



The upside of disruption

Megatrends shaping 2016 and beyond



EY

Building a better
working world



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Foreword

Welcome to EY's *The Upside of Disruption*. Disruption is everywhere and the future is uncertain – no one knows what the world will look like even a decade from now. Our response is to help organizations find the opportunity in this challenge and ask: how do you seize the upside of disruption?

This report has been produced by EYQ, a new initiative from EY that will bring together businesses, the public sector and academia to challenge entrenched thinking, shift perceptions and help catalyze change. This is the first of many insights to come from EYQ. For more information on EYQ, see page 7.

In this report, you'll see the primary causes of disruption and how these give rise to a range of megatrends that are shaping our future.

We investigate how each of these megatrends are affecting the world of work and society as a whole, and we share the questions that organizations must ask themselves to stay relevant. Asking better questions is now more important than ever.

Due to the accelerated pace of change, plans of today might be obsolete tomorrow, and thus learning how to ask the better questions can create or lead to the right thinking.

When responding to disruption and these megatrends, organizations cannot afford to fall back on old solutions. Embracing creativity, entrepreneurial spirit, diversity and inclusivity will enable businesses to challenge the prevailing paradigm and create new business models. By building robust and responsive ecosystems and driving collaboration in previously unexpected places, they can meet the evolving demands of customers. Innovative practices such as these will be key to revealing the upside of disruption.

The era of being afraid to make mistakes and take risks is over. Over the next 5 to 10 years, those who are bold and able to embrace disruption – and transform the way we all operate – will be the winners.

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From disruption to megatrends

As disruption becomes an everyday occurrence, we explore its primary causes and the megatrends that are shaping our future

Disruption is fundamentally changing the way the world works. Today's businesses, government and individuals are responding to shifts that would have seemed unimaginable even a few years ago. Artificial intelligence and robotics are reinventing the workforce. Drones and driverless cars are transforming supply chains and logistics. And changing preferences and expectations – most notably in the millennial generation – are altering consumption patterns and demand for everything from cars to real estate.

We have looked at the root causes of these transformative trends and, consequently, have identified three primary forces behind this current wave of disruption: technology, globalization, and demographic change. By understanding the interaction between these forces, we've identified eight global megatrends which are shaping the future. These are large, transformative trends that define the present and shape the future by their impact on businesses, economies, industries, societies and individual lives.

The eight megatrends generate key questions to answer:

Industry redefined. Is every industry now your industry?

The future of smart. What intelligence will we need to create a smart future?

The future of work. When machines become workers, what is the human role?

Behavioral revolution. How will individual behavior impact our collective future?

Empowered customer. How will you change buyers into stakeholders?

Urban world. In a fast-changing world, can cities be built with a long-term perspective?

Health reimaged. With growing health needs, is digital the best medicine?

Resourceful planet. Can innovation make the planet resource rich instead of resource scarce?

EY on disruption

See the connections, not just the dots

The march of disruption is unrelenting and this can leave today's decision makers and leaders grappling with tremendous uncertainty and a broad array of challenges. Responding to disruption has become a central issue for incumbent organizations everywhere.

EY's approach to disruption is to amplify the signal rather than the noise, and see the connections, not just the dots. We do this by widening the lens through which we see disruption.

Disruption has commonly come to mean a transformation of business models and value networks driven by technology or business innovation. However, the evidence is growing that it can come from public policy, macroeconomic trends, geopolitical events and other developments. At the same time, disruption upends more than business models and value networks; it can transform political systems, regulatory regimes, social compacts and much more.

Just as important, the perception of disruption is shifting from that of threat to opportunity. Incumbents have begun to embrace disruption to take advantage of the rapidly changing environment.

At a time when there are so many unknowns and no easy answers, we believe we must ask better questions. As people are becoming less afraid of disruption and more accepting of its inevitability, the better question becomes: **How do you seize the upside of disruption?**

EYQ

EYQ helps organizations seize the upside of disruption. We generate new insights by bringing together people from business, the public sector and academia to challenge entrenched thinking, shift perceptions and help catalyze change.

By asking better questions around megatrends and other disruptive forces impacting the global economy, we can tease out more creative answers. This report is an example of the insights EYQ will continue to deliver.

Asking better questions helps reveal the upside of disruption, which leads to a better working world.

The background features a complex, abstract composition of glowing blue and cyan lines and shapes. These elements form a dense, interconnected network that resembles a digital or data structure. The lines vary in thickness and brightness, creating a sense of depth and movement. Some lines form sharp, angular shapes, while others are more fluid and curved. The overall effect is that of a dynamic, multi-layered geometric pattern against a dark, almost black background.

Section 1:
Understanding disruption

1. How did disruption become mainstream?

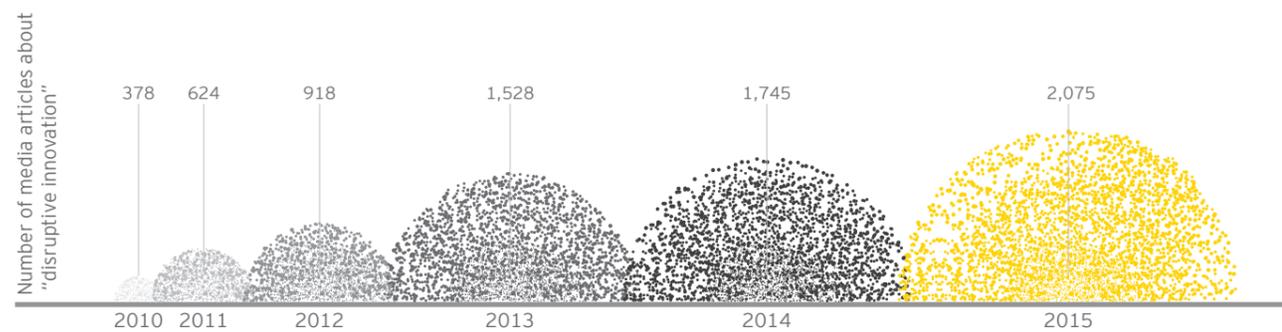
Disruption has worked its way into every sphere of our lives. The rapid acceptance of disruptive innovations has led to a growing awareness in the business community that disruption is ubiquitous and accelerating.

To highlight how commonplace the idea has become, we charted the number of media articles mentioning “disruptive innovation” between 2010 and 2015. Our research found an increase of more than 440% during this period (see *Media mentions of “disruptive innovation”*, below).

However, despite growing commercial awareness, only a handful of companies have successfully disrupted their own business models. For instance, Netflix switched its business model from one built on DVD home deliveries to one built on streaming. More recently, auto giant Daimler have begun experimenting with moves into car-sharing and ride-sharing.

Meanwhile, hundreds, perhaps thousands, of firms – from Blockbuster Video to Waldenbooks and Zenith Electronics – failed to adapt in time, and ended up either shadows of their former selves or out of business altogether.

Media mentions of “disruptive innovation”



Source: EY analytics using Factiva database. Figures show number of media articles mentioning “disruptive innovation” in each calendar year, excluding duplicates.

The birth of disruption

The theory of disruptive innovation was first posited by Harvard Business School professor Clayton Christensen in 1995. According to Christensen, the term describes the transformation of business models and value networks by technology or business innovation.

At the time, he wrote about “disruptive technologies,” since the most visible examples of disruption were in the information technology space. The frame of analysis soon expanded from disruptive technologies to disruptive innovation, since the phenomenon is not just about technological breakthroughs – disruption can equally come from other innovations, such as new business models or production processes. For instance, the disruptive innovation that allowed automobiles to displace horse carriages was not the internal combustion engine but rather assembly line production, which created reliable automobiles at an affordable price point.

2. How is our understanding of disruption changing?

In the past two decades, the definition of disruption has expanded far beyond its textbook meaning – the transformation of business models and value networks by technology or business innovation (see *The birth of disruption* on page 11).

For one, it is increasingly evident that disruption does not stem solely from technology or business innovations – it is also influenced by demographic shifts, globalization, macroeconomic trends and more.

It is also evident that the effects of disruption are beginning to extend far beyond the business world. For example, “sharing economy” start-ups such as Uber and Airbnb are already disrupting regulatory frameworks. Meanwhile, some of the most disruptive technologies on the horizon (e.g., AI and robotics) will not only disrupt corporate business models, but also society as a whole – realigning income distribution, altering relationships

between governments and citizens, and perhaps even calling into question fundamental aspects of the human experience. Indeed, one reason that the concept has gained widespread traction – appearing in everything from Hollywood movies to the surge of populist political movements – is that it resonates so well with much of our shared experience.

3. What are the root causes of disruption?

Based on our analysis, we see three root causes behind disruption – what we refer to as “primary forces.” These forces – technology, globalization and demographics – are not new. Indeed, they have been around for centuries. But they evolve in successive waves, and it is these new waves that generate new megatrends. Understanding the next waves of disruption – and the interactions between them – gives this root-causes-first approach more predictive power.

Our approach also provides a simpler and more balanced perspective. It narrows the field of vision by focusing on three causes rather than a longer list of effects. It also widens the field of vision, since focusing on new waves of primary forces reinforces that any list of megatrends is by definition incomplete and will expand over time.

The three primary forces of disruption are:

1 Technology. While we usually think of disruption in the relatively recent context of IT, advances in technology have been disrupting business models for centuries. The Industrial Revolution, for instance, eliminated guilds and created massive labor displacement. In our lifetime, successive waves of the IT revolution (PC, online, mobile, social) have democratized data, empowered consumers and spawned scores of new industries. The next waves – the Internet of Things (IoT), virtual reality, AI, robotics – promise to be even more revolutionary.

2 Globalization. Like technology, globalization has been upending the status quo for centuries, going at least as far back as the 15th century launch of the Age of Discovery and colonialism. Globalization has accelerated in recent decades, thanks to trade liberalization and emerging market growth. These trends disrupt existing business models by creating new competitors, reordering supply chains and lowering price points. The next waves – including the emergence

of Africa and a more multipolar world – will increase complexity and require flexible business models to respond to global shifts.

3 Demographics. Throughout human history, demographics have determined destiny. In the decades ahead, relatively high birth rates will make Africa and India engines of economic opportunity. Aging populations will transform everything from health care to real estate. Millennial-dominated workforces will reinvent the workplace. Urbanization will increase cities’ economic and public policy clout, even as it strains their ability to grow in sustainable ways. Migration and immigration will have profound impacts on workforces and economic development. All these demographic shifts will require new strategies and business models.

The continued evolution of these primary forces – and interaction between them – leads to the disruptive megatrends outlined in section 2.

4. Why is responding to disruption so critical?

Business' response to disruption is perhaps the most important strategic imperative facing companies, for three reasons:

1 Everyone is affected. The pace of disruption is accelerating and impacting a growing list of sectors. The next wave of digital innovation – harnessing AI, robotics and virtual reality – will transform activities long considered safe from disruption. Indeed, these developments are already starting to disrupt sectors such as legal and professional services in ways that would have seemed unimaginable even a few years ago.

Meanwhile, disruption no longer emerges from Silicon Valley alone. It can just as easily come from emerging markets. Today's leaders need to be aware of the game-changing threats and opportunities bubbling up in markets around the world.

- ▶ *If you think you won't face disruption, it's not because you won't – it's because you don't yet know how it will happen.*
- ▶ *What are you doing to understand the myriad ways in which your organization could be disrupted?*

2 It's easy to underestimate the pace of change.

"In retrospect, all revolutions seem inevitable. Beforehand, all revolutions seem impossible." That observation, attributed to Michael McFaul, former US Ambassador to Russia, is just as applicable to business and economic revolutions as it is to political ones.¹ It's easy to declare in hindsight that the collapse of the Soviet Union was inevitable, but in the summer of 1989, even amid the rumblings of perestroika and glasnost, one would have been hard pressed to find anyone predicting that the Berlin Wall would fall just a few months later.

In 2012, when Google announced that it had been testing driverless cars on US roads and had already driven over 200,000 miles in everyday traffic conditions, the news reverberated like a shock wave across the world. Driverless cars – a staple of science fiction just a few years earlier – had become reality faster than most of us expected. Time and again, we underestimate the significance and speed of disruptive innovation.

- ▶ *Time is not on your side.*
- ▶ *Are you embracing disruption quickly enough?*

3 Smart strategy and execution are not enough. It may sound counterintuitive, but organizations get disrupted not by doing the wrong thing, but by doing the right thing. The long list of companies that have fallen victim to disruption includes firms that dominated their industries for decades. They were often ruthlessly competitive, relentlessly focused on the market and led by competent strategic thinkers. In many ways, they succumbed to disruption not despite, but because of, that focus. Organizations are typically structured and incentivized to focus on fulfilling the needs of their existing constituents – blinding them to disruptive opportunities, which often do not initially meet those needs.

- ▶ *The strategy that got you here may not be the one you'll need for the road ahead.*
- ▶ *How are you realigning incentives and structures around disruptive innovation?*

5. Why is it so difficult to respond to disruption?

Incumbent companies typically fall victim to disruption. The reasons for this have been well documented in Clayton Christensen's classic book, *The Innovator's Dilemma*.²

Incumbents dismiss the initial disruption of their industry because it appears inconsequential relative to established products/services and fails to meet the needs of existing customers. However, a small core of customers embraces the disruptive offering, giving market entrants a toehold, and the offering improves more quickly than incumbents expect. Its capabilities soon surpass those of the prevailing product or service – at which point existing customers, who have so far resisted the offering, adopt it en masse.

Incumbent firms now scramble to move into this new market, but it is often too late, particularly if the space has significant network effects or switching costs. Time and again – whether with the 1980's PC revolution that disrupted mainframe computers or the more recent disruption of standalone GPS devices by smartphone apps – the same pattern occurs with predictable regularity.

6. How do businesses seize the upside of disruption?

Fortunately, as disruption becomes mainstream, organizations have become more proactive in addressing the challenge. With the right response, disruption offers tremendous upside to firms that can harness its forces. Discovering the upside of disruption requires both learning from those who do it well and being aware of the constraints that companies face in formulating their responses.

Companies in the technology sector are laser focused on creating disruptive opportunities. For example Alphabet, the parent company of Google, has its famous "20% time" policy, which encourages employees to spend as much as a fifth of their time on any idea they consider promising, even if completely unrelated to their regular work projects.

More generally, the title of the late Andy Grove's 1999 book is part of the DNA of technology firms: *Only the Paranoid Survive*. Without exception, the titans of technology are obsessed with getting into each other's business because they understand how real the threat of disruption is.

Sometimes these ventures are successful, sometimes they aren't – but technology firms know that this single-minded focus gives them their best shot at remaining relevant in the long term.

However, companies outside tech face constraints that are not an issue for tech firms. Investors are often willing to give technology firms more leeway – until recently, Amazon never posted a quarterly profit and Apple sat on a US\$200 billion stockpile of cash without issuing dividends, and neither firm's stock price suffered as a result. But investors aren't always as forgiving of firms from sectors that don't have the same disruptive innovation aura and credibility around efforts to disrupt their own business models.

Companies looking to disrupt their business models need to begin a process of rigorous self-interrogation. To start the conversation, we offer a few better questions at the end of this report. See *How do you seize the upside of disruption?* on page 52.

¹ David Brooks, "Fragile at the Core," *The New York Times*, 18 June 2009.

² Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Harvard Business School Press, 1997).

From primary forces to megatrends

7. How does disruption lead to megatrends?

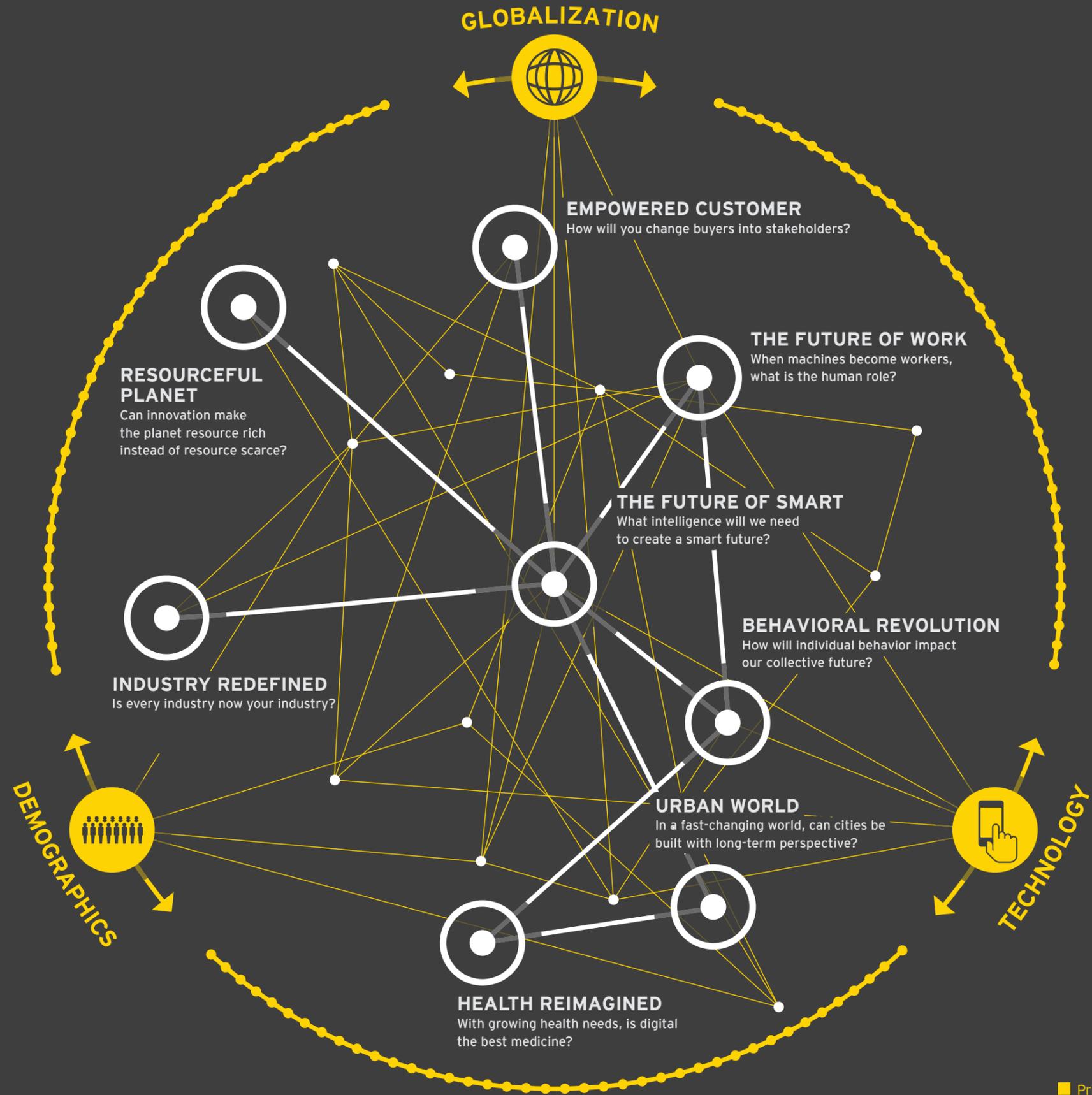
The three primary forces – technology, globalization and demographics – are evolving in a succession of waves including AI, robotics, global urbanization, aging populations, millennial workforces and more. As these new waves of technology, globalization and demographics interact, they give rise to a range of megatrends.

For instance, just as global demographic shifts (population growth and an increasingly *urban world*, a trend explored on page 40) are straining resources and fueling an urgent need for sustainable solutions, the rise of technologies is providing an answer – something explored in *The future of smart*, page 24. The same basic interaction between demographic-driven resource constraints and technology-empowered sustainable solutions is at the heart of two other megatrends – *Health reimagined*, page 44 and *Resourceful planet*, page 48 – which examine industry-specific implications.

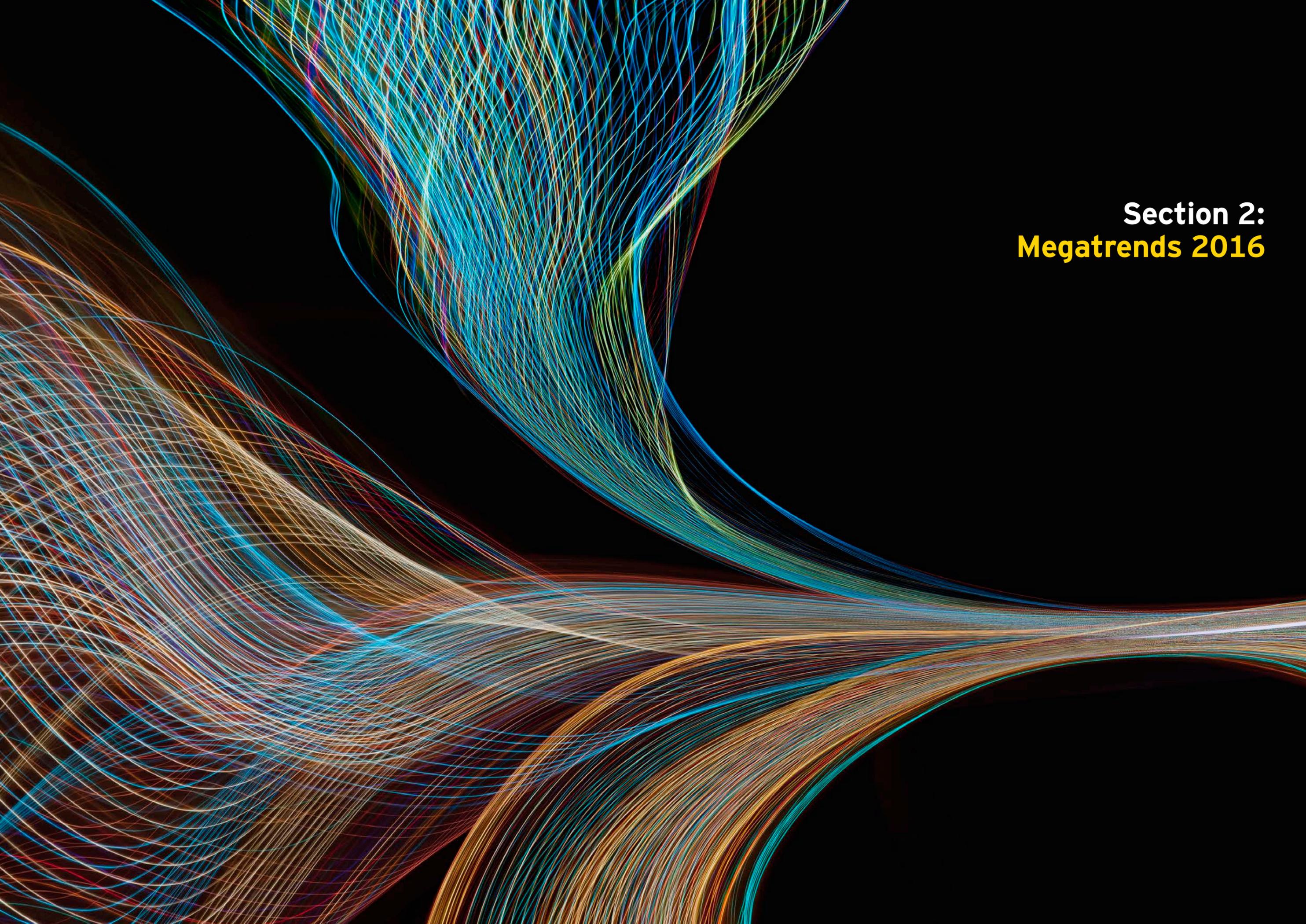
Meanwhile, sectors themselves are being redefined, as information technology lowers entry barriers and challenges driven by demographic change and globalization, such as climate change and chronic disease, attract companies from far-flung sectors to develop innovative solutions. This blurring of boundaries – explored in *Industry redefined*, page 20 – is also being driven by the rise of the *empowered customer*, page 36, a product of digital disruption and the changing expectations of the millennial generation.

There are two final megatrends that will fundamentally reshape our future. The next wave of technology is transforming *the future of work*, page 28, with disruptive implications for businesses, governments and society. Meanwhile, a budding *behavioral revolution*, page 32, is allowing behavioral economics to solve urgent challenges such as climate change and chronic disease as digital platforms enable real-time, real-world behavior modification.

Exploring these megatrends in depth can give companies the power to understand a rapidly changing world and adapt accordingly.



■ Primary forces ■ Megatrends



Section 2:
Megatrends 2016

1

Industry redefined

Is every industry now your industry?

Alphabet is competing hard to win the race to driverless transport, logging more than **3 million miles**



per day in simulation and 10,000–15,000 autonomous miles per week on public streets.³

Four mobile telecom operators



recently received licenses from the Reserve Bank of India to launch payments banks within the next 18 months.⁴

The US retail chain CVS eliminated tobacco products from its stores, changed its corporate name to CVS Health, and now operates over **1,100** retail-based health care clinics across the country.⁵



1. Disruption is driving convergence

Traditional diversification or consolidation sees competitors enter new industry categories, even unrelated ones. These models allow a company to meet its business objectives, whether spreading risk, adding new revenue streams, gaining greater control over supply chains, or more. However, neither strategy alters the basic characteristics of the industries involved. Even though new competitors enter the space, the boundaries of the industry – key activities, value chain fundamentals, the customer value proposition, and dominant economic characteristics – remain virtually the same.

Industry convergence – the blurring of two or more previously distinct industries and sets of participants – is different. It is about what happens to industries when disruption takes place. Disruption reconfigures and democratizes information, creates new levels of complexity, and takes place at unprecedented speed. In turn, barriers to entry are lowered. Disruption dramatically alters the “invaded” industry’s basic and often long-held characteristics. The converged industry is redefined.

2. Technology underpins convergence

Technology companies – both start-ups and existing titans like Alphabet and Apple – are disrupting industry spaces and uprooting incumbents. Several reasons are behind this phenomenon:

- ▶ The growing software content of products and services confers an advantage on companies that excel at code and algorithms as they enter new competitive spaces.
- ▶ Opportunities to substitute digital platforms for physical world ecosystems catalyze convergence. Uber has disrupted the taxi industry and could do the same for packages and prepared food delivery.
- ▶ Technology companies tend to be asset-light. Industry incumbents are saddled with legacy costs in real estate, IT infrastructure, supply chains, and other hard assets.
- ▶ Incumbents can lack the digital savvy at the leadership level – both C-suite and board – to react and compete effectively when challenged.

- ▶ Incumbents may be burdened with greater regulatory constraints than smaller, more agile start-ups.

The automotive industry is a clear example of how technology can disrupt a traditional sector and drive convergence. In the recent past, a handful of global car manufacturers competed against one another to design, manufacture and sell vehicles. Today, value in cars is shifting from being 90% hardware-based to being more than 50% software and experience-based.⁶ The vehicle has become a rolling software platform able to deliver services based on data, sensors and analytics, allowing technology companies such as Alphabet and Apple to compete directly with car manufacturers for “ownership” of the dashboard and connected driver experiences. When cars, trucks and other vehicles become autonomous, the automotive, transportation, and logistics industries could converge into a broader mobility industry. This new sector will likely attract new competitors and success will go to those that offer the best capabilities for the redefined marketplace.

³ “Google Self-Driving Car Project Monthly Report,” January 2016, <https://static.googleusercontent.com/media/www.g.u.00rz.com/en/selfdrivingcar/files/reports/report-0116.pdf>

⁴ “Reliance Industries, Bharti Airtel, 9 others get RBI nod for payments banks,” *The Financial Express*, 19 August 2015.

⁵ Walter Loeb, “Why CVS’ New Health Initiatives Are A Winning Strategy,” *Forbes*, 18 December 2015, <http://www.forbes.com/sites/walterloeb/2015/12/18/why-cvs-health-new-initiatives-are-a-winning-strategy/#1e3b333530f0>

⁶ Don Butler, Ford Motor Company, “Digital Transformation and the Automotive Industry,” CXO Talk, 8 May 2015, <https://www.cxotalk.com/connected-vehicles-automobiles-technology-platform-don-butler-ford>

3. Customer empowerment drives demand for novel solutions

Just as every company is now a technology company, every company – whether B2C or B2B – is also a consumer company. The rise of digital technologies has democratized consumer access to knowledge, given customers a more powerful voice, allowed more informed decision-making, and enabled greater choice between providers.

Empowered consumers with greater choices are helping redefine traditional markets and accelerate the elimination of traditional boundaries. They are becoming the center of evolving industries. See *Empowered customer*, page 36, for more on this megatrend.

One such example is the power and utility space. Renewables, smart metering and smart grids are reshaping the sector. But customers themselves are also redefining the industry. The industry was once prone to viewing customers as impersonal ratepayers and has traditionally suffered from low levels of customer satisfaction. Today's enlightened customers demand transparent and competitive pricing, as well as energy-efficient, environmentally friendly solutions.

This has led retail companies from industries such as telecommunications, consumer products, security services and technology to move into the home energy management market. The distributed energy revolution allows residential, commercial and industrial customers to generate and store their own electricity, as well as sell it back to the grid. The former ratepayers have evolved to become actual suppliers to incumbent power and utility companies.

Regardless of industry, when customers feel chronically underserved, they welcome offerings from insurgent players. Industries with high customer pain points may be those most ripe for convergence.

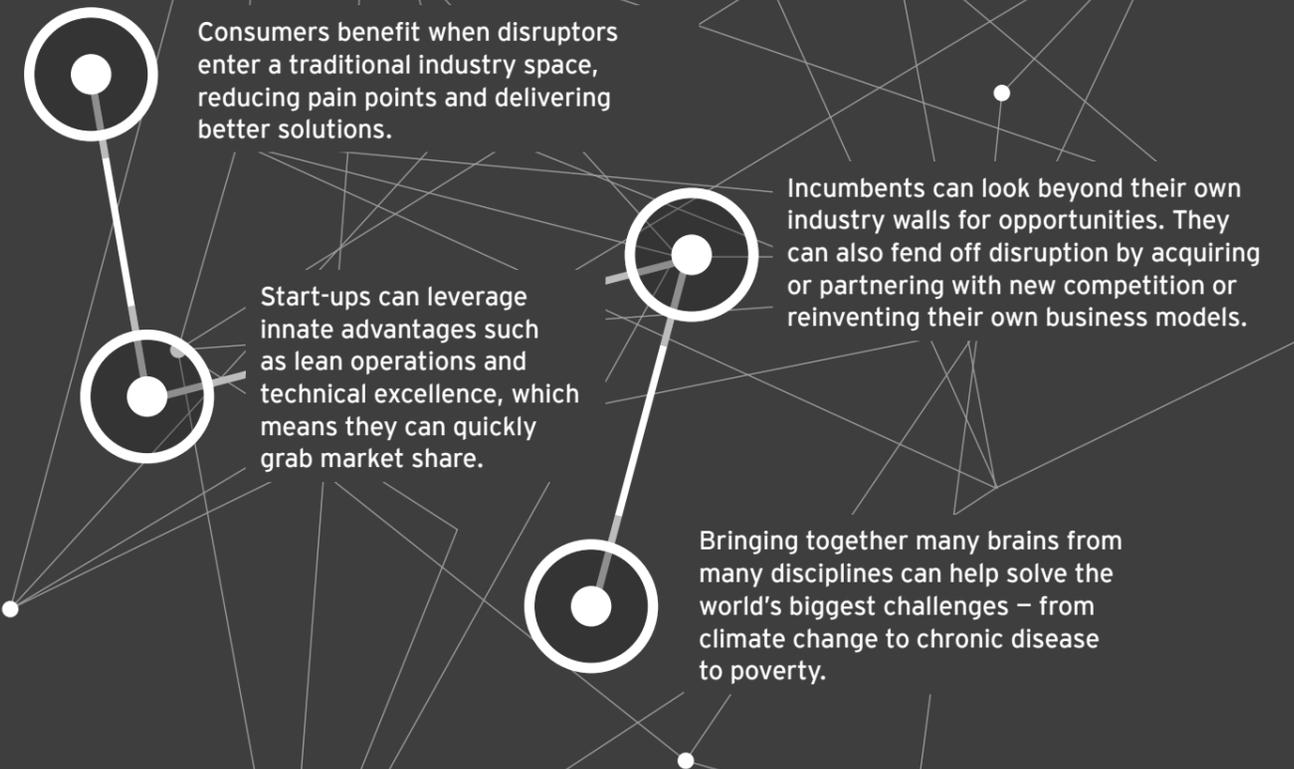
4. Companies should seek opportunity beyond their own industry walls

In a converging world, all industry spaces will be hotly contested. As boundaries break down, incumbent companies will face competitive threats from start-ups with disruptive business models and from formidable companies in previously unrelated sectors.

While disintermediation captures headlines, cross-sector collaboration, partnerships and acquisitions within contestable industries will be far more likely. The world is challenged by large, costly problems such as climate change, rapid urbanization and soaring health care costs, which are beyond the scope of any single organization or even industry to address effectively. In the face of such challenges, the future of competition will shift from company versus company in a single industry to cross-industry ecosystem versus ecosystem. Partnerships and alliances will become ever more important.

In this context, organizations need to think differently. For those companies that look beyond traditional industry borders, asking not what they can sell but what problems they can solve, convergence represents a major growth opportunity. Indeed, industry convergence should be considered alongside more traditional market considerations as companies strategize, plan and allocate investments for future growth.

INDUSTRY REDEFINED Upsides



Better questions

Do you understand who your competitors are, and would your customers agree?

What are the fault lines to indicate your industry is ripe for convergence?

Putting aside what you do or make today, what new problems could your company help solve?

What will you do alone and what will you do as part of collaboration or an ecosystem of companies?

Will tomorrow's business landscapes still be comprised of individual sectors?

2 The future of smart

What intelligence will we need to create a smart future?

Each year, utilities collect four data points about usage in each household. A household smart meter can allow utility companies to collect almost

35000

data points.⁷

For US drivers, autonomous vehicles could free up almost



50 billion hours each year.⁸

In 2015, smart cities used



1.1 billion connected things.

By 2020, that figure will rise to



9.7 billion.⁹

1. Smart brings technology to life

Smart is a term that has come to describe everything from health and banking to entire cities. It takes an asset, infrastructure, or even transaction, ensures it is connected, analyzes its data and makes it more autonomous and effective. Smart is the layer of insight and decision-making above the interactions between connected things.

We are on the cusp of a smart revolution that could fundamentally change the way the world works for two reasons.

First, in an aging world that is becoming more resource-constrained, globalized and urbanized, governments and organizations see the need to invest in more efficient and smart solutions.

Second, the demand for such solutions is being fulfilled by the next wave of digital disruption: the industrialization of technologies such as the internet of things (IoT), AI and robotics.

2. Robotics and AI launch smart to a new level

AI is integral to smart because it can autonomously assimilate inputs, perceive and understand a need and deliver the best possible decision. It is hard to overstate the possibilities of AI. It is already being deployed in call centers to answer basic queries, in autonomous cars to transform mobility, and in smartphones as a personal assistant. The next step is the combination of AI's autonomous reasoning with "deep learning." By learning from every new input and experience, AI adds to the efficacy of subsequent actions.

Together, AI and robotics will combine greater decision-making power with the ability to execute. Organizations could see exponential improvements as software and hardware develops and costs decline.

AI's deep learning and robotic automation also bring closer the possibility of "singularity": the point at which machine thought supersedes human capability. It sounds like science fiction, but consensus suggests that, within a decade, smart might solve problems that humans struggle to conceptualize.

And investors and industries are seeing the significance of AI. In recent years, investor funding in AI has risen nearly sevenfold, from US\$45 million in 2010 to US\$310 million in 2015¹⁰. Across industries, the widespread rollout of robotics is already under way, with spending expected to reach US\$67 billion annually by 2025.¹¹

3. Smart is changing the world

Smart drives economic, environmental and social benefits, but the nuance lies in where, when and how.

In the past, an energy grid was deemed successful if it kept the lights on. Exploring a grid's limits was perceived as too risky. However, when decisions become more autonomous and are based on more complex and varied inputs and the consequences are tested, assessed and adjusted in real time, the grid can be optimized.

¹⁰ "Deep Interest In AI: New High In Deals To Artificial Intelligence Startups In Q4'15," *CB Insights*, February 2016.
¹¹ International Federation of Robotics; Japan Robot Association; Japan Ministry of Economy, Trade & Industry; euRobotics; Company Fillings, Boston Consulting Group; EY Analysis.

Now, apply the same approach to transportation networks, production lines, health services and supply chains. Reallocating passengers, resources and energy to different parts of a network eases peak demand and lessens periods of downtime. The smartest networks can anticipate issues and, if necessary, self-diagnose and self-heal.

The ability to assimilate, analyze and make decisions in more complex and scalable ways than ever before also enhances effectiveness. Using personal sensors and AI to analyze patient data, even to the level of detecting subtle changes in individual biochemistry, makes it possible to diagnose diseases with greater accuracy and to deliver improved outcomes.

Smart is also empowering customers with more information and greater insight than ever before – but insight is not enough. The empowered customer is expected to use those insights to take action, to adapt their energy usage, change their travel habits or manage their health proactively. See *Behavioral revolution*, page 32, for more.

4. The smart solution is holistic

The greatest challenge in smart is execution. It is easy to view implementation through a narrow lens, focusing only on technology transformation. Smart requires holistic change encompassing three core elements.

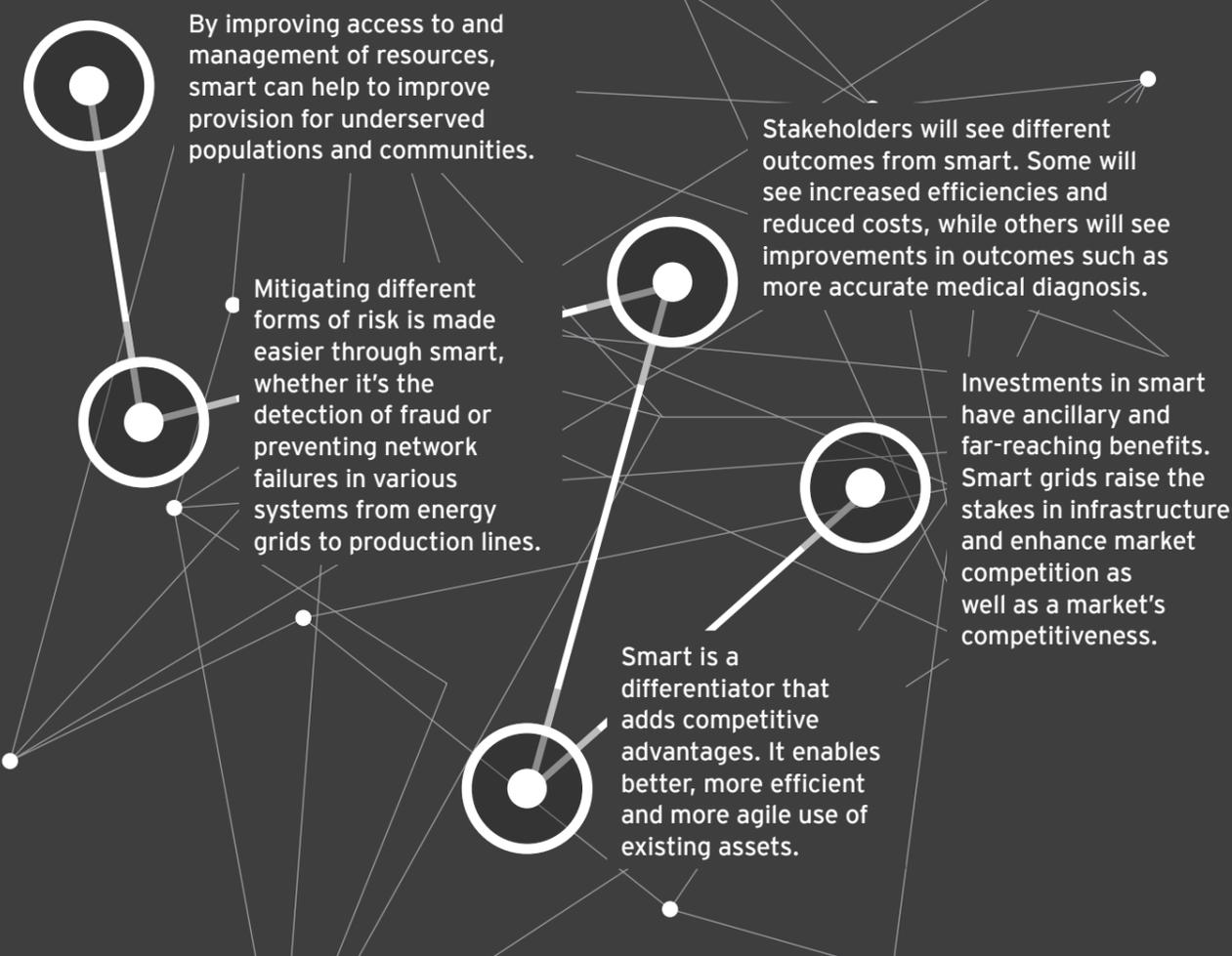
1 Setting the change agenda: In many aspects, the business case for smart still needs to be clarified and repeatedly tested. Even in smart utilities, where the case is better understood, the rationale varies by context. Among

other things, smart grids and meters can reduce carbon emissions, combat energy piracy, increase competition and competitiveness and drive investments in infrastructure.

2 Transforming beyond the core: If smart is to be effective, it requires an end-to-end redesign of organizational models. Companies with a heritage in manufacturing, health care, engineering and other established industries are becoming more like IT and data organizations. This will create new roles and increase the importance of others, such as the chief data officer.

3 Activating inside and out: Smart goes far beyond technological implementation and organizational change. Like any strategy, it requires activation. For example, the empowerment of customers is about more than installing meters or providing access to data. A smart strategy is activated through educating customers about what to do with the data and what actions to take.

THE FUTURE OF SMART Upsides

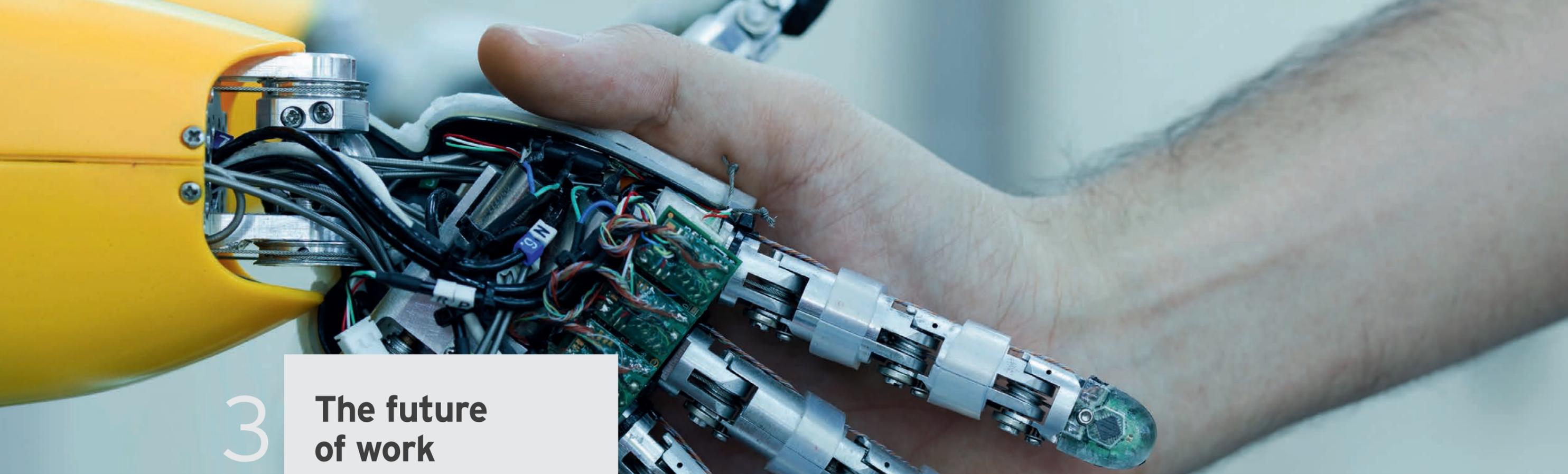


Better questions

When AI controls decisions, who controls your company?

How can smart best combine efficient and effective?

Does your organization know enough to be smart?



3

The future of work

When machines become workers, what is the human role?

1. An unprecedented reinvention of work is coming

The coming reinvention of work is unlike anything we have witnessed before, even in this era of disruption.

The displacement of labor by technology and globalization is hardly a new phenomenon. Technology has been reshaping work since the first Industrial Revolution, which demolished guilds and replaced artisanal craftsmanship with assembly line production. Globalization has been changing work for decades, thanks to trade liberalization and emerging markets.

Now, the next waves of disruptive technology – AI, robotics, virtual reality, IoT and sharing economy platforms – are poised to take labor displacement to a higher level. Automation has long displaced workers in blue-collar jobs, from factory laborers to supermarket cashiers. To appreciate the scale of blue-collar displacement ahead from driverless vehicles alone, consider that driving is the single largest occupation of US men today.

2. Even white-collar and creative work will be affected

AI is now disrupting jobs long considered immune to technological displacement such as white-collar work and creative endeavors. Algorithms have uprooted white-collar work in the financial sector (high-frequency trading) and are starting to do so in health care (mobile health apps, robotic surgery and diagnosis by algorithm). They are even expanding into spaces once considered exclusively the domain of human creativity. Already, algorithms are writing articles indistinguishable from those written by humans and have even recently composed a musical play.^{15, 16}

Not all jobs will be affected and not all affected jobs will be eliminated – as always, automation will both replace and supplement human labor – but jobs that are truly untouched will be the exception rather than the norm.

¹⁵ Shelley Podolny, "If an Algorithm Wrote This, How Would You Even Know?" *The New York Times*, 7 March 2015.
¹⁶ Joe Berkowitz, "Computers Writing Broadway Musicals Is The Next Phase Of The Inevitable Robot Uprising," *Fast Company*, 5 February 2016, <http://www.fastcreate.com/3056409/computers-writing-broadway-musicals-is-the-next-phase-of-the-inevitable-robot-uprising> (accessed 25 April 2016).

3. Moving from the gig economy to the machine economy

We see the future of work evolving in two stages:

- ▶ **The gig economy.** The rise of platforms such as Airbnb, Deliveroo, Didi Kuaidi, Etsy, TaskRabbit and Uber has already spawned what is often referred to as the gig economy – in which non-employee freelancers provide labor in temporary assignments.
- ▶ **The machine economy.** The next stage will be driven by AI and robotics: the mass disruption of labor and the rise of the machine economy.

We are in the early stages of these shifts, and it's hard to know exactly how they will play out. On one hand, it has been predicted there will be massive net losses of jobs. Today, for instance, a worker displaced by globalization may freelance as an Uber driver. In the future, many more office workers will be displaced by AI – but they won't have the option of becoming freelance drivers if the ride-sharing platform of the future uses driverless cars.

The World Economic Forum estimates that a confluence of technological, socioeconomic and demographic drivers will displace

5.1 million jobs across 15 major economies by 2020.¹²

Also by 2020, Intuit predicts that

40% of American workers will be independent contractors – an estimate that may be conservative since it was created in 2010, when platforms such as Uber and TaskRabbit had barely been launched.¹³

In late 2015, several respected thinkers and technology leaders

– including **Stephen Hawking** and **Elon Musk** – highlighted the risks raised by the rapid rise of AI and its implications for humanity.¹⁴

¹² World Economic Forum, "The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution," 2016.
¹³ Intuit, "Intuit 2020 Report: Twenty Trends that will Reshape the Next Decade," 2010.
¹⁴ Nick Statt, "Bill Gates is worried about artificial intelligence too," *CNET*, 28 January 2015, <http://www.cnet.com/news/bill-gates-is-worried-about-artificial-intelligence-too/> (accessed 25 April 2016).

On the other hand, history shows that automation surprises us with new sectors and forms of employment. Just as digital disruption spawned jobs for web designers and app developers that few foresaw in the computer revolution's early days, the machine economy is likely to generate jobs, companies and even entire sectors that we are unable to envision today.

4. The future of work will disrupt business, government and society

1. **Disrupting business.** The disruption of work is already spawning business model innovation. Ride-sharing platforms, which use transportation resources more efficiently, envisage a future with fewer vehicles. So, auto manufacturers are exploring ways to reinvent traditional models (GM's partnership with Lyft) while disruptive entrants (Uber and Lyft, plus newer entrants Fasten, Split and Bridj) are experimenting with multiple approaches.

In the future of work, the ultimate resource that companies will use more efficiently is the human resource. Labor-intensive firms everywhere will need to reinvent their business models, deploying smart technologies and using labor more productively. One result is that work will be unbundled. Just as disruption unbundled music albums into songs, it will unbundle jobs into tasks, with each task performed in the most efficient manner.

However, some of the biggest disruptive implications will extend beyond the business world. Work is more than a cog in a business model;

it is a fundamental part of the human experience. The radical disruption of work has profound political and social implications.

2. **Disrupting government.** Gig economy start-ups are already challenging regulations governing the operation of hotels, restaurants, taxis and more. The trend will accelerate with the move to such machine economy innovations as driverless cars and medical algorithms. Workplace protections could well be challenged. In the growing gig economy, hard won rights that have become commonplace such as collective bargaining, the five-day workweek, paid time off and insurance against workplace injuries and unemployment could all come under threat. Independent contractors in a gig economy have none of these protections.

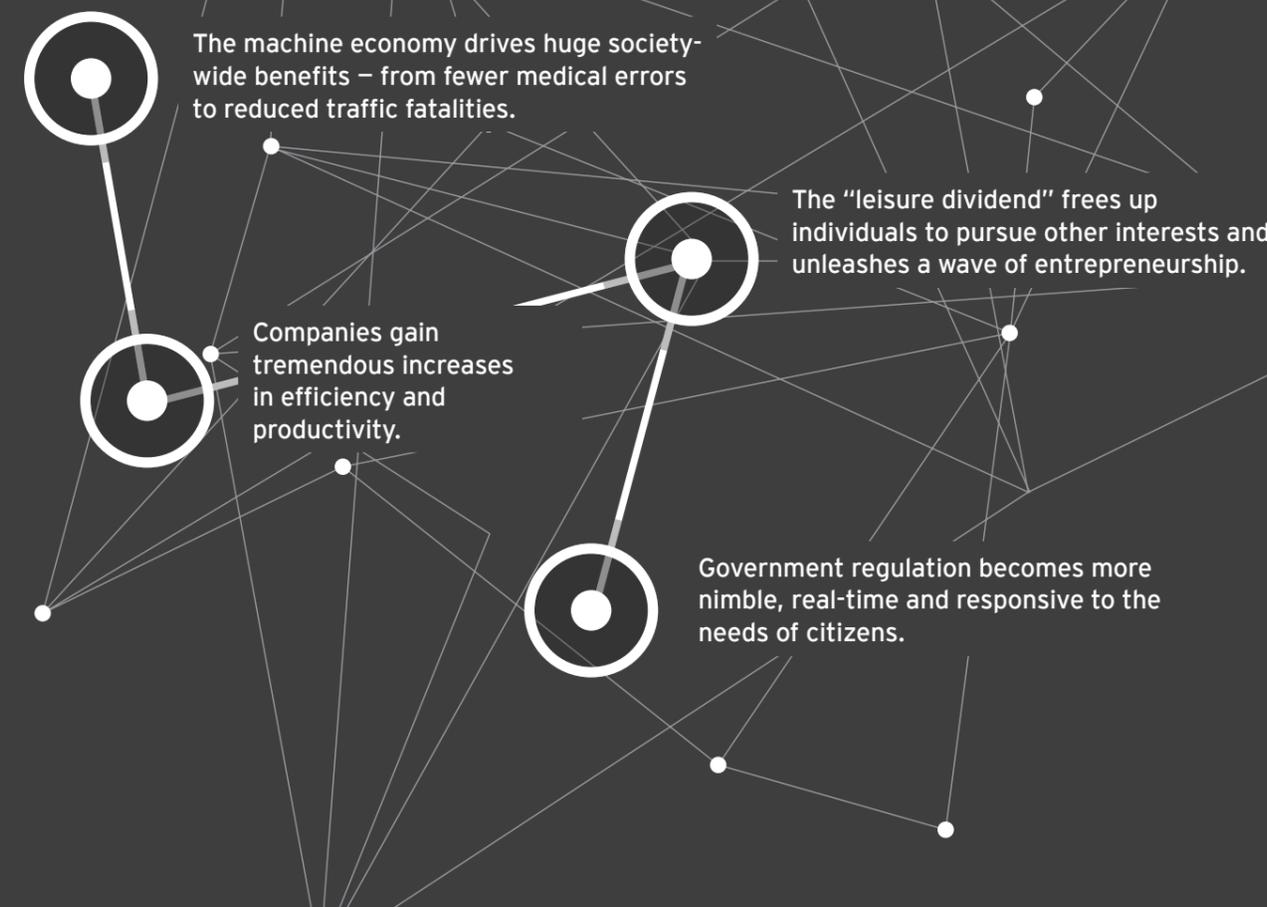
The start-ups disrupting work argue that existing regulations were designed for another era and do not apply to the gig economy. There's some validity in that, but regulation also protects consumers and workers in important ways. Governments will need to find the right balance, creating regulatory regimes designed for the future – nimble, real-time and powered by big data and smart technologies.

3. **Disrupting society.** Income inequality could be greatly exacerbated by wholesale labor displacement and by the dismantling of key elements of the social safety net such as health care benefits and retirement savings, which are often provided through the employer-employee relationship. To maintain social stability, we will need bold solutions – including, perhaps, a universal basic income.

Meanwhile, the machine economy promises to deliver a "leisure dividend" unlike anything we have seen before. We don't yet know whether we will use this spare time to enrich our lives culturally and intellectually or whether the loss of work will deprive us of something elemental that gives our lives a sense of purpose.

How do you build a better working world in a world with less work?

THE FUTURE OF WORK Upsides



Better questions

How will workers and citizens be motivated in the machine economy?

How will governments adapt to remain relevant for the future of work?

How do you build a better working world in a world with less work?

With massive labor displacement ahead, how will we address income inequality?

4

Behavioral revolution

How will individual behavior impact our collective future?

1. Behavioral economics will become a growing resource for business

Some of the biggest, most intractable challenges confronting humanity – chronic disease, climate change, excessive household and public debt – stem from human behavior such as poor diet and lack of exercise, unsustainable energy use and excessive consumption.

These challenges have been around for decades, but they are now becoming increasingly urgent – due to demographics and globalization – bringing behavioral economics (BE) into the mainstream.

BE marries insights from psychology and economics and, despite being around since the 1970s, has only recently begun moving from academia to the real world.

Incentives to act rationally are all around us – from legal restrictions to the ways in which companies price goods and motivate workers. The vast majority of these enticements and impositions assume that people are utility-maximizing rational agents who act in their best interests. Except, as BE demonstrates, we aren't.

2. Global challenges and tech drive the growth of behavioral economics

BE has sought to demonstrate our irrational behavior in a number of ways. For example, we excessively discount the future (hyperbolic time discounting), making us value an impulse purchase today over a secure retirement decades later. Our status quo bias leads to dramatically different participation rates for retirement savings and organ donation, depending on whether the choice is an "opt in" or "opt out."

Meanwhile, loss aversion bias means we dislike losing US\$100 more than we like gaining US\$100 – leading to unpredictable behavior on stock markets and elsewhere. Social norms can motivate us more powerfully than market norms – one of the reasons behind the success of Wikipedia's volunteers.

However, our behavioral biases are consistent and unidirectional, which means we can build incentives that correct for them. Instead of hurting us, our biases can be used to help us make better decisions.

The growing use of BE will stem from two major shifts:

- **Increasingly urgent behavioral challenges.** As the cost of issues such as chronic disease and climate change rises with aging demographics and globalization, the imperative to address them becomes increasingly urgent. This is leading more governments to use BE. The UK's pioneering Behavioural Insights Team has been advising foreign governments interested in adopting BE. The US became the latest government to do so in September 2015, when it established the Social and Behavioral Sciences Team.

The huge economic opportunity in these behavioral challenges is also attracting the private sector. Large companies, in a variety of sectors, are experimenting with BE approaches. And, intriguingly, a number of start-ups have sprung up with disruptive business models built entirely around BE – see *Inventive businesses are already employing behavioral economics*, page 34.

- **The march of technology.** The digital revolution is catalyzing the deployment of BE. Smartphones and sensors can monitor behavior and adapt incentives

Citi estimates that the cumulative global cost of climate change will reach **US\$44 trillion** by 2060.¹⁷



The World Economic Forum estimates that chronic disease will cost the global economy

US\$47 trillion

between 2010 and 2030.¹⁸

The National Institute on Retirement Security estimates that between



65%–92% of Americans (depending on net worth) aren't saving enough for retirement, leading to a savings gap of as much as US\$14 trillion.¹⁹

17 Citi, "Energy Darwinism II: Why a Low Carbon Future Doesn't Have to Cost the Earth," 2015.

18 World Economic Forum and the Harvard School of Public Health, "The Global Economic Burden of Non-communicable Diseases," 2011.

19 National Institute on Retirement Security, "The Retirement Savings Crisis: Is It Worse Than We Think?" 2013.

in real-time, real-world conditions. In addition, social media can tap the immensely motivating power of social norms and gamification – harnessing game-playing principles such as competition to motivate human behavior. Digital and online platforms can deploy A/B testing – a key technique for customizing nudges – at tremendous speed and scale.

3. Incentive businesses are already employing behavioral economics

The power of BE can already be seen in a number of sectors. In health care and wellness, BE start-ups such as Pact and stickK are helping people improve behaviors such as diet and exercise, using approaches that succeed where traditional incentives fail.

The financial pain of gym membership fees fails to motivate most people to exercise because the fees are automatically deducted from their bank accounts (defanging the bite of loss aversion), while hyperbolic time discounting makes lazing today more attractive than better health years later.

Pact is an app that uses BE to turn behavioral weaknesses into strengths. Users make a weekly pact, choosing how often they intend to exercise and wagering money on their commitment. Users who fail to honor their pact forfeit the money they wagered – aversion to this tangible loss has proven to be a great motivator. The forfeited money is pooled and distributed to those who did go to the gym – turning hyperbolic time discounting on its head by making rewards from exercise immediate instead of deferred.

BE can also motivate sustainable energy and resource use. Opower – a start-up that was recently acquired by technology giant Oracle – helps utility companies nudge consumer behavior by applying the motivating power of social norms. The company designs personalized energy bills informing consumers how their energy use compares to that of neighbors and energy-efficient households. This simple tweak has delivered considerable savings – and far more cost-effectively than traditional marketing or economic incentives.

In the area of retirement savings, companies are paying close attention to the presentation of different choices (known as choice architecture) in their plans. For instance, in the “Save More Tomorrow” plan, created by behavioral economists Richard Thaler and Shlomo Benartzi, employees commit to increasing their contributions at a future date rather than today – curbing the desire to delay because of hyperbolic time discounting. Increases in contribution rates are tied to pay raises – minimizing loss aversion. Employees stay in the plan until they choose to opt out – and status quo bias ensures that most remain. Firms implementing this approach have significantly boosted employees’ retirement savings.

4. The next challenge: long-term behavioral change

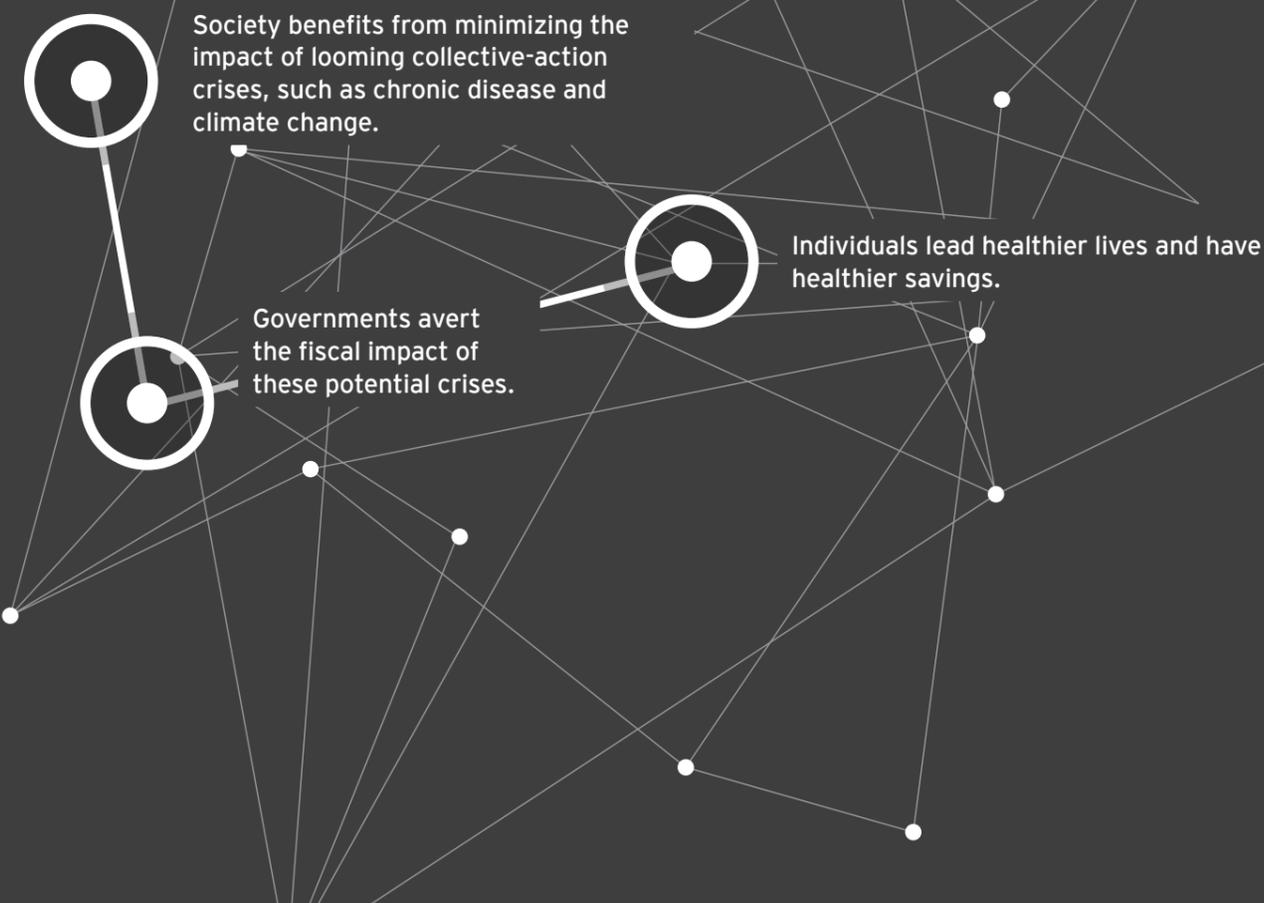
Businesses and governments will have to overcome challenges as BE approaches are more widely adopted. One stems from concerns about “Big Brother” taking away individual freedom. To address this issue, it is critical that incentives be designed to preserve individual freedom, even

as they nudge (not force) people toward better choices.

A second challenge is that chronic disease and climate change will play out over decades, requiring long-term behavioral change. Behavioral economists don’t yet know enough about whether nudges that work in the short term will lose their impact over time, and practitioners will need to experiment and learn along the way.

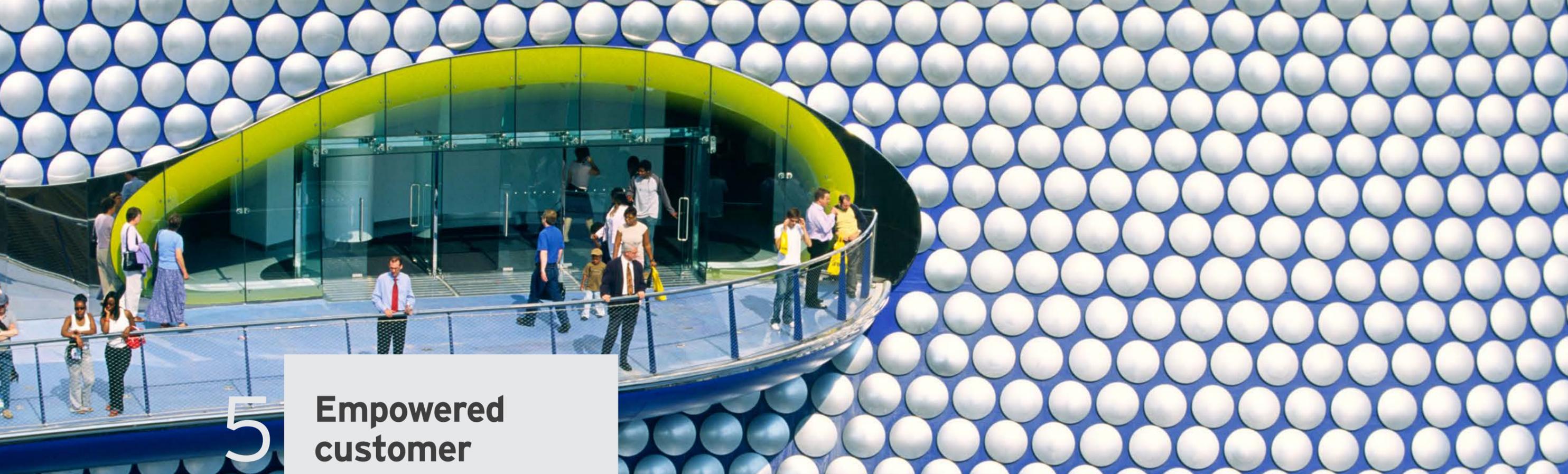
Lastly, businesses and organizations need to realign short-term institutional incentives, such as election cycles and quarterly earnings expectations, toward the long-term focus needed to address our biggest collective challenges.

BEHAVIORAL REVOLUTION Upsides



Better questions

- How will societies improve collective behaviors without restricting individual freedoms?
- How can organizations be motivated to focus on the long term?
- How can we nudge individuals to save more – and save our collective future?
- How will we nudge people to adopt healthy behaviors – for the rest of their lives?



5

Empowered customer

How will you change buyers into stakeholders?

1. Empowered customers know their worth

Today's individual customers understand their commercial value. They can block ads and they can opt out at a moment's notice. However, they are willing to pay for what they value.

Customers expect to be understood and appealed to in their full complexity. Organizations need to see them as nuanced individuals. One consumer may say, "I'm a 21-year-old female who skateboards, listens to jazz rap, wears Boho Chic, goes to poetry slams, and plans a career in environmental conservation. What can you do for me?" Another says: "I'm a 46-year-old entrepreneur who founded an online gaming service, has a wife and one son, loves to shop in Hong Kong, owns a BMW, likes to try new grooming products, and when in Beijing, dines in luxury-branded cafes. What can you do for me?" Customers can no longer be conveniently categorized.

In this culture of the niche, all interactions, products and services need to be personalized. Spotify personalizes your music, Netflix customizes your entertainment,

and Coca-Cola displays your name on billboards as you drive by.

Customers are bombarded daily with information, promotions and brand messages. Curated retail options such as Stitch Fix or Birchbox and social reading apps such as Kite are helping consumers overcome the paralysis of too many choices.

Software hasn't killed retail, but retail's future, as well as the future of all business types, depends on delivering experience. While mundane products and commoditized services will increasingly be delivered via subscription, experiences that employ all five senses are becoming distinct offerings. Differentiated interactions – both live and virtual – will be embedded in everything human beings do – from dining to vacationing to riding in a taxi. The growing primacy of delivering differentiated experiences will have profound effects on how value is created and measured – both for companies and economies.

As the demand for personalized services has grown, the direction of trust has also changed. Customers trust each other more than they trust brands or businesses. Online shoppers have

more faith in peer recommendations and earned media such as customer tweets than they do in traditional paid advertising. Today's brands are built by consumers themselves, not advertisers.

Today's customers distrust traditional ways of selling and eschew traditional supply chains. They want multiple routes to transaction – whether website, mobile app or physical store. They expect seamless engagement across these channels. Customers anticipate that their providers will have a deep understanding of their needs contextually at any point in time; all provider touch points must be highly relevant or be discarded as spam.

2. Empowered customers want a piece of the action

Today's customers are creative. They sell their dreams through Etsy. They use small-scale desktop 3D printers such as those sold by MakerBot to print products sourced from free designs provided by the Thingiverse 3D design community. They work hand-in-hand with organizations to co-create products and services. They expect to participate. Through the European Citizens' Initiative, citizens are co-developing EU policies by successfully

GE is using immersive **virtual reality technology** to demonstrate large, complex deep sea oil and gas drilling equipment to its B2B customers.²⁰

Companies such as **Levi's** and **Mercedes-Benz** are creating and distributing content starring young "influencers" on Snapchat, YouTube, Vine and other social media channels.²¹

Consumers are leveraging invention platforms like Edison Nation and financing these projects through crowdfunding platforms such as Indiegogo and Kickstarter.

²⁰ Lauren Johnson, "GE's First Stab at Virtual Reality Takes You Under Water," *Adweek*, 16 January 2015, <http://www.adweek.com/news/technology/ges-first-stab-virtual-reality-takes-you-under-water-162392>

²¹ "How Brands Market with Top Instagram Influencers," *MediaKix*, 2016, <http://mediakix.com/2016/03/brand-guide-to-working-with-top-instagram-influencers/>

petitioning the European Commission to consider specific legislative proposals.

And customers are entrepreneurial. They demand vehicles for commercial self-expression. Crowdfunding platforms such as AngelList, Crowdcube, Demohour, Indiegogo and Kickstarter provide access to capital and visibility for entrepreneurs as well as foster communities of evangelists. And their clout matters. For example, the growing affinity for small, local, craft products has had an impact on big companies. Customers are not just buyers, but stakeholders.

Customers drive efficiency and speed to market. The global B2B platform Buyerparty facilitates gathering orders when products are in the design stage, allowing their owners to move into costly production only upon sufficient demand, helping to eliminate problems like overstock and resource wastage.

3. Customer empowerment is a business opportunity

Customer empowerment is a chance for consumers and providers to realize greater value from a more intimate and trusted relationship. However, there are challenges that businesses must overcome.

Providers must develop the right mix of automated and human touch points. They must manage paid, owned, and earned media channels – as well as data across all consumer touch points and the physical/digital divide – seamlessly.

They must view customers holistically, both end-to-end and continuously. Advances in artificial intelligence and the IoT will turbocharge customer analytics, but also raise the stakes around privacy and the kinds of products and services that customers are willing to accept in

return for their personal data. Consumers will likely demand greater choice about who receives their data. At the same time, organizations that provide consumers more control over how their personal information is leveraged may gain competitive differentiation.

The power of analytics is not just about understanding consumer behavior but also influencing it. Nearly all companies are using advanced data to build algorithms intended to influence the choices that consumers make. When building these big data strategies, businesses need to consider not only how to preserve human values such as privacy and confidentiality, but also need to examine the ethical dimensions of subverting free choice.

4. B2B must adopt B2C techniques to satisfy empowered customers

Business-to-business (B2B) organizations increasingly will need to adopt business-to-consumer (B2C) techniques. Business customers want the same level of empowerment relative to their suppliers and distributors that they receive from Amazon as individual consumers. This raises supply chain questions for B2B companies that work with middlemen. For example, the supply chain required to deliver in bulk to a distributor is much different than that designed to accommodate individual consumers.

5. Customers continue to evolve

Customers themselves will continue to evolve. The emerging gig economy is spawning a whole new customer group – freelancers. These professionals are being targeted by new B2P (business-

to-professional) companies and solutions. For example, India's cross-border payments company, Transpay, enables freelancers across the world to get paid quickly and securely when contracting with online workplace platforms such as Upwork.

6. Invent the future with customers

Organizational aspiration and ability to be customer-centric across the value chain, including innovation, will be a key determinant of future competitiveness. Of course, companies will still need to help invent the future for customers. As Henry Ford allegedly said: "If I had asked people what they wanted, they would have said faster horses." But they may also have said that they preferred Ford to continue making cars in colors other than black. Innovation can no longer take place in hermetically sealed places of invention – tomorrow's success requires innovation in lockstep with customers.

EMPOWERED CUSTOMER Upsides



Treating customers as stakeholders rather than buyers generates a virtuous cycle – customers benefit from better products and services and companies are more likely to meet their needs.



Co-creation gets customers invested in the success of an idea and builds loyalty – even evangelism.



From maker spaces to crowdfunding to invention platforms, there are more ways than ever to get an idea off the ground.



Empowered customers carry their rights with them into other domains. Empowered citizens help governments to become more transparent and responsive, boosting efficiencies and helping to achieve policy goals.



Delivering rich experiences – either wrapped around products or services or standalone – has the potential to improve margins and create new revenue streams.

Better questions

Power has shifted to customers; what will they do with it next?

If today's customers are kings, will tomorrow's customers be kingmakers?

When experiences trump things, how will you delight your customers?

What can you offer the customer that has it all?

When you can go over-the-top to your customers, how will it change your value chain?



6

Urban world

In a fast-changing world, can cities be built with long-term perspective?

1. Asia and Africa will see the bulk of urban growth

In 2008, the world reached a milestone. For the first time in history, the majority of the world's population lived in cities. By 2050, at current rates of urbanization, the world will be two-thirds urban and one-third rural, a reversal of the global distribution pattern of 1950.²⁵

Most of that growth will occur in Asia and Africa.²⁶ Those regions are expected to receive an additional 1 million inhabitants – roughly the population of Boston and Zurich combined – every week for the next 40 years.²⁷ Such growth puts pressure on existing megacities to expand and for new cities to form, heightening infrastructure demand. The effects of climate change – especially rising water levels – will leave many cities in both the developed and developing world vulnerable. This puts pressure on infrastructure to be sustainable and resilient.

2. Innovation is at the heart of the cities of the future

Future cities built on driverless transit systems, smart buildings and green

spaces – all inhabited by connected and aware citizens – are already beginning to emerge. Dubai is testing electric buses and driverless cars with plans to deploy them during its hosting of Expo 2020.²⁸ Singapore is on the verge of launching a driverless taxi pilot. Seoul is leveraging smart technologies and mobile-web applications to provide citizen-centric services.²⁹

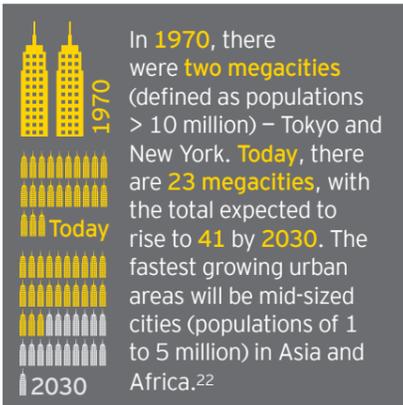
Innovation to reduce the cost curve of infrastructure – ranging from smart grids and better network load balancing to less expensive natural gas extraction to improved flow rates across roads – is helping cities to become sustainable and more habitable. Urban residential and commercial customers are generating more of their own energy and getting more of their power from distributed renewable sources. Net zero energy – where the renewable energy generated by a building in a given year equals the total energy the building uses – has become a goal for many buildings around the world.

3. New cities are being built from the ground up

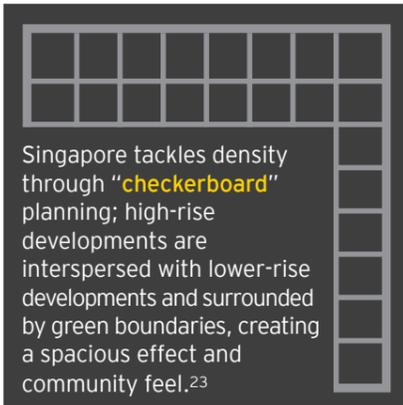
Brand new cities are being built in China, India, Malaysia, Saudi Arabia and the

Philippines, among others. Greenfield urban experiments serve as test beds for addressing environmental and sustainability challenges. Tianjin Eco-city, a joint venture of China and Singapore, is being built from scratch on a sustainable model that emphasizes green buildings and transportation, as well as affordable housing. South Korea's brand new urban zone, Songdo International Business District, offers one of the highest number of LEED-certified projects in the world.

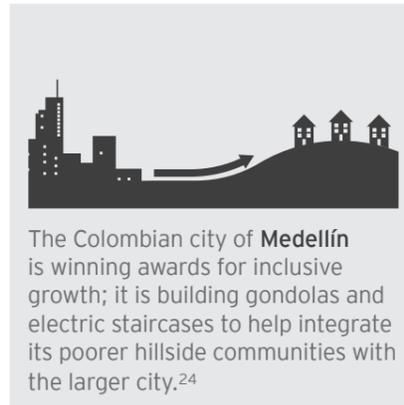
China has combined trade incentives and tax subsidies to build or jump-start new cities in the interior as part of its Go West program. Some of China's newer cities, such as Zhengdong New District, are beginning to fill up, suggesting that



In 1970, there were **two megacities** (defined as populations > 10 million) – Tokyo and New York. **Today**, there are **23 megacities**, with the total expected to rise to **41** by 2030. The fastest growing urban areas will be mid-sized cities (populations of 1 to 5 million) in Asia and Africa.²²



Singapore tackles density through “**checkerboard**” planning; high-rise developments are interspersed with lower-rise developments and surrounded by green boundaries, creating a spacious effect and community feel.²³



The Colombian city of **Medellín** is winning awards for inclusive growth; it is building gondolas and electric staircases to help integrate its poorer hillside communities with the larger city.²⁴

²² United Nations, “World Urbanization Prospects,” 2014, <http://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf>

²³ Limin Hee and Scott Dunn, “Does High Density Mean the End of Liveability?” *Skyline*, March/April 2013, <https://www.ura.gov.sg/skyline/skyline13/skyline13-02/files/Does%20high-density%20mean%20the%20end%20of%20liveability.pdf>

²⁴ Coby Joseph, “Medellín Metrocable improves mobility for residents of informal settlements,” *The City Fix*, 26 August 2014, <http://thecityfix.com/blog/medellin-metrocable-improves-mobility-informal-settlements-low-income-accessibility-equity-development-coby-joseph/>

²⁵ United Nations, “World Urbanization Prospects,” 2014, <http://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf>

²⁶ United Nations, “World Urbanization Prospects,” 2014, <http://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf>

²⁷ Joel E. Cohen, “Beyond Population: Everyone Counts in Development,” *Working paper 220, Center for Global Development*, July 2010, http://www.cgdev.org/files/1424318_file_Cohen_BeyondPopulation_FINAL.pdf

²⁸ “Driverless cars plan for Dubai Expo,” *The National UAE*, 22 February 2016, <http://www.thenational.ae/uae/technology/driverless-cars-plan-for-dubai-expo>

²⁹ “Smart Cities Seoul: A Case Study,” *ITU-T Technology Watch Report*, February 2013, https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000190001PDFE.pdf

what were termed ghost cities by the international press were actually just cities slowly coming to life.³⁰

While centrally planned urbanization has its challenges, unplanned urbanization has its costs as well. Roughly 32% of city dwellers in 2050 will live in slums, a doubling of today's numbers.³¹ Subsisting on informal economies to a large extent, some slums have become ungoverned and unserved cities within cities. The realities of slums – unemployment, poverty, disease and despair – make them fertile recruiting grounds for criminal and terrorist networks. The idea of inclusive urbanization, whereby all citizens share in the benefits, is gaining traction but will require real political commitment and innovative mechanisms.

4. Mature cities must upgrade or replace infrastructure

Many established cities in mature markets face the challenge of retrofitting and upgrading their existing infrastructure. Four-fifths of the £1.3 trillion (US\$1.9 trillion) cost of the London Infrastructure 2050 plan is earmarked for upgrading existing infrastructure, for example.³²

In a time of fiscal stress, policymakers and the public have tended to favor new projects, but maintaining and upgrading existing infrastructure is also essential. A 2014 EY survey highlighted that the public's willingness and ability to pay for infrastructure are the keys to shaping the future of urban projects and real estate over the next decade.³³ Extracting additional value from existing assets, whether through optimization (e.g., dynamic tolling rates on roads to shift peak use) or creating new revenue streams (e.g., selling air rights to build

above existing highways or rail lines) can be an alternative to building new infrastructure. The most effective investment and creative planning will also be underpinned by behavioral solutions, such as pricing mechanisms to reduce vehicle usage.

5. Public-private partnerships will be the foundation of the urban world

Successful urban solutions will entail public and private cooperation. Meeting the challenge will require the creativity and investment of the private sector alongside the long-term vision and funding of the public sector, as well as a dedication to inclusive growth. The gravest challenges cities face will require international cooperation, such as the COP21 Paris climate talks.

6. Cities will become as powerful as nations

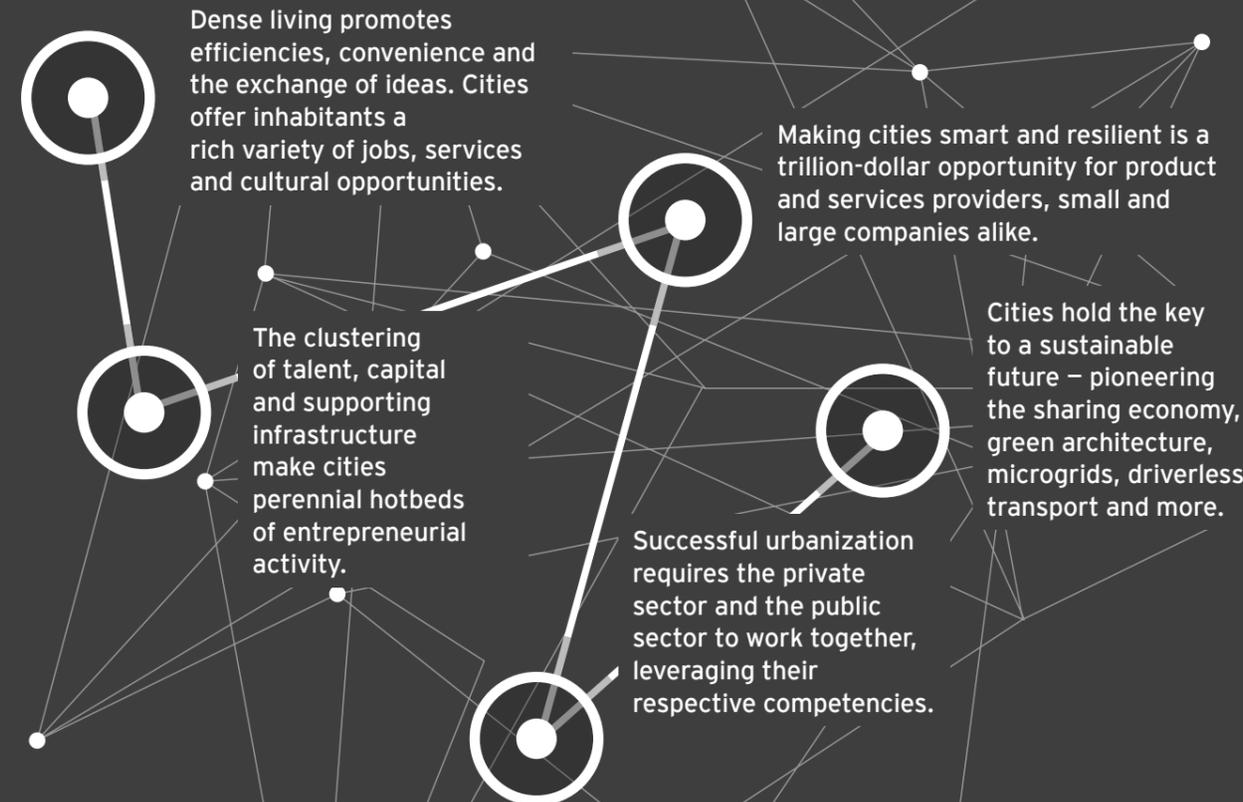
Within decades, cities are likely to become as powerful, if not more so, than nations themselves. Local city governments are better positioned to understand the specific needs of citizens and tend to be pragmatic (and less driven by raw politics) in their approaches to urban challenges.

Cities are already leapfrogging national roadblocks to play an important role in determining what our urban world will look like. For example, the C40, a network of the world's megacities, is acting both locally and collaboratively to reduce greenhouse gas emissions. The potential for megacities to emerge as the world's most important economic entities will

have profound effects on future geopolitics, governance, and corporate plans.

³⁰ Wade Shepard, "The Myth of China's Ghost Cities," *Reuters*, 22 April 2015, <http://blogs.reuters.com/great-debate/2015/04/21/the-myth-of-chinas-ghost-cities/>
³¹ Richard Florida, "The Amazing Endurance of Slums," *The Atlantic CityLab*, 23 January 2014, <http://www.citylab.com/work/2014/01/amazing-endurance-slums/8120/>
³² "The Cost of London's Long-Term Infrastructure: Greater London Authority (GLA): Final Report," *ARUP*, 29 July 2014.
³³ Urban Land Institute and EY, "Infrastructure 2014: Shaping the Competitive City," 2014, [http://www.ey.com/Publication/vwLUAssets/EY_-_Infrastructure_2014:_shaping_the_competitive_city/\\$FILE/EY-Infrastructure-2014-shaping-the-competitive-city.pdf](http://www.ey.com/Publication/vwLUAssets/EY_-_Infrastructure_2014:_shaping_the_competitive_city/$FILE/EY-Infrastructure-2014-shaping-the-competitive-city.pdf)

URBAN WORLD Upsides



Better questions

Will we become citizens of cities not nations?

In a world where income inequality is rising, how can urban growth be more inclusive?

How can cities be made resilient to the future's known and unknown stressors?

New cities are built with "brains," but how will they develop their hearts and souls?

How will the public and private sector co-author this century's urban story?

7

Health reimaged

With growing health needs, is digital the best medicine?

1. Disruption and economic sustainability drive the health care revolution

Health care is being reinvented. The shift is being driven by two main factors: the search for economic sustainability and digital disruption. Health care spending is on an unsustainable trajectory, thanks to demographic shifts (aging populations) and globalization (sedentary lifestyles that accompany economic development and urbanization).

This is motivating health care systems to focus as never before on sustainability and value as they strive to balance three fundamental imperatives: expanding access, improving quality and managing costs. Meanwhile, just as health systems need to contain costs, digital health (mobile apps, wearables, social media, and analytics) is providing a key part of the answer by enabling approaches that are dramatically more cost-effective.

2. The journey to Health 2.0

The search for economic sustainability is playing out in different ways across geographies, reflecting the realities

of individual markets. In the US, the Affordable Care Act has significantly expanded access to health coverage and led to considerable experimentation with approaches that align incentives with value (pay-for-performance) instead of volume (fee-for-service). Hospitals across the West are implementing initiatives to maximize efficiencies with better resource scheduling, discharge planning, and clinical pathways.

Developing economies in Africa and elsewhere are using mobile health solutions to expand access in rural areas. Resource-rich economies in the Persian Gulf and emerging markets such as China are investing in health care systems and have the opportunity to build more sustainable approaches from the start.

Developing sustainable approaches will require varied skills, from app development to analytics and customer engagement. So, entrants from once far-removed sectors – technology, telecommunications, and retail, for example – are moving in. For more, see *Industry redefined*, page 20. Their entry creates opportunities for cross-sector partnering – but also raises the specter of disruption for mature health care incumbents.

Over time, these trends promise to take us to Health 2.0, a fundamentally different model for health care. Instead of being passive recipients of care, patients will become empowered consumers, with more information and control over their health decisions. Sophisticated analytics will allow providers to focus on prevention and disease management. Instead of being delivered only in hospitals and clinics, health care will be available wherever patients happen to be.

3. The next wave of digital innovation will be even more disruptive

The next generation of smart technology promises even greater change. Consider the disruptive potential of the following:

- ▶ **Artificial intelligence:** Much of medicine involves heuristic, rules-based problem solving based on symptoms and test results. This is fertile ground for AI. Today's decision-support tools could soon be replaced by sophisticated algorithms that diagnose and prescribe – with greater accuracy and less random variability than their human counterparts.

The World Economic Forum estimates that chronic disease will cost **\$47 trillion** globally between 2010 and 2030.³⁴

The volume of health data worldwide is projected to balloon to **2.3 exabytes** (2.3 billion gigabytes) by 2020 – growing 48% per year and outpacing the growth of big data overall.³⁵

2.3 exabytes
2020

In 2015, an astonishing **165,000 mobile health apps** were available on the iOS and Android platforms – about twice as many as just two years earlier.³⁶



³⁴ World Economic Forum and the Harvard School of Public Health, "The Global Economic Burden of Non-communicable Diseases," 2011.
³⁵ EMC and IDC, "The Digital Universe Driving Data Growth in Healthcare," 2014.
³⁶ IMS Institute for Healthcare Informatics, "Patient Adoption of mHealth: Use, Evidence and Remaining Barriers to Mainstream Acceptance," 2015.

- ▶ **Sensors:** Monitoring health in real-time, real-world conditions promises huge efficiencies through disease prevention and care management. Today, this is done through medical devices, smartphones and wearables, which are essentially mobile platforms packed with sensors. The next generation of sensor technology – cheaper, smaller, more efficient – will unbundle sensors from phones, embedding them in tattoos and adhesive bandages.
- ▶ **Real-world analytics:** Sensors do more than enable timely interventions; they also deliver an abundance of real-time, real-world data. Today, analytics firms are combining and analyzing big data streams across health care organizations, but the gold mine of data from sensors sits largely untapped. Imagine combining the information in a patient's health record with round-the-clock sensor data on diet, activity levels and medication adherence to comprehensively understand the drivers of her blood pressure. When it happens, this will be a game changer.
- ▶ **The sharing economy:** Sharing economy platforms are terrific at deploying underutilized assets – allowing people to list their unused cars on Turo or their guest bedrooms on Airbnb, for instance. This approach could have tremendous applicability in health care systems, which are rife with excess capacity. Start-ups have already begun tackling the problem.

health technologies has grown rapidly, mainstream adoption has remained elusive. Payers often do not provide reimbursement and providers remain skeptical in the absence of scientific data on efficacy. The next generation of sensors – less invasive and with more accurate and useful data – could finally take us to the tipping point.

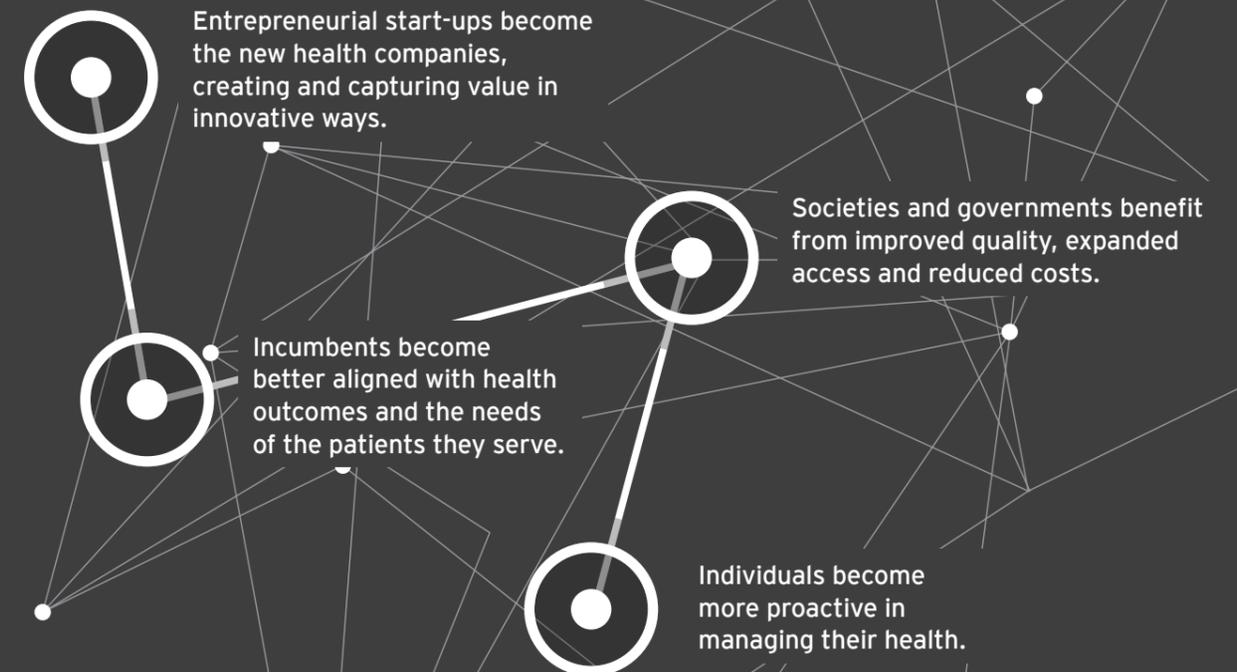
Digital health has also compounded the challenge of fragmentation in health care. Achieving the vision of Health 2.0 requires integrating data across diverse streams to see the big picture. This has never been easy in health, where interoperability is limited and data sharing restricted by regulations and concerns about privacy and security. The rapid proliferation of data sources is making the challenge considerably more difficult. The need to address this challenge will continue to drive partnerships and acquisitions to access data, as well as work on analytical techniques, industry standards and platforms to integrate it.

As the chronic disease burden escalates, systems will be forced to tackle the biggest challenge of all: behavioral change. Expect to see increasing action in this space, as payers, providers and employers combine insights from behavioral economics with mobile health technologies to “nudge” behaviors. See *Behavioral revolution*, page 32, for more.

4. Fragmentation, adoption and behavior patterns challenge Health 2.0

It is relatively easy to imagine the future of health; getting there will be more challenging. While the number of mobile

HEALTH REIMAGINED Upsides



Better questions

When algorithms prescribe and diagnose, how will providers adapt?

In a world of fragmented health data, how do we see the big picture?

While everyone in health care is focused on the short term, how do we incentivize the long-term behavioral changes needed for tackling chronic disease?



8

Resourceful planet

Can innovation make the planet resource rich instead of resource scarce?

1. The resources transformation is at an inflection point

As demographic trends push the world's population to 9.7 billion by 2050, natural resource constraints – whether in availability or infrastructure – challenge established modes of consumption, from the individual through to global corporate supply chains.

At the same time, changing climate patterns, rising seas and more frequent extreme weather events exacerbate natural resource issues. The Earth's ability to absorb human-generated carbon emissions is arguably our most important resource constraint.

Of necessity, the future will be resource-efficient, carbon-constrained and resilient.

The recent alignment of a number of drivers suggests we are at an inflection point in a natural resources transformation that has been gaining force over the past decade:

- ▶ **Growing political will:** With its objectives of limiting global warming

and achieving net global carbon neutrality, the COP21 agreement signaled a global course change in energy use and development.

- ▶ **Rise of renewables:** Aided by falling costs, renewables are the fastest-growing energy source. Renewables accounted for half of global new generating capacity in 2014 and are expected to represent more than 50% of all capacity growth through 2040.⁴⁰

- ▶ **Shift to gas:** Natural gas is on track to surpass coal as the world's second-largest energy source by 2035, thanks to its low prices, its low-carbon characteristics and new export facilities.⁴¹

- ▶ **Corporate energy and resource optimization:** Corporate adoption of renewables as part of an optimization strategy is beginning to cascade beyond a core group of Fortune 500 companies.

- ▶ **Global utility market reform:** More than 30 countries are reforming their energy and water markets. Most of these reforms enable increased clean energy production and introduce resource efficiency innovations.

2. Industry convergence creates the fourth industrial revolution in natural resources

The resources transformation is already challenging utility business models and driving down coal's share of the global energy mix. A convergence in energy, batteries, smart technology (see *The future of smart*, page 24, for more) and transportation is driving the establishment of innovative, integrated and networked resource solutions with even broader potential disruption and upsidess – the fourth industrial revolution in natural resources.

Corporate power customers are combining on-site clean energy generation, energy management technologies and energy storage to reframe their relationship to the grid and participate in energy markets. The growing penetration of the Internet of Things (IoT) paired with machine learning in industrial

⁴⁰ "World Energy Outlook 2015 Factsheet," *International Energy Agency website*, http://www.worldenergyoutlook.org/media/weowebbsite/2015/WEO2015_Factsheets.pdf, accessed 21 April 2016.
⁴¹ BP, "BP Energy Outlook: 2016 Edition," p. 15.

The world's population consumed the equivalent of

1.6 planets' worth of resources in 2015;

this figure is set to rise to **two planets** by 2030.³⁷

21 of the world's 37 largest aquifers, providing the water for more than 2 billion people, have passed their sustainability tipping points.³⁸

Unchecked, rising temperatures due to climate disruption would cause a **23%** reduction in global incomes by 2100.³⁹

³⁷ "World Footprint," *Global Footprint Network website*, http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/, accessed 21 April 2016.
³⁸ "Study: Third of Big Groundwater Basins in Distress," *NASA Jet Propulsion Laboratory website*, <http://www.jpl.nasa.gov/news/news.php?feature=4626>, accessed 21 April 2016.
³⁹ "Study finds climate change will reshape global economy," *Berkeley News, UC Berkeley*, <http://news.berkeley.edu/2015/10/21/study-finds-climate-change-will-reshape-global-economy/>, accessed 21 April 2016.

energy, logistics and manufacturing systems is enabling new levels of energy efficiency and performance optimization. This is also enabling the wider aggregation and monetization of energy demand response.

The increasingly distributed and connected nature of resource technologies is pushing assets to the edge of the network and changing ownership models. For example, sharing business models have made it possible for residential customers to buy solar energy from someone else's leased rooftop panels.

In terms of transportation, electric drivetrain vehicles, connected and autonomous vehicle technology, and ride-sharing platforms are converging to transform mobility.

Value is shifting away from the asset owner to the network operator who aggregates demand, drives utilization and provides services on assets it does not own.

Smart technology is being embraced by cities globally to create smart "systems of systems" that yield more resource-efficient and resilient infrastructure. San Francisco, for example, is piloting a cellular network for the internet of things as a platform for urban innovation.

3. Energy storage will be a catalyst for disruption

Steeply declining energy storage costs – the price of grid-scale lithium-ion battery packs is projected to fall 47% over the next five years – will be an essential catalyst for the fourth industrial revolution in resources.⁴² As energy storage costs fall, new value streams and a rising number of business models

become economically compelling. Economical energy storage paves the way for upsides in renewable energy integration, energy trading, grid optimization and electric vehicles, which could all potentially disrupt industry incumbents.

4. Carbon and water solutions

Fossil fuels will be critical to meeting the world's massive energy needs for years to come – 80% of the global energy mix is expected to be supplied by fossil fuels in 2035 – making carbon solutions a critical part of the approach to climate disruption.⁴³ A growing number of conventional energy companies are embracing the need to participate in the low-carbon energy transition. Fresh impetus is being given to developing innovations in carbon capture, reuse and sequestration.

The United Nations' climate conference (COP 21), held in December 2015, gives new energy to putting a price on carbon to provide the much-needed economic drivers to achieve climate objectives. Only 12% of annual global greenhouse gas emissions are covered by a carbon pricing mechanism.⁴⁴ In the run-up to COP21, six oil majors called for a global carbon pricing system to set a level competitive playing field and incentivize development of mitigating technologies. China plans to launch the largest carbon market in the world in 2017, which could help neutralize competitive objections to carbon pricing mechanisms in other regions.

Water has become the most important medium for climate disruption, with rising seas, drought and flooding exacerbating resource challenges in developed and emerging markets. Developed markets face a trillion-dollar investment gap in

maintaining existing water infrastructure. Emerging markets contend with the fundamental challenge of meeting the needs of growing populations – 770 million people lack access to clean drinking water.⁴⁵

Crisis is spurring innovation and adoption. Water system managers are deploying sensors and smart meters that enable more resource-efficient operations. Distributed water systems are being integrated with centralized systems to avoid expensive infrastructure build-out. Modular water treatment systems and innovative business models are helping to bring water to remote and underserved communities.

Supply chain risks and license-to-operate challenges arising from water issues are leading corporations to adopt on-site water treatment innovations and water efficiency measures as well as engage with local communities on mitigation initiatives.

5. Distributed resource innovation could transform lives in emerging markets

The demographic growth, urbanization and economic development of this century will be centered in emerging markets; so will growth in resource consumption and the impact of climate disruption. Emerging market countries have embraced renewables and nuclear energy as part of an "all of the above" strategy to

⁴² "Market Data: Advanced Batteries for Utility-Scale Energy Storage," *Navigant Research*, 1Q 2016, p. 12.
⁴³ BP, "BP Energy Outlook: 2016 Edition," p. 6.
⁴⁴ "FEATURE: Climate change and sustainability key to future development agenda, says former UN official", *UN News Centre*, <http://www.un.org/apps/news/story.asp?NewsId=50165#.VxmV200UWPw>, accessed 21 April 2016.

meet growing energy needs. Lack of a centralized resources infrastructure in many regions is leading to the adoption of distributed resource innovations, such as off-grid solar for lighting, mobile phone charging and water purification. Distributed resource innovations could have a transformative impact for the billion people without access to power and clean water.

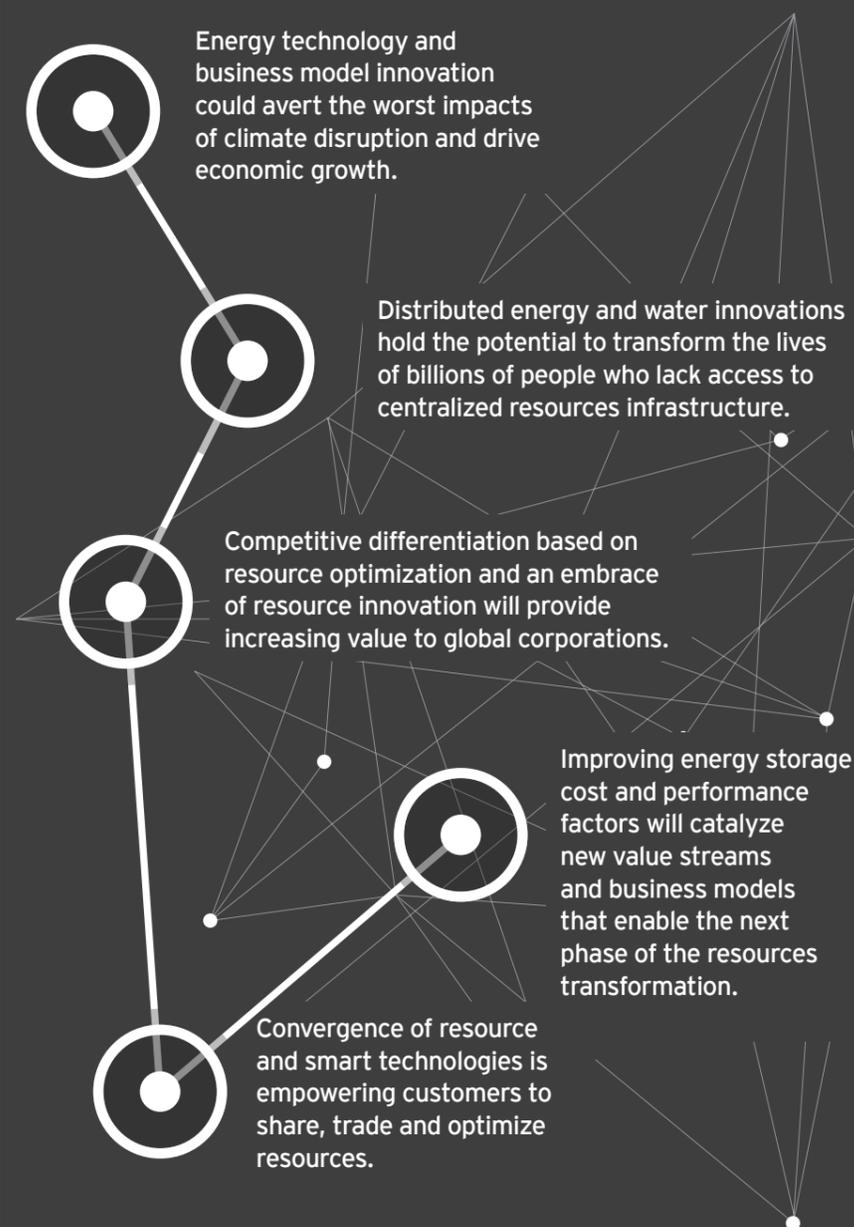
6. Disruptors will be the winners

While the resources transformation is at an inflection point, it will not be easy or occur in a linear fashion. Remaking how the world produces and consumes resources such as energy and water will require mobilizing vast amounts of capital, replacing incumbent systems and spurring innovation. Inherent in this process are disruptions and upsides that will reshape industries, generate new sources of value and alter the corporate and international competitive landscape.

In this context, nimble innovators are combining new technologies, digital, understanding of the customer and new financing models to disrupt resource incumbents. Corporations are accessing this resource innovation pipeline and crossing industry boundaries – in pursuit of new revenue opportunities. Competitive differentiation based on resource optimization and an embrace of resource innovation will provide increasing value to global corporations.

For corporates, governments, innovators, investors and other stakeholders, now is the time to assess current capabilities and competencies against the disruptions and future upside opportunities created by accelerating change toward a resource-efficient and low-carbon economy.

RESOURCEFUL PLANET Upsides



Better questions

How will we link prosperity and sustainability?

Can business disruption also address climate disruption?

How is climate purpose reflected in your corporate purpose?

Who is your Chief Resources Officer?

How do you seize the upside of disruption?

Companies looking to disrupt their business models could start by asking important questions such as: How can we set the right tone at the top? What rigorous processes should we institute? What metrics will encourage experimentation?

These are all good questions. But we argue that the starting point is elsewhere. When disruption upends incumbent business models, it challenges many of the most basic assumptions underpinning those models. The first, and most important, step in self-disruption therefore involves challenging long-held assumptions about matters as fundamental as what your business is and who your customers and competitors are. Here are five better questions to ask yourself.

1. What business are you in?

Disruption has a way of changing the very business that companies are in. You may have thought you were in the business of assembling steel and glass into motor vehicles – but disruption clarifies that the business you are really in is mobility. Customers don't necessarily want to own a car. Their real need is to get from point A to point B, which can just as easily be accomplished with a ride-sharing service.

Are you in the business of manufacturing compact discs – or the business of streaming music? Are you in the business of licensing human drivers – or the business of regulating algorithms in driverless cars? Understanding how your core activity has changed is the first step in reinventing your business model.

2. Who's your customer?

Disruption does more than empower customers. It creates entirely new customer segments, with different needs and expectations. Are your customers' corporations buying mainframe computers – or individuals buying PCs? Are you selling to doctors buying medical devices – or patients managing their health on smartphone apps? Understanding how the customer base has changed, and what the needs of the new customers are, are critical inputs for self-disruption.

3. What's your value proposition?

To respond to the expectations of the new customer base, you need a different value proposition – the one that customers traditionally appreciated may be entirely different from what new customers demand. The traditional value proposition of newspapers was authoritativeness and reputation. In a world of

social media and blogs, they have had to create business models built on new value propositions – convenience, 24/7 access, customizability – to remain relevant.

4. Who are your competitors?

Responding to disruption requires making the right comparisons, including comparing yourself with the appropriate competitors. Since disruption attracts non-traditional entrants from other sectors, the peer group you once used may no longer be relevant.

Fifteen years ago, should executives at Circuit City have compared themselves to Best Buy and Radio Shack – or should they have been more concerned about a Seattle start-up named Amazon?

How can Ford face the challenges presented by GM and Uber? Today, is it more important for car makers to compete with each other – or to understand how they are competing with sharing-economy start-ups that are disrupting their business?

5. What's the risk of standing still?

Time is not on your side. We tend to underestimate the speed of revolutions. In assessing the cost, benefit and risk of investments, we often make comparisons in the context of a world similar to today's.

The more meaningful comparison, however, is against the environment that will exist in the near future, which could be radically different. The market potential of a disruptive opportunity may seem insignificant relative to the size of your business today – but that calculus could be very different in a disrupted environment, where the market share of the traditional offering has shrunk dramatically. In a world where everything is changing, the biggest risk is standing still.

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EYG no. 01096-163GBL

ED 0617

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