2018 CHANGE THE WORLD ISSUE

FORTUNE

SEPTEMBER 2018

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& 53 MORE

ASIA PACIFIC EDITION
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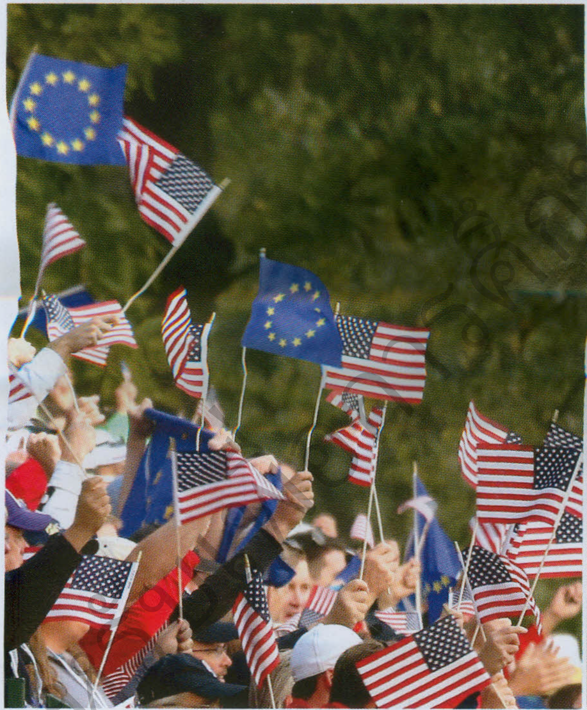
GLENEAGLES, 2014 RYDER CUP



LE GOLF NATIONAL, 2018 RYDER CUP

THE RYDER CUP
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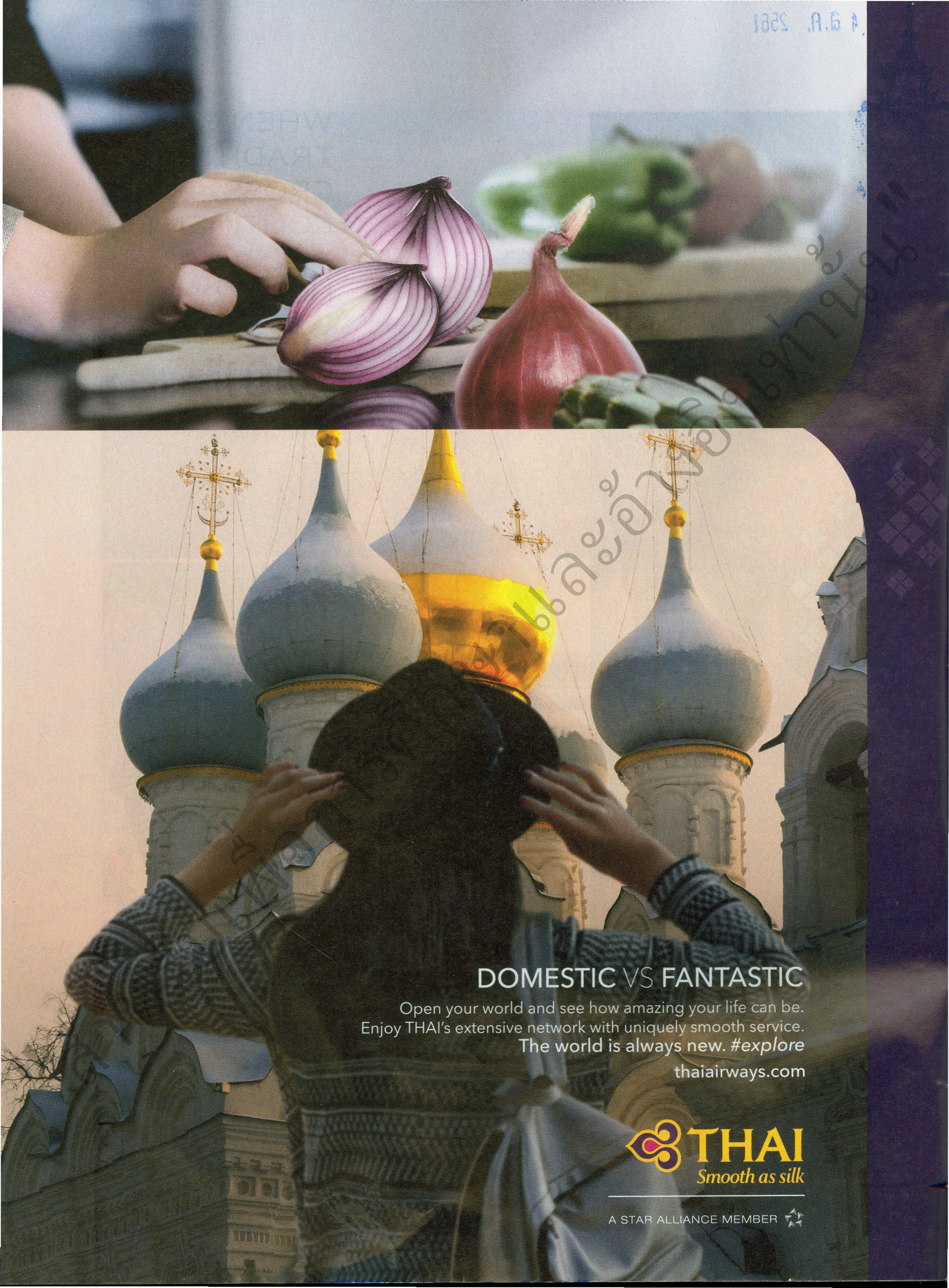
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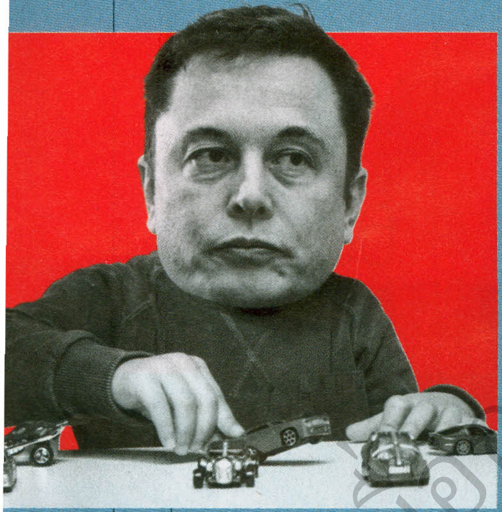

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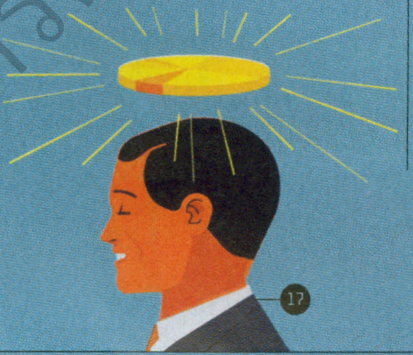

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PROFIT FOR PROGRESS

"FEW TRENDS COULD SO THOROUGHLY UNDERMINE the very foundations of our free society as the acceptance by corporate officials of a social responsibility other than to make as much money for their stockholders as possible."

So wrote the late Nobel Prize–winning economist Milton Friedman in *Capitalism and Freedom*, his 1962 paean to limited government and unfettered markets, which has influenced some three generations of readers and counting. Friedman's concerns, it seems, were pragmatic as well as principled: "If businessmen do have a social responsibility other than making maximum profits for stockholders," he asked, "how are they to know what it is? Can self-selected private individuals decide what the social interest is? Can they decide how great a burden they are justified in placing on themselves or their stockholders to serve that social interest?"

Such questions, posed decades ago, are worth pondering—in large part because they continue to divide people today. They are at the very center of the great debate over what role companies should play in our free-market society: Should capitalism be "just" or "conscious," as many contend... or should its aim be just the conscious pursuit of profit?

At *Fortune*, we've concluded that trade-off is a false one, or at least unnecessary. Companies can and often do serve the social good by ambitiously pursuing their business objectives; indeed, such efforts can be a boon to their operations, and ultimately to shareholders as well. To illustrate this fact, for the fourth straight year, we've highlighted dozens of such companies in our Change the World list (please see page 22).

Consider Hilton, which has shaved a billion dollars in costs over the past decade by reducing its energy and water waste. The fast-expanding hotel chain now generates 30% less carbon emissions on a square-foot basis than it did in 2008, thanks to its aggressive sustainability program.

To answer one of Friedman's questions, "self-selected private individuals" (also known as corporate executives) did make a judgment as to what the social interest might be in this endeavor—just as they determined where to break ground on each new hotel property or whether to serve free coffee and doughnuts in the lobby. And all of these collective business decisions haven't seemed to hurt business any. The chain had 10 million more guests in 2017 than in the year before.

Hilton shareholders, it's worth noting, have gotten an upgrade too. The stock is up 23% over the past year compared with the S&P 500's gain of 16%, and shares have outpaced the market since Hilton's IPO in 2013.

Supermarket chain Kroger is simultaneously working to eliminate food waste and feed the hungry, while its shareholders get fat: The stock is up 27% over the past year. Bank of America (please see Matt Heimer's feature story on page 40) is helping to finance earth-friendly, low-carbon businesses through so-called green bonds—a market it all but created in 2013. Shares are up 28% over the past year, and the stock's returns have been twice as good as the S&P's over the past three.

Then there's Adidas, which is recovering plastic from the oceans and converting them into chic $200 shoes. (Hey, it's a business.) And that stock, by the way, is up an annualized 44% over the past three years running.

In each case, these businesses are doing what great businesses do: meeting an unmet need and making money doing it. Don't get fooled into thinking this is charity (though these companies do some of that as well). No, this is good, old-fashioned capitalism. When it comes to problem solving, it just works.

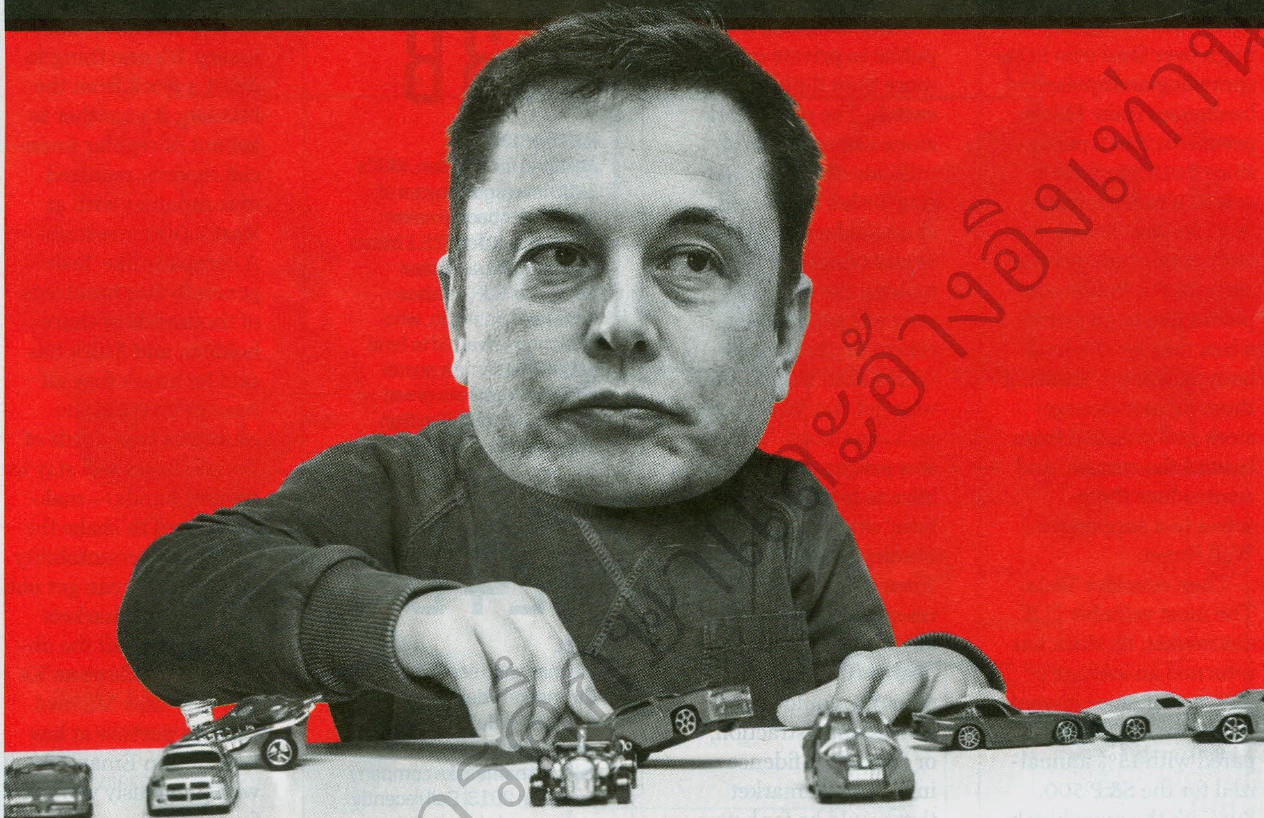
Plenty of seemingly intractable problems remain, of course. One of those involves cobalt, a key mineral in the lithium-ion batteries that power our ubiquitous smartphones, electric vehicles, and more. As Viv Walt writes in her unflinching special report, "Blood, Sweat, and Batteries" (page 60), the cost of mining that cobalt is often paid by some of the poorest people in the world.

Perhaps with the right business model, we can change that too.

CLIFTON LEAF
Editor-in-Chief, *Fortune*
@CliftonLeaf

THE WORLD IN 6 PAGES

BRIEFING



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Done Playing With Wall Street

Elon Musk, backed by Saudi billions, wants to delist Tesla from the Nasdaq. It may be more hassle than it's worth.

By Jen Wieczner

INVESTING

WITH THE MARKET'S attention fixated in recent days on how Elon Musk would achieve his proposal of taking Tesla private, where he would get the money to do so, and the peculiar (and legally controversial) way he tweeted out the idea, one key question has gone largely overlooked: Does going private even make sense for Tesla?

When public companies say they want to go private, they usually fall into one of a few challenged categories: a middling player ▷▷

▲ PHOTO ILLUSTRATION BY TRES COMMAS

▷▷ grasping for growth in an industry dominated by A-list brand darlings (case in point: Burger King, which went private—then public again—twice); an aging icon struggling to reign over (and rein in) a sprawling archipelago of businesses (take Hilton, private in 2007, public since 2013); or a cash cow in a niche industry (e.g., Jo-Ann Stores, the craft emporium, private since 2011). Public companies like to go private when they need a total body makeover, allowing them to later emerge sleek and polished from behind the curtain, and reintroduce themselves to a supportive Wall Street.

Then consider Tesla. The most valuable U.S. automaker, its stock has returned an average of 45% a year since it went public in 2010, compared with 15% annualized for the S&P 500. Sure, it's the most highly shorted stock in the U.S., but that's not because of any fading popularity. Just the opposite: Tesla, valued at 233 times forward 12-month estimated earnings, is like the Taylor Swift of stocks—it's so red-hot, investors love to hate it. Whereas Burger King went private to figure out how to make itself cool again, Tesla, hyping its product pipeline—the Model Y, Semi truck, and Roadster—suffers no such image issue. The electric-car company can make a surfboard, throw it on its website for $1,500 without preamble, and watch it sell out in a matter of hours.

After all, going from public to private entails more than flipping a switch. The paperwork alone can cost tens of millions of dollars. Getting Tesla's board and shareholders to sign off would typically mean making the case that they will get a better return on their investments than they'd otherwise get. Yet Wall Street isn't convinced. "Is Tesla as a private company a 'nice to have' or a 'must have' situation?" Morgan Stanley analyst Adam Jonas asked in a recent research note. "Is there anything about Tesla's near-term business plan that could lead to confusion, distraction, or lack of confidence in the public market that would be far better suited to a private company? We simply do not know at this stage."

Compare a Tesla buyout—for which Musk says the Saudi Arabian sovereign wealth fund has offered to provide financing—to when Dell went private in 2013 in a $24.4 billion deal. With the PC maker badly in need of a comeback, founder and CEO Michael Dell hailed the newfound "time and flexibility" to invest "without the scrutiny associated with a publicly traded stock, quarterly targets, and other limitations of operating as a public company."

In Musk's vision of a private Tesla, though, he may not have that luxury. It's one thing to delist a stock from the Nasdaq; it's another to get out of regular financial reports, required of companies with at least 2,000 investors. A company like Tesla generally has hundreds of thousands of shareholders, and Musk has said he hopes they all remain invested (he estimates two-thirds of Tesla's shares will stay in current hands)—making it hard to shake the quarterly accountability burden. "You can get out of the public markets but still have all the obligations to file your 'Ks and 'Qs," says Michael Liftik, a partner at law firm Quinn Emanuel who previously worked for the SEC.

But even if going private helps Musk escape Tesla's short-sellers, he can't hide from Tesla's customers. With a queue of about 420,000 Model 3 orders waiting to be filled, and Tesla still struggling to produce more than 5,000 of the cars a week, Musk can't afford to test his clients' patience. And as the company grows, even if its stock goes into hibernation, Tesla the brand will only become more public.

PRIVATIZE? WE'RE WATCHING YOU

$53 B

RJR NABISCO

Adjusted for inflation, KKR's 1988 leveraged buyout of food and tobacco maker RJR Nabisco for $25.1 billion is the largest such deal on record. RJR Nabisco boss Ross Johnson, who launched a rival bid to fend off KKR, became a poster child for corporate greed and pocketed $50 million in the fallout.

$24 B

DELL

We may soon see the jury of the markets deliver a verdict on Michael Dell and Silver Lake's blockbuster deal to take his namesake company private in 2013. Dell recently announced plans to list Class C common stock on public markets on the New York Stock Exchange.

+44%

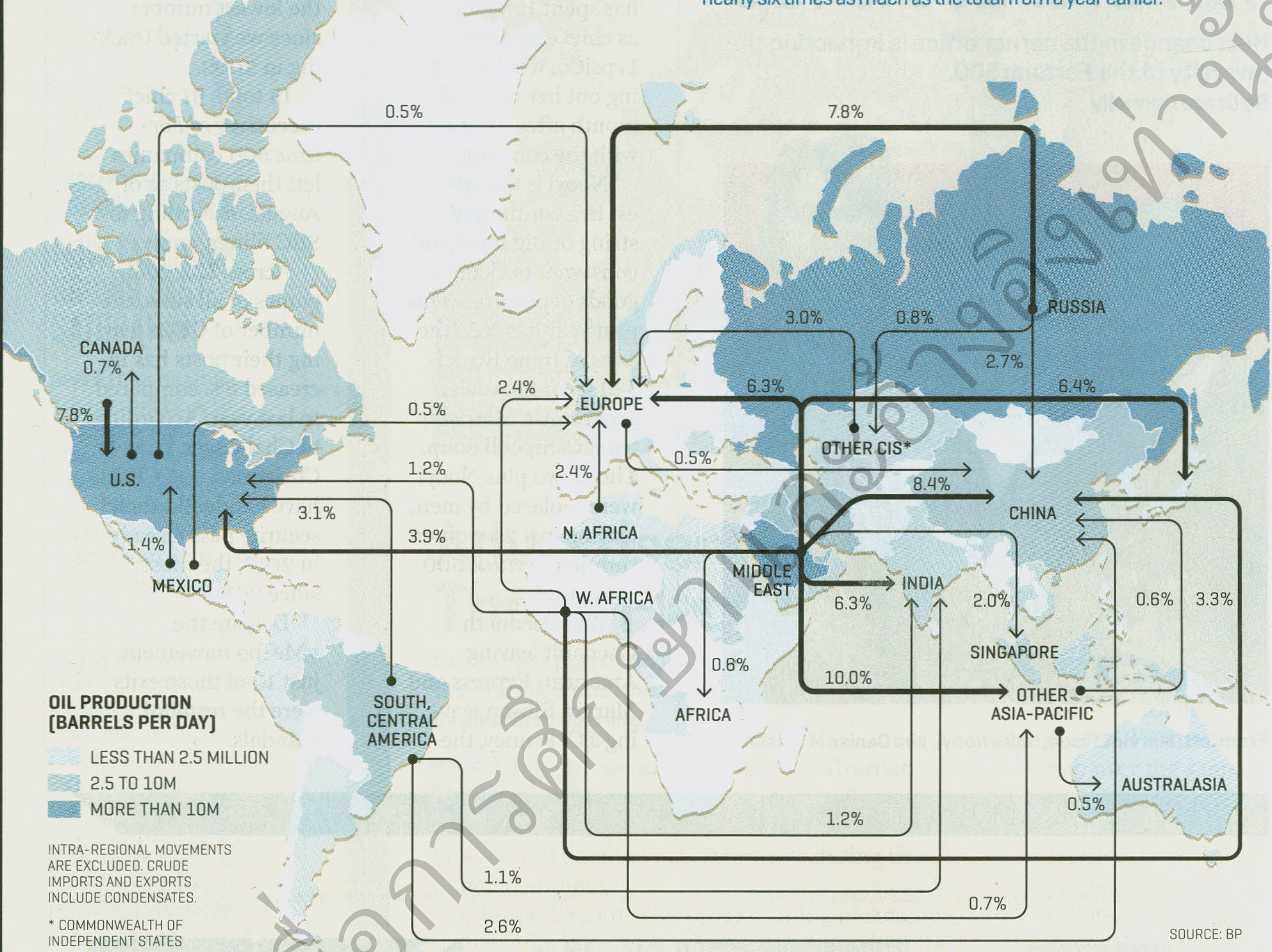
YEAR-OVER-YEAR INCREASE IN BUYOUTS

Private equity is writing checks like nobody's business. The volume of leveraged buyouts in 2018 is expected to beat every year since 2007 with an estimated $156 billion, according to Dealogic.

ANALYTICS Seeing Trends in the Data

THERE'S A RISING SUPERPOWER in oil exports: the United States. Thanks to the fracking revolution, U.S. oil production has more than doubled in a decade, hitting 10.4 million barrels a day in May and putting America on track to surpass Saudi Arabia and Russia as the biggest crude producer. Meanwhile, the repeal by Congress, in 2015, of a 40-year-old ban on U.S. exports has begun to reshape the world market. In late June, U.S. crude exports hit 3 million barrels a day—nearly six times as much as the total from a year earlier.

MAJOR CRUDE OIL TRADE MOVEMENT, 2017 (SHARE OF TOTAL CRUDE OIL MOVEMENT)



INTRA-REGIONAL MOVEMENTS ARE EXCLUDED. CRUDE IMPORTS AND EXPORTS INCLUDE CONDENSATES.

* COMMONWEALTH OF INDEPENDENT STATES

SOURCE: BP

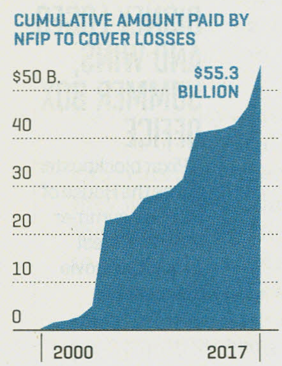
WORKERS START SEEING THE BENEFITS

With an economy at full employment, competition for workers is growing fierce in the U.S. Employers dished out the largest pay raises in over a decade in the 12 months ending in June, following a period of stagnant paychecks. Wages and salaries jumped 2.8%, approaching the pre-recession average of 2.9% annual growth.

SOURCE: BUREAU OF LABOR STATISTICS, NOT SEASONALLY ADJUSTED

HURRICANES HIT FLOOD INSURANCE

Since 2000, the National Flood Insurance Program has paid out about $55.3 billion to cover damages from catastrophic storms Katrina through Harvey. Still, it's a mere fraction of the full impact those storms have had on the economy. It's estimated they have cost about $497 billion total.



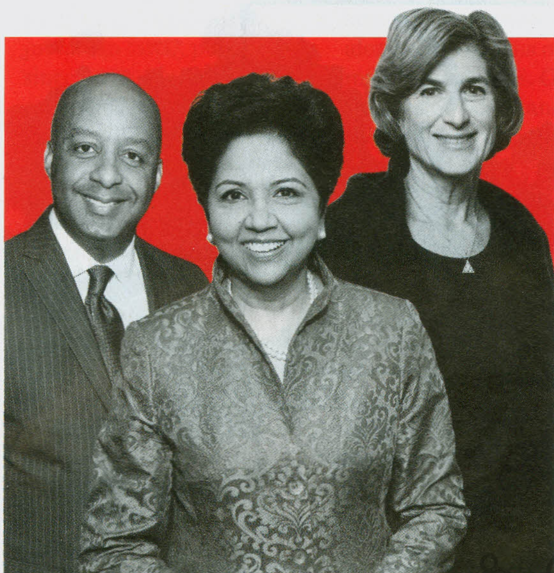
SOURCE: FEMA

TURNOVER

Turnover at the Top

How change in the corner office is impacting the diversity of the *Fortune* 500.

By Grace Donnelly



From left: Marvin Ellison, Indra Nooyi, and Denise Morrison.

THE CORNER OFFICE has grown a bit more white and a bit more male.

Indra Nooyi, who has spent 12 years as chief executive of PepsiCo, will be clearing out her desk this month after 24 years with the company.

Nooyi is the latest in a continuing string of Big Food and consumer packaged-goods departures. This past year has seen the exits of Irene Rosenfeld from Mondelez and Denise Morrison from Campbell Soup. Those two plus Nooyi were replaced by men, leaving just 24 women running *Fortune* 500 companies.

With Kenneth Chenault leaving American Express and Marvin Ellison leaving J.C. Penney, the number of black CEOs in the *Fortune* 500 is now just two—TIAA's Roger Ferguson and Merck's Ken Frazier—the lowest number since we started tracking in 2002.

In total, 91 chief executives of *Fortune* 500 companies left their posts as of August, according to SEC filings.

Across U.S. companies of all sizes, the number of CEOs leaving their posts has increased 8% compared to last year. According to Challenger, Gray & Christmas, 725 CEOs have handed in their security pass already in 2018, the most since 2014.

Despite the #MeToo movement, just 10 of those exits were the result of scandals.

MOVIES

DISNEY LOSES, AND WINS, SUMMER BOX OFFICE

A Pixar blockbuster saves the House of Mouse's summer after the latest *Star Wars* movie disappoints.

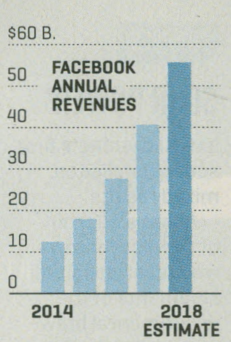
WINNER **THE INCREDIBLES 2**

A sequel 14 years in the making shattered box office records in *The Incredibles'* heroic return, including the biggest opening weekend gross for an animated movie in North America with $182.7 million.

LOSER **SOLO: A STAR WARS STORY**

Adjusted for inflation, *Solo* is the lowest-grossing live-action *Star Wars* movie, with $210 million in domestic box office as of August. Disney sank $250 million into the project.

© ELLISON: DIMITRIOS KAMBOURIS—GETTY IMAGES; NOOYI: MONICA SCHIPPER—GETTY IMAGES; MORRISON: EMMA MCINTYRE—GETTY IMAGES; INCREDIBLES 2: WALT DISNEY STUDIOS MOTION PICTURES/COURTESY EVERETT COLLECTION; SOLO: LUCASFILMS/WALT DISNEY STUDIOS MOTION PICTURES/COURTESY EVERETT COLLECTION



GROWING PAINS

HOW FACEBOOK GROWS PAST SATURATION

INVESTORS dealt a staggering blow to Facebook shares after it announced second-quarter results revealing revenues and user growth that failed to meet lofty expectations.

Saturation was always inevitable for a media company with a user base to rival the world's major religions.

Facebook's financial engine is still cranking, mind you, putting it at No. 6 on *Fortune*'s Fastest-Growing Companies list (see page 55).

The trick going forward is to reap more revenue per user. Facebook currently makes about $6 per quarter from each user. Boosting that number—especially outside the U.S. and Canada, where it makes $27 per user—is far easier than drawing new followers.

—**DANIEL BENTLEY & ANDREW NUSCA**

Beast mode is still a prime-time draw for advertisers.

Advertisers Yet to Throw Flag on NFL

Continued player protests are unlikely to deter the league's commercial partners.

By Jonathan Sperling

ADVERTISING **NFL GAME RATINGS** and advertising spending are still going long, in spite of claims that the league's numbers have faltered as a result of player protests during the national anthem.

Ad spending on NFL programming picked up in 2018, during which the league showed growth of 1.7% in playoff game ad revenue, totaling $556 million for the 2017–18 season, according to Standard Media Index (SMI), an advertising intelligence company that tracks ad dollars.

The league was also the largest source of television advertising spending in December—the last month of the 2017 regular season—when it commanded 16% of the total TV ad spending market, according to SMI.

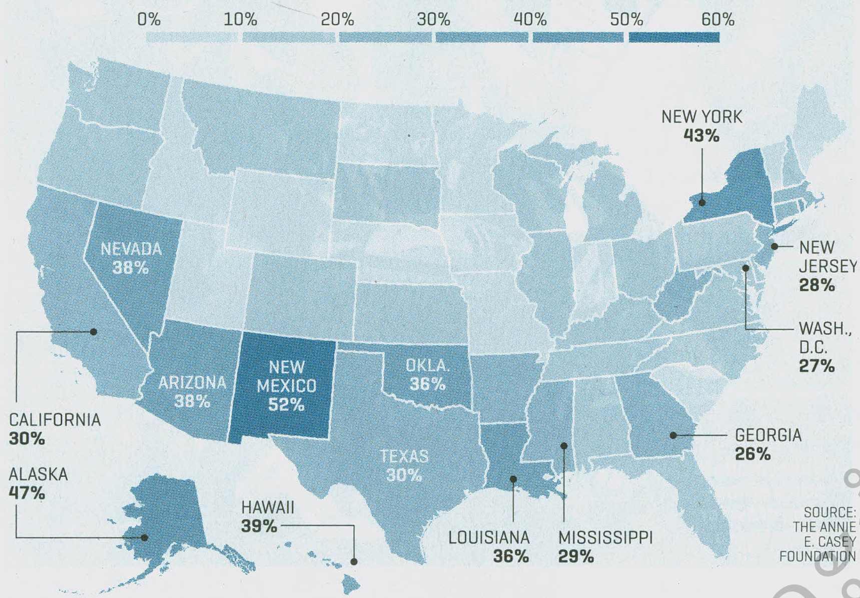
"Despite soft ratings and ongoing political distractions, the NFL continues to be the marquee media property in the country. Playoff revenue jumped almost 2% from the prior year, and the cost of a 30-second spot was up almost 4%," says SMI CEO James Fennessy.

While 2017 NFL season ratings were certainly down in absolute numbers compared with 2016, they didn't decline nearly as much as general TV viewership over the same period.

Ratings are heavily determined by what happens after the anthem is sung, says Jon Lewis, writer of ratings tracker Sports Media Watch. "It depends so much on the results. And if a team like the Dallas Cowboys have the season they had two years ago [when they went 13–3], then the ratings are going to go up," says Lewis. "It wouldn't shock me at all if we have a pretty positive 2018 NFL season."

O NFL: THURMAN JAMES—CSM/REX/SHUTTERSTOCK; CHART SOURCE: SSP GLOBAL

SHARE OF YOUNG CHILDREN AT RISK OF BEING UNDERCOUNTED IN THE 2020 CENSUS



SOURCE: THE ANNIE E. CASEY FOUNDATION

Do You Know Where the Children Are?

The U.S. Census doesn't. And there are serious repercussions for undercounting under 5s.

By Grace Donnelly

CENSUS SNAFU

NEARLY ONE IN FOUR children under the age of 5 in the U.S. lives in an area at risk of being missed by census employees in 2020, according to the Annie E. Casey Foundation's annual *Kids Count Data Book*, which assesses the Census Bureau's ability to accurately count children in each region.

And the problem of counting the youngest Americans has gotten worse with each census since 1980—during the same period that the accuracy for other age groups improved. That's a problem for the well-being of the country's children as well as their future global competitiveness.

Language barriers, high poverty levels, distrust of government, and households with mixed immigration statuses make collecting accurate counts challenging for the Census Bureau, especially after the addition of a citizenship question in March that experts say is sure to affect response rates. Across the U.S., 6 million citizen children live with someone who is undocumented. In New York, home to the city with the highest percentage of immigrant residents in the country, 43% of kids are at risk of being undercounted.

An inaccurate count means fewer federal dollars going to those states and a direct blow to the quality of education and health care that state governments can provide. A study from George Washington University found 37 states lost more than $1,000 in programs funded by the Department of Health and Human Services for each person missed by the last census.

Don't expect a quick fix. Regional offices are understaffed, underfunded, and unprepared to remedy this before the 2020 census begins.

TIPPLES

SOUR POWER

SAM CALAGIONE'S first sour beer elicited mixed results.

About a quarter of the distributors who received initial shipments of the experimental brew—a peachy Belgian Lambic—returned them, the Dogfish Head Brewery founder recalls. Their complaint: "Hey, idiots, your beer went sour."

Fifteen years later, sales are rising faster for sours than just about any other craft-beer style, says Nielsen's Caitlyn Battaglia. Wine lovers—and women, in particular—tend to favor the flavor, drawing new drinkers into the $26 billion (and growing) market for craft beer, says Bart Watson, chief economist at the Brewers Association.

Today, Dogfish Head boasts America's bestselling sour beer, bar none: SeaQuench Ale, a tripartite Kölsch, Gose, and Berliner Weisse. Who knew sour could taste so sweet?

—**ROBERT HACKETT**

BEER: COURTESY OF DOGFISH HEAD

BUSINESS IN THE CLOUD

THE GREAT GAME IN THE SKY

Like music and movies before it, the video game industry confronts streaming and business model disruption. By Chris Morris

IN THE BEGINNING, there were video game stores. There were bricks, and there was mortar, and hours before the stroke of midnight of a highly anticipated release, there were snaking lines of customers outside GameStop or Toys "R" Us or Best Buy, waiting with excitement for the sale to begin. This was the first age of video games, and it was good.

And then broadband Internet service began creeping across the nation. Game publishers began experimenting with a different model, allowing people to download titles directly to their gaming systems. There were issues. Servers were overloaded when a big game would drop. Gamers became angry when ▷▷

▲ ILLUSTRATION BY TRES COMMAS

▷▷ publishers revoked licenses to the games the players thought they owned. But both sides adapted, Toys "R" Us vanished, and GameStop started searching for a buyer. This was the second age of video games, and it, too, was (mostly) good.

Streaming technology has existed for some time, but laggy broadband Internet connections made good game play difficult. That has changed, sparking a new arms race.

And then Daniel Ek and Reed Hastings said, Let there be streaming. And gaming companies, keen on the success of Spotify and Netflix and their peers, began exploring how to use cloud-computing technology to deliver games instantly and on demand to players. This is the third age of video games, and some believe it could be the best of them all.

"The greatest disruption of entertainment is the combination of streaming and subscription," says Andrew Wilson, CEO of Electronic Arts. "More people are engaging, with less friction, through cloud-driven services."

Gaming companies are stepping carefully into the future. Consider two prominent players: Electronic Arts and Sony. In May, EA snapped up the cloud-streaming technology of GameFly, a game-rental service. The next month, EA showed off a prototype of a streaming service to journalists at E3, the video game industry's annual trade show. Sony, meanwhile, offers PlayStation Now, a four-year-old service that gives players instant access to a library of 650 games—mostly older, catalog titles—for $99 a year. In 2012, Sony acquired Gaikai, an early game-streaming service; three years later, it bought Gaikai rival OnLine.

Such maneuvers make possible an all-you-can-eat pricing scheme for video games that, at first blush, seems ill-advised—a $100 annual subscription inherently devalues individual titles that retail for $60 each. But in the long term it transforms the business model into one built on incrementally rising fixed costs yet exponentially rising revenue and customer numbers. "It's not unreasonable for us to believe that, for what is essentially the same investment in the creation of the content, we might entertain an additional 100 million players through subscription than we would in the traditional model," EA's Wilson says.

Ubisoft CEO Yves Guillemot agrees. He too believes that streamed video games will become a significant part of his company's earnings within five years. But he disagrees with Wilson on the specifics. Guillemot argues that a Netflix-like platform business model won't work for games, preferring instead a "publisher channel" model that allows each game publisher to maintain a direct relationship with its players. "I believe there will be lots of services with lots of different types of games," Guillemot tells *Fortune.*

Some publishers, mindful of early technical challenges that made for poor streaming game play, aren't as bullish. "It's exciting, but we really don't think it's a game changer," says Strauss Zelnick, CEO of Take-Two Interactive. Nintendo feels similarly. "In the end, the consumer wants a great experience," says Reggie Fils-Aime, president of Nintendo of America. "We don't think it's quite there yet."

There is risk in a wait-and-see approach. Some of technology's giants are investing in ways that could put them in the catbird seat for a $36 billion industry. Amazon, Microsoft, and Google maintain the world's top cloud-computing platforms; their ownership of Twitch, Xbox Live, and YouTube, respectively, gives them enormous audiences to leverage. And don't count out Tencent, the Chinese conglomerate that owns stakes in Activision-Blizzard, Epic Games, Ubisoft, Riot Games, and two Chinese live-streaming platforms similar to Twitch: Douyu and Huya.

In other words, this game is far from over—music to the ears of hundreds of millions of potential gamers around the globe. ■

© DAN SAELINGER—TRUNK

Shane Evans (above) had a back injury that was helped by frequent massages. Problem was, she couldn't always afford to pay spa prices. Frustrated, and inspired, she and her husband, Wayne, cashed in their investments and savings to start Massage Heights, a massage membership business that offers an upscale environment at affordable prices. Today the company has 147 franchisees in the U.S. and Canada and generated revenues of $110 million in 2017.

GOLDEN TOUCH

How to build a health and wellness empire. **Interview by Dinah Eng**

HOW I GOT STARTED

I WAS ALWAYS INTERESTED in health and wellness and was born into an entrepreneurial family: My parents owned different businesses where I grew up, in San Antonio. After high school, my dad said, "You either need to go to college or get a job, and we don't have the money to send you to college." So I looked through the newspaper and found a job at a President's Health Club.

The gym business was on fire in the late '80s and early '90s. I worked my way up the ranks, learning customer service and management skills. Wayne, my future husband, came to work there, and we were married in 1994.

When I was 21, I experienced a lower back injury and was in excruciating pain. Finally, I ended up going to a massage therapist who recognized the issue was muscular in nature. I'd always thought a massage was just a way to relax and didn't know that it had real health benefits. The massages worked wonders, but treatments were expensive, and I couldn't afford them often.

In December 2003, my husband arranged a massage at a spa for my birthday, and it wasn't a good experience. I was so disappointed that it made me think, There's got to be a way to offer great massage services at an affordable price. With our gym experience, we knew about membership-based, revenue-recurring models. There wasn't any competition in the massage space, so we decided to start our own business.

Some people say that when they meet their significant other, it hits them like a ton of bricks. That's how I felt getting the idea for Massage Heights. Four months later, we opened the first location, in San Antonio. It cost $250,000 to do it.

We cashed out our 401(k)s, our kids' college fund, and our savings. We kept the ▷▷

▷▷ cost down by doing a lot of our own work. My husband was the general contractor, and we painted it ourselves.

We used furniture I'd inherited from my grandmother. We didn't buy in bulk, which would have saved money, but bought supplies as needed because we didn't have the cash. We had to watch every expense. Family members were a big help with our kids, since we couldn't afford sitters or send them to a lot of extracurricular activities.

We made a lot of mistakes. We bought cheap clocks to monitor the time in each treatment room, but you could hear them ticking, which didn't make for a relaxing experience. We laid carpet down, but essential oils would drip and get into it. We had five treatment rooms and realized there was no room for supplies, laundry, or a place for therapists to sit while waiting for clients. One bathroom wasn't enough for everyone. But somehow, it became a success. We opened the second location nine months later.

Our first year's revenue was $360,000. We thought we'd get women coming in just for relaxation at an affordable price, but men and women came with back pain, fibromyalgia, and other medical ailments, looking for therapeutic relief. They didn't have the time to sit and have tea or hang out in a steam room. They wanted a great massage more frequently at an affordable price.

Customers started coming from all over the city asking about our expansion plans, so we started franchising to friends and family in Texas.

In 2007 we found someone with franchising experience who helped us move forward nationally. Transitioning from being a small-business owner to being a franchisor brought different problems.

Brand consistency is key, and early on, a group of franchisees hired someone to create their own websites. I should have shut that down quickly, but I thought we could leverage what they created to drive traffic to the site we managed. By the time I realized it wouldn't work, it had cost us a lot of money. I should have been more direct. I wanted to protect the relationship, and instead, it caused a rift.

In 2008 we started a supply-chain business to provide a turnkey operation to our franchisees, making it easier for them to open. We have a truck that rolls in 48 hours after the floors go down, loaded with furniture, lotions, uniforms—everything needed to make a location operational over several days. That year, we made our first million in profit.

Back then, I had my hand in everything. I helped create training programs, worked in the field to support new franchisees, did product selection, headed marketing efforts, and dealt with legalities.

It can still be hard to control how our operators run their businesses. Last year a franchisee in Chattanooga shut its doors unexpectedly, and we offered to help the employees who were suddenly without jobs. Another franchisee nearby offered to hire people, and our family nonprofit gave each employee $500 to help mitigate the pain.

Because of our success, people started asking us for advice on how to franchise their brands. My brother, Glenn Franson, who's a partner in our business, started talking with the founders of The Gents Place, a members-only club that offers upscale men's grooming. We agreed to partner with them in 2016 to form a franchising company.

We then started Elevated Brands, with the hope of having three to five brands over time that we can partner with—like The Gents Place—to franchise in the health, wellness, and beauty space.

One thing that's hard with a family-owned business is work/life balance. As president of the company, I need to be able to go home and not have a conversation about work with my husband. Strategy decisions are now made with the board, not just by me, which has made it easier to leave work discussions at the office.

I'm proud of building a company with a caring culture that represents our family values. I'm especially proud of showing our daughters that with a dream, passion, diligence, and a plan, you can do anything you want in life. ■

BEST ADVICE: LEADING WITH A MIND-BODY-SPIRIT CONNECTION

SHANE EVANS, COFOUNDER AND PRESIDENT OF MASSAGE HEIGHTS

AGE: 48

FROM: San Antonio

START THE DAY WITH 10 MINUTES OF MEDITATION. It gives you time to reflect and prepare for work.

DO HIGH-INTENSITY INTERVAL TRAINING. Short 30-minute workouts with weight training and cardio will raise your endorphins, give you energy, and clear your head.

GET A MASSAGE. It helps you relax, slows down the heart rate, and helps you reduce stress.

GOOD BEHAVIOR, HEAVENLY RETURNS

Owning stock in a well-run, socially responsible company is a way of making a statement. Owning stock in a *bunch* of responsible companies is a recipe for beating the market. **By Ryan Derousseau**

BACK IN 2012, when Andreas Feiner and his colleagues at asset-management startup Arabesque first began pitching investors about including environmental, social, and governance factors (ESG) in their investing decisions, they encountered plenty of skepticism, not to mention eye rolls, sidelong glances, and crooked looks. Investors, recalls Feiner, believed that "if you do something right, you have to pay for it" by accepting smaller profits and lower returns.

A lot can change in six years. Today there's a growing body of evidence showing that companies that put social responsibility first can also finish first in the market. The question is no longer whether you can do well while doing good, but how best to distinguish the do-gooders from the also-rans. (To learn about 63 companies that fit in the first category, see the Change the World list in this issue.) ▷▷

▲ ILLUSTRATION BY **CHRIS GASH**

▷▷ And several companies—including Arabesque, a spinoff of banking giant Barclays—are deploying data to build tools that can help investors build and test their portfolios.

The demand from investors is certainly there: In a recent survey, Bank of America Merrill Lynch found that about 20% of investors—and 50% of those with a five-year time horizon or longer—considered ESG issues in their analysis. Their motives involve both a sense of public responsibility and commonsense self-preservation: When companies make decisions that show respect for the environment, their communities, and their employees, there's less likelihood that they'll be hit with the kinds of fines, public backlash, and boardroom turmoil that can slam their share prices.

There's also a strong correlation between ESG-minded management and longer-term strategic thinking—another factor that increasingly distinguishes top companies from laggards. Last year, a study by consulting firm McKinsey quantified the effects of long-termism: Looking at 615 large- and mid-cap companies from 2001 to 2014, the firm found that those that managed with a long-term mindset, by consistently investing profits back into their businesses through research or hiring, had 47% greater revenue growth and 36% greater profit growth than companies that focused on shorter-term maneuvers designed to aggressively boost earnings per share.

These trends are creating opportunities for companies that analyze data about how companies perform in ESG terms. The spark that launched Arabesque first ignited when a Barclays customer asked its founders if they could develop tactics that mixed investment performance with social value. In response, Feiner and colleagues, including Omar Selim (Arabesque's CEO), did research convincing themselves that, over time, investments chosen with social concerns in mind proved "more resilient and less risky," as Feiner puts it.

Today, Arabesque manages a database that covers 7,000 companies, with information drawn from 50,000 news sources and 8,000 NGOs, among other resources. Its customers include asset-management firm State Street, consultants like Accenture, and Standard & Poor's, which uses Arabesque data to underpin some of its ESG-specific indexes. Arabesque last year unveiled S-Ray, a tool that enables customers to assign scores to companies based on the issues investors care about most—corporate governance, for example, or labor rights.

Those tools are now generating the type of hard statistics that Feiner loves to pitch to clients. Using S-Ray to apply its broader ESG scoring analysis to the S&P 500, Arabesque found that over the past decade, companies

LONE RANGERS DON'T ALWAYS WIN …

Some individual companies with great ESG scores have had disappointing returns, while some ESG laggards have thrived.

ESG SCORES AS OF 6/30/18

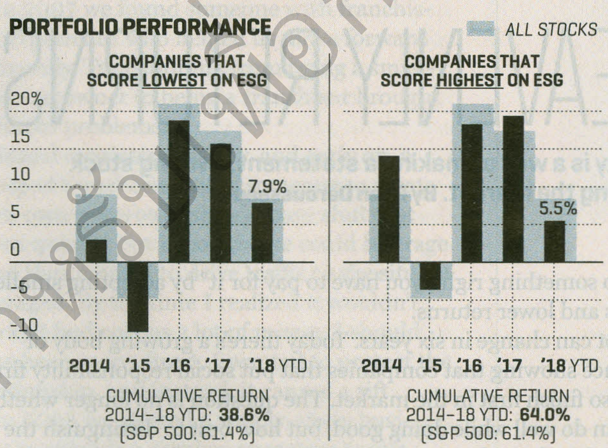
TOP FIVE	ESG	ANNUALIZED RETURN 12/31/13 through 6/30/18
TEXAS INSTRUMENTS	71.7	25.9%
CUMMINS	71.0	1.4
INGERSOLL-RAND	70.1	10.8
INTEL	69.6	19.0
PRAXAIR	69.4	6.9
S&P 500		*11.2%*

BOTTOM FIVE	ESG	ANNUALIZED RETURN
DISCOVERY	30.1	-10.9%
ALLIANCE DATA SYSTEMS	31.5	-2.3
MYLAN	32.0	-4.0
DIGITAL REALTY TRUST	33.0	25.4
TRANSDIGM GROUP	33.3	26.9

… BUT THERE'S STRENGTH IN NUMBERS.

In the aggregate, the stocks of companies with top ESG scores have outperformed those at the bottom over the past five years.

PORTFOLIO PERFORMANCE



SOURCES: ARABESQUE S-RAY; BLOOMBERG

that scored in the top three quintiles had less stock-price volatility than those in the bottom two, while their shares returned about two percentage points better annually than the lower scorers. The performance gap grows wider still when you compare the top quintile with the bottom quintile (see chart).

Arabesque has also been putting its tools to use with the launch of two of its own mutual funds—the global-focused Prime fund, which trades in Luxembourg, and the U.S.-centric **Arabesque Systematic USA (ASUIX)**. (In all, the firm has about $250 million under management.) The funds' managers focus on companies that score higher on Arabesque's ESG measures and on a scoring system based on the United Nations Global Compact for sustainable businesses. Guided by those standards, the funds have avoided investing in Facebook, Wells Fargo, and Volkswagen, whose stocks have been clobbered by scandals that reflected underlying governance problems. Early results from the funds are promising; the Systematic fund has returned 23% over the past 12 months, compared with 14% for the MSCI USA index of large- and mid-cap stocks.

IT'S WORTH NOTING that an ESG-driven approach doesn't always help with picking individual stocks that win in the short-to-medium term. The five S&P 500 companies that currently score highest and lowest in Arabesque's broader ESG ranking underscore that point (see previous page): Since the end of 2013, two of the top five have trailed the S&P 500 by a significant amount; two of the bottom five, meanwhile, have beaten the market handily. On a similar note, Netflix and Amazon, up 98% and 92% over the past 12 months, each post relatively low ESG scores. (Arabesque doesn't comment on the factors that drive individual company scores.)

But as Arabesque's broader data suggests, there's strength in numbers for ESG-conscious investors: In the aggregate, the "virtuous" stocks win over time. A low-cost socially responsible mutual fund—or exchange-traded funds like **Vanguard ESG U.S. Stock** and **Vanguard ESG International Stock**, both of which launch in September—is an efficient way to capture the benefits of socially responsible management. And for investors who'd like to make a more concentrated bet, here are a few stocks that you're likely to find in those funds:

ARABESQUE'S STANDARDS HAVE KEPT IT FROM INVESTING IN FACEBOOK, WELLS FARGO, AND VOLKSWAGEN, ALL OF WHOSE STOCKS HAVE BEEN HURT BY SCANDAL.

Ingersoll-Rand (IR, $98) builds a range of industrial products, but 79% of its revenue comes from HVAC systems, where it has doubled down on energy efficiency. The company went through a downswing in 2015 as oil prices plummeted, hurting some of its industrial clients. But the stock has rebounded along with a surging economy and a bustling construction sector, and Ingersoll-Rand's interior-climate business continues to gain market share. Over the past five quarters, the growth in HVAC bookings has gone from 3% to 17%, which is "quite an attractive trajectory," says Barclays analyst Julian Mitchell.

It may seem surprising to see **Cummins (CMI, $142)**, a manufacturer of diesel engines, so high up on an ESG-centered list. But the Indiana-headquartered company has long been a standard setter in clean-air technology. In the early 2000s, Cummins boosted R&D to create engines whose emissions standards surpassed federal regulatory requirements, even as those rules got tighter. That effort has paid dividends in markets like China, boosting revenue from Cummins's emission-solutions segment by 20% in 2017. The stock has been beaten down this year owing to concerns that the industrial sector has reached the peak of its cycle. Cummins stock is now valued at 10 times 2019 earnings, says Jefferies analyst Stephen Volkmann, making it fairly cheap as a potential long-term play.

When corporate leaders act poorly, a company with good governance will make sure they don't remain leaders for long. In July, Brian Crutcher stepped down as CEO of **Texas Instruments (TXN, $116)** after just six months in the role for violating company policy with unspecified "personal behavior." Reenter chairman Richard Templeton, who had held the CEO position for 14 years before Crutcher's ascension. Templeton is recognized as the "architect of Texas Instruments today," says Nomura Instinet analyst Romit Shah; he was the chief who steered the company to focus on its analog semiconductor business, which has grown 19% since 2015 while the stock price has more than doubled. Texas Instruments' share price dipped only modestly after Crutcher's departure and has already rebounded—a sign that investors have faith that doing the right thing won't set the company back. ■

Station F, in Paris's 13th arrondissement, is the world's largest tech incubator.

IN THE LAB OF LUXURY

Rejecting the hegemony of Silicon Valley startup culture, these rebels are stirring tech's soul. By Richard Morgan

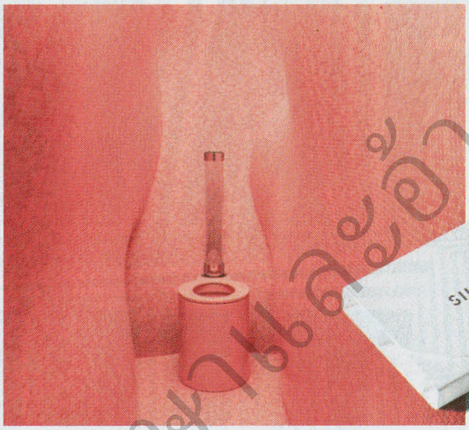
ROXANNE VARZA pushes open a door covered in Ken dolls, lures me into the men's room, and begins knocking on stalls, looking for a vacant one. "Here," she says on a third try. "Open it." In contrast to the gray, antiseptic bathroom, the stall is an opulent oasis, as if Alexander McQueen had designed an outhouse. Varza pierced the stunned silence: "This startup is called Trone. We do things very differently here."

Such is Station F, where Varza is director. It's the world's largest tech incubator, housed in an 111,550-square-foot converted Parisian freight train station that's as long as the Eiffel Tower is high. It opened in June 2017 with 1,000 founders and uncanny timing: That same month, President Emmanuel Macron unveiled a new tech visa program and a mission to make France "a startup nation."

While Station F hosts Amazon, Apple, Facebook, Google, and Microsoft, those blue chips are boilerplate behemoths on tech campuses these days. Much more interesting is the presence of two French megabrands: L'Oréal, the cosmetics giant,

© COURTESY OF PATRICK TOURNEBOEUF

[Clockwise from right] LVMH CEO Bernard Arnault inspects a Euveka mannequin. L'Oréal's Sillages delivers a concierge *parfumeur* to your mailbox. A lavish lavatory from Trone.



CLOCKWISE FROM TOP: VINCENT ISORE—IP3/GETTY IMAGES; COURTESY OF SILLAGES PARIS; COURTESY OF TRONE

and LVMH, the umbrella group covering Louis Vuitton, Givenchy, Hennessy, Sephora, TAG Heuer, and many more.

L'Oréal, which made its first-ever tech acquisition in March, runs a Station F atelier of nine beauty-oriented startups. Down the hall, LVMH's venture—La Maison des Startups—has 89 workstations for 23 startups (50 by November). These are not Facebook killers. But while these burgeoning firms are unlikely to change tech financially, interviews with more than a dozen of them suggest something bolder: the ability to revolutionize tech tonally.

While many startups are dreamed up by Bay Area brogrammers as a means of easing and simplifying entitled bachelorhood, the luxury thinking of L'Oréal and LVMH suggests room beyond *la vie en bros* for a new digital dialect, a kind of tech couture. Instead of scale, specificity. Instead of disruption, finesse. An understanding that customers are as sophisticated as founders, and that nothing tailor-made is stuck in beta. Why move fast and break things when you can bask in refined craftsmanship? Who ever stopped to optimize the roses?

Consider LVMH's Euveka, for example, which replaces wooden mannequin torsos with robotics that can adapt to a client's specific measurements. "We were amazed that in 2018 the industry standard is still wood," says sales manager Eva Moudar. Euveka frees designers and tailors to expand their clientele to any body.

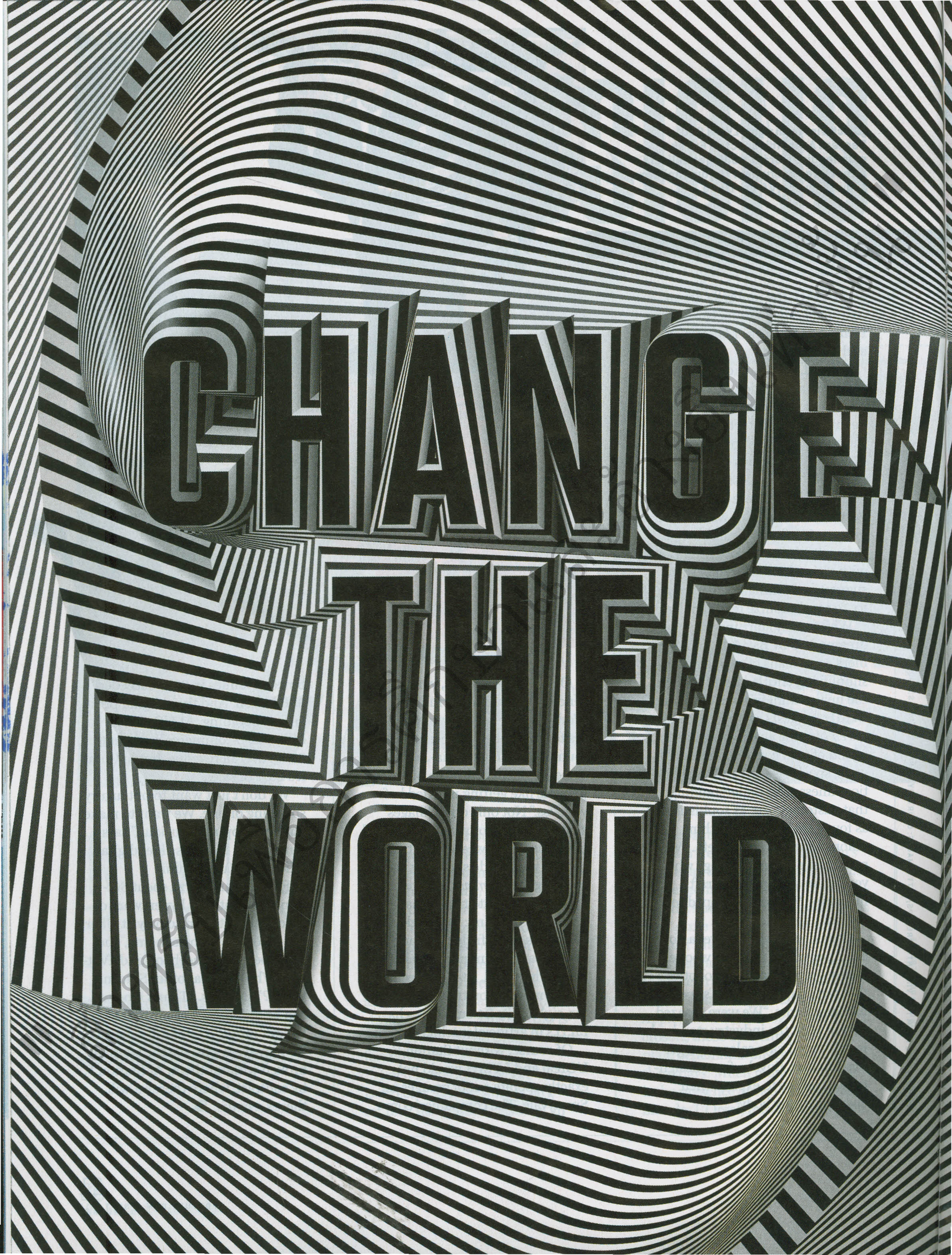
Or L'Oréal's Sillages, which sends personalized perfumes Warby Parker–style for customers to sample before deciding. As founder Maxime Garcia-Janin says, "Choosing a perfume off a piece of paper is like getting married before you kiss." Not only does Sillages shatter the monotony of a room full of Chanel No. 5 wearers, but customers worldwide suddenly have a concierge *parfumeur* in Paris.

Others navigate traditional CES-style thinking: Beautigloo's cosmetics microfridge or Daumet's proprietary technique to make shiny white gold. At Heuritech, an image-recognition trend detector, eight of its 24 employees have Ph.D.s in artificial intelligence.

Of course, without Station F, L'Oréal and LVMH would not exactly operate out of garages in Sunnyvale. The companies' combined revenues in 2017 exceeded $80 billion. And their digital presence is booming. At L'Oréal, for example, e-commerce represents 8% of overall revenue, but in China it's 26% of sales.

"We don't just want to put luxury shopping online. We want to make online shopping luxurious," says Ian Rogers, LVMH's chief digital officer, an iTunes alum.

For her part, Varza spent Station F's debut year hyperaware of Silicon toxicity—misogyny at Uber, the notorious Google memo, and hate speech on Facebook and Twitter. "Who wants another Silicon Valley?" she asks. "Thank God we can be different." For all of Silicon Valley's range, it's broadly a haven for naysayers who see the world as broken without them. At Station F, by contrast, where there's a will, there's a *ouais*. ■


CHANGE
THE
WORLD

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▲ ILLUSTRATION BY **MARIO DE MEYER**

WHERE THE PROFIT MOTIVE WORKS FOR THE PLANET.

ON MAY 3, REPORTS that a strange and frightening illness had struck more than 20 people in the village of Ikoko-Impenge reached health officials in the province of Équateur, on the western border of the Democratic Republic of Congo. By May 8, the Ministry of Health confirmed what many had feared: Ebola was back.

But this outbreak ran a different course than many of the previous ones across Central and West Africa. By mid-July it was over. Instead of more than 11,000 deaths—the grisly toll of the 2014–2016 epidemic in Sierra Leone, Liberia, and Guinea—this one killed 33 and never spread far beyond its immediate zone of infection.

There was much that was different this time around. Both local health officials and the World Health Organization had responded with lightning speed. And now there was something else to contain the spread: an experimental vaccine.

The vaccine, codeveloped by Merck, No. 2 on this year's Change the World list, kept Ebola in check through a protective ring of immunization, with health workers vaccinating virtually everyone who may have been in contact with a person infected with the virus. And while it's still too early to tell (and another outbreak has since begun), the new vaccine and immunization strategy may well be a turning point in the battle against one of the scariest diseases of the past century—and perhaps even give us clues to staving off other viral epidemics.

Merck's investment in the Ebola vaccine has been prodigious. The company tested it in the crucible of past outbreaks. And the production of each vial of this live attenuated vaccine, combined from the DNA of different viral components, is so complex that it takes a full year to complete, says Beth-Ann Coller, who heads up Merck's Ebola research efforts. But the drug giant isn't doing this out of charity. Rather, the company's vaccine business—which includes inoculations against pneumonia, shingles, and the cancer-causing HPV—had more than $6 billion in sales last year. Even if the Ebola vaccine doesn't make gobs of money on its own, the knowledge gained from developing it should help inform R&D across the business.

Merck, in short, is doing what so many great companies do: trying to fix something that needs fixing and trying to turn a profit while doing it. Indeed, businesses around the globe manage to accomplish both of these things—they do well by doing good—every day, and often away from the headlines.

We at *Fortune* think that's a phenomenon worth exploring. So for the fourth straight year, with the help of our partners at the Shared Value Initiative, we've identified dozens of companies that are tackling public health, environmental, economic, or other societal challenges as part of their everyday operations (please see our methodology on page 26). The list, importantly, isn't about the charity companies give—and, no, we're not weighing corporations on some omniscient scale of good and bad. (We couldn't make that assessment if we tried.) *Fortune*'s Change the World list, rather, is about solving problems through the only sustainable and scalable problem-solving machine we know of: business.

Back in 2015, when we started this effort, we thought we'd have a hard time finding 50 companies that fit the bill. This year we had so many worthy candidates that we stretched the number of big-company honorees, those with at least $1 billion in annual sales, to 57 and included six rising stars as well. (To see alumni from years past, visit fortune.com.)

One of those rising stars has also helped, in a surprising way, to fight the latest Ebola outbreak—that's Chinese refrigeration company Aucma. One major challenge of Merck's Ebola vaccine is that it needs to be stored in ultralow temperatures (−60 degrees Celsius or less). The feat was nearly impossible to manage in remote parts of sub-Saharan Africa, where there's often no power grid to speak of—until, that is, a group of inventors at Global Good created a portable deep-freeze container called the Arktek, capable of storing hundreds of vials of vaccine anywhere.

So how does Aucma fit into this story? It manufactures the Arktek. —CLIFTON LEAF

1

RELIANCE JIO

Mumbai

Connecting tens of millions of Indians to the economic opportunities of the Internet, at rock-bottom prices.

IF ACCESS TO the Internet is a basic human right—and the United Nations declared it one in the summer of 2016—then Reliance Jio deserves more credit than most for expanding access to it. The telecom upstart, launched in September of that year by Mukesh Ambani, the chairman of Reliance Industries, likes to say it provides the public with "digital oxygen."

Two years ago, there wasn't much oxygen to go around in the world's second-most-populous country. Mobile phones crawled on 2G networks, and consumers typically paid more than 200 rupees ($2.88) for one gigabyte of data. India had just 153 million mobile Internet subscribers among its population of 1.3 billion. Enter Jio, with a speedy 4G network (which it spent billions building out), free calls, and dirt-cheap data (as low as 4¢ per GB). It has since issued a super-low-cost smartphone and is rolling out fixed broadband service as well. Reliance Jio, which says it's profitable, has amassed 215 million subscribers in just 22 months.

The resulting "Jio-fication" has been nothing short of revo-

▲ PHOTOGRAPH BY VIVEK SINGH

lutionary; with data use surging and Jio's competitors scrambling to match its offerings, the development has jump-started India's digital economy. The biggest winners are those in rural areas or of modest means—the farmers, students, and entrepreneurs who finally have in their hands the tool they need to participate in the modern economy.

↑ A store offering Jio products in Mumbai. Jio's offerings triggered competition that has slashed the cost of mobile data in India.

↗ A health worker at Itipo in the Democratic Republic of the Congo, where a vaccine developed by Merck helped stop an Ebola outbreak.

2: LINDSAY MACKENZIE—WHO

2 MERCK

Kenilworth, N.J.

Introducing a potent weapon in the war against one of the world's deadliest diseases.

THE TIMING WAS TRAGIC. Merck embraced a vital mission in 2014 when it began developing an Ebola vaccine in collaboration with Canada's public health agency and NewLink Genetics, not long after the deadly virus broke out in West Africa. Effective vaccines take months to create, and by the time V920 could be deployed, the disease had claimed thousands of lives.

But when the scourge rose again earlier this year, in the Democratic Republic of the Congo, Merck was ready. It shipped nearly 13,000 doses of V920 to the World Health Organization, which provided vaccinations to more than 3,300 people. The DRC's health ministry says no vaccinated people developed the disease—and with another outbreak declared in the eastern DRC in August, Merck's lifesaver is on the front lines once more.

CHANGE THE WORLD

3 BANK OF AMERICA

Charlotte

Underwriting big innovations in green banking.

In 2007, even as the financial crisis began taking huge bites out of its balance sheet, Bank of America committed to lending, investing, and otherwise raising $20 billion for low-carbon and sustainable business. It has since added $125 billion to that commitment—and deployed $96 billion—financing everything from green skyscrapers in Manhattan to cleaner cookstoves in Kenya. The bank helped invent, and now dominates, the market in "green bonds," which secure better financing for climate-protecting projects; green bond issuance soared from $13 billion in 2013 to $161 billion last year. *Fortune* takes a closer look at Bank of America's green innovations on page 40.

4 INDITEX

Arteixo, Spain

A fast-fashion retailer slows down to make time for worker well-being.

MINDFUL OF CONSUMERS' growing desire to know their clothes were made under safe working conditions, Inditex, the retailer and parent of fast-fashion chain Zara, has steadily shifted production to suppliers with stronger safety records. Last year, 95% of its products were made at those better factories, up from 80% in 2012 and well above industry averages. Acting ethically hasn't hurt the company financially; Inditex has posted 7% annual sales growth since 2012. The company also conducts its own training on worker safety, with an emphasis on educating women—85% of its factory staff—about how to recognize gender discrimination and defend their rights and their value.

↑ **A worker at a clothing factory in Bangalore, site of one of Inditex's women's empowerment programs.**

HOW WE CHOSE THE COMPANIES

1 MEASURABLE SOCIAL IMPACT
We consider the reach, nature, and durability of a company's impact on one or more specific societal problems. (Companies with revenue of $1 billion or more are considered for the main list.)

2 BUSINESS RESULTS
We consider the benefit the socially impactful work brings to the company. Profitability and contribution to shareholder value outweigh benefits to the company's reputation.

3 DEGREE OF INNOVATION
We consider how innovative the company's effort is relative to that of others in its industry and whether other companies have followed its example.

4. COURTESY OF INDITEX

CHANGE THE WORLD

5 ALIBABA GROUP

Hangzhou, China

Steering opportunity to rural China.

Alibaba wants to drive money into rural China in a fairly literal way. Its popular maps service, AutoNavi, launched a "poverty alleviation map" feature in Henan province this year, designed to entice day-trippers into remote countryside towns. It flags what facilities are available, helping local restaurants, gas stations, and shops draw customers and develop an online presence.

9 WEIGHT WATCHERS

New York City

Helping healthy habits take root.

Weight Watchers has built a \$1.3 billion business around the fight against obesity, emphasizing gradual, sustainable changes in eating and exercise habits rather than crash diets and packaged meals. The company has also successfully combated the stigma that keeps men away from weight-loss programs, in part by enlisting popular spokesmales like producer DJ Khaled.

6 KROGER

Cincinnati

A huge grocer addresses a major food scandal.

Nearly half the food produced in the U.S. is thrown away, yet 40 million Americans go hungry. Grocery giant Kroger is tackling these issues simultaneously, aiming to eradicate hunger in communities where it operates and to eliminate internal waste by 2025. Last year it donated the equivalent of 325 million meals through a partnership with Feeding America; for 2025, its goal is 3 billion.

▲

7 XYLEM

Rye Brook, N.Y.

Protecting and conserving something the world can't live without.

XYLEM'S STATED MISSION, to "solve water," is as broad as it is urgent: By 2025, roughly 25% of the world's population, or 1.8 billion people, are expected to be living in areas with absolute water scarcity. The \$4.7 billion firm, bolstered recently by a spree of "smart infrastructure" acquisitions, is working to tighten the pipes of the world's water supply, installing sensor-driven, software-enabled technologies that can reduce losses (which typically siphon off an estimated one in six gallons for municipal systems in the U.S. and up to 60% of supply in emerging markets). Xylem also works to treat wastewater more efficiently and helps cities cope with severe flooding and other water-related consequences of climate change. The company can help avert smaller-scale disasters too: Xylem's technical experts were on hand to engineer the pumping system that helped free the Thai youth soccer team trapped in a flooded cave this summer.

↑

Xylem pumps at a sewer-main break in Memphis. The average U.S. municipal system loses one in six gallons of water.

8 ABB

Zurich, Switzerland

Helping drivers plug into a planet-friendly trend.

As electric vehicles have grown more popular, robotics maker ABB has installed over 7,000 fast charging stations worldwide—saving about 2 million gallons of gasoline over the past seven years. The charging business has posted double-digit annual revenue growth since 2015. Next up: a plan with Electrify America to place hundreds of charging stations in the U.S. in the next year.

10 HUGHES NETWORK SYSTEMS

Germantown, Md.

Rescue by satellite.

When Hurricane Maria hit Puerto Rico last year, the island's communications infrastructure was largely destroyed. Enter the Disaster Relief Support unit of Hughes, one of the world's biggest satellite operators. Hughes set up links that enabled doctors to arrange lifesaving hospital transfers and helped residents in some of the most damaged communities connect to the outside world.

7: COURTESY OF XYLEM

CHANGE THE WORLD

11 DANONE

Paris

A global food giant aims to lead by example as a social-good-doing "B Corp."

EARLIER THIS YEAR, the French yogurt maker's $6 billion-plus North American subsidiary became the world's largest B Corp, a status granted only to companies that meet a rigorous set of environmental, social, and governance standards. It was the latest of eight Danone's subsidiaries, covering about 30% of the business, to win B Corp certification, and CEO Emmanuel Faber vows it will be far from the last: He is aiming to make his entire $28 billion enterprise a B Corp by 2030.

That will be no easy feat—B Corp standards are high, and the demanding certification process wasn't initially developed with publicly traded giants like Danone in mind, since they challenge companies to make binding commitments to put social good on par with profit. Faber says that challenge motivates his workers: The North American unit, for example, which enhanced its policies around supplier selection and improved its methods for measuring impact, sped through the certification process in one year (Faber had anticipated it would take three). Faber points out that the journey has been good for business as well as society: The sustainability investments, for example, have reduced costs and helped Danone to negotiate friendlier borrowing rates. Overall, the company's profits more than doubled between 2014 and 2017, to 2.45 billion euros ($2.8 billion).

To pave the way for other giants to strike the same balance—Faber reports lots of interest from CEO peers—Danone is working closely with B Lab to establish a better-fitting certification process for big public companies.

Even the fake trees are green: Lego is now making toys like these out of plant-based plastic from Braskem.

12 ALPHABET

Mountain View, Calif.

Flooding the zone with laptops for learning.

In a time of tight school budgets, cheap Chromebook laptops from Alphabet's Google unit accounted for nearly 60% of PC shipments to U.S. K–12 schools in 2017, according to Futuresource Consulting. And over 30 million students and teachers use Google Classroom software. The business isn't high-margin, but Google stands to benefit by ensuring the next generation knows its technology.

13 WESFARMERS

Perth, Australia

Jobs and aid for a neglected group.

Indigenous Australians are 13 times as likely as the nonindigenous to be unemployed. Wesfarmers, a huge retail holding company, is doing its part to rectify that. It employs about 4,000 indigenous people, and it partners with organizations focused on education and transition-to-work opportunities for those communities; it also finances indigenous public-art projects.

14 BRASKEM

São Paulo

Making "green plastics" with no fossil fuels, and helping the environment in multiple ways.

IN 2007, Braskem, a $15.4 billion petrochemical firm (controlled by Petrobras and Odebrecht) announced that it had grasped a holy grail: green plastic, in the form of polyethylene made from sugarcane ethanol rather than fossil fuel. The process has environmental advantages: Because the cane crop captures CO_2, and its biomass powers Braskem's plant, it actually mitigates emissions. Braskem claims its annual output of 200,000 kilotons of green plastic results in an 850,000 kiloton reduction in CO_2. The bioplastic, while still a small part of its business, is now used by 150 eco-minded brands including Danone (for milk bottles), Grupo Bimbo (for Nutella bread bags), and Lego (for toys).

15 INTEL

Santa Clara, Calif.

Building better car-safety tech for a mass market.

Road-related injuries took 1.4 million lives in 2016. But crash-avoidance technologies could sharply reduce that toll, and Intel doubled down on that solution in 2017 by acquiring Mobileye, an Israeli company whose autonomous driving and anti-collision tech is installed in over 27 million vehicles. Intel aims to keep the technology affordable, pricing its collision avoidance system below $1,000.

14. MARIA TUXEN HEDEGAARD—COURTESY OF LEGO

16 WALMART

Bentonville, Ark.

A fight to keep gases out of the air and garbage out of landfills.

THE WORLD'S LARGEST company by revenue does not want to be a top source of greenhouse gas emissions. So Walmart last year launched Project Gigaton, aiming to reduce emissions related to its operations by a total of 1 billion tons by 2030. It plans to achieve that goal by using more renewable energy and more recycled content in packaging, and urging its suppliers to do the same. It also aims to reduce the amount of food that ends up in landfills. By the end of 2017, Walmart said it had diverted about 78% of waste from its facilities that would have gone to landfills, thanks to recycling and other measures; it also cut waste in its grocery business. Such efforts don't just protect the environment; they also protect Walmart's operating margins.

↑ **Food banks like Feeding America work with Walmart to use groceries that would otherwise be wasted.**

16. COURTESY OF WALMART

17 VMWARE

Palo Alto

A software innovation that quashes CO_2 emissions.

DELL TECHNOLOGIES unit VMWare's virtualization software grew popular with IT departments because it reduced the costs of running server farms. But the use of virtual machines also reduces electricity consumption, since not every user has to have his or her own dedicated hardware. In 2016 alone, virtualization lowered CO_2 emissions by roughly 76 million metric tons, according to IDC, equal to getting 15 million cars off the road. From 2003 to 2016, use of VMWare virtual servers saved a total of 415 million metric tons of CO_2, or almost half the pollution caused by U.S. household power consumption in a year.

18 JPMORGAN CHASE

New York City

New tools for small urban businesses.

Lending rules designed to curb risk can keep promising startups in low-income communities from getting financing. JPMorgan Chase has leapt that hurdle with its Entrepreneurs of Color Funds, which team with local nonprofits to steer funding to small businesses. Having proved the concept in Detroit, the bank this year set up new EOCFs in Chicago, the South Bronx, and the Bay Area.

19 SAFARICOM /VODAFONE

Kenya/U.K.

A pioneering service goes global.

M-Pesa, the pioneering money transfer service this duo launched in Kenya in 2007, now claims more than 30 million customers in 10 countries, mostly in remote areas far from banks. More than 8 million of those users are in India, where state governments are employing M-Pesa to pay pensions to rural retirees, eliminating the delays and crime risks that come with shipping cash.

20 JOHNSON & JOHNSON

New Brunswick, N.J.

Surgical innovation expands its reach.

Through its Johnson & Johnson Institute, the pharma giant has trained some 250,000 health care workers in India since 1993. The curriculum includes instruction in advanced techniques such as minimally invasive surgeries. That's a positive for patient outcomes in a country with a dearth of doctors and nurses—and a savvy strategic move, since the trainees learn to use J&J's tech.

21 NEXTERA ENERGY

Juno Beach, Fla.

A green-energy Goliath bets on solar.

The huge utility, already the No. 1 producer of wind energy in North America, has been increasing its reach in solar. In March, the company struck one of the largest solar-panel supply deals in history, with JinkoSolar, agreeing to buy up to 2,750 megawatts of high-efficiency solar modules—some 7 million solar panels, enough to power hundreds of thousands of homes—over the next four years.

22 HUMANA

Louisville

Taking on the social determinants of illness.

The health care system might work better if it did more to keep people healthy. Humana is testing that idea with Bold Goal, an effort to reduce "unhealthy days" among plan members by tackling hurdles such as loneliness, food insecurity, and transportation barriers. Humana has recorded health gains in Baton Rouge and New Orleans, among other cities, since Bold Goal launched.

23 MAHINDRA & MAHINDRA

Mumbai

A lighter footprint for heavy industry.

This multinational makes potentially high-polluting equipment—cars, tractors, and other agricultural machines—but that hasn't stopped it from cutting its CO_2 output. Through a range of emission-busting measures (switching over to 100% LED lighting, for instance), it has shrunk its carbon footprint 44% in seven years. Mahindra was also the first to sell four-wheel electric vehicles in India.

CHANGE THE WORLD

(24) APPLE

Cupertino, Calif.

The world's most valuable company shares the wealth.

It would be pat, but true, to say simply that Apple has improved the planet by revolutionizing the way we communicate. Yet the decade-old iPhone changed human behavior, from facilitating computing on the go to sending instant messages in times of need.

Apple has reaped huge rewards in the process, including achieving a valuation of $1 trillion. But it has generated plenty of wealth for others along the way: In June, the company announced that its App Store had generated $100 billion for developers since its launch. Apple has taken principled stands on privacy, such as not selling access to its users' data. It is mindful, too, of its carbon footprint—no trivial matter considering its size.

(25) STRYKER

Kalamazoo

A medical device maker aims to make hospitals and their equipment greener.

STRYKER'S SUCCESS in the medical device business has earned it a market capitalization of $62 billion. Increasingly, it's using its reach as a supplier to hospitals to be an environmental champion. Through "Pulse Ox for the Planet," the company last year encouraged hospitals to collect rather than throw out more of its pulse oximeters, devices that keep tabs on your heart rate and the oxygen in your blood. (As part of its inducement, Stryker made a donation of thousands of trees.) Stryker has also gotten creative about environmentally friendly materials—for example, using soy-based oils to replace some petroleum-based ones in the "positioners" that help hospital patients avoid bedsores.

26 DSM

Heerlen, the Netherlands

A company with roots in coal mining and chemicals reinvents itself as a planetary problem-solver. Its next challenge? The world's overfished, polluted oceans.

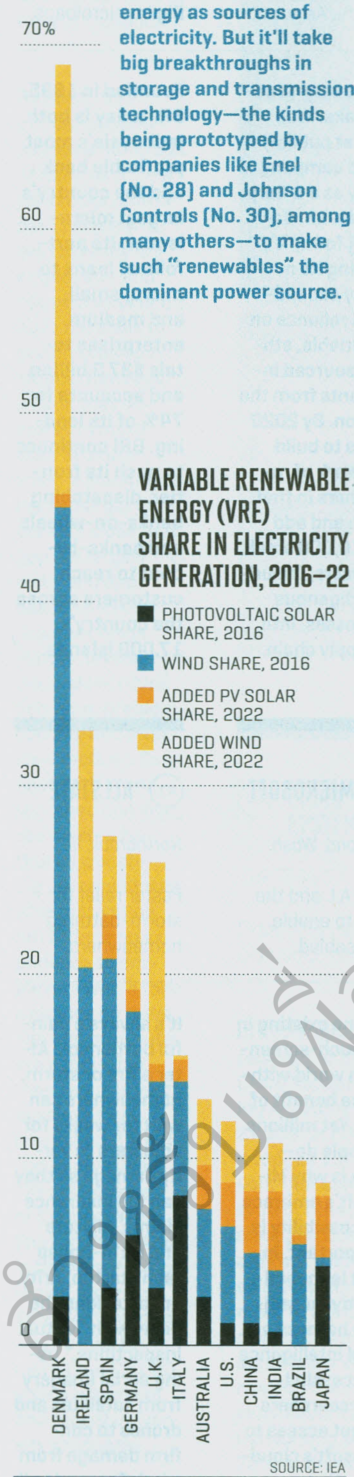
THE OCEANS ARE AILING, overfished, and overtaken in places by island-size masses of plastic waste. Enter the science-driven multinational DSM, which is betting big on innovations to protect the oceans. Its Dyneema-brand fiber—the world's strongest—is being used by the Ocean Cleanup, an organization that attacks trash drifts (in September, they're going after the Great Pacific Garbage Patch). And a new venture aims to make aquaculture sustainable by using algae to produce omega-3 fatty acids. Previously that substance, a vital feed ingredient for farmed fish, could be sourced only from wild fish, and the harvest of omega-3 has played a big role in the depletion of the wild stock. DSM's sustainability-minded strategy has paid off for investors; its stock price has climbed 61% in the past five years.

↑ **Farmed salmon pens in Norway. Fish like these may soon be fed food with ingredients made from natural marine algae rather than sourced from wild fish.**

O26: COURTESY OF VERAMARIS

Room to Grow

The world's major economies are rapidly adopting wind and solar energy as sources of electricity. But it'll take big breakthroughs in storage and transmission technology—the kinds being prototyped by companies like Enel (No. 28) and Johnson Controls (No. 30), among many others—to make such "renewables" the dominant power source.



27 SALESFORCE

San Francisco

A giving culture builds a tech-savvy generation.

The business software company is renowned for its giving culture (it gives 1% of equity, 1% of product, and 1% of employees' time to charity). Trends in hiring show how that giving flows back to strengthen the company: Salesforce has hired about 150 full-time staff to date from "Year Up," a tech-training program for underrepresented minorities that is one of its main philanthropic partners.

28 ENEL

Rome

Building a network of clean-energy innovators.

Italy's Enel is one of the world's top producers of energy from renewables—zero-emission sources account for 51% of its production. Now, through its Open Power strategy, it's sharing green tech and tactics with startups, industrial partners, universities, and others. Enel has launched 147 energy projects with startups, 39 of which scaled to industrial deployment in the past three years.

29 HENRY SCHEIN

Melville, N.Y.

Help for those who can't pay a dentist.

This dental supply company partners with dental schools to help patients in underserved communities worldwide, from a refugee camp in Kenya to a Jamaican beachside village. A related program, Give Kids a Smile, has provided care for more than 5.5 million children since 2003. The kindness gets rewarded: The company has seen a 10% sales bump from dentists who join the outreach.

30 JOHNSON CONTROLS

Cork, Ireland

Making paradise even greener.

This tech giant creates energy-saving "intelligent buildings," and since 2010 it has been collaborating with the University of Hawaii on the nation's first 100%-renewable-energy campus system. Johnson Controls' solar-panel systems and battery storage now enable five of the 10 campuses to run on self-generated energy; the energy efficiency upgrades will save $79 million over 20 years.

31 TOYOTA

Aichi, Japan

Providing help for the elderly in a fast-aging society.

Toyota believes robots can do more than assemble Corollas and Camrys; it's building and investing in robotics to help the disabled and elderly. It has created a walking-assist system to help stroke victims or others with disabilities learn to use their legs again. Toyota also recently invested in Israel's Intuition Robotics, whose robots can remind the elderly to handle tasks like taking medication.

32 TE CONNECTIVITY

Schaffhausen, Switzerland

Vital electronics.

It's not a household name, but TE Connectivity is a $13 billion company that supplies the world's largest automakers with electric connectors—vital components of any cleaner-energy vehicle. Its sensors help reduce pollution from diesel engines; they're also crucial to the operation of experimental green tech like hydrogen fuel-cell engines and electric long-haul trucks.

33 BIDVEST

Johannesburg, South Africa

Battling an unemployment crisis.

This conglomerate with stakes in financial services and freight hauling is tackling South Africa's youth unemployment rate (57%). In 2017, Bidvest spent $42 million on skills development programs, focusing on the motor industry, management, and executive training. Much of the help went to black communities, where joblessness is severe; nearly 400 students have found work so far.

34 PRUDENTIAL FINANCIAL

Newark

Rescuing retirement for millions.

Private pensions are almost extinct in the U.S., but 1.4 million workers whose pensions were once in danger get paid today by Prudential. The insurer pioneered "pension risk transfers," taking over and managing the funds of overstretched companies such as GM and Motorola. Those companies come away financially stronger, while retirees get paid what they're owed—$5.2 billion in 2017.

CHANGE THE WORLD

▲

35 99 CENTS ONLY STORES

Commerce, Calif.

Bringing good, affordable produce to America's food deserts.

THE UNITED WAY estimates that 43% of American households can't stretch their income to cover a basic monthly budget (for housing, transportation, food, childcare, health care, and cell phone use). This California-based "extreme value retailer" serves that clientele—64% of its customers have an household income of less than $50,000—and helps their money go a little further. The sub-dollar chain's 400 or so stores stock locally grown produce (see photo), often the perfectly good but imperfect-looking items that higher-end grocers reject. Just as crucially, they operate in areas often described as food deserts. It's a winning strategy for reducing food waste, meeting the needs of underserved customers, and doing business.

36 GRAB

Singapore

Leveraging the technology behind ride-sharing to become a banker to the unbanked.

SINGAPORE'S ride-hailing startup, now valued at $10 billion, set out with the objective of making taxi services safer for customers, but it has also made business better for drivers. Over 2 million drivers across eight countries in Southeast Asia use Grab; according to the company, a survey found that its drivers earned 32% more per hour than the average local pay. The company has expanded into financial services, harnessing its data to offer insurance plans to its drivers, and using big data to generate credit scores and offer microloans. On a broader scale, its mobile payment app, GrabPay, allows users to make transactions and store cash virtually. In Southeast Asia, where roughly 70% of people are unbanked, solutions like this can be a vital lifeline.

37 LEVI STRAUSS

San Francisco

Taking caustic chemicals out of clothes making.

The venerable outfitter is making cleaner, greener jeans, cutting out harmful chemicals that have long been part of the production process. Rather than merely relying on government "do not use" lists, Levi Strauss since 2013 has screened the hundreds of chemicals in its supply chain to ensure their safe use. The company, which shares its findings with the rest of its industry, has so far scratched 50 agents from its dungaree-making "recipes" (it has cleared 500). The 165-year-old company has also turned to lasers to do the chemical-heavy finishing work that used to expose its workers to the most risk. That has made the process more efficient and the work environment safer.

38 NATURA COSMETICOS

São Paulo

Sourcing ethically from the Amazon.

This beauty-product maker was the first publicly traded company to certify as a B Corp. (See No. 11, Danone.) Today it's pursuing its mission by expanding its reliance on sustainable, ethically sourced ingredients from the Amazon. By 2020 it aims to build a network of researchers in that region and add over 10,000 small producers, including indigenous businesses, into its supply chain.

39 MICROSOFT

Redmond, Wash.

Using A.I. and the cloud to enable the disabled.

Imagine existing in our touch-screen-driven world without the benefit of sight. Yet millions of people do—which is why Microsoft's embrace of accessibility is so important. In May it launched a multiyear project to harness artificial intelligence for accessibility. Researchers now get access to Microsoft's cloud-computing resources—which in turn expands the reach of that fast-growing business.

40 BANK RAKYAT INDONESIA

Jakarta

Big in microloans.

Founded in 1895, BRI today is both Indonesia's most profitable bank and the country's largest microlender. Its portfolio of loans to micro, small, and medium enterprises totals $37.3 billion and accounts for 74% of its lending. BRI continues to push its frontier, dispatching banks-on-wheels and banks-by-boat to reach customers across the country's 17,000 islands.

41 ALLSTATE

Northbrook, Ill.

Faster relief for storm-battered homeowners.

It's always a painful bottleneck: After a fire or storm, homeowners can wait for weeks for adjusters to verify damage so they can file insurance claims. Allstate and its in-house tech startup, Arity, are attacking the delay with "virtual inspections," using aerial imagery from satellites and drones to confirm damage from wind, fire, and hail. Customers get paid faster, while Allstate's processing costs drop.

© 35. COURTESY OF 99 CENTS ONLY STORES

42 BARCLAYS

London

Helping young job-seekers up the first rung of the ladder.

By 2020, the global economy will need hundreds of millions of new jobs to accommodate people who are currently unemployed—and many jobless don't have the skills to match those positions. Barclays, a bank that operates in more than 50 countries, is working to help younger job-seekers close that gap. Its largely web- and app-based LifeSkills program helps people develop basic skills (think listening, problem solving, and interview tactics). Connect With Work, launched last year, goes a step further by matching job candidates with motivation but little or no experience to employers who'll take a chance on them. The two programs are simple, but their reach is vast: Barclays says more than 2.1 million people used either LifeSkills or Connect With Work in 2017. And in the Asia Pacific region, Connect With Work helped secure jobs for more than 60,000 young engineers and recent university graduates.

43 CISCO SYSTEMS

San Jose

Extending tech education to millions.

In 1998, global enrollment at the Cisco Networking Academy was 27,129. In 2017 it topped 1.3 *million*. That soaring growth reflects a changing economy but also Cisco's deep commitment to workforce development. Students learn skills ranging from cybersecurity to networking and IT; 70% of those who earn Academy certifications go on to get new jobs, better pay, or new responsibilities.

44 TYSON FOODS

Springdale, Ark.

Rethinking how meat is made.

Tyson is rethinking what it means to be a meat company, by investing in disruptive but more sustainable food ideas: Its venture arm has backed Beyond Meat, which is replicating meat using plants, and two companies that are growing meat from cells. Tyson is also battling antibiotic-resistant bacteria by moving to eradicate such drugs from the supply chain of its chicken business.

45 JD.COM

Beijing

Using drones and robots to bring e-commerce to populations that couldn't be reached before.

CHINA'S RURAL POPULATION—around 589 million people—is larger than the entire U.S. population but constitutes an economy relatively untapped by e-commerce. JD.com is rectifying this by pioneering innovative delivery solutions for rural China. Most striking is its drone delivery program: To date, JD drone deliveries are servicing over 100 villages and have made more than 20,000 delivery runs. Ultimately, JD envisions combining unmanned planes and wingless drones to complete long distance and last-mile deliveries for rural areas. (It has also innovated in urban areas, with four-wheeled autonomous minicars that can avoid traffic and find uncongested routes.) CEO Liu Qiangdong claims that when the network is expanded nationwide it will save 70% on delivery costs. Those savings will benefit not just consumers but producers too, such as farmers who want to get their goods to urban markets quicker than trucking allows.

An unmanned robot delivers packages in Guiyang, China. Robots and drones have expanded e-tailer JD.com's reach.

© 45. QU HONGLUN—CHINA NEWS SERVICE/VCG VIA GETTY IMAGES

CHANGE THE WORLD

(46) HILTON

McLean, Va.

A smaller energy footprint for a big hotel chain.

The venerable hotel chain, which has more than 5,400 properties worldwide, welcomed 160 million guests in 2017. That's a lot of sheets to wash and mini-fridges to power. But Hilton generates 30% less carbon emissions and waste and uses 20% less water and energy, on a per-square-foot basis, than it did in 2008. Anchoring that achievement is an internal platform called LightStay that enables individual hotels' managers to measure their environmental impact and spot possible fixes; the platform has helped Hilton save about $1 billion over the past decade through operating efficiencies. This spring, Hilton pledged to reduce water use and waste by an additional 50%, and CO_2 output by 61%, by 2030.

47 ADIDAS

Herzogenaurach, Germany

Turning a seaborne menace into a million-selling product line.

REDUCING PLASTIC USE is laudable; finding clever, profitable ways to employ plastic waste is even more so. Adidas, the German athletic-gear maker, is a founding member of Parley for the Oceans, which brings together people and organizations to collaborate on protecting the seas. Its biggest inspiration: using plastic recovered from the ocean to make new iterations of its UltraBoost shoe. Adidas has now sold 1 million pairs of those shoes, priced at $160 to $200; each one reuses the equivalent of 11 plastic bottles. Other offerings made from ocean-retrieved plastics include soccer kits and hoodies. It adds up to a great example of doing well by doing good in retail—an environmentally friendly product line for a public that's increasingly sensitized to the dangers of plastic waste.

(48) PAYPAL

San Jose

Helping small businesses get financing when banks aren't in the picture.

AMERICA'S LARGEST PLAYER in online payments (with 237 million accounts), PayPal is harnessing its huge scale to increase access to financial services for underbanked populations—and boosting the economy as a result. Over the past five years, for example, the company has loaned more than $5 billion to 150,000 small businesses—especially those in regions that lost brick-and-mortar bank branches after the financial crisis—through its Working Capital offering, which lets borrowers pay back the money with a cut of their PayPal sales. It has also mobilized the generosity of its vast community, with $8.5 billion donated to charity by PayPal customers and merchants in 2017.

49 SIEMENS

Munich

3D printing helps manufacturers test new products without creating new junk piles.

BUILDING PROTOTYPES for machinery takes a lot of time and creates a lot of waste. Additive manufacturing, a.k.a. 3D printing, reduces both, and Siemens, which makes everything from locomotives to medical X-ray machines, has embraced it avidly. Siemens says additive techniques have enabled its gas- and steam-turbine unit to use an average of 65% fewer resources in the production process. The company also sells software that helps customers reap similar 3D rewards.

↑ **A Siemens worker retrieves a metal component from a 3D printer.**

O 47: COURTESY OF ADIDAS; 49: COURTESY OF SIEMENS

(50) MCDONALD'S

Chicago

Taking greenhouse gases out of the fast-food flow.

Want less guilt with your burger? McDonald's is working on it. The fast-food powerhouse has committed to reducing greenhouse gases related to its offices, restaurants, and supply chain—promising, by 2030, to cut that output by about a third from 2015 levels. The environmental impact would be massive: the equivalent of taking 32 million cars off the road for a year. It's also a symbolically important move; environmental advocacy organizations say McDonald's is the first restaurant group to set such a specific science-based target for reducing emissions.

To reach its goal, the company is doing everything from using LED lights to installing more energy-efficient appliances in its kitchens. And by 2025, all of its customer packaging will come from renewable, recycled, or certified-sustainable sources, and the company's goal is to recycle it all in its own restaurants.

51 TELENOR

Fornebu, Norway

A telecom company brings health care advice, by app, to a country where doctors and hospitals are few and far between.

TELENOR'S HOME COUNTRY is among the world's healthiest; now the company is helping to improve health in Bangladesh, where getting access to health care is difficult. Through Tonic, an app-based program aimed at subscribers of Telenor's Grameenphone service, some 5 million customers have signed up for benefits like the Jibon ("Life") app, which provides free information about maintaining a healthy, sanitary routine. Tonic Daktar ("Doctor") provides access to immediate medical advice by phone for a fee of about 6¢ per minute. Tonic also offers discounts on medical services and financial aid for hospitalizations.

↓

A health care worker in Bangladesh registers a child with local authorities, using a birth-registration app developed by Telenor in collaboration with Unicef.

© 51. COURTESY OF TELENOR GROUP

(52) DELOITTE

London

A global consultant goes all in on "re-skilling."

Emerging technologies, including robotics and artificial intelligence, can displace even the most talented of workers. And for Deloitte, which helps *Fortune* 500 companies adapt to technological change, keeping its own staff of 265,000 professionals re-skilled is an existential priority. There are now six Deloitte University facilities worldwide, training 65,000 staffers each year, including thousands of new hires. (Deloitte brings on a new employee every 8 minutes.) Last year, that added up to a $69 million investment, including 400,000-plus hours of skills development and teaching. And those skills benefit other companies when Deloitte trainees move on to new employers.

53 DIDI CHUXING

Beijing

Taking on congestion and pollution.

To solve China's endemic traffic problem, the ride-sharing company is working with local authorities on an initiative it calls Smart Transportation. Over 20 Chinese cities have adopted the program, which includes installing smart traffic lights and "reversible lanes" to improve flow during traffic peaks. In some locations, the system has reduced delays by up to 20%, an annual savings of 11.5 million commuter hours. This translates to increased turnover and revenue for Didi drivers, and a reduction in carbon emissions from idling cars.

54 ABBOTT

Abbott Park, Ill.

Training farmers to produce safer, healthier milk.

Abbott's $7 billion nutrition business depends on a reliable supply of high-quality milk. Working with nonprofit TechnoServe and Indian dairy firm Prabhat, Abbott is teaching Indian farmers, about half of whom are women, how to consistently produce such milk—and get fair prices for it. The program provides best practices in feeding and helps farmers improve their infrastructure. One year and 1,500 students in, farmer income has doubled, the volume of milk has nearly doubled, and its levels of nutrients are much higher.

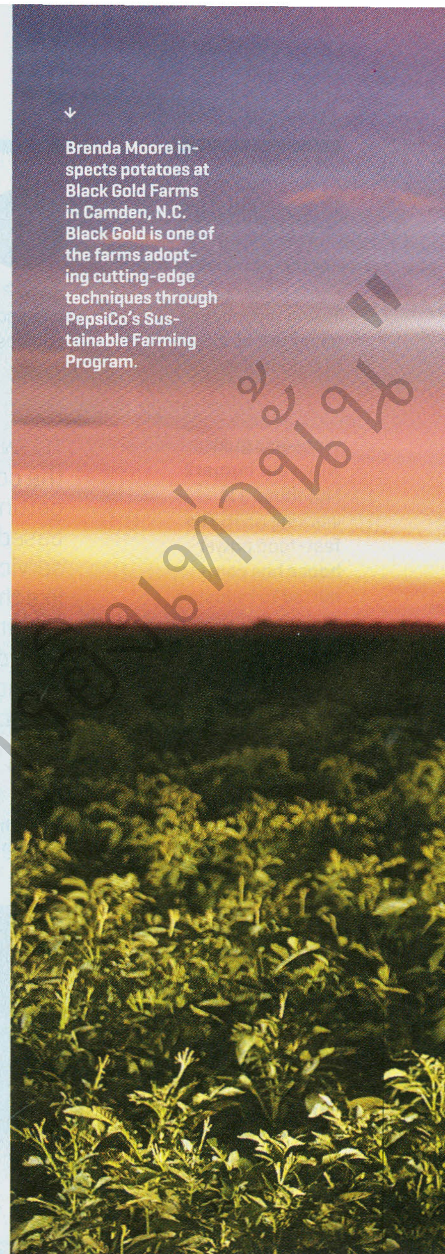
55 GAP

San Francisco

Providing first jobs as a foundation for better, more secure futures.

RETAIL requires soft skills like decision making and time management that come in handy in any job. This Way Ahead teaches such skills to "opportunity youth" who are disconnected from work or school, by giving them first jobs at Gap, Old Navy, or Banana Republic. About 5,300 have completed it to date; for alumni, high school graduation and employment rates are significantly higher than their peers'.

Gap's This Way Ahead has trained thousands of at-risk teens in retail job skills.



Brenda Moore inspects potatoes at Black Gold Farms in Camden, N.C. Black Gold is one of the farms adopting cutting-edge techniques through PepsiCo's Sustainable Farming Program.

Breakdown Dead Ahead

Traffic and the pollution it creates are increasingly vexing global problems, and the congestion rate is rising faster in China's huge cities.

COUNTRY RANK	WORLD RANK	CITY	CONGESTION LEVEL	1-YEAR CHANGE
1	12	LOS ANGELES	45%	4%
2	30	SAN FRANCISCO	39	3
3	49	NEW YORK	35	2
4	53	SEATTLE	34	3
5	65	SAN JOSE	32	2
6	75	MIAMI	30	2
7	82	PORTLAND	29	3
8	89	HONOLULU	29	0
9	90	WASHINGTON	29	3
10	97	BOSTON	28	3

COUNTRY RANK	WORLD RANK	CITY	CONGESTION LEVEL	1-YEAR CHANGE
1	4	CHONGQING	52%	14%
2	7	CHENGDU	47	6
3	10	BEIJING	46	8
4	11	CHANGSHA	45	8
5	14	GUANGZHOU	44	7
6	15	SHENZHEN	44	7
7	16	HANGZHOU	43	5
8	18	SHIJIAZHUANG	42	6
9	22	SHANGHAI	41	5
10	23	TIANJIN	41	2

SOURCE: TOMTOM, BASED ON 2016 NUMBERS

55. COURTESY OF GAP INC.

57. LOU BOPP—COURTESY OF PEPSI

56 BANCO SANTANDER

Madrid

Spain's biggest bank sows the seeds of its future with a bet on higher education.

ACCORDING TO the Varkey Foundation, Santander is the world's largest corporate contributor to higher ed. Through 2017, it has invested more than 1.6 billion euros ($1.83 billion) in universities and awarded more than 39,000 scholarships; in 2017, it launched Santander X, a program to boost entrepreneurship at colleges. It's all a long-term bet to nurture future employees and future clients.

57 PEPSICO

Purchase, N.Y.

A food-and-beverage giant campaigns to lessen its products' impact on the planet through smarter farming and more conscientious recycling.

PEPSICO IS USING its massive purchasing and brand power to lighten the impact of what and how we consume. Through its Sustainable Farming Program, the snacking and beverage behemoth works with more than 40,000 growers in 38 countries to implement best practices like precision farming technology, which maximizes yields—all while using fewer resources. The move makes good business sense: In the U.S., sales of products with clear links to sustainability grew 5% last year. With a $10 million investment, PepsiCo's foundation is also leading an industrywide initiative to reverse declines in household recycling in the U.S., with a goal of capturing 7 billion additional containers over the next five years.

CHANGE THE WORLD

DREAM BIG

Our Rising Stars list honors companies with less than $1 billion in annual revenue that are having a significant world-changing impact. Some are upstarts, some are old hands, but all are having an outsize influence on their communities, their customers, and the planet.

—ERIKA FRY, MATT HEIMER, AND AARON PRESSMAN

DEXCOM

San Diego

THIS MED-TECH PIONEER is dedicated to helping diabetes patients better manage the chronic disease. Its continuous glucose monitoring system, which allows individuals (and their doctors and loved ones) to track blood sugar levels on a smartphone in real time, was the first of its kind to win FDA approval. This summer, the enormously life-improving mobile device became available to Medicare patients.

WARI

Dakar, Senegal

THE DECADE-OLD money transfer company has transformed life in West Africa. Its 200 million customers can go to one of its 500,000 outlets—in banks, shops, and freestanding kiosks, they're abundant even in remote parts of the region—and send money, for a tiny fee, from one mobile phone user to another. The fintech has facilitated the exchange of $5 billion to date, helping innumerable families.

ETSY

Brooklyn

THE CRAFTSY E-COMMERCE SITE is associated with a proud amateur ethos, but it's also a launching pad for small entrepreneurs; 1.9 million active sellers sold $3.3 billion worth of merch via the site last year. What's more, 87% of those sellers were women (as are 50% of Etsy's board and five of its top seven execs). Etsy hit a crucial milestone in 2017, registering its first profitable year since its 2015 IPO.

EF EDUCATION FIRST

Lucerne, Switzerland

AT A TIME WHEN GLOBAL TENSIONS are rising and cultural clashes are becoming more frequent, EF is spreading greater understanding across borders. The company started in the 1960s, taking Swedish high school kids to study English in the U.K. Today it's a Goliath with almost 50,000 employees across 55 countries, running trips for students, exchange programs, and foreign language schools.

AUCMA

Qingdao, China

VACCINES ARE LIFESAVERS—but they can go bad if they aren't kept cold. Aucma, a refrigeration company, is tackling that challenge by producing the Arktek PSD, a portable cooler invented by the nonprofit Global Good that can maintain temperatures of –60 degrees Celsius for up to six days. The Arktek helped curb an Ebola outbreak this summer; that won't be its last moment in the sun.

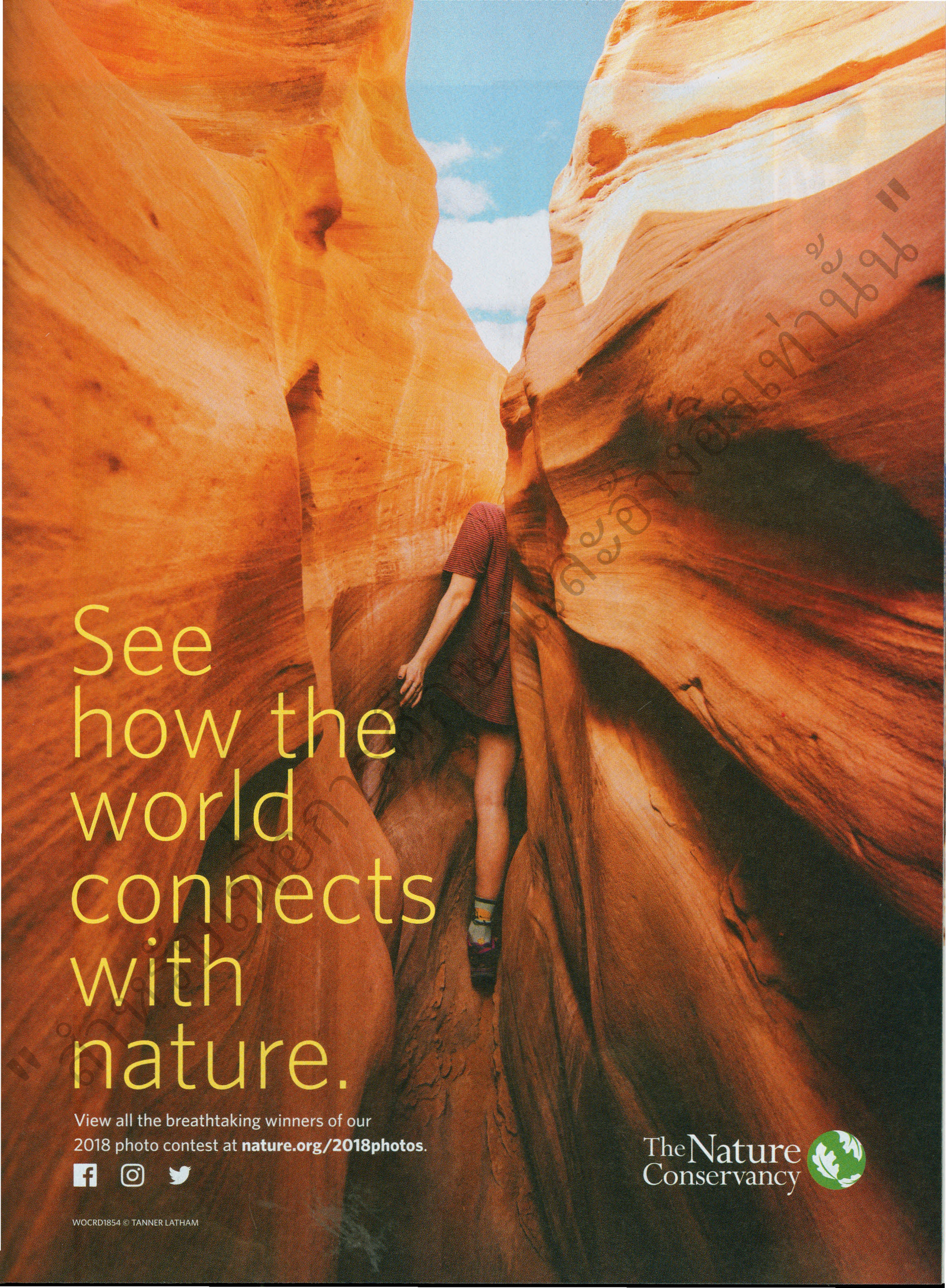
THRIVE GLOBAL

New York City

ARIANNA HUFFINGTON'S Huffington Post helped create today's digital culture; with Thrive Global, launched in 2016, she's helping us manage it. One of its products is already having an impact in this regard: The Thrive app, released last fall on Samsung devices, nudges users to turn off their phones and recharge themselves. Even mighty Apple has followed suit: In June, it unveiled software to do the same.

FEEDBACK LETTERS@FORTUNE.COM

▲ ILLUSTRATION BY ANDREA MANZATI


See how the world connects with nature.
View all the breathtaking winners of our 2018 photo contest at **nature.org/2018photos**.
The Nature Conservancy
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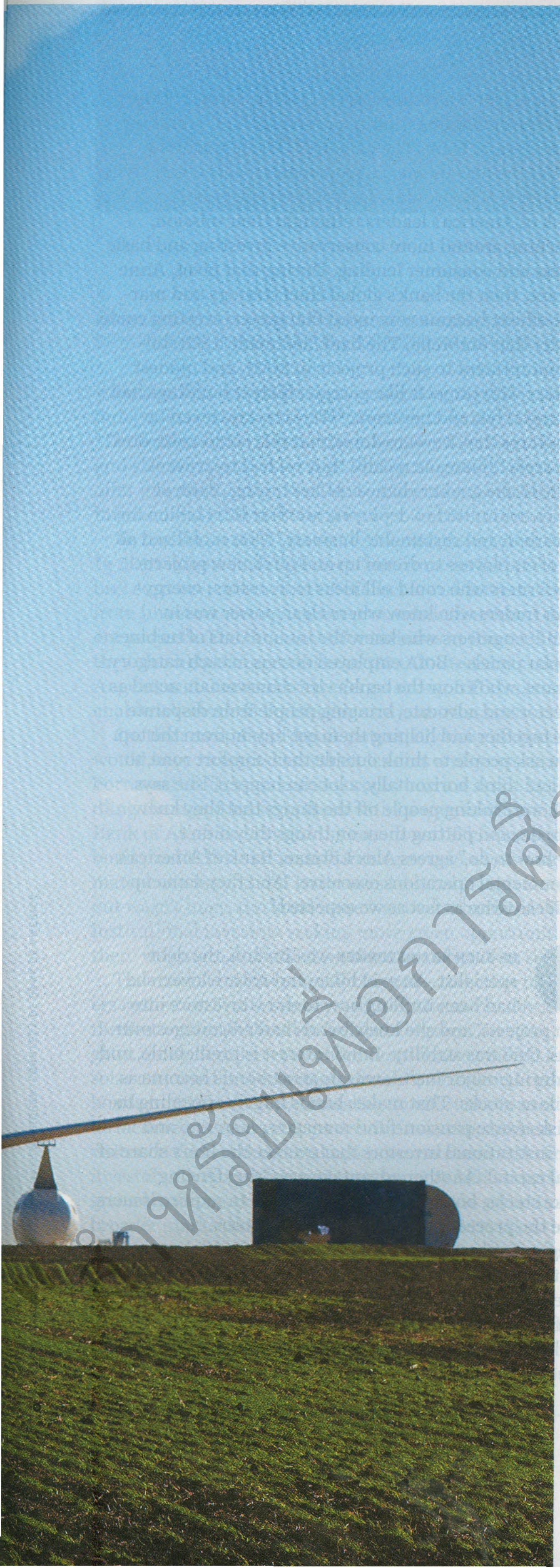
CHANGE
THE
WORLD

BUILT TO SPIN A turbine under construction at Blackwell Wind Energy Center in Kay County, Okla. Bank of America "green bonds" have financed dozens of wind farm projects.



THE WIND AT GREEN ENERGY'S BACK

Clean-energy projects once struggled to attract financing. Then Bank of America found the formula that lured more money into green investing.

BY MATT HEIMER

OKLAHOMA IS AN EPICENTER of fossil-fuel production, a state where oil-well pump jacks punctuate the pastures. But if you drive out to Grady County, an hour west of Oklahoma City, you'll encounter a different mechanical landscape. There, atop the hills outside Minco, dozens of 80-foot-tall turbines churn, their blades generating a steady drone to accompany the occasional dairy-cow bleat and the buzz of distant cars.

This metallic display is part of Pioneer Plains, a sprawling wind-power project that generates electricity for some 42,000 homes. The turbines are part of a high-stakes transformation in the energy economy—a bet that

A DECADE AGO, "MOST ENVIRONMENTAL INVESTING WAS SEEN AS RISKY."
—SUZANNE BUCHTA, BOFA MERRILL LYNCH

renewable power can scale up as a cost-effective replacement for fuels that contribute to climate change. But the wind farm is also a symbol of financial transformation: It might never have sprouted if it weren't for "green bonds"—an investment vehicle that didn't exist a decade ago.

Those bonds were the brainchild of dealmakers at Bank of America—the $87 billion, 209,000-employee giant that occupies the No. 3 spot on *Fortune*'s Change the World list this year. Their work is part of BofA's $125 billion Environmental Business Initiative, a campaign that has established the Charlotte-based bank as a powerhouse in "climate finance"—the unglamorous but essential business of steering investor capital into the low-carbon economy. Green bonds, which the bank all but invented, have raised $442 billion worldwide since 2013, helping borrowers both tiny (the Antioch, Calif., Unified School District) and enormous (trillion-dollar Apple) pay for renewable-energy innovations.

Most environmental advocates agree that a renewable revolution can't happen without a big private-sector push. And a behemoth like Bank of America—with its web of relationships and deep pool of expertise—can make a decisive impact in connecting investors with cash-hungry green projects. "Doing the first-ever commercial green bonds, appealing to institutional investors—BofA gave this market credibility," says Sean Kidney, cofounder and CEO of the Climate Bonds Initiative (CBI), a London nonprofit that tracks green-energy investing. "They've been invaluable."

IN AN ERA WHEN AMERICANS can buy solar power through their local utilities and run errands in Teslas, it's hard to imagine that wind farms or solar-panel arrays ever went begging for funds. But a decade ago, during the financial-crisis catastrophe, that's exactly what was happening. "Risk appetite was really diminished," explains Suzanne Buchta, managing director of ESG debt-capital markets at BofA Merrill Lynch. "And most environmental investing was seen as risky."

At the time, Bank of America was paying a heavy price for misjudging risk. Bad bets on subprime mortgages had demolished its balance sheet. Fleeing investors wiped out more than 80% of its market value, and the bank wound up taking $45 billion in federal bailout money. Brian Moynihan, who was tapped as CEO in December 2009, found himself holding multiple rounds of soul-searching with his C-suite team. The bailout had been repaid by then, but the new theme, as Moynihan recalls it, was "Why are we here? Who would miss us if we were gone?"

Bank of America's leaders rethought their mission, retrenching around more conservative investing and basic business and consumer lending. During that pivot, Anne Finucane, then the bank's global chief strategy and marketing officer, became convinced that green investing could fit under that umbrella. The bank had made a $20 billion commitment to such projects in 2007, and modest successes with projects like energy-efficient buildings had encouraged her and her team. "We were convinced by the business that we were doing that this could work on a larger scale," Finucane recalls, "but we had to prove it."

In 2013 she got her chance: At her urging, Bank of America committed to deploying another $125 billion for "low-carbon and sustainable business." That mobilized an army of employees to dream up and pitch new projects. Underwriters who could sell ideas to investors; energy-market traders who knew where clean power was in demand; engineers who knew the ins and outs of turbines and solar panels—BofA employed dozens in each category. Finucane, who's now the bank's vice chairwoman, acted as connector and advocate, bringing people from disparate teams together and helping them get buy-in from the top. "If you ask people to think outside their comfort zone, to work and think horizontally, a lot can happen," she says.

"We were taking people off the things that they knew how to do, and putting them on things they didn't know how to do," agrees Alex Liftman, Bank of America's environmental operations executive. "And they came up with ideas twice as fast as we expected."

ONE SUCH BRAINSTORMER was Buchta, the debt specialist. An avid hiker and nature lover, she had been mulling how to draw investors into green projects, and she knew bonds had advantages over stocks. One was stability: Bond interest is predictable, and only during major meltdowns do most bonds become as volatile as stocks. That makes bonds hugely appealing to the risk-averse pension-fund managers, insurers, and other institutional investors that oversee the lion's share of global capital. Another advantage was "ring fencing": Unlike stocks, bonds could be structured to require issuers to use the proceeds only for specific purposes.

Beginning in 2013, Buchta collaborated with her counterparts at several big banks, hashing out some broad "Green Bond Principles." A bond, they agreed, could be called "green" only if its proceeds paid for projects with a clearly positive environmental impact. Issuers would have to be transparent with investors about where the money

PREVIOUS SPREAD: COURTESY OF NEXTERA; BUCHTA: COURTESY OF BANK OF AMERICA

CHANGE THE WORLD

↑ **BEFORE AND AFTER: A view of Los Angeles from the slopes of Mount Wilson, before (left) and after the city retrofitted tens of thousands of streetlights with LED bulbs, in a project financed in part by a Bank of America green bond. The orange glow is a sign of the energy "leaked" by traditional sodium bulbs.**

© COURTESY OF LOS ANGELES BUREAU OF STREET LIGHTING

went and how the projects progressed, and, ideally, an independent party would certify the bond's greenness. "The brilliant thing about the concept is that it's so simple and so easily accessible," says Buchta: A green bond would offer investors a clear, verifiable connection between their financial commitment and a project that helps the climate.

To test the concept, Bank of America played guinea pig. In 2013 it issued the first-ever "benchmark-size" (that is, big) corporate green bond. BofA borrowed $500 million from investors, deploying the proceeds into a dozen different projects. The funds paid for turbines at Pioneer Plains; they also helped upgrade some 170,000 streetlights in Los Angeles and Oakland with energy-saving LED bulbs, and enabled Antioch to build solar arrays at 24 schools.

On their own, those small, potentially risky projects would have struggled to attract lenders and would have borrowed at high rates if they could borrow at all. By bundling them and backing them with its own credit rating, Bank of America brought the cost down. (The three-year bond paid 1.35%—attractive to investors in a low-rate climate, but a bargain for borrowers.) And although the payout wasn't huge, the bond issue was oversubscribed: With institutional investors seeking more green opportunities, there was more demand than there were bonds to sell.

The market had its proof of concept—and other borrowers rushed in. The Commonwealth of Massachusetts issued the first municipal bond to be labeled "green," in 2013. The giant utility Southern Co. raised more than $1 billion for solar and wind projects. Apple issued $2.5 billion in green bonds in 2016 and 2017, financing an effort to run more of its facilities on renewable power. BofA was the lead underwriter on each of those deals, playing matchmaker to attract investors. To date, it has underwritten $27 billion worth of green bonds, more than any U.S. bank. At the same time, a broader market has taken off. Since Jan. 1, 2017, there have been $254 billion in green-bond issuances, according to CBI—more than in the previous four years combined.

Bank staffers take pride in the creative ways they've deployed capital for green causes. At Pioneer Plains (which is owned by NextEra, No. 21 on the Change the World list) and two dozen other energy projects, BofA has used bond proceeds to make "tax equity" investments, paying developers upfront in return for the right to claim their green-energy tax credits. The deals give the developers funding for construction and repairs; the bank uses the credits to cut its own tax bill. Another BofA project, the Catalytic Finance Initiative, specializes in crafty climate-finance puzzle solving. Last year the CFI team helped Vivint Solar package the cash flows from 30,000 of its residential solar accounts into a $203 million bond and sell the debt to investors.

BofA doesn't break out how much revenue its environmental business has generated, but underwriting fees, loan interest, and advisory fees have made the enterprise profitable. To date, the bank has deployed more than $96 billion of the $145 billion it has committed to green business since 2007. Its own fortunes have improved lately too. Over the past three years, its stock has risen twice as fast as the S&P 500, and profits are up 20%.

In April, four economists released a working paper that gave green-bond fans reason for optimism. They found that municipal bonds labeled "green" paid six basis points (0.06%) less in yield than nongreen bonds—and that the effect doubled or tripled for bonds that took the extra step of being *certified* green. Bond yields fall when buyers drive up prices, so the lower yields suggest that demand for green bonds is stronger than the norm. On a typical muni bond, that could result in millions of dollars in savings on interest. Compared with those benefits, "the cost of certifying a green bond is modest," says coauthor Jeffrey Wurgler, a professor of finance at the NYU Stern School of Business, while borrower and investor alike "get a green glow."

The urgent question is how much bigger and brighter that glow can get, and how quickly. Electric-vehicle production, energy storage, the building of "smart grids"—all are areas where great strides could be made, but only if the private sector can mobilize the money to fund them, at the rate of trillions per year rather than billions. "Public capital is not enough," notes BofA's Moynihan. "But private capital has to be accessed in a way that it's used to being accessed." If green bonds, with their relative stability and familiarity, lure more big money into the game, Bank of America will have done a lot to pave the way for it. F

DYNAMIC DUO
Jeff Sprecher and Kelly Loeffler at ICE headquarters in Atlanta.

WALL STREET'S

POWER COUPLE

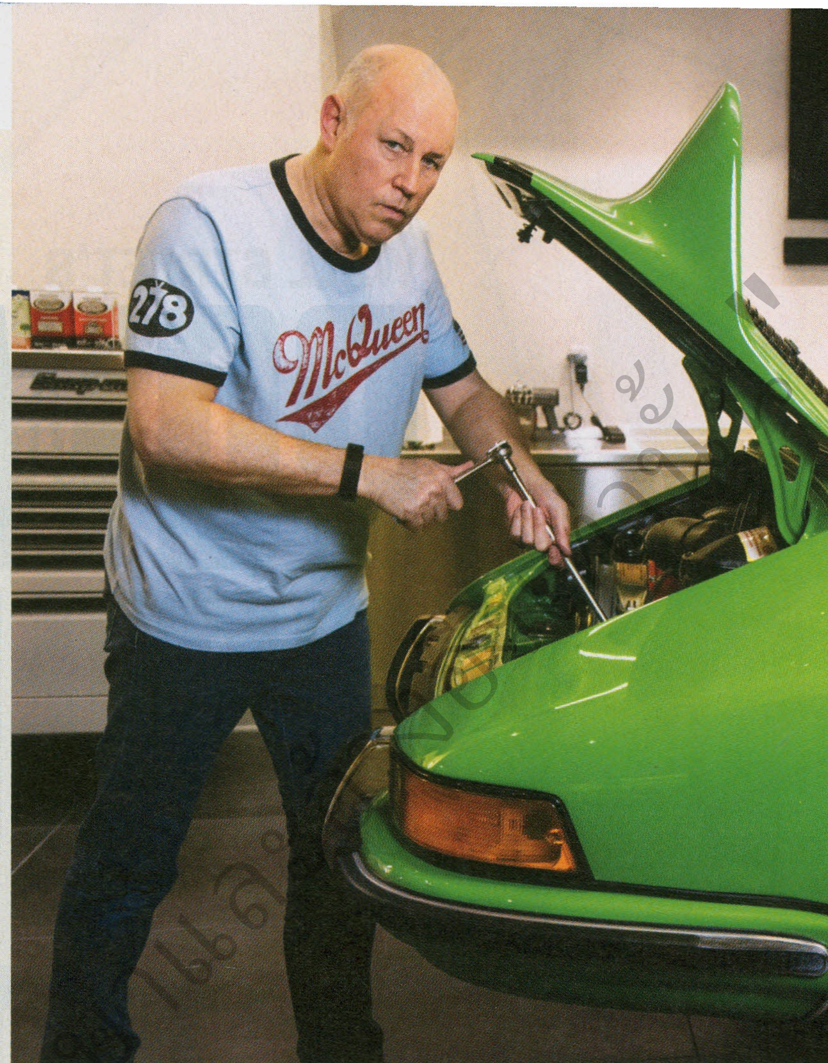
TAKE ON

BITCOIN

Intercontinental Exchange CEO Jeff Sprecher has revolutionized electronic trading and revitalized the NYSE. Now he and a key ICE exec—who happens to be his wife—are launching a startup to bring cryptocurrencies to your 401(k). Are crypto credit cards next?

BY **SHAWN TULLY**

▲ PHOTOGRAPHS BY GILLIAN LAUB



Jeff Sprecher is explaining his radical plan to help Bitcoin break through as a mainstream currency—and making it sound surprisingly simple. As the CEO and chairman of trading colossus Intercontinental Exchange, he has already revolutionized the world of electronic marketplaces and revitalized the New York Stock Exchange, which he acquired in 2013. Now he intends to add to his legacy by addressing problems with cryptocurrencies that have limited their adoption thus far.

As he talks, Sprecher is sitting with his wife and business partner Kelly Loeffler in the plush Bond Room of the NYSE, its walls festooned with framed bond certificates chronicling the great railway and infrastructure financing that built America. The setting is appropriate, because Sprecher believes Wall Street's acceptance is just what Bitcoin needs. "We're planning to give Bitcoin the same protections the big banks and money managers provide in trading stocks and bonds in venues like the NYSE," he says. "Once that happens, Bitcoin could be on its way to changing the world."

The conversation would turn out to be the first in a series of exclusive interviews that Sprecher and Loeffler gave to *Fortune* over the spring and summer as they formalized their strategy to make Bitcoin a safe and easy-to-access asset for the masses.

Sprecher and Loeffler went public with their Bitcoin blueprint in early August, when ICE announced that it is forming a startup called Bakkt. The new venture, which is expected to launch in November, will offer a federally regulated market for Bitcoin—as we'll see, a key factor in creating scale. According to Loeffler, ICE and its partners have been

MARKET MECHANIC
A born tinkerer, Sprecher relaxes by working on vintage Porsches in his home garage.

"building the factory" that will power Bakkt in the strictest secrecy for well over a year. The name of the company is a play on "backed," as in "asset-backed securities," and it's meant to evoke a highly trusted investment.

To build Bakkt, ICE is partnering with some of America's leading companies: Microsoft, Boston Consulting Group, and Starbucks. ICE isn't yet disclosing the total investment of the partners—a group that also includes Fortress Investment Group, Eagle Seven, Susquehanna International Group, and others—or the ownership stakes.

The founding imperative for the startup will be to make Bitcoin a sound and secure offering for key constituents that now mostly shun it—the world's big financial institutions. Doing so, believes Sprecher, will clear the way for major money managers to offer Bitcoin in mutual funds and ETFs.

If the Bakkt blueprint works as planned, a panoply of new Bitcoin funds will tap pent-up demand for the cryptocurrency, making it a safe and easy choice for everyday investors—notably millennials getting their first 401(k)s. Wall Street could then tap Bitcoin's popularity to generate giant trading volumes. And that flood of institutional buying and selling, in turn, should take the terror out of Bitcoin by smoothing its wild swings in price. The volatility of the cryptocurrency has both attracted speculators and scared off institutional money. In the fall of 2017, the price of Bitcoin spiked from \$6,400 to nearly \$20,000; it had recently fallen all the way back to around \$6,400.

Getting Bitcoin into 401(k) and IRA products would be a huge win for Bakkt. But the startup's next step could be even bigger: using Bitcoin to replace your credit card for retail transactions, say, with a Bitcoin-linked app. The market opportunity is gigantic: Consumers worldwide are paying lofty credit card or online-shopping fees on \$25 trillion a year in annual purchases.

Sprecher and Loeffler tell *Fortune* that the institutional investor campaign is the first of two phases for Bakkt. They're coy about the second phase. But the presence of Starbucks and Microsoft strongly suggests that Bakkt will strive to change the way consumers pay at the mall and online. The coffee giant is already a leading player in encouraging customers to pay with their smartphones rather than their credit cards. And Microsoft, through its Azure cloud business, serves a huge base of retailers, handling back-office tasks from invoice processing to e-commerce.

If Bakkt's goals appear exceedingly ambitious, keep in mind that Sprecher (pronounced "Sprecker") is a disrupter par excellence. He has been a leading force in modernizing the world's exchanges in recent years from open-outcry pits into superefficient electronic marketplaces. Along the way, Sprecher built a flailing electricity exchange—that he purchased for \$1—into a global trading and data empire now worth \$44 billion. He has richly rewarded shareholders in the process: Since going public in 2006, ICE has delivered annual total returns of 24.1%. "In 25 years he's gone from nothing to the most powerful exchange entrepreneur in the world," says Larry Tabb, chief of consultancy the Tabb Group. "He hasn't failed yet."

Today ICE, based in Atlanta, is the world's second-largest owner of financial exchanges by revenue behind CME Group, and one of the largest purveyors of market data. ICE's 2017 sales of \$4.6 billion divide pretty evenly between those two main franchises. ICE owns 12 exchanges, served by six clearinghouses. The NYSE is by far the world's largest stock market, trading 1.5 billion shares a day—or nearly one in four of all equity transactions. ICE also owns NYSE American (the former American Stock Exchange), the leading platform for midcap companies, as well as NYSE Arca, the world's largest marketplace for ETFs. ICE is the world leader in most categories of futures for "soft" agricultural commodities such as sugar, coffee, and cotton, chiefly through its 2007 acquisition of the New York Board of Trade. And ICE Futures Europe is the dominant marketplace for

Brent crude, the global oil price benchmark.

To build Bakkt, Sprecher is turning to a first-time CEO who is his soulmate in both business and in life: Kelly Loeffler. The ICE executive has ridden shotgun alongside Sprecher since the company's fledgling days in 2002. In 2004, they married. Loeffler (pronounced "Leffler") has long run marketing, investor relations, and communications for ICE. Now she's giving up her ICE roles to run Bakkt.

Sprecher stresses that Loeffler has been a collaborator in charting ICE's next big move. "Kelly and I brainstormed for five years to find a strategy for digital currencies," says Sprecher.

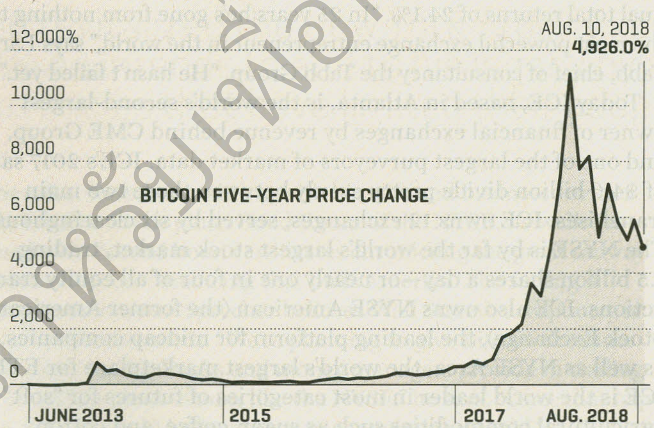
At over six feet in heels, Loeffler, 47, easily stands taller than her 63-year-old husband. But the common bond of this power couple is quickly apparent—both have a passion for ambitious ideas that need lots of tinkering to succeed. "I'm an engineer who likes to fix things that are broken," says Sprecher, who repairs his vintage Porsche race cars on weekends. Adds Loeffler, "Jeff and I get excited about big things that, for most people, seem to have no answer."

If they succeed with Bakkt, it could be the most significant development in the world of cryptocurrencies since a mysterious programmer, or programmers, under the pseudonym Satoshi Nakamoto unveiled Bitcoin in 2009.

SPRECHER'S PLAN FOR BRINGING CRYPTO to the masses runs contrary to what Bitcoin supporters typically champion. The purists favor Bitcoin's "distributed" architecture and adamantly oppose putting an exchange at the center of the system. "A regulated exchange with a custodian in the middle contradicts the basic idea of Bitcoin," says Abhishek Punia, a cryptocurrency analyst with venture capital firm Draper Associates.

BITCOIN'S WILD RIDE

One goal of Bakkt is to reduce the currency's volatility. In the past year, Bitcoin spiked to almost $20,000 before falling back to around $6,400.



SOURCE: BLOOMBERG

"Bitcoin was designed to be decentralized, without intermediaries taking fees. A regulated exchange may be popular for a short period of time, but it's not the future. The future will be the original idea of a peer-to-peer network."

Sprecher and Loeffler disagree, arguing that a strong central infrastructure is precisely what's needed, and that ICE and its partners are the ones to supply it. "Being from the exchange world, we looked at the problem differently," says Loeffler.

Large institutions are ICE's main customers, and Sprecher and Loeffler are confident they understand their thinking about cryptocurrencies. They believe that Bitcoin can thrive as a mainstream investment because the large money managers recognize that tens of millions of their current and future investors want to own it—but only if it can be packaged as mutual funds and ETFs.

To study how digital currencies work, ICE in early 2015 took a minority stake in the largest U.S.-based marketplace for digital currencies, Coinbase. "Coinbase has twice as many customers as Charles Schwab," says Loeffler. "Many of the people who have opened accounts on Coinbase are millennials who use it to make small investments in cryptocurrencies." Those millennials tend to have less trust in traditional financial institutions and more interest in products like Bitcoin.

So far, cryptocurrencies have gained little traction with asset managers. The reason, says Sprecher, is that "Bitcoin does not have a good market structure." For consumers, it's expensive to exchange dollars for Bitcoin, in part because trading is spread thinly across too many venues. He notes that more than 200 marketplaces trade over a dozen major digital currencies, from Ether to Ripple to Litecoin. "Even for Bitcoin, different markets are posting lots of different prices," says Sprecher.

Cryptocurrencies today serve primarily as a vehicle for speculation by traders and by the hedge funds that own 80% of the roughly $300 billion in digital currencies worldwide. (Bitcoin is by far the biggest cryptocurrency for now, with a recent total value of around $134 billion.) In addition, the freewheeling Bitcoin ethos clashes with the cautious, post–financial crisis mindset on Wall Street. "People at the big institutions have the view

▲ GRAPHIC BY NICOLAS RAPP

> Bitcoin can't survive as a rogue idea." It needs "the kind of trust that the Big Board represents."
>
> *—Jeff Sprecher, chairman and CEO of Intercontinental Exchange*

NOT JUST A TOKEN INVESTMENT Starbucks' involvement with Bakkt suggests that the startup will work on ways to use Bitcoin for retail payments.

that cryptocurrencies can be unsavory actors procured by elicit means," says Loeffler.

But Sprecher and Loeffler are confident that the right ecosystem for Bitcoin will unlock a vast new investor universe for the cryptocurrency.

HOW DO YOU PERSUADE the Vanguards and BlackRocks to commit to this vision? For Sprecher and Loeffler, it starts with fundamentals. "Two things are missing," says Sprecher. "Trading on an official exchange, and safe storage for digital currencies on an institutional scale."

The major money managers won't create digital currency funds, argues Sprecher, unless they can first buy the tokens on a federally regulated exchange and, second, store the tokens for their investors in super-secure accounts overseen by federal regulators.

Today, the tokens for cryptocurrencies such as Bitcoin and Ether aren't traded on the leading futures or securities exchanges. The venues where folks exchange dollars or euros for digital currencies—including the biggest ones such as Coinbase and Gemini—are often called "exchanges," but they're actually marketplaces with different types of oversight. These platforms fall under three main regulatory regimes: First, Coinbase and many other marketplaces are licensed in the individual states as "money transmitters." Second, Gemini, the platform founded by Cameron and Tyler Winklevoss, is licensed in its home state of New York as a trust company, and that designation is its passport to operate in a number of other states. The third category consists of marketplaces called Swap Execution Facilities, or SEFs, a structure created by the Dodd-Frank legislation.

To regulate cryptocurrencies, federal authorities first have to figure out how to classify them. The Securities and Exchange Commission (SEC), which oversees stocks and bonds, has said that the two most prominent cryptocurrencies, Bitcoin and Ether, are not securities. Bitcoin, meanwhile, has been deemed to be a commodity. It's the job of the Commodity Futures Trading Commission (CFTC) to regulate all commodity futures and options—a vast portfolio comprising contracts for everything from crude oil to soybeans to gold. As a commodity, Bitcoin futures could trade only on a CFTC-regulated futures exchange, called a Designated Contract Market.

Bitcoin's commodity status opens a rich opportunity for ICE, which operates two of the largest commodities-futures exchanges on the planet—ICE Futures U.S. and ICE Futures Europe. For Sprecher and Loeffler, these venues provide exactly the type of protections needed to, as Loeffler puts it, "get the institutional engine running."

Major exchanges—those regulated by the SEC or CFTC—ensure that clients receive three heavily regulated services: trading, clearing, and either safe storage in the form of custody (for securities), or "warehouses" (for futures). On trades, the exchange guarantees that the posted price the money manager clicks on is what he or she pays for a stock or futures contract. But the exchanges also set exacting rules for clearing and custody or warehousing.

By utilizing a CFTC-regulated futures exchange for Bitcoin, Bakkt would provide two layers of security that money managers regard as essential. The first is the ability to purchase a security or commodity—in this case a digital token—through a regulated broker-dealer or futures commission merchant that's a member of the ICE futures exchange. Only parties fully vetted by the regulated exchanges are allowed to trade as "members" of ICE Futures U.S. That way investors can be sure that, for instance, they're not buying Bitcoin from warlords who hacked into a hedge fund to pilfer the tokens.

The second safety feature is regulated storage for digital currencies. Bakkt's approach will be to furnish supersafe digital lockboxes. "Bakkt's revenue will come from two sources," says Loeffler, "the trading fees on the ICE Futures U.S. exchange, and warehouse fees paid by the customers that buy Bitcoin and store with Bakkt."

To access their Bitcoins, clients will use "private keys"—randomly generated strings of numbers and letters that resemble digital

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signatures. Most Bitcoin owners store their keys on PCs or servers, or in accounts at unregulated marketplaces. But private keys on those devices are vulnerable to hacking. Cyberthieves have stolen more than $1.6 billion in cryptocurrencies since 2011 by hacking investors' accounts, according to Autonomous Research.

Bakkt's solution to that problem is to store the private keys "off-line" in its heavily guarded digital warehouse. When a fund manager or company wants to take Bitcoin out of the warehouse, Bakkt will confirm the client's identity and release the Bitcoin using the private key. The warehouse will also hold a second key, called the public key, that opens the recipient's account to receive the Bitcoins. The double-key security resembles how it takes a bank rep and the customer, both with their own keys, to open a safety-deposit box.

TO TAKE BITCOIN MAINSTREAM, Bakkt must also overcome the cryptocurrency's chief drawback: its slow transaction speed. Bitcoin runs on a system known as blockchain, operated by a network of millions of individual members who compete to package and verify transactions. Essentially, every time a Bitcoin owner on the network buys anything, the transaction is broadcast to all the "nodes," or computers in the network. The nodes battle to prove the transactions are legitimate, and the winner is rewarded with free Bitcoin. Every transaction—from a $1.50 cup of coffee to a $60,000 SUV—must be broadcast to all the nodes. As a result, the existing system can manage only around seven transactions per second. That's much too slow to ever work on the institutional scale that Sprecher and Loeffler envision.

For Bakkt, Sprecher has devised a work-around. Let's say Asset Manager A buys $200 million in Bitcoin from Asset Manager B, and both are inside the Bakkt ecosystem. The Bitcoin tokens simply move from B's account at Bakkt to A's account. The total number of Bitcoins held at Bakkt doesn't change—and thus there's no need to alert the blockchain. Bakkt simply keeps a ledger of those offsetting Bitcoin debits and credits. Only payments coming into or exiting Bakkt's warehouse need to be broadcast.

Hence, so long as Bakkt controls a big share of the market, it would need to report only a tiny sliver of transactions to the blockchain, enabling its system to operate at warp speed. "Our system would operate on a layer above the blockchain, and we'd keep our own omnibus ledger apart from the blockchain," explains Loeffler.

SPRECHER IS A BLEND of engineer and adventurer. He grew up in Madison, the son of a financial planner who sold insurance on the side. "Our mother says that when he was 6 years old, he took apart a toaster and put it back together," says his sister Jill Sprecher. "Then, at 16, he rebuilt a Toyota in the garage and traded it for a 'hugger orange' Camaro."

Sprecher, in fact, longed to be a professional race car driver, attending the famous Road America driving school in Wisconsin. "Mario Andretti said the best drivers aren't the bravest, but the smartest," says Sprecher. "He was wrong. I was smart, but I feared for my life. In tense situations I took my foot off the gas and hit the brake."

GETTING BIG MONEY MANAGERS TO BUY INTO BITCOIN

Bakkt wants institutional investors to introduce Bitcoin mutual funds, ETFs, and other products. That in turn will create the liquidity needed to make Bitcoin a safe, stable currency suitable for use in retail payments. To get there, the startup has a three-step plan:

1 Offer trading for "members only"

Bakkt will launch a new, first-of-its-kind platform on the CFTC-regulated ICE Futures U.S. exchange to trade Bitcoin for dollars, euros, and other fiat currencies. Federal oversight will ensure that trading partners are vetted.

2 Build a digital lockbox

The startup says it'll offer ultrasafe storage for Bitcoin in a secure, CFTC-approved digital "warehouse" that shields the tokens from theft, just as physical warehouses protect cotton or gold sold on ICE futures exchanges. Money managers need to know their assets won't be hacked.

3 Solve for speed

Logging transactions on the blockchain can be slow. To get around that, Bakkt will use its superfast trading system on which institutions exchange Bitcoin for cash on ICE Futures U.S., and the tokens move from the seller's to the buyer's ledger, all inside the Bakkt warehouse. —*S.T.*

He now indulges more in the nitty-gritty than the romance of racing by lying on a mechanic's creeper, wrench in hand, to repair exhaust systems and rocker panels on his collection of a dozen decades-old Porsches that competed at Le Mans.

Following a dozen years building power plants in California, Sprecher in the late 1990s sought a way to sell surplus electricity on a spot market. In those days, almost all electricity trading happened over the phone. Sprecher wanted to get multiple utilities bidding for his power on an electronic marketplace. He could find only one, a platform owned by an Atlanta power company that had signed 63 utilities but was doing minimal business—and losing a million dollars a month. In 1997, Sprecher bought it for that famous $1 sum. Then he set about building what would become ICE.

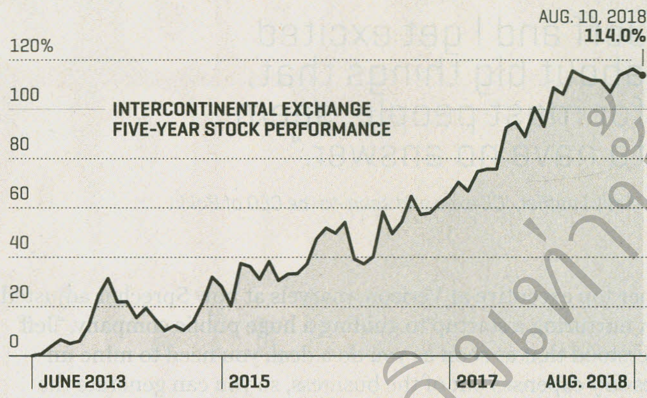
The fledgling exchange stumbled for three years. "We were selling old routing equipment on eBay to raise a few thousand dollars," says Chuck Vice, now ICE's vice chairman in charge of technology.

Sprecher was about to lose his house when a trip to Manhattan in 2001 brought a reversal of fortune. At the time, Enron was pioneering energy trading, but it was the buyer or seller in every transaction. Sprecher offered an alternative—a major marketplace where utilities could trade directly with one another. On that trip to Manhattan, Goldman Sachs and Morgan Stanley told Sprecher they were wary of Enron's dominance and loaned ICE $15 million, saving Sprecher's business and his home. Sprecher then turned around and handed 90% of his equity, basically for free, to 13 banks, energy companies, and utilities in exchange for their commitment to conduct a guaranteed volume of trades on his marketplace. In November of 2001, Enron collapsed. The next month, the volume on Sprecher's exchange soared 180%.

Meanwhile, Loeffler, who grew up on a farm in Illinois, had traded a stint as a retail analyst in Chicago for a private equity position in Texas. Loeffler had spent about a year at the new job when her boss, the current Secretary of the Navy, Richard V. Spencer, announced that he was joining a struggling power exchange in Atlanta. Loeffler had studied the natural-gas market and was convinced the time was ripe for electronic trading. So she

THE ICE-MAN RISETH

At Intercontinental Exchange, CEO Sprecher has built a global market empire while richly rewarding his own shareholders.



SOURCE: BLOOMBERG

told Spencer she wanted to go with him. She joined ICE in 2002 when it still had fewer than 100 employees.

Around that time, Sprecher bought the International Petroleum Exchange in London, an antiquated open-outcry marketplace choked with floor traders shouting orders. The traders fought his campaign to go electronic, so Sprecher closed the exchange in the afternoons. Clients had no choice but to trade on their terminals half the day. All the action shifted to the p.m. hours, and by 2005 the IPE, now ICE Futures Europe, went fully electronic. Two years later, ICE bought the New York Board of Trade and engineered another painful but highly profitable transition to computerized trading.

Then, in 2013, Sprecher made his biggest and most prestigious acquisition to date by purchasing NYSE Euronext for $9.75 billion and in 2015 grabbed Interactive Data Corporation (IDC) in the deal that made ICE a major player in market data. Why does ICE keep making these big deals? "We're like a network that keeps adding hit shows," says Sprecher.

Two distinct qualities distinguish Sprecher's management style: his instinctive, improvisational approach to hiring, and his ability to marry entrepreneurship with financial performance that appeals to shareholders. "I've never regretted hiring anyone when I followed my instincts," he says. "Only when I was swayed by their résumé instead."

In one of his signature stories, Sprecher relates that at a board meeting for his condo association in Atlanta years ago, an argument erupted about a couple whose two dogs were regularly pooping in the elevator, sans cleanup by their owners. "Then this guy gets up and volunteers for what nobody else wanted to do," says Sprecher. "He says, 'I'll take care of the pooping-dogs problem.' I was really impressed that he jumped right in." Sprecher was looking for a can-do manager to run the exchange's help desk. So he hired the guy who tackled the canine problem—Mark Wassersug, who is now ICE's chief operating officer.

Sprecher's results-oriented approach to managing has smoothed his path. Fred Salerno, ICE's lead independent director and a

> Jeff and I get excited about big things that, for most people, seem to have no answer."
>
> *—Kelly Loeffler, ICE exec and soon-to-be CEO of Bakkt*

former top executive at Verizon, marvels at how Sprecher adjusted from nurturing a startup to guiding a huge public company. "Jeff understood that as soon as you do a deal, you need to mine unnecessary expenses out of the business, so you can generate the savings to fund future projects. His culture isn't, 'We'll just promise something in the future.' You need to deliver performance at the same time. Jeff understands that, and most entrepreneurs don't."

Sprecher revitalized the NYSE by deploying just that strategy—sharply paring bloated costs and channeling the savings into rebuilding one of the world's great brands. When ICE bought the NYSE in 2013, Sprecher quickly raised roughly $2 billion by spinning off its European exchanges as Euronext. Even so, the NYSE still had more than 3,000 employees and around 1,000 consultants. Moreover, the NYSE's legendary building was a wreck. The paint in its once-grand baroque Board Room was peeling.

Many Wall Street traditionalists fretted that Sprecher would kill the Big Board's allure by going all-electronic. But he did just the opposite, restoring the landmark at Wall and Broad streets to its former splendor. He found the money by radically improving the NYSE's efficiency. A bunch of brainiacs sequestered on the 21st floor created a single tech platform called Pillar that replaced the crazy quilt of trading systems for the company's different exchanges, a coup that helped lower the headcount to 900.

Sprecher stopped chasing small IPOs and concentrated on bigger fish, since newly listed companies pay fees based on the number of shares outstanding. The NYSE established a streak of winning 38 straight IPOs that raised over $700 million. Surprisingly, for an apostle of electronic trading, Sprecher recognized that the specialist traders who brought so much color to the Big Board's floor were crucial to the brand. "Electronic trading went too far," he says. "The specialists perform a service by smoothing out the spikes and valleys in prices by using their own capital."

But it's also clear that the folks in the blue smocks are a visual symbol of the U.S. capital markets. "There are 250 places to trade equities," says Sprecher. "Of those, 249 are the same. Which one would you want to own? That's why we want the NYSE to be one of a kind."

To restore its fading mystique, Sprecher moved employees to cubicles on the upper floors and installed a spectacular staircase composed of backlit marble slabs to join the sixth and seventh floors. Those refurbished floors now house three giant reception halls and 15 smaller conference rooms. "The idea was to turn the NYSE into a clubhouse for the *Fortune* 500," says Sprecher. It's happened. On one two-day stretch in early June, for example, no fewer than 10 companies held events at the NYSE.

THE RETAIL PAYMENTS INDUSTRY appears ripe for Sprecher-style disruption. Today, Americans charge $8 trillion in goods and services every year—more than 40% of GDP—on credit and debit cards and through digital portals such as PayPal. The stores and restaurants that accept those cards typically pay 2% to 3% to around six intermediaries—a group that includes "merchant acquirers" who sign up the merchants, credit card giants such as Visa and Mastercard, and the banks that issue the cards.

It's hard to overstate how drastically a shift to Bitcoin could crunch those lofty fees. Consumers could pay for groceries or detergent directly from the Bitcoin wallets on their iPhones or PCs, using a scanner at Walmart or Starbucks, with no banks taking fees in the middle. If Bitcoin became the chief currency for retail, credit cards could conceivably disappear.

Does that mean that ICE and Bakkt would be antagonizing ICE's main customers, the major banks? Not necessarily. Where banks make big money is on the interest charged on balances on credit cards, not transaction fees. And changing the purchasing system wouldn't alter the amounts that folks borrow, just where they hold those balances.

According to payment industry experts, the banks might cooperate with Bakkt because the new system could actually encourage different forms of borrowing. For example, a customer whose Bitcoin purchase is declined because of a low balance could get an immediate loan from his or her bank, right at the checkout counter, to cover the shortfall.

But that's looking down the road. First, Sprecher and Loeffler have to convince traders that Bakkt is the future of Bitcoin. In the NYSE's Bond Room, Sprecher again makes the case that the cryptocurrency needs Wall Street, and his new exchange, to succeed. "Bitcoin can't survive as a rogue idea," he says. To be fully embraced, Bitcoin must have "the kind of trust that the Big Board represents." If Sprecher can use Bakkt to get Bitcoin to the next level, it might be his most impressive fix-it job yet. ■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100 FASTEST-GROWING COMPANIES

GROWTH IS A JOURNEY, not a destination. In that sense, *Fortune*'s annual list of the world's Fastest-Growing Companies—which ranks the top performers in revenues, profits, and stock returns over the past three years (the methodology is explained on page 59)—is merely a way station. But it offers a good vantage point from which to examine the trends driving the global economy, such as the continued ascendance of the technology sector. Almost one-third (32) of this year's 100 entrants are tech companies. The roster includes Silicon Valley giants like Facebook (see Briefing for more on the social network's future growth prospects) as well as smaller players such as new entrant Control4, which makes smart-home automation systems. For more surprises, explore the full list on the pages that follow and on Fortune.com. —*Brian O'Keefe*

LIST BY **SCOTT DECARLO, DOUGLAS G. ELAM,** AND **KATHLEEN SMYTH**

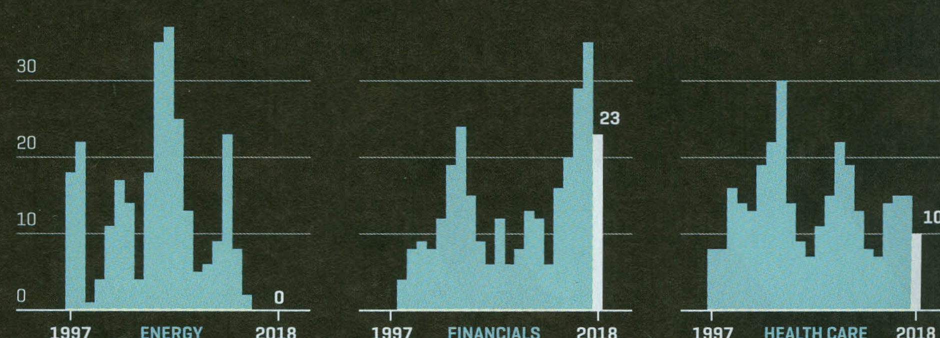
RANK 2018	RANK 2017	For an explanation of Fortune's methodology, go to the end of the list.	EARNINGS PER SHARE: THREE-YEAR ANNUAL GROWTH RATE (%)	EARNINGS PER SHARE: RANK	NET INCOME: PAST FOUR QUARTERS† ($ MILLIONS)	REVENUE: THREE-YEAR ANNUAL GROWTH RATE (%)	REVENUE: RANK	REVENUE: PAST FOUR QUARTERS† ($ MILLIONS)	TOTAL RETURN: THREE-YEAR ANNUAL RATE* (%)	TOTAL RETURN: RANK	P/E, CURRENT FISCAL YEAR PROFITS (EST.)
1		**HEALTH INSURANCE INNOVATIONS** *Tampa*	253	2	16	46	15	262	87	2	15
2		**STAMPS.COM** *El Segundo, Calif.*	132	7	165	50	8	497	51	9	31
3		**SUPERNUS PHARMACEUTICALS** *Rockville, Md.*	154	5	73	46	19	335	52	8	29
4		**APPLIED OPTOELECTRONICS** *Sugar Land, Texas*	155	4	56	43	22	351	37	26	23
5	2	**PAYCOM SOFTWARE** *Oklahoma City*	97	13	82	42	24	467	43	17	59
6	6	**FACEBOOK**[2] *Menlo Park, Calif.*	91	15	17,858	50	9	44,587	31	34	24
7	36	**NVIDIA** *Santa Clara, Calif.*	80	21	3,784	32	36	10,984	129	1	36
8	10	**ARISTA NETWORKS** *Santa Clara, Calif.*	64	25	485	40	26	1,783	47	11	43
9	9	**AMAZON.COM** *Seattle*	107	11	3,938	27	55	193,194	58	7	143
10		**LGI HOMES** *The Woodlands, Texas*	50	38	129	44	21	1,374	43	15	8
11		**ULTRA CLEAN HOLDINGS** *Hayward, Calif.*	141	6	85	26	56	1,035	39	22	7
12		**INOGEN** *Goleta, Calif.*	52	33	26	29	46	276	61	5	113
13	24	**GRUBHUB** *Chicago*	44	48	112	38	29	760	45	13	95
14		**COHERENT** *Santa Clara, Calif.*	53	32	242	36	32	1,913	35	29	13
15	23	**TAL EDUCATION GROUP**[1] *Beijing*	25	88	198	58	5	1,715	84	3	67
16		**EAGLE PHARMACEUTICALS** *Woodcliff Lake, N.J.*	392	1	32	109	1	207	**–2**	97	32
17	89	**MKS INSTRUMENTS** *Andover, Mass.*	42	54	379	41	25	2,033	38	23	12
18	18	**VEEVA SYSTEMS** *Pleasanton, Calif.*	49	42	149	30	41	721	40	19	77
19		**NETFLIX** *Los Gatos, Calif.*	42	52	671	30	45	12,757	61	6	132
20		**BROADCOM** *San Jose*	49	43	10,961	57	6	19,648	24	55	13
21		**ADOBE SYSTEMS** *San Jose*	85	18	1,879	22	73	7,699	44	14	45
22		**BUILDERS FIRSTSOURCE** *Dallas*	83	20	58	68	2	7,202	13	84	9
23	13	**NV5 GLOBAL** *Hollywood, Fla.*	28	81	26	46	18	364	42	18	24
24	64	**META FINANCIAL GROUP** *Sioux Falls, S.D.*	32	72	48	46	16	309	32	31	14
25	33	**CONSOLIDATED-TOMOKA LAND** *Daytona Beach, Fla.*	113	9	40	45	20	78	**2**	92	8

[1] Incorporated in the Cayman Islands. [2] Incorporated in the United States. † As of April 30, 2018.

TECHNOLOGY MOUNTS A COMEBACK

After a two-year reign, the financial sector lost its title as the best-represented industry on the list. Rising to take the crown is tech, which placed more names in the top 100 than it had since the dotcom-bubble days.

NUMBER OF COMPANIES IN EACH SECTOR >



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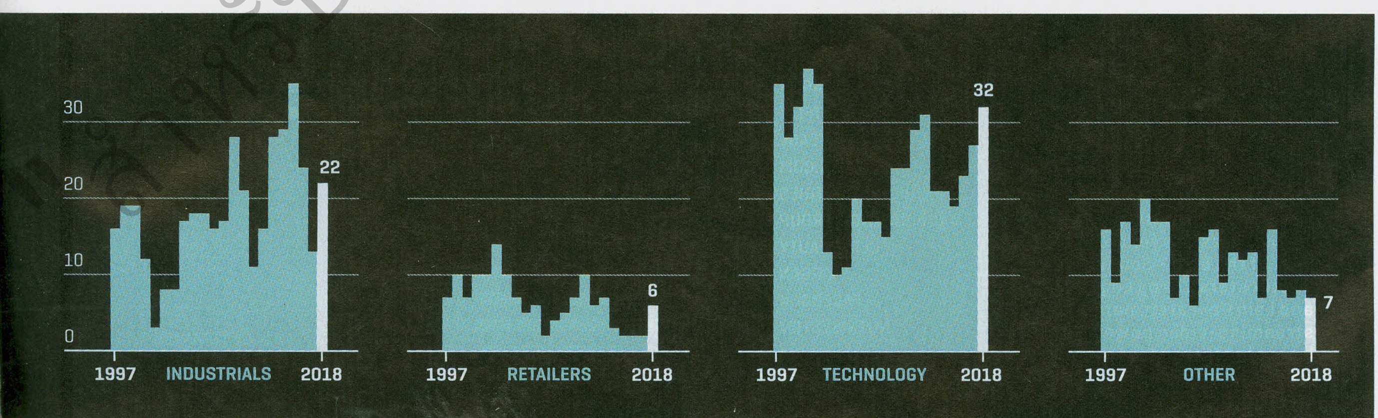
26		**SEACOAST BANKING CORP. OF FLORIDA** *Stuart, Fla.*	57	29	53	30	42	267	26	51	18
27		**MERCURY SYSTEMS** *Andover, Mass.*	39	59	40	30	44	456	38	24	23
28		**MOLSON COORS BREWING** *Denver*	70	23	1,484	47	12	10,886	**1**	94	13
29		**LOGMEIN** *Boston*	38	61	148	64	3	1,082	18	68	19
30	40	**PATRICK INDUSTRIES** *Elkhart, Ind.*	38	60	98	31	39	1,842	31	36	13
31	35	**TUCOWS** [2] *Toronto*	41	56	24	30	43	356	30	39	29
32	22	**HOOKER FURNITURE** *Martinsville, Va.*	32	71	31	46	14	633	25	54	13
33		**APPLIED MATERIALS** *Santa Clara, Calif.*	52	34	3,171	21	80	16,484	36	27	11
34	7	**NETEASE** [1] *Beijing*	30	78	1,139	58	4	8,257	22	60	38
35		**TTM TECHNOLOGIES** *Costa Mesa, Calif.*	66	24	101	25	61	2,697	21	61	16
36	32	**NEXSTAR MEDIA GROUP** *Irving, Texas*	41	55	517	53	7	2,507	**12**	85	9
37	21	**PACIFIC PREMIER BANCORP** *Irvine, Calif.*	22	95	79	46	17	350	31	35	15
38		**SS&C TECHNOLOGIES HOLDINGS** *Windsor, Conn.*	43	50	332	33	35	1,690	19	63	25
39		**DAQO NEW ENERGY** [1] *Wanzhou, China*	94	14	102	26	58	372	15	78	8
40	91	**ALIGN TECHNOLOGY** *San Jose*	24	90	258	26	57	1,600	76	4	72
41		**NEWELL BRANDS** *Hoboken, N.J.*	47	44	2,164	49	10	14,493	**-13**	99	10
42	17	**WALKER & DUNLOP** *Bethesda, Md.*	49	41	205	23	70	701	28	43	11
43		**NOVA MEASURING INSTRUMENTS** *Ness-Ziona, Israel*	42	53	47	25	63	230	30	38	16
44	84	**LAM RESEARCH** *Fremont, Calif.*	40	57	1,886	25	62	10,296	30	37	11
45	53	**AUTOHOME** [1] *Beijing*	30	79	326	39	28	929	26	49	27
46		**FANHUA** [1] *Guangzhou, China*	28	82	77	25	64	548	50	10	22
47		**AXCELIS TECHNOLOGIES** *Beverly, Mass.*	160	3	131	20	88	446	19	65	16
48		**CONTROL4** *Salt Lake City*	46	45	16	20	91	254	40	20	30
49	27	**CENTENE** *St. Louis*	32	69	1,029	47	13	49,852	15	75	19
50		**INSTALLED BUILDING PRODUCTS** *Columbus, Ohio*	27	85	41	30	40	1,179	32	32	18

* Through June 29, 2018. The S&P 500 returned 11.9% annually over the same period. **(Company returns lower than that of the S&P are bolded.)**



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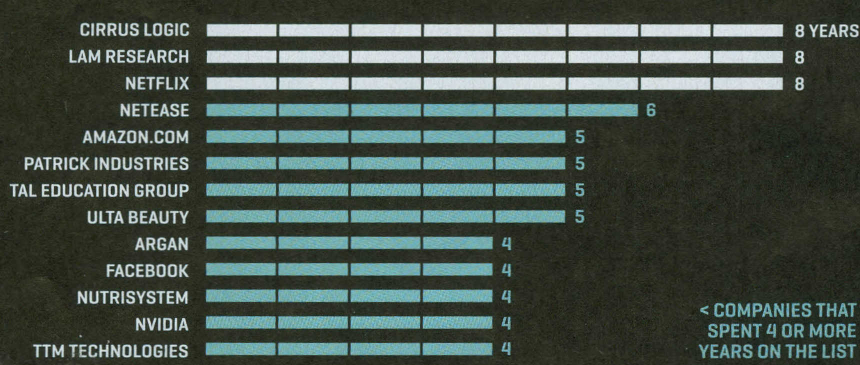
51		**DOLLAR TREE** *Chesapeake, Va.*	52	35	1,674	36	30	22,512	**2**	93	16
52		**COSTAR GROUP** *Washington, D.C.*	91	16	153	18	96	1,012	27	47	60
53		**CHEETAH MOBILE**[1] *Beijing*	105	12	201	29	49	745	**-31**	100	18
54	98	**THOR INDUSTRIES** *Elkhart, Ind.*	35	65	461	31	38	8,389	22	59	11
55		**INTEGRA LIFESCIENCES HOLDINGS** *Plainsboro, N.J.*	78	22	69	16	99	1,287	28	42	26
56	30	**ESSENT GROUP** *Hamilton, Bermuda*	49	40	424	32	37	616	**9**	87	9
57	8	**ELLIE MAE** *Pleasanton, Calif.*	42	51	45	35	34	442	14	79	116
58	11	**AMN HEALTHCARE SERVICES** *San Diego*	49	39	143	23	69	2,016	23	57	19
59		**BGC PARTNERS** *New York City*	108	10	73	21	84	3,527	16	73	8
60		**UNIVERSAL DISPLAY** *Ewing, N.J.*	85	19	99	21	82	324	19	66	55
61	26	**CENTURY COMMUNITIES** *Greenwood Village, Colo.*	26	87	61	47	11	1,597	16	71	7
62		**FORTINET** *Sunnyvale, Calif.*	60	27	62	25	65	1,553	15	77	75
63		**ON SEMICONDUCTOR** *Phoenix*	55	30	872	20	85	5,484	24	56	13
64		**FARMERS NATIONAL BANC CORP.** *Canfield, Ohio*	33	66	25	25	60	107	27	48	14
65	41	**BSB BANCORP** *Belmont, Mass.*	51	37	17	24	67	86	16	72	15^
66	66	**YY**[1] *Guangzhou, China*	32	70	436	39	27	1,901	13	81	13
67		**FIVE BELOW** *Philadelphia*	29	80	116	23	71	1,342	35	28	39
68		**EVERCORE** *New York City*	38	62	140	21	76	1,800	28	45	15
69		**FORTUNA SILVER MINES** *Vancouver*	61	26	67	21	83	274	16	74	21
70		**FABRINET** *George Town, Cayman Islands*	27	86	89	29	47	1,397	25	52	11
71		**TOWER SEMICONDUCTOR** *Migdal Haemek, Israel*	123	8	279	18	94	1,370	13	83	11
72		**B&G FOODS** *Parsippany, N.J.*	46	46	205	28	52	1,687	**7**	88	15
73		**MARINE PRODUCTS** *Atlanta*	30	76	22	16	98	274	46	12	24
74		**REPLIGEN** *Waltham, Mass.*	44	47	29	29	50	155	**4**	89	67
75	71	**ARGAN** *Rockville, Md.*	33	67	56	36	31	804	**3**	91	26

[1] Incorporated In the Cayman Islands. [2] Changed name from Bank of the Ozarks, July 16, 2018. † As of April 30, 2018.

GROWING FAST, YEAR AFTER YEAR

A lot of companies can catch a one-time hot streak. But sustaining growth to make our list consistently is a truly impressive feat. The best of the best? Semiconductor stars Cirrus Logic and Lam Research matched streaming-video powerhouse Netflix with an eighth appearance this year.



< COMPANIES THAT SPENT 4 OR MORE YEARS ON THE LIST

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76		**FOX FACTORY HOLDING** *Scotts Valley, Calif.*	31	73	54	16	100	499	43	16	27
77		**MALIBU BOATS** *Loudon, Tenn.*	39	58	25	20	90	433	28	44	13
78	38	**CIRRUS LOGIC** *Austin*	58	28	162	22	75	1,532	**4**	90	16
79		**TOTAL SYSTEM SERVICES** *Columbus, Ga.*	15	100	622	29	48	4,730	27	46	22
80	51	**MEDIDATA SOLUTIONS** *New York City*	88	17	45	18	97	567	14	80	93
81	50	**REGENERON PHARMACEUTICALS** *Tarrytown, N.Y.*	54	31	1,428	25	66	6,065	**-12**	98	21
82		**IPG PHOTONICS** *Oxford, Mass.*	19	98	379	22	74	1,483	37	25	28
83	88	**PREFERRED BANK** *Los Angeles*	21	97	50	26	59	172	29	41	14
84		**MONOLITHIC POWER SYSTEMS** *San Jose*	27	84	73	18	95	500	40	21	54
85	70	**BANK OZK**[2] *Little Rock*	28	83	446	42	23	1,100	**1**	95	11
86		**SHENANDOAH TELECOMMUNICATIONS** *Edinburg, Va.*	16	99	69	29	51	610	25	53	79
87	93	**SERVISFIRST BANCSHARES** *Birmingham, Ala.*	21	96	103	21	77	297	31	33	17
88		**FIRST INTERNET BANCORP** *Fishers, Ind.*	23	92	18	35	33	104	13	82	12
89		**JOHN BEAN TECHNOLOGIES** *Chicago*	25	89	64	20	89	1,700	34	30	29
90	77	**WESTERN ALLIANCE BANCORPORATION** *Phoenix*	23	91	353	28	54	934	19	64	14
91		**INTERACTIVE BROKERS GROUP** *Greenwich, Conn.*	43	49	98	19	92	2,139	17	70	27
92	82	**TYLER TECHNOLOGIES** *Plano, Texas*	36	64	169	20	86	862	20	62	61
93	96	**GRAY TELEVISION** *Atlanta*	51	36	271	21	81	906	**0**	96	8
94	46	**AMERIS BANCORP** *Moultrie, Ga.*	22	94	79	21	79	412	29	40	14
95	44	**LEGACYTEXAS FINANCIAL GROUP** *Plano, Texas*	30	75	97	28	53	419	**11**	86	16
96	73	**LCI INDUSTRIES** *Elkhart, Ind.*	32	68	137	21	78	2,300	18	69	12
97	37	**NUTRISYSTEM** *Fort Washington, Pa.*	38	63	53	20	87	695	18	67	19
98		**VSE** *Alexandria, Va.*	23	93	39	24	68	740	22	58	17^
99	90	**TRISTATE CAPITAL HOLDINGS** *Pittsburgh*	30	77	41	19	93	194	26	50	17
100	56	**ULTA BEAUTY** *Bolingbrook, Ill.*	31	74	591	22	72	6,113	15	76	23

* Through June 29, 2018. The S&P 500 returned 11.9% annually over the same period. **(Company returns lower than that of the S&P are bolded.)**
^ P/E estimates for the current fiscal year are not available. The figure shown is the trailing 12-month P/E ratio.

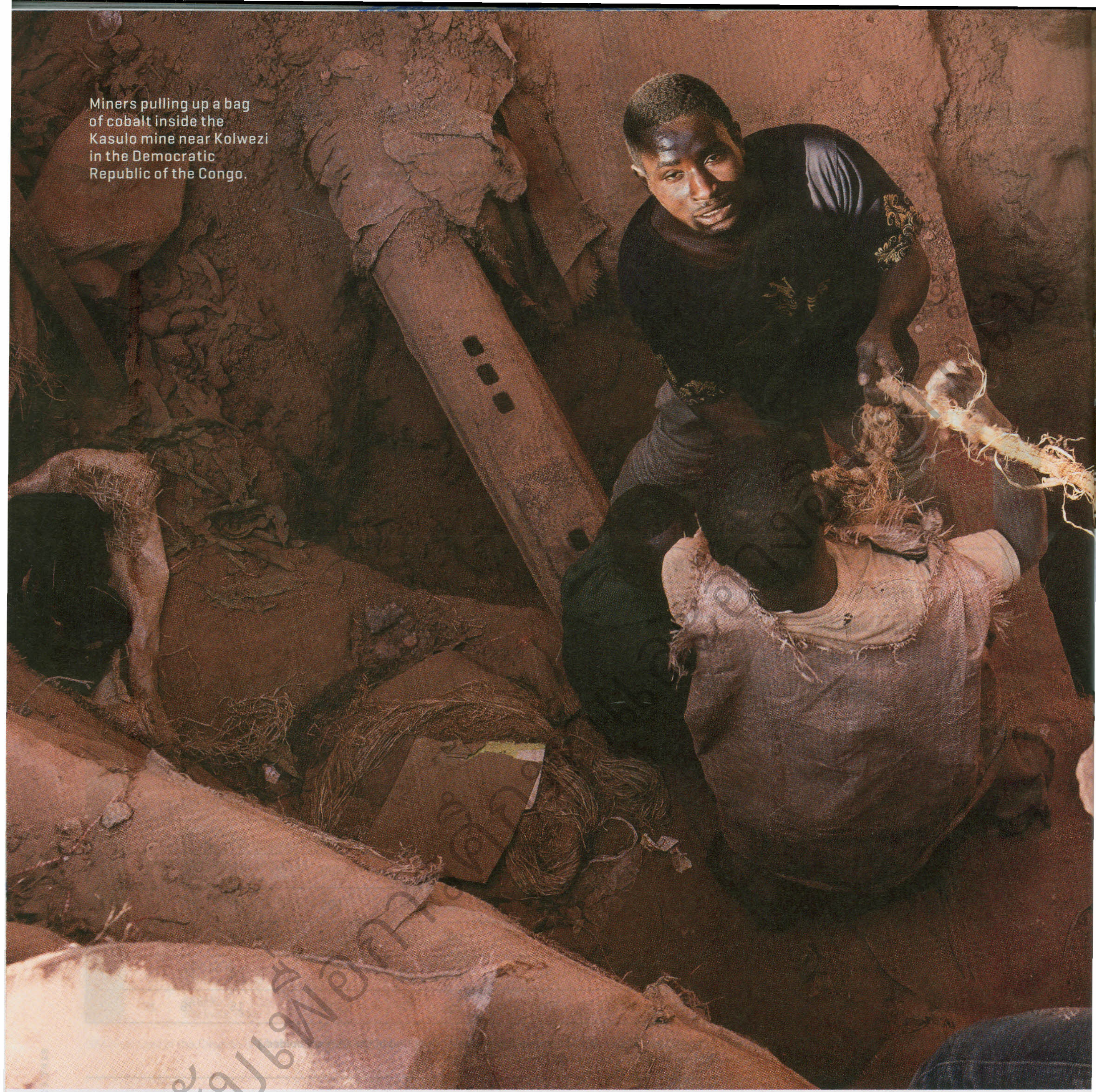
2018 FASTEST-GROWING METHODOLOGY

To qualify, a company—domestic or foreign—must be trading on a major U.S. stock exchange, report data in U.S. dollars, file quarterly reports with the SEC, have a minimum market capitalization of $250 million and a stock price of at least $5 on June 29, 2018, and have been trading continuously since June 30, 2015. Companies must have revenue and net income for the four quarters ended on or before April 30, 2018, of at least $50 million and $10 million, respectively, and have posted an annualized growth in revenue and earnings per share of at least 15% annually over the three years ended on or before April 30, 2018.

Companies that meet these criteria are ranked by revenue growth rate, EPS growth rate, and three-year annualized total return for the period ended June 29, 2018. (To compute the revenue and EPS growth rates, Fortune uses a trailing-four-quarters log linear least square regression fit.)

The overall rank is based on the sum of the three ranks. Once the 100 companies are identified, they are then reranked within the 100, using the three equally weighted variables. If there is a tie, the company with the larger four-quarter revenue receives the higher rank.

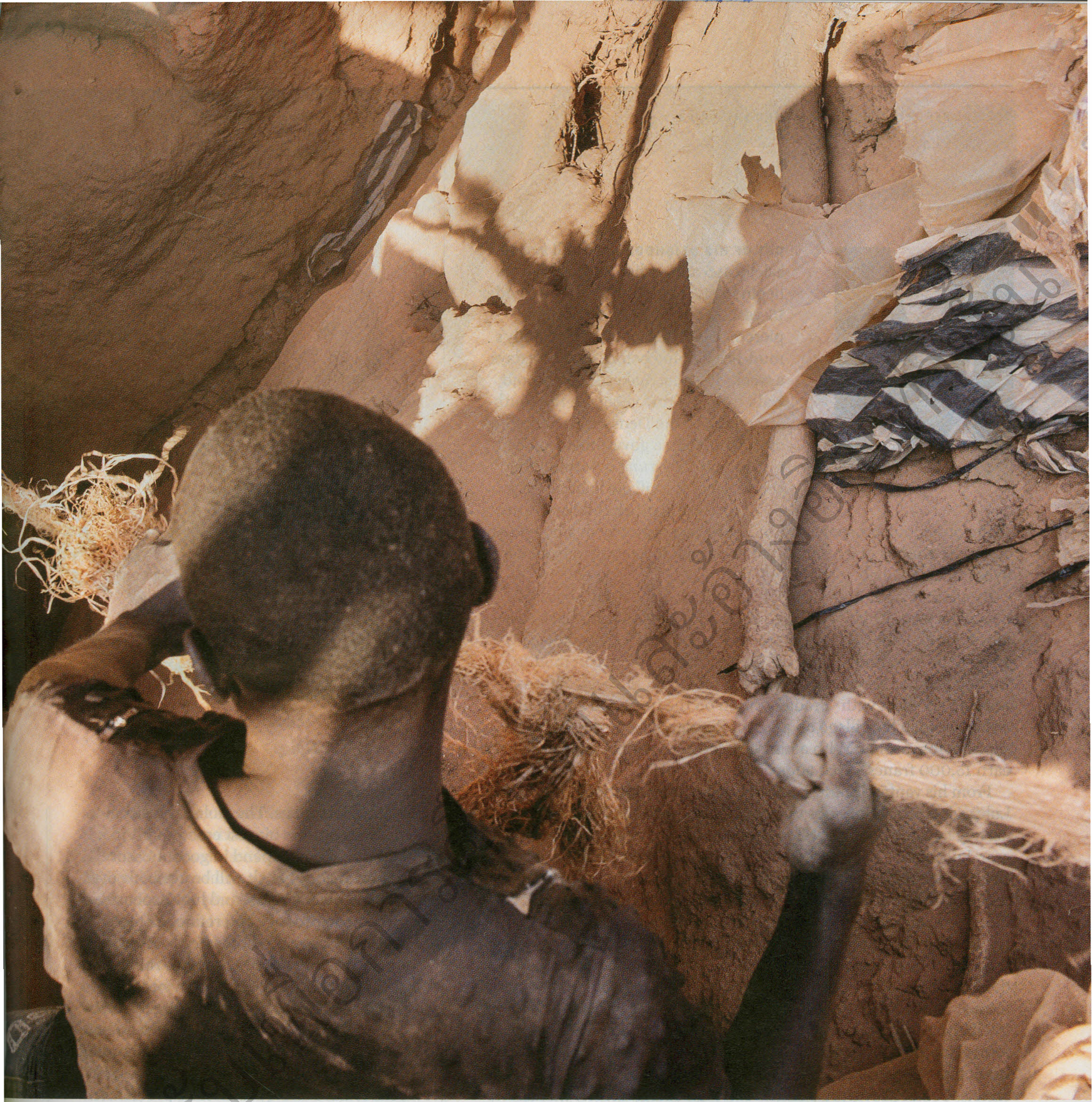
Excluded are real estate investment trusts, limited-liability companies, limited partnerships, business development companies, closed-end investment firms, and companies that lost money in the quarter ended on or before April 30, 2018. In addition, Fortune excludes companies that have announced intentions to restate previously reported financial data, if these errors appear to have a significant impact. Also, Fortune excludes companies that lost money in the quarter ended May 31 or June 30, if the loss represents a deterioration in business conditions. The data are provided by Zacks Investment Research. The data checking process was aided by information provided by S&P Global Market Intelligence.



Miners pulling up a bag of cobalt inside the Kasulo mine near Kolwezi in the Democratic Republic of the Congo.

SPECIAL REPORT

BLOOD, SWEAT, AND



BATTERIES

TWO-THIRDS OF THE WORLD'S COBALT, AN ESSENTIAL INGREDIENT IN OUR SMARTPHONES AND ELECTRIC CARS, COMES FROM ONE OF THE PLANET'S POOREST COUNTRIES. ALL TOO OFTEN IT IS MINED BY CHILDREN.

BY **VIVIENNE WALT**

PHOTOGRAPHS BY **SEBASTIAN MEYER**

MOST OF HIS NEIGHBORS are still sound asleep at 5 a.m., when Lukasa rises to begin his 12-hour workday. The slender 15-year-old, with an oval face and piercing stare, slips out of his family's mud-brick home before dawn six days a week. Then he makes the two-hour walk from his tiny village in the southern region of the Democratic Republic of the Congo to a government-owned mining site. (*Fortune* is withholding the name of the village in order to protect Lukasa and other children.) Once at the mine, Lukasa spends eight hours hacking away in a hole to accumulate chunks of a mineral that is crucial to keeping our modern lives moving: cobalt.

By about 3 p.m., Lukasa has filled a sack with his day's haul. He hoists the load, which can weigh up to 22 pounds, on his back and lugs it for an hour by foot to a trading depot. "I sell it to Chinese people," he says, referring to the buyers from Chinese commodity trading companies who dominate the market in the area. Lukasa is wearing a T-shirt with "Prada" written on the front and sitting under a shade tree in his village on a recent Sunday, his one day off, as he explains his routine. With a hint of pride he says, "On good days I can earn 15,000 francs." That adds up to about $9.

From his vantage point in one of the poorest countries in the world, Lukasa has little awareness that a multibillion-dollar scramble is underway for the grayish metal he digs out of the ground some 300 days a year. Lukasa has, he says, recently begun to grasp that his cobalt mining earnings are a pittance compared with the sums that traders make selling it on the world market. But that business is hard to fathom for those living near Kolwezi, the hardscrabble center of the cobalt industry in Congo. It's more difficult still for diggers living in poverty, like Lukasa, to understand a surge in demand for the mineral that has sent the price of cobalt on commodities markets rocketing up some 400%, from about $10 a pound in 2016 to a peak of about $44 in April.

That soaring appetite for cobalt is a product of today's device-driven tech economy: The metal is a key component in the lithium-ion batteries that power countless millions of smartphones, computers, and tablets. Cobalt provides a stability and high energy density that allows batteries to operate safely and for longer periods. Without it, our digital lives—at least for the moment—would be unable to function as they do.

And yet, as valuable as cobalt is today, its crucial role is only now coming into focus. The global transition to renewables—the biggest energy shift in a century—could depend in good measure on how readily cobalt will be available over the next several years, and how expensive it will be to produce and refine. As many governments around the world—if not the one in Washington, D.C.—begin rolling out their climate-change targets to curb carbon emissions, so automakers are hugely ramping up production of electric vehicles. General Motors, for example, says it is planning for an all-electric future. And Volkswagen aims to have one-quarter of its production devoted to electric vehicles by 2025.

Absent a breakthrough invention in battery technology, each electric-vehicle battery will need about 18 pounds of cobalt—over 1,000 times as much as the quarter-ounce of cobalt in a smartphone. Volkswagen, for example, expects it will need to build six giant battery factories within a decade simply to supply its electric-car plants.

That means the spike in cobalt may have only just begun. Demand for cobalt for lithium-ion batteries alone could triple by 2025, and then double again, reaching about 357,000 tons a year by 2030—nearly

This story was produced with support from the Pulitzer Center on Crisis Reporting.

Left: A miner holds chunks of cobalt he has dug out at the Kasulo mine near Kolwezi in the DRC. Right: An 11-year-old mine worker named Daniel carries a bag of cobalt from a dig site to a depot to be sold.

seven times the current level, according to the London-based cobalt-trading company Darton Commodities. On the ground in Congo, the pressure to produce cobalt has reached a fever pitch. "If you want to be king of the world in the next 10 years, you have to have cobalt," says Jean-Luc Kahamba Kukenge, deputy general manager of the Congolese mine Commus Global, which is owned by the China's Zijin Mining Group, when I meet him in Kolwezi. "In the next 10 years, it will be everything."

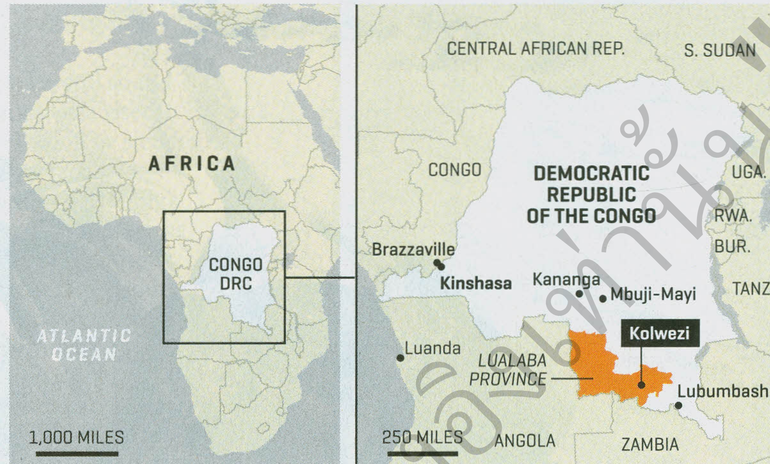
The reliance on a single raw material is nothing new, of course: The auto industry owes its very existence to pumping crude oil out of the earth. But there is a key difference between the car revolution that began a century ago and the electric-vehicle revolution that is just beginning. Oil reserves are tapped in dozens of countries and under every ocean. By contrast, cobalt has until now been heavily concentrated in one sliver of territory. Worse still, that territory is within a country beset by conflict, corruption, poverty, and dysfunction: the Democratic Republic of the Congo, or DRC, as the former Belgian colony is known. That reality poses urgent ethical conundrums for the technology, automotive, and mining companies that need cobalt—problems that, if not resolved, could threaten the very ability of those companies to win over millions of consumers to cleaner energy.

ROUGHLY TWO-THIRDS of the world's cobalt is produced in the DRC's southeastern province of Lualaba, near the border with Zambia. The region sits atop a dizzyingly rich mineral vein known as the Copperbelt—and cobalt is mostly a by-product of copper and nickel extraction. Mining accounts for about 80% of the DRC's earnings. Stretching across Africa's broad midsection, the DRC has for decades epitomized the term "resource curse." Despite giant riches of tin, gold, nickel, copper, and now cobalt, the average person there earns just $700 a year.

Life is grindingly difficult for the millions of Congolese who have no running water or electricity at home; the average life expectancy is about 60. The DRC ranked near the bottom on the UN's Human Development Index in 2015, at 176th out of 188 countries. And it fares little better on the anti-corruption index of the NGO Transparency International, which cites rampant patronage among a small elite, headed by President Joseph Kabila, who has held power for nearly 18 years. Kabila has picked a close ally to succeed him, in December

PLAGUED BY POVERTY BUT RICH IN RESOURCES

The Democratic Republic of the Congo is one of the world's poorest nations despite its mining wealth. Two-thirds of global cobalt supply comes from the DRC's Lualaba province, which sits astride a mineral vein called the Copperbelt.



elections, which could spark violence.

When our small plane bumps to a halt one wintry afternoon in mid-July on the airstrip in Kolwezi, the small provincial capital of Lualaba, there is nothing to suggest we have landed in the epicenter of the world's cobalt wealth. A small cinder-block structure serves as the "Aéroport National de Kolwezi," as the hand-painted sign names it.

In 2016, I had landed in the same spot, on assignment for *Fortune*, traveling in an eight-seater aircraft leased by the Switzerland-based commodities giant Glencore. On that trip, the company's representatives whisked me off to the bright-lit, air-conditioned complex of Mutanda Mining, the world's biggest cobalt production facility, with state-of-the-art technology and a meticulous corporate management system that felt like an alien planet amid the chaotic galaxy beyond the gates. Mutanda's CEO Pedro Quinteros, a seasoned Peruvian engineer, told me then that the mineral concentration in Congo's Copperbelt was so high that he had "never seen anything like it in my career."

Now I was back to see the other side of the story. Glencore still mines and exports more cobalt than any company in the world, and it says it is planning to double its production over the next two years in expectation of a looming global shortfall in supply.

That industrial-scale output dwarfs the production of the more than 100,000 so-called artisanal cobalt miners around Kolwezi—traditional, independent diggers who have converged on the area to search for cobalt, often with primitive tools. The diggers include an unknown number of children like 15-year-old Lukasa, who support their families by digging small quantities of cobalt by hand, then selling them to middlemen, virtually all Chinese; children in a small village near Kolwezi greet us in Chinese with *"Ni hao!"* since the only non-Africans most have ever seen are from China.

While it is impossible to know how many underage miners there are, Congolese activists working to end child labor say poverty has driven up the numbers. "Because of the economic crisis, there are about 10,000 of them," says Hélène Kayekeza Mutshaka, who coordinates a monitoring program in Kolwezi that the government began last year, to try to stop children from mining cobalt. Mutshaka says she faces strong resistance from poor families, who have long sent their children to dig for minerals in order to supplement their meager earnings. "They believe they can try to make it into the middle class if they work as artisanal miners," Mutshaka says.

Around Kolwezi, that seems an almost impossible dream.

One morning in July, on the edge of an artisanal mine called Kingiamiyambo, about eight miles outside of Kolwezi, we meet 11-year-old Daniel, a small boy walking up the hill from the digging site, caked in dust and carrying a load of cobalt on his back, on his way to sell it to Chinese traders; he tells us he has never attended school. Children like Daniel toil at the very bottom of the global cobalt market. For their families, many of whom depend on the tiny sums their children bring home, there seems little hope of actual life improvement. Yet asking them to stop mining seems equally difficult, so long as cobalt appears a ready source of income. "What do they do then, these children you keep at home, without work?" asks Jean Pierre Muteba, a veteran copper miner who heads an organization in southern DRC called New Dynamics, which monitors the mining sector. "They will seek survival. And what is survival here?" he says. "It is obvious: a mine next door."

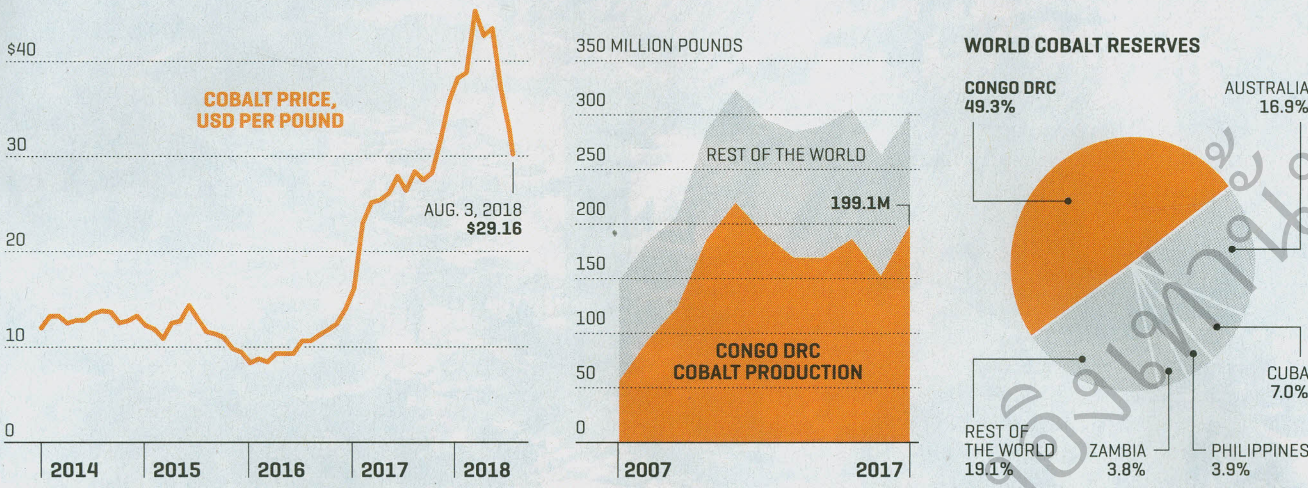
Despite the grueling conditions, the temptation for children to keep working is strong. Many earn just $2 per day, often acting as human mules for cobalt diggers. "When kids are not in school, they all go work in the mines," says Franck Mande, who oversees a project funded by Apple that aims to teach child miners new skills. "They work from 14, 15, 16 years—even from 10 years old," Mande says.

Congolese authorities say that they are trying hard to stop children from mining cobalt, but that it is almost impossible to end child labor completely. And they point out that artisanal miners—the vast majority of them adults—account for just 20% of the country's cobalt output.

But for companies sourcing cobalt from the DRC, the existence of artisanal miners

FEEDING A GLOBAL HUNGER FOR BATTERIES

Cobalt is a key component in lithium-ion batteries, helping to provide high energy density and stability. Soaring demand for smartphones, tablets, and now electric vehicles has caused the price of cobalt to spike. The DRC remains the biggest source of the mineral. But concerns about the country's labor conditions are pushing companies to explore elsewhere for the commodity.



SOURCES: BLOOMBERG; BP

creates another headache: It is virtually impossible to assure consumers of iPads, smartphones, or electric vehicles that no children have dug, crushed, washed, or transported the cobalt inside their devices. For some companies, it has seemed simpler, in fact, to end all business with artisanal miners—a decision that NGOs and Congolese officials say devastates millions of people who depend on the work.

CORPORATE CONCERNS have risen sharply since 2016, when Amnesty International issued a deeply researched report naming more than two dozen electronics and automotive companies that, Amnesty concluded, had failed to do enough due diligence to ensure that their supply chains didn't include cobalt produced with child labor at artisanal mines. The report caused a firestorm—and set some companies scrambling to find ways to avoid the DRC altogether. As the debate over Congo's cobalt rages on, the question is whether the country can overhaul its mining practices before global businesses succeed in going elsewhere. In a country where dysfunction and corruption have endured for decades, the prospect for far-reaching, rapid change seems hard to imagine.

Congolese officials are not the only ones at fault, however. Amnesty blasted Western tech giants for blithely ignoring the problems surrounding child labor and corruption—in large part because consumers had rushed to buy tech devices, without asking questions about the industry's darker side. "Millions of people enjoy the benefits of new technologies, but rarely ask how they are made," the organization said at the time.

But that is finally changing. The shift has come after recent TV reports have depicted child miners like Daniel and Lukasa, digging for cobalt under tough conditions. "We have reached a tipping point where it's become more expensive not to abide by good standards," says Tyler Gillard, senior legal adviser to the Organization for Economic Cooperation and Development, or OECD, in Paris, who helped draft due-diligence guidelines for corporations on mineral supply chains. "Companies see this as a major threat to brand value," he says. "Are consumers going to demand child-labor-free, corruption-free electric vehicles? I think it is coming."

The prospect that bad publicity about child labor could provoke growing consumer anger toward the Congolese cobalt industry might explain why we faced suspicion and some outward hostility from DRC officials in reporting this story.

Despite obtaining media accreditation in advance from the central government in the national capital of Kinshasa, once photographer and filmmaker Sebastian Meyer and I arrived in Kolwezi, we had to seek permission from Lualaba's provincial governor, Richard Muyej, to conduct interviews without being detained or ordered out of the country. Sitting in Muyej's office, we listed sites we wanted to visit. In response, the governor told us several times, in French, "*On a rien à cacher*"—we have nothing to hide.

But our experience during one week in Kolwezi suggested a very different picture. The provincial Ministry of Mines and the police refused us entry into all but one mine site, telling us that we were forbidden to do any independent reporting without their permission. Some of our interviews were conducted under surveillance by police.

At the only cobalt mine to which we were granted official access—Kasulo, owned by the government—provincial mining officials rushed us around the site under the escort of armed police, telling us that the

Inside the Kasulo mine, which is owned by the DRC government and run by China's Congo Dongfang International Mining, or CDM.

security presence was to protect us from harassment by miners. They refused our request to return to Kasulo a second time, despite the fact that we had an appointment there with Pact, the Washington, D.C.–based NGO working in Kasulo, with government approval, to end child labor in the mines.

On our last morning in the country, I asked Governor Muyej why his police and local officials had blocked us at virtually every turn. "People come with prejudices," he said, citing journalists who have recently described child cobalt miners in Kolwezi. "They see all the bad, not the good."

SINCE AMNESTY'S DAMNING REPORT in 2016, the government has indeed made attempts to clean up cobalt production—a task that is dauntingly difficult, if not paradoxical, given that top officials have benefited for years from opaque mining deals.

As an example of its new efforts, Lualaba's mining authorities point to its "model mine" of Kasulo. The sprawling 420-acre site sits north of Kolwezi and began in 2012, when locals living on the land struck reserves containing cobalt with an extraordinary 14% mineral concentration; thousands of people poured in, sparking a free-for-all hunt for cobalt.

In response to the human-rights outcry, the provincial authorities last year fenced off Kasulo, creating a single entrance and exit to the site, at which it posted armed security guards. Next to the entrance are now hand-painted signs proclaiming in French and Swahili that children under 18 and pregnant women are banned from entering, as is anyone with alcohol.

Now, about 14,000 diggers converge on Kasulo every day to find cobalt, organizing themselves into small teams, then dividing their day's earnings at sundown. The mine accounts for one-quarter of the cobalt from the DRC's artisanal mines, and the exclusive rights to the ore are held by China's Congo Dongfang International Mining, or CDM, a wholly owned subsidiary of Huayou Cobalt, which Amnesty's 2016 report assailed for purchasing artisanal cobalt with little knowledge of labor conditions; Huayou says it has since implemented programs for Kasulo's miners, run by Pact, to teach safety and explain why children should not mine. It remains unclear how people's ages or pregnancy status are checked. "Do you see any child? No, none," says Erick Tshisola Kahilu, director general of the province's Ministry of Mines, standing amid hundreds of miners digging in the ground, as he guides us around the site. "And no babies either."

Signs in French at the entry gate to the Kasulo mine say pregnant women and children under 18 are not allowed inside.

Three months before I landed in Kolwezi, I had listened to DRC mining officials espouse their efforts in Kasulo, at a conference on mineral supply chains in Paris, hosted by the OECD. Congolese officials distributed a glossy 10-page brochure, proclaiming Kasulo as a "*merveille émergente*," or emerging wonder. But the wonder inside Kasulo's gates more closely resembles a frenzied scene from the California gold rush of the 1850s, rather than a current-day mining enterprise. Several hundred men chip away in deep holes and open pits without overalls, helmets, or any other protective gear, using basic hand tools like lengths of rebar to hack away at the surface, and hauling up rocks with handmade lengths of rope.

Around 4 p.m., the men load sacks of cobalt atop rickety bicycles or motorbikes, and roll them downhill to CDM traders, who stand ready to weigh the day's output in an open-air hangar inside the gates of Kasulo. The buyers check the cobalt concentration of the rocks, which determines the price they will pay, using a small digital instrument called a Metorex. The prices are marked on handwritten lists tacked to the walls of the hangar. Inside caged areas, Chinese traders pass wads of Congolese francs to weary miners. Despite the digital measurements, several miners told us they suspected that the buyers routinely lowered the cobalt concentration figures in order to decrease the pay. There is no proof their suspicions are correct. But the free-for-all atmosphere seems primed for conflict. As the digging day in Kasulo ended, I witnessed a fierce argument among six miners standing on one rutted path amid the pits over how to split the day's proceeds. The group's total sum: 60,000 francs, or just $37.

For thousands of diggers working outside the more formal structure of Kasulo, the main trading hub is Musompo cobalt market, a cluster of about 50 open-air depots stretching a half-mile or so along the main east-west road out of Kolwezi. Musompo looks like the kind of village market that typically sells food or housewares. But for many tons of cobalt, this is a key gateway to the huge export market. Chinese middlemen, who speak rudimentary Swahili, test the concentration of cobalt brought in by diggers, and for about eight hours each day conduct a brisk trade in the metal. "I arrived recently from Nigeria," says Xu Bin Liu, 30, from Hebei province, China, who runs the "Boss Liu" depot on the edge of the Musompo market. Seated at a small wooden table knocked together with nails and covered in burlap, Xu says the job involves tough haggling over prices.

Officially, Huayou's CDM no longer buys cobalt from the Musompo market. But when we asked a Chinese buyer in Musompo for an interview, he said he needed the approval of his "boss," a CDM official in Kolwezi. Tech companies like Apple, Samsung, and others have said that it is exceedingly difficult to prove that Musompo's cobalt is free of child labor, and that the battery manufacturers that supply them—largely in South Korea and China—source the metal from child-labor-free mines.

The situation has prompted companies to make some tough choices: cut all artisanal miners out of their supply chain, for example, or halt purchases of DRC cobalt—either option potentially an economic disaster for the country. "If everybody simply runs, that can put children and families in a more vulnerable position," says Ben Katz of the NGO Pact. "That is not reducing harm. It's causing more harm."

Among companies, a race is underway to decrease the cobalt in electric-vehicle batteries, from the current 10% or so to 5% or less. Under current technology, cobalt is essential in making high-performing batteries. But Tesla CEO Elon Musk has said he intends to produce non-cobalt batteries for the next generation of Tesla vehicles. Likewise, Volkswagen has partnered with QuantumScape, a startup in San Jose, to invent a cobalt-free, solid-state battery to replace the lithium-ion version—but they do not expect quick results. "We are at a very early research stage," VW's research director Axel Heinrich says. "I cannot tell you which year we will have batteries with no cobalt."

Shaken by the possibility that children might be mining cobalt used in iPads and iPhones, Apple says that it has identified every smelter providing cobalt in its supply chain, and that they are regularly audited by independent third parties. Last year, the company announced that it would stop sourcing all cobalt from informal mines in the DRC, but that it did not agree with those pushing to pull out of Congo altogether. "There are real challenges with artisanal mining of cobalt in the Democratic Republic of Congo," the company said in an email to *Fortune*. "But we believe deeply that walking away would do nothing to improve conditions for people or the environment."

In an effort to lessen their dependence on the DRC, some companies are instead investing to develop new cobalt reserves;

Left: A miner crushes cobalt that will be tested for purity at the Kasulo mine depot. Right: Cobalt buyer Xu Bin Liu, 30, from Hebei province in China, tests the purity of cobalt he's buying at the Musompo market on the outskirts of Kolwezi.

exploration projects are underway in Australia, Papua New Guinea, Canada, and Montana and Idaho in the U.S. That is partly because of rising anxiety that China is locking up most of the world's cobalt supplies; in March, Glencore agreed to dedicate one-third of its entire cobalt production during the next three years to GEM, the Shenzhen-based battery recycling company. China produces a whopping 80% of the world's cobalt sulfate—the compound used in lithium-ion batteries. And by 2020, China will likely produce 56% of those batteries, according to Benchmark Mineral Intelligence in London.

Yet leaving the DRC entirely is hard to manage so long as cobalt demand keeps soaring. Cobalt-free batteries are likely years away from mass production, and new mines outside Congo could take years to come on line. "The DRC is absolutely critical to the production of lithium-ion batteries," says Caspar Rawles, Benchmark's analyst on battery technology. "Without the DRC, we are not going to have enough cobalt. There is no question about that."

NORTH OF KOLWEZI IS THE TINY VILLAGE known as UCK (pronounced "oo-say-kah" for the French acronym of its original copper mine). There, amid the dirt paths where children kick battered soccer balls, is one sign of how Silicon Valley is trying to grapple with child labor without alienating consumers.

In the backyard of a small house down a side lane in the village one morning in July, three teenage boys were bent over a van, learning how to repair it. They were participants in an Apple-funded program that began late last year, operated by Pact with the approval of Congolese authorities. The idea is to switch children from mining to new moneymaking skills. Today, about 100 teenagers are being taught sewing, cell phone repair, hairdressing, carpentry, catering, and other skills in villages around Kolwezi.

Not all families have welcomed Apple's efforts, however. Some fear they will lose the income they desperately need to survive. "My parents asked me why I would abandon the mine," says Thomas Muyamba, a soft-spoken 16-year-old helping to fix the vehicle in UCK village. He says he began digging for cobalt at age 12, and earned between $3.50 and $9 a day—crucial support for his family. Attending school is not an option, he says, since his family cannot afford school fees. So he convinced his mother that being an auto mechanic would ultimately serve the family best. "I tell them it will guarantee my future," he says.

The family has the same hope for Thomas's sister Rachel, 15, whose bushy pigtails frame her round cheeks like antennae. Rachel is one of about 10 girls who, until joining an Apple-funded project a few months ago, washed cobalt in the tailings in the river in Kolwezi—low-paid work that NGOs believe is particularly toxic for young lungs. Now, as part of the training program, the girls are seated at Singer sewing machines in a shed about five miles from Kolwezi, taking orders for clothes from clients and working on commission.

But the Apple program is not the only one trying to root out labor abuses in cobalt mining. Last year, China's Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters launched the Responsible Cobalt Initiative, bringing together companies that agree to follow the OECD's due-diligence rules by trying to eliminate child labor from their supply chains. The group includes Apple, Samsung SDI, HP, and Sony. In a separate program, Huayou and other refiners, miners, and carmakers have joined the Better Cobalt project, launched in March by RCS Global, a London-based organization that tracks and audits supply chains of natural resources. The group claims it will be able to identify cobalt that meets "the highest global standards," focusing on child labor and human-rights abuses. And the large commodities trader Trafigura has begun registering some

12,000 artisanal cobalt miners at the large Chemaf mine in Kolwezi, implementing health and safety standards and organizing them into cooperatives. Trafigura claims miners are earning dramatically more money as a result.

Besides the threat of a consumer backlash, companies also increasingly worry about potential legal liabilities, perhaps from an investor lawsuit, should they violate human rights. In July, the London Metal Exchange said that starting in January it would require every company that sources more than a quarter of its metals from Congo's artisanal mines to be audited independently. Those that fail to meet human-rights standards risk being banned from trading on the LME. And in April, an informal WhatsApp group began among major investors, to share information with locals about abuses in the DRC's cobalt industry. "If there are violations and there are lawsuits on a local level, the claims can be brought back to an international level, to a company traded on London Stock Exchange," says Christine Chow, director of Hermes Investment Management in London. "I do not want to use a phone that has been put together by a 4-year-old."

Thomas Muyamba, 16 [left], used to mine cobalt but is now in an Apple-funded apprenticeship program. His friend Lukasa, 15, rises before dawn six days a week to work in the cobalt mines.

FOR ALL THE EFFORTS of companies and investors, the projects nonetheless have strong limitations—so long as grinding poverty persists for millions of Congolese.

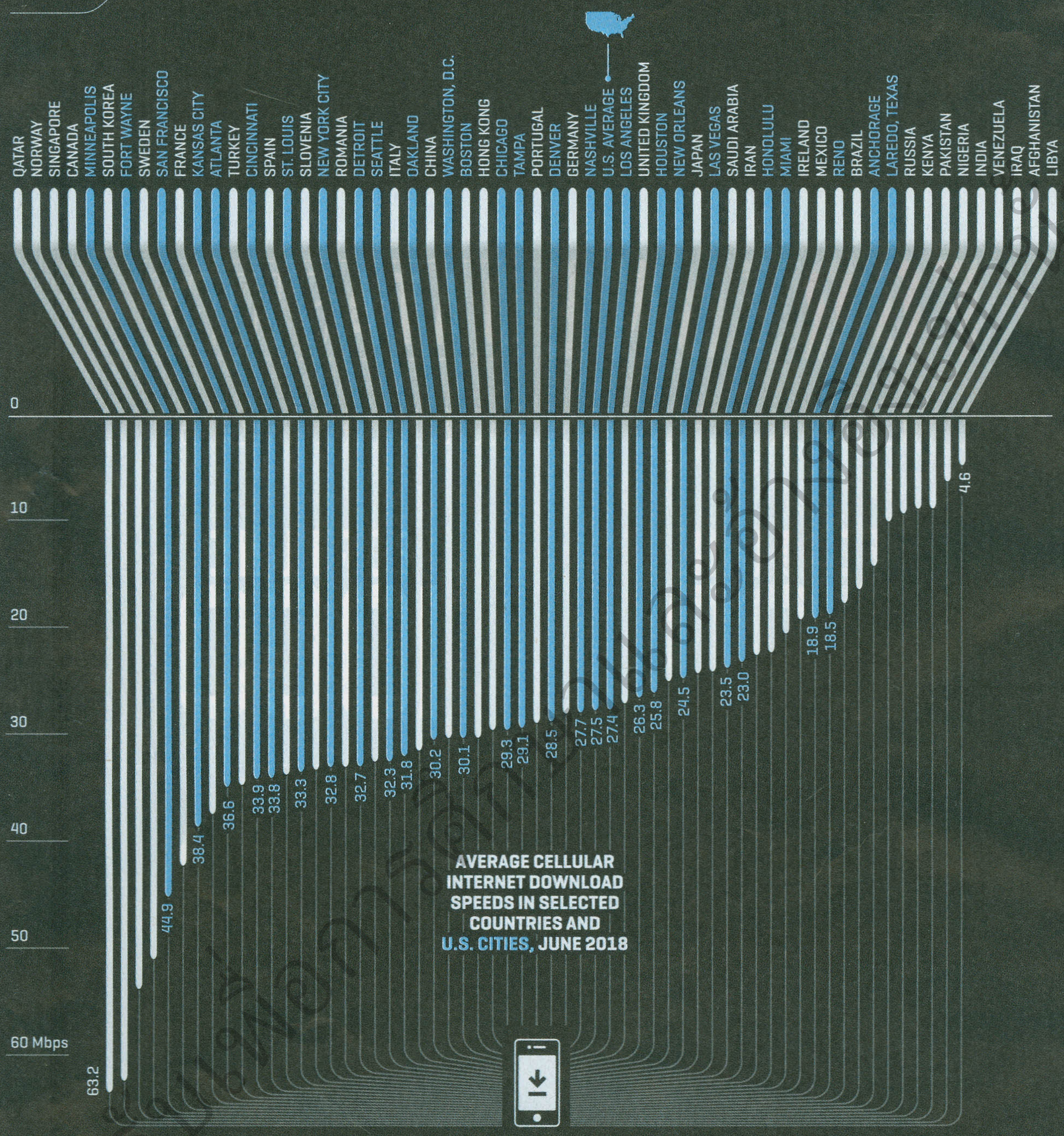
That much is clear when you travel just a few miles away from the digging sites in Kolwezi. The day after meeting the teenagers Thomas and Rachel Muyamba, we meet them again, by happenstance, in their home village. (Again, *Fortune* has not named the community, for fear authorities might target those children in the village still mining cobalt for talking to journalists without permission.)

Sitting outside the tiny, mud-brick dwelling where Thomas and Rachel live with their family, it is clear that their mother and grandfather's decision to allow them to join Apple's training programs, and stop mining cobalt, has been difficult. The teenagers still earn just a fraction of what they made in the mines, putting a squeeze on the family.

As a crowd gathers around us while we talk, I ask which children are still digging for cobalt. Several hands shoot up—including that of 15-year-old Lukasa, the boy whose 12-hour day begins at 5 a.m. in this village.

For these child miners, the daily task of digging for cobalt still seems worth the backbreaking work—despite the growing number of business-backed programs urging them to quit. Lukasa's earnings—$9 on good days—are far higher than Thomas's pay from his Apple-funded job as a trainee auto mechanic, and match what Rachel makes for an entire week of sewing. Rachel says she expects to earn a solid living as a seamstress after a few years. "I will have my own shop," she says.

If Rachel succeeds in her plans, it will be a rare chance indeed for one of Congo's child miners to rise above the bare-bones survival gleaned from cobalt. Tech and auto companies are hoping thousands of other children find their way out of the mines too—allowing the technology industry to ward off consumer anger even as it continues tapping Congo's giant wealth to give us the batteries we demand. ■

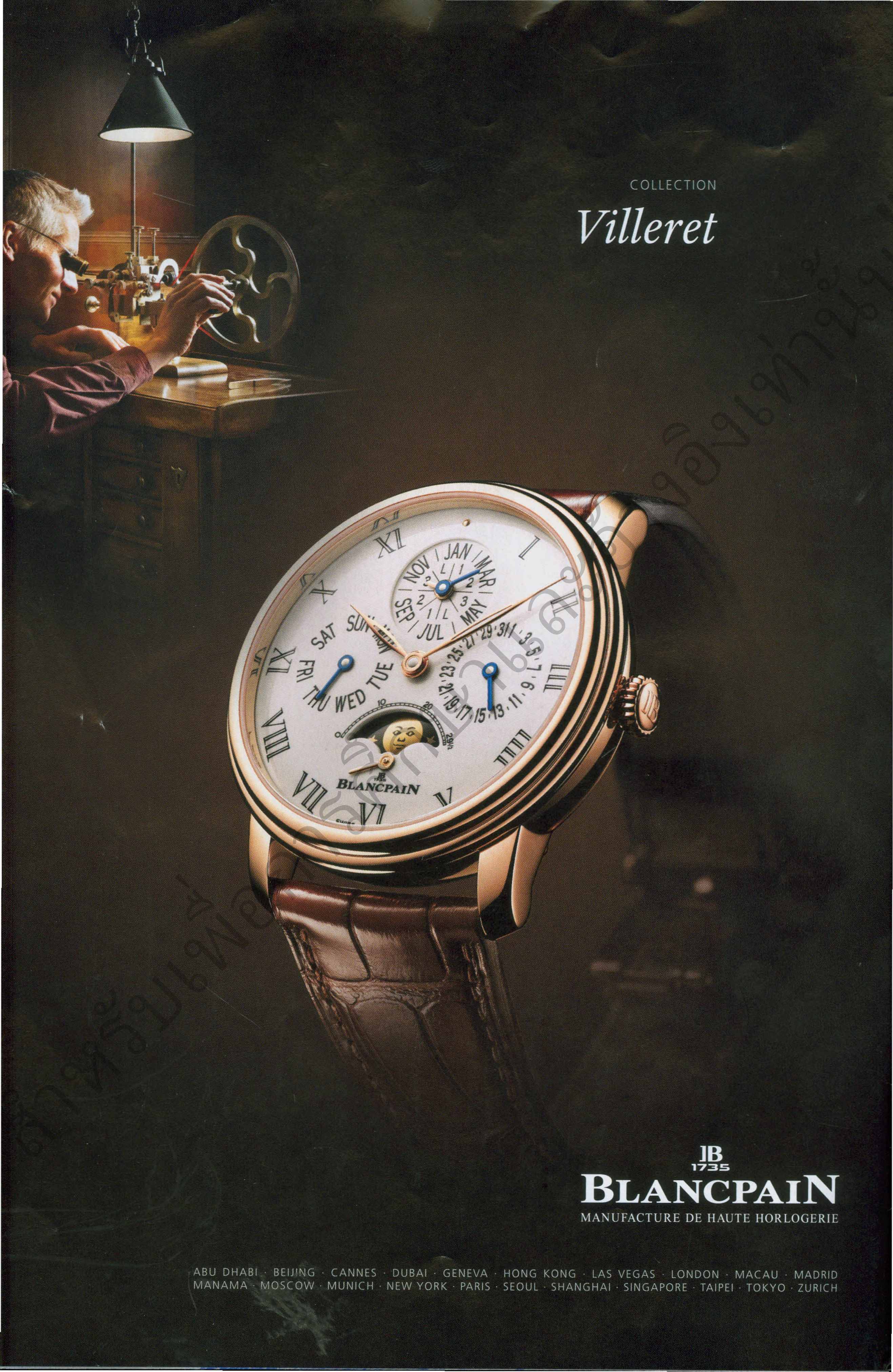


THE NEED FOR SPEED

WAITING ON 5G CAN FEEL A LOT like trying to download *Avengers: Infinity War* with just one bar of cell service—in a word, excruciating. But after years of hype, fifth-generation wireless technology and the blazing speeds it promises will finally start to roll out this year. The U.S. must ramp up investment to avoid falling behind. According to Internet metrics specialist Ookla, which gathers data through its Speedtest product, as of June the U.S. ranked 47th globally in mobile download speed, with an average of 27.5 megabits per second. U.S. networks are slower in part because of high usage. But since 2015, according to Deloitte, China has outspent the U.S. by $24 billion on wireless infrastructure. —BRIAN O'KEEFE

SOURCE: **OOKLA**

GRAPHIC BY **NICOLAS RAPP**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