software companies, to internet and web-hosting service providers, to regulators.[2] The success of security strategies such as defense in depth or layered defense depends on all of these stakeholders working toward a common goal. But importantly, each of these stakeholders has a different set of incentives pushing and pulling their behavior. Even adversaries are incentivized by different trends to increase or decrease their attacks. The challenge is that, in a complex environment such as critical infrastructure, the incentives of one player may combine with the incentives of other players in unexpected ways, often leading to actions that look individually rational but have irrational effects at the industry level.

Securing critical infrastructure from cyberattacks takes more than defending critical infrastructure assets. It requires an understanding of the incentives of all those stakeholders and then shaping them. If we can harness the positive incentives toward collaboration and social connection, then, just like the children in the experiment, we can enjoy the reward: more resilient critical infrastructure that's available when people need it most.

Threats to critical infrastructure are outpacing protections

Attacks targeting critical infrastructure are nothing new. From cutting off a besieged city's water supply to the Allied strategic bombing campaign in World War II, adversaries have always sought to use critical infrastructure as leverage against opponents. However, the need to physically attack infrastructure typically limited these attacks to wartime. Today, trends in digital technology and international relations have come together to make the threat to critical infrastructure not only more common, but also potentially more dangerous. And industries and organizations are contending with the potential fallout.

Threats to critical infrastructure are increasing

Tech trends are driving increasing vulnerability. The increasing computing power and falling size and cost of processors, memory, and batteries mean that the physical and digital worlds are blending. Objects that had been purely physical, such as pumps and valves, may now have digital sensors or controls. Those digital devices at the edge (sensors, controllers, Internet of Things) are then often linked to the core IT networks (data storage, enterprise software) that may themselves be connected to the wider internet. This convergence of information and operational technology (IT and OT) can make every valve, switch, and pump in a critical infrastructure operation a computer potentially accessible to the internet, vastly increasing the challenge of securing them.

While these physical-digital devices help boost efficiency, they can also make security more difficult in two ways. First, they've led to a proliferation of devices that need to be protected. There were an estimated 46 billion connected devices in 2021, a number that doubles just over every three years.[3] While only a small percentage of those devices might belong to critical infrastructure, the trend of a growing "attack surface" that needs to be defended increases the technical challenge of trying to secure all of those end points, as well as the human/organizational problem of having to collaborate with even more manufacturers, vendors, and contractors to maintain the security of all of those systems. This translates into a significant increase in the risk faced by critical infrastructure, given that about 85% of all data breaches result from human error.[4]

Second, the convergence of physical and digital worlds makes the consequences of attacks harder to predict and, potentially, more damaging. While the security of IT and OT is different, increased connectivity is driving their security considerations together.

In a world where digital systems can control physical outcomes, digital attacks can have catastrophic consequences in the physical world as well. The first recorded cyber-physical attack against critical infrastructure involved a disgruntled former employee who used radios to send faulty commands to industrial control systems at a wastewater plant, resulting in the release of 800,000 liters of sewage into a local community.[5]

What's even more concerning is that the interconnections of modern commerce and the difficulty in the attribution of cyberattacks blur the lines between what's simply one company's problem and what is a national security crisis. For example, a criminal gang knocking a school district's network offline may be a matter for law enforcement, but a nation-state cyberattack causing physical damage to a steel plant, for example, could be seen as a clear act of war.[6]

Economic and international trends encourage actors to act on those vulnerabilities. More than just technology is driving the increase in cyberattacks. Rising geopolitical tensions, the difficulty with attribution, and the increasing balkanization of technology ecosystems encourage nation-states to see cyberattacks as an effective tool below the threshold of armed conflict.[7] International tensions give nation-states the motivation to attack, while balkanized tech ecosystems allow them to attack with greater assurance of avoiding the consequences of either adversary responses or unintentional blowback on their own systems. These drivers have played a role in the significant increase in nation-state–sponsored attacks in recent years, an increase that some researchers have measured at up to 100% over the past three years.[8]

Nation-states aren't the only threats. The critical nature of this infrastructure also makes it a lucrative target for cybercriminals who see owners as being more likely to pay ransoms to avoid disruption.[9] Not only has the potential benefit of attack risen, but the means of attack are also becoming more available.

Trends in digital technology and international relations make the threat to critical infrastructure more common, and potentially more dangerous. And industries and organizations are contending with the potential fallout.

The emergence of malware-as-a-service, along with the escrow and dispute resolution services that facilitate deals on the dark web, have effectively lowered the barrier to entry into cybercrime. Attackers no longer need to be skilled hackers. Rather, they just need access to criminal marketplaces and a few dollars to buy readymade malware from thriving businesses that sell malware-as-a-service.

Defensive efforts to date have largely been ineffective

While technology and international trends may be driving an increase in cyberattacks against critical infrastructure, the threat itself isn't new. The United States federal government has been working on the problem since 1996, when Executive Order 13010 defined "critical infrastructure" for the first time and established the National Commission on Critical Infrastructure to protect it. Successive executive orders and policy directives further refined the structure and responsibilities for protecting critical infrastructure.

However, even with that early focus on both critical infrastructure and cyberthreats specifically, the number and severity of attacks have increased.[10] The question then is, why haven't we been able to protect the national critical infrastructure, despite the resources and talent at our disposal? US National Cyber Director Chris Inglis sees this as a problem of how we all work together. "We don't actually defend these systems as a collaborative endeavor such that they have to beat all of us to beat one of us," he told CBS News in November 2021. "It's not to say we don't have some very talented people and we don't have some really great technology, but we're not really joined up to solve this problem in a way that's required."[11]

Critical infrastructure sectors already understand the importance of working together, and the concept of "collective defense" is well-known in cyber circles. So what's standing in the way of defending collaboratively? It's likely the very incentives that push and pull the different players involved.

Incentives driving individual stakeholders might make their choices difficult, but these incentives are known and can be managed. The real challenge is the swirl of incentives when all stakeholders begin to interact.

A tangle of incentives may be the problem

If the cybersecurity of critical infrastructure is a known and important problem and yet progress toward greater security has been slow, it implies that there are other pressures on people's decision-making. In other words, there are incentives tugging many stakeholders—including owners of critical infrastructure—away from actions that support security.[12]

There are clear incentives for individual stakeholders to act in ways that may not support the long-term security of critical infrastructure. Take attackers, for example: The sheer amount of money that can be made from ransomware attacks alone provides a strong incentive for criminals of every stripe. In fact, our research into ransomware has found a clear correlation between the size of ransom demand and the volume of attacks. The more money to be made, the more attacks.

Despite the fear of being the target of such attacks, critical infrastructure owners may see little incentive to improve security beyond the bare bones. Profit motives and thin margins in many of these industries often mean there's little money left for costly investments in cybersecurity. And when incidents do happen, incentives to protect brand or minimize liability can often lead owners or operators of critical infrastructure to be reluctant to share information about vulnerabilities and incidents, further increasing the risk to other owners/operators. And infrastructure owners aren't the only group whose incentives can lead to more insecure behavior. Manufacturers in some tech sectors such as the Internet of Things and embedded systems could be prone to marketing insecure products because of incentives to be first to market and maintain low costs.[13]

Incentives driving individual stakeholders might make their choices difficult, but these incentives are known and can be managed. The real challenge is the swirl of incentives that arise when all stakeholders begin to interact. Incentives can add up in odd ways. An individual actor making a rational choice based on its own personal incentives can unwittingly impose higher costs on itself due to the incentives of other players. This is the generalized form of the tragedy of the commons. It was rational for each individual owner to graze their sheep on common land as much as possible, but the sum of those incentives was an outcome no one wanted: the destruction of the common lands.

The same issue can occur in cybersecurity. Inglis describes it as "proactive ambivalence." The confusing nature of the cyber ecosystem can mean that even in the face of massive, disruptive cyberattacks, individual stakeholders can have little incentive to change. "We're generally aware as a society that something is amiss," he says. "You can't miss this. You can't stand there and watch the news reports and believe that nothing is amiss. Where the proactive ambivalence comes in is we all believe it's somebody else's problem."[14]

While the traditional solution to such "tragedies of the commons" is government regulation, that can be difficult in an ecosystem with as many players as cybersecurity. Rather, government may be able to shape the incentives of stakeholders to indirectly encourage them to take appropriate actions. Just like changes to Section 401K of the US tax code encourage personal retirement savings, government can help jumpstart new action on cybersecurity.

But shaping incentives first requires a clear understanding of how the actions of all stakeholders influence one another. Using the analytical tool of causal loop diagrams (see the sidebar, "Using causal loop diagrams to tease apart complex problems"), we have created a simplified picture of those interactions. With that picture, we can begin to identify where incentives are adding up in unintended ways, and even where changes can begin to reshape those incentives to help improve cybersecurity.

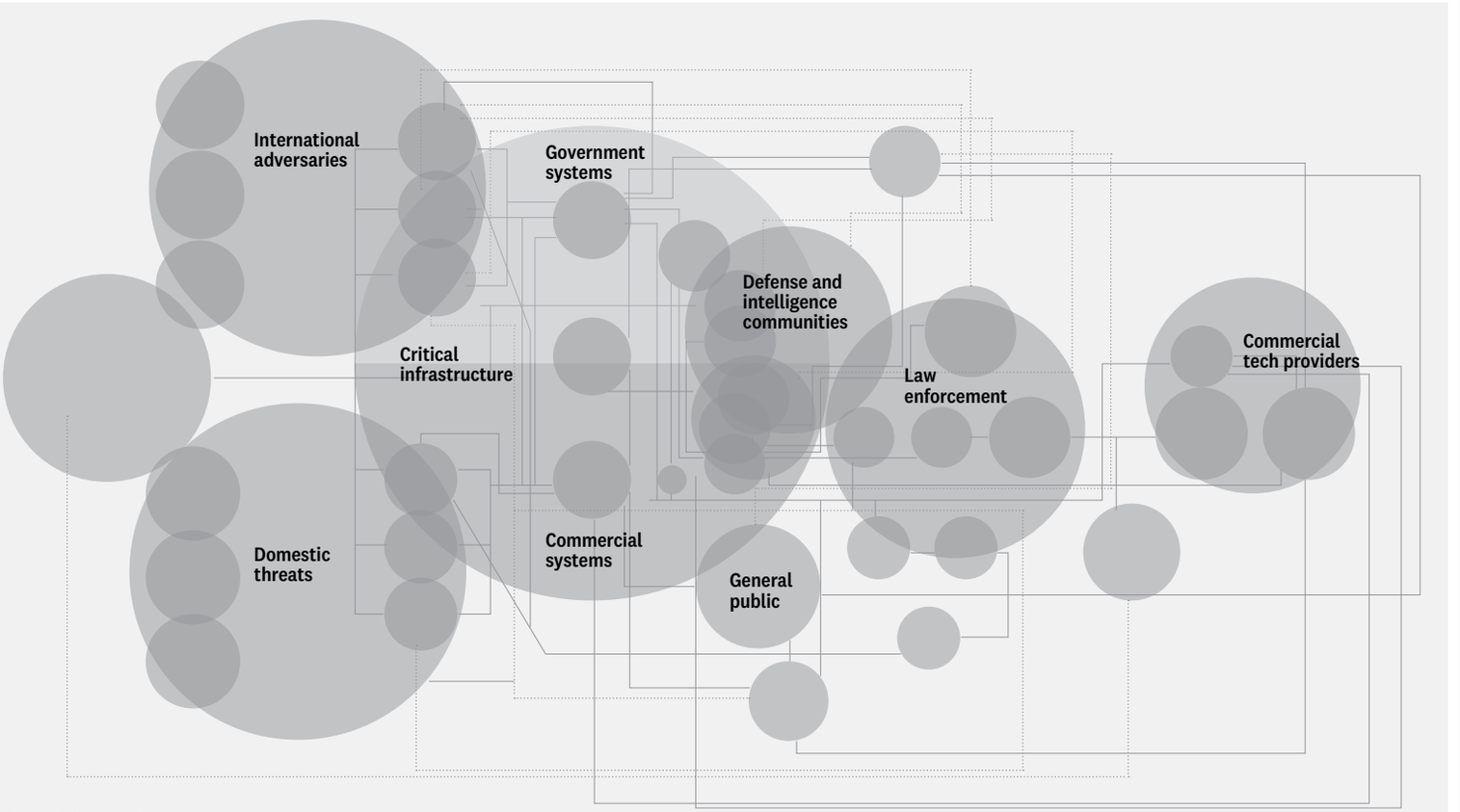
USING CAUSAL LOOP DIAGRAMS TO TEASE APART COMPLEX PROBLEMS

The web of interactions—that is, the cyber ecosystem—may mean that no single actor can accomplish much alone, but it also means that by mapping out the loops in those interactions, we can identify where stakeholders' actions come together to either improve or degrade overall security. The causal loop diagram is an analytical tool designed to create that literal map of stakeholder interactions. Each box in the diagram is an action taken by a stakeholder. The boxes are then connected if that action makes another action more or less likely.

Once the full map of interactions is drawn, we can trace the lines of influence to see where they create feedback loops that either incentivize further attacks (called reinforcing loops in the literature) or disincentivize them (called balancing loops). These reinforcing and balancing loops can help identify where the seemingly rational incentives of single stakeholders, when layered with the competing incentives of other stakeholders, can create undesirable results.

The causal loop diagram isn't just a descriptive tool. Because it lays out actions and incentives, it can help guide interventions. Looking at a particular loop from the perspective of a government regulator, for example, it can become clear which actions they may want to incentivize/disincentivize to reduce the risk of cyberattacks.

FIG 1: The influence of cybersecurity stakeholders' actions over each other can result in a tangled web of incentives



Source: Deloitte analysis.

The most direct path to reducing cyberattacks is to target the incentives of the attackers themselves.

Reshape incentives to protect critical infrastructure

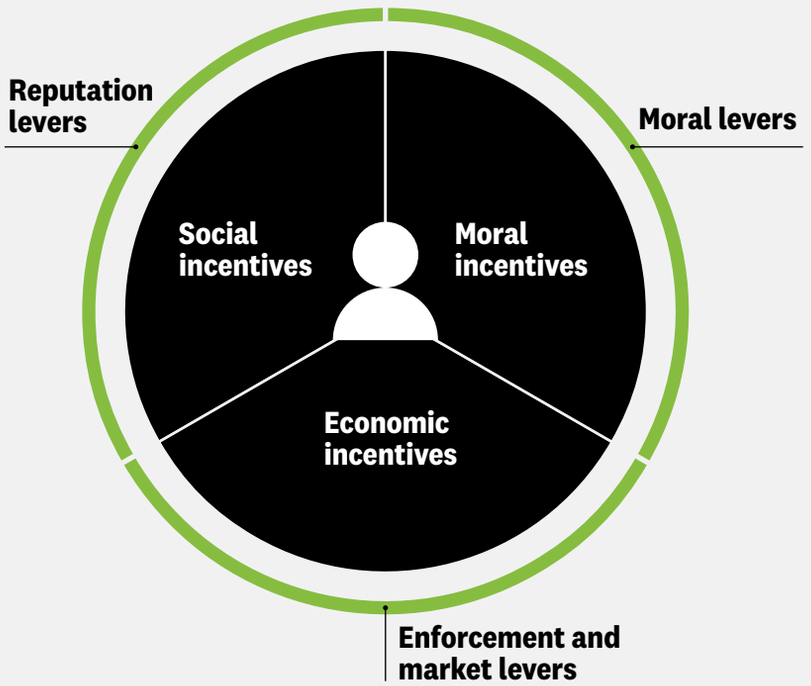
The complex mix of incentives across all stakeholders is a massive challenge, but it can also offer the path to a solution. If incentives stand in the way of the adoption of better security procedures or more effective information-sharing, then reshaping those incentives can be an effective way to make progress toward more security.

There are many ways to reshape incentives for individuals, organizations, and even adversaries. Economists, philosophers, and legal theorists have argued over them for centuries. One useful categorization is to think that incentives can be shaped by enforcement, market, reputational, and moral pressures (figure 2).[15] Our mapping of the tangled web of incentives across the various cyber stakeholders can help show not only where those pressures can be exerted, but also who has the ability to exert them.

Enforcement pressure: The most direct path to reducing cyberattacks is to target the incentives of the attackers themselves. Reducing attackers' motivation to attack is difficult, but given the relatively finite set of attacks, it can often still be preferable to trying to secure the near-infinite attack surface of today's critical infrastructure. Our map of incentives in the cyber domain shows that defense and intelligence organizations have two main levers to influence attacker motivations: They can disrupt the confidence of attackers by "defending forward" in the digital domain or they can reduce the perceived legitimacy of attacks by using influence operations in the cognitive domain.

For example, following a series of attacks carried out by a state-sponsored hacker group, Dutch Intelligence hacked the group back. The "defend forward" approach allowed the agency to get access to the hacker group's systems and cameras, enabling the agency to get confidential information and even warn their international allies of impending attacks.[16] Such actions can dent the confidence of the adversary to attack in the future.

FIG 2: Individuals and organizations are pulled by a variety of incentives, but these incentives can also be shaped by levers



Source: Deloitte analysis.

Figure 3 shows the anatomy of this loop of incentives: Cyberattacks encourage defense and intelligence organizations to increase information and "defend forward" operations. Defend-forward operations decrease the confidence that attackers have in their ability to successfully carry out attacks—and so reduce the number of attacks. Information operations reduce the perceived legitimacy of cyberattacks, thereby reducing the attackers' motivation to conduct more attacks.

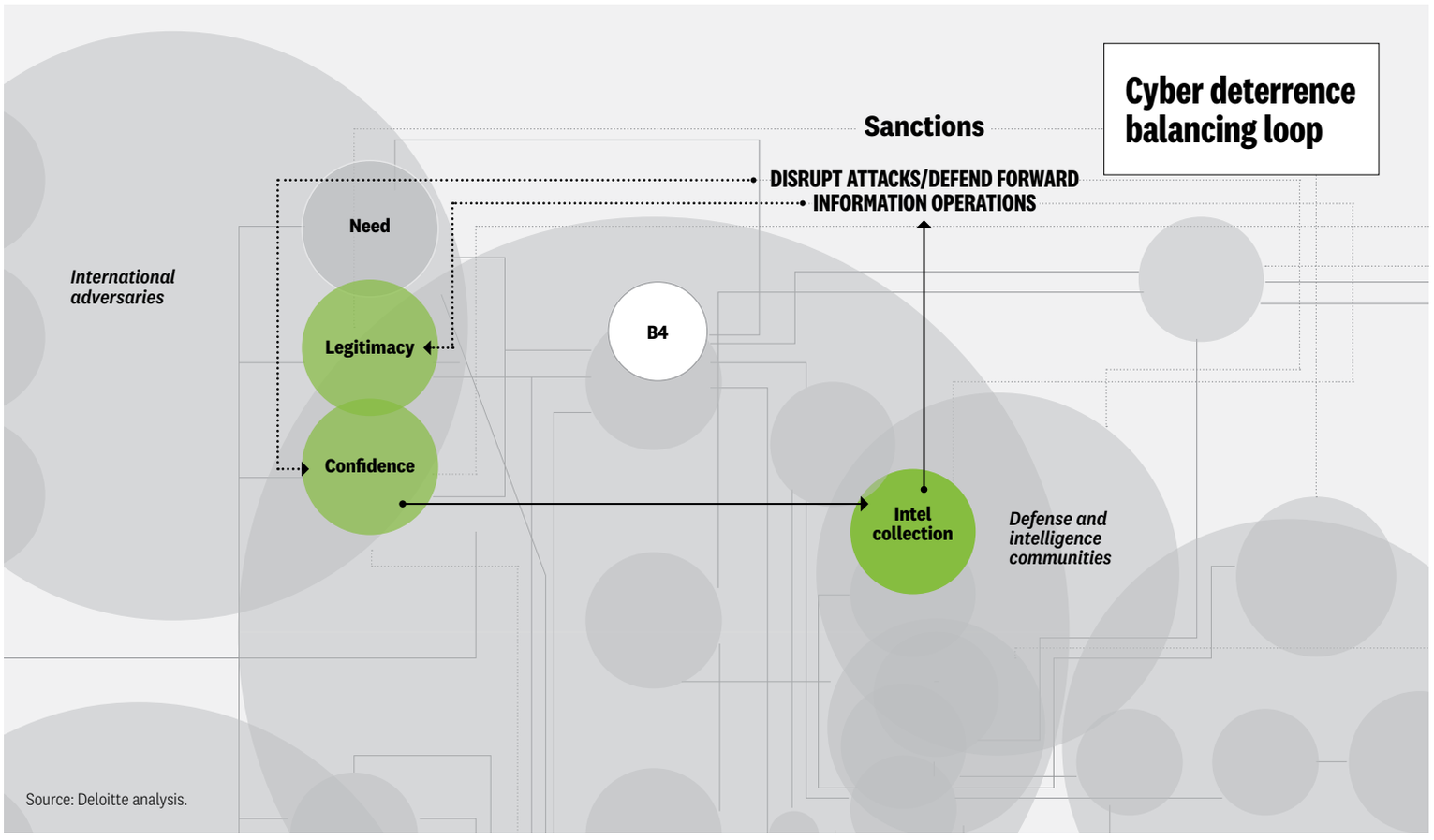
Market pressure: Shaping the incentives of attackers can only go so far. Systems should be minimally secure. Part of the problem is that in today's tragedy of the commons, infrastructure owners can be incentivized to push their own costs onto society. For cyberattacks, that means avoiding the cost of better cyber defenses and allowing society to absorb the costs of any attack that may occur—whether in the form of lost services or government response to an attack.

To remedy this, the full societal cost of potential attacks needs to be built back into infrastructure owners' calculations. One way to reflect the true societal cost of cyberattacks is to penalize those who fail to meet basic security standards. For example, the US Federal Trade Commission recently warned companies to patch the Log4j vulnerability or face legal actions, including penalties.[17] Another way is to ensure that products such as cyber insurance reflect the true cost of attack and recovery. Rising cyber insurance costs that reflect the massive costs of responding to cyberattacks may help encourage infrastructure owners to invest more in cyber defenses.[18] Further, some insurers also require organizations to adhere to baseline security practices to prevent attacks or reduce disruption in case of an attack.[19]

Figure 4 shows the cyber insurance reinforcing loop of incentives. Successful attacks can increase the rate at which targeted industries buy cyber insurance. In some cases, that cyber insurance can be used to pay a ransom if attacked. The payment of ransom, in turn, encourages attackers to attack more.

The full societal cost of potential attacks needs to be built back into infrastructure owners' calculations.

FIG 3: Defense and intelligence agencies can exert enforcement pressure directly on attackers to reduce their incentive to attack



Source: Deloitte analysis.

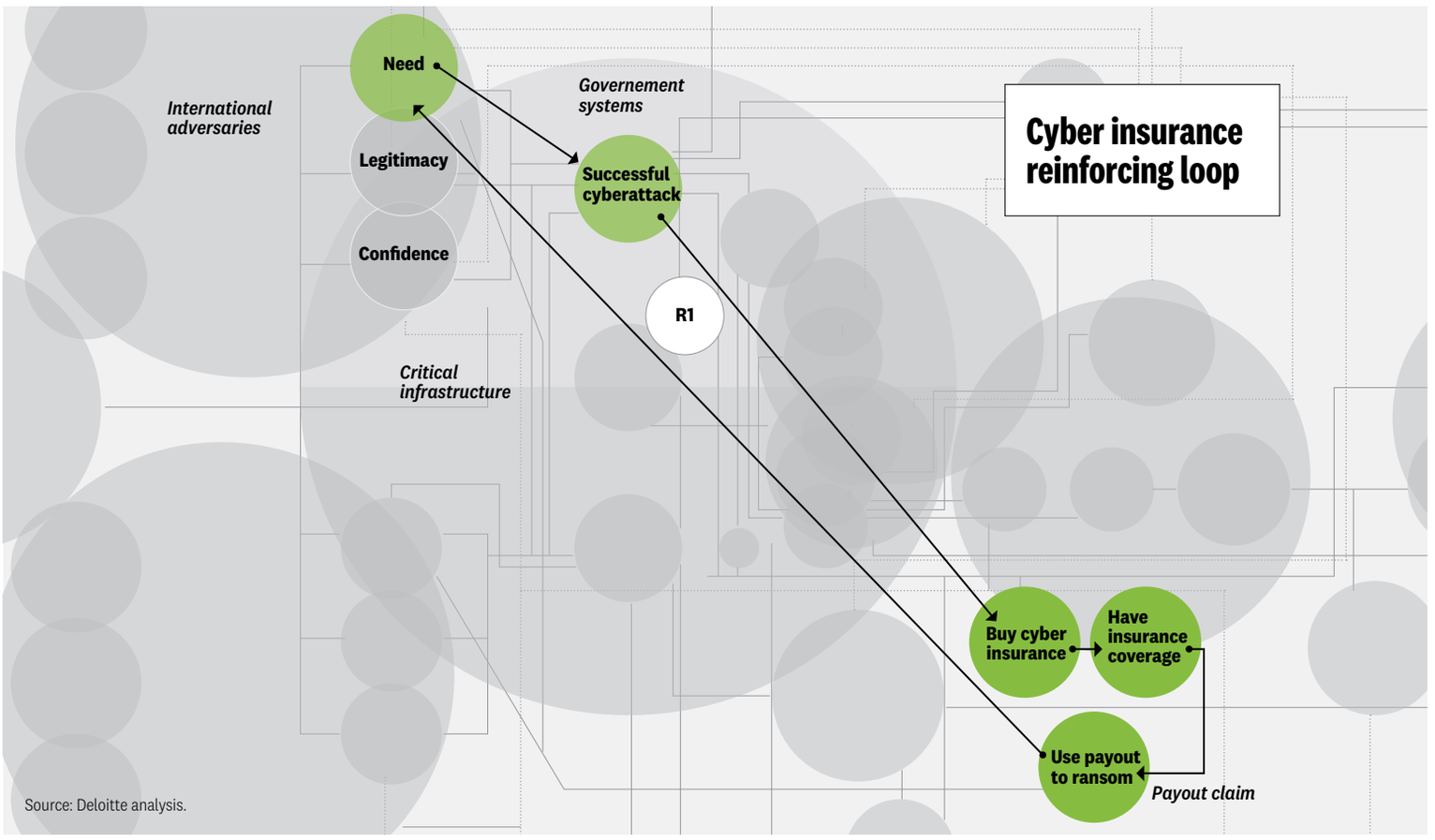
Paying more is not the only form of economic incentive. There can also be positive economic pressures that encourage more secure behaviors—for example, the opportunity for companies to make money by filling a needed role in the cybersecurity ecosystem.

Our map of incentives uncovered a few responses to cyberattacks that function like "AND" gates where an appropriate action can only be taken when two different stakeholders have the same information about an attack. For example, taking a malware marketplace offline requires both law enforcement with the legal authority to seize websites and servers, AND the denial of key services by web hosting and internet service provider (ISP) companies.

The takedown of Emotet, the world's largest botnet, is a prime example. Europol, the European Union's law enforcement cooperation agency, worked with the law enforcement agencies of eight countries and private security researchers to disrupt Emotet malware.[20] With infected computers spread across 90 countries, Europol not only needed to coordinate with legal authorities and law enforcement agencies in eight countries, but also needed the technical expertise of technology companies. In the global takedown, law enforcement agencies and a large group of security industry players collaborated to hijack hundreds of Emotet's command and control servers.[21] In the United States, threat intelligence company Team Cymru was one of the companies that worked with the FBI in the operation. The company detailed and validated internet protocol (IP) addresses of Emotet's controllers and recruited network operators to help take down the servers.[22]

Without a common picture of the threat shared across law enforcement and commercial companies, this type of action would be impossible. For these types of operations to be successful, there needs to be an organization brokering the sharing of information between the different parties. In the Emotet example, Europol filled much of that role because of its expertise and relationships. But in other cases, the needed expertise and trusted relationships may lie outside of government.

FIG 4: Reflecting the true cost of cyberattacks in cyber insurance can harness the market to incentivize more investment in cybersecurity



Source: Deloitte analysis.

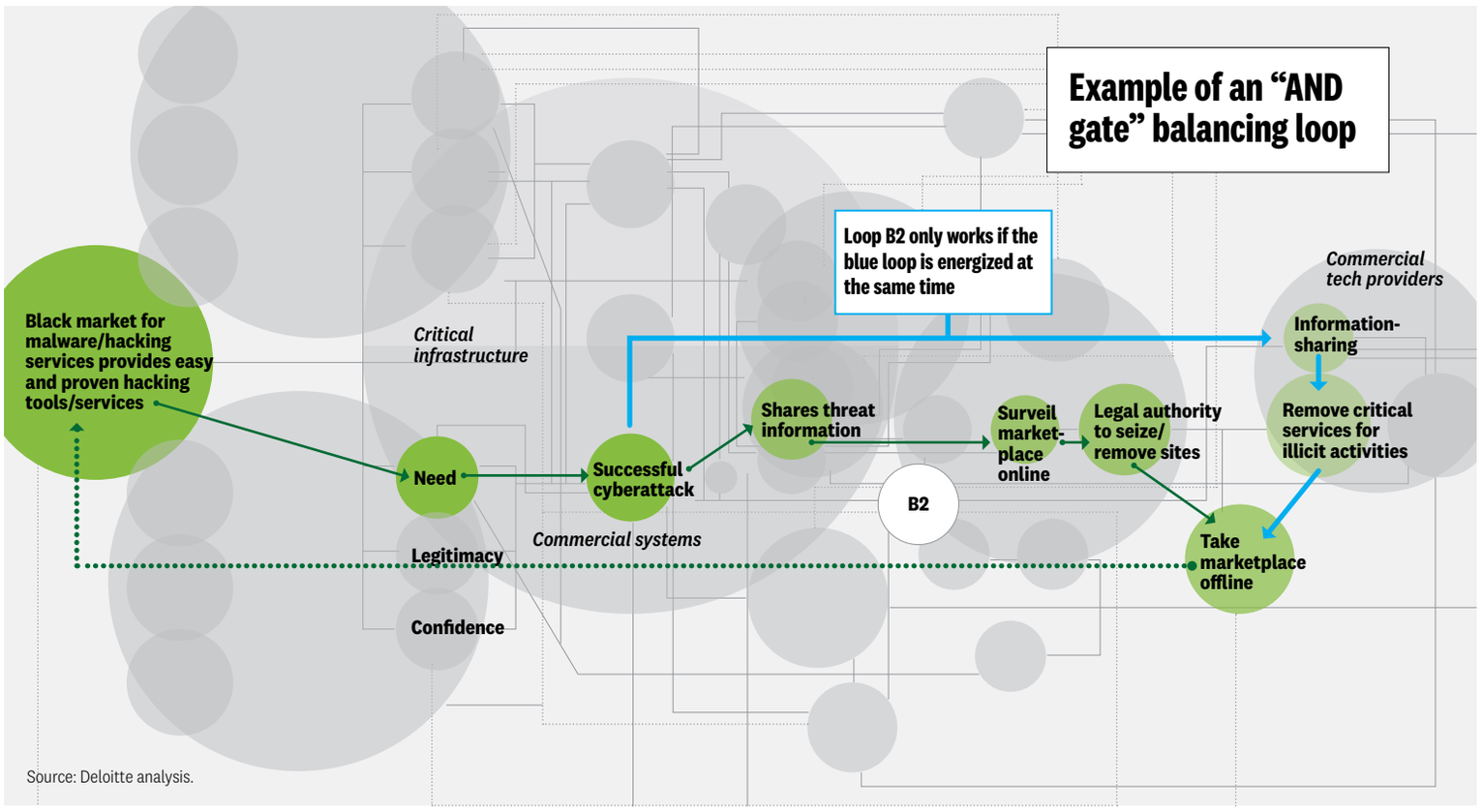
This situation can create a classic need for brokerage where trusted players can help facilitate the rapid movement of information between stakeholders. Just like brokerage in other industries, from oceanic shipping to choosing a restaurant, this economic opportunity can attract players to help improve the efficiency of the whole system. In the case of cybersecurity, the need goes beyond mere information-sharing and into connecting technical knowledge with threat data and the knowledge of government authorities. These connections also need to happen at machine speed, which means that a brokerage solution could look more like a platform such as the Bloomberg Terminal, where users can subscribe and be connected as their needs align.

Figure 5 shows the anatomy of the "AND gate" balancing loop of incentives. It features two loops that need to overlap to succeed. A successful attack against government may increase the sharing of threat information with law enforcement, leading to legal authorities taking down a malware marketplace (green loop). But taking down that marketplace is only possible if the relevant technology companies are also aware of the details of the attack at the same time and can act to deny the services needed by the marketplace (blue loop). Only then will the marketplace be taken down completely, depriving attackers of the ability to conduct further attacks.

Reputational pressures: Reputation is another area where both positive and negative pressures can share incentives. We are all familiar with negative reputational pressures, the bad press and brand perception that can come from falling victim to a cyberattack. However, this bad press can serve a good purpose.

Just like brokerage in other industries, from oceanic shipping to choosing a restaurant, this economic opportunity can attract players to help improve the efficiency of the whole system.

FIG 5: The market can also create positive incentives for new players to step in to improve cyber coordination



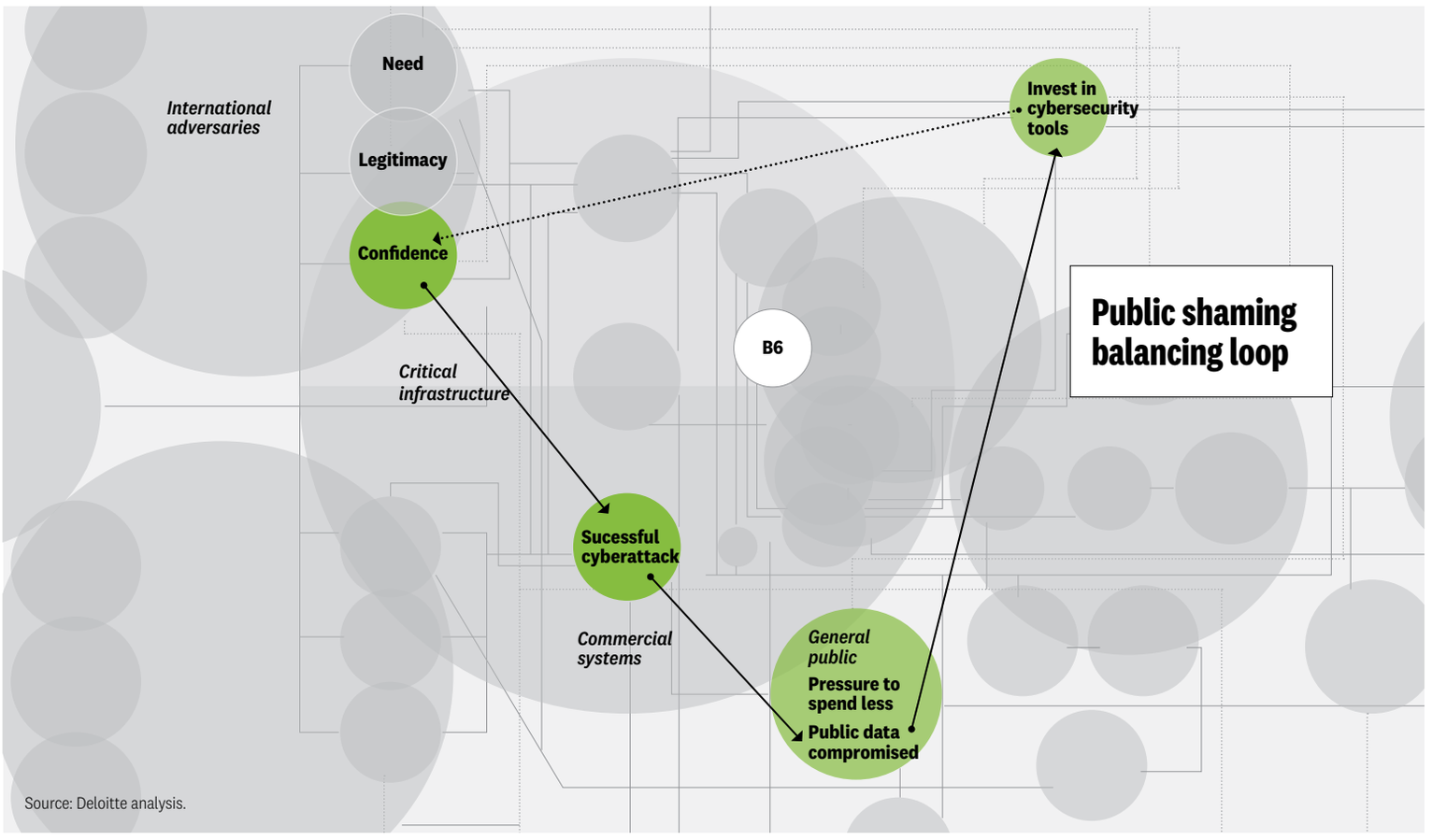
Source: Deloitte analysis.

If harnessed, it can be an important incentive encouraging critical infrastructure owners to invest more in cyber defenses.

Figure 6 shows the anatomy of the public shaming balancing loop of incentives. An attack resulting in a public data compromise can lead to public outcry that motivates greater investment in cybersecurity, thereby making further attacks more difficult.

There are also positive reputational pressures that can be even more effective. By telling positive stories of companies that did the right thing and the results it produced, a few positive outliers can serve as exemplars, pulling everyone's behavior in positive directions. For example, imagine a technology service provider that's attacked, but rather than sweeping the incident under the rug, it divulges the information quickly to the right government authorities. Law enforcement is then able to take action while the trail is still hot and arrest the perpetrators. One good example of such a story is Microsoft's recent action against the Necurs botnet. To eliminate the botnet, Microsoft obtained legal authority to take control of Necurs servers in the United States, worked with domain registrars in multiple countries to prevent Necurs from registering new domain names, and even worked with ISPs to help uninstall Necurs malware from infected computers. Similar good-news stories of commercial-led cyber defense could be an important balance to the instinct to hide bad news.

FIG 6: The reputation damage of a cyberattack can create positive incentive to improve cybersecurity



Source: Deloitte analysis.

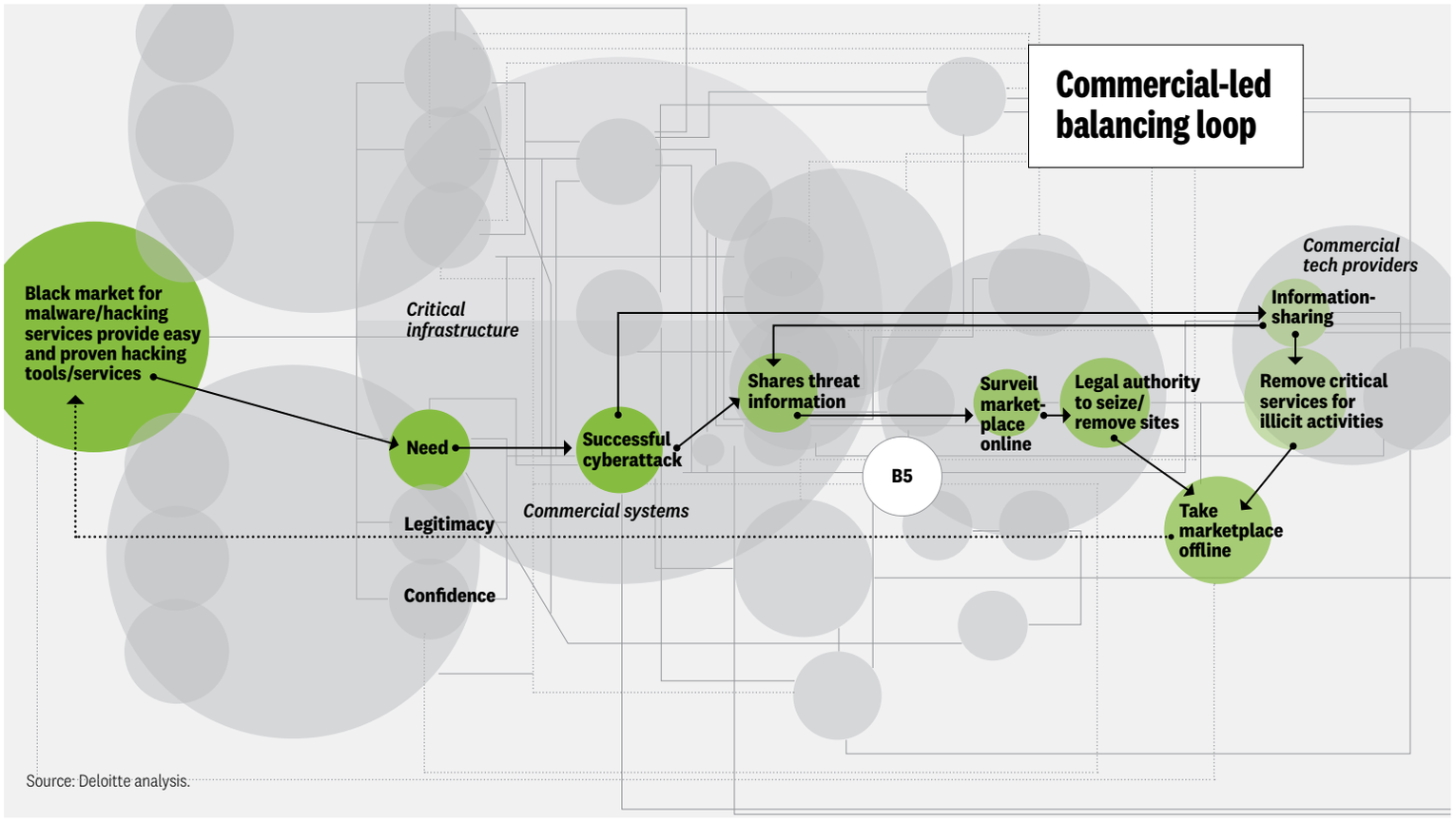
Figure 7 shows the anatomy of the commercial-led balancing loop of incentives. Often, a technology provider may be the first to become aware of a cyberattack. That technology company can then not only take steps to deny critical services to attackers, but also share information with law enforcement to gain appropriate legal authority to do so. This commercial-led activity can then remove marketplaces or other tools that attackers rely on, reducing their ability to conduct further attacks.

Moral pressures: Talking about moral pressure may seem out of place in a discussion on cybersecurity, but especially when dealing with large groups of people, common conceptions of what's right can be important pressures. For example, two of the largest and often-overlooked stakeholder groups in cybersecurity are users and the public. Both can create strong positive or negative pulls on cybersecurity. For example, users' desire for greater functionality and ease of use can often run counter to cybersecurity tools that restrict features or access. Similarly, public desire for limited government spending can shrink resources for cybersecurity.[23] But the public can also be a force for better cybersecurity. Public pressure following high-profile cyberattacks has been an important impetus to improving cyber defenses.[24]

Communicating the value of cybersecurity to these groups—in terms that they can understand and value—can help set up cybersecurity as one of the many more "goods" that people balance in making decisions. This can help users be more accepting of limited functionality if it makes their data more secure or the public more willing to support greater government investments in cybersecurity.

Figure 8 shows the anatomy of this loop of incentives. Users' desire to have maximum functionality and ease of use in systems can, at times, exert pressure that reduces investment in cybersecurity. Similarly, the general public's perfectly reasonable desire to see responsible use of public spending can combine with other budget incentives within government organizations to exert similar pressure to reduce cybersecurity investments.

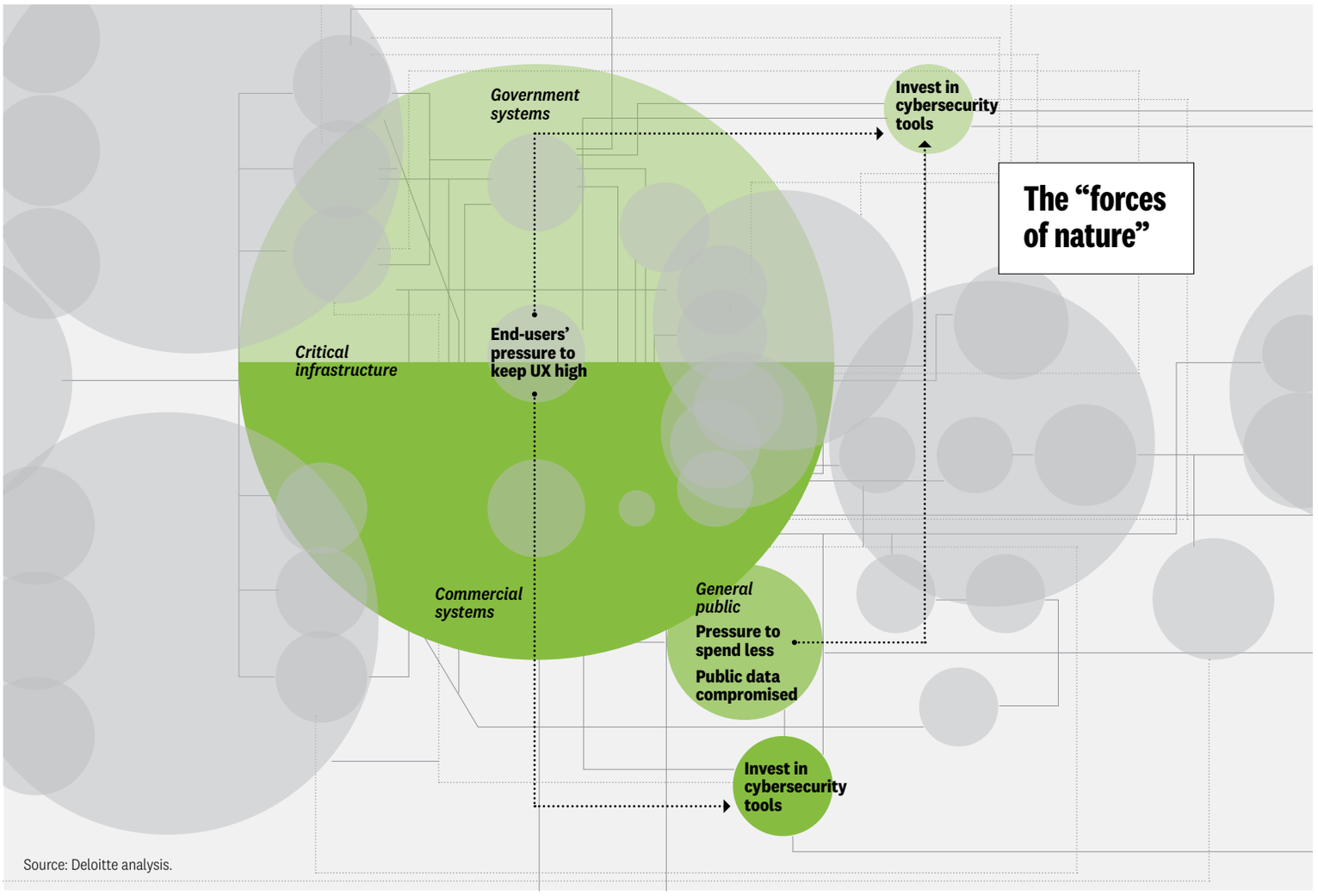
FIG 7: Telling good news stories of companies helping to bring attackers to justice can create positive incentives to talk about, rather than hide, attacks



Source: Deloitte analysis.

Two of the largest and often-overlooked stakeholder groups in cybersecurity are users and the public. Both can create strong positive or negative pulls on cybersecurity.

FIG 8: Consistent communication with users and the public can help increase support for better cybersecurity



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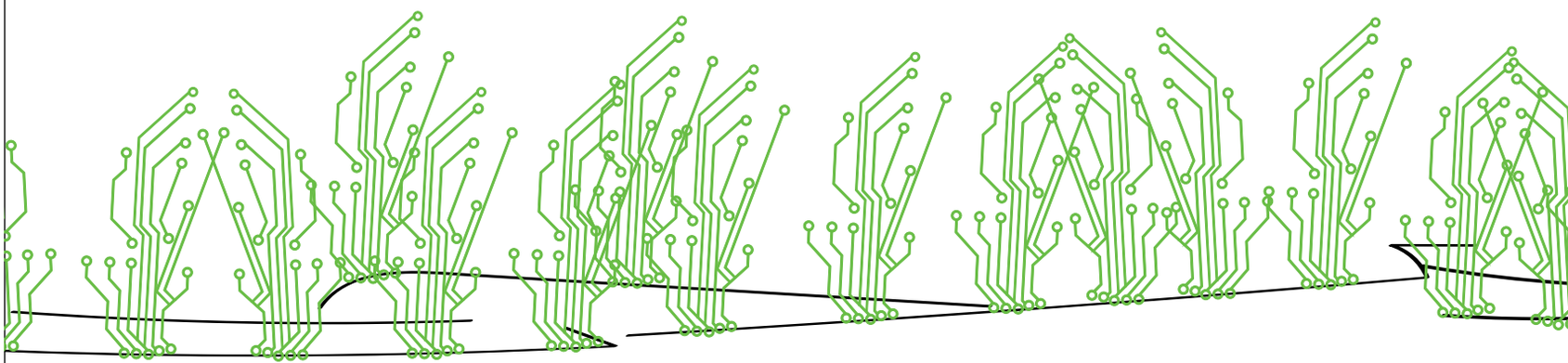

Getting started

From the categories of pressures that can reshape incentives, we can see that some actions are more suited to certain stakeholders than others. While there's no single silver bullet for cybersecurity, there are a set of actions that every stakeholder can begin to take today to help reshape the cyber environment.

1. **Scope the problem: Inventory and monitor critical infrastructure assets.** Critical infrastructure industries and government agencies should work together to inventory and monitor critical assets. If we can't see the critical assets, we can't defend them. The US Department of Energy (DOE) launched a 100-day action plan to increase real-time information-sharing, visibility, detection, and response capabilities of OT in the electricity sector. The CEO-led Electricity Subsector Coordinating Council of electricity companies liaised with the DOE and deployed a technology tool that could provide visibility into electric systems. The initiative, known as Neighborhood Keeper, improved the visibility and monitoring of US electrical systems from 5% to 70%, while keeping the data anonymous and protecting companies' privacy. Information about threats and vulnerabilities is shared in real time with each participant and with E-ISAC (Electricity-Information Sharing and Analysis Center) for the collective defense of a critical infrastructure sector. Many companies in the water and gas sectors are also adopting a similar approach and technology to protect against cyberattacks.[25]

2. **Make connections: Understand your organization's connections in the cyber ecosystem and build personal relationships across them.** The tangle of incentives in our maps shows the complexity of the cyber ecosystem. Every stakeholder should understand their role in the ecosystem—whom they can influence and who influences them. This can help government and technology companies alike find new opportunities to reduce attacks and improve critical infrastructure defenses.

   But that level of collaboration is only possible with relationships of personal trust. A critical infrastructure owner is only going to share the details of a cyberattack—which may not only prove embarrassing but could also reveal some trade secrets—if they trust both the organization and the specific individual at the other end. Exercising incident response playbooks with multiple stakeholders can help build the needed trust between government, tech providers, and critical infrastructure owners. While some ISACs run rehearsals or offer response tools, making the exercises more regular and widespread is a key aspect of building the human trust needed to react quickly in the event of a crisis.[26]

3. **Set minimum security standards: Use regulatory and financial tools to ensure basic cyber hygiene for all.** All of the complicated relationship-building and information-sharing is for naught if trust is immediately lost via a data breach or if critical infrastructure is left unprotected. Every organization, whether a critical infrastructure, government, technology company, or third party, should put in place minimum sets of security standards calibrated to the function of critical infrastructure and the impact of its loss. For government, this means considering the use of regulatory power to set minimum cybersecurity standards for all IT goods sold. This can be done via hard regulations, such as government-defined minimum safety standards for automobiles, or soft regulations, such as the Underwriters Laboratory seal of approval on compliant household goods.

   However, setting minimum standards isn't solely a task for government. Everyone, from tech companies to infrastructure owners to banks, has a role to play:
   - ISPs and cloud service providers could work together to create "comply to connect" schemes where devices will

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Research and analysis by the Deloitte Center for Government Insights

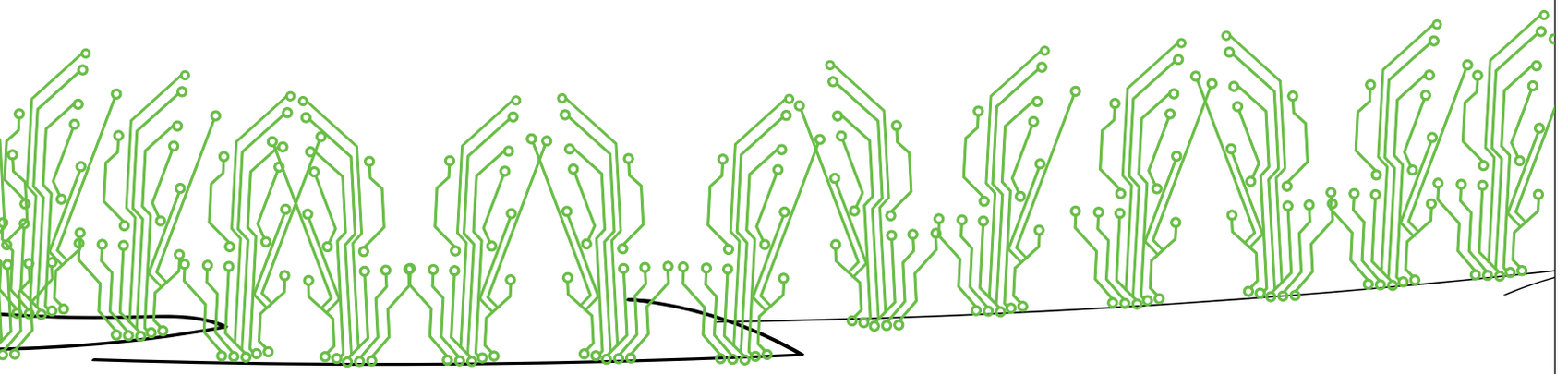


Illustration by Matt Lennert

be unable to connect to the internet unless they're up to date on operating system updates and other key patches.
- Banks and venture capitalists can use their financial levers to encourage security to be baked into earlier stages of product development.
- Infrastructure owners should implement multifactor authentication (MFA), adopt zero-trust architectures, and require cyber hygiene training for all users. These minor changes can have a significant impact. In fact, research indicates that MFA can block 99.9% of automated attacks on systems.[27]
- Government should create a national cyber hygiene campaign to educate all citizens about the basic operations of the technology they use every day and how to protect themselves from common threats.

4. **Harness market forces to do more: Economic incentives can drive greater confidential information-sharing.** Going beyond the minimums of cybersecurity requires more than just penalties. It takes opportunities. By tapping into market forces, government and critical infrastructure players can encourage a mindset in which cybersecurity isn't an afterthought, but a central business focus.

These market incentives could also help attract new players to fill the critically needed brokerage role between government and tech companies in cyber incident response. If the government commits to funding such a role, it could greatly improve the information flow to defenders and increase the chances of attackers being identified and foiled.

However, historically, many organizations have been reluctant to share information rapidly due to public disclosures, liabilities from the breach, reputation damage, and fears of class action lawsuits. This reticence can be overcome in two ways. First, governments can glean lessons from the US Federal Aviation Administration's aviation safety reporting systems that are premised on nonpunitive, anonymous reporting to regulators and communities about aviation threats.[28] Second, governments can help companies "win" by sharing information. Currently, only negatives can arise from sharing details of a cyberattack, such as lawsuits and reputation damage. But if companies could gain positive coverage, it could help change the dynamic. If governments could work with companies to help counter or even arrest attackers, it could give them a reputation boost in the market, which in turn could help encourage further information-sharing.

Closer working relationships such as the US Cybersecurity and Infrastructure Security Agency's new Joint Cyber Defense Collaborative can help make this a reality, but clearer ideas about who to report information to and how are still needed. For government, this means having a single door that critical infrastructure industries and technology partners can use. That lead agency can then fuse received information with other useful information to further disseminate it to those who need it in industry, government, and beyond. This level of sharing will likely require creative approaches to tiered levels of reporting for sensitive information (via automated tear lines), rapid analysis to support standardized threat reporting, and automated distributions along industry verticals.

This is just the beginning

In recent years, cyberattacks on critical infrastructure have had a far-reaching impact. But with no stakeholder able to tackle the problem alone, progress is only possible if we create incentives for stakeholders to work together. Reshaping the incentives of an entire industry may be difficult, but it's possible. Collaborating to get more marshmallows is certainly worth the effort. We have the safety of our critical infrastructure as an incentive. What are we waiting for?

For more information, visit www.deloitte.com/insights/deterring-cyber-attacks

Investing in creative potential

Creativity doesn't spark in a vacuum. Nurturing it with the right ingredients and trusting in the eventual payoff is what sets a creative business apart.

By **Peter Evans-Greenwood, Robert Hillard, Robbie Robertson, Peter Williams,** *and* **Matt Lawson** *Illustrations by* **Dana Smith**

When we think of creativity, we often think of some essential but rare human attribute—the gift of a lone genius touched by the gods or born with a unique genetic inheritance. Creativity is seen as an inborn trait that can be nurtured, but also as something that is fundamentally a quality of the person possessing it. We picture Leonardo da Vinci or Thomas Edison feverishly working away in their studio or workshop to emerge with the *Mona Lisa* or the first practical electric light—creative works sprung fully formed from their solitary efforts.

This, of course, is a romantic fiction. Though brilliant, both da Vinci and Edison owed their creations as much to the context in which they worked as to their own considerable talents. It's far from certain that da Vinci would have been as productive and innovative had he lived in the Dark Ages instead of the Renaissance. And without the equipment and staff of his famous Menlo Park laboratory, Edison would likely have won far fewer than the thousand-plus patents he acquired over his career.

Individual talent is important to creativity, but there's much more to it than that. Research shows that creativity is the result of multiple factors that have to converge for it to spark. It's an "ecological" or "systems" phenomenon that arises out of the interactions of individuals and teams, both with each other and with the environment around them.1 Creativity is not just something we have; it's also something we do—both a noun and a verb.

This is as true for organizations as it is for individuals. Creative organizations—those that generate new, useful, and commercially successful products and ideas—become that way by embedding creative teams within a supportive social and physical context. These supports include not just material resources—funding, equipment, and so on—but also a culture that values new ideas, appropriate mechanisms for vetting and developing them, and methods and governance frameworks that allow teams to engage creatively with internal and external stakeholders. Without such supports in place, an organization risks its creative ideas dying on the vine, strangled by bureaucracy, poorly aligned incentives, unfortunate group dynamics, or an inability to find customers.

Sparking creativity

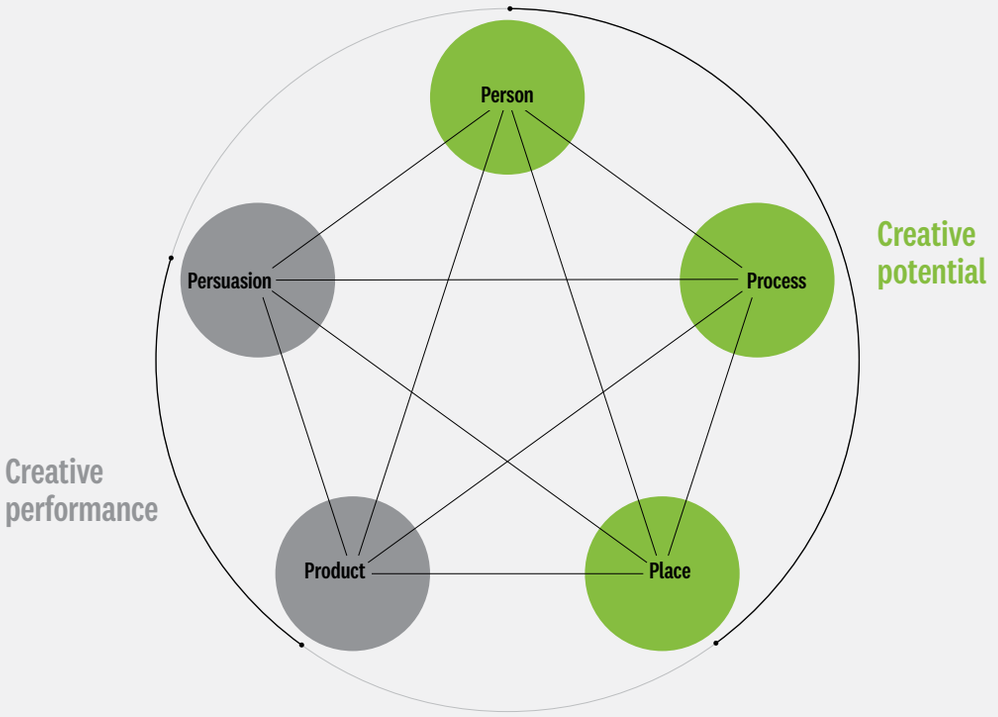
What does it mean to invest in creativity?

All organizations that prioritize innovation understand that they need to focus on their people—the groups charged with developing new and useful things to take to market. The research on creativity conventionally terms these groups as the creative *person*—the individuals and teams (and their skills, talents, knowledge, and experience) involved in creative work. This is where most organizations direct their investments in creativity—toward hiring people with the "right" skills and putting them to work.

However, research into creativity also points to three more factors that shape creative outcomes: *process*, *place*, and *product*.[2] *Process* is a creative team's development journey, the steps and actions they take to do the work. *Place* refers to the setting in which the work is done, covering everything from access to material resources to high-level organizational policies and governance to an organization's culture and its social norms.[3] And *product* is the creative work itself—the new object, idea, or behavior that the organization hopes to commercialize.[4]

Researchers conventionally see creativity as emerging from the interactions between these four P's. But in organizations where teams are so interdependent that getting things done

FIG 1: Creativity arises from the interactions of person, process, place, product, *and* persuasion



Source: Adapted from Mark A. Runco, "A hierarchical framework for the study of creativity," *New Horizons in Education* 55, no. 3 (2007): pp. 1–9.

The historical and social milieu of the team, department, and organization that people belong to all influence creativity. Even as seemingly small an act as including "creative" in some workers' job titles can stifle creativity as it implicitly labels other workers as "not creative."

needs a great deal of interteam coordination, we should also add *persuasion* as an equally important factor.[5] A team wishing to execute a creative idea needs to convince other teams, managers, executives, and even external stakeholders that what they want to do is novel and useful enough to be worth helping along.

Adding persuasion as a factor helps us recognize that the five P's naturally fall into two groups (figure 1). First, there is creative potential, comprising *person*, *process*, and *place*—the elements that influence how creative the new product, idea, or behavior could be. Second, we have *creative performance* comprising *product* and *persuasion*—the creative outcome, composed of the novelty and utility of the product, idea, or behavior, mediated by the effectiveness of the persuasion that goes into convincing others that it's valuable.[6]

Investing in the five P's

The five P's are a useful way to think through what kinds of investments an organization can make to increase its ratio of creative hits to misses. Investments in creative potential aim to make person, process, and place more conducive to generating and realizing creative ideas. Investments in creative performance aim to remove creative barriers, (re)defining creative products and enabling persuasion to create space for ideas to flourish.

Firms need to invest in both creative potential and creative performance if they are to foster creativity. Invest only in creative potential and the space to pursue creative ideas will likely be limited.

Opportunities will be set aside due to a lack of time and resources or the firm's inability to deviate from standard operating procedures. Similarly, investments solely in creative performance—investments designed to create the organizational space for creativity—are likely to go to waste without simultaneous investments in the creative potential necessary to generate new and useful ideas for exploration.

Person

While *person* isn't the only source of creativity, it's still essential to equip teams with skills and knowledge that they can draw on to come up with and develop creative ideas, and to judge when creativity is (and isn't) appropriate. Some people, like Batman, need tools and methodologies to realize their creative superpower. For these people, who may struggle to step outside their usual thinking to develop creative ideas, tools such as problem-posing or methodologies like design thinking can be helpful.[7]

Others are more like Superman, with a natural flair for generating novel ideas, a more innate creative superpower. Superman's challenge is that he struggles to understand when his powers detract from the work (for example, by distracting or annoying coworkers with a seemingly endless stream of new ideas) rather than adding to it. To benefit from Superman's contributions, the organization needs to help him fit in, to be Clark Kent,[8] to understand when creativity is appropriate and new ideas are useful rather than distracting.

Investing in *person* can also involve fostering norms and practices within teams that promote creative thinking and behavior. How should a team react, for example, if an interesting idea emerges quite late in a meeting? They might set the idea aside. It's late and some participants have planes to catch. Or they could extend the meeting indefinitely, pursuing the idea until it either bears fruit or proves to be a dead end. There's also a middle ground where the team allows a little time to explore how the idea is connected to the topic at hand—an investment in seeing if the idea is worth capturing for more in-depth exploration later. What's important is not so much what they choose to do as that they know how to find the approach that would be most productive at that time.

A third aspect of *person* is team diversity. As is well known, diversity of identity and demographics such as gender, age, ethnicity, and socioeconomic factors improves creative potential by allowing teams to tap into different viewpoints and lived experiences.[9] Organizations should also consider cognitive diversity, the variety of ways that individuals can approach and think about problems.[10] In business, this is often tied to the business area or discipline in which people have the most experience.

A team of accountants, for example, is likely to frame all problems as accounting problems and assume accounting solutions.[11] In contrast, a team that includes accountants alongside engineers, anthropologists, and skilled tradespeople, will have the different perspectives needed to develop a multidisciplinary understanding of the problem and will likely come up with a superior solution.

Process

Research suggests that the creative *process* is most effective when it's iterative, allowing teams to engage in multiple cycles of divergence (generating new ideas) and convergence (winnowing out the poor ideas and developing the good ones). Does the project schedule or organizational culture effectively ensure that only one approach can be tried? Or does the process give teams room to experiment, to develop a range of approaches to see which is best, to deliver something a little different and potentially more valuable than expected? The latter process requires budgets and timelines to be flexible, and procedures for requesting and evaluating changes to be formalized, well understood, and accessible.

Place

Place, the setting in which person and process operate, is important for creating favorable conditions for both.[12] Besides the actual physical and virtual work environment and tools, *place* also extends to culture, norms, and expectations. The historical and social milieu of the team, department, and organization that people belong to all influence creativity. Even as seemingly small an act as including "creative" in some workers' job titles can stifle creativity as it implicitly labels other workers as "not creative."

Performance management and organizational metrics are especially important elements of *place*. They need to foster creativity rather than stifle it. A worker measured mainly or solely on financial metrics will be implicitly punished if they spend time on actions without a direct, immediate link to financial results. For example, salespeople who are measured solely on revenue will have little interest in creativity. Any creativity in their work will not be considered in performance reviews, even though engaging creatively with their clients and collaborating to find novel and valuable solutions to unusual problems may lead to more numerous and larger future opportunities.

Similarly, operations groups measured only on cost and levels of service delivered are unlikely to have an incentive to consider a novel and potentially valuable idea that the marketing team wants to explore.[13] A well-designed performance management system understands the creative process and recognizes inputs, which are under the team member's control, as well as outputs, which also depend on factors outside the team member's control.

Product

In one sense, the creative *product* is an output—the thing or idea born of person, process, and place. At the same time, the way in which the product is defined can also be an important input to its eventual value. Just as we need to create space in the process for it to be a creative process, we also need to create space with the product if it is to be a creative product.

Creating space with *product* involves recognizing that iteration and experimentation can sometimes yield a result that's different in some way from what's expected. It might be delivered a little later than originally planned, solve the problem in an unanticipated or unconventional way, or even solve a different, but more relevant, problem. As an example, the Chinese domestic appliance company Haier developed a washing machine that could successfully wash potatoes as well as clothes after discovering that farmers were using washing machines for both and having problems with them becoming clogged with dirt.[14]

The challenge is that being flexible with the product needs to be reconciled with other teams' counting on the product to be delivered on time and to original specifications. Hence, if the potential benefit justifies changes to a product's functionality or schedule, an organization will need to invest in updating governance processes to cascade these changes across the relevant teams and into portfolio governance bodies such as program management offices.

Persuasion

The last of our P's, *persuasion*, is essential to securing the support required to make the other four P's productive. The major investment here is in integrating creativity into governance mechanisms to allow leaders to consider creativity's "investment opportunity" value alongside the more usual cost-benefit metrics.[15] In this way, creativity and efficiency can be put on an equal footing in an organization's operating model. Otherwise, efficiency will always trump creativity.

To create these mechanisms, governance teams need to develop metrics that track both how much value creativity generates and how much the organization is spending on promoting creativity. These metrics should cover investments in individual projects as well as in improving the overall creative infrastructure, such as by training workers or instituting governance processes that consider efficiency and creativity. They can then be integrated into decision-making and performance management,[16] as well as be used to appropriately direct the organization's investments. For instance, teams may be asked to integrate formal investment-opportunity metrics into business cases to help leaders decide which projects to fund and how best to support them.

Investments under this kind of system are unlikely to be a blank check, where every request to pursue a creative opportunity is granted. Instead, they will arise out of a negotiation where the team describes the opportunity and outlines how it intends to explore it, and the governance team determines if the opportunity justifies an investment. It's also important for

governance to consider the organization's portfolio of creative pursuits as a whole. While an investment in a single opportunity might not pay off, investments in enough of the right opportunities across the organization almost certainly will.

Persuasion could, in a sense, be described as "politics." While many people shy away from the term, the best organizations recognize that politics in this sense is inescapable in the allocation of resources. The genius who assumes that their ideas will attract budget on their own merit is doing their employer a disservice. The role of leaders in a creative organization is to ensure that politics is in fact about persuasion, not about playing the person.

Creativity inside requires investments outside

So far, we've discussed the five P's in the context of teams within organizations. But creativity also operates in broader domains—the industry and institutional ecosystems with which the organization engages, as well as the larger marketplace (figure 2).[17] Each domain influences the creativity of the one below it, with practices and norms that can encourage or discourage creativity all the way down to the team level.

Creativity emerges from the bottom up, from teams at the bedrock of the organization working together to ideate and experiment, to test and develop, and to inspire each other to work in new ways. For example, during the first few months of the pandemic, the bespoke stage construction firm Stagekings was able to quickly transition to selling flat-packed furniture to home workers not just because of adroit leadership, but also because of a community pulling together to quickly solve the myriad challenges of developing, manufacturing, and selling a new product to new customers via new channels.[18] Haier's potato-washing machine emerged from a chance observation by a field technician, triggering a long chain of creative actions that culminated in a successful, new product.[19]

Supporting creativity at the team level takes investments at the organizational level—developing training, defining metrics, adjusting processes, and evolving governance—to make *person*, *process*, and *place* conducive to creativity. Since these investments are made by executives and managers who themselves work in teams, a positive-feedback loop can occur in which investing in organization-level creativity helps leadership teams take a more creative, and potentially more effective, approach to future investments.

Investing in creativity in the institutional and market domains is trickier as organizations have less control over external ecosystems and markets than what happens within their own four walls. Still, opportunities exist. As with groups of workers, organizations can enhance the creativity of supplier and partner ecosystems by constructing a diverse network, and they can promote governance and performance management processes in the ecosystem that measure and factor creativity into contract management. They might even advocate for different and more flexible norms and practices in their industry through industry forums, lobbying, and one-on-one negotiation.

As for markets, practices to enhance a firm's creative potential, such as involving customers in helping to discover and solve problems, are a well-mined seam. Much has also already been written about the need to field creative products and convince clients and customers that the product is, in fact, creative and thus worthy of purchase.

We will only add that organizations will likely need to establish their creative credentials in the marketplace, demonstrating their ability to successfully pull off small creative ideas, before progressing to more ambitious creative efforts.[20] It's only when an organization has persuaded its customers and clients of both the organization's and product's creativity that there is permission to be creative. This is why creative products need to be beautifully packaged in persuasive reasoning. It takes time to develop this persuasive reasoning—to defend with data, build trust, and educate on best practice—but it's an investment that has to be made to build a more creative business. Being an organization that has creative ideas is only half the battle. Inspiring customers, clients, partners, and suppliers to join you on the journey is the real trick.

The mindset for leading a creative business

Integrating creativity (the verb) into your operations is a major undertaking. The interplay between creative performance and creative potential within and beyond each domain needs to be carefully considered. Metrics need to be developed, organizational measures updated, governance modified, new processes constructed, job profiles rethought, training designed, and a new operating model imagined. Organizations also need ways to understand the scope of the investment, as well as how improved creativity will translate into increased value—and how this increased value will be accounted for. Then the hard work of instituting the needed changes begins.

Perhaps the most important investment in creativity is in developing executive and leadership teams' ability to lead a creative organization. This isn't the same as leaders being personally creative or having a creative leadership style. Rather, it's the adoption of a fundamentally different mindset from traditional philosophies that insist that all investments lead directly to predictable outcomes.

To really invest in creativity, at scale and with full commitment, leaders need to value initiatives based on what the organization can learn from them and the opportunity they present to explore potentially useful new avenues, as well as on how efficiently they can deliver a solution. Leaders of a creative business understand that not every project, initiative, or interaction needs to (nor should) deliver a creative outcome, while also understanding that all projects, initiatives, and interactions are possible sources of creativity. They're sensitive to the trade-off between creativity and efficiency, and they trust that the seemingly unproductive activity of the generative creative process will result in greater value in the end. They have confidence in the fact that if the ingredients for creativity are consistently present, the organization will stimulate enough creative outcomes to make the investment worthwhile, and it will sustain these investments when times are troubled and cash tight, as this is when creativity is most valuable.[21]

The spark of creativity within an organization needs to be ignited. It doesn't just spark on its own. Leaders who understand how to invest in developing the right conditions for creativity will see it spark more often and more productively, lighting the path to innovation and greater commercial success.

Creativity emerges from the bottom up, from teams at the bedrock of the organization working together to ideate and experiment, to test and develop, and to inspire each other to work in new ways.

FIG 2: Creativity operates at multiple levels within and outside an organization

DOMAINS OUTSIDE THE ORGANIZATION		DOMAINS INSIDE THE ORGANIZATION	
MARKET	**INSTITUTIONAL**	**ORGANIZATIONAL**	**TEAM**
Who it covers:			
Consumers, customers, and clients	The organization and its external ecosystem: partners, suppliers, and the institutions the organization interacts with	The organization within its four walls	Individuals and the teams they belong to
Characterized by:			
Market preferences and demand	Institutional assumptions; industry conventions and norms	Organizational culture, policies, processes, standard operating procedures, and governance	Group dynamics and social norms
Creativity is:			
Innovation: the creativity of products and services in the market as a whole	New and valuable approaches to engaging with the ecosystem across an industry or sector	Finding and enabling new and effective ways to engage across the organization	The creation of a new and useful thing: creative work products

Source: Adapted from C. M. Ford, "Theory of individual creative action in multiple social domainsm," *Academy of Management Review* 21, no. 4 (1996): pp. 1112–1142; Mark A. Runco, "A hierarchical framework for the study of creativity," *New Horizons in Education* 55, no. 3 (2007): pp. 1–9.

Renewable transition: Separating perception from reality

The health of our planet requires a successful transition to net-zero emissions. Here are five common challenges around renewables— and a data-driven look at the reality.

By **Marlene Motyka, Jim Thomson, Mike Piechowski, Craig Rizzo,** *and* **Suzanna Sanborn**
Illustrations by **Mark Conlan**

In just 10 years, renewable energy's share of US electricity generation has doubled, from 10% in 2010 to 20% in 2020.[1] The overwhelming majority of that growth has been in solar and wind energy, which rose at compound annual growth rates of 84% and 15%, respectively, over the decade.[2] Despite these impressive gains, the pace will have to accelerate significantly for the United States to achieve clean energy goals. At the end of 2020, the country had more than 100 gigawatts (GW) of solar[3] and 122.5 GW of wind power capacity,[4] but will need to add as much as 70 to 100 GW each of solar and wind per year to decarbonize the power sector between 2035 and 2050.[5]

Most countries are targeting net-zero emissions by 2050, and the US administration supports a goal of emission-free electricity by 2035.[6] How difficult will it be to get there? To answer that question, we combined electric power industry research with a survey of more than 40 power industry executives and senior leaders in July 2021, and interviews with executives and leaders in utilities and other electric power providers. Let's take a data-driven look at five of the most commonly raised challenges and the common perceptions associated with them, and discuss what's required to solve them.

Comparing the costs of wind and solar to conventional generation

Common perception

Solar and wind are too expensive, or they're only competitive with conventional generation plants because of government incentives like tax credits.

Reality and industry perspectives

Solar and wind have become the cheapest power generation sources across most of the United States and the world, even without tax incentives and with integration costs included. In many cases, these resources are competitive even with battery storage included. And costs continue falling.

The cost of electricity from wind and solar generation has declined sharply in the past decade, by about 55% for onshore wind and 85% for utility-scale solar photovoltaics (PVs) in the United States and globally.[7] Figure 1 compares the revenue required to build and operate a generation source over a 30-year period for several types of generation technologies, or the levelized cost of energy (LCOE). The LCOE ranges indicate that even without the benefit of tax credits, wind and solar LCOEs are still cost-competitive.

Since wind and solar are variable renewable energy (VRE) resources, ongoing investment is required to integrate them smoothly on the grid, such as new transmission, energy storage, and further digitalization[8] to add flexibility. But even adding industry estimates of US$5 per megawatt hour (MWh) for integration costs still leaves wind and solar LCOEs competitive with gas- and coal-fired plants.[9]

Given the variability of wind and solar, plants are increasingly being built with battery storage, which can make them more dispatchable. The average LCOE for solar-plus-storage "hybrid" plants is not yet competitive with combined-cycle gas turbines (CCGTs) across the entire United States (figure 1). But in some states with high renewable penetration, such as California, market forces make hybrid plants more cost-effective than CCGTs, and this trend is expected to spread to other states as renewable market penetration increases.[10]

Power purchase agreement (PPA) prices for wind and solar power are also competitive with other resources. The weighted average US price for the first half of 2021 from auction and PPAs for solar PVs is US$31/MWh, while for onshore wind it is US$37/MWh.[11] This compares with a weighted average wholesale electricity price of about US$34/MWh across US markets over the same period.[12]

In many cases, it costs less to build new solar and wind plants than to continue running existing coal-fired plants. In fact, between 77% and 91% of existing US coal-fired capacity in 2021 has operating costs that are estimated to be higher than the cost of new solar or wind power capacity.[13] And that trend may increasingly apply to nuclear- and natural-gas–fired plants. Figure 2 compares the LCOE from new-build wind and solar plants with the marginal costs of existing conventional generation.

The electric power industry, consumers, and the investment community appear to be voting for renewables growth with their wallets, as wind and solar development pipelines have expanded to 119.4 GW and 67.4 GW for solar and wind, respectively, through 2025.[14] And these two technologies will likely become even more attractive as their costs are projected to fall to half of what they are today by 2030.[15]

Integrating variable renewables

Common perception

Intermittency is a major obstacle, and more than 10% penetration of variable wind and solar power on the grid could destabilize it. Wind and solar need to be backed up 1:1 with conventional generation, which is too expensive.

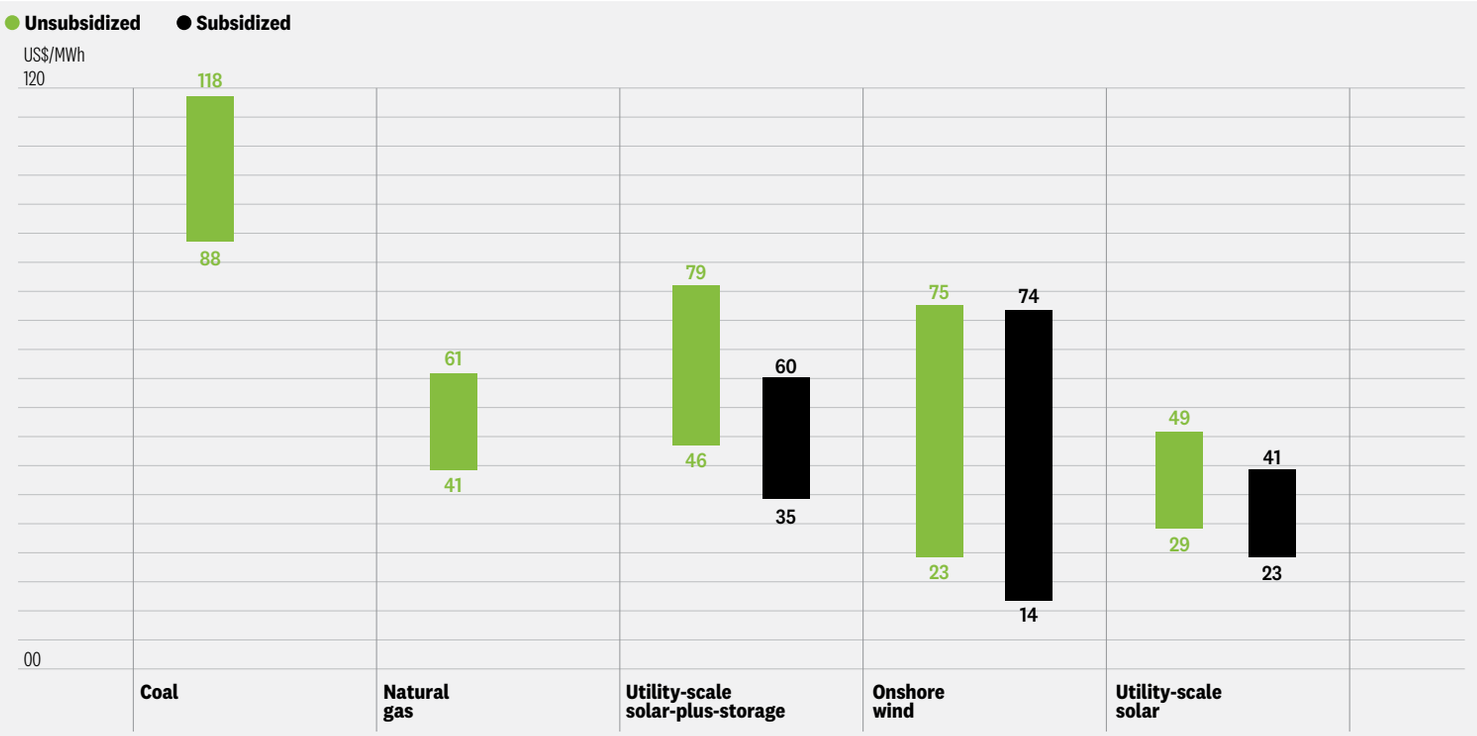
Reality and industry perspectives

Power systems in some countries and states are already operating with more than 50% penetration of wind and solar generation annually without impacting reliability. There's an expanding set of operational and technical solutions to help integrate these resources, and building new conventional power plants to back them up hasn't been necessary.[16]

The challenges of integrating VRE resources are real,[17] but US VRE penetration is already 11% nationwide and has reached more than 58% in Iowa and 43% in Kansas without impacting reliability.[18] Twelve states generated more than a quarter of their electricity from VRE in 2020 (figure 3),[19] and European countries have seen even higher penetrations, with Denmark topping 61% annually in 2020 (figure 4)—all without major supply shortages or outages associated with renewable variability. Many projections show VRE penetration rising to over 40% across the United States by 2035 and up to 70 to 80% in 2050.[20]

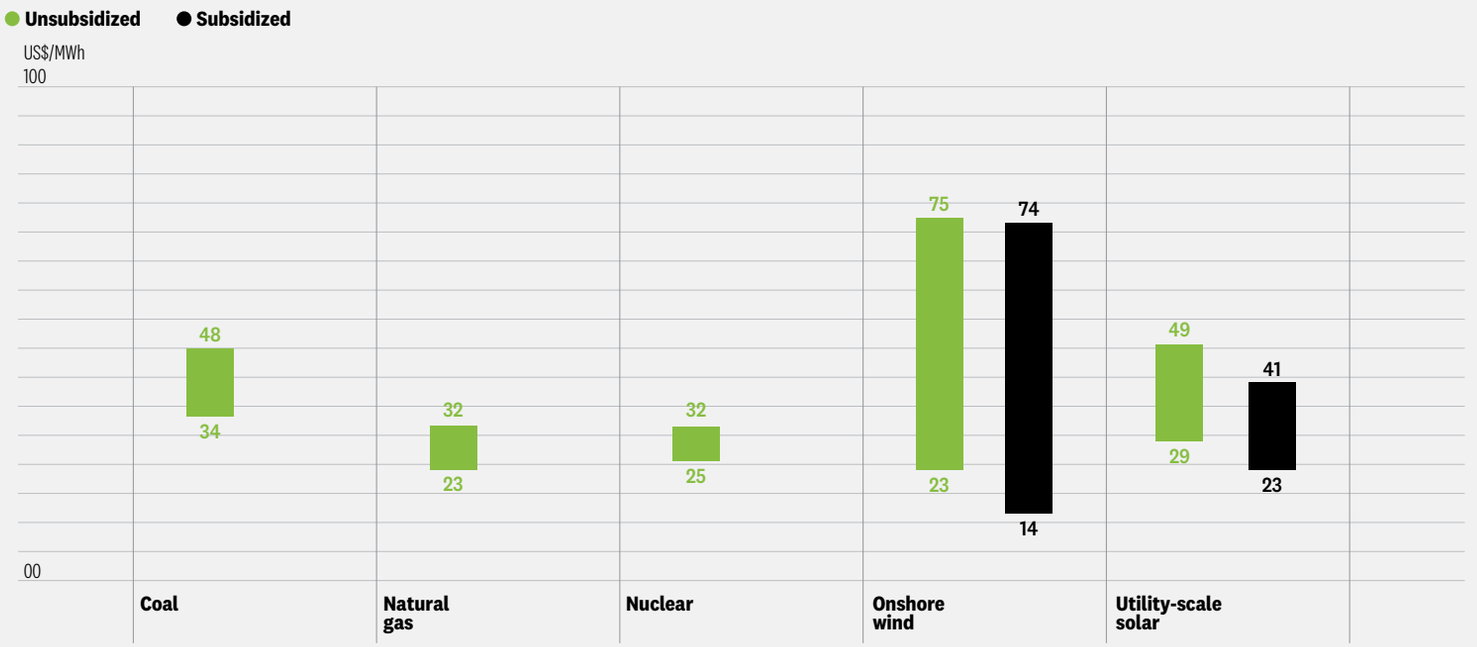
Most countries are targeting net-zero emissions by 2050, and the US administration supports a goal of emission-free electricity by 2035. How difficult will it be to get there? We looked into it.

FIG 1: Levelized cost of energy for generation resources in the United States



Sources: Wind and solar: National Renewable Energy Laboratory, "2021 electricity ATB technologies and data overview," 2021; coal and natural gas: International Energy Agency, "Levelized cost of electricity calculator," December 9, 2020.

FIG 2: New-build renewable energy vs. marginal cost of existing conventional generation



Sources: Wind and solar LCOE: National Renewable Energy Laboratory, "2021 electricity ATB technologies and data overview," 2021; coal, natural gas, and nuclear marginal cost: Lazard, *Lazard's levelized cost of energy analysis* - version 14, October 2020, p. 7.

FIG 3: Share of annual electricity generation from VRE

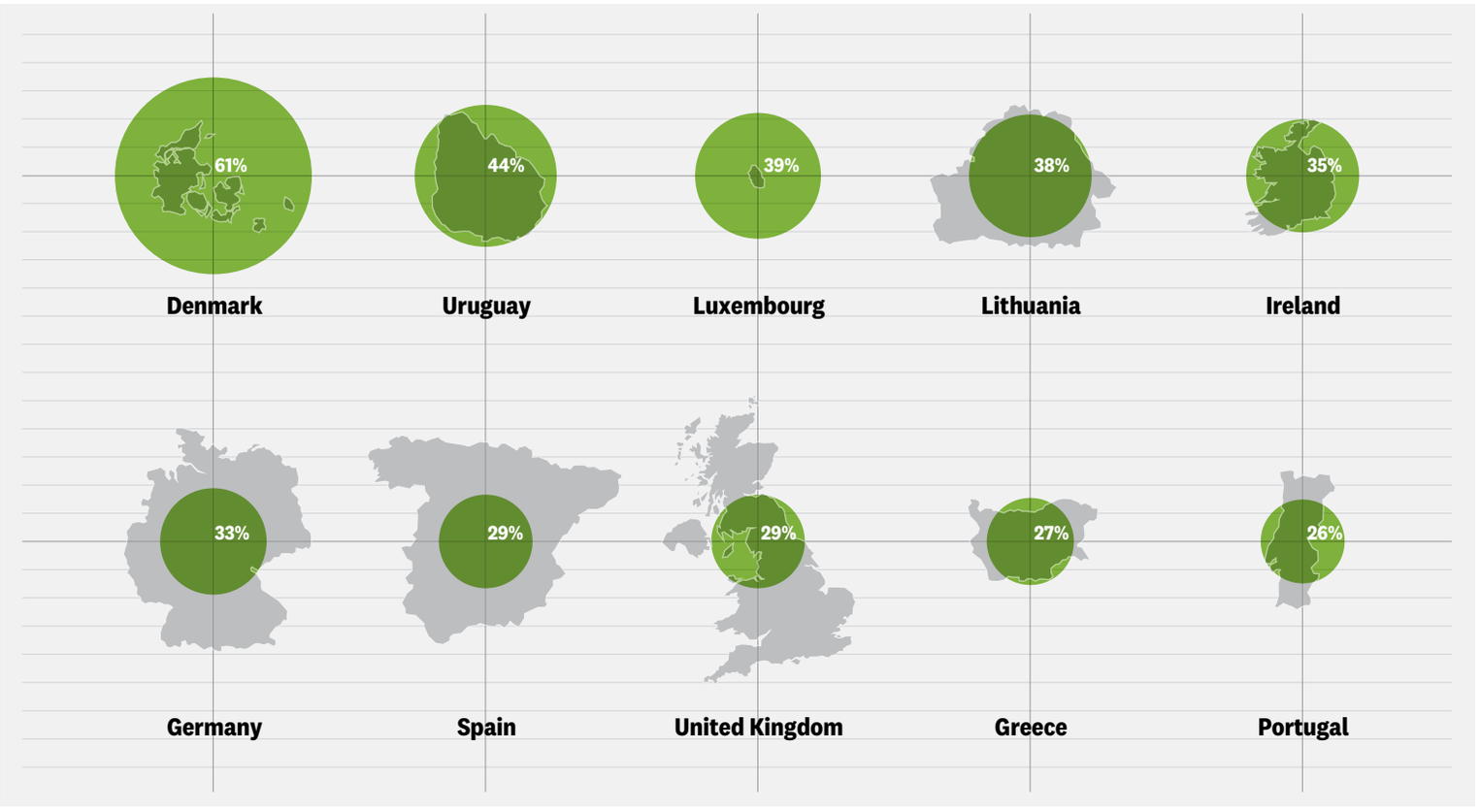
Sources: 2020 data: US Energy Information Administration (EIA), which includes generation from utility-scale wind and solar as well as small-scale solar (<1 MW); 2035 and 2050 data: National Renewable Energy Laboratory, North American Renewable Integration Study (NREL/NARIS), which includes utility-scale wind and solar as well as distributed solar; 2035 data is the average of 2034 and 2036 NREL/NARIS data; Deloitte analysis.

Planning and flexibility are often key to smoothly integrating VRE, and solutions typically fall into 10 categories:[21]

- **Redesigning markets:** Wholesale market operators are revising rules and innovating market design to provide more flexibility to integrate variable resources.
- **Improving forecasting:** Advanced weather forecasting can more accurately determine when and where the sun will shine or the wind will blow to forecast VRE output. On the demand side, operators are also working to forecast load more accurately.
- **Accessing dispatchable centralized generation resources:** Operators can access output from fast-ramping resources such as CCGTs and hydropower plants with reservoirs to address intermittency.
- **Tapping into dispatchable DERs:** Distributed energy resources (DERs) can either reduce demand (e.g., demand response) or increase supplies (e.g., fuel cells) to help reduce grid impacts from VRE.
- **Deploying energy storage:** Fast-ramping capability makes energy storage a particularly useful resource in countering VRE intermittency.
- **Expanding/optimizing transmission:** Adding transmission capacity through expansion or technology upgrades allows access to resources in neighboring regions for balancing.
- **Increasing regional coordination:** Coordinating resource dispatch across regions can facilitate VRE integration as weather patterns vary across larger areas.
- **Planning/optimizing location of DERs:** Analyzing existing grid resources, capacity, and current and future load patterns can help determine where DERs can be most valuable.
- **Testing new technologies:** Utilities and grid operators are testing new technologies for integrating VRE around the world. For example, operators are applying artificial intelligence or machine learning to weather and power plant output data to increase the accuracy of renewable output forecasts.[22]
- **Modernizing the grid:** Boosting the grid's flexibility to integrate growing volumes of VRE requires deployment of a host of supporting technologies to enhance visibility and control. Utilities are already including many of these same technologies in grid modernization plans because they facilitate overall grid reliability and operational efficiency.

The following examples highlight some key strategies employed by Denmark, the country with the highest VRE penetration globally, and by two high-penetration US states with different approaches, Iowa and California.

FIG 4: Top 10 countries' share of annual electricity generation from VRE, 2020



Source: Ember, *Global electricity review 2021*, March 2021.

LOCATIONS WITH HIGH VRE PENETRATION

Denmark (VRE penetration: 62%)

Key strategies

Redesigning markets:
In 1999–2000, Denmark cocreated the Nord Pool power exchange, a market that helps its 16 member countries balance electricity supply and demand.[23] The country also maintains four ancillary/balancing markets. In 2006, Denmark began requiring its combined heat and power (CHP) plants to settle at market prices, effectively transforming them into flexible resources to balance increasing wind output.

Tapping into DERs:
Denmark has a sophisticated demand-response market based largely on CHP systems, which produce nearly half of the country's power. Fueled by gas, biomass, and waste, the CHP systems can respond to market pricing and balance output against varying wind generation. The country also encourages new DERs, such as heat pumps and electric vehicles (EVs), to provide storage for excess wind output.[24]

Expanding/optimizing transmission:
Denmark has interconnections that allow it to sell excess wind output to neighboring countries or source its entire peak load from them if needed.[25] Its electricity system operator proactively plans new transmission capacity, anticipating the future interconnection of wind farms.

Accessing dispatchable centralized generation resources:
Denmark's conventional power plants are designed for hourly ramping and daily cycling to quickly adjust to fluctuating output.[26]

Iowa (VRE penetration: 58%)

Key strategies

Regional and interregional coordination:
Iowa is part of the Midcontinent Independent System Operator (MISO), which delivers power and operates a wholesale electricity market across 15 states and one Canadian province. MISO's real-time and day-ahead markets help balance electricity supply and demand throughout the midcontinent.

Expanding transmission:
MISO's 66,000 miles of transmission lines connect Iowa to resources across the region and to neighboring grids,[27] enabling operators to send excess wind output or access additional energy as needed. The proposed SOO Green HVDC Link would link wind resources across Iowa to northern Illinois and connect MISO to mid-Atlantic grid operator PJM, further expanding those capabilities.[28]

Accessing centralized generation:
Iowa's 11.7 GW wind generation capacity[29] is a part of 199 GW of generating capacity of all types within MISO.[30] Diversified resources across a large geographic region help enable the smooth integration of Iowa's wind output. Studies show that MISO needs almost no additional fast-acting power reserves to back up the wind power on the system.[31]

Deploying energy storage:
Iowa has approximately 6.9 MW of utility-scale battery storage[32] and another 415 MW in the queue as of May 2021, while MISO has 5,625 MW in the queue.[33] Green hydrogen producers are exploring production potential in Iowa, due to the abundance of low-cost wind and increasing solar output needed to produce this long-term energy storage resource.[34]

California (VRE penetration: 29%)

Key strategies

Improving forecasting:
Recent extreme heat waves have caused electricity demand to exceed resource adequacy and planning targets. The California Independent System Operator (CAISO), the California Public Utilities Commission (CPUC), and the California Energy Commission (CEC) are collaborating to modernize load forecasting and resource planning to anticipate extreme climate events, while accounting for the state's transition to a cleaner but potentially more variable energy resource mix.[35]

Planning/optimizing location of DERs:
The CPUC requires the state's investor-owned utilities (IOUs) to file and update distribution resource plans annually, which identify optimal locations for deploying DERs.[36] This helps the CPUC assess where DERs, such as EV charging stations, can be added without costly upgrades and/or lengthy interconnection studies.[37]

Regional coordination:
CAISO offers the Energy Imbalance Market as a real-time, energy-only market for participants anywhere in the western United States to buy and sell energy when needed. CAISO can send excess solar output to other states and potentially tap their resources when needed through this market.[38]

Deploying energy storage:
The CPUC set targets for California's three largest IOUs to procure and install 1.325 GW of energy storage by the end of 2020 and 2024, respectively. The IOUs exceeded the target, procuring 1.5 GW of storage by end 2020. The state set an additional target for IOUs to procure 500 MW of distributed energy storage systems.[39] Additional storage can help integrate growing VRE generation.

For additional examples, visit www.deloitte.com/us/new-era-grid

These solutions can serve as building blocks, and their value likely will grow as VRE penetration rises across the United States and globally. The good news is that the required technologies and capabilities are advancing, and their costs are falling. Battery storage costs, for example, have dropped 89% over the last decade.[40] US states and other countries should plan and forecast in detail, strengthen and modernize their grids in advance, and consider retaining the resources needed (however seldom used) to fill in gaps until they have been replaced with robust, low-carbon solutions.

When surveyed on this topic, power industry executives appeared optimistic about meeting integration challenges with long-term planning and innovative solutions—and that DERs can help. Seventy-three percent of power industry respondents think the United States can integrate far more wind and solar power than it has now without compromising reliability as long as the country builds flexibility into the grid and plans ahead to use resources such as energy storage to manage intermittency. And 70% of respondents think DERs will be a big component of the clean electricity grid that will help balance intermittent resources.

Managing supply chain constraints

Common perception

There's concern that renewable energy, battery storage, and EV growth could be hampered by supply chain disruptions—from manufactured components to critical minerals and materials.

Constrained access to these commodities may hamper the United States' ability to reach ambitious renewable energy and decarbonization targets.

Reality and industry perspectives

Constraints on manufactured components, key materials, and critical mineral supply chains are real and can potentially slow growth, at least temporarily, as they have during the pandemic. But longer-term solutions exist and are being explored and implemented to address longer-term postpandemic constraints.

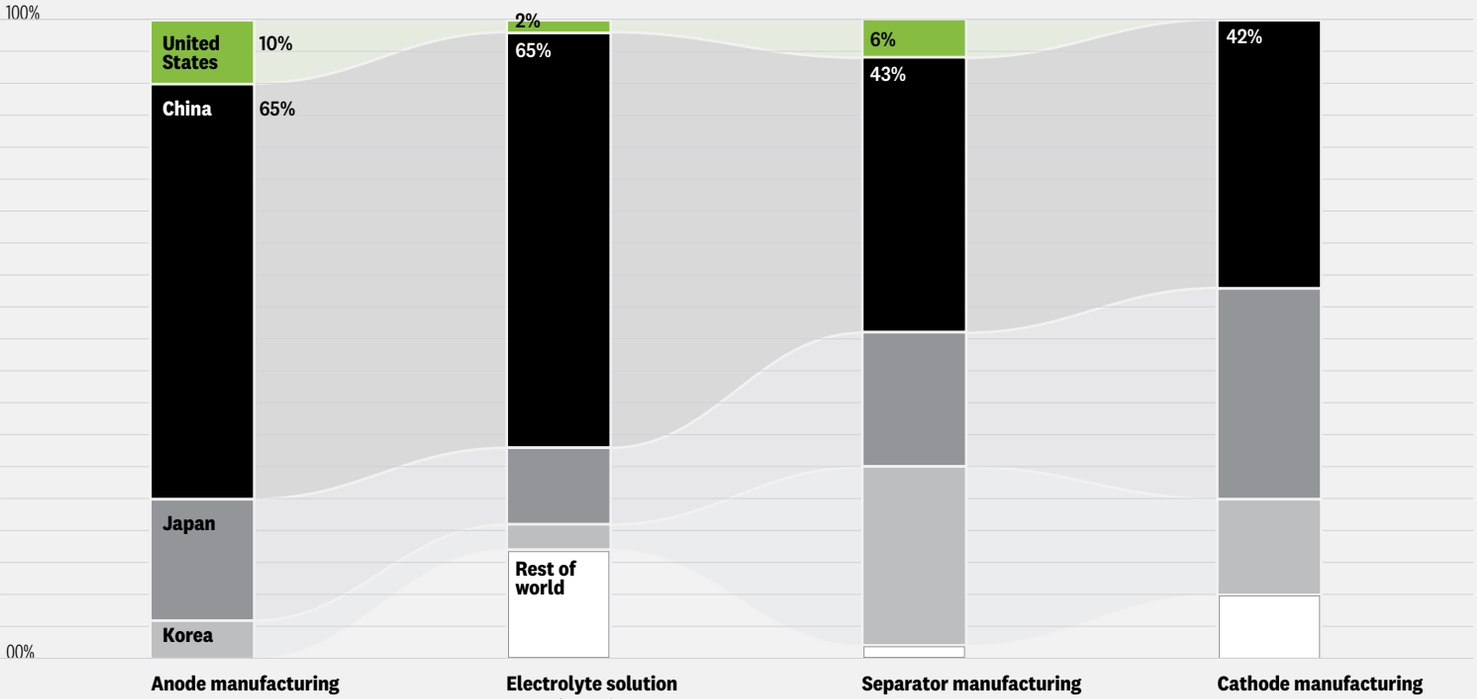
Most clean energy components are manufactured abroad, with the United States most exposed in the solar, battery storage, and wind sectors. US-China trade tensions (including issues around production using forced labor) and pandemic-driven supply chain vulnerabilities have raised concerns about supply chain resiliency.[41] About 85% of the solar panels sold in the United States are imported from China and Chinese companies operating in Southeast Asia.[42] As for lithium-ion battery manufacturing, the United States manufactures 10% or less of global supplies of key battery components such as anodes, while 42 to 65% of these and other components come from China (figure 5).

In the wind sector, the United States has increased the domestic content of turbines with more than 500 manufacturing facilities in 40 states.[43] Still, it imports nearly three-quarters of wind-power–generating sets from Spain, 64% of wind towers from three Asian countries, and 22% of blades and hubs from China.[44] Record demand and the COVID-19 pandemic strained the global supply chain in 2020, triggering shortages of blades, bearings, and core materials used in blades.[45] As the global economy reignites, shortages are also emerging for everything from semiconductors to steel to flatbed trucks. Record-high freight rates and port congestion are further straining clean energy supply chains.[46]

Efforts to support US solar, battery, and wind supply chains are addressing not just the clean energy components themselves but also the materials that go into them, such as aluminum, steel, polysilicon, and critical minerals. The International Energy Agency describes a "looming mismatch between the world's strengthened climate ambitions and the availability of critical minerals that are essential to realizing those ambitions."[47]

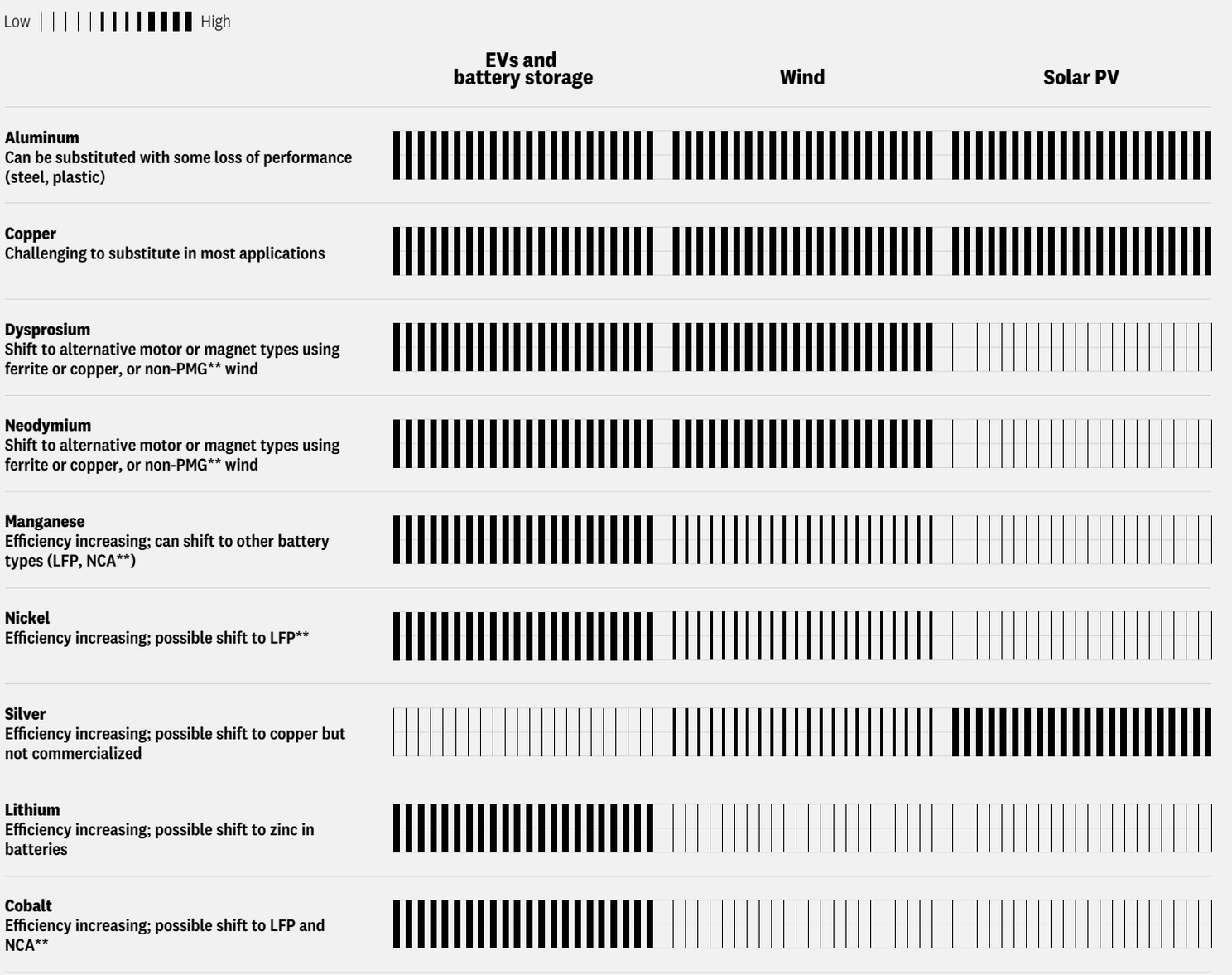
The need for critical minerals and rare earth elements (REEs) could increase by as much as six times by 2040.[48] Constrained access to these commodities may hamper the United States' ability to reach ambitious renewable energy and decarbonization targets.[49] Lithium-ion battery production requires lithium, nickel, cobalt, manganese, and graphite, while wind turbines and EV motors require REEs such as neodymium, praseodymium, and dysprosium for permanent magnets, and solar PVs require polysilicon and silver. Electricity networks overall need significant amounts of both copper and aluminum.[50] Figures 6 and 7 illustrate critical mineral needs for clean energy technologies and global supply sources.

FIG 5: Share of total manufacturing capacity for lithium-ion battery components, by country

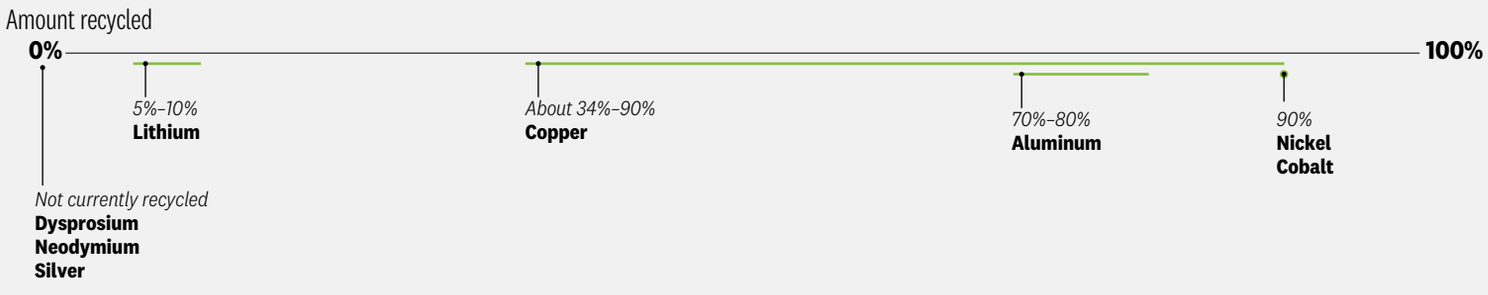


Source: Federal Consortium for Advanced Batteries, *National blueprint for lithium batteries 2021–2030*, June 2021, p. 19.

FIG 6: Degree of criticality by industry*

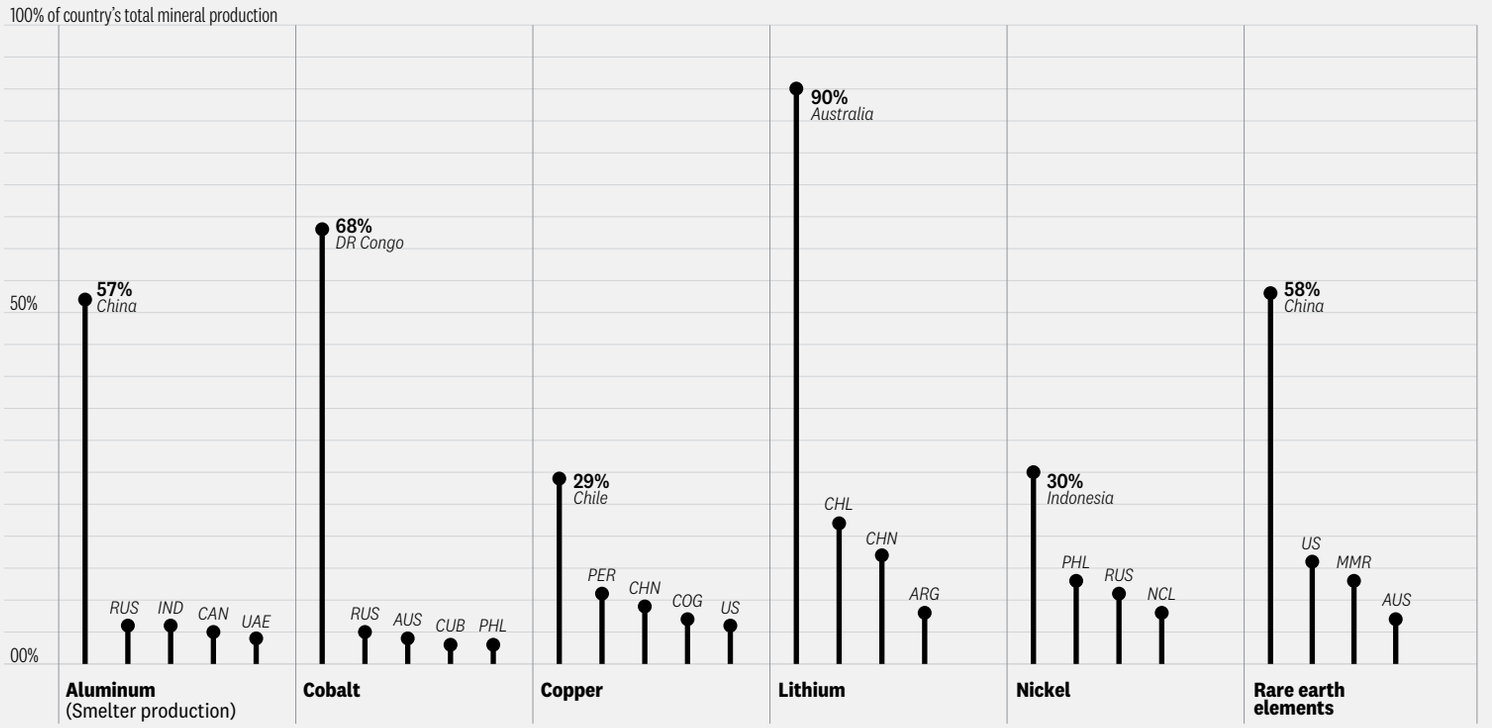


Notes: *Criticality is determined by factors such as use in multiple technologies or being hard to replace;
**LFP = Lithium iron phosphate; NCA = Lithium nickel-cobalt-aluminum oxide; PMG = Permanent magnet generator.



Sources: International Energy Agency, *The role of critical minerals in clean energy transitions*, May 2021, p. 45; Claudiu C. Pavel et al., *Substitution of critical raw materials in low-carbon technologies: lighting, wind turbines and electric vehicles*, European Commission, 2016; Deloitte analysis.

FIG 7: Share of global critical mineral supplies from top suppliers, 2020



RUS: Russia, IND: India, CAN: Canada, UAE: United Arab Emirates, AUS: Australia, CUB: Cuba, PHL: Phillipines, PER: Peru, CHN: China, COG: Congo, US: United States, CHL: Chile, ARG: Argentina, NCL: New Caledonia, MMR: Myanmar
Source: US Geological Survey, *Mineral commodity summaries 2020*, Jan. 21, 2020.

Many of these materials are not scarce, but it takes time, investment, expertise, and commitment to start or restart mining operations to extract and process them.[51]

Governments, end-user industries, and individual companies are working to address these supply chain issues. Solutions include developing domestic manufacturing and sustainable mining, working with allies and partners to secure additional supplies, committing to future demand to incentivize investment, recycling materials, and changing designs to limit use of scarce resources. For example, wind turbine developers are exploring a move to smaller and lighter permanent magnet generators that use fewer REEs, gearless design for wind turbines that are REE-free, and replacing permanent magnets with high-temperature superconductors.[52] The alternative pathway for solar PVs (with silicon) could be scaling up perovskite solar-cell manufacturing in tandem with existing silicon cells to reduce silicon demand and boost efficiency. And EV manufacturers are working to develop low- or no-cobalt cathodes due to price spikes and ethical concerns around current cobalt mining.[53]

A recent executive order in the United States supports the development of an end-to-end domestic supply chain for advanced batteries and seeks to strengthen supply chains for multiple critical production materials.[54] In addition, some manufacturers are lobbying for the reinstatement of advanced energy manufacturing tax credits.[55]

Respondents to our Deloitte Renewable Transition Survey were somewhat optimistic about the impact of manufactured components' supply chain constraints on renewable growth, and more concerned about the impact of critical minerals shortages. Fifty-nine percent of power industry respondents said that supply constraints for wind and solar components manufactured abroad likely will impact renewable growth only temporarily because renewable developers can find alternative suppliers of wind and solar manufactured components. Meanwhile, 31% of power sector executives we surveyed said manufactured components' supply constraints could significantly slow renewables' growth. Fifty-one percent of respondents said that constrained supplies of critical minerals will likely slow renewable energy growth, while 41% thought industry and government steps to alleviate constraints make a significant slowdown unlikely.

For more on the mining sector's potential role, visit www.deloitte.com/insights/clean-energy-future

Addressing disaster vulnerability

Common perceptions

Renewables are sometimes perceived as more vulnerable to extreme weather than conventional generation plants. There's also a misconception that renewables are more apt to fall prey to another type of disaster: cyberattacks.

Reality and industry perspectives

Renewables have sometimes come under scrutiny after severe weather–driven power outages. However, nearly all types of power generation can be impacted by storms, extreme temperatures, and other natural disasters.[56]

Weatherization to reduce this vulnerability can often be economically justified and should be evaluated, especially given recent severe weather trends. Diversifying energy sources, expanding interregional connections, and adding DERs such as onsite solar, battery storage, microgrids, and demand response can also help

ensure against weather-related outages and provide resilience. In addition, all types of generation assets face the risk of cyberattacks and require cyber risk management.

Weather vulnerability: The United States experienced 22 weather or climate disasters in 2020 that each caused at least US$1 billion in damage, breaking the previous annual record of 16 events, which occurred both in 2017 and in 2011.[57] With more extreme weather events, both renewable and conventional energy sources face increased risk from climate-related disasters.

In the case of coal- and natural-gas–fired plants, extreme weather can impact fuel delivery and storage. Subzero temperatures can freeze coal stockpiles as well as natural gas wellheads and pipelines.[58] Similarly, wind turbine parts can become brittle under cold temperatures, which can impact output and longevity. To address these issues, operators can invest in weatherization packages that include heaters and special lubricants. Solar plants typically do not require winterization, although fewer daylight hours and heavy snow on panels may reduce energy output.[59] Wildfires can also cut solar production as particulate matter from the smoke may reduce the amount of sunlight absorbed. One remedy is to spray panels with water to remove the grime.

For most generation assets, particularly in areas that typically have milder winters, it may be difficult to determine when weatherization packages are economically justified. Figure 8 highlights weatherization solutions for different assets with typical costs.

Cyber vulnerability: Recent highly publicized cyberattacks across industries suggest that not only are nearly all types of power generation vulnerable, assets and systems across other energy infrastructure could also be susceptible.

Natural gas and coal are both, to varying degrees, dependent on supply chain interfaces that are exposed to cyberthreats. Sensors, valves, and pressure within pipelines and leak detection systems may be vulnerable to attack in gas plants.[60] Although nuclear plants are not connected to unsecured networks, effectively creating "air gaps" that provide some level of cyber protection, they could be vulnerable to a targeted attack perpetrated by a well-resourced adversary using USB sticks.[61]

In solar plants, inverters have been identified as a source of cyber risk due to their two-way communications with the grid and a perceived lack of strong standards to protect those communications. Likewise, operators' remote access to wind, solar, and storage systems may also pose cyber risk. Researchers in Oklahoma demonstrated that their wind turbines could

FIG 8: Options and costs for weatherizing assets

Asset type	Weatherization options	Costs
Natural gas production, delivery, processing, and storage infrastructure	• Prioritize electricity delivery to gas infrastructure during a crisis • Winterize gas production, delivery, processing, and storage infrastructure with solutions such as methanol injection, enclosures, heaters, insulation, and dehydration	Capex for winterizing a typical gas well: US$42,000 + US$8,000 annual opex[a]
Natural-gas–fired plants	Install insulation, wind breaks/enclosures, heaters, heat tracers, temperature and dew point monitors, sensors, and alerts	US$60,000–600,000 per plant[b]
Coal-fired plants and coal storage		Winterization of thermal plants typically costs <1% of the initial capital cost of the plant, while retrofits are more costly[c]
Nuclear plants		
Wind turbines/plants	Solutions to prevent ice buildup include:[d] 1. Heaters and blowers 2. Carbon fiber coating to prevent ice buildup 3. Embedded warming equipment in blades, turbine, and gear box (allows production at temperatures down to -22°F)	Cost of solutions:[e] 1. Heaters and blowers: US$80,000–150,000 2. Coating: US$40,000 + US$5,000 annual opex 3. Embedded warming: US$150,000–450,000 Winterization packages add about 5% to turbine cost[f]

Figure 8 sources:
[a]Federal Energy Regulatory Commission and North American Electric Reliability Corporation, *Report on outages and curtailments during the Southwest cold weather event of February 1-5, 2011*, August 2011, p. 36. Costs converted to 2021 USD using the Bureau of Labor Statistics inflation calculator.
[b]Ibid., p. 179.
[c]Charlotte Huffman and Jason Trahan, "Winterizing Texas power plants could cost between $5B and $20B," WFAA, May 2, 2021.
[d]American Clean Power Association, Asset management and standard development department.
[e]Ibid.
[f]Baker Institute, "Winterization and the Texas blackout: Fail to prepare? Prepare to fail," *Forbes*, February 19, 2021.

be hacked in less than one minute through a single lock on the door to gain access to their servers.[62] Distributed solar and wind, like other DERs, may expand the potential attack surface. And, as with other assets, increasing dependence on digital communications and control, without cyber risk management, could increase vulnerability.

However, Deloitte Renewable Transition Survey results suggest wind and solar are not more vulnerable to cyberattacks than other assets. Eighty percent of power industry respondents said it's not clear that wind and solar assets add any more vulnerability to cyberattacks than other types of assets.

The power industry and government have increased efforts to address growing cybersecurity threats. The nonprofit North American Electric Reliability Corporation mandates cybersecurity standards for the bulk power system and operates a data-sharing and incident management center for the industry. The Energy Sector Coordinating Council helps industry members coordinate with the government to prepare for and respond to disasters or threats. A recent executive order outlines several initiatives, including improving software supply chain security.[63] And the US Department of Energy is working to establish wind industry–specific guidelines for cyber incident reporting, event response, and recovery.[64] Integrating cybersecurity measures into new renewables projects from the start can help manage cyber risk.

Meeting future electricity and renewable electricity demand

Common perception

As the United States further electrifies the transportation, heating, and industrial sectors, there's sometimes concern about whether there will be enough electricity to power it all—in particular, enough renewable electricity to meet US needs.[65]

Reality and industry perspectives

Overall power supplies will likely be sufficient as electrification boosts consumption, as long as the industry continues long-term, holistic system planning, grid modernization, demand-side management, and integration of DERs. As for renewable supplies, meeting a 100% clean electricity standard between 2035 and 2050 will require doubling or tripling the 35 GW of wind and solar capacity that was added in 2020, every year. This is an ambitious goal and would be more likely with federal policy support, such as a Clean Energy Standard (CES). It will also likely require accelerated grid interconnection rates.

Electricity supply: Utilities are already planning and preparing for electrification. Electricity supplies will likely be sufficient if the timing of demand, such as EV charging, can be managed. Many utilities are implementing grid modernization plans, which involve harnessing advanced analytics and digital technologies to forecast demand and consumption, monitor and manage load, and match supplies to it (or, increasingly, vice versa). In 2020, the North American market for digital grid solutions, such as sensors, meters, and communications technology, was estimated to be US$1.16 billion, and that's expected to grow at a compound annual growth rate of 3.5% over the decade, to reach US$1.64 billion in 2030.[66]

Despite the ability to plan and manage the growth of electrification and renewables, some are still concerned about electricity supplies due to other factors. In some areas, climate change is having unpredictable effects on consumption patterns and on the grid itself.[67] Recent infrastructure and supply challenges in the western United States due to record-breaking heat and wildfires, and in Texas and other states due to an unprecedented winter freeze, illustrate this trend. This is likely behind the split in power industry respondents' attitudes on the issue.

Despite the ambiguity, nearly three-quarters of respondents see DERs as a key potential solution. Fifty-three percent of power industry executives surveyed said as long as the industry can project increased consumption, build the necessary infrastructure to support it, and manage usage to avoid spiking peak demand, supply shortages are unlikely. At the same time, more than half of power industry respondents said as additional end-uses are increasingly electrified, there's a risk of not being able to meet increased electricity demand by 2035. Seventy-three percent of power industry respondents think DERs will play a key role in fulfilling increased electricity demand by 2035.

Renewable/clean electricity supply: While the power industry is committed to leading the clean energy transition,[68] the 2035 deadline is sooner than some had planned. Nearly two-thirds of power industry respondents were skeptical of reaching the target in 2035. Utilities continue to announce decarbonization goals, but most of their targets extend closer to 2050.[69] In addition, while renewables developers already have 187 GW of wind and solar in project pipelines through 2025,[70] interconnection has become a bottleneck, with average wait times rising to 3.5 years over 2010–2020, up from 1.9 years in the previous decade.[71]

To understand how much electricity and renewable electricity the United States may require in 2035 and 2050, consider the EIA's most recent data (2020) and projections to 2050, as well as three alternative scenarios that model different degrees of electrification and carbon reduction (figure 9).

US wind and solar installations hit an all-time high of 35 GW in 2020.[72] But the scenarios depicted in figure 9 require 70–100 GW to be added annually to meet clean electricity goals by 2035–2050. Many factors are driving strong renewable growth, from declining costs for wind, solar, and storage; to efficiency advances; corporate and public sector decarbonization goals; and stakeholder pressure from employees, shareholders, insurers, and financiers.

Another key driver is policy. State Renewable Portfolio Standards (RPS) and federal renewable tax credits have boosted renewables growth. Roughly half of all growth (45%) in US renewable electricity generation and capacity since 2000 is associated with state RPS requirements.[73] The investment tax credit for solar and the production tax credit for wind have also contributed significantly to growth. But their impact has been inconsistent as the tax credits were allowed to expire and then reextended numerous times in the last 20 years (figure 10).

To meet the most ambitious clean electricity goals, many electric utilities and renewables developers are advocating for a federal CES, renewables tax credit extensions plus new credits for transmission and stand-alone storage, as well as permitting reform. The power industry also seeks federally funded research in technologies such as low-carbon hydrogen, long-duration energy storage, advanced nuclear, and carbon capture. The current administration supports a CES or similar policy and has initiated or proposed legislation to fund new research programs for these technologies.[74]

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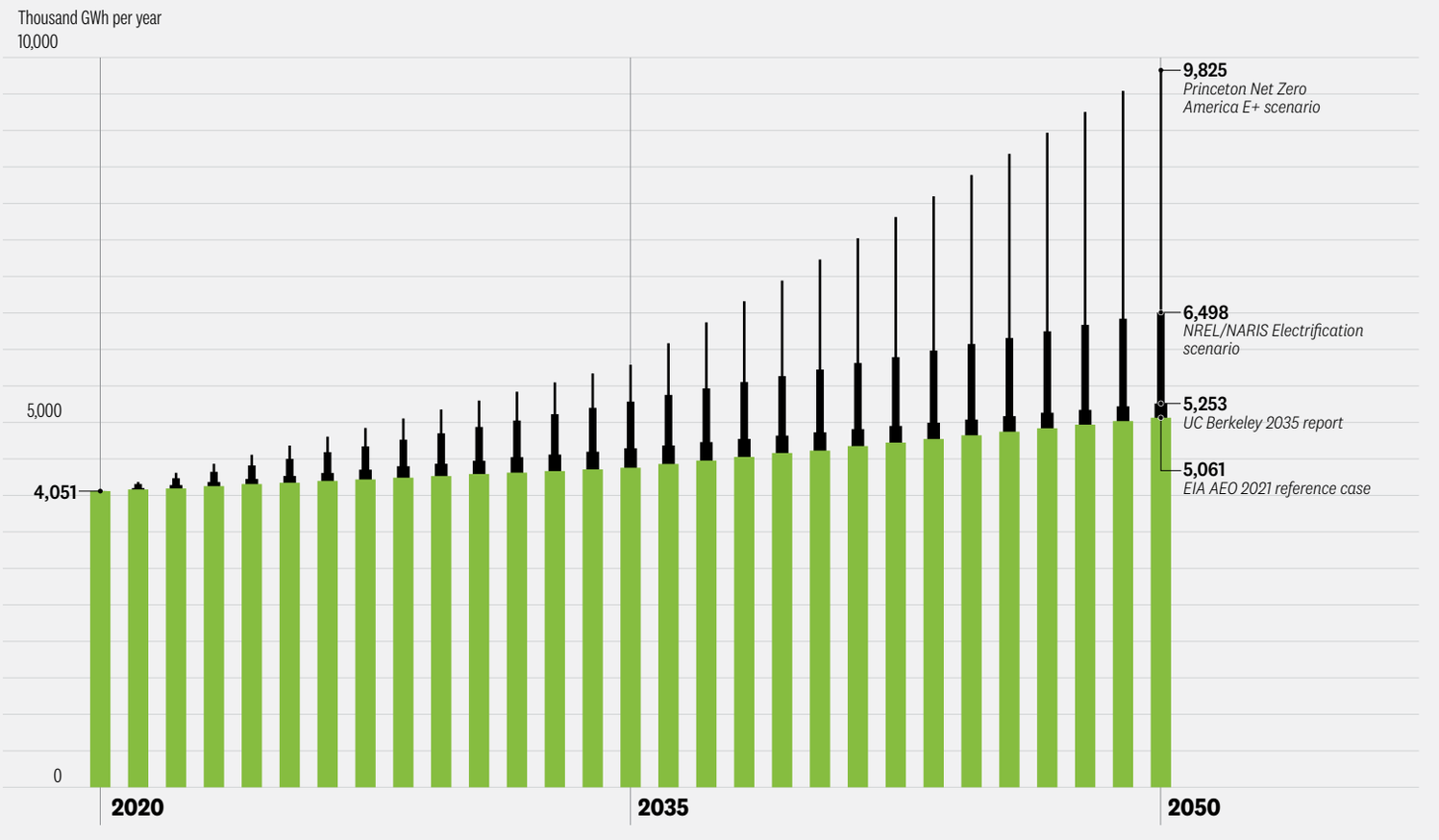
FIG 9: US electricity generation in select carbon reduction scenarios



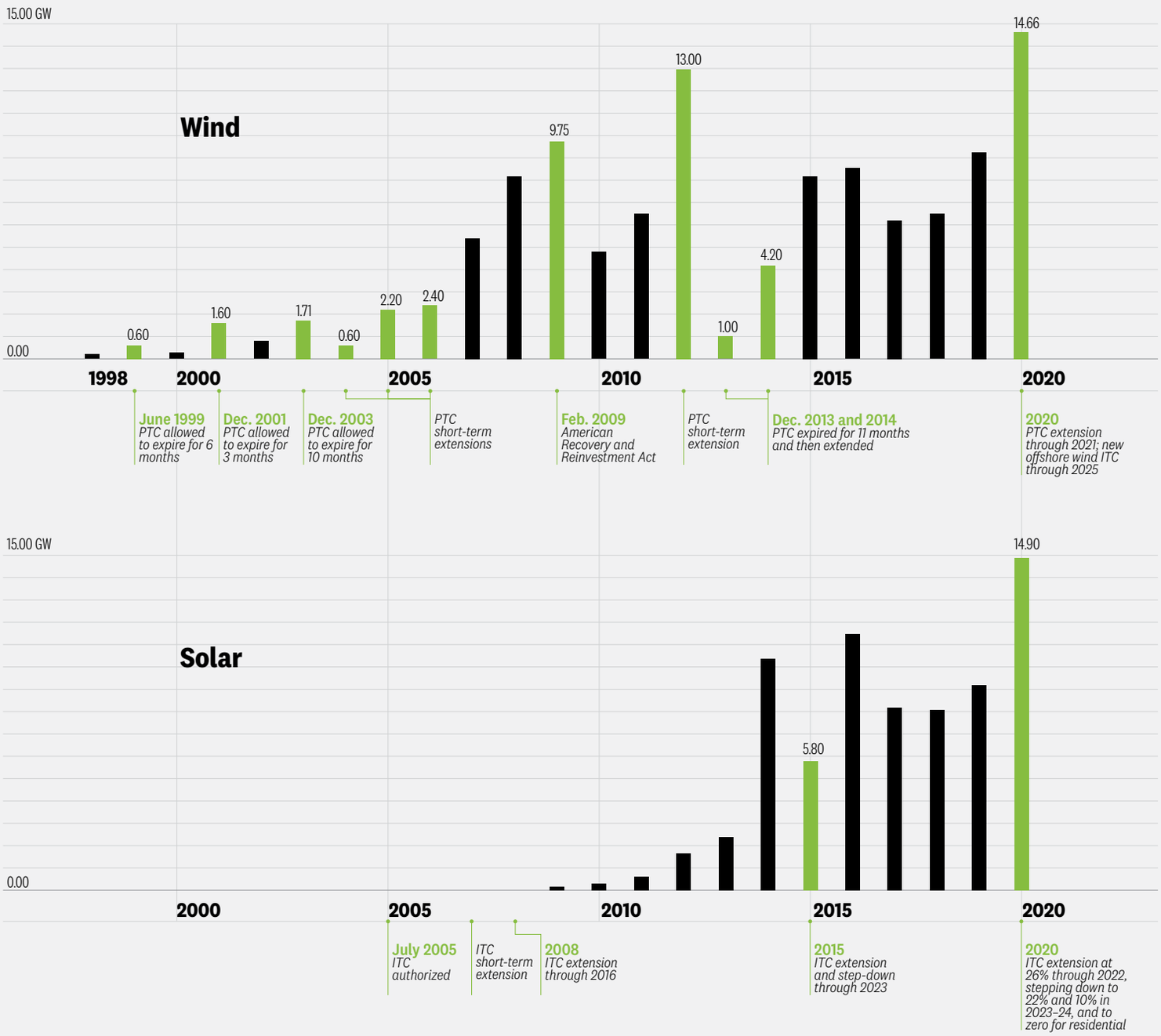
Sources: E. Larson et al., *Net-zero America: Potential pathways, infrastructure, and impacts,* interim report, Princeton University, December 15, 2020; (the E+ scenario assumes aggressive end-use electrification to reach net-zero carbon emissions economywide by 2050); NREL/NARIS, June 24, 2021 (the Electrification scenario assumes electrification of new transportation and heating demand and reduces power sector carbon emissions 80% by 2050; 2035 data point is the average of 2034 and 2036 data); Center for Environmental Public Policy, University of California, Berkeley, The 2035 Report: *Plummeting solar, wind, and battery costs can accelerate our clean energy future*, June 9, 2020 (The 2035 Report models a pathway to 90% carbon-free electricity by 2035); US Energy Information Administration, *Annual energy outlook 2021*, February 3, 2021 (the reference case assumes no policy changes and current laws and regulations, including current expiration dates, apply); Deloitte analysis.

What it all adds up to

Exploring these five challenges demonstrates that although some common perceptions sound like showstoppers that could halt renewable energy growth, that's not likely. Some perceptions are actually misperceptions, or the reality is that solutions are already being explored and implemented.

Several of the challenges are difficult and require planning, coordination, and potentially, new policies. And getting there by 2035 may be a tall order. But progress will likely continue, buoyed by innovation and the proliferation of distributed energy resources. Innovations such as cost-effective technologies for long-term energy storage could make affordable renewables increasingly reliable and dispatchable, speeding their penetration. And, as more than 70% of our survey respondents indicated, DERs can play a key role both in fulfilling increased electricity demand and in helping to balance intermittent renewables. Reality is often more encouraging than perceptions imply.

FIG 10: Impact of tax credits on wind and solar annual capacity additions



Note: PTC = wind production tax credit, ITC = solar investment tax credit.

Sources: EIA; A. Will Frazier, Cara Marcy, and Wesley J. Cole, "Wind and solar PV deployment after tax credits expire: A view from the standard scenarios and the annual energy outlook," *Electricity Journal* 32, no. 8 (2019); Deloitte analysis.

Endnotes

P16

Where global execs stand on making health equity a business priority

1. Nancy Brown, Punit Renjen, and Michelle Williams, *Investing in health equity: Why strong ESG strategies help build a healthier, more inclusive world*, World Economic Forum, April 2022.
2. Kulleni Gebreyes et al., *Activating health equity: A moral imperative calling for business solutions*, Deloitte Insights, April 12, 2021.

P17

The potential impact of a broken DEI promise

1. Jennifer Tonti and Jill Mizell, "95% of Black Americans agree that it's important for companies to promote racial equity. 80% believe they can do more," JUST Capital, April 1, 2021.
2. Weber Shandwick, "Nearly 2/3 of US workers plan a professional change due to COVID-19," October 28, 2020.
3. Brittany Levine Beckman, "How performative became the most searing callout in 2020," *Mashable*, January 4, 2021.
4. Tony Simons, "The high cost of lost trust," *Harvard Business Review*, September 2002.
5. Colin Mayer, *Firm Commitment: Why the Corporation Is Failing Us and How to Restore Trust in It* (Oxford, England: Oxford University Press, 2013), pp. 117–56.

P20

Addressing the link between financial, physical, and emotional health

1. American Psychological Association, "Stress in America: Money, inflation, war pile on to nation stuck in COVID-19 survival mode," press release, March 2022.
2. Eva Selenko and Bernad Batinic, "Beyond debt: A moderator analysis of the relationship between perceived financial strain and mental health," *Social Science & Medicine* 73, no. 12 (2011): pp. 1725–32.
3. Board of Governors of the Federal Reserve System, "Report on the economic well-being of U.S. households in 2020 – May 2021," May 2021; Stella U. Ogunwole et al., "Population under age 18 declined last decade," US Census Bureau, August 12, 2021.
4. According to the 2017 FDIC National Survey of Unbanked and Underbanked Households, "underbanked" are defined as those who have a checking or savings account and used one of the following products or services from an alternative financial services provider: money orders, check cashing, international remittances, payday loans, refund anticipation loans, rent-to-own services, pawn shop loans, or auto title loans.
5. Pew Charitable Trusts, *Payday loan facts and the CFPB's impact*, May 2016.
6. Megan Leonhardt, "Payday loans can have interest rates over 600%—here's the typical rate in every U.S. state," *CNBC*, February 16, 2021.
7. Meghan Greene et al., *The FinHealth spend report 2021*, Financial Health Network, June 2021.
8. Union Bank, annual report 2021.
9. Tala, "Use Tala," accessed May 30, 2022.

P23

Climate change breeds climate anxiety

1. Lukoye Atwoli et al., "Call for emergency action to limit global temperature increases, restore biodiversity, and protect health," *Lancet* 398, no. 10,304 (2021): pp. 939–41.
2. Deloitte Global State of the Consumer Tracker, April 2022.
3. Leon Pieters et al., *Who is setting the pace for personal sustainability?*, Deloitte Insights, April 4, 2022.

P24

Making smartphones live longer—and greener

1. We have used a range of publicly available information to arrive at this prediction. For CO2e emissions per device and the split by production, use, transport, end-of-life processing, see Apple, *iPhone 12 product environmental report*, October 13, 2020; Huawei, "Product environmental information," accessed April 25, 2022; Google, *Pixel 5: Product environmental report*, accessed October 6, 2021. For 2022 smartphone shipments information, see International Data Corporation, "Smartphone shipments to grow 5.5% in 2021 driven by strong 5G push and pent-up demand, according to IDC," March 10, 2021.
2. The market for mobile phone insurance is forecast at US$29.5 billion globally in 2022, with a base value of US$23.3 billion in 2020, and a CAGR of 12.6%. Grand View Research, *Mobile phone insurance market size, share & trends analysis report by coverage, by phone type, by region, and segment forecasts, 2021–2028*, April 2021.

P25

Data-protection tech that helps AI fulfill its potential

1. This article and *Deloitte Insights Magazine* are independent publications and have not been authorized, sponsored, or otherwise approved by Apple Inc.
2. Centre for Data Ethics and Innovation, "PETs adoption guide: Repository of use cases," accessed May 16, 2022.
3. ReportLinker, "Federated learning solutions market research report by application, by vertical – Global forecast to 2025 – Cumulative impact of COVID-19," press release, May 14, 2021; MarketWatch, "Global homomorphic encryption market size forecast 2021–2027," August 2, 2021.

P26

Automation won't end the labor shortage

1. Alexander Börsch, Mark Bommer, and Julius Elting, *Die jobs der zukunft: Berufswelt bis 2035—fünf trends*, Deloitte, accessed May 20, 2022.
2. Ibid.
3. Ibid.

P28–31

The new supply chain equilibrium

1. Rebecca Elliott, "How Elon Musk's software focus helped Tesla navigate chip shortage," *Wall Street Journal*, December 30, 2021; Andrew J. Hawkins, "Tesla rewrote its own software to survive the chip shortage," *Verge*, July 26, 2021.

P32–34

Collaborative advantage: Activating the power of many

1. Ronald H. Coase, "The nature of the firm," *Economica* 4, no. 16 (1937): pp. 386–405.
2. Bloomberg, "More than 11.8 billion shots given: COVID-19 vaccine tracker," accessed May 27, 2022.
3. Daniel Kraemer, "Greta Thunberg: Who is the climate campaigner and what are her aims?," *BBC News*, November 5, 2021.
4. Leo Schwartz, "Amateur open-source researchers went viral unpacking the war in Ukraine," *Rest of World*, March 7, 2022.

P35–37

Why reporting workplace well-being metrics is a good idea

1. BusinessPundit, "How much do absenteeism and presenteeism cost your business?," July 10, 2020.
2. US Bureau of Labor Statistics, "Job openings and labor turnover survey news release," May 3, 2022.
3. Randstad, *Workmonitor 2022*, 2022.
4. Ryan Nelson, "Examining the state of worldwide mandatory ESG disclosures," Conservice ESG, November 16, 2021.
5. International WELL Building Institute website, accessed June 2, 2022.

P38–39

Employee health contributes to organizational health

1. Tim Sandle, "No rest: U.S. workforce is experiencing high pressure and burnout," *Digital Journal*, May 9, 2022; Tim Allen, "The pandemic is changing employee benefits," *Harvard Business Review*, April 7, 2021.
2. US Bureau of Labor Statistics, "Job openings and labor turnover summary," March 2022.
3. Deloitte, "Winter 2022 Fortune/Deloitte CEO Survey," accessed May 24, 2022.
4. Employee Benefit Research Institute and Greenwald Research, "2021 Workplace Wellness Survey," May 2, 2022.
5. Steve Hatfield, Jen Fisher, and Paul Silverglate, *The C-suite's role in well-being:*

How health-savvy executives can reimagine workplace wellness—for themselves and their people, Deloitte Insights, June 22, 2022.
6. Kimberly Lankford, "What to expect from your employer's health plan in 2021," *US News & World Report*, August 31, 2020.
7. David Villa, "How celebrating success can lead to more of it," *Forbes*, May 12, 2022.
8. Gene Marks, "Four ways small businesses can support child and dependent care for their workers," *Philadelphia Inquirer*, May 9, 2022.
9. Eva Selenko and Bernad Batinic, "Beyond debt: A moderator analysis of the relationship between perceived financial strain and mental health," *Social Science & Medicine* 73, no. 12 (2011): pp. 1,725–32.
10. Corlinda Wooden and Scott Bell, "The employee perk your business should be offering," *Portland Business Journal*, April 22, 2022.
11. Kelsey Griffis, "Are you taking the right foundational steps toward an inclusive workplace?," *Forbes*, April 18, 2022.
12. Kulleni Gebreyes et al., *Activating health equity: A moral imperative calling for business solutions*, Deloitte Insights, April 21, 2021.
13. Katie Kuehner-Hebert, "Employees who participate in wellness programs are healthier, at least," BenefitsPRO, May 21, 2018.
14. Gebreyes et al., *Activating health equity*.

P40–41

Smart cities, smarter public health

1. A. Betâmio De Almeida, *The 1755 Lisbon earthquake and the genesis of the risk management concept*, 2005.
2. UK Parliament, "The 1848 Public Health Act," accessed June 7, 2022.
3. Mary Schons, "The Chicago Fire of 1871 and the 'Great Rebuilding,'" *National Geographic*, May 20, 2022.
4. Miguel Eiras Antunes, Jean Gil Barroca, and Daniela Guerreiro de Oliveira, *Urban future with a purpose—12 trends shaping the future of cities by 2030*, Deloitte, 2021.
5. United Nations, "68% of the world population projected to live in urban areas by 2050, says UN," May 16, 2018.
6. The World Bank, "Urban development," April 20, 2020.
7. European Commission, "Discover the 100 cities selected for the Cities Mission," May 6, 2022.
8. António Guterres, "COVID-19 in an urban world," United Nations, accessed June 1, 2022.
9. Stephanie Allen, *2022 Global health care outlook: Are we finally seeing the long-promised transformation?*, Deloitte, 2021.
10. Ibid.
11. Ibid.
12. Organisation for Economic Co-operation and Development, *Cities policy responses*, July 23, 2020.
13. Jean Barroca and Mahesh Kelkar, *From "doing" digital to "being" digital: Transforming service delivery and operations in cities post the pandemic*, Deloitte, 2021.
14. Deloitte, *CitySynergy™ COVID War Room*, 2020.
15. Antunes, Barroca, and de Oliveira, *Urban future with a purpose*.
16. Ibid.
17. Ibid.
18. Allen, *2022 Global health care outlook*.

P42–43

Thinking about investing in the metaverse? Let history be your guide

1. Janet Foutty and Mike Bechtel, "What's all the buzz about the metaverse?," Deloitte, March 2022.
2. US Census Bureau, *Quarterly retail e-commerce sales: 4th quarter 2021*, February 18, 2022, pp. 1–3.
3. Denise Lee Yohn, "The pandemic is rewriting the rules of retail," *Harvard Business Review*, July 6, 2020.
4. Retail SEE Group, "Nike & H&M jumping into the metaverse," November 19, 2021.
5. David Kirsch and Brent Goldfarb, "Small ideas, big ideas, bad ideas, good ideas: 'Get big fast' and dot com venture creation," Robert H. Smith School Research Paper No. RHS-06-049, November 2006, pp. 22–23.
6. Matthew Kanterman and Nathan Naidu, "Metaverse may be $800 billion market, next tech platform," Bloomberg Professional Services, December 1, 2021.
7. Deloitte, "A whole new world? Exploring the metaverse and what it could mean for you," April 2022.

P44–46

The importance of sharing success—and stress—metrics

1. Michele Wucker, *The Gray Rhino: How to Recognize and Act on the Obvious Dangers We Ignore* (New York: St. Martin's Publishing Group, 2016).
2. Jo Mitchell-Marais et al., *2022 Deloitte Restructuring Survey*, Deloitte, April 2022.
3. Ibid.

P48–61

Incentives are key to breaking the cycle of cyberattacks on critical infrastructure

1. Jill Suttie, "Kids do better on the marshmallow test when they cooperate," *Greater Good Magazine*, February 24, 2020.
2. Cybersecurity & Infrastructure Security Agency, "National critical functions set," accessed May 12, 2022.
3. Juniper Research, "'Internet of Things' connected devices to triple by 2021, reaching over 46 billion units," press release, December 13, 2016.
4. Verizon, *2021 data breach investigations report*, accessed May 12, 2022.
5. Marshall D. Abrams and Joe Weiss, "Malicious control system cyber security attack case study: Maroochy Water Services, Australia," MITRE, August 2008.
6. Public-Private Analytic Exchange Program, *Commodification of cyber capabilities: A grand cyber arms bazaar*, accessed May 12, 2022.
7. For a description of how increasing tech balkanization encourages nation-state cyberattacks, see Jesse Goldhammer et al., *Leading the way with an adversary focus: Government's role in deterring cyberattacks*, Deloitte Insights, August 4, 2021. For more on how geopolitical tensions can drive cyberattacks, see CISA Insights, "Increased geopolitical tensions and threats," January 6, 2020.
8. HP Threat Research Blog, "Nation states, cyberconflict and the web of profit," April 8, 2021.
9. Rishi Iyengar and Clare Duffy, "Hackers have a devastating new target," *CNN*, June 4, 2021.
10. Stephanie Jones, "Protecting the United States' critical infrastructure from cyberattacks," *Texas A&M Today*, November 2, 2021.
11. *CBS News*, "National cyber director Chris Inglis on deterring cyber threats – 'Intelligence Matters' podcast," November 24, 2021.
12. Ross Anderson, "Why information security is hard—an economic perspective," University of Cambridge, accessed May 12, 2022.
13. Bruce Schneier, "Security economics of the Internet of Things," Schneier.com, October 10, 2016.
14. *CBS News*, "National cyber director Chris Inglis on deterring cyber threats."
15. Our categorization of incentives comes from Stephen Levitt and Stephen Dubner's book *Freakonomics*, in which they categorize "three basic flavors of incentive: economic, social, and moral." Our categorization of the levers that can shape those incentives is a combination of Lawrence Lessig's norms, markets, laws, and architecture, and Bruce Schneier's moral, reputational, institutional, and security.
16. Catalin Cimpanu, "Netherlands can use intelligence or armed forces to respond to ransomware attacks," Record, October 7, 2021; Sean Gallagher, "Candid camera: Dutch hacked Russians hacking DNC, including security cameras," ARS Technica, January 26, 2018.
17. Tonya Riley, "FTC warns of potential penalties for firms that fail to fix Log4j software flaws," *CyberScoop*, January 4, 2022.
18. US Government Accountability Office, *Insurers and policyholders face challenges in an evolving market*, accessed May 12, 2022.
19. Institute for Security and Technology, *Combating ransomware*, accessed May 12, 2022.
20. Andy Greenberg, "Cops disrupt Emotet, the internet's 'most dangerous malware,'" *Wired*, January 27, 2021.
21. Ibid.
22. Lance Whitney, "Emotet malware taken down by global law enforcement effort," *TechRepublic*, January 27, 2021.
23. The inherent tension between wanting more/better services and where funding for those services should come from can be seen in research by the Pew Research Center. Pew Research Center, "Little public support for reductions in federal spending," April 11, 2019; Pew Research Center, "In a politically polarized era, sharp divides in both partisan coalitions," December 17, 2019.
24. David E. Sanger and Nicole Perlroth, "Pipeline attack yields urgent lessons about U.S. cybersecurity," *New York Times*, May 14, 2021.
25. Energy Commerce, "Countering ransomware in critical infrastructure," July 20, 2021.

26. Examples of such exercises and tools include those from the E-ISAC (Maggie Miller, "Hundreds participate in electric grid cyberattack simulation amid increasing threats," *Hill*, November 18, 2021) and FS-ISAC (FS-ISAC, "Exercises: Build stronger plans and a more resilient business," accessed May 12, 2022).
27. Catalin Cimpanu, "Microsoft: Using multi-factor authentication blocks 99.9% of account hacks," *ZDNet*, August 26, 2019.
28. US House Committee on Oversight and Reform and the House Committee on Homeland Security, "Prepared statement of Kevin Mandia, CEO of FireEye, Inc.," February 26, 2021.

P62–69

Investing in creative potential

1. An ecological approach is one that is focused on the relationship between the individual and the systems in which they act, a relationship that is seen as interdependent. Ecological psychology is an embodied, situated, and nonrepresentational approach pioneered by J. J. Gibson and E. J. Gibson.
2. The Four P's framework—where creativity is framed as an emergent property of *person*, *process*, *place* (press in the original), and *product*—was first discussed in M. Rhodes, "An analysis of creativity," *The Phi Delta Kappan* 42, no. 7 (1961): pp. 305–10.
3. Rhodes's original article calls this setting "press" rather than "place," the idea being that there are *pressures* (or *influences*) on our behaviors. While it's true that the social and physical context we find ourselves in influences our creative behavior, it is also true that some of these influences are not necessarily environmental. Consequently, it is common for press to be replaced by place, as we have throughout this essay, as place is a more intuitive term; ibid.
4. A useful, and short, definition for innovation is "the economic exploitation of creativity."
5. Vlad Petre Glăveanu, "Rewriting the language of creativity: The five A's framework," *Review of General Psychology* 17, no. 1 (2013): pp. 69–81.
6. Mark A. Runco, "A hierarchical framework for the study of creativity," *New Horizons in Education* 55, no. 3 (2007): pp. 1–9.
7. Problem-posing is a technique where an issue is framed and reframed to try and identify and define the core challenge. It is commonly used in both education pedagogy and design.
8. It's for this reason that the 1978 *Superman* film has a long section at the start showing the challenges Clark Kent faces when trying to fit into society while having superpowers.
9. Lu Hong and Scott E. Page, "Groups of diverse problem solvers can outperform groups of high-ability problem solvers," Proceedings of the National Academy of Sciences 101, no. 46 (2004): pp. 16,385–89.
10. What we have referred to as "cognitive diversity" is often called "functional diversity" in the literature; ibid.
11. Thanks to Peter Williams—a charted accountant—for the analogy.
12. Traditionally, this has been approached through office-space design, from inspirational decor to collaborative tools such as stages, small auditoriums, and floor-to-ceiling whiteboards. But increasingly, place can be just as much virtual as physical as organizations invent new ways to collaborate digitally, perhaps even in the imagined metaverse of coming years.
13. The first report in this series, *Unshackling the creative business*, discussed how creativity in business is contingent, in that the creativity of one team depends on the creativity of others; see Peter Evans-Greenwood et al., *Unshackling the creative business: Breaking the tradeoff between creativity and efficiency*, Deloitte Insights, April 9, 2021.
14. Joel Backaler and China Tracker, "Haier: A Chinese company that innovates," *Forbes*, June 17, 2010.
15. The authors developed on "investment opportunity" in the previous essay in the series *Setting the stage for creative performance*. The intention with "investment opportunity" is to put creativity on an equal footing with efficiency in an organization's operating model by creating a metric for creativity to balance cost-benefit; see Peter Evans-Greenwood et al., *Setting the stage for creative performance: Improving creativity in business by measuring creativity*, Deloitte Insights, October 29, 2021.
16. Several rubrics have been developed to measure realized creativity, the creativity of some work product. Typically, this is done by consulting some suitable set of domain experts to determine how novel and useful they consider the work to be. These subjective metrics are typically called *consensual assessment*. For examples, see T. M. Amabile, "The social psychology of creativity: A consensual assessment technique," *Journal of Personality and Social Psychology* 43, no. 5 (1982): pp. 997–1,013; D. H. Cropley, "The creative solution diagnosis scale (CSDS)," *Creativity in Engineering: Novel Solutions to Complex Problems* (Cambridge, MA: Academic Press, 2015), pp. 78–85; Susan P. Besemer and Karen O'Quin, "Confirming the three-factor creative product analysis matrix model in an American sample," *Creativity Research Journal* 12, no. 4 (1999): pp. 287–96.
17. C. M. Ford, "A theory of individual creative action in multiple social domains," *Academy of Management Review* 21, no. 4 (1996): pp. 1,112–42.
18. Sarah Sharples, "Sydney furniture company IsoKing made $3.6 million after COVID-19 launch," News.com.au, May 7, 2021; Vanessa Croll, "Stage builders transform business with aim to help more Aussies," News.com.au, October 16, 2020.
19. Backaler and China Tracker, "Haier: A Chinese company that innovates."
20. We might compare this to the Four-C Developmental Trajectory for creativity, which breaks the development of creativity into a journey from Mini-C (personal creativity) through Little-C (everyday creativity) and Pro-C (professional creativity) to Big-C (legendary creativity). See Ronald A. Beghetto, James C. Kaufman, and John Baer, *Teaching for Creativity in the Common Core Classroom* (New York: Teachers College, Columbia University, 2014), pp. 21 and 27.
21. Such as a pandemic. Indeed, this series was triggered by the observation (toward the end of the first year of the pandemic) that many otherwise "creative" organizations struggled to respond creatively, while some organizations not particularly known for their creativity provided creative and innovative responses.

P70–83

Renewable transition: Separating perception from reality

1. US Energy Information Administration (EIA), "FAQs: What is U.S. electricity generation by energy source?," accessed June 7, 2022.
2. Deloitte analysis of data from Table 1.1. from EIA, "Electric power monthly," accessed May 10, 2022.
3. Solar Energy Industries Association, "Solar industry research data," accessed August 19, 2021.
4. Energy.gov, "US installed and potential wind power capacity and generation," accessed May 10, 2022.
5. EIA, "Short-term energy outlook data browser," May 10, 2022.
6. The White House, "Fact sheet: President Biden sets 2030 greenhouse gas pollution reduction target aimed at creating good-paying union jobs and securing U.S. leadership on clean energy technologies," press release, April 22, 2021.
7. For global cost decline, see International Renewable Energy Agency (IRENA), *Renewable power generation costs in 2020*, June 2021, p. 3; for US cost decline, see Mark Bolinger, *Utility-scale wind and solar in the US: Comparative trends in deployment, cost, performance, pricing, and market value*, Electricity Markets and Policy Department at Lawrence Berkeley National Laboratory, December 8, 2020, p. 21.
8. Digitalization refers to applying information and communications technology to the electric grid. This may involve connecting smart meters, sensors, and other devices to monitor grid activity, analyzing the data collected, applying AI, and using software to manage, control, and automate operations.
9. IRENA, *Renewable power generation costs in 2020*, p. 11.
10. Emma Penrod, "Solar-plus-storage poised to become more financially attractive, but seasonal solutions remain key," *Utility Dive*, December 1, 2020.
11. IRENA, *Renewable power generation costs in 2020*, p. 18.
12. EIA, "Wholesale electricity and natural gas market data," May 5, 2022.
13. IRENA, *Renewable power generation costs in 2020*, p. 18.
14. Deloitte analysis of data from S&P Global Market Intelligence.
15. Michael Taylor, "Analysis shows wind and solar costs will continue to fall dramatically throughout the 2020s," *Energy Post*, November 6, 2020.
16. Electric power systems in regions with high wind-power contributions have operated reliably without added storage and with

little or no increase in generation reserves (see American Clean Power Association, *AWEA US wind industry annual market report, year ending 2013*, 2013). MISO has been able to integrate huge amounts of wind without adding power plants to back up its renewable energy production, partly because MISO is a large balancing area with many different energy resources available (see Glen Anderson, "Integrating renewable energy," National Conference of State Legislatures, June 20, 2016). The IEA could not be any clearer: No additional dispatchable capacity ever needs to be built because VRE is in the system. On the contrary, to the extent of the capacity credit of VRE, its addition to the system reduces the need for other capacity (see American Clean Power Association, "News roundup: A carbon-free Iowa energy boom, renewable integration is easy, wind and solar work together," March 5, 2014).

17. Variable renewable energy (VRE) refers to utility-scale wind and solar resources as well as distributed solar PV. Distributed wind is also a VRE, but volumes are low, and data was not available for this analysis.
18. EIA, "Detailed state data," July 30, 2021; EIA, "Small-scale PV estimate," July 9, 2021.
19. Ibid.
20. Electrification scenario data from NREL, *The North American renewable integration study: A US perspective*, accessed May 10, 2022.
21. Deloitte, *Managing variable and distributed energy resources: A new era for the grid*, accessed May 10, 2022.
22. IRENA, *Innovation landscape for a renewable-powered future*, February 2019.
23. Nord Pool website, accessed May 10, 2022.
24. Silvio Marcacci, "Denmark may hold the key to integrating large amounts of intermittent renewables," *Greentech Media*, July 27, 2016.
25. Asma Aziz et al., "Issues and mitigations of wind energy penetrated network: Australian network case study," *Journal of Modern Power Systems and Clean Energy* 6 (2018): pp. 1141–57.
26. Eric Martinot, "How is Denmark integrating and balancing renewable energy today?," Martinot.info, January 2015.
27. Midcontinent Independent System Operator (MISO), "Corporate fact sheet," accessed May 10, 2022.
28. Iulia Gheorghiu, "Independent developer proposes $2.5B underground transmission line, to bring Iowa wind to PJM, MISO," *Utility Dive*, March 13, 2019.
29. Iowa Environmental Council, "Iowa wind energy fact sheet," March 2021.
30. MISO, "Corporate fact sheet."
31. Iowa Environmental Council, "Iowa wind energy fact sheet."
32. Ibid.
33. Deloitte analysis based on data from MISO, "MISO interactive queue," accessed May 10, 2022.
34. Ideal Energy, "Renewable hydrogen," accessed May 10, 2022.
35. California ISO, *Root cause analysis: Mid-August 2020 extreme heat wave*, January 13, 2021. While some have attributed California's electricity supply shortages to VRE, the causes appear more related to demand surges from unprecedented multistate heat waves coinciding with wildfires that constrained transmission and triggered systemwide failures (for more details, see Ken Silverstein, "Green energy is not among the culprits behind California's energy crisis," *Forbes*, September 8, 2020). Nevertheless, California's plans to prevent future shortages include accounting for the state's changing generation mix.
36. Ca.gov, "Distributed energy resources," accessed May 10, 2022.
37. Edith Hancock, "California amends grid mapping process to make it easier to site distributed energy resources," *Energy Storage News*, February 4, 2021.
38. Western Energy Imbalance Market, "Home page," accessed May 10, 2022.
39. Morgan Lewis, *Energy storage procurement tracker*, June 2021.
40. BloombergNEF, "Battery pack prices cited below $100/kWh for the first time in 2020, while market average sits at $137/kWh," December 16, 2020.
41. Jeff St. John, "Biden admin aims to make the US a world leader in lithium-ion batteries," *Canary Media*, June 9, 2021.
42. Bob Davis, "Biden to deter forced labor with ban on China's solar-panel materials," *Wall Street Journal*, June 24, 2021.
43. Daniel Moore, "Biden links his climate, trade goals in comment on making wind turbine blades in Pittsburgh," *Pittsburgh Post-Gazette*, April 29, 2021.
44. Lawrence Berkeley National Laboratory, *Wind energy technology data update: 2020 edition*, August 2020, p. 30.
45. Wood Mackenzie, *Global wind turbine supply chain trends 2020*, accessed May 10, 2022.
46. Mike Short and James Mancini, "Overcoming the 5 supply chain barriers that threaten the growth of renewable energy," C.H. Robinson Blog, June 28, 2021.
47. International Energy Agency (IEA), "Clean energy demand for critical minerals set to soar as the world pursues net zero goals," press release, May 5, 2021.
48. Ibid.
49. Ibid.
50. IEA, *The role of critical minerals in clean energy transitions*, May 2021.
51. Adriaan Davidse and Jacek Guzek, *Trend 10: Meeting demand for green and critical minerals*, Deloitte Insights, February 1, 2021.
52. Claudiu C. Pavel et al., "Substitution strategies for reducing the use of rare earths in wind turbines," *Resources Policy* 52 (2017): pp. 349–57.
53. Sissi Cao, "Panasonic, GM show off cutting edge electric vehicle batteries, cobalt-free," *Observer*, January 15, 2021.
54. The White House, "Fact sheet: Biden-Harris administration announces Supply Chain Disruptions Task Force to address short-term supply chain discontinuities," press release, June 8, 2021.
55. Miranda Willson, "Biden's 'Buy America' plan may hit a solar wall," *Politico Pro*, March 1, 2021.
56. Melissa R. Allen-Dumas, Binita KC, and Colin Cunliff, *Extreme weather and climate vulnerabilities of the electric grid: A summary of environmental sensitivity quantification methods*, Oak Ridge National Laboratory, August 16, 2019.
57. National Oceanic and Atmospheric Administration, *Billion-dollar weather and climate disasters*, accessed May 10, 2022.
58. Aaron Larson, "Prepare your coal plant for cold weather operations," *Power*, October 1, 2014.
59. Sunrun, "Do solar panels work in cold weather?," November 29, 2021.
60. Collin Eaton, James Rundle, and David Uberti, "U.S. pipeline shutdown exposes cyber threat to energy sector," *Wall Street Journal*, May 9, 2021.
61. Alexandra Van Dine, Michael Assante, and Page Stoutland, *Outpacing cyber threats*, Nuclear Threat Initiative, January 1, 2016.
62. Andy Greenberg, "Researchers found they could hack entire wind farms," *Wired*, June 28, 2017.
63. The White House, "Executive order on improving the nation's cybersecurity," May 12, 2021.
64. US Department of Energy (DOE), *Roadmap for wind cybersecurity*, accessed May 10, 2022.
65. Anmar Frangoul, "Renewable electricity generation is growing—but it's not enough to meet rising demand, IEA says," *CNBC*, July 15, 2021.
66. Frost & Sullivan, "Global digital grid (sensors, meters, and communications) growth opportunities," August 20, 2021, pp. 50–51.
67. Brad Plumer, "A glimpse of America's future: Climate change means trouble for power grids," *New York Times*, February 16, 2021.
68. Edison Electric Institute, "The clean energy transformation: Electric companies are leading the way," accessed May 10, 2022.
69. Stanley Porter et al., *Utility decarbonization strategies: Renew, reshape, and refuel to zero*, Deloitte Insights, September 21, 2020.
70. Deloitte analysis of data from S&P Global Market Intelligence.
71. Joseph Rand et al., *Queued up: Characteristics of power plants seeking transmission interconnection as of the end of 2020*, Lawrence Berkeley National Laboratory, May 2021, p. 3.
72. EIA, "Form EIA-860 detailed data with previous form data (EIA-860A/860B)," accessed May 10, 2022.
73. Galen Barbose, *U.S. renewables portfolio standards*, Lawrence Berkeley National Laboratory, February 2021, p. 16.
74. DOE, "DOE announces $52.5 million to accelerate progress in clean hydrogen," July 7, 2021; Julian Spector, "Newsletter: DOE goes long on long-duration storage," *Canary Media*, July 15, 2021; United States Senate, 117th Congress, 1st session, H.R.3684, "Infrastructure Investment and Jobs Act, Division D – Energy: Title III—Fuels and Technology Infrastructure Investments," accessed May 10, 2022.

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The end note: The shifting balance between health, safety, and financial concerns

1. Deloitte, "Global State of the Consumer Tracker," accessed May 26, 2022.
2. Ibid.
3. Ibid.

The shifting balance between health, safety, and financial concerns

Some research and insights have a short shelf life, while others continue to gain color and context. In each issue of Deloitte Insights Magazine*, we look back on research we published and ideas we pitched, and evaluate whether they've stood the test of time.*

By **Stephen Rogers**
Managing director of Deloitte's Consumer Industry Center

What we said then

"In the span of a few months, what started as a global health crisis morphed into an economic one as well. It's been more than a century since the world has seen these two forces so intertwined. We do not expect to see a return to normal, or even a new normal, until total concern descends from its elevated level and financial concerns overtake those of immediate health and safety."

In the throes of a dual-front crisis: Establishing the road to a global consumer recovery, Deloitte Insights, April 2020.

What we say now

We're still in a dual-front crisis, according to the Deloitte Global State of the Consumer Tracker. However, after lagging behind for the better part of two years, financial stress is now overpowering health and safety concerns as the primary determinant of consumers' decision-making by quite a strong margin.

Following omicron, global pandemic anxiety subsided dramatically among the 23,000 respondents across 23 countries who participated in our monthly consumer survey. Consumers' perceived safety of doing everyday things like going to the store quickly reached two-year highs, and it continues to improve with each passing month.[1]

At the same time, record inflation continued unabated, exacerbated by geopolitical conflict. And with government stimulus programs no longer around to help consumers make ends meet, financial sentiment metrics have begun flashing warning signals. Globally, financial anxiety is high—as is concern around inflation, and consumers' level of savings and credit card debt.[2] In some countries, including the United States, China, and England, discretionary spending intentions are weakening.[3]

In many ways, consumer businesses face similar challenges compared to early pandemic days. They still need the agility to respond to rapidly changing consumer behavior. And few can predict the extent of the financial headwinds that lie ahead.

Even as the pandemic gradually fades, many companies are finding that prepandemic financial and forecasting models no longer work. The "new normal" remains elusive.