Are you reframing your future or is the future reframing you?

Understanding megatrends will help you see opportunities where others don't.

Megatrends 2020 and beyond | EYQ 3rd edition | ey.com/megatrends

The better the question.
The better the answer.
The better the world works.

EY
Building a better
working world

Foreword

The world changed in March 2020. Almost overnight, the COVID-19 pandemic strained health care systems to the breaking point, put much of the global economy on an indefinite hiatus and radically reshaped societal norms and interactions. For businesses everywhere, these events are undermining established assumptions while catalyzing new models and approaches.

The crisis has accelerated transformation. One way of thinking of this is using the S-curve pattern of growth – in which a paradigm or technology is adopted gradually at first, then rapidly, before slowing again in the end stage as the model matures and delivers diminishing returns. COVID-19 has thrust the entire global economy onto a new S-curve. The global system has been on the current curve, driven by a prolonged wave of globalization and information technology adoption, for decades. To succeed on this curve meant driving a company toward global market leadership and creating value based on ever-larger scope, scale and efficiency. This created sustainable and defensible competitive advantages for decades. But lately, the curve has been waning, as a global economy built on unfettered "take, make, waste" has delivered increasingly unsustainable societal, environmental and business outcomes.

The next S-curve has been visible for a while now. It doesn't yet have a name, but it is essentially the future we describe in our megatrends reports. In this future, social contracts will be rewritten to be more inclusive and sustainable, compelling businesses to take a more proactive role in creating long term value. The global system will be reshaped by everything from shifting power dynami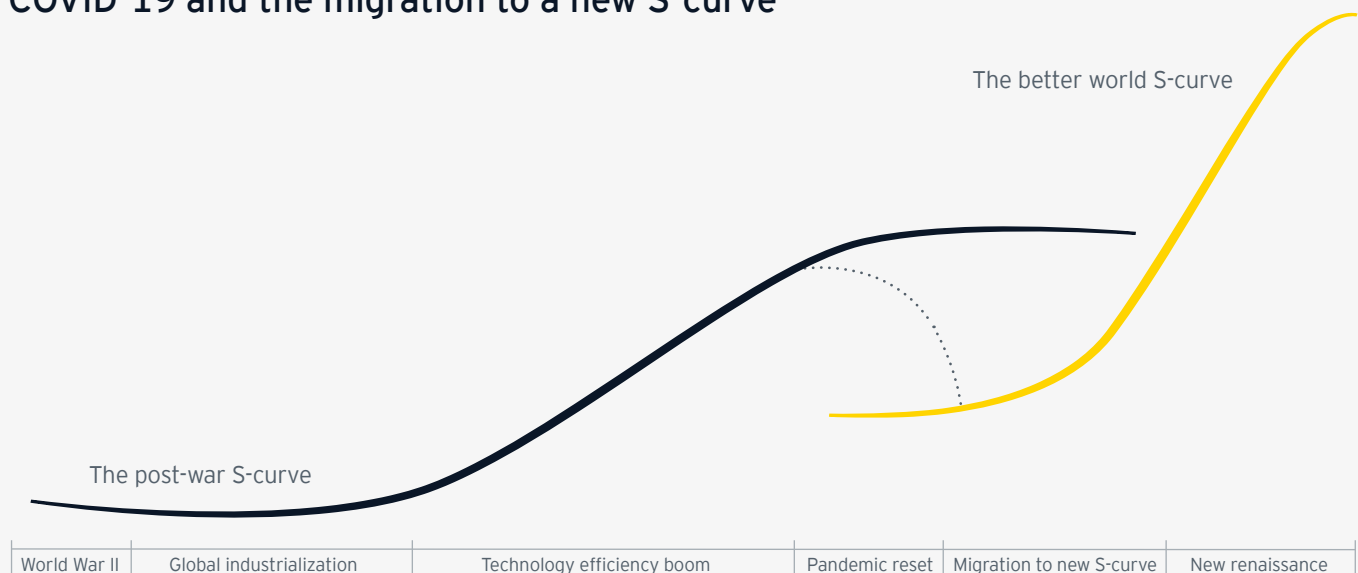cs to 3D printing. Human augmentation technologies, such as artificial intelligence (AI) and the Internet of Things, will transform every human domain, from consumer behavior to the nature of work.

So far, these have been long term trends over a distant horizon. In one fell swoop, the COVID-19 pandemic changed that. It has moved us, almost overnight, into a new renaissance, a global reset. In an instant, many of us have been compelled to adopt remote work, virtual learning and online shopping. These changes are often proving to be more effective and sustainable, and they will likely be sustained in the long term.

The pandemic has also brought the fault lines of economic inequality into sharp relief, highlighting that we are all made more vulnerable by weaknesses in our social safety nets. This could catalyze trends we have been discussing for some time – populism, renewed social contracts, long term value and new economic metrics – and accelerate the move to the next S-curve.

These developments make a megatrends-based approach more relevant than ever. For one, the rapid technology adoption and other changes catalyzed by the crisis have suddenly made the megatrends – from future of work to health reimagined to "superconsumers" – more near-term. CEOs and boards need to focus on them now to remain competitive.

COVID-19 and the migration to a new S-curve

The better world S-curve

The post-war S-curve

| World War II | Global industrialization | Technology efficiency boom | Pandemic reset | Migration to new S-curve | New renaissance |

The crisis has also brought home a central tenet of our megatrends approach: that disruption does not come from technologies and business models alone. It can equally be unleashed by national elections, climate disruption or, in this case, a pandemic. More than ever, your strategy needs to look far beyond your traditional sector and legacy competitors to identify potential threats and opportunities. The megatrends are designed to enable precisely such an approach.

This is not entirely uncharted territory. In recent years, some companies have become market value leaders by operating by the rules of the new S-curve. These companies have been labeled as disruptors or "unicorns" – labels that make them sound rare, almost mythical. In the world beyond the pandemic, they will be anything but. Every company will need to revamp its strategy and approach to operate by the rules of the new S-curve.

A key part of your approach in this new environment should be future-back planning, as explained in the first chapter of this report. The megatrends are a valuable basis to generate new planning scenarios, define a relevant purpose for the future and execute with urgency – all with the goal of becoming a more resilient and transformative company.

The megatrends discussed in this report existed prior to the pandemic and will continue to move forward in its aftermath. While COVID-19 has upended much of the world, the basic framework of the megatrends – the forces driving them and the future working worlds they enable – remain as relevant as ever.

How will you thrive in this new environment – in which humans are at the center, technologies are leveraged with greater speed, and innovation scales quickly? The global EY organization stands ready to help you.

Jay Nibbe
EY Global Vice Chair – Markets

CONTENTS

USING MEGATRENDS TO SHAPE YOUR STRATEGY

Imagine rebuilding a Formula One car not in pit lane, but as you hurtle around the track. That's the challenge business leaders face in this moment of disruption. The recent global pandemic and its fallout on businesses has been the greatest global disruption in modern history. It is permanently changing the future of society, work, geopolitics and businesses. If conducting future-back planning based on megatrends and scenarios was important before, it is now critical. This way of thinking and resetting for the future will determine which companies exit the pandemic cycle in a renaissance and which will become irrelevant.

Leadership teams have always found it hard to plan using megatrends and scenarios despite the best intentions. Why? Because future disruption raises challenges and questions with no easy answers:

▸ First, disruption comes from far afield. It can emerge from uncontrollable wildfires, geopolitical power shifts or a global pandemic that shuts down society and commerce. Some companies, labeled "disruptors," start to build businesses that will thrive within the disruptive scenarios and operate on a different set of value drivers. Yet, incumbent market leaders often find it hard to even imagine the potential impact of scenarios that may disrupt an entire industry, customer needs or company relevance. **How do you make sure you don't miss the next disruptive shift? How do you identify the uncertainties or trends you're afraid to confront?**

▸ Second, disrupting yourself requires placing long term bets on untested approaches and models. At the same time, disruption reshapes the competitive landscape, creating tremendous uncertainty about the assumptions and projections underlying those long term bets. Balancing these two forces is not impossible – it just needs the right innovation approach **How do you optimally invest scarce resources in a multi-horizon portfolio, given this uncertainty? How do you identify which models and approach will succeed?**

▸ Third, disruption requires you to make investments that might ensure your relevance and survival in the long term, but could hurt financial performance in the short run – the fundamental tension underpinning the innovator's dilemma. **How do you invest for long term disruption while continuing to win in the short run? How do you solve the now, explore the next and imagine the beyond?**

These challenges are thorny, but not insurmountable if you take a structured and deliberate approach. We have found that a future-back strategy development process works best: using megatrends as a key analytical tool to envision where you'll be in the future, then working backward to craft strategies for today. This method flips the script on the standard approach to developing projections, plans and strategy, which uses the current state as the starting point. It is particularly suited to disruption, which creates entirely new markets and ecosystems that make extrapolations based on historical trends meaningless. Future-back thinking also broadens the perspective of executives, helping to confront the reality of potential futures where the company could become irrelevant or the industry itself totally redefined.

Megatrends and future-back strategy

A major strategic risk companies face is developing plans that assume today's industry structure, competitors and profit pools will persist through the 5-to-10-year planning horizon. Our megatrends help challenge these assumptions. They expose teams to trends and forces far outside their usual scope of analysis, reducing the risk of "missing the next big thing."

Here's how we recommend using this report:

Start by using the megatrends to envision multiple future scenarios, unencumbered by the past and unconstrained by the present. Customize the list of megatrends based on factors such as your sector and channel mix. Our framework generates a potentially countless collection of megatrends, since the evolution of primary forces continuously creates new ones. This helps you to identify other megatrends based on the primary forces. Design thinking and design-based innovation are critical to blend creativity and analysis in this process. Environments built on these principles, such as EY wavespace™ facilities, allow executives to experience the art of the possible in an immersive way.

With your future scenarios as a starting point, create a multi-horizon strategic map that bridges from the future back to today. The map targets a clear purpose and vision of the future with a portfolio of initiatives that provide immediate impact – as well as the optionality to test and move into emerging or future markets over time. You'll also want to assess whether you have the capabilities needed for future business models. This starts by examining the core business model and business practices, and expanding to your external ecosystem of partners and other stakeholders. This can include analysis to determine which options to prioritize, inform investment decisions and align transformation efforts.

What about the tension between long term investments and short term earnings pressure? To address this, develop a two-speed model, looking to create immediate value even as you identify and prioritize initiatives that lay the foundation for longer-term strategies.

In a rapidly changing world, developing strategic options is not a one-off process. It should be part of an iterative journey of continual monitoring, experimentation, evaluation, execution and learning. Here again, the EY Megatrends framework can help. It distinguishes between different types of forces, allowing you to prioritize those that are relatively near-term, while monitoring others that are further out (such as weak forces). This enables you to invest resources more efficiently, while keeping a watchful eye on trends that might require investment at a future date.

The EY Megatrends framework

The EY Megatrends framework identifies four types of forces:

Primary forces

- Primary forces are the root causes of disruption: **technology, globalization, demographics and environment.**

- These forces aren't new. But they evolve in waves; each new wave is disruptive in different ways. For instance, we have seen several waves of technology in recent years, including personal computers, mobile, social and Internet of Things.

- In this report, we highlight four examples of the latest waves occurring in the primary forces:
  - **Powering human augmentation** (technology)
  - **Beyond globalization** (globalization)
  - **Gen Z rising** (demographics)
  - **Exponential climate impacts** (environment)

Megatrends

- The interaction between the waves of primary forces creates new megatrends.

- Our list of megatrends is not exhaustive. Disruption continually spawns new ones at an ever-faster rate as the primary forces evolve. Consequently, the megatrends in our previous reports are still valid.
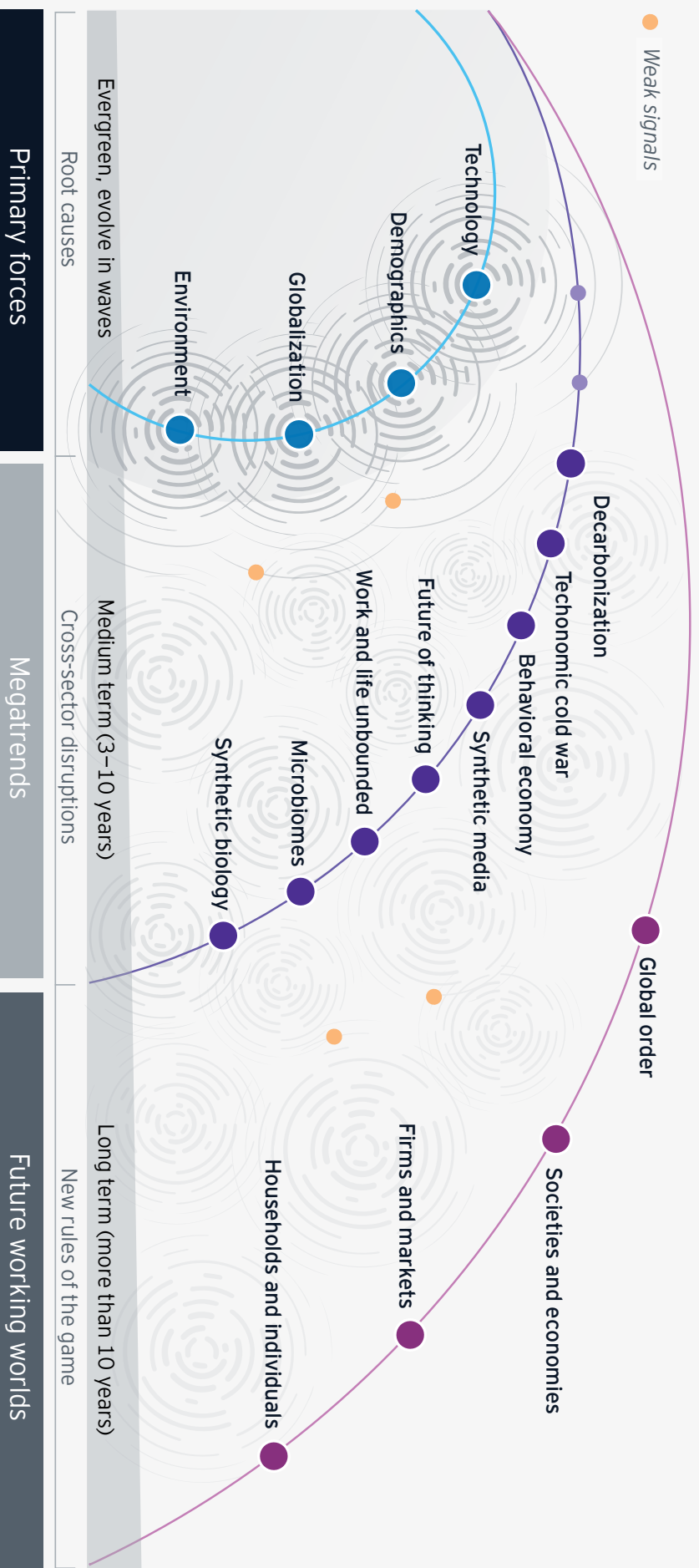
Future working worlds

- In the longer term, the combined effect of megatrends reshapes the political and economic landscape.

- The future working worlds describe the new rules that will govern various systems:
  - **The global order** (in this report, we examine the implications of the rise of Africa)
  - **Societies and economies** (topics such as the need for new economic metrics and a new social fabric)
  - **Firms and markets** (topics such as superfluid markets, discussed in *Megatrends 2018*)
  - **Households and individuals** (topics such as our exploration of behavioral economics in multiple *Megatrends* reports)

Weak signals

- Weak signals are waves of primary forces whose biggest impact is further in the future (e.g., quantum computing, passenger drones).

- Their likelihood and the scale and nature of their impact are more uncertain.

The upside of disruption

A framework for understanding where disruption comes from, where it's headed and what it means for you

- Weak signals

Primary forces
- Evergreen, evolve in waves
- Root causes

- Technology
- Demographics
- Environment
- Globalization

Megatrends
- Medium term (3–10 years)
- Cross-sector disruptions

- Decarbonization
- Techonomic cold war
- Behavioral economy
- Future of thinking
- Synthetic media
- Work and life unbounded
- Microbiomes
- Synthetic biology

Future working worlds
- Long term (more than 10 years)
- New rules of the game

- Global order
- Societies and economies
- Firms and markets
- Households and individuals

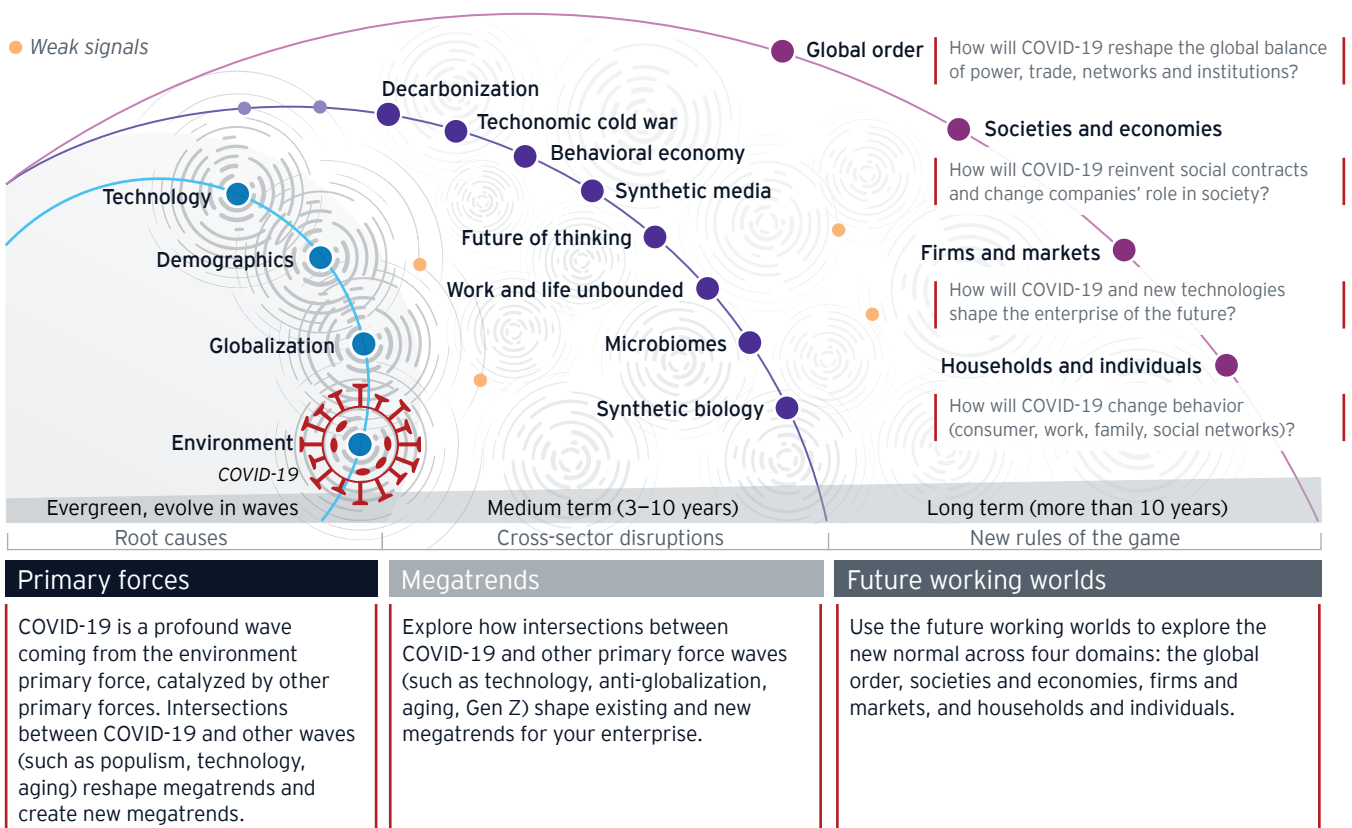# Using the EY Megatrends framework to understand COVID-19

The EY Megatrends framework provides a robust basis for understanding and responding to COVID-19. In our framework, the pandemic has emerged mainly from a highly disruptive wave of the environment primary force, boosted by the other primary forces (e.g., globalization and air travel have facilitated its spread across borders). With this starting point, the framework allows you to identify and explore the megatrends most likely to affect your business.

To understand how COVID-19 is shaping existing megatrends and spawning new ones, look at the intersections between the COVID-19 wave and waves emerging from the other primary forces. How are the pandemic's impacts on global supply chains, trade and migration affecting the backlash against **globalization**? How will COVID-19 affect young **generations** coming of age under the pandemic and how will this cohort reshape work, consumption habits and more in decades to follow?

How is the pandemic catalyzing and transforming the next generation of **technologies** and how will this affect the future of work, learning, health care and more? Consider questions such as these to identify the megatrends most relevant to your business in the age of COVID-19.
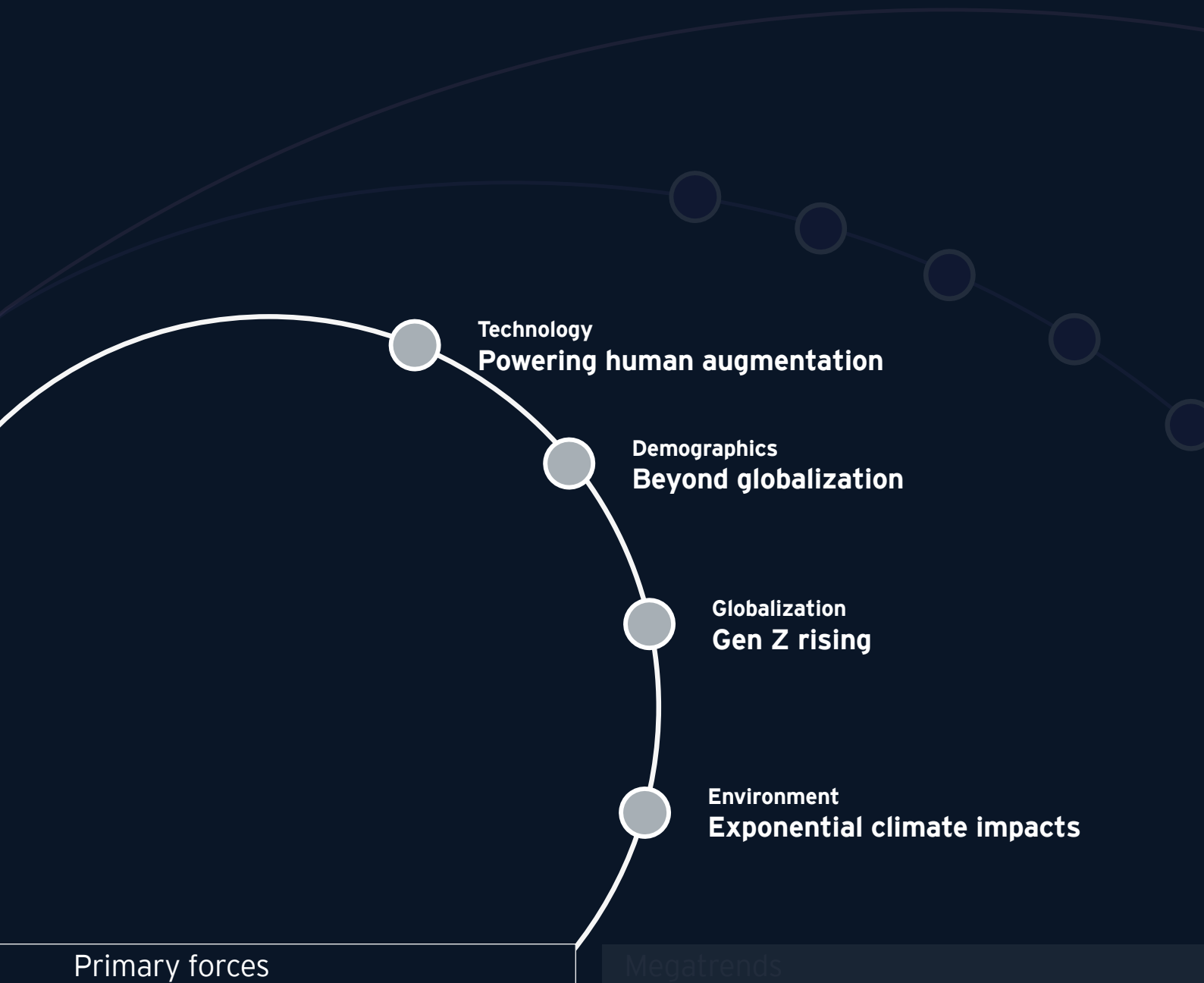
The framework also provides a good structure with which to explore the world beyond COVID-19. The four future working worlds are the domains that will be fundamentally reshaped by the pandemic. How will new rules, norms, institutions and networks realign the **global system**? How will **societies and economies** be reinvented by changing social contracts, and how will companies' role in society change? How will **companies and markets** be fundamentally altered by the crisis? How will the behaviors of **individuals and households** change?
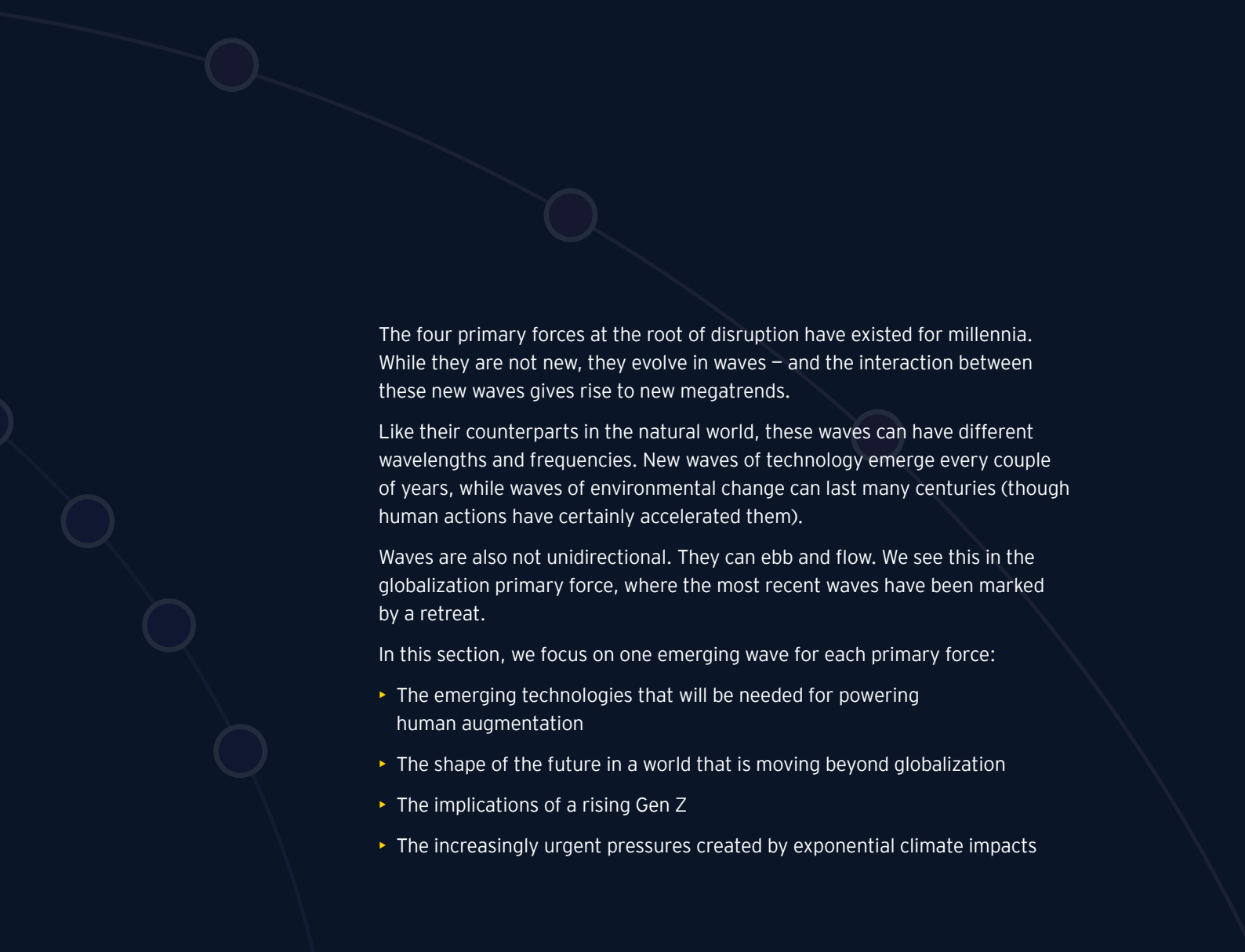
Using the EY Megatrends framework to chart your COVID-19 strategy

Primary forces	Megatrends	Future working worlds
COVID-19 is a profound wave coming from the environment primary force, catalyzed by other primary forces. Intersections between COVID-19 and other waves (such as populism, technology, aging) reshape megatrends and create new megatrends.	Explore how intersections between COVID-19 and other primary force waves (such as technology, anti-globalization, aging, Gen Z) shape existing and new megatrends for your enterprise.	Use the future working worlds to explore the new normal across four domains: the global order, societies and economies, firms and markets, and households and individuals.

PRIMARY FORCES

Technology
Powering human augmentation

Demographics
Beyond globalization

Globalization
Gen Z rising

Environment
Exponential climate impacts

Primary forces

The four primary forces at the root of disruption have existed for millennia. While they are not new, they evolve in waves – and the interaction between these new waves gives rise to new megatrends.

Like their counterparts in the natural world, these waves can have different wavelengths and frequencies. New waves of technology emerge every couple of years, while waves of environmental change can last many centuries (though human actions have certainly accelerated them).

Waves are also not unidirectional. They can ebb and flow. We see this in the globalization primary force, where the most recent waves have been marked by a retreat.

In this section, we focus on one emerging wave for each primary force:

▸ The emerging technologies that will be needed for powering human augmentation

▸ The shape of the future in a world that is moving beyond globalization

▸ The implications of a rising Gen Z

▸ The increasingly urgent pressures created by exponential climate impacts

Future working worlds

Technology: the next wave

Powering human augmentation

5G will provide the speed, data volume and low latency to become the connective backbone of human augmentation

100x

Data speed and devices connected

1/10th

The delay

In the 1800s, the Industrial Revolution was visible through an expanding network of canals, telegraph wire and railroads. We are now on the cusp of another revolution, powered by human augmentation technologies – AI, autonomous vehicles, robots, augmented and virtual reality, and more – that are unprecedentedly lifelike and autonomous (see "Human augmentation" in *Megatrends 2018*).

This revolution requires its own infrastructure, more so now as the COVID-19 pandemic places increasing demands on digital and network resources. Five technologies will be critical for bringing human augmentation to mainstream use, and they will likely see increased R&D and funding as they become essential in the post-pandemic world:

‣ **5G** is the fifth generation of mobile connectivity, able to power 100 times the devices at 100 times the data speed while using 1/10th the energy. The speed, data volume and low lag time of 5G allows millions of connected devices to continuously communicate with each other and adjust their responses to changing dynamics in the environment. As more autonomous systems, such as drones and robots, are deployed to mitigate the spread of COVID-19, 5G will be imperative to enable responsiveness and handle bandwidth demands from so many more devices.

‣ **Edge computing** moves computing from the cloud to the device. This is a transformative shift for human augmentation technologies. Allowing a self-driving car or drone to conduct computations locally rather than having to communicate with the cloud is critical when lives are at stake. In the post-pandemic future, the need for intelligent edge devices that can substitute some portion of human acumen is likely to continue. The current renaissance

5G connections by 2025

2023	0.1b
2024	0.4b
2025	1.4b

in the semiconductor industry is helping fuel the growth of new chipsets and designs to enable edge computing and intelligence. The adoption of these new architectures could accelerate to enable the future that COVID-19 will bring.

‣ Human augmentation will require highly dependable power sources. The market for **next-generation batteries** – at one-sixth the cost and 20 times the operating life – is expected to grow 120 times between now and 2040, powering the infrastructure of human augmentation.

‣ **Precision sensors** that collect accurate data on usage and performance of digital infrastructure are fundamental to fulfilling the vision of smart, responsive environments and experiences. New materials such as graphene and quantum sensors are enabling new use cases, such as continuous, real-time monitoring of changes in the human body or detecting pathogens in the environment. This latter application gains even more importance as the threat of future COVID-19 surges loom large without a vaccine.

‣ Ultimately, fulfilling the promise of human augmentation requires efficient computing that can process huge volumes of data in real time. The unique properties of **quantum computing** will allow significantly faster and more efficient computing than the most powerful current supercomputers, and will be particularly useful in solving certain types of complex scientific problems, especially in the medical domain, such as drug discovery. With researchers looking for viable vaccines to combat the novel coronavirus, quantum computing is starting to get more attention and may see accelerated development. However, significant hurdles remain, but when quantum computing becomes practical, it will unlock opportunities that will turbocharge human augmentation in the post-pandemic world.

Science fiction tells the tale of humans and robots, two races apart. The reality will be more benign and more encouraging. Technology will augment our bodies, work and home life. But to get there, we will need an entirely new infrastructure that can enable the real-time sensing, efficient processing and transmission of data to deliver dynamic, secure and trusted decision-making. These qualities will become ascendant as the new normal arising from the COVID-19 pandemic leads to new demands for intelligent and resilient technology infrastructure.

Next-generation batteries will become the sustainable energy source that powers human augmentation

-90%

Reduction in power required by 5G connections

-85%

Decline in battery cost

$620b

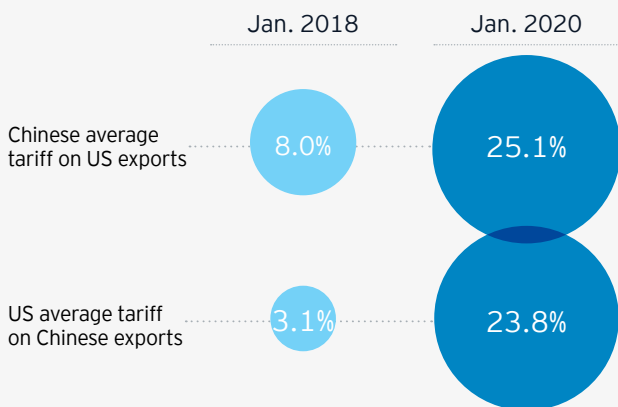Projected investment in battery technologies (to 2024)
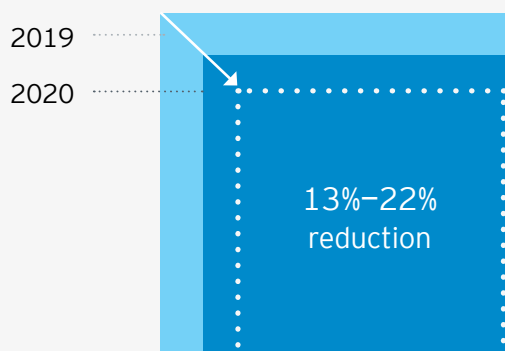
122x

Growth in battery storage market

Globalization: the next wave

Beyond globalization

Trade disputes have recently escalated

Jan. 2018   Jan. 2020

Chinese average tariff on US exports: 8.0% → 25.1%

US average tariff on Chinese exports: 3.1% → 23.8%

Global trade is expected to shrink as a result of COVID-19

2019
2020

13%–22% reduction

We have grown accustomed to living in a globalizing world. For more than seven decades, the international economy has moved toward trade liberalization, and increased cross-border flows of labor and capital.

Recent developments are shifting globalization's tectonic plates. Populism and nationalism are on the rise. That's fueling protectionism, with the US and China imposing tit-for-tat tariffs undermining institutions – such as the World Trade Organization – that are critical foundations of the global order.

Non-tariff barriers are also appearing, notably in the high-stakes competition to dominate next-generation technologies such as AI and 5G networks (for more, see our "Techonomic cold war" megatrend).

Building on trends that emerged in the aftermath of the Global Recession, these developments are having a tangible effect on the volume of international trade, cross-border capital flows and global supply chains. And there is a backlash against immigration and migration everywhere, from the US to Europe and India.

What is the long term outlook for globalization?

First, populism and nationalism are likely here to stay. As analyzed in *Megatrends 2018*, the root cause of populism is growing economic inequality, a long term challenge with no simple solutions. A change in government in a country or two is unlikely to reverse the persistent trend toward protectionism.

Second, regionalization will characterize the future of globalization. The economies of China and India are becoming more self-reliant and their companies moving up the value chain, expanding their activities beyond running back-office operations and assembling products for Western companies.

Real differences in societal values, legal structures and regulatory approaches will also spur regionalization. This is particularly relevant in emerging technology spaces, on issues such as data privacy and the ethical implications of AI. Combined with the protectionism arising in the context of the techonomic cold war, such differences could bolster the development of distinct spheres of influence, most likely along regional lines. As this happens, multinational companies may no longer operate on a single global stage and their supply chains may become fragmented. Trade and investment flows would become more regional than global.

Technology could also enable a more regionalized future. Distributed manufacturing, driven by technologies such as 3D printing, could radically shrink and localize global supply chains.

Finally, global collective challenges will shape these developments. The COVID-19 pandemic, for instance, could accelerate many of these trends. The pandemic has highlighted economic inequality and taken a disproportionate toll on the poor, which could fuel social unrest and more populism. The crisis also revealed the fragility of global supply chains, which could motivate multinationals to explore nearshoring more seriously. On the other hand, even as the pandemic

Non-tariff barriers are rising as competition heats up in next-gen technologies

Electric vehicle stock   2013   2018

China   8.0%   45%

Europe   27%   24%

US   44%   22%

Other   21%   9%
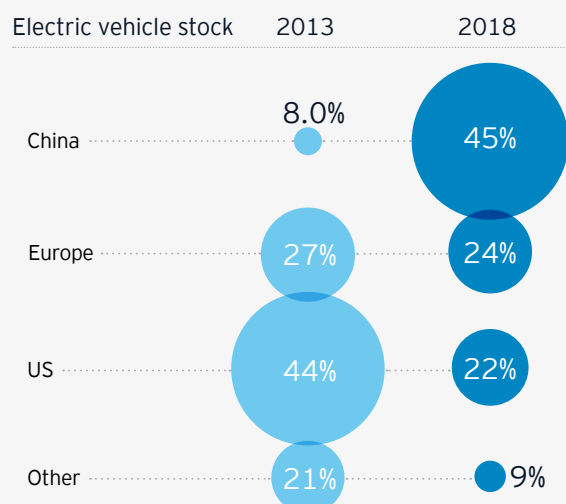
amplified some fissures between countries, it led to unprecedented international cooperation by bringing home that global challenges can only be addressed through global approaches.
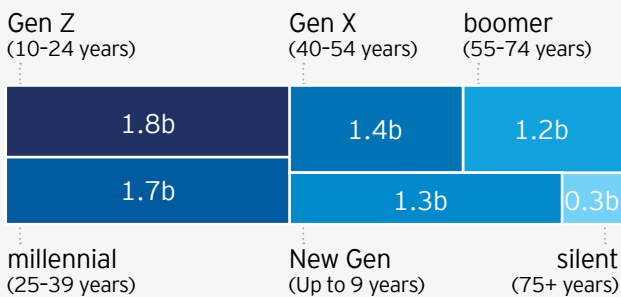
The existential challenge of climate change (see "Exponential climate impacts") will similarly complicate the picture. Large numbers of climate migrants will likely fuel more populism, but climate change will also demand unprecedented global cooperation.

Demographics: the next wave

Gen Z rising

born
between 1995 & 2015

The next decade will be shaped by the maturation of Generation Z, the largest generational cohort in history

Gen Z (10-24 years)	Gen X (40-54 years)	boomer (55-74 years)
1.8b	1.4b	1.2b
1.7b	1.3b	0.3b
millennial (25-39 years)	New Gen (Up to 9 years)	silent (75+ years)

Source: EY analysis of World Bank Population Projections and Estimates data for 2020; age ranges adapted from Pew Research for globally consistent data

While millennials today are having their moment, the next decade will be shaped by the maturation of the largest generational cohort in history − Generation Z. This cohort of people between 10 and 24 years old comprises 1.8 billion people, making up 24% of the global population, according to our analysis (see endnote on our generational definitions).[1]

The Gen Z future is not evenly distributed. Generational change is occurring between countries, not just within them. The populations of the world's leading economies are growing elderly, while developing-market societies have growing numbers of youths. India stands out with a population that includes 375 million people − 27% of total − in Gen Z. At the other extreme is Japan, where Gen Zers make up just 14% of the population.[2]

The differences in imperatives between youthful countries (employing talent and development) and aging countries (managing social costs and maintaining lifestyles) will create geopolitical crosscurrents as domestic politics influence economic, trade and foreign policies.

Different life experiences shape this large, diverse generation. In developing markets where the majority of Gen Zers reside, members of this generation have shared an experience of rapid growth, wealth accumulation and increasing consumption. Developed markets, in contrast, have seen low growth and slowing consumption. As a result, optimism reigns in developing markets, while few

in developed markets envision a better future for their youths than they had themselves.

While Gen Z is generally more progressive on social issues than preceding generations, important differences in attitudes emerge across geographies. In developing markets, Gen Z is more socially conservative, trusts more in business and feels more pressured to succeed than peers in developed economies. Gen Zers in developing markets also have a much greater say in household spending. Companies will have to identify the important distinctions among Gen Zers to serve this global cohort effectively.

Generational change is happening both within and between countries as leading economies age and developing market remain young
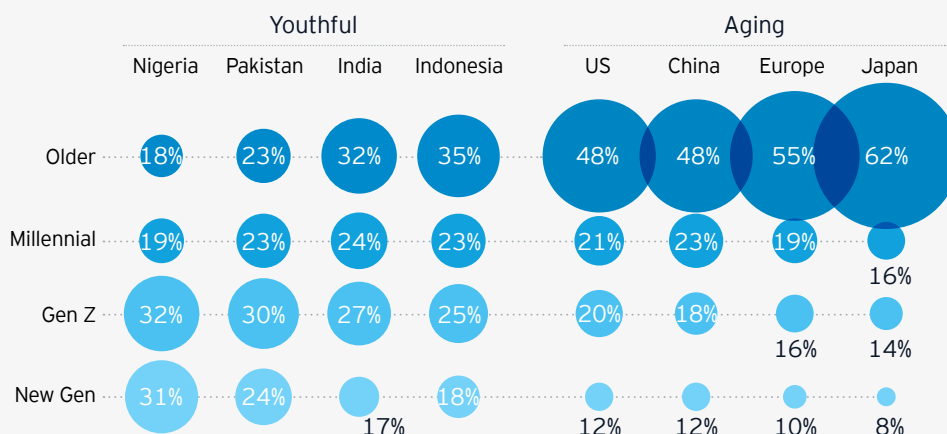

Source: EY analysis using the Quid platform

Gen Zers in developing countries have experienced rapid growth and wealth accumulation in their lifetimes, while those in developed countries see slowing growth and consumption
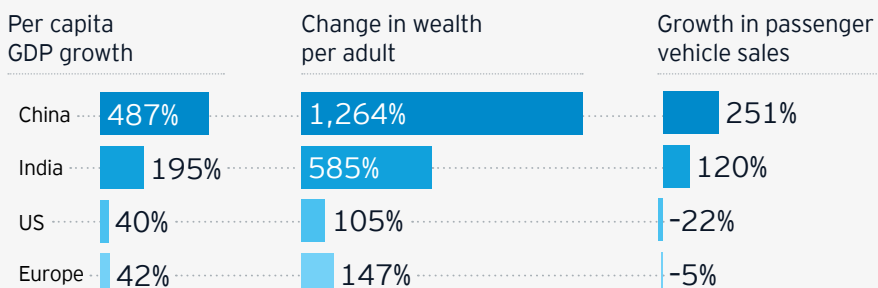
Sources: World Bank Economic Development Indicators; GDP per capita, PPP (constant 2011 international $); Credit Suisse Global wealth databook 2019, October 2019; OICA

Gen Z was born entirely in the internet age and finds commonality in digital

96%+
smartphone
ownership

7+
social media
accounts

2.9 hours
social media
time daily
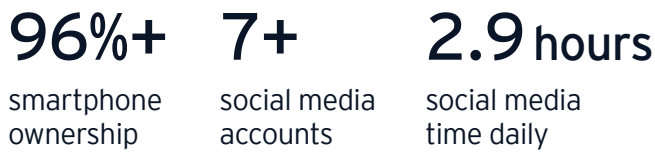
Gen Zers from developing markets are more socially conservative, trusting in business, and pressured to succeed

Gays and lesbians should be free to live their
lives as they wish

69%
Agree

Developing markets

83%
Agree

Established markets

High level of trust in businesses in general

51%
Agree

Developing markets

38%
Agree

Established markets

Under a lot of pressure to succeed

68%
Agree

Developing markets

60%
Agree

Established markets

Source: Beyond Binary; The lives and choices of Generation Z, Ipsos Mori

Gen Z's fundamental commonality lies in digital. As the first generation born entirely in the internet age, Gen Z boasts a smartphone penetration that nears 100% everywhere in the world.[3] Members of this generation also maintain more social media accounts, and spend more time on social media, than any other generation.[4] Increasing travel has also helped to give Gen Z the most global outlook.

Gen Zers also share a commitment to global sustainability. Climate change tops their list of most important global challenges. Other environmental concerns, such as pollution and the loss of natural resources, are not far behind.

Gen Z's fear of climate change is well-founded. Our analysis shows that nearly 60% of the Gen Z population lives in countries with a high vulnerability to climate change but low readiness for responding to it, intensifying climate's impact on this generation. Additionally, in the top 20 Gen Z countries with coastlines, 121 million people currently live in areas that will be below high tide by 2050, while 252 million will be subject to coastal flooding by that date.[5]
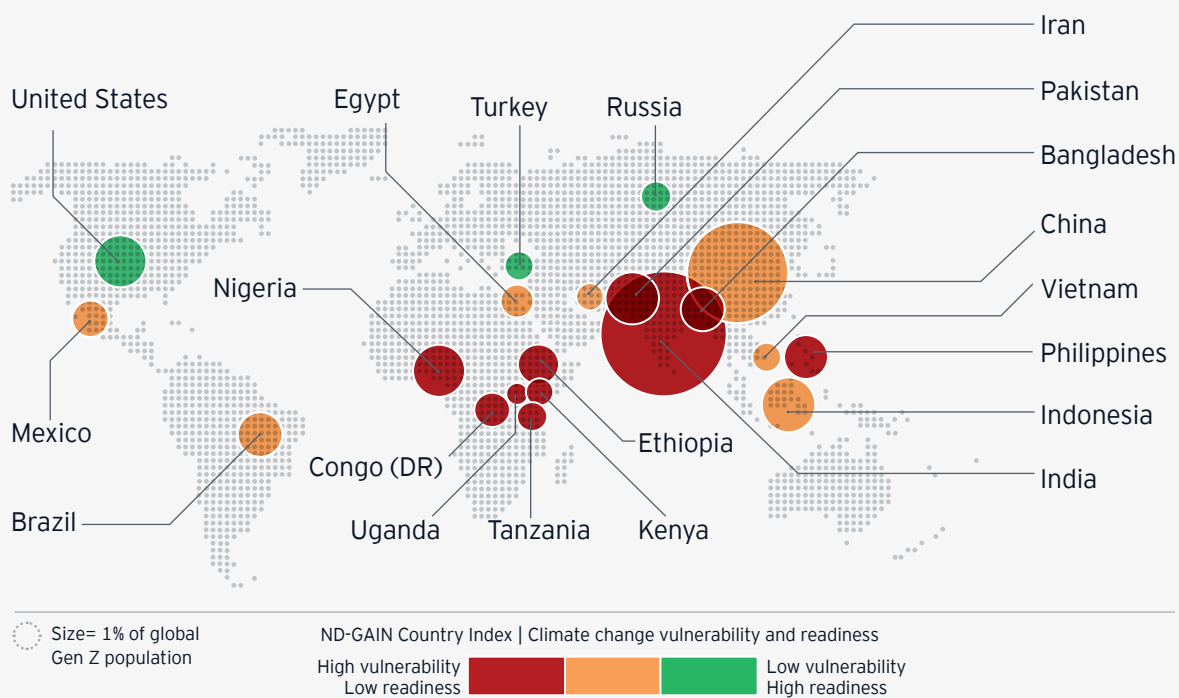
Will the COVID-19 pandemic and its aftermath distract Gen Z from the climate crisis? Certainly the pandemic is a landmark in the lives of this youthful generation. Schooling at all levels was upended by the need for social distancing. Because young people disproportionately work in service jobs and are in the lowest rungs of professional ranks, Gen Zers were laid off at much higher rates than older workers. And Gen Zers will be entering or returning to the job market in a severe recession. Yet for the Gen Z climate activist Greta Thunberg, the takeaway from the global response to the pandemic shows us that "we can act fast and change our habits and treat a crisis like a crisis."[6]

The digital connectedness of Gen Z and its growing shared experience of climate change (see "Exponential climate impacts") will likely cause more Gen Z figures such as Thunberg to emerge from different corners of the world and demand action on the existential climate crisis. The maturing of Gen Z as leaders, workers, consumers and voters over the next decade will increasingly drive the decarbonization imperative in business and society.

While COVID-19 is a milestone for Gen Z, it is the starting point for the next generation. Generational cohorts are defined by the societal changes impacting those in their formative years, enough to shape their intuitive understanding of how the world works. For the generation coming up behind Gen Z, the post-pandemic new normal will just be "normal."

The impact of this generational shift will likely be profound. Compared with their predecessors, this generation will likely bring very different assumptions and expectations related to society, technology and ethics, and the role of private companies in providing public goods. Think of the business transformations − corporate purpose, sustainability, ways of working, use of digital and new business models − sparked by the emergence of millennials and Gen Z. The next generational wave of transformation is on the horizon.

Half of Gen Z lives in countries that are highly vulnerable to climate change but with low readiness for responding to it

Size= 1% of global Gen Z population

ND-GAIN Country Index | Climate change vulnerability and readiness

High vulnerability Low readiness

Low vulnerability High readiness

Environment: the next wave

Exponential climate impacts

Despite all our technological prowess, humanity depends on the environment for water, breathable air, food and shelter. With population growth, the use of polluting, carbon-intensive technologies and the development of a linear, take-make-waste economy that overexploits ecosystems, we face a set of interconnected environmental challenges.

For example, land degradation diminishes agricultural productivity and the soil's ability to absorb and retain carbon dioxide (CO_2). Air pollution impairs human health and quality of life. Water scarcity threatens industry and agriculture, and burdens nearly a billion people with lack of reliable access to safe drinking water. Deforestation decimates the ecosystem's ability to provide resources, such as clean water, and creates the human-wildlife interactions leading to disease transmission. Marine pollution impoverishes the billions of people who depend on ocean biodiversity for their livelihoods and food.

The next wave of disruption in the environment interlinks with and exacerbates these challenges: exponential climate impacts. The earth has passed a climate change threshold. A centuries-long period of rapid but linear warming and change is now behind us. We are entering a new phase marked by exponential climate impacts, volatility and disruption. Evidence can be found in the planet's air, oceans and ice in the wake of the six hottest years on record since 1880.

New technologies reveal that climate-driven geophysical change is happening much faster than we thought, reducing our time to adapt. For example, new satellite data shows that the Himalayan glaciers supplying water to 800 million people in South Asia are melting twice as fast as previous estimates.[7] Another satellite survey indicates that 300 million people worldwide – not 120 million as thought – will be subject to coastal flooding due to sea rise by 2050.[8]

What could happen in a time of climate volatility? History provides examples of how rapid climate shifts can tip precarious social and economic situations into disruption with far-reaching impact.

Climate-driven changes to the earth are happening faster than we thought

Oceans heating
40% faster

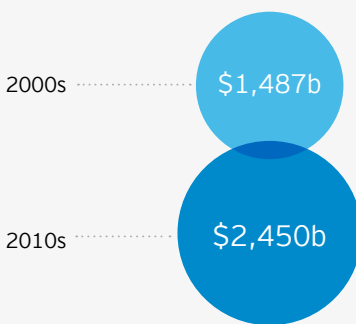Sea level rising
57% faster

Himalayan glaciers melting
100% faster

Greenland ice cap melting
670% faster

Extreme weather is becoming more frequent and costly

2000s ········ $1,487b

2010s ········ $2,450b

Source: Weather, Climate & Catastrophe Insight 2019 Annual Report, Aon

Climate disruption exacerbates existing resource and social challenges

Income inequality
Extreme heat to cause productivity loss equivalent to **80 million jobs**

Food insecurity
500 million people live in desertifying areas

Urbanization
300 million people to live in areas subject to coastal flooding by 2050

In 1788, summer drought and an abnormally cold winter in France caused crop failures, famine and rising food prices. The revolt that became the French Revolution began in the areas experiencing the most extreme weather, and most dependent on agriculture.[9]

1816 was the "year without summer" due to a volcanic explosion that blocked sunlight, reducing global temperatures and causing agricultural failure, disease, famine and bankruptcy. Rising food prices caused rioting among a population already dislocated by the onset of the Industrial Revolution. The disruptions sparked a wave of European migration to the US, and westward migration within the US.[10]

A decade of drought in North America in the 1930s exacerbated the impact of unsustainable farming practices, causing dust storms and loss of topsoil – the Dust Bowl. Agricultural failure accelerated and deepened the Great Depression, while over 2 million people migrated from the US Midwest to other regions, transforming US politics and society.[11]

How will climate impacts amplify the many dislocations of our era, such as populism, pandemics, automation, immigration, income inequality and demographic change? It's hard to attribute the impact of any event entirely to global warming: many factors may contribute, from underinvestment in infrastructure to social inequities, lack of resilience and poor planning. Even so, the role of climate as catalyst and driver of profound economic and social disruptions is clear.

Business leaders must look at climate risk in a new way. Exponential climate impacts threaten more than supply chains and physical infrastructure – they endanger growth by exacerbating systems-level disruption to customers, investors, employees and communities. The wildfires in California, the world's 7th-largest economy, and Australia, the 11th-largest, provide an indication of the potential impacts. It is perhaps no surprise, then, that climate change is already the signature issue of Gen Z, the largest generation and the one most vulnerable to climate impacts (see "Gen Z rising").

Averting worse climate impacts will require reducing global greenhouse gas emissions by about 8% every year for the next decade to limit global warming to 1.5 degrees Celsius. Decarbonizing the economy will be one of the biggest economic transformations ever.
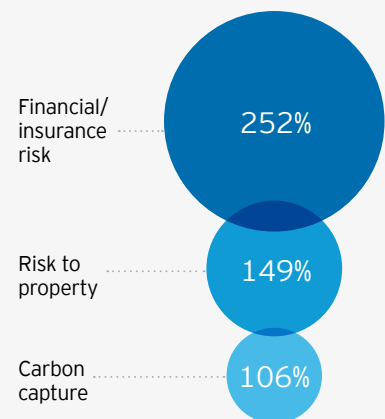
The COVID-19 crisis comes amid the climate crisis. There are hopeful signs that global experience of the pandemic and the lessons learned will help to mobilize the climate transformation. The global community has experienced how connected and mutually dependent, and vulnerable to the natural world, we are. The pandemic's spread and human toll illustrate the reality of global existential threats and the need to act on them as quickly as possible. Many governments are implementing green recovery plans, funding projects designed to stimulate economic growth and accelerate decarbonization.

Even in recovery mode, business can, and must, play a leading role in driving decarbonization, enabled by market forces and backed by the right policy and regulatory incentives. But to lead, businesses must undertake their own decarbonizing transformation to reposition their business and protect long term value. As with COVID-19, our human ability to innovate and problem-solve must be put front and center.

As the world approaches 1.5 degrees of warming, companies that embrace the challenge will secure their future, improve their capacity to create long term value for all stakeholders and be well-placed to capture an innovation opportunity of a generation.

Public discussion of these risks and potential solutions is intensifying

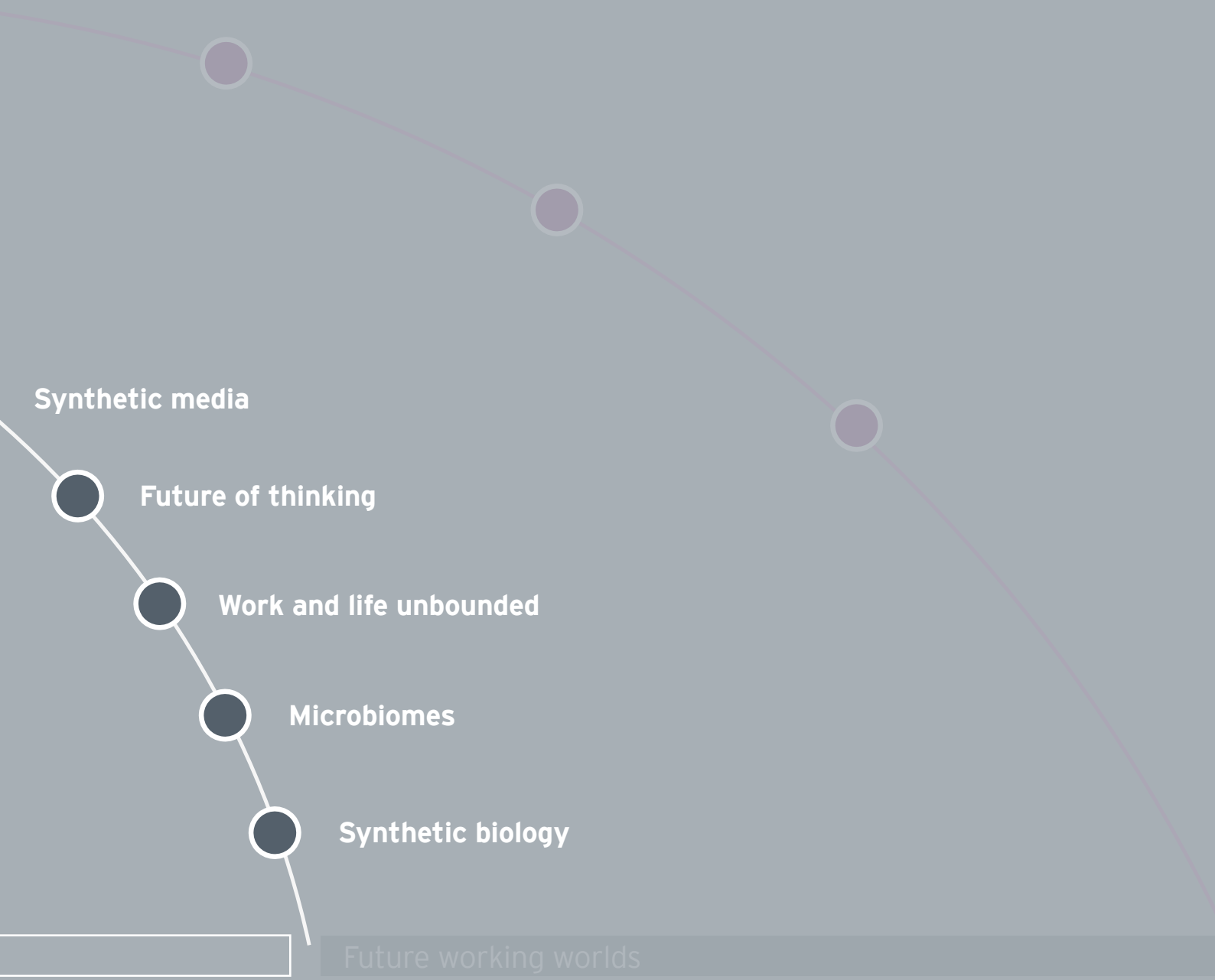Increase in climate news coverage since 2016

Financial/insurance risk 252%

Risk to property 149%

Carbon capture 106%

Source: EY analysis using the Quid platform

MEGATRENDS

Decarbonization

Techonomic cold war

Behavioral economy

Megatrends

Synthetic media

Future of thinking

Work and life unbounded

Microbiomes

Synthetic biology
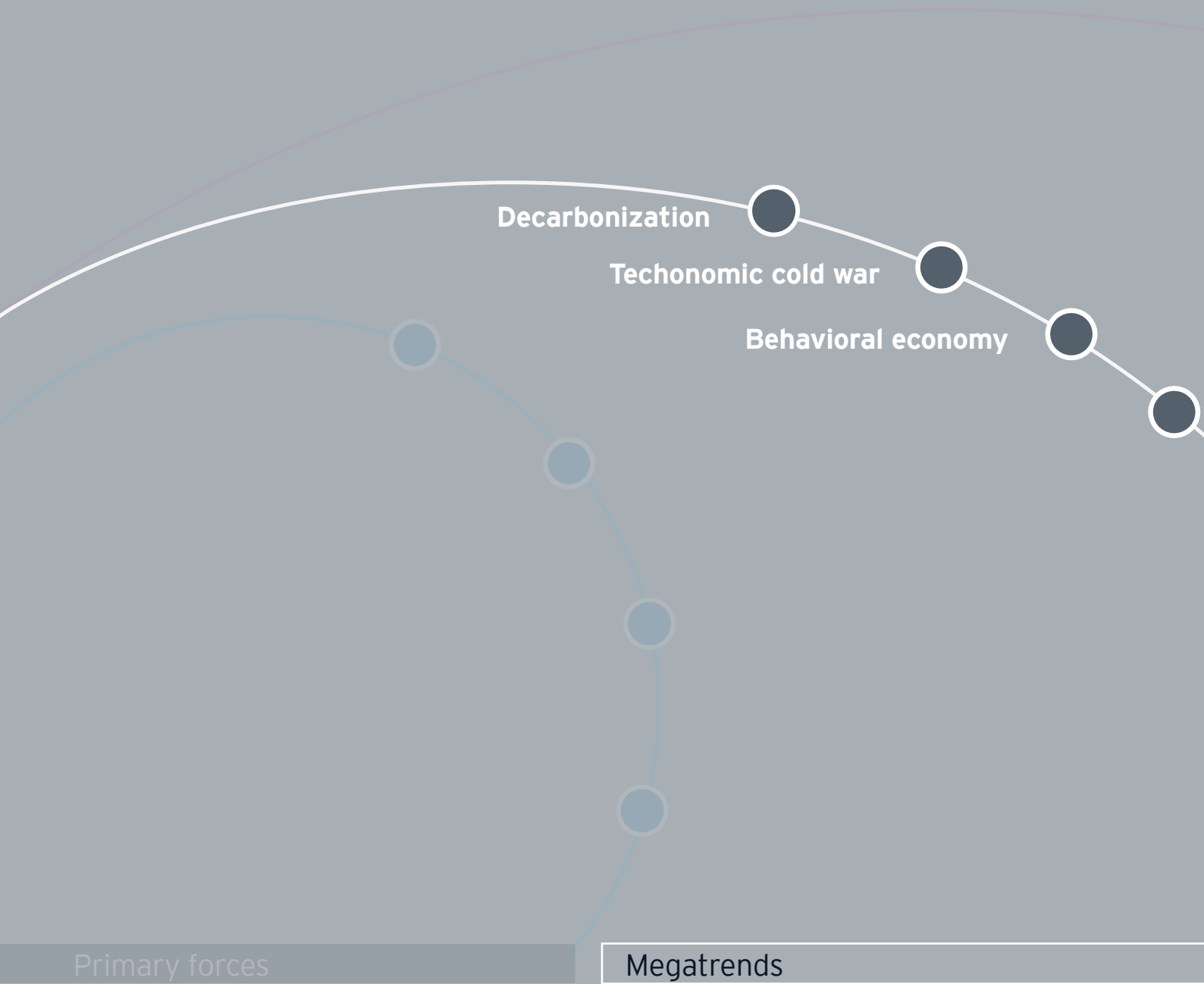
Decarbonization

New carbon removal solutions are emerging for decarbonizing business models, driving long term value and demonstrating climate leadership.

The onset of disruptive climate change underscores the urgency of limiting global warming to 1.5 degrees Celsius above preindustrial levels (see "Exponential climate impacts"). Failure will result in wide-reaching social and economic disruptions. Success depends on decarbonizing the global economy, an economic transformation on the scale of the fossil fuel-driven First Industrial Revolution.

For businesses across sectors, this will involve decarbonizing business models and entire value chains. The main levers of this transformation are cost-competitive renewables, the "electrification of everything" (transportation, heating, industrial operations, etc.) with clean energy, digitally-optimized efficiency and the adoption of decentralized energy generation, particularly by corporates (see our perspective, *As the countdown to a new energy world intensifies, who will beat the clock?*).

An emerging suite of carbon capture and sequestration solutions allow companies to augment these key levers to not only avoid emissions but reverse them. These carbon removal approaches include engineered solutions, such as direct air capture, conversion of waste gases and sequestration in the built environment (construction), and natural solutions, such as soil sequestration, reforestation and afforestation. All flip the script on carbon, capturing it and turning it into a source of value.

For the heaviest emitters, these sequestration and reuse solutions provide another tool to accelerate the drive to carbon neutrality. But for many global companies the ability to capture and revalue carbon opens the path to going carbon-negative, removing more CO_2 than they emit or cause to be emitted. In our climate emergency, the ambition of neutrality – doing no climate harm – is insufficient when there is a way to do climate good.
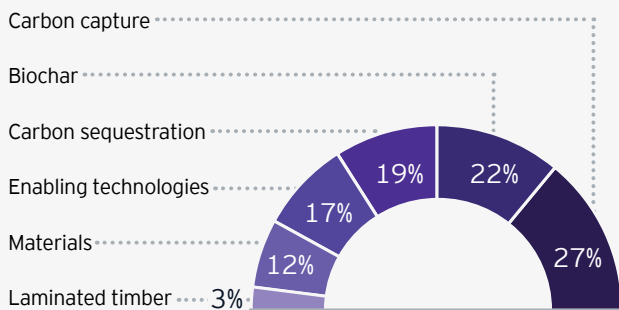
Carbon removal approaches flip the script on carbon, capturing it and turning it into a source of value.
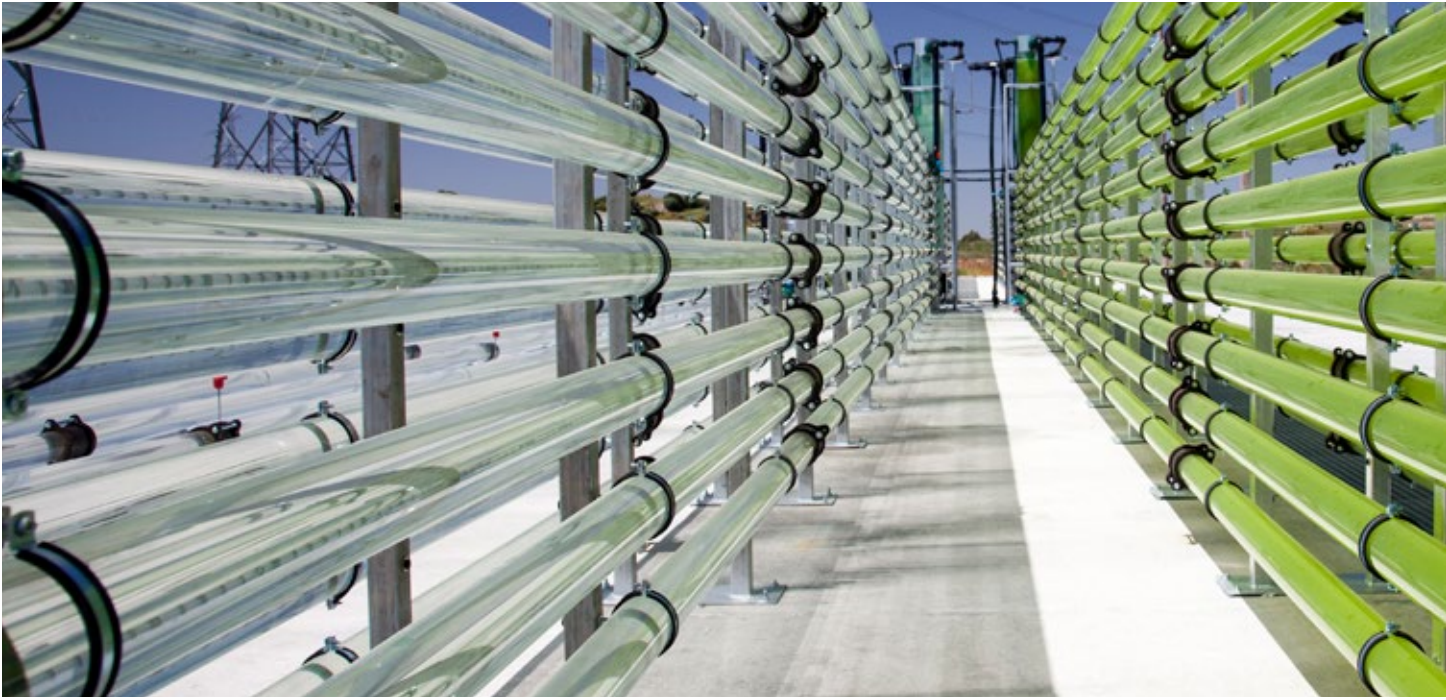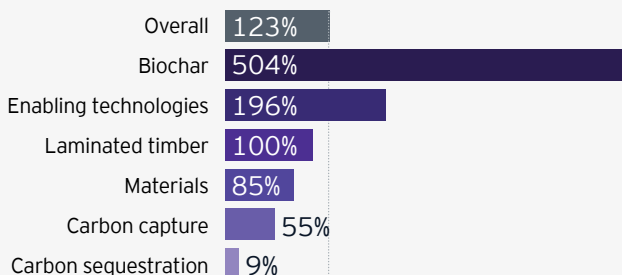
Carbon removal innovation

More than 3,000 patent applications related to carbon removal innovations were made from 2009-18.

Carbon-removal patent applications 2009−18

Carbon capture

Biochar

Carbon sequestration

Enabling technologies

Materials

Laminated timber ···· 3%

19% | 22%

17%

12%

27%

Annual applications increased by 123% to 419% overall during this time. The biggest gainer was biochar, used in biogas and for sequestering carbon in the built environment and soil.

Growth in carbon removal patent applications 2009−18

Overall	123%
Biochar	504%
Enabling technologies	196%
Laminated timber	100%
Materials	85%
Carbon capture	55%
Carbon sequestration	9%

Source: EY analysis using the Quid platform

Engineered solutions

Carbon is an important input to a variety of commercial products and materials, from beverages to chemicals, diamonds, plastics, building materials, fertilizer, coolants and fuels. Nearly all of that carbon is refined from petroleum or natural gas. Swapping in recycled carbon, or carbon captured from the air, for the manufacture of these products could be a $6 trillion market opportunity[12] and reduce global emissions by 10%.[13]

Direct air capture

Direct air capture extracts carbon dioxide from the atmosphere. Companies like Carbon Engineering and Climeworks pump air over sorbent chemicals that soak up the CO_2, which is then separated so their chemicals can be reused. Because the process is energy-intensive, it requires a low-carbon energy source to be net carbon-negative. Global Thermostat's solution gets around this by using industrial waste heat to power the process. The Center for Negative Carbon Emissions at Arizona State University is piloting a passive solution a thousand times more efficient than a tree at removing CO_2. Achieving scale will be critical to driving down costs.

Conversion of waste streams

Another strategy is to capture the highly concentrated greenhouse gases in the waste streams of heavy emitters, such as power plants, foundries and chemical plants. Lanzatech does this with synbio bacteria that convert carbon into fuel and chemicals. NovoNutrients' specially

The amount of carbon embodied in the built environment will increase through 2050 to accommodate an increase of **2 billion** in the world's population.

cultivated microbes grow quickly on waste CO_2 to become feed for aquaculture. Opus12 creates carbon-negative plastic using chemicals catalyzed from waste gas. (See the sections on "Microbiomes" and "Synthetic biology" for more on bio-based sustainability.)

Reducing and sequestering carbon in the built environment

About 11% of global CO_2 emissions are generated from the manufacture of building materials and building construction itself.[14] For example, cement, the world's second-most-consumed resource after water, is very carbon intensive: every kilogram produced generates 1kg of CO_2, adding up to about 4gt of emissions annually.[15]

The amount of carbon embodied in the built environment will increase as we add an average of 13,000 new buildings per day through 2050 to accommodate an increase of 2 billion in the world's population, mainly in cities.[16] Innovations coming to market could significantly reduce or reverse this impact. Companies such as Solidia and CarbiCrete create concrete that sequesters carbon. Cross-laminated timber offers an alternative to carbon-intensive concrete and steel building materials; the wood that composes it sequesters carbon (as long as it is the result of sustainable forestry practices). Puro has launched a marketplace for carbon removal certificates based on sequestration in building materials – biochar, concrete and wood.

Natural solutions

Carbon capture can also be achieved the old-fashioned way, with trees, by reforesting degraded areas or foresting treeless areas, and by restoring soil through regenerative agricultural practices.

Reforestation and afforestation

A recent study identified an opportunity to restore forests on 900 million hectares of land globally (an area equivalent to the United States) not being used for human industry or in urban areas. The maturing forests could capture and store two-thirds of the carbon released by humans since the industrial revolution. Planting a trillion trees is a monumental task, but companies like Land Life are tackling this old-fashioned opportunity with the most modern digital tools – drones, robots, satellites and AI – to optimize and accelerate planting.[17]

Regenerative agriculture

There is more carbon in the soil than in the atmosphere and vegetation. Farming practices that improve soil health by improving the microbiome and increasing stored organic matter can remove carbon from the air; maintaining those practices can keep it there. We could sequester an estimated 4-8gt of CO_2 per year in this way.[18] Several big food and agriculture companies have made commitments to regenerative agriculture. (See the "Microbiomes" section for more on the role of microbiomes in soil sustainability.)

To bring regenerative practices to farmers more broadly, Nori has established a blockchain-enabled carbon removal marketplace; individuals and companies can buy credits for net carbon removals, while farmers are compensated for adopting and maintaining regenerative practices. Other companies have also established regenerative-based carbon credits to support farmers.

New verification technologies

Carbon credits generated by soil and forestry interventions face questions of quality and persistence. Is the resource what it purports to be? Is it still there and performing as expected? Satellites employing LIDAR technology can now address these questions with fine-grained data regarding trees and soil. Artificial intelligence then parses the data to determine carbon performance. Pachama, for example, provides satellite-verified forestry credits, while Planet provides earth-monitoring services.

Going negative

Corporations and their CEOs must lead on global challenges like climate change (the EY global *CEO Imperative* study explores this in depth). Institutional investors are prepared to support companies to do so. Boards and investors will support leaders who takes a stand. And Gen Z, the largest generational cohort with rapidly growing in influence, expects it. (See "Gen Z rising" for more on Gen Z and climate change.)

The end goals for corporate climate leadership have shifted with the onset of disruptive climate change. It's not enough to be climate-neutral: companies must make net positive contributions to climate. While adopting renewable energy, electrifying operations and transportation, and improving efficiency remain the key pillars of decarbonization, carbon removal solutions allow companies to go a step further, to reverse their emissions. Microsoft, for example, recently pledged to become carbon-negative by 2030 with a goal of removing all the carbon it has emitted since founding.

With a growing number of countries with net-zero carbon goals, we can expect a supportive policy environment for negative carbon solutions. In a similar vein, 46 national and 28 subnational jurisdictions are pricing carbon.[19] The numbers for both are likely to grow as climate impacts become acute.

Finally, a warning: greater transparency will expose companies to greater scrutiny from stakeholders. The same satellite technologies that monitor carbon sequestration can observe corporate assets to measure carbon and methane emissions and land use (visit ey.com for a profile of a Canadian entrepreneur monitoring emissions from space). The resulting data will inform the decisions of investors, insurers and activists.

Reframe your future

You've already focused on how your organization can reduce carbon emissions, with the laudable goal of achieving neutrality – doing no further harm to the world's deteriorating climate. Now it's time to be more ambitious. New carbon removal solutions can actually reverse carbon emissions and secure competitive advantage not only by getting ahead of regulations, but by generating consumer goodwill, driving long term value, and capturing value from a $6 trillion market for products with carbon inputs.

Where to begin: critical questions

- ▸ What carbon removal solutions could you adopt to not only accelerate achievement of your organization's current climate commitments, but expand them?

- ▸ How much of your waste emissions could you turn into value, either independently or with partners?

Techonomic cold war

Populism and trade disputes, company blacklists and a technology arms race, cyber attacks and information warfare. The future of war is permanent, invisible — and fraught with risks for multinational companies.

We are entering a new kind of cold war, driven by the growing competition to shape the next generation of technology infrastructure and the rise of a new breed of populist leaders with interventionist instincts. As the line between the political and business worlds blur, a variety of protectionist tools emerges, from tariffs to corporate blacklists to cyber war and disinformation. Companies could increasingly find themselves in the crosshairs.

Populism and nationalism

Populist and nationalist leaders have been gaining power across the world. To varying degrees, such leaders have interventionist and protectionist instincts, as well as an appetite for bucking long-standing policies and norms. The fact that such leaders are emerging in democracies is shifting long-standing norms across the global system.

Many see this as a temporary aberration, anticipating a return to the old normal in the near future. But the trend toward government intervention and domestic boosterism is widespread and sustained. China's "Made in China 2025" initiative, for instance, aims to promote domestic manufacturing across a range of high-technology sectors, from aerospace to robotics – an ambition that would increasingly put it in direct competition with the US.
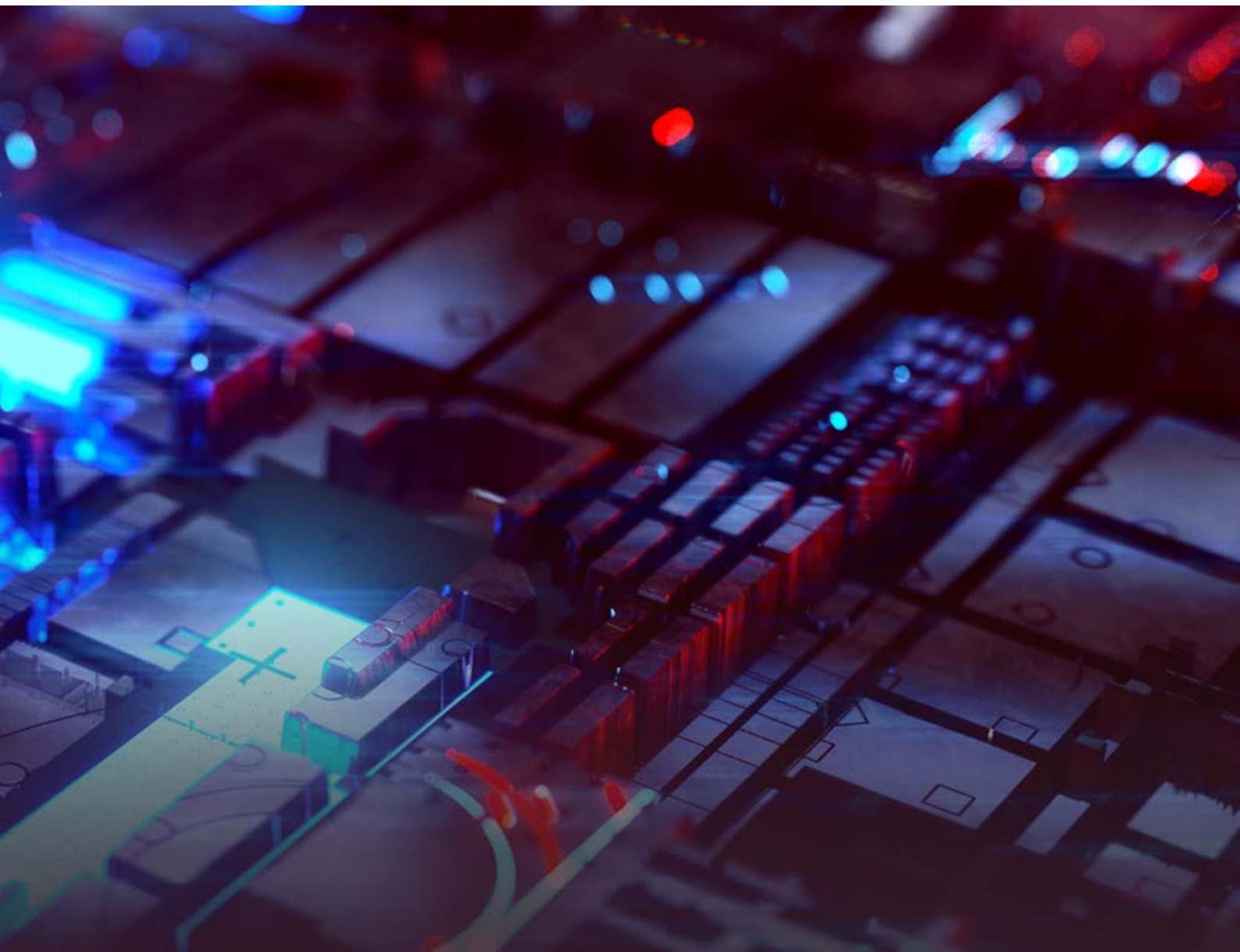
In parallel, the Indian Government of Prime Minister Narendra Modi has launched a similarly named initiative, "Make in India," which gives preference to domestic manufacturing across a spate of industries.

We don't view populism and nationalism as passing fads (see "Populism" in *Megatrends 2018*). Regardless of the back-and-forth of individual election results, populism is here to stay because the forces driving it, such as economic inequality and job displacement, are long term trends. While the COVID-19 pandemic has undermined the credibility of some populist leaders, others have used the crisis to consolidate power. Since populist and nationalist leaders tend to have interventionist instincts and, by definition, favor nationalist policies, the examples above are likely a sign of things to come.

Cyber warfare has expanded into a new domain altogether: disinformation. The target is not physical infrastructure, data or money, but truth itself.

The techonomic cold war

Initiatives such as "Made in China 2025" are driven in part by the increasingly heated competition to dominate the next generation of technological infrastructure, from AI to supercomputers to electric vehicles. The stakes are high; significant economic benefit and power may accrue to those who shape these technologies. Is that why governments are intervening in these technology domains – and not just with traditional tariffs and quotas? The US has banned specific foreign (mostly Chinese) companies.[20] China has indicated it may retaliate in kind.[21] There are reports of increased scrutiny of Chinese scientists working in the US.[22] Russia has banned smartphones, computers and smart televisions that are not pre-installed with Russian software,[23] even announcing plans to set up its own alternative to Wikipedia.[24] And the US military has banned service members from using Chinese-made social media platform TikTok amid growing concerns about security risks.

It is hard to untangle the true motivations behind these actions. They're often justified not by protectionism but issues such as national security risks, industrial espionage or human rights violations. While these concerns may be valid, it's difficult to tell since much of the relevant information is classified. And regardless of the motivation, the result is the same: national governments are targeting foreign companies, platforms and individuals in critical technology infrastructure spaces such as 5G, AI and facial recognition.

Cyber and information warfare

Cyber attacks are nothing new. But in the decade since Stuxnet (often regarded as the world's first cyber weapon), the line between state and non-state actors has blurred. Governments have begun using cyber attacks not just for national security purposes against military assets or public infrastructure, but for financial reasons (for example, the theft of millions of dollars from the Bangladeshi central bank) or to pursue other political goals. In many cases, governments are collaborating with non-state actors on these cyber attacks, to mask the state's involvement and give it a veneer of deniability.

Meanwhile, the targets of state-directed cyber warfare have expanded beyond military and infrastructure assets. Companies are increasingly becoming victims, either as intended targets or as collateral damage.

More recently, cyber warfare has expanded into a new domain altogether: disinformation. The target is not physical infrastructure, data or money, but truth itself. This form of cyber warfare burst into the public consciousness after the 2016 US presidential election. This experience rightfully raised concern about the use of disinformation in future political campaigns; news

coverage of cyber warfare spiked almost 30% in 2017, according to our analysis.[25] But there's every reason to think similar tactics could be used to attack companies. Since markets thrive on transparent information, undermining its credibility is a potent weapon.

Adjusting to permanent, invisible "war"

General Carl von Clausewitz famously said, "war is the continuation of politics by other means." So it is with the emerging battlegrounds of the future. As high-stakes competition intensifies over everything from mineral resources to technology infrastructure – and populist and nationalist leaders are increasingly willing to intervene in unconventional ways – states may begin using "other means" to further their ends. As company blacklists, cyber warfare and weaponized disinformation become just another instrument of foreign policy or economic state craft, companies would be fair game.

This is the future of war, in many ways. This permanent, invisible and bloodless "war" will be increasingly attractive to those waging it, which is why we expect to see more

of it. Cyber and information attacks are considerably cheaper than conventional ones and can be deployed with pinpoint precision. Since cyber attribution is extremely difficult, such attacks also offer the cloak of plausible deniability. The weaponizing of disinformation itself makes it easier to undermine cyber attribution, by sowing doubt in the public mind about the veracity of information. (For more, see "Synthetic media" and "Future of thinking.")

These ingredients make cyber and information attacks the ultimate weapons of asymmetric warfare, rendering it attractive to not just small states, but also failed states and terrorist groups. "Hacktivists" have been using cyber attacks to further the cause of fringe political views for some time now. Expect more to be drawn to these means in the years ahead.

The techonomic cold war threatens the mechanisms that make global operations possible.

Risks and challenges

These trends create significant challenges and risks for government and business leaders.

The implications for governments are more apparent. States typically don't disclose their cyber capabilities, whether offensive or defensive, but this is clearly an increasingly important area of focus and investment. The other instruments of intervention, from company blacklists to information warfare, are somewhat newer. They undermine existing norms and make international relations more complex and unpredictable.

The implications for business are no less disruptive. For one, these trends reinforce the importance of cybersecurity, while emphasizing the definition of cyber risk is itself expanding. Companies today need to guard against not just malware and phishing attacks, but weaponized disinformation. A second challenge is lack of transparency. Commerce thrives on transparency, yet instruments such as company blacklists are opaque and seemingly arbitrary. To the extent these instruments undermine transparency, they create uncertainty for businesses.

The net result of these trends could be an increasingly balkanized global economy. Multinational companies operate today on a truly global stage, with sophisticated supply chains, R&D outfits, and sales and marketing networks that span national boundaries. The techonomic cold war threatens the mechanisms that make global operations possible. In the future, companies may be restricted to operating within the spheres of influence of their home states.

Reframe your future

You're familiar with the risks of running operations around the world. But it's a whole new world now. The global arena is becoming more opaque and uncertain. New instruments of interventionism are targeting companies. Navigating this changing environment requires understanding the new rules and risks.

Where to begin: critical questions

‣ How are you preparing for the cyber risks of tomorrow, such as weaponized disinformation and so-called deepfakes?

‣ What risks would you face in an international order that is less transparent and less governed by rules and norms?

‣ How might a balkanized international order affect your global operations?

Behavioral economy

If data is the new oil, behavior is the new data. Armed with sophisticated capabilities, companies and governments can shape behavior like never before. How will you succeed amid shrinking trust?

The future of behavior is upon us. Human behavior is becoming a commodity – quantified, standardized, packaged and traded, much as consumer data is today. This commoditization, combined with the maturing of disciplines such as behavioral economics and affective computing, will give companies and governments the ability to influence and shape our behavior as never before. And while companies have always been in the business of seeking to influence what we do, the behavioral economy takes this to a whole new level. Instead of today's relatively blunt levers, we're entering a world of increasingly precise and sophisticated instruments of persuasion.

> We're entering a world of increasingly precise and sophisticated instruments of persuasion.

The internet of behavior

We all know about the explosion in the volume and types of data our lives generate. This has been enabled to a significant extent by the expansion from an internet of computers to an Internet of Things – sensor-embedded smart objects that spit out real-time, real-world data about the physical world.

We are now in the early stages of another shift: from the Internet of Things to an internet of behavior. The technologies we use, and the breakthroughs coming next, are generating data not just about the digital and physical realms but, more significantly, about all of us. We unwittingly reveal more about our desires and fears to search engines than to our families or friends. Our phones and social media platforms have more data about our behaviors, preferences and states of mind than we may realize.

News coverage of the behavioral economy has trended negative in recent years

	Negative sentiment	Positive sentiment
2016	3%	69%
2017	3%	62%
2018	7%	54%
2019	11%	43%
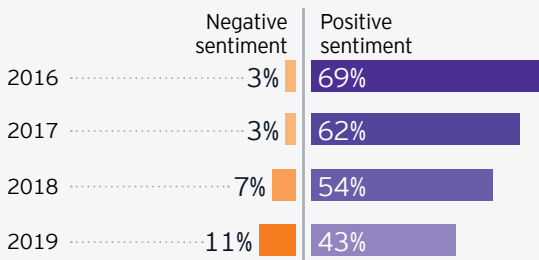
Source: EY analysis using the Quid platform

Consider how much more data the next generation of technologies will produce about our thoughts, motivations and behaviors. As voice interfaces replace typing and tapping as our primary way of interacting with technology, they will make transactions seamless. Will they also give devices that are constantly listening vastly more data about us? Facial recognition technology will allow us to instantly check in at an airport or hotel. But in a world of facial recognition cameras, will simply walking down the street generate data about our movements for law enforcement? A future of on-demand mobility in which people no longer own cars but instead summon autonomous vehicles whenever needed will provide tremendous convenience and environmental benefits. Will it also generate reams of data about our locations, routines, social networks and travel patterns?

People are already becoming aware of these issues. The "techlash" against technology companies has been motivated in large part by privacy concerns, missteps by technology companies and the growing realization that when services are "free," they are really being paid for in consumer data. Driven by such concerns, the conversation around behavioral economy topics has become consistently more negative over the past four years, with positive coverage dropping below 50% for the first time in 2019, according to our analysis.[26]

The European Union has enacted the General Data Protection Regulation (GDPR) to respond to such concerns; lawmakers elsewhere are considering regulations of their own.[27] It's not yet clear how all of this will play out across different jurisdictions, but it is clear we are moving to a world in which technology will have the ability to collect vastly more data about our behavior. While companies will have to work within emerging regulatory frameworks, they will aim to combine these disparate data streams, connect dots and view everything in context.

Breakthrough capabilities

As the volume of behavioral data expands, several technologies and disciplines are evolving to parse behavioral data and influence behavior in sophisticated ways. We analyzed the first of these extensively in previous *Megatrends* reports: behavioral economics (BE). Academics have studied BE, which applies insights from psychology to better understand human decision-making, for decades, but the discipline has only gained mainstream adoption in recent years. By understanding and compensating for widespread human heuristics and biases, governments and companies are now helping people lead healthier lives, save for retirement and make more environmentally sustainable choices. Meanwhile, marketers and advertisers have been using BE principles to boost sales and profits.

The second breakthrough capability is even more revolutionary: affective computing, also known as emotion AI. Like behavioral economics, affective computing is interdisciplinary – in this case, combining insights from computer science, psychology and cognitive science. Affective computing is bringing machines into the realm of human emotion by enabling systems that can both recognize human emotion (for instance, by analyzing eye movements, facial expressions and tone of voice) and convincingly simulate it when interacting with users. Startups are already developing applications using these capabilities, from systems that can save lives by recognizing the emotional state of drivers to tools that can boost the emotional engagement of fans at live events.

The combination of behavioral economics and affective computing creates a potent toolkit. It will allow platforms and interfaces not just to analyze and simulate behavior but, ultimately, to influence behavior in ways that are highly customizable even at a large scale. This is already starting to happen. For instance, social media platforms have used consumer data and BE principles to motivate people to vote in elections.

> The real challenge will be to participate in the behavioral economy while being transparent with consumers and winning their trust.

The coming wave of "human augmentation" technologies will enhance these capabilities. For instance, augmented and virtual reality could shape behaviors by customizing interactions in ways far beyond what is possible in the physical world. Imagine a salesperson avatar that can simultaneously maintain eye contact with hundreds of customers while modifying her accent, choice of words and tone of voice based on data about each customer's preferences.

Governments could also use these capabilities to influence the behavior of citizens. The UK's Behavioral Insights Team (often referred to as the "Nudge Unit") has used behavioral economics to increase tax compliance, encourage charitable giving and more. China's proposed Social Credit System could go a lot further, tracking and seeking to influence a broad range of behaviors among its citizens. The COVID-19 pandemic demonstrated the power of these capabilities, with the use of location and other individual data playing a key role in contact tracing and enforcing social distancing mandates. The ability of governments to motivate citizens this way will only increase with time.

Investment in the behavioral economy has already been skyrocketing, growing by about 146% over the past five years.

Opportunities and challenges

The shift to the behavioral economy brings significant challenges and opportunities.

Governments will be at the center of these issues in a couple of ways. First, they will set the rules of the road. Privacy mishaps by social media platforms are already spurring a regulatory response; calls for oversight will only grow as the amount of behavioral data expands and the sophistication of behavioral capabilities increases. Second, governments will themselves adopt some of these techniques, since behavioral change could generate better societal outcomes and significant savings for public budgets. The challenge will be to do so in ways that do not feed fears about "Big Brother" or the "nanny state."

The implications for companies could be even more profound. Our analysis shows investment in the space has already been skyrocketing, growing by about 146% over the past five years.[28] The biggest growth opportunities might go to those who can create the new business models this segment needs. Consumers are hungry for innovative approaches using behavioral capabilities to empower and engage with them rather than exploit and alienate them. Companies able to fill this void could see tremendous market potential. Among other things, this will involve using behavioral design (see *Megatrends 2018*) and will require identifying and building the relevant skills and competencies.

Compliance with evolving regulatory frameworks will be a complex task, especially if disparate approaches evolve in different regions. But mere compliance is a low bar. The real challenge will be to participate in the behavioral economy while being transparent with consumers and winning their trust. Appropriately enough, this is itself a behavioral challenge. Addressing it will require companies to examine not just consumer behavior, but their own.

Reframe your future

We are moving from the data economy to the behavioral economy. Like data, behavior is becoming quantified, standardized, packaged and traded. Using sophisticated capabilities such as behavioral economics and affective computing, companies can now measure, understand and shape behavior — a key driver of value and competitive success.

Where to begin: critical questions

▸ What new business models will the next generation of behavioral economy companies need?

▸ What new risks does the behavioral economy raise (e.g., regulatory, reputational, market) and how might you mitigate them?

▸ Will every B2C company need to become a behavioral company, and do you have the required competencies?

Synthetic media

Synthetic media is emerging as a new cyber risk for businesses. Ensuring authenticity will be critical to maintain trust with stakeholders, safeguard brand reputation and drive business performance.

Around the world, governments, businesses and media face a significant trust deficit. While there are multiple causes, the net result is the same: the loss of a shared reality and the growing irrelevance of facts. Access to information in our increasingly digital world has proved a double-edged sword, and it's only getting worse as it becomes easier and quicker to create and spread false information.

It's now easier than ever to fabricate realistic graphical, audio, video and text-based media of events that never occurred. Moreover, the availability of sophisticated digital editing tools is also making it easier to creatively edit audiovisual information, manipulating the context and

messaging – these are called "shallow fakes." The issue has captured public attention in recent years, with media coverage of synthetic media increasing tenfold between 2016 and 2019, and coverage of deepfakes mushrooming more recently over the last year.

Disinformation – completely forged or selectively edited existing information – deployed on social media platforms can spread like wildfire, generating pervasive and profound impacts on public opinion and behavior. So far, election campaigns, politicians and celebrities have been the main targets of synthetic media. Now the risk to businesses is beginning to emerge, with substantial implications for brand reputation, customer loyalty, stock performance and other factors.

Synthetic media has become a hot topic in recent years

Articles covering deepfakes

Articles covering synthetic media

		108	638
121	497	761	587
2016	2017	2018	2019
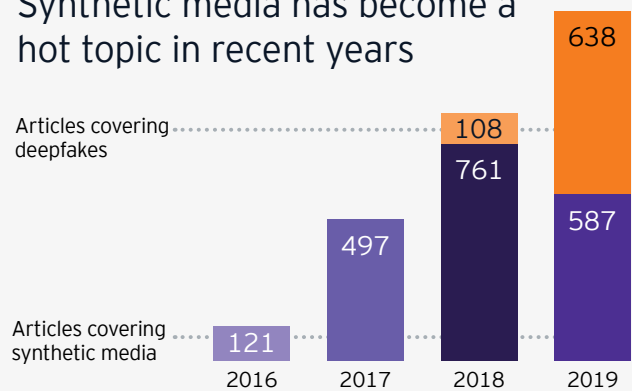
Source: EY analysis using the Quid platform

Three successful deepfake audio attacks that impersonated a CEO's voice initiated money transfers, resulting in the theft of millions of dollars.

Confronting corporate cyber threats

With enough training data, AI algorithms can generate credible audio, video and text showing anyone doing and saying things they never did or said. Adversaries can wield synthetic digital content and deploy it in a variety of ways, making companies vulnerable to fraud, defamation, extortion and market manipulation.

A well-timed, sophisticated deepfake video of a CEO saying their company won't meet targets could send the share price plummeting. Phony audio of an executive admitting to bribing officials is prime fodder for extortion. If released, these could cause serious reputational damage, alienate customers, impact revenue and contribute to the volatility of financial markets.

While the media has focused on deepfake videos, the first attacks have come in the form of audio. Earlier this year, reports emerged[29] of three successful deepfake audio attacks that impersonated a CEO's voice, requesting an urgent money transfer from a senior finance officer. The officer, thinking the request was authentic, initiated money transfers, resulting in the theft of millions of dollars.

It's not just C-suite-level fraud. Industries that rely on visual evidence are particularly vulnerable. In the insurance industry, digital claims processing requests customers to submit digital photos of damage. It is easy to see how bad actors could use doctored photos to defraud insurance companies.

The selective editing of original audio, video or text altering its intended meaning or reusing old digital media and presenting it as new or current is perhaps even worse. Consider that a 2011 video of consumers apparently swarming a grocery store in a suburb of Amsterdam to stock up because of the novel coronavirus went viral.[30] Although the video is real, it has been taken out of context and in a time of heightened anxiety, could stoke unnecessary panic. Now imagine the consequences if a speech or interview with a CEO was similarly edited to have them admitting to dangerously low stocks of groceries.

Although we have not yet seen a string of high-profile deepfakes or shallow fakes targeting the private sector, companies need to be prepared. The reality distortion created by even one attack will make it difficult for the public to believe any subsequent information they read, hear or see. This could create suspicion in interactions within companies and with customers. In the absence of trust, businesses will struggle to operate, much less to succeed.

A technology solution?

Cyber attacks are not new to the business landscape. Phishing, spam, malware and the like have plagued companies since the advent of the internet, spurring a burgeoning array of tools and techniques to mitigate and respond to threats. We now require an entirely new set of antibodies to fight the risks posed by synthetic media.

Technology may deliver the solution. Cybersecurity companies, startups, academic institutions and government agencies are exploring and cultivating means of authenticating videos, photos and text on the internet — our analysis shows patents filed in this space jumped by 276% between 2007 and 2017.[31] Techniques under development to restore trust in digital media include:

1. **Digital forensics**. Typically used for after-the-fact detection, this approach identifies contrived media by looking for inconsistencies in lighting and shadows in an image or eye-blinking patterns in a video. Some employ machine learning to analyze pixel-level incongruities that may trick the human eye.

2. **Digital watermarking**. This helps identify bogus content by placing hidden marks in images or videos. Such signatures could also be built into software for cameras, speakers and other content-creation devices to automatically tag images, videos or audio at the moment they are created.

3. **Hashing and blockchain**. This technique takes digital watermarking one step further. Once created, content is tagged with date, time, location and device-level information that identifies how it was generated. A hash representation of the content is then written to a public blockchain, creating an immutable copy directly from the source. An audit log establishes provenance by recording future alterations.

Each solution has upsides and downsides. While these techniques provide some ways to identify fakery, will they be enough to curb the production and distribution of fake information? And what about shallow fakes that are generated from factual content but manipulate the originally intended message?

Authentication patents jumped by **276%** between 2007 and 2017.

Adopting a multi-tool approach

The use of AI to generate media poses a particularly complex set of challenges. Those creating fake media and the experts battling to uncover them are engaged in a cat-and-mouse game. AI techniques enabling counterfeit content are becoming increasingly sophisticated and cheaper, enabling creation with far less skill. Each time new detection techniques arise, algorithms learn to create realistic forgeries that circumvent them. Eventually, it may become nearly impossible to distinguish original content from counterfeit. In addition, the sheer volume of information published to the internet makes real-time discovery of fakes daunting, to say nothing of attempting to debunk unaltered video twisted out of context through editing. Controversial information – regardless of its authenticity – can go viral in an instant, with damage already done by the time a forgery is proved.

Techniques, such as digital forensics and machine-learning-based detection, will be critical for identifying media lacking provenance information. The challenge for digital watermarking or blockchain-based tracking systems is they demand new digital publishing policies for social media platforms, requiring every piece of uploaded content to be stamped with a seal of authenticity. Establishing provenance from the moment of creation would require new software to be installed on hardware from speakers to cameras, which could add cost. And provenance standards will need to be adopted and enforced globally to be truly effective. That raises concerns[32] that such a system may have unintended – and potentially worse – consequences for issues such as privacy rights, surveillance and democracy itself.

Ultimately, practical solutions will have to draw from all approaches, including those that extend beyond technology. Companies will need to institute media literacy and critical-thinking training, equipping employees to detect phony information. In schools, such training has successfully helped students become better at spotting fake news.[33] In addition, as AI algorithms underpinning fraudulent content are trained on publicly available audio and video of C-suite-level executives from industry events and quarterly earnings calls, companies must act. PR and marketing departments will need to be judicious about how much media of senior leadership is exposed to the public and what technologies are used to establish the provenance and integrity of digital content being shared across the internet.

Policymakers and regulators face even thornier problems. Some may see verification technologies as infringing on free speech and individual privacy. And if these tools become the de facto solution, they will need to be accessible and affordable to everyone; otherwise only those who can afford them will be able to publish their content. This risks further sidelining and repressing already marginalized populations.

Companies, markets and customers rely on trusted information to function; in its absence, the very integrity of our modern economy and society is at stake. Legislative bodies around the world are investigating how best to meet the challenge of synthetic media. Yet for any policy to be meaningful, mechanisms for enforcement, auditing and compliance will be essential.

A long term imperative

Information creation and consumption technologies are becoming increasingly digitized. Augmented reality (AR) and virtual reality (VR) experiences immerse the senses. If tampered with, they can become powerful tools for manipulating public sentiment and behavior. The technology of 3D printing promises to democratize manufacturing, but virtual designs can be altered, resulting in potentially dangerous consequences from faulty car or machine parts. With these technologies, developing guarantees of authenticity will be critical to realizing their potential while securing trust.

While a technology-based approach to re-instilling trust may work in an increasingly technology-driven world, it may not be enough. With fake news, deepfakes, shallow fakes and misinformation already in the public consciousness, we may see a fundamental reshaping of human behavior and cognition. We explore this in our next megatrend: "Future of thinking."

Reframe your future

You have already seen the impact of synthetic media on politicians and celebrities. Now it's time to consider the threats posed by disinformation, misinformation and deepfakes on your business — from operations and marketing to employees and customer perception. New authentication tools and techniques will need to become part of your broader cybersecurity arsenal to safeguard your brand reputation, customer loyalty and revenue streams.

Where to begin: critical questions

▸ How will your risk management framework and strategy need to change to account for and mitigate the threat of synthetic media?

▸ What technological and non-technological approaches will you take to help your customers and employees distinguish authentic information from fakery?

Future of thinking

Phone addictions and filter bubbles are so 2019. How will AI, deepfake videos and autonomous vehicles change mental faculties — and transform workers and consumers?

Technology is profoundly changing how we think. Yet while we've all experienced the dramatic effect that social media and smartphones have on behavior and cognition, there could be even broader effects from the coming wave of human-augmentation technologies, such as AI, robots and autonomous vehicles. This will create significant challenges for not only us as individuals, but for companies and governments in terms of how they interact with customers, employees and citizens.

Your brain on today's technology

Here's a short list of ways our minds are shifting as mobile devices proliferate and we become more and more dependent on social media:

Addiction

We can't put our smartphones down, to the point where the condition now has its own name: nomophobia. A survey found 66% of British adults are addicted to their phones.[34] The average millennial checks their phone 150 times a day.[35] Parents are increasingly concerned about the effects of smartphone addiction on children and adolescents. Our analysis shows that news coverage of smartphone addiction and youth development increased by 251% from 2017 to 2018.[36] There is emerging evidence that smartphone addictions have a deleterious effect on mental health, including correlations with increased depression and suicidal behavior.[37]

Polarization

A big reason our phones are so addictive is that they have become the primary means by which most of us use social media platforms. And we increasingly use social media platforms not just to connect with friends, but to get our news – which is also why social media is being associated with other worrying trends, such as growing polarization and declining social trust. Pew Research data finds a sharp increase in political polarization in the US since the mid-1990s, and similar trends are occurring in other parts of the world. Social media is not the only factor behind these shifts; they were underway before social media emerged, and developments such as growing economic inequality and the fragmentation of broadcast and print media have likely played a role as well. But social media's echo chambers and filter bubbles make it easier to widen schisms between segments of society.

Perhaps this should never have come as a surprise. The business model of social media gives users free access, then depends on maximizing and monetizing user engagement to earn a return. Through millions of real-time experiments, programmers and designers have honed ways to do just that. As a result, social media apps, and the phones on which they reside, have ended up designed in ways that lead to dopamine-fueled addictions – from "infinite scroll" feeds to delayed notifications to algorithms that maximize engagement by serving up ever more extreme content.

Critical thinking

We may also be witnessing a more fundamental shift in how we analyze information, interpret it and even distinguish fact from fiction.

Consider that the Edelman Trust Barometer finds about 6 in 10 people, across 27 countries, are no longer sure what's true and what's not.[38] This is astonishing at a time when practically all the information in the world is instantly accessible to anyone with a smartphone in their pocket. Part of the problem, of course, is that our mobile devices have not just given us access to information; they also enabled the proliferation of misinformation and disinformation.

This can range from the simply absurd – such as the growing popularity of flat-earthism – to genuinely dangerous, such as the anti-vaccine movement. As

vaccination rates have fallen, diseases once under control have come roaring back. There is, of course, broad consensus in the scientific community that our planet is indeed spherical and that the safety and efficacy of vaccines far outweigh their risks. But one result of declining trust is that many people no longer trust the experts with PhDs and medical degrees.

These trends were on display even in the depths of the COVID-19 pandemic. While social media platforms made a concerted effort to disseminate factual information and tackle fake news, misinformation was still prevalent. Even in the face of a lethal pandemic, many individuals proved susceptible to conspiracy theories and pseudoscience. While the pandemic forced political opponents to join forces and close some gaps, the response to the crisis

Coverage across mis- and disinformation increased 93% in 2019

Legend:
- Anti-vaxxers
- Deepfakes
- Disinformation (fake news)
- Conspiracy theories
- Other

Year	Other	Conspiracy theories	Disinformation (fake news)	Deepfakes	Anti-vaxxers	Total
2016	25	144	48	9	14	229 Articles
2017	19	107	96	22	33	273 Articles
2018	21	125	83	48	21	297 Articles
2019	23	120	103	115	212	573 Articles
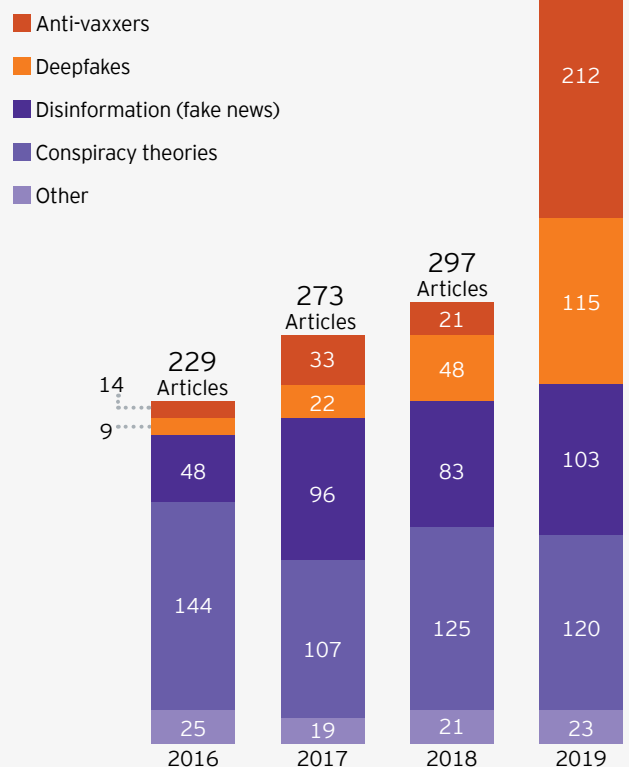
Source: EY analysis using the Quid platform

remained somewhat polarized in the US, where the acceptance of facts and seriousness of response was correlated with political affiliation.

These developments have been getting attention in recent years. Our analysis finds that in 2019, the news coverage of fake news and conspiracy theories increased by 93%, after remaining relatively flat the three years prior.[39]

Other cognitive abilities

Our ability to focus might similarly be declining. A 2019 study by researchers at the Technical University of Denmark suggests attention spans are shrinking globally[40] – not surprising, perhaps, at a time when much of our communication has been reduced to short tweets and text messages, and when we are constantly distracted by the beeps and chimes of alerts. Similarly, researchers at McGill University have found evidence that increased dependence on GPS may reverse the navigational capabilities – and enlarged hippocampi – drivers used to acquire when they navigated using printed maps and mental compasses.[41] Finally, a meta-study at the University of North Dakota found reading online is linked with lower retention of information.[42] Even more noteworthy, this trend is visible across all age groups, refuting the conventional wisdom that younger generations have a greater ability to learn on digital media.

Here comes human augmentation

This is probably a partial list – and almost certainly a partial understanding – of what's happening. Researchers are only just starting to study the effects of social and mobile technologies on our thinking and behavior. Meanwhile, technology marches on. It's worth considering, and preparing for, the effects the next generation of innovation might have on our cognitive abilities.

Consider how social media has undermined our ability to discern truth, enabled by technologies that make it easy for anyone to create deceptive articles or doctored photographs. So far, video has remained beyond the reach of the fake news merchants, but with the emergence of deepfakes, that's rapidly changing. How much more will our ability to tell fact from fiction be damaged when deepfake videos become mainstream? Or consider how autonomous vehicles will likely build on the effects of GPS to undermine both our ability to navigate and our ability to drive. It's conceivable that today's youngest children may live their entire lives without ever taking a driving test or consulting a map, whether printed or digital.

Finally, consider what brain-machine interfaces might do. While the prospect of communicating directly with computers using brain waves sounds like science fiction to many, researchers have made noteworthy strides toward this frontier. It's hard to tell what technologies that interface directly with our brains might do to human cognitive abilities, but they'll surely impact how we think.

We are already seeing the effects of social media on societal cohesion and democracy. What will the next generation of technologies do to informed citizenship, trust and our shared sense of reality?

The upside of mental disruption

The picture isn't all doom and gloom. While technology may be negatively affecting our mental capabilities in some ways, it is also giving us instant access to vast amounts of information and computing power. The technologies discussed here generate huge benefits for users, including convenience, connectivity and mobility. They enable positive changes in our thinking and behavior, from motivating people to lead healthier lifestyles to empowering them to save more for retirement (for more, see "Behavioral revolution" in *Megatrends 2016*). Our goal is not to deny such benefits, but to focus on a troubling set of risks.

Some are taking steps to curtail these risks. For instance, researchers in Australia have developed a new font, Sans Forgetica, designed to help users retain information they read online. New apps and smartphone features allow users to measure and limit the amount of time they spend on their devices. Social media networks are making positive moves, such as hiding "likes" on users' feeds and banning deepfakes. These are all encouraging steps, but they are dwarfed by the scale of the problem. More needs to be done.

Implications

We are already seeing the effects of social media on societal cohesion and democracy. What will the next generation of technologies do to informed citizenship, trust and our shared sense of reality? While disinformation campaigns have so far most visibly attacked elections, it's very likely that they will soon target companies as well. Imagine a deepfake video impersonating a CEO to drive down the company's stock price or a viral disinformation campaign that refuses to die.

More fundamentally, companies will be affected as these trends reshape stakeholder behavior, from employees to consumers to investors. Corporate talent and human resources leaders will struggle to motivate employees to function at their highest capacity amid technology addictions and dwindling attention spans. Marketing functions will need to fundamentally rethink branding and advertising if consumers become increasingly dependent on technology to make their purchasing decisions. Investor relations and public relations functions will need to be vigilant against new forms of disinformation, requiring skill sets that these departments likely do not possess today.

The future of thinking will require rethinking by companies, governments and all of us.

Reframe your future

People – customers, employees and investors – are key to the success of your enterprise. From marketing to human resources to investor relations, you have entire functions dedicated to understanding and influencing these stakeholders. What if every assumption and insight you have into these groups of individuals is up for question? How is technology reshaping the cognitive abilities of your customers, employees and investors?

Where to begin: critical questions

▸ How much productivity are you losing to shrinking attention spans and social media distractions?

▸ How prepared are you for next-generation cyber attacks that use weaponized disinformation or deepfake videos?

▸ At a time of diminishing trust, how will you ensure that you remain trusted by your key stakeholders?

Work and life unbounded

Imagine a world without weekends, colleges replaced by lifelong learning, and 30-year-old retirees and 70-year-old workers. Are you ready for the unbounded future of work, leisure and learning?

The boundaries that define our lives are shifting to an extent not seen in generations – blurring work, leisure and learning, and enabling profoundly different approaches to each. We are moving to a future in which individuals will adopt a portfolio approach, repeatedly rebalancing their mix of these three activities according to changing life circumstances.

Entrenched norms govern the time we spend on these activities today. Why do we choose to concentrate on learning in the first couple of decades of life? Why do we roughly work eight hours each weekday, then take two days off? Why do we retire when we do?

Relative to the arc of human history, these norms are recent developments, relics of the last industrial revolution. They're not permanent and unchanging and, indeed, a radically different future of work promises to completely reshape them, bringing profound implications for individuals, businesses and societies.

Norms are changing

The four major components of life's portfolio – work, leisure, learning and retirement – have already been changing in recent years, presaging even bigger shifts ahead:

Work

The century-old norm of the eight-hour workday and the five-day workweek is shifting. Across the rich, industrialized member states of the Organization for Economic Cooperation and Development (OECD, the average number of hours worked per year fell by 11% between 1970 and 2018.[43] But this downward trend is not as visible in the developing world; in 2019, Chinese technology entrepreneur Jack Ma attracted considerable attention for espousing the "996 system," in which workers work from 9:00 a.m. to 9:00 p.m., six days a week.[44]

Leisure

As work has become less bounded, so too has leisure time. Among elite professionals, being busy has frequently become a badge of honor. Smartphones today ensure workers are "always on," and this blurring of work and leisure has even spurred French legislators to respond with a "right to disconnect" law in 2017.[45] For low-income individuals, work has seeped into leisure in other ways. Growing income inequality and the escalating cost of living are compelling many to take on multiple jobs to make ends meet. Longer commute times, fueled by a global affordable-housing crisis and unsustainable migration to the cities of the developing world, have created a new class of "supercommuters" for whom long commutes have cannibalized leisure time.

Retirement

The norm of retirement, the biggest block of leisure time for many, is changing as well. As people live longer and remain healthier, some are choosing to work well into their silver years. Financial necessity is also fueling this "unretirement" trend, with millions worldwide projected to outlive their retirement savings by decades. Yet as some work longer, others are retiring earlier. The Financial Independence, Retire Early (FIRE) movement has gained traction as a small but growing cohort of people attempt to live frugally, save aggressively and retire in their 30s or 40s. Our analysis shows a tenfold increase in media coverage of the FIRE movement between 2016 and 2019.[46]

Learning

The norms that anchor our educational systems were originally created to churn out armies of workers for industrial-era factories. Those norms are shifting gradually. While the education sector has been slow to change overall, there are promising pockets of innovation. For instance, the adoption of educational technology is empowering students to learn in customizable ways and putting teachers to their best use.

The unbounded future

What lies beyond? The future of work, leisure and learning is much more than the sum of these individual shifts. It promises to undo the boundaries between work, leisure and learning, fundamentally reshaping the institutions and norms we take for granted – from higher education to weekends to retirement savings.

Nine decades ago, economist John Maynard Keynes forecast that technology would soon allow people to work 15 hours a week. That never happened, but the scale of technological disruption ahead may finally bring Keynes' forecast to fruition. Automation has the potential to significantly reduce the amount of time spent on work, albeit by inevitably taking over much work traditionally done by humans. That will theoretically allow us to focus on more creative and nuanced work, leaving drudge labor to machines, while technology's enablement of more flexible, on-demand working arrangements promises to further erode the boundaries of the nine-to-five workday.

The COVID-19 epidemic has blurred the boundaries between work and leisure in other ways. As social distancing mandates went into effect across much of the world in March 2020, large segments of the working population moved almost overnight to remote work models. While the technologies enabling this shift had been around for years, their adoption had been spotty. In the wake of the crisis, companies and workers put unprecedented effort into adopting remote work.

These developments are likely to be sustained beyond the pandemic. Over time, they will have profound implications for the future of work, affecting everything from team building to the demand for commercial real estate. For many workers, these shifts also had an immediate impact on the structure of time. As commutes disappeared, workers gained a leisure dividend in their daily routines. But this windfall has been accompanied by other complications – the challenge of demarcating personal and work domains, declining motivation, and feelings of isolation – highlighting issues that will need to be addressed in a more virtual future of work.

The trends disrupting work will also reshape the norm of shared time off. The erosion of the five-day, 40-hour week could eliminate the concept of weekends as we know them. The norm of giving the vast majority of society the same two days off helps build social cohesion, and its loss could undermine social capital at a time when it is already being depleted (for more, see our article on "Mending social fabric").

Within a generation, the concept of retirement could be fundamentally redefined. Retirement may no longer be a back-loaded, monolithic block. A world of more flexible work arrangements could give many the ability to unbundle retirement, and take time off for leisure activities along the way – moving from retirement to "pretirement." This assumes, of course, that people have the financial means to retire early or take significant chunks of time off, which will require measures to moderate economic disparities as well as new financial planning and benefits programs. Meanwhile, as many stay in the workforce beyond traditional retirement ages, work cultures will need to evolve.

The biggest shake-up could be in learning. The education sector is largely tradition-bound and slow to change, but our legacy educational institutions will soon find themselves increasingly misaligned with the future of work. To remain relevant in a world of ever-faster disruption – in which the average worker may have not just multiple jobs, but multiple careers, across their lifetime – education will be transformed to become truly lifelong. Individuals will take time off for learning repeatedly over the course of their lives. And businesses will play a central role in this new learning ecosystem. No wonder interest in lifelong learning is increasing: our analysis shows while coverage of the future of education was relatively flat between 2016 and 2019, articles about lifelong learning increased by more than 250% during the same period.

To remain relevant in a world of ever-faster disruption, education will be transformed to become truly lifelong.

Interest in lifelong learning has increased significantly in recent years

- ■ Lifelong/continuous learning
- ■ Future of education

	2016	2017	2018	2019
Total	1,004 Articles	1,267 Articles	1,574 Articles	1,756 Articles
Lifelong/continuous learning	29% 287	37% 468	45% 706	57% 1,007
Future of education	71% 717	63% 799	55% 868	43% 749
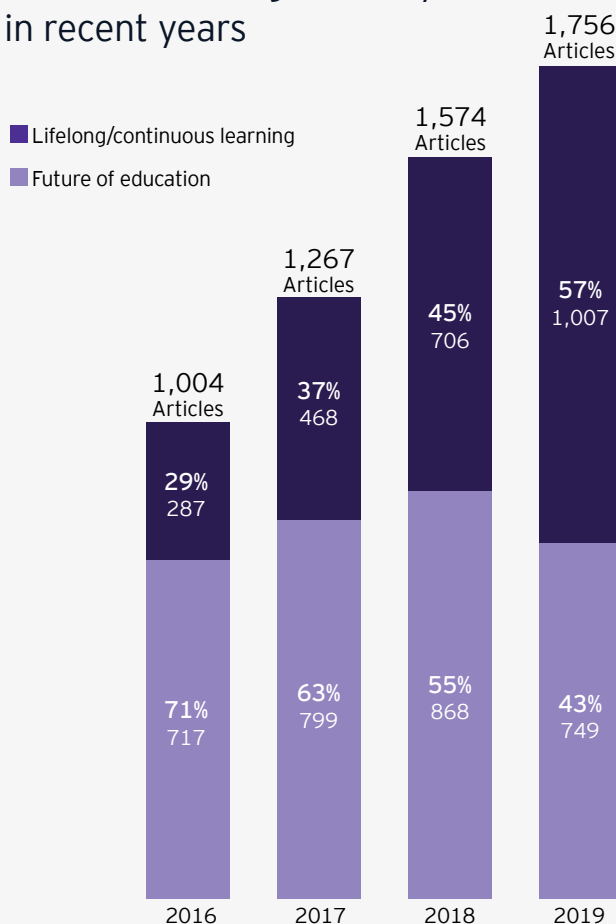
Source: EY analysis using the Quid platform

Opportunities and challenges

This vision of the future brings profound challenges for societies, governments, businesses and individuals.

For one, it is not clear that large amounts of leisure time will be good for life satisfaction and social cohesion. People need a certain amount of work to remain happy and healthy. What new mechanisms will we develop to keep individuals engaged and productive? Public policy will have a role in addressing transitional challenges and distributional impacts. How will we equip workers to reinvent themselves repeatedly? How will people make ends meet in a world with less work? Given the early experience with the gig economy, how will we ensure new work models are empowering and not exploitative? How will we address the prospect of widening economic inequality?

> Being finally unshackled from the nine-to-five day may even induce a societal shift in how we sleep.

Addressing these societal challenges will create opportunities for business. We are already seeing, for instance, new business models emerging to provide specialized services to meet the unique needs of gig workers: our analysis found that funds invested in banking for gig economy workers rocketed by almost 6,500% in 2019.[47]

For employers, this future presents huge opportunities – and significant challenges. Companies will have an unprecedented opening to boost purpose, job satisfaction and productivity. As drudge labor is offloaded to machines, humans can focus on work that is truly satisfying. Being finally unshackled from the nine-to-five

day may even induce a societal shift in how we sleep – the norm of sleeping in a single eight-hour block is another artifact of the Industrial Revolution, and returning to historic patterns of biphasic or polyphasic sleep would better align with our natural circadian rhythms, while paying dividends for mental health and worker productivity.

Employers will also fundamentally rethink their approach to talent and the workplace. To thrive in this fluid ecosystem, companies will need adaptive workforces and environments, making workforce agility and the workforce experience critical competitive differentiators. In the wake of the COVID-19 pandemic, this will extend not just to the physical workspace, but to the increasingly virtual and remote environments in which teams now operate. Achieving this will require developing new solutions that enable teaming in increasingly flexible ways. It will involve creative work arrangements that give employees the ability to repeatedly rebalance their work and life portfolios. A world in which pretirement becomes increasingly popular will also demand new approaches to financial planning based on near-term flexibility and not just long term security. Lastly, companies will play a key role in reinventing learning, making it continual, flexible and customizable to individuals' changing needs.

Some of the biggest implications for businesses may lie beyond their walls. While an unbounded future of work will create tremendous opportunity and flexibility, it will also bring significant dislocation in the lives of individuals. Corporate leaders will increasingly be called on to help mitigate these impacts. How will companies help share the cost of lifelong learning and retraining programs? How far will they go in helping not just their employees, but gig workers, laid-off workers and society at large? To fully realize the upside potential of an unbounded future of work, leaders will need to find answers to these questions with courage and creativity.

Reframe your future

How you optimize and manage your workforce – from recruiting to training to retirement planning – is based on the ways in which work, learning, leisure and retirement have traditionally been structured. Now, those structures are becoming reshaped, creating the impetus and the opportunity to fundamentally rethink the work environment, approaches to learning and the meaning of retirement in ways that are better aligned for the future of work.

Where to begin: critical questions

- ‣ How are you reinventing learning to be continual, flexible and customized?
- ‣ How are you preparing workers for a fluid future of retirement?
- ‣ How do you build employee experiences that transcend the physical boundaries of the work environment?

Microbiomes

Harnessing the capabilities of microorganisms will help solve our biggest challenges and create innovation opportunities across industries.

All visible life depends on organisms we can't see: multitudes of microorganisms such as bacteria, archaea, fungi, viruses and nanoplankton. This invisible life inhabits microbiomes in the soil, air, oceans and buildings, as well as on and in plants and animals, including humans. Half of the earth's oxygen comes from the ocean microbiome. Microbes in the soil sequester carbon. The human gut microbiome plays such a large role in our physical and mental health that it's considered a "virtual organ." And we've long harnessed microbiomes – think yeast for bread or wine, or bacteria for cheese or yogurt.

What's changed? While we already enlist microbes for myriad tasks including making antibiotics and insulin, turning biomass into biofuels, and purifying wastewater, the emergence of a powerful set of tools is enabling us to not just better understand and mobilize the microbiome, but supercharge it. Metagenomics, for instance, rapidly sequences the deoxyribonucleic acid (DNA) of an entire microbiome to identify its constituent organisms and genetic makeup. Metabolomics identifies all chemicals produced by a microbiome in real time. Synthetic biology imbues microorganisms with new functions and capabilities (see also "Synthetic biology"). And big data and AI analyze large volumes of genetic data and undertake predictive modeling.

Small but mighty

These advances are just in time, too, because microbiome applications could play a critical role in solving severe global challenges. From mitigating climate disruption to treating chronic disease, microbiomes present companies with opportunities to address challenges with new products, services and operational approaches. How can microscopic organisms help solve problems of such scale? It is possible by taking advantage of their natural, alchemist-like ability to turn one substance into another and supercharging it with synthetic biology.

The climate challenge

Innovative companies have gene-engineered microbes in the fight against climate change to turn CO_2 and methane into carbon-neutral, or even carbon-negative, commercial biochemicals and materials. Newlight Technologies, for example, utilizes microbes to produce carbon-negative thermoplastic for bottles and parts. Photanol and Phytonix repurpose cyanobacteria – the ones in the ocean giving us oxygen – to photosynthesize valuable chemicals. Researchers in Israel recently evolved bacteria to live on a diet of CO_2 directly from the air, opening a path to carbon-neutral food, fuels and other products at new scales.[48] The climate crisis and the opportunity for negative emissions are explored in the "Exponential climate change" and "Decarbonization" sections.

Last year **US$621 million** was invested in startups pursuing microbiome solutions related to climate and agriculture.

Climate disruption exposes crops to extreme heat, drought, heavy rainfall, flooding and saltwater incursion from sea rise. Yet, agriculture will have to produce 56% more calories to feed the world's population by 2050.[49] One way to increase agricultural productivity while reducing climate impacts is to promote the symbiotic relationship between plants and microbes in the soil to improve nutrient uptake and resilience. Mammoth Microbes, for example, deploys a consortium of four soil bacteria that release enzymes making it easier for plants to absorb the phosphorus in fertilizer. Pivot Bio focuses on providing nitrogen, another key nutrient, through root-colonizing microbes gene-edited to enhance their nitrogen-fixing properties.

Crop productivity improves as a result of soil probiotic applications such as these, while farmers save money because they can apply less synthetic fertilizer. Less fertilizers mean fewer greenhouse gas emissions, while improved soil quality allows the earth to sequester more carbon. Developing markets, most vulnerable to climate change and most farming-dependent, stand to benefit from microbiome solutions that result in hardier, more productive crops that require fewer inputs.

Even cows present an opportunity. If the global cattle herd were a country, it would be the world's third-largest greenhouse-gas emitter because of its production of methane, a gas that traps 30 times as much heat as CO_2. Cows are also very inefficient at converting their feed into food for humans, which will present a problem as meat and milk demand is likely to double by 2050 as the world becomes more populous and wealthier.[50] The cow's gut microbiome, source of the methane, could also be the solution. Researchers recently found that a small subset of a cow's microbiome influences methane emissions and milk productivity. More importantly, a low-methane, high-milk production microbiome is a heritable trait – some cows just have it in their DNA. This opens the door to targeted changes in the bovine microbiome and breeding for more efficient and climate-friendly cows.[51] (Further insights into food and sustainability can be found in this article on "Food by design" from the *Megatrends 2018* report.)

Money is following opportunity: last year US$621 million was invested in startups pursuing microbiome solutions related to climate and agriculture, according to our analysis.[52]

Human health and performance

A growing body of research links an imbalance in the gut microbiome to diseases affecting billions of people, with enormous costs in terms of medical spending, lives lost and diminished quality of life. Microbiome-influenced illnesses include type II diabetes, cancer, food allergies, a variety of inflammatory diseases (such as asthma, multiple sclerosis and rheumatoid arthritis), Parkinson's disease, obesity, autism, depression and anxiety.

A number of biotechs are pursuing potential therapies. These range from individualized microbiome-based diets to prebiotics that nourish desirable microbes, probiotics that introduce beneficial species and applications that target the gut-brain axis. Annual investment in microbiome health and wellness startups has risen by 1,600% to US$863 million since 2010, our analysis shows.[53] Given the huge potential upside, large pharmaceutical companies are moving into the space through investments and partnerships. We can expect to see increasing numbers of microbiome therapies come to market.

And the adage that an army marches on its stomach could be truer than ever imagined. The U.S. Army is investigating how stress affects the composition and metabolic activity of troops' gut microbiomes and the resulting impact on their performance, while another research stream looks at how the microbiome could help maintain troop health and cognition at high altitudes. The aim is to develop prebiotic or probiotic foods to help maintain troop health and performance in the field. If the Army is successful, applications in sports and other physically demanding occupations won't be far behind.

The built environment

As the world's population continues to urbanize, people moving to cities are for the first time interacting with an urban built environment suffused with pollution, adopting a more Westernized diet, increasing antibiotic use and changing hygiene practices.[54] There is evidence that the microbiomes of new city dwellers become less diverse and converge on the Westernized microbiome that has been linked to certain health problems.

Each room in every building hosts a unique microbiome affected by its human occupants and their activities; heating, cooling and ventilation; plumbing and the outside air. Building microbiomes are so distinct that one startup, Phylagen, offers a global supply chain authentication service based on the microbial fingerprints of suppliers and shippers. The company establishes the DNA fingerprint of the entire microbiome at manufacturing facilities and intermediate stops along the way to consumers. Each of those fingerprints can then be detected on authentic products at the end of the chain, avoiding the need for physical tags.

The onset of the COVID-19 pandemic has sparked growing concerns about the possible presence of the virus in the microbiome of the built environment. In response, a biotech company has developed an RNA-based COVID-19 test for businesses to test objects, such as door handles, pin pads and handrails, that could carry the virus. The not-for-profit MetaSub Consortium, which samples and conducts metagenomic analysis of the microbiomes of cities, subways and beaches worldwide, has prioritized looking for COVID-19. As a result of the pandemic, we will likely have much greater visibility into the microbiomes of our shared spaces and a much better understanding of whether they harbor any potential threats to human health.

Annual investment in microbiome health and wellness startups has risen by **1,600%** to **US$863 million** since 2010.

Tapping the biochemical potential of the microbiome

The global microbiome is a vast reservoir of genetic diversity that has been described as a "biochemical treasure chest."[55] Microbes produce secondary metabolites, biochemicals generated in response to their environment. These give us products worth billions annually: antibiotics, antitumor agents, cholesterol-lowering drugs, pigments, flavorings, nutraceuticals, bioherbicides, bioinsecticides and enzymes used in a variety of industries.

Yet, this biochemical potential has been hardly tapped because wild microbes usually don't produce secondary metabolites once put in the laboratory setting. Also, genetic engineering tools have traditionally been tailored to individual microorganisms, requiring a slow, one-at-time approach to testing.

This is changing as synthetic biology unlocks the biochemical potential of the microbiome (see also "Synthetic biology"). For example, a team at Lawrence Berkeley National Laboratory has developed genetic engineering tool called chassis-independent recombinase-assisted genome engineering (CRAGE) that accelerates the discovery of valuable secondary metabolites. CRAGE enables researchers to transfer groups of genes from one microorganism to many other potential production hosts simultaneously. By compressing the design-build-test cycle, CRAGE makes it possible to quickly identify the organisms that will produce in the lab and the ones best-suited to particular jobs (such as producing biofuels at scale). One immediate application is speeding the search for new antibiotics, given growing drug resistance and the lack of new products in the pipeline.

Arrival of the microbiome era

Our ability to harness and enhance the powers of the microbiome is rapidly accelerating. In the next decade, we can expect the microbiome to become an important part of the solutions to our global sustainability challenges. We can also expect the microbiome to play a bigger role in the innovation of nearly every industry. Above all, we'll be surprised by what emerges from the microbiome's biochemical treasure chest as it's explored in greater depth.

Growing microbiome innovation

The past decade has seen a growing wave of microbiome innovation. The annual number of global microbiome-related patents grew by 233% over the past 10 years, reaching 613% in 2018, according to an EY analysis of Quid data. A total of 3,748 patents were filed from 2009–18.

Microbiome patent applications 2009–18

Health and wellness — 72%
Agriculture — 17%
Climate change — 7%
Manufacturing — 4%
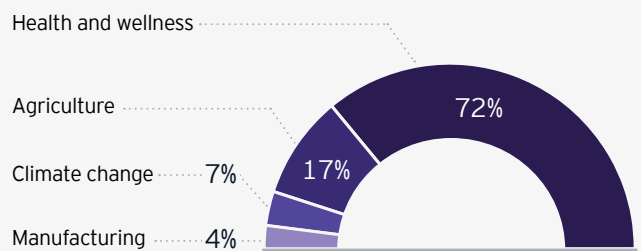
Source: Quid; EY analysis

Growing microbiome investment

Annual microbiome financing has more than doubled since 2010.

2010	2019

Microbiome startup investment: $0.6b → $1.6b
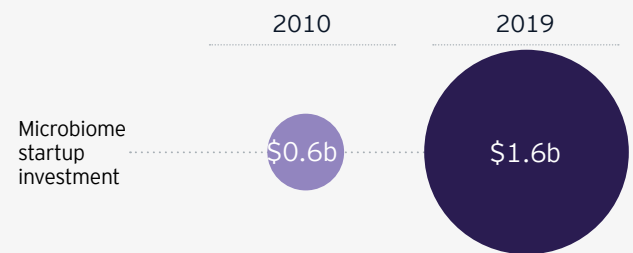
The most money went to health and wellness during this period.

Microbiome investment 2010–19

$3.6b Health and wellness
$3.5b Climate and sustainability
$1.6b Industrial
$1.5b Agricultural
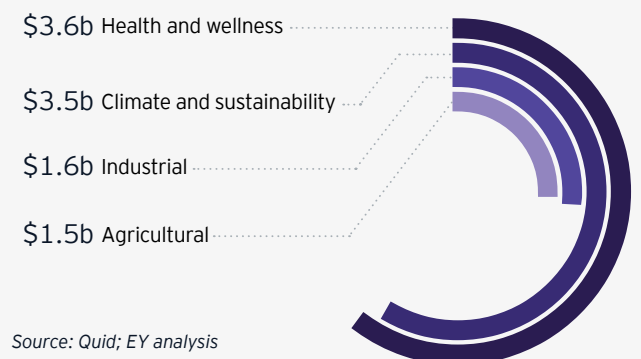
Source: Quid; EY analysis

Reframe your future

When you think of microbes – if you think of them at all – it's most often as the enemies of human health or as the helpers in food and beverage production. But these ubiquitous, innumerable organisms are essential to global human and environmental sustainability. Their vast genetic diversity represents a biochemical treasure chest for applications across industries. Innovations that work with, not against, microbiomes and unlock their potential with synbio can help solve both your business challenges and humanity's global challenges.

Where to begin: critical questions

▸ How could innovations using the microbiome's "biochemical treasure chest" improve the sustainability or performance of your company's products and operations?

▸ How could you expand your innovation ecosystem to encompass the microbiome?

Synthetic biology

Our ability to read and rewrite the code of life is transforming the way we treat illness, make things and feed ourselves.

You awaken to subtle changes in your window shades, as their embedded protein-based sensors adjust to the rising sun. Slipping on faux-spider silk pants and lab-grown leather shoes, you're hit by the aroma of woolly mammoth steak and hen-free eggs. Grabbing coffee with cow-free milk, you hop into your car furnished with bioplastics and powered by biofuel made from the waste gases generated when the metal in its body was forged. On your drive, you smile, knowing the gene-tailored medicine you took is keeping at bay the Alzheimer's that runs in your family. And it's a big day: you're revealing how your company's vast digital archives can be safely stored for millennia on a DNA-based device the size of a sugar cube.

This isn't science fiction. It's not far away, driven by synthetic biology (synbio) — or what many call this century's equivalent of computing, given its potential to reshape our world. As Steve Jobs put it, "The biggest innovations in the 21st century will be at the intersection of biology and technology. A new era is beginning."[56] Synbio is transforming the way we treat illness, make things and feed ourselves.
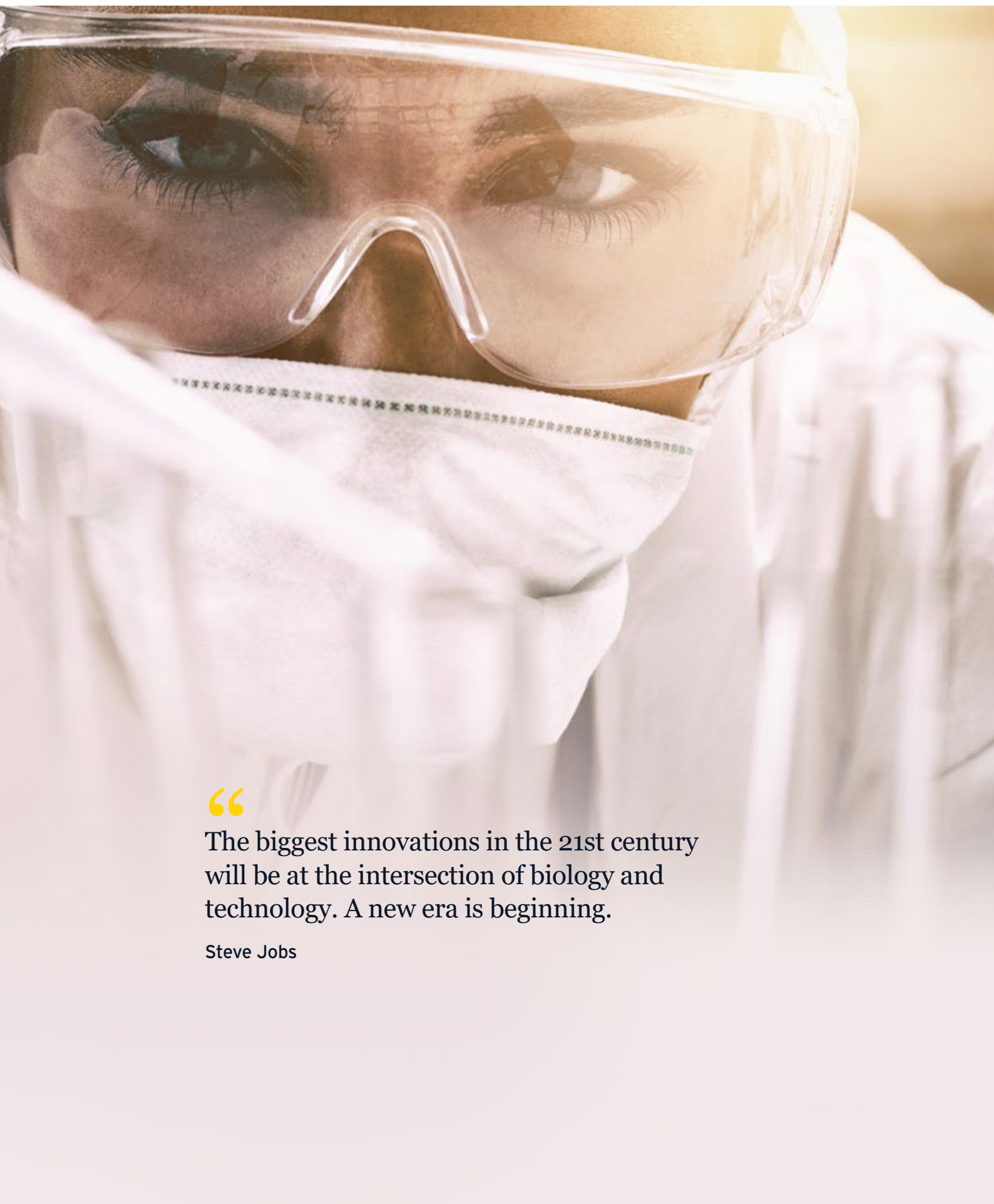
> **"**
> The biggest innovations in the 21st century will be at the intersection of biology and technology. A new era is beginning.
>
> Steve Jobs

Reading and rewriting the code of life

How does synbio bring to life innovations like these? Synbio is an interdisciplinary science that uses an engineering approach to biology to design and build functions in cells. At the heart of synbio are tools for reading and writing DNA, the code that drives cell operations. The synbio approach also standardizes biological parts and systems to copy, change and scale genetic innovations much more quickly than legacy genetic engineering methods.

What's fueling synbio's moment?
Four technological advances:

▸ The rapidly declining cost, and increasing speed, of DNA sequencing and synthesis

▸ Machine learning's ability to crunch data to identify ideal DNA configurations for products or processes

▸ Editing tools, such as clustered regularly interspaced short palindromic repeats (CRISPR), that can snip and combine new genes quickly, with surgical precision

▸ Emerging public and private "biofoundries" that enable affordable, standardized, plug-and-play genetic designs that can be copied or tweaked for multiple purposes

For a sense of the speed of change, consider that the first sequencing of the human genome required 13 years and US$3 billion; today, it takes a week and US$600.[57] This increasing speed and power drives the agile design-test-build-learn-based work synthetic biologists have adopted from the coding world.

The GP-Write Project, an outgrowth of the Human Genome Project involving hundreds of scientists, aims to make our ability to synthesize (write) human and other large-scale genomes as fast, powerful and cheap as our ability to sequence (read) them. Achieving this will supercharge progress in human health and magnify synbio's impact across industries.

The speed and scale are democratizing synbio. Already, high school students are conducting CRISPR-based experiments in class using synbio educational kits and participating in boot camps to learn how to tap into the field's vast potential. Community biolabs that strive to expand access to synthetic biology are organizing workshops around the world. Public labs take a sharing economy approach, providing the essential tools and infrastructure. Small groups with small budgets can now create products with powerful impacts, such as the mobile malaria-testing kit piloted in Africa.

Innovators are seizing the opportunity. Our analysis shows that annual private investment in synbio reached $US4.4 billion in 2019, an increase of 310% since 2010.[58]
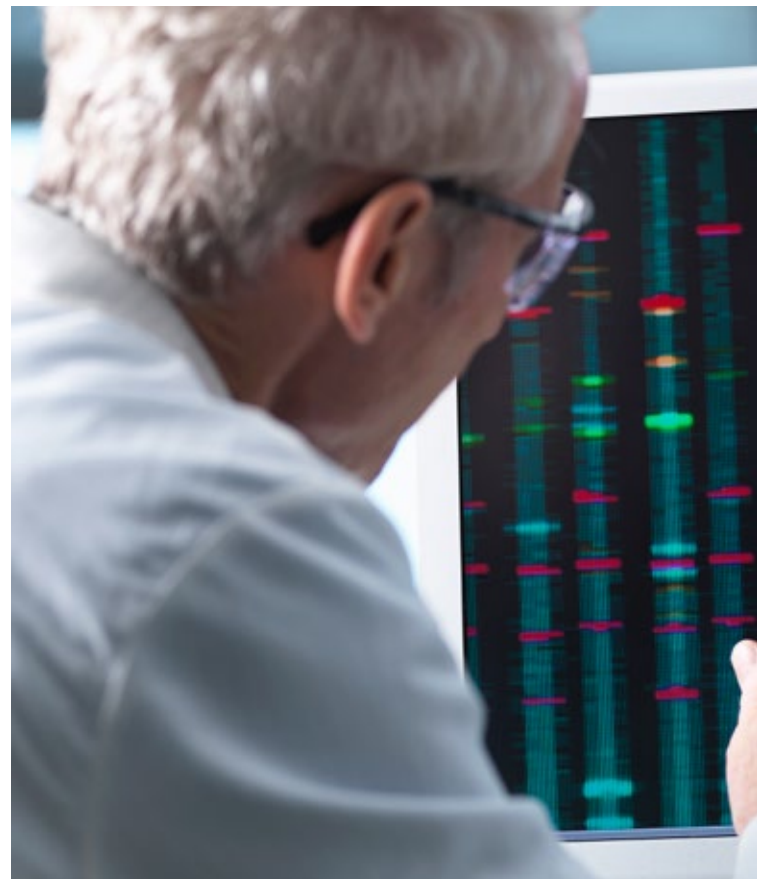
Synbio's revolutionary business potential

Synbio applications are poised to disrupt the world's largest industries, such as health care, food and chemicals, even as they help us address chronic disease, climate change, food security and other pressing global challenges.

Personalized therapies

We will likely look back with incredulity at today's standard therapies for chronic disease and genetic disorders. Synbio promises smart, personalized health care applications, from editing out cystic fibrosis genes to tweaking bacteria in the gut biome to address metabolic diseases.

One major stream of work surrounds efforts to cure cancer — the annual number of synbio patents focused on cancer rose fivefold between 2013 and 2018, according to our analysis.[59]

CAR-T cell therapies coming to market genetically modify a patient's T cells to recognize and attack the patient's specific cancer cells. Biotech startup Humane Genomics is working on a therapy that identifies the unique characteristics of each patient's tumor and then genetically tailors a virus to infect and kill it. Researchers at Stanford Medicine have developed a therapeutic approach called rewiring of aberrant signaling to effector release (RASER) that rewires cancer cells so the hyperactive proteins fueling tumor growth instead kill cancer cells, potentially eliminating or reducing the costs and harmful side effects of chemotherapy.

Personalized gene therapies such as these dramatically change the flows of information and materials in health care. Where today drugs move from factory to patients for mass treatment, tomorrow's individualized genetic therapies will move from patient (cellular material) to factory (personalization) and back to patient (administration) in a process some experts call "from biopsy to bedside." This will require the pharmaceutical supply chain to collaborate in new ways with zero faults while ensuring patient data privacy.

COVID-19 response

Synbio approaches are being quickly deployed in the response to COVID-19. When the pandemic struck, several synbio companies pivoted from developing vaccines for other viruses to focus on the novel coronavirus. Their bioengineering tools and approach has already enabled several of them to bring forward COVID-19 vaccine and antibody candidates faster and with greater potential functionality than classical approaches, which involve creating a weakened or neutralized form of the virus. Because these synbio vaccines don't involve cultivating the virus in any form, their manufacture requires much less space, doses occupy less volume and scaling up production can go faster. If a synbio company is the first, or among the first, in the race to end this pandemic, it will be an important validation of the engineering approach to biology and a dramatic debut to the broader public.

Biosensors

Synbio-powered sensors bring new capabilities to identify diseases and other risks in the body and environment as they emerge. One company recently launched a graphene-based CRISPR chip that detects gene mutations in DNA. While its first application is medical, later it could be used to detect DNA in the environment; a hand-held device, for example, could identify pests in a farm field.[60] Scientists in the UK have developed paper-based biosensors to test for infectious diseases such as Ebola.[61] An MIT team is working on a "wearable laboratory" using synbio to stretch tracking beyond physiological data into measuring hormones, genomes and microbiomes.[62] Pakistan's IGEM team won a prize for developing a genetically modified "reporter fish" that changes color in the presence of heavy metal contamination in water.[63]

Sustainable manufacturing

The synbio era is already here for efficient bio-based manufacturing, offering far more sustainable ways of creating or improving clothing, food, drugs, energy, chemicals, consumer goods and building materials. (The "Decarbonization" article discusses the opportunity to address climate change with new materials enabled by synbio).

Gene-edited microorganisms or cells make possible the production of chemicals and proteins for food, clothes or building materials in ways not found in nature. Think fermentation by gene-edited or modified yeast, bacteria or other microorganisms – the microbiome is the workhorse of synbio (the article on "Microbiomes" explores this intersection in more detail). Some fragrances and flavors are already made this way; so is the malaria treatment artemisinin and most insulin. Now this approach is being used to produce milk and egg proteins, leather like materials, polymers for bioplastics, monomers for bio-rubber, and fuel from industrial waste gases. The metabolic engineering and food companies doing this work received US$634 million in 2019, up 314% over five years.[64]

Like nature itself, biomanufacturing is decentralized. Production can take place close to demand, using local bio-based inputs. This shortens supply chains, cuts energy use, improves resilience and reduces the need for petrochemicals as manufacturing inputs. The efficiency of nature also reduces byproducts and waste because it generates only what is needed.

The U.S. Army, for example, is researching ways to use synbio to produce important chemicals for basics, such as glue and detergent, in forward operating bases rather than depending on factories using petrochemicals in the US thousands of miles away. The US military is investing millions of dollars in these and other synbio initiatives, such as fabric with higher tensile strengths and armor that can detect contaminants.

Optimized food production

Synbio not only produces food in new ways, it also improves the performance, sustainability and resilience of traditional agriculture. Where once agronomists undertook lengthy breeding programs, with CRISPR they can now quickly edit a plant's DNA to optimize productivity, size, disease resistance, flavor, aroma, drought tolerance and other important characteristics. Some crops are already in development, including drought-resistant soy, caffeine-free coffee beans, low-gluten wheat, heirloom-tasting tomatoes and fungus-proof bananas.[65]

Gene editing will improve the characteristics of vegetable proteins in the fast-growing vegetable-based meat category, enhancing veggie versions of hamburgers, sausage and other meat products (see ''Food by Design'' in *Megatrends 2018* for further discussion on the shift to plant-based proteins). And researchers hope to commercialize new crops with CRISPR that reduce reliance on the three crops that provide more than half the world's calories from plants: rice, corn and wheat.

Work is also underway to modify the soil microbiome to reduce the need for fertilizer, improve drought tolerance and minimize pesticide use (see the ''Microbiomes'' section for further discussion of the intersection of synbio and the microbiome in agriculture.)

What leaders need to know

The world's oldest technology − DNA − will become one of the most disruptive over the next decade as humans continue to read and write the operating system of life. Though the science may appear complex, the end is simple. The Fourth Industrial Revolution, as described by The World Economic Forum's Klaus Schwab, anticipates the synthesis of the physical, digital and biological, and synbio provides the final piece of the puzzle.

Governments globally recognize synbio as both an economic opportunity and a means to solve some hard problems. For example, China, Singapore and the UK view synbio as a national industrial priority. Japan has a bioeconomy strategy, and last year launched a global biofoundry. The US calls synbio a priority industry for innovation, employment and sustainability, although it has not yet articulated a national strategy. Similarly, the EU supports a variety of synbio initiatives in pursuit of its innovation, bioeconomy and sustainability objectives, while India sees the need to develop synbio capacity to accelerate its national priorities in biofuels and biopharma.

With so much at stake, moving so fast, what should business leaders do?

Scan and imagine

Start conversations and stress-testing ideas early. Consider the inputs, products, processes or properties that synbio could optimize or replace. What would be the net benefits from the perspectives of supply chain, sustainability, climate risk and customer?

Take an ecosystem approach to expand your horizons. Scan the innovation pipeline to understand the new products and capabilities coming to market. Augment your innovation ecosystem with synbio researchers, investors and innovators. Don't just solve the now and explore the next but devote time and investment to imagining the beyond.

Watch regulations

As with any fast-moving technology with potentially profound impacts, there are regulatory and ethical concerns to consider, from the safety of health care and food to the ethics of human genetic engineering, biowarfare and biosecurity to the potential unintended consequences as synbio organisms are introduced. Industry participants also debate how to balance the intellectual property protection with the benefits of broad adoption of synbio technologies and products.

The global regulatory landscape is multi-speed, varying by geography and application. Cultural attitudes play a large role. As the regulatory questions posed by synbio are settled, new markets and product opportunities will open.

Diverse synbio innovation

Nearly 4,000 synbio patents were filed across several categories over the last decade.

Synbio patent applications 2009–18

- Agriculture and food — 25%
- Diagnostics and therapies — 33%
- DNA sequencing and synthesis — 18%
- Microbiome and metabolic engineering — 15%
- Industrials — 9%
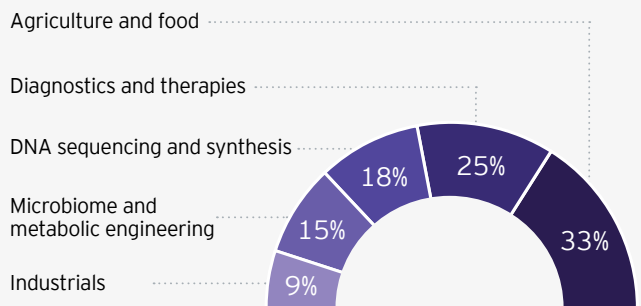
Source: Quid; EY analysis

Surging synbio investment

Annual microbiome financing has more than trebled since 2010.

	2010	2019
Symbio startup investment	$1.0b	$4.4b
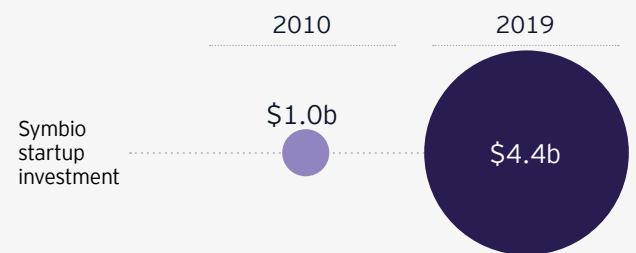
Diagnostics and therapies have been the major focus of synbio investment during this period.

Synbio investment 2010–19

- $14.0b Diagnostics and therapies
- $3.3b DNA sequencing and synthesis
- $2.5b Machine learning and AI
- $1.6b Agriculture and food
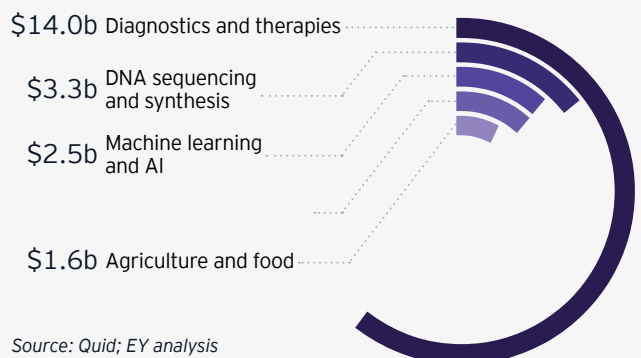
Source: Quid; EY analysis

Reframe your future

In an increasingly digital world, you've come to expect the next disruption in your industry to come from engineering electronic bits and bytes. Now the same approaches are yielding an unprecedented ability to control a much older, biological code – DNA. Drawing on software engineering approaches, and enabled by big data and AI, synbio has become a platform for DNA innovation. This ability to read and rewrite the code of life at scale will have far-reaching impacts across industries.

Where to begin: critical questions

▸ What new possibilities for supply chains, materials, manufacturing, logistics and business models can synbio create in your industry?

▸ What are the innovation opportunities for bringing synbio into your value chain?
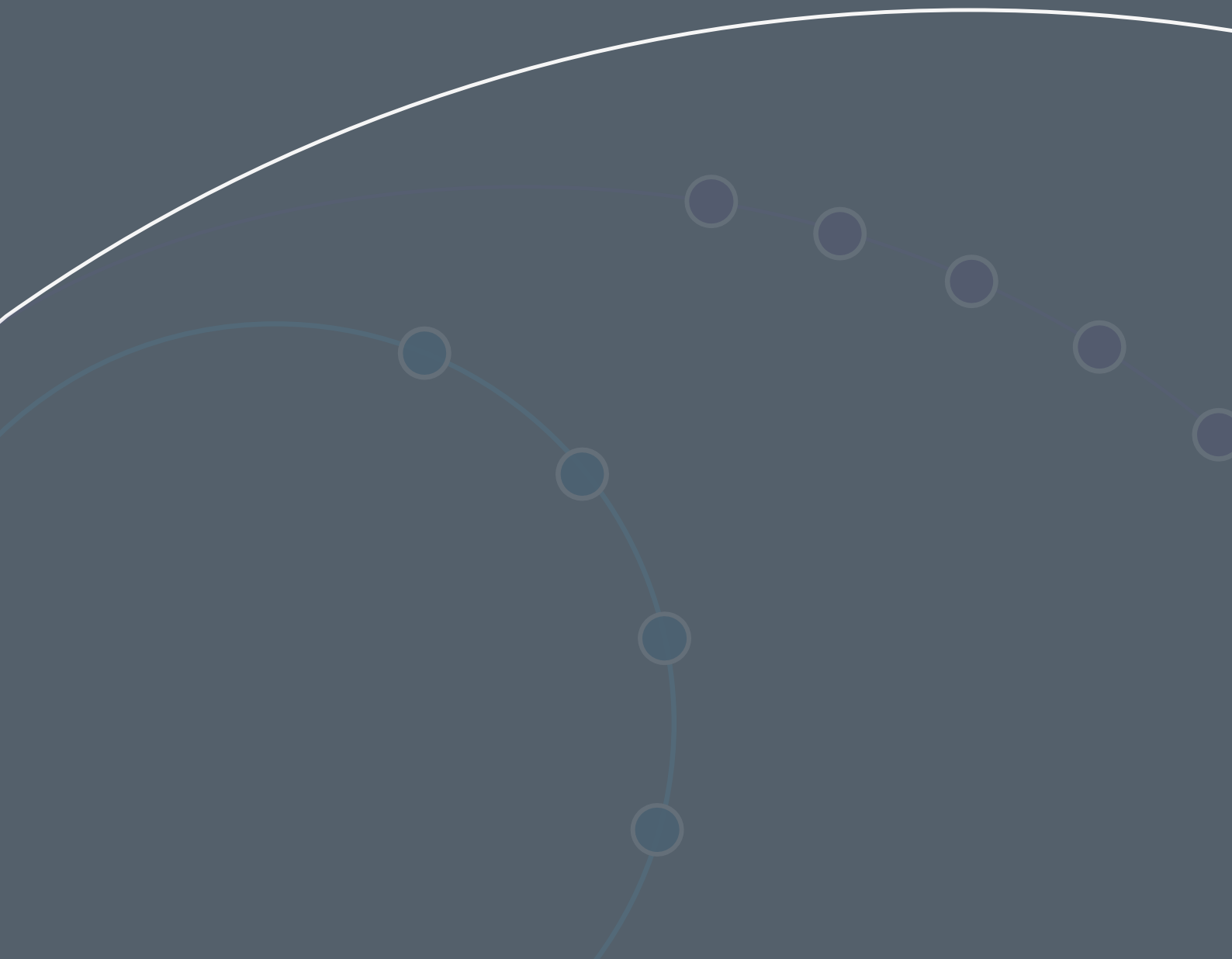
FUTURE WORKING WORLDS

Africa's new century

New economic metrics

Mending social fabric

Future working worlds

The global order

Africa's new century

With supercharged growth and interactive mobility,
Africa is forging its own path to economic development.
Is the continent finally reaching the tipping point?
What's your Africa strategy?

Grand prognostications about Africa seem to surface every few years. Headlines such as, "Why Africa Can Thrive Like Asia"[66] or "Africa Rising"[67] or "Africa is Becoming the New China and India,"[68] seek to will into being the continent's tremendous potential. So far, they've been off the mark. Yet we believe this time is different. Within this decade, Africa will likely hit a unique and unprecedent inflection point of positive economic development for the countries in its rapidly forming regions.

Africa in regions

Because of Africa's vastness, history and proximity to neighboring continents, experts increasingly view the continent through the lens of regions. With a unified and frictionless Africa in a similar vein to the European Union as long term aspiration, economic cooperation and integration will first take place regionally. For instance, the regional currency of CFA franc was initially set up by the French during the colonial days and has now become a catalyst to intra-Africa trade. Moreover, these regional blocs have the added benefit of enhanced bargaining power with foreign countries. (For more, listen to the Africa episode of the *EYQ Better Question Podcast*[69])

Why is it different this time? Because Africa's economy is evolving in an age of supercharged mobility, allowing the continent to escape the traditional model of linear growth (see sidebar, "Solow-Swan model explained"). The combination of technology, globalization and demographics has the potential to supercharge Africa's productivity, allowing its economy to leapfrog the traditional growth trajectory. For companies, this trajectory presents tremendous opportunities – and challenges.

Solow-Swan model explained

For several decades, the Solow-Swan Economic Model has been the framework of choice for economists and policymakers for explaining economic growth. The model suggests countries experience a linear economic path: a "catch-up growth" phase where savings and investment rapidly accelerate economic growth from a low base, followed by a "sustained growth" phase driven by technological progress.[70]

Mobility unbounded

How is supercharged mobility upending Africa's economy? First, Global System for Mobile Communications (GSMA) forecasts mobile penetration in sub-Saharan Africa to be 50% by 2025, compared with 44% in 2018.[71] Mobile devices allow farmers to quickly identify pockets of demand and up-to-date prices for their crops. Impoverished students can access top-quality education online previously available only to those in the developed world, with the added benefit of curriculum being uninterrupted by pandemic. Parents can learn to apply preventative measures to lower their newborn's exposure to diseases such as COVID-19, malaria and Ebola. In other words, information can increasingly be disseminated in a frictionless manner. (For more, see "Superfluid markets" in *Megatrends 2018*.)

Second, technological advancement has led to a major uptick in the velocity of capital. The increasingly ubiquitous mobile network coverage in Africa, together with payment platforms, is facilitating the almost instantaneous transfer of wealth between people and entities, driving financial inclusion. The capability for people to connect virtually, share information and wire funds is boosting trade: intra-Africa trade jumped to 14.8% of total trade in 2017, compared with around 10% a decade ago.[72]

The enhanced reach of information also becomes the mobility of people. As the dissemination of real-time information becomes cheaper, the impoverished can quickly and easily become cross-border economic migrants. In fact, migrants from Africa rose to 26.5 million people in 2019 compared with 15 million in 2000, according to United Nations.[73] This same force, however, is also driving a growing number of aspiring Africans to pursue overseas education, as the continent accounts for 8.3% of all international students pursuing tertiary education at Organization of Economic Cooperation and Development (OECD) countries in 2017.[74] Not unlike the experience in China, where there have been 3.1 million returnees since 1978[75] from a population of 1.3 billion, these young and globally educated Africans are returning in greater number and will have an outsize impact on Africa's development as entrepreneurs, scientists, innovators and professionals.

Last but not least is the movement of goods. Regional trade unions such as Economic Community of West African States (ECOWAS[76]), Common Market for Eastern and Southern Africa (COMESA[77]) and Southern African Development Community (SADC[78]) have helped boost intra-Africa trade, driving it to 14.8% of total trade in 2017 from the 10% a decade ago.[79] Total exports, averaged at US$760 billion during 2015–17,[80] will grow with further effort to bridge Africa's annual infrastructure gap of between US$68 billion and US$108 billion[80]. The most notable influencer in recent years is China, which, through its Belt and Road Initiative, has committed US$614 billion since 2013.[81] As policy response, the EU and Japan have pledged US$54 billion[82] and US$20 billion[83] respectively. While it is likely too early to ascertain the exact impact of COVID-19 on these pledges, the secular trend of increased trade will prevail as the world learns to overcome this pandemic.

Supercharged economic development

Africa has a landmass greater than the US, China, India and Europe combined; the precise manner and pace in which economic development for each country remains unclear. But the nonlinear nature of such growth, due to supercharged mobility, will make development uneven.

Agriculture

The first economic growth engine is agriculture, because the challenge of feeding Africa's growing population (forecast to double by 2050) cannot be solved with imports alone. Despite having 60% of the world's arable land,[84] farmland productivity in Africa has yet to evolve beyond subsistence levels, largely because of the lack of economies of scale from fragmented ownership and insufficient technology and capital. Yet there are already promising signs that the continent's farmers can dramatically increase productivity through basic mechanization and agricultural technologies such as fertilizer, irrigation, crop rotation and improved seeds. The production of cocoa from Ghana and Ivory Coast now makes up 60% of the world's supply,[85] while major exporting countries such as Kenya, Ethiopia, Uganda, and Tanzania increasingly view coffee and tea (from which Africa generates 11% and 12% of world's supply respectively[86]) as high-value crops.

Manufacturing

The second engine is manufacturing, where low-cost labor and proximity to natural resources will be Africa's competitive advantage. Unlike Asia, exports mainly served markets in the West, Africa will develop its own manufacturing capability to serve its nascent consumer market, further boosting already burgeoning intra-Africa trade. For example, Rwanda recently announced made-in-Africa smartphones[87] solely for local consumers. North Africa has in recent years[88] successfully lured European automotive manufacturers to build operations there, with the near-term strategy of lowering cost of production for their home markets and the long term strategy of developing cars for Africans.

Services

Finally, Africa's services sector is taking off, even though traditional models suggest it should expand only after the industrial and agricultural economies are well-established. In financial services, banks and insurance companies already benefiting from the increasing ubiquity of mobile payments will get a further boost when a modern identity system,[89] akin to India's Aadhaar, is implemented. On the back of improving physical infrastructure, e-commerce companies such as Jumia, Kilimall and Takealot are playing a significant role in a consumer market developing even more quickly than its peers in Latin America and Southeast Asia. In the longer term, the knowledge economy will also emerge; green shoots are already appearing with the recently established R&D centers of American technology giants. Furthermore, francophone countries such as Madagascar,[90] Morocco [91] and Tunisia are already developing a thriving business process outsourcing (BPO) market.

Africa matters

While this confluence of factors suggests Africa's ascension is at last imminent, challenges remain. First and foremost is governance and state capacity. Ethiopia and Rwanda, the poster children of successful economic development in the past decade or so, are both landlocked with few natural resources. They succeeded largely because of their focus on building business confidence by stamping out corruption, ensuring stability and enhancing the ease of doing business. In 2014, faced with the threat of Ebola, the containment actions undertaken by Nigeria and Senegal were exemplary.[92] In 2020 and beyond, COVID-19 presents another daunting challenge. Only with a stable, healthy and business-friendly environment will foreign direct investment flow in — and stay.

Another potential impediment to African economic growth is the level of mistrust for foreign powers sown throughout African's colonial history, and among African countries dating back to their tribal histories. Pan-continent initiatives such as common currency and free trade agreements cannot progress quickly without earnest dialogue fostering trust.

If the barriers can be overcome, the potential upside for businesses is obvious. The continent has abundant resources and a young and increasingly educated population[93] that is eager to rise above poverty as Africa becomes an even bigger player in the global economy. That potential — and its geopolitical importance — also explains why Africa is quickly becoming an ideological battleground between China's state-directed capitalism, as seen by the success of Rwanda and Ethiopia, vs. the US-led free enterprise capitalism. Regardless of how it develops, Africa matters to everyone because of its impact on collective challenges such as climate change, biodiversity and overpopulation that threaten planetary survival. (For more, see "Decarbonization.")
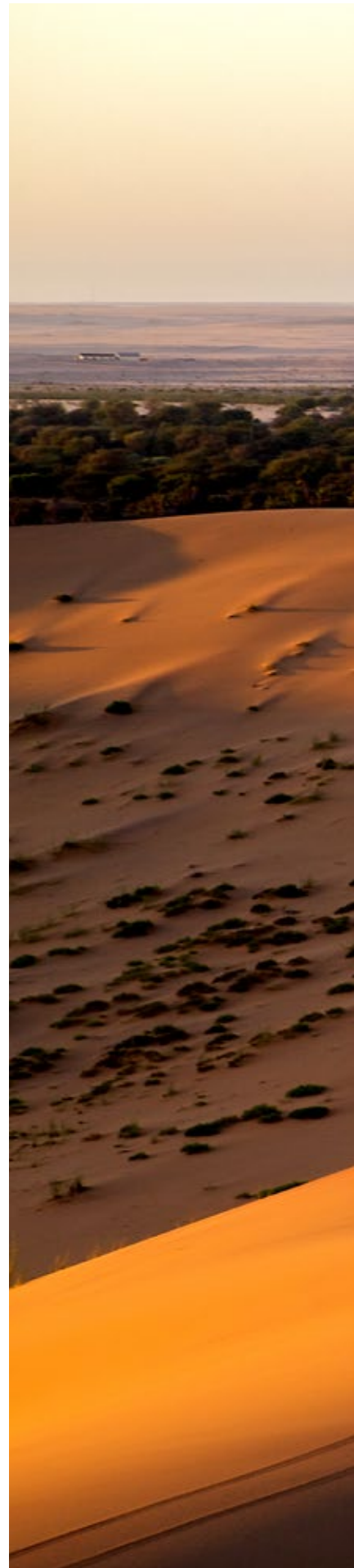
Reframe your future

Africa is both a resource and an opportunity – the potential to leverage the collective brainpower of 1.2 billion people and develop innovative solutions, not just for the continent, but for the rest of the world. Successful strategies will find sustainable business models for lifting Africa's impoverished out of poverty and turning them into valued customers.

Where to begin: critical questions

▸ Is your business purpose aligned with prevailing social values in the 21st century?

▸ Is your organization investing enough in intangibles, including human and social capital?

▸ Are governments moving quickly enough in leveraging new data technologies to promote greater well-being?

Societies and economies

New economic metrics

Is GDP aligned with a digital economy? Is the unemployment rate relevant in the future of work? Does shareholder value reflect what society values? As capitalism changes, so must our metrics.

What we measure no longer reflects what we value. The metrics guiding national policies and corporate investments focus narrowly on short term financial value. As social values diverge, growing misalignment between businesses and governments foments critical policy failures, including inequality, climate change and falling living standards. These crises are destabilizing Western democracies, so we must act now. By not fully accounting for the long term impact of externalities, businesses are more free to impose them. Without appropriate feedback, policymakers lack visibility on the true impact. Making progress solving these fundamental challenges requires a longer-term perspective, a deeper understanding of value, and new metrics measuring human, social and environmental well-being.
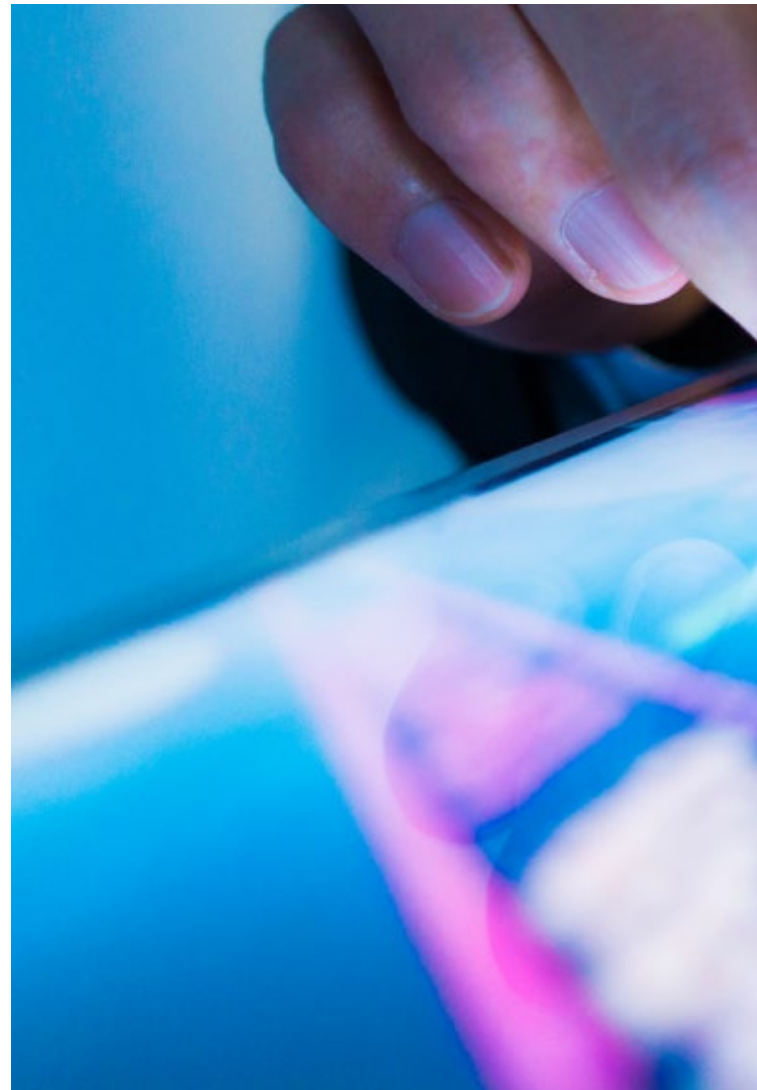
Moving beyond GDP

Gross domestic product (GDP) is the most well-known measure of economic activity, with a correspondingly huge influence on policymaking. However, GDP suffers established weaknesses that we can no longer ignore. GDP captures the financial value of goods and services exchanged (i.e., as in an income statement), but omits:

‣ Anything "external" to the market, including environmental and social costs, which is a fatal flaw as the costs of climate change mount (see our "Decarbonization" megatrend)

‣ Income and wealth distributions, which contributes to rising inequality, boosts populist leaders and diminishes trust in our political institutions (see our "Techonomic cold war" megatrend)

‣ Stocks of assets (e.g., as in a balance sheet), which combined with frequent election cycles, skews policymaking incentives to the short term
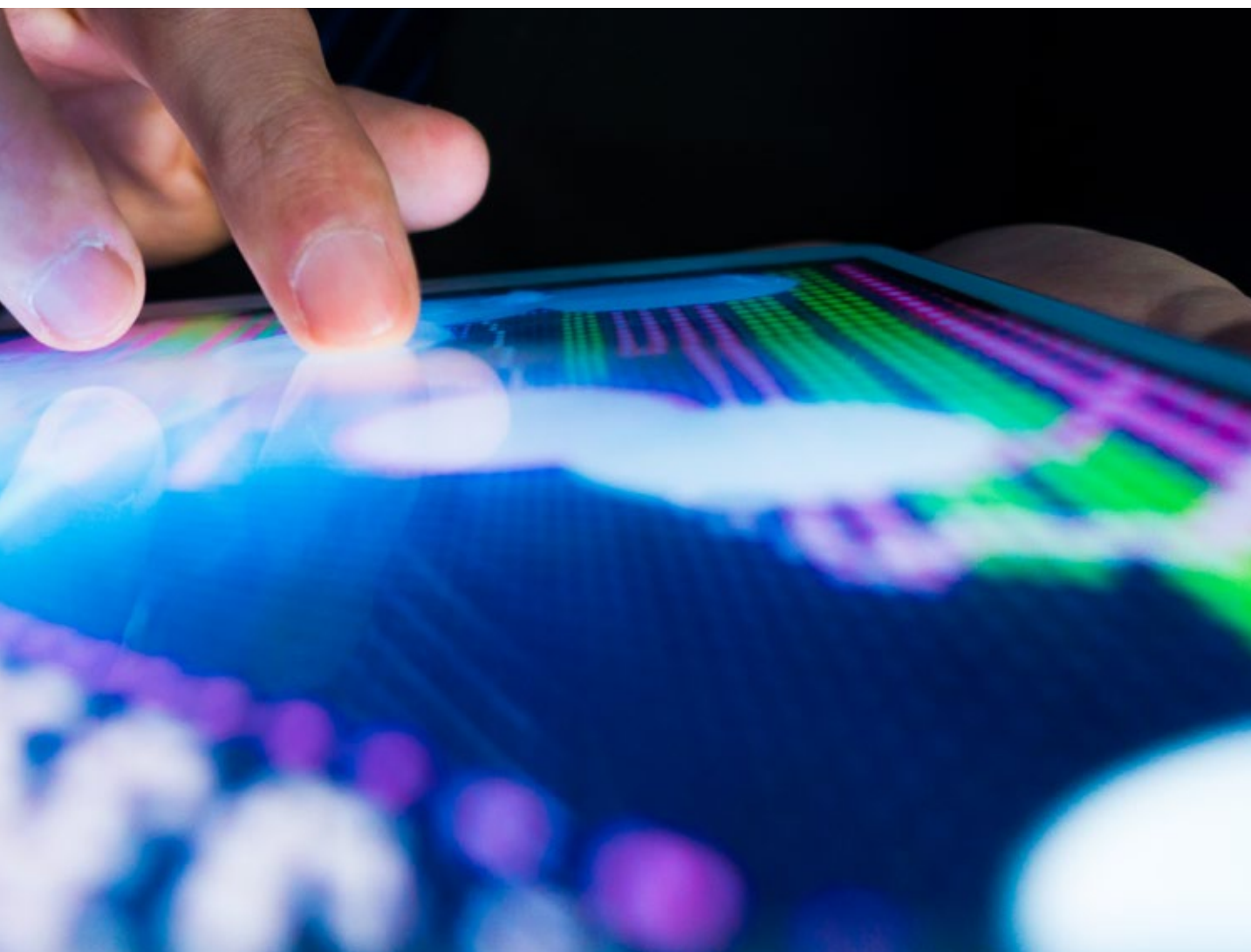
▸ "Free" digital services such as internet search and mapping or social media, which renders it ill-suited for much emerging activity[94]

▸ Intangibles such as knowledge and data, which represent an increasing share of output

Incorporating a broader set of metrics, such as hours worked and life expectancies, dramatically changes our understanding of the economy. To illustrate, although the UK's per capita GDP is 75% of the US, UK citizens live 2% longer than Americans and enjoy a third more leisure time. After reasonable adjustments for these differences, overall well-being in the UK is estimated at 97% of the US level.[95]

Many groups are developing new metrics as social pressures stimulate a government response. The United Nations and the OECD support a dashboard approach to measuring well-being, arguing a range of indicators is appropriate given the challenges of quantifying and communicating something so multi-faceted.[96] One promising new metric is the genuine progress index, or "GPI," developed in a handful of American states, Finland and Canada.[97] It's designed to take broader measures of social well-being explicitly into account. For example, the GPI falls in value if the poverty rate increases.

To realign policies toward what people value, some policymakers are seriously exploring alternatives to measures of output. China's leadership announced a reduced emphasis on GDP in its policy approach, declaring that "harmonious" economic growth requires preserving the natural environment.[98] Following China's initiative, the Asia-Pacific Economic Cooperative (APEC) selected "Beyond GDP" as the theme of its Malaysia 2020 meeting.[99] Elsewhere, New Zealand built a supplementary 2019 budget around measures of well-being.[100] In doing so, its leaders acknowledge a hard truth: that despite enviable GDP performance, well-being isn't keeping pace.

Measuring work's worth

The rapid emergence of the gig economy has exposed flaws in how we measure employment.[101] As labor markets become more fluid, binary measures of unemployment are increasingly irrelevant. Platform companies in the ride-sharing industry often rely on contractor rather than employees, arbitraging gaps in labor regulations and leaving workers exposed to greater risks. Moreover, headline unemployment figures exclude people who have given up looking for work.[102] The forces of technology and globalization have displaced many of these "discouraged" workers. Their omission risks encouraging policymakers to ignore precisely the constituencies where targeting reforms may help stem the rise of populism and nationalism (see "Techonomic cold war" megatrend).

In addition, unemployment statistics don't capture, and companies don't systematically report, metrics measuring the quality of work, such as employee autonomy, absenteeism, engagement, the precariousness of worker income, instances of harassment and mistreatment, or hours spent in training. Surveys consistently indicate the most important factor in job satisfaction is the opportunity to learn new skills. This is logical; accumulating skills and competencies are the most important driver of growth in recent years.[103] And much valuable human capital is co-created by businesses and their employees via training and learning-by-doing. But measuring job quality poorly restricts the flow of talent to its most productive use. Without vital information signals, prospective workers may end up in a job that isn't suited to their preferences, culture or lifestyle. Job satisfaction suffers as a result, and so does well-being. Measuring the quality of employment is thus essential to promoting well-being.

Corporate metrics and the business of long term value

Enabling better measurement at the national level requires concurrently changing the way companies report activities, because macroeconomic statistics are typically aggregated from firm-level reporting. Current social and environmental exigencies demand that businesses finally report externalities. These changes are already underway with the boardroom focus shifting toward the long term.

Business leaders face increasing social pressure as millennials come of age (see our "Gen Z rising" megatrend) and environmental damage accumulates (see the EY *2019 CEO Imperative Study*). For example, Blackrock CEO Larry Fink, head of the world's largest asset manager, overseeing a US$7 trillion balance sheet, recently announced sustainability as a key new benchmark. Fink called for all governments, companies and shareholders to confront climate change.[104] Similarly, the Business Roundtable chaired by Jamie Dimon acknowledged the changing corporate environment by announcing support for a more inclusive, long term variety of capitalism. It also redefined the purpose of the corporation to reflect a wider set of stakeholders, including employees and communities rather than just shareholders.[105] But without new metrics and more robust cost accounting, it's impossible to know if strategy is aligned with purpose.

Companies that fully account for externalities can incorporate the complete range of stakeholder impacts. The announcement in Davos of a new accounting framework with broad business support is a welcome first step.[106] Environmental targets might include carbon intensity, water usage and resource efficiency. Where a new product has a negative spillover into public health, disclosure of risks and reasonable costing becomes

a priority. Employees represent an important new stakeholder in the emerging value framework. Employers can collect more detailed and granular data about their workers than any government agency. But they generally fail to report informative statistics on worker well-being, such as the share of employees participating in wellness programs.

A redefined business purpose demands changes to traditional notions of shareholder value. In 1975, more than 80% of value was captured on balance sheets. Today it's common to see just 20%, the balance derived from intangibles, which are difficult to measure. Yet rising investment in intangibles is the defining characteristic of the current economic paradigm shift. EY analysis has previously found intangibles account for roughly half of all corporate assets, and as much as 90% for certain highly innovative firms.[107] After all, a smartphone isn't special because of the silicon and glass used to construct it, but the intangibles such as design, branding and innovation. Existing accounting metrics show these intangible investments as expenses in income statements, but the assets that result (such as a stronger workforce and deeper human capital) never make it to the balance sheet. This skews strategic and financial incentives against innovating.[108] As a greater share of economic activity shifts to the production of intangibles, our mismeasurement problems compound. Misaligned incentives for innovation reduce living standards and aggravate existing social inequities. Encouraging the accumulation of human capital is key to creating long term value.
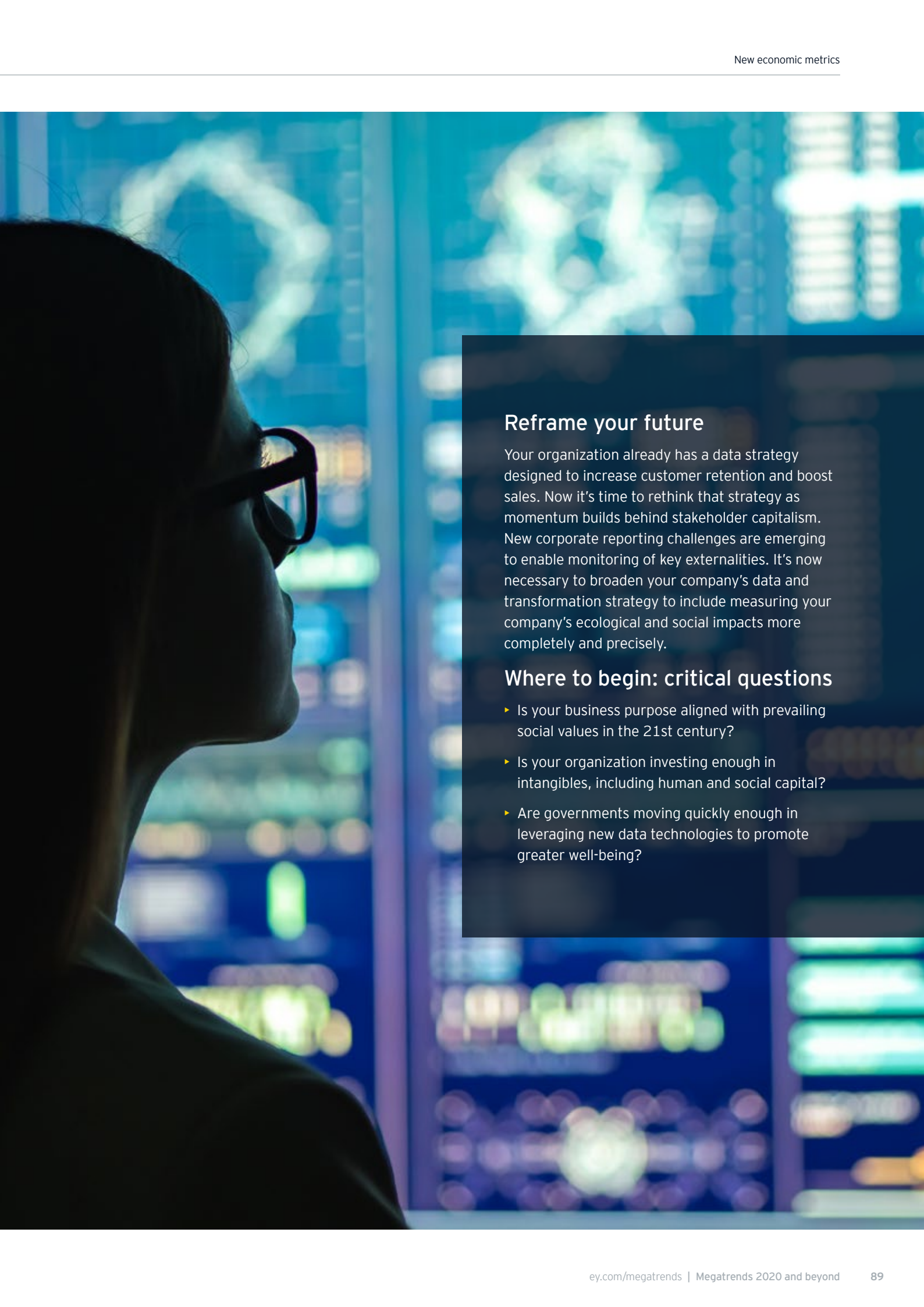
Charting a new path

Moving away from our existing metrics won't be easy. It's a monumental coordination challenge requiring steady leadership commitment to battle deeply entrenched habits, philosophies and incentives. Groups such as the Business Roundtable and the Embankment Project for Inclusive Capitalism can facilitate communication and collaboration, both between public and private sectors as well as across countries (see the EY EPIC report with the Coalition for Inclusive Capitalism). Policymakers can encourage the shift toward new metrics by establishing consistent global accounting principles for externalities and intangible assets. Such changes may help realign strategic and investment incentives with changing social values while simultaneously promoting innovation. Senior business leaders can help by engaging seriously in the dialogue around long term value, and by embracing a modernized business purpose. Developing strategies to achieve inclusiveness starts with a fresh perspective focused on the long term (see EY LTV initiative).

To some extent, technology can help meet these new challenges. The costs of data collection and analysis are falling rapidly thanks to Internet of Things and AI. Satellites and sensors, for example, can generate highly accurate real-time data. A broader corporate data strategy aimed at collecting social and environmental cost data, in addition to the well-being of employees and local communities, might help fill significant gaps in measurement. Useful new corporate reporting that details progress toward a broader business purpose means building the prerequisite data capabilities first.

Governments also have an opportunity to leverage data-generating technologies to enhance feedback. More than 20 countries from Singapore to Sweden have "smart city" initiatives, demonstrating how better measurement through data can improve public safety and citizen services, albeit not without risks. The UK's National Health Service has dozens of partnerships with leading technology companies analyzing the vast troves of patient data to support the provision of its services.[109] And big data techniques have also proved a significant part of the policymaking process when fighting the COVID-19 pandemic. Countries that successfully implemented track-and-trace techniques using smartphones fared better in managing the deadly outbreak.

An inflection point is approaching, driven by necessity. Our industrial-era metrics are misaligned with the needs of a knowledge-based economy characterized by widespread technological disruption. We are on the cusp of a significant change in the way societies make policy and conduct business. Companies will either evolve to realign with new values, or risk dissolving as their social contract is withdrawn. There is no looking back.

Reframe your future

Your organization already has a data strategy designed to increase customer retention and boost sales. Now it's time to rethink that strategy as momentum builds behind stakeholder capitalism. New corporate reporting challenges are emerging to enable monitoring of key externalities. It's now necessary to broaden your company's data and transformation strategy to include measuring your company's ecological and social impacts more completely and precisely.

Where to begin: critical questions

‣ Is your business purpose aligned with prevailing social values in the 21st century?

‣ Is your organization investing enough in intangibles, including human and social capital?

‣ Are governments moving quickly enough in leveraging new data technologies to promote greater well-being?

Societies and economies

Mending social fabric

Endemic loneliness, financial fragility, political polarization, rapid shifts in migration, family structure and digital media are creating new risks. Mending our social fabric requires investment.
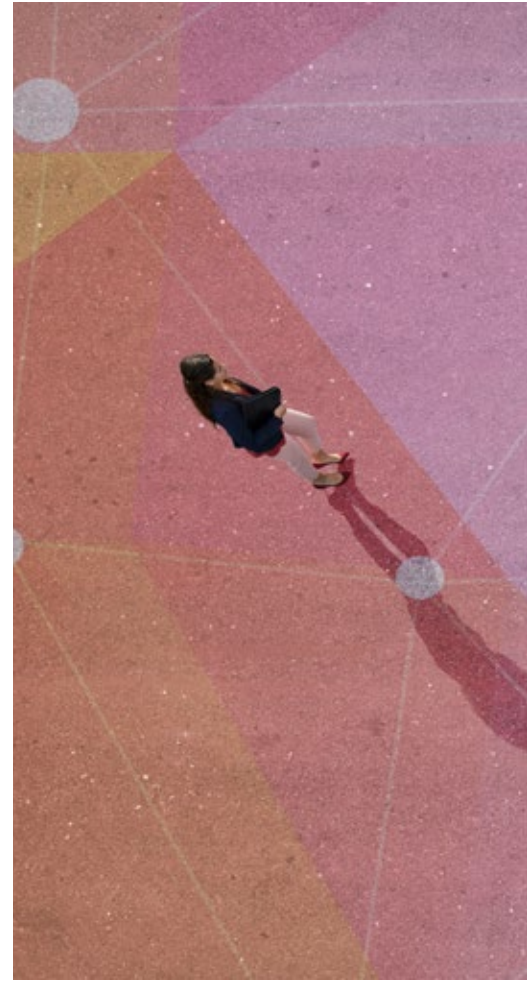
After an Australian gunman killed 50 Muslims at their houses of worship in Christchurch, New Zealand, in March 2019, the country reacted as one to the horrific violence. Prime Minister Jacinda Ardern donned a hijab at victims' funerals, while hundreds of non-Muslim New Zealand women went to work wearing headscarves. News anchors began broadcasts with the Arabic greeting "*as-salam aleikum*."[110] New Zealand's notorious Mongrel Mob street gang became volunteer mosque guards, providing a protective circle around houses of worship at the invitation of New Zealand imams.[111]

This nation of under 5 million people, less than 1% of whom identify as Muslim, showed something remarkable in the face of national tragedy: a resilient and supportive social fabric. People who had nothing in common beyond being New Zealanders supported one another in ways that can seem all too rare in a world often polarized and isolating. Often it seems we see the benefits of a strong social fabric only at moments of crisis and terror, not in everyday life.

Fears of a weakening social fabric — the intricate network of weak ties that connect us in our neighborhoods, workplaces and public spaces — have long been a topic of debate. In his influential 1995 essay "Bowling Alone: America's Declining Social Capital," Robert Putnam blamed the loosening of social bonds on the demise of voluntary organizations, including fraternal, civic

and religious organizations such as the Elks, the Lions Club and the Knights of Columbus, as well as the titular bowling leagues. These groups brought together neighbors who might otherwise have had no reason to interact, and created a web of ties that could be used to find a job or launch a political campaign. Putnam saw 1960s counterculture, television and sprawling suburbia as reasons why social capital declined and social fabric frayed. Subsequent to Putnam, dozens of commentators have mourned the death of social capital, blaming everything from increased geographical mobility (Bill Bishop's *The Big Sort*) to the rise of social media (Sherry Turkle's *Alone Together*).

Yet nostalgia for a time when neighbors took care of each other disguises some uncomfortable truths. Political philosopher Danielle Allen points out that most of the clubs Putnam celebrated were all-male clubs before a 1987 U.S. Supreme Court decision forced them to allow women.[112] The rich civic fabric Putnam warns we're losing was built in part on the exclusion of women and people of color. When we consider the challenges of building a resilient social fabric today, we can't look back to a past when the fabric was solid, but exclusionary. Our challenge is living and working in a world where the strength of the social fabric comes from its variability and diversity.

Global shifts and strains

While Putnam focuses on the US, similar changes are visible in other developed economies and many developing nations. In Japan, low birth rates and the emergence of "ohitorisama" – people committed to living single – are rapidly changing social dynamics.[113] Solo households make up 28% of all households in Canada, and 34% across the European Union.[114] The massive decrease in church attendance across much of Europe, leading one scholar to conclude that secularism is now the continent's default belief system, has consequences for community ties, as houses of worship provide key points of social connection.[115]

Four major social shifts have radically changed the nature of the social fabric in the past 50 years:

Transnational migration:
In the 1970s, less than 5% of the US population was born in another country; that number approaches 14% today, nearing the 1890s high of 14.8%.[116] While the percentage of a population that is foreign-born ranges widely by country, from almost 30% in Switzerland to well below 1% in China and India, we are experiencing a global migration boom, echoing the pre-World War I wave of mobility that reshaped the world. In 1970, 2.2% of the world's population lived in countries other than country of birth; that number was 3.4% in 2017, a 55% increase.[117] In nations where many neighbors were raised speaking different languages in different school systems, watching different teams and different sports, it's harder to assume common experiences with the people we encounter every day.

Digital connection:
During the wave of migration between the 1880s and the 1910s, immigrants were usually expected to rapidly adopt the culture of the nations they'd moved to. Separation forced by long distances aided this assimilation; many migrants never saw their families again. The rise of the internet means that modern migration is a very different experience. Not only can families stay in touch via online communication platforms but the Pakistani migrant to the UK can remain culturally in Pakistan, watching television and movies from their homeland while abroad. The same technological developments that allow migrants to remain culturally rooted while being geographically mobile allow ideological partisans to surround themselves with consonant information; the progressive German need not watch the same news as his conservative neighbors when he moves to Poland. The rise of digital media allows us to choose our social ties, which may be a blessing for the gay teen in a homophobic community, but can create strains in diverse, multicultural cities.

Racial and religious integration:
As we've moved from low to higher immigration rates, most societies have recognized the ways that the dominance of particular races and religions raises deeply unjust barriers to civic inclusion. A society that believes the default citizen is white, Anglo-Saxon and Protestant is always going to make black, Latinx, Asian, Catholic, Jewish and Muslim individuals feel excluded. But as we recognize the legitimacy and full citizenship of all our neighbors and their values and beliefs, we lose the assumption of a common culture. Instead of appealing to common experiences in our cultural pasts, we are forced to look for experiences we've shared together, creating a common culture in real time.

Family transformation:

Finally, the full inclusion of women in the workforce is only one transformation we've experienced to the structure of the family. Acceptance of marriage equality for gay and lesbian couples and the rise of transgender and nonbinary identities have broadened the range of shapes that families can take in the 21st century. A move toward later household formation and fewer or no children changes not only the shape of families, but of communities. Traditionally, children create a set of loose social ties for their parents, who are likely to befriend parents of their children's friends. In many communities, schools become a center for civic engagement as well, as children's education is a government function that parents are inclined to pay close attention to. As the shape of the modern family shifts, we may need new mechanisms that help build and recognize connections to our neighbors.

Challenges of a shifting social fabric

In the past few decades, managers have learned that employee health and well-being are part of a leader's responsibilities. Workers struggling with alcohol or opioid addiction aren't able to be full parts of a team; workers overcoming domestic violence or suffering from mental illness require our help and support to thrive at work. In the next few decades, we will begin to recognize loneliness as a serious public health issue that requires our attention.

Close relationships with friends and family are now regarded by the scientists behind the Harvard Study of Adult Development, the longest-running longitudinal study of adult health, as a critical element of long term health, alongside more conventional factors such as cholesterol levels. Loneliness, one researcher found, is as damaging as smoking or alcoholism.[118]

But as the social fabric shifts, loneliness is becoming epidemic in some societies, with 1 in 7 Britons reporting they are often or always lonely; Teresa May's Government named a minister for loneliness in 2018.[119] And while there's an understandable fear of the elderly suffering from loneliness, people age 18-34 report loneliness at twice the rate of older people.[120] Some 42% of single people said remaining alone was their worst fear, outpacing chronic illness, terrorist attack or other catastrophic event.

In addition to the psychologically and physically corrosive effects of a weakening social fabric are increases in financial fragility. As economic inequality rises, many individuals in wealthy nations are finding themselves unable to cope with routine financial shocks. A 2019 report from the Board of Governors of the Federal Reserve System found 39% of American households would have difficulty paying for an unexpected US$400 expense, such as a medical bill or a car repair.[121] This fiscal fragility is amplified by a fraying social fabric: people with strong familial and friendship ties can rely on their community to navigate these difficult straits, while those facing loneliness have fewer resources.

What leaders can do

What responsibilities do business and government leaders have for addressing the challenges of a fraying social fabric? Should businesses try to provide the community connections many neighborhoods and cities lack, or do they risk invading sacrosanct parts of an employee's life in the process? Is the rise of loneliness a temporary phenomenon that will disappear as generations master the art of interacting digitally, or are we on a dangerous path toward individual isolation? Will we develop new social institutions that bring people face to face in the way churches and festivals once did? Can we imagine a social fabric in which diverse traditions and ways of interacting with our neighbors interoperate smoothly, or do diverse societies necessarily have a looser social fabric?

Faced with these challenging questions, New Zealand's resilience offers lessons for both societies and companies. Older institutions such as churches and social clubs were such powerful reservoirs of social capital not just because they brought people together, but because they united them in shared projects. Ardern and other New Zealanders took on the Christchurch attacks as a common project to heal and comfort the nation, bringing together everyone from television anchors to gang leaders. More than any other contemporary institution, the workplace has the possibility of bringing together diverse groups toward a common goal. As more people choose work that aligns with their values rather than just seeking to maximize their earnings, workplaces become a place to unite with the like-minded and seek meaning from working together. Perhaps the workplace, in turn, can be a site for the revitalization of a social fabric we all benefit from.

Reframe your future

In many societies, social fabric — the ties that connect people in their neighborhoods, workplaces and public spaces — is becoming increasingly frayed. Companies exist in a social setting, and these trends have implications — and create opportunities — for enterprises to rethink their roles and responsibilities.

Where to begin: critical questions

‣ What challenges and risks does a fraying social fabric create for your enterprise?

‣ What responsibility should businesses assume for mending our social fabric?

‣ What could companies do to reimagine the workplace as a place for repairing social fabric?

Endnotes

Gen Z rising

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