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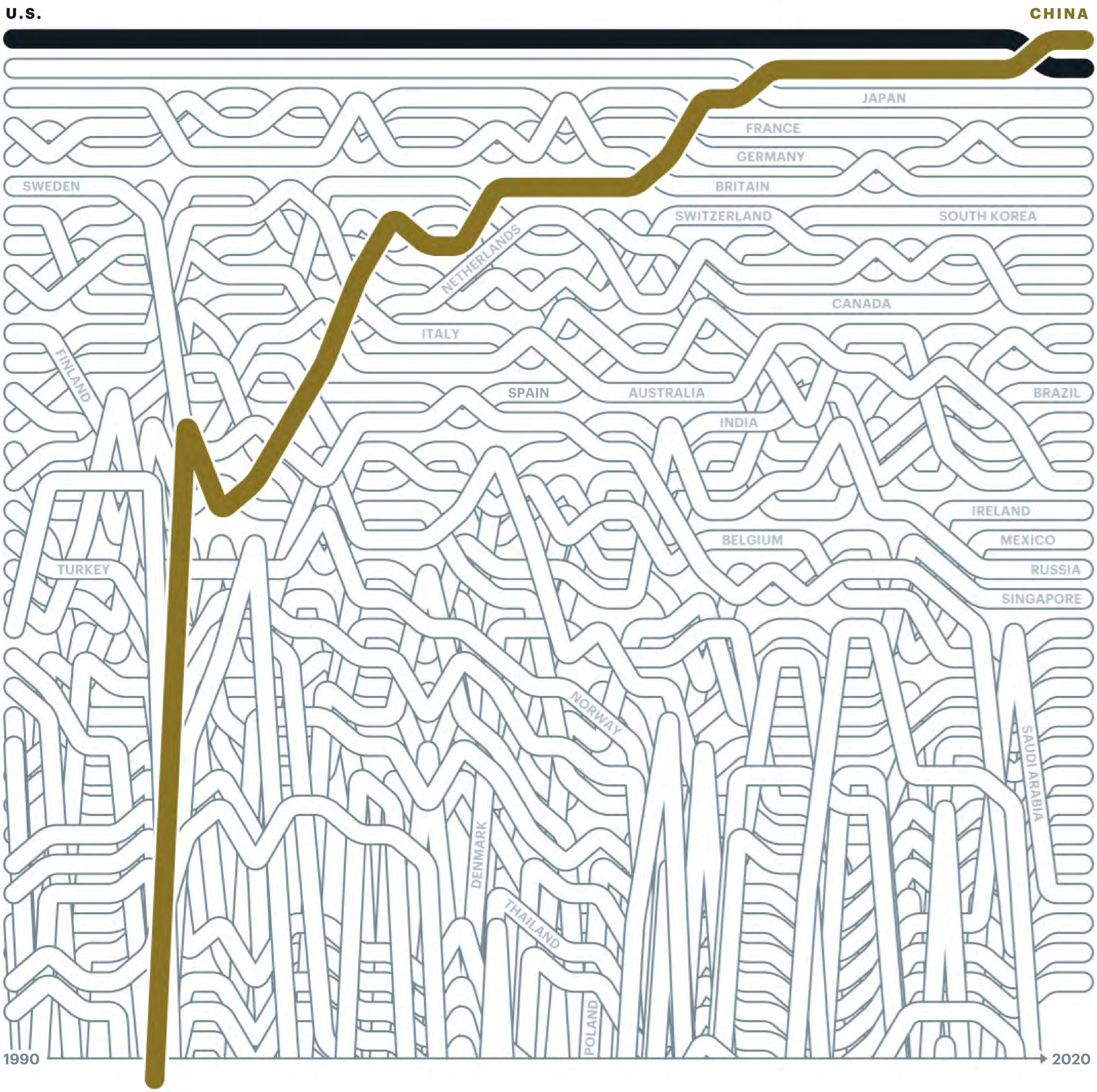
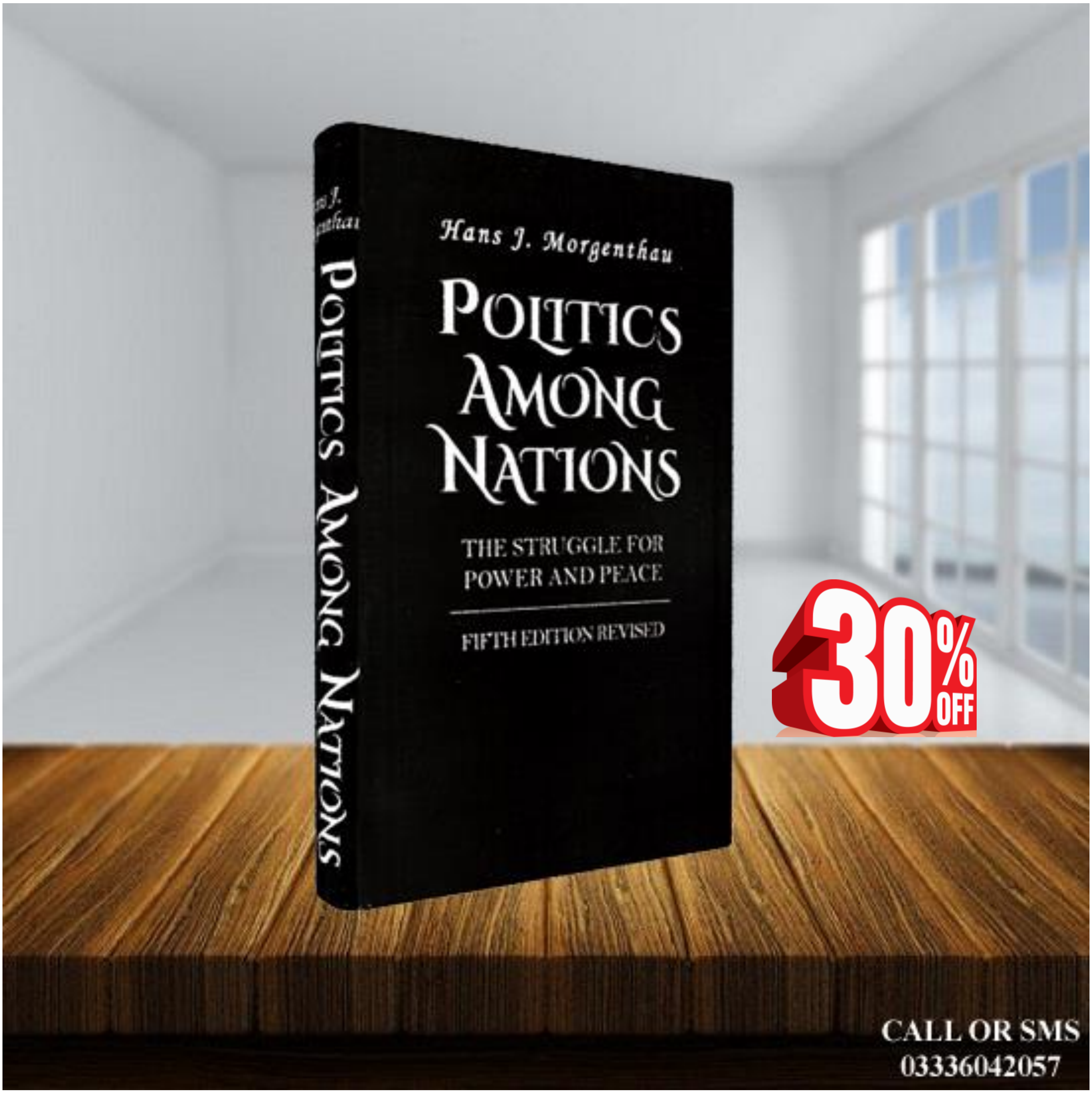


GLOBAL 500 • 30TH ANNIVERSARY

The World at a Crossroads

HOW CHINA'S RISE WILL RESHAPE THE POST-PANDEMIC ORDER.

Politics Among Nations: The Struggle for Power & Peace
By Hans Morgenthau

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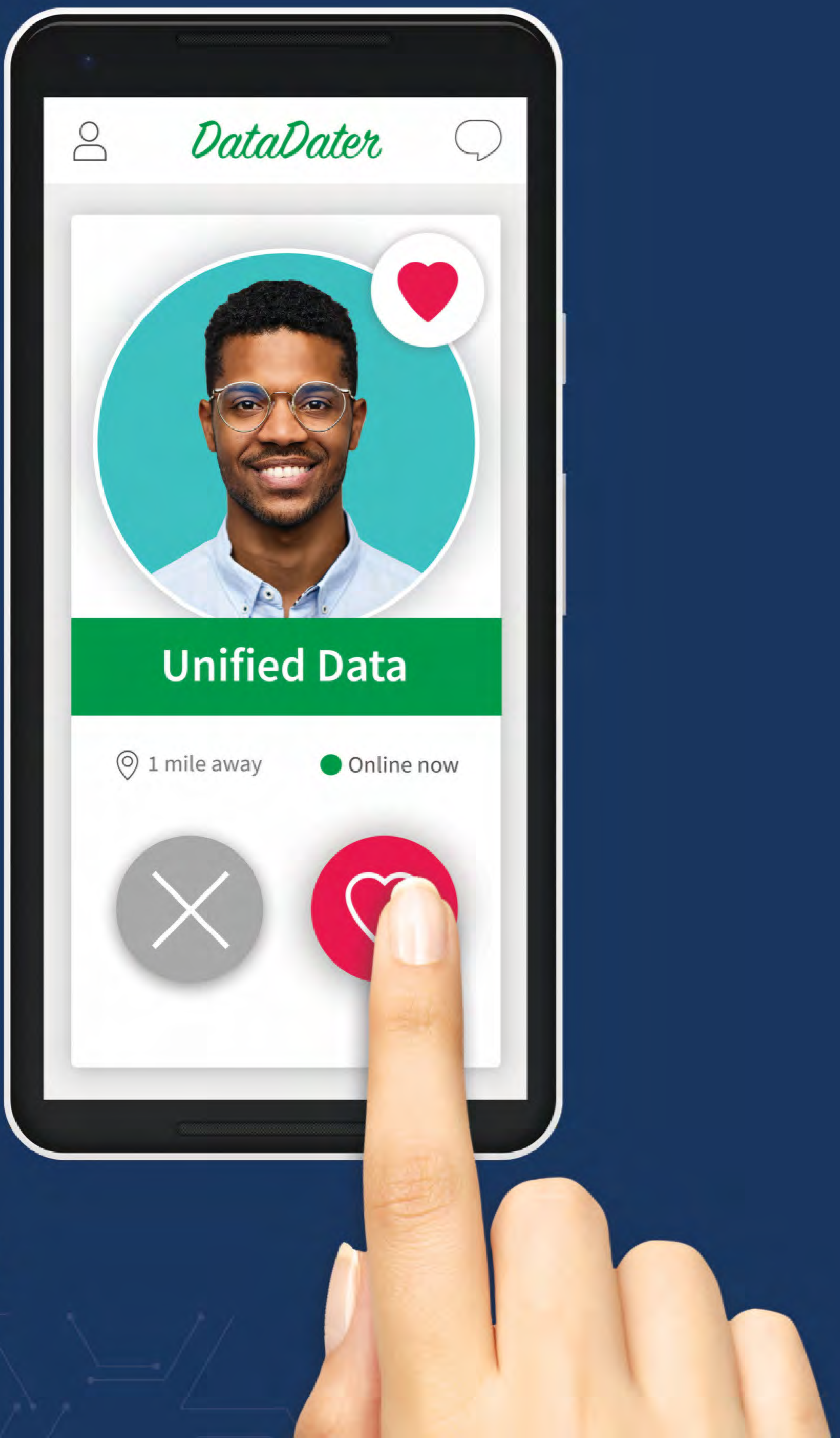

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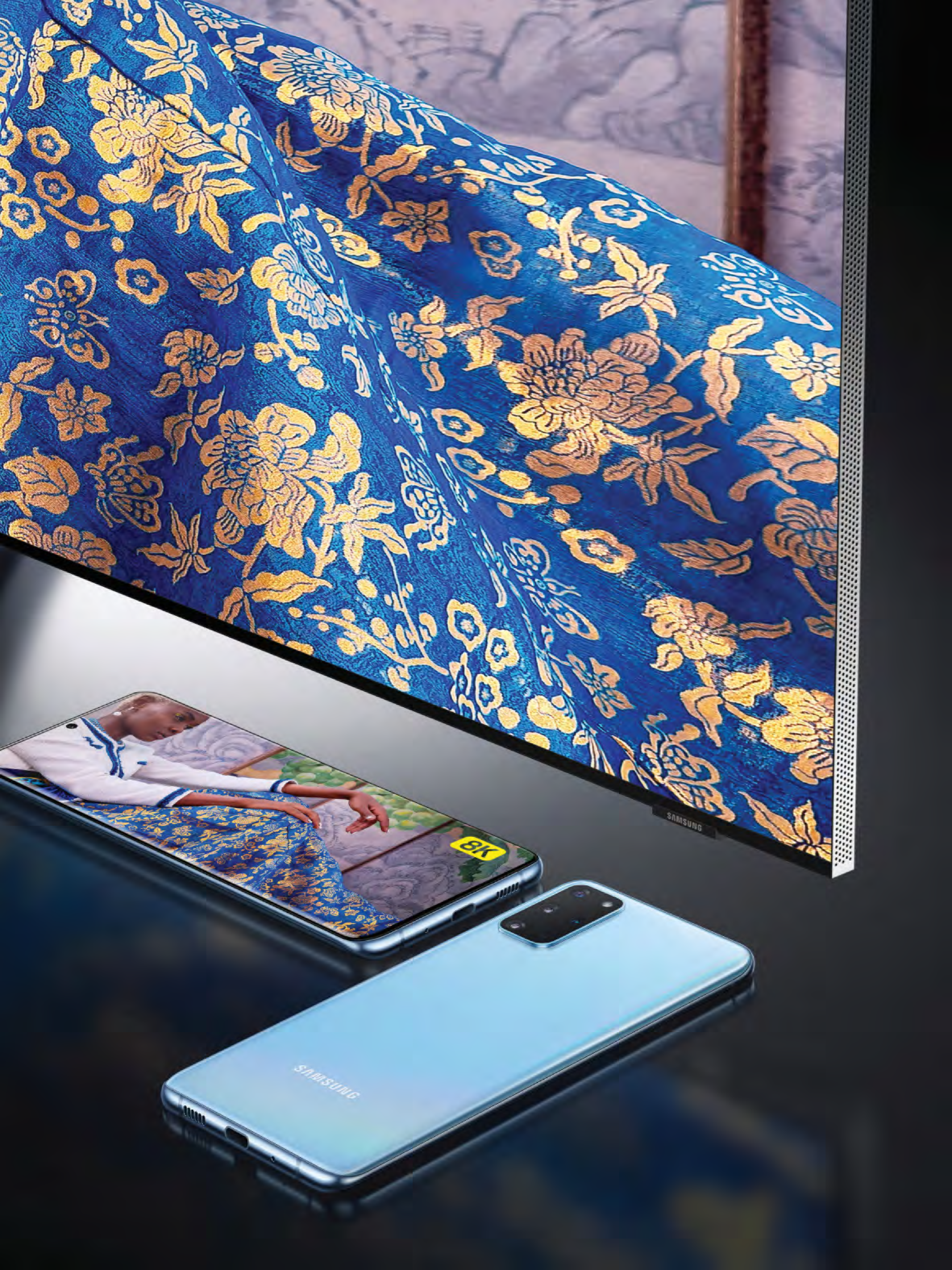
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Features August/September 2020

VOLUME 182 • NUMBER 1

IN TOO DEEP?
Oil super-major BP attempts the most dramatic pivot in its 111-year history.

Cover Illustration by
NICOLAS RAPP

COURTESY OF BP

Departments

Foreword

The Brief

The Conversation

Passions

The Cartographer

WHAT OUR EDITORS ARE UP TO THIS MONTH

WORKIN'
The cochairs of our virtual Most Powerful Women Summit bring the heat Sept. 29 to Oct 1. *fortune .com/conferences*

STEAMIN'
Ellen McGirt and Alan Murray set the pace at their weekly *Leadership Next* podcast. *fortune .com/podcasts*

COOKIN'
Clay Chandler & Co. break down the business of Asia in our *Eastworld* newsletter. *fortune.com/ newsletters*

RANKIN'
From the "100 Best Companies to Work For" to the "100 Top Hospitals," *Fortune* lists can help you make hundreds of decisions better.

SCHNEIDER: PHOTOGRAPH BY SEBASTIEN AGNETTI; TRUCK: COURTESY OF NIKOLA

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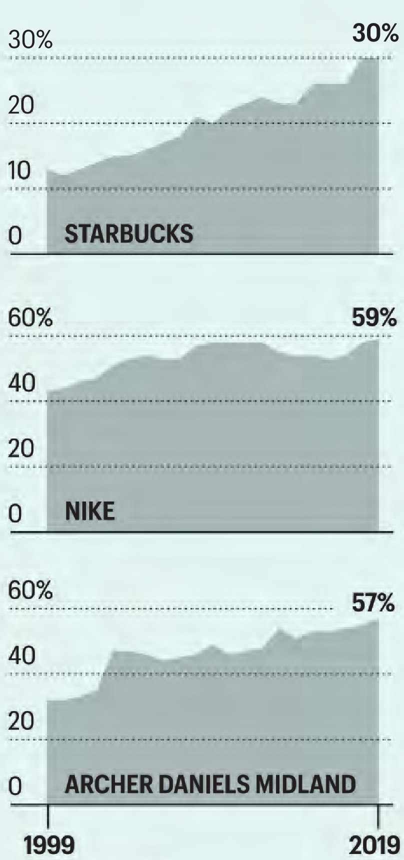
Great Ideas Are Global

IN THE THIRTY YEARS since we launched the *Fortune* Global 500, our annual ranking of the world's largest companies by revenue, two very clear themes have emerged.

The first—which *Fortune*'s incomparable director of infographics, Nicolas Rapp, has captured artfully on the cover of this issue—is the sheer gravity-defying rise of China as a leader of global business. There were precisely zero Global 500 companies based in mainland China in 1990 when we began our survey. Today there are more giant for-profit enterprises there than anywhere else on earth.

The second—and equally dramatic—narrative is the steep rise of global trade in general, which has been just as inexorable, it seems, as China's ascent. In the first running of the Global 500, world trade represented less than 39% of global GDP, according to the World Bank; in 2018 (the latest year available), such trade accounted for more than 59% of our planet's economic output.

SHARE OF COMPANY REVENUES ORIGINATING OUTSIDE THE U.S.



SOURCE: S&P GLOBAL

It should go without saying (but, unfortunately, too often goes unsaid) that cross-border trade is precisely what made America the first economic superpower—long before it made China one. American companies exported $2.5 trillion worth of goods and services in 2019, up from $487 billion three decades earlier—a greater than fivefold increase in nominal dollars. Even adjusting for inflation, the growth rate is 152%. (For those who believe imports have increased at a substantially faster rate over the past three decades, prepare to be shocked: In inflation-adjusted terms, imports have grown 160%, barely more than exports.)

Market-based economies, naturally, need markets. And in order to thrive, businesses in those market-based economies need to either expand existing markets or find new ones. America's free-spending, high-living, 328-million-strong population makes for a pretty robust cohort of consumers—but outside its borders are nearly 7.5 billion more who might be turned into possible customers one day. Starbucks, which makes its Global 500 debut this year (at No. 478) figured this out early, and now gets 30% of its $26.5 billion in revenue outside the U.S. (see chart). With a compound annual growth rate of over 22% since 1999, Starbucks' international sales are growing about a third faster than domestic sales. Nike (No. 322), the pride of Beaverton, Ore., now gets 59% of its sales outside America; Archer Daniels Midland (No. 168), purveyor of the American breadbasket, gets 57%.

Which brings us back to the Global 500. The ability to export—to open up and thrive in a new market—is a key attribute of the world's most successful firms. That ability, moreover, is often self-reinforcing. "The opportunity to export more incentivizes companies to innovate more on their products and to sell better products in the market," says Fabian Trottner, an assistant professor of economics at the University of California, San Diego, who has written about the connection between exporting and innovation. Launching into a new market also helps a firm tap foreign knowledge, from process efficiencies to product design. "You open up a new market for ideas," says Trottner, who has studied these effects on 6,000 German manufacturing firms. "You get to dip into an entire new world of knowledge and innovation activity that has been closed to you before."

Indeed, you'll see that same narrative thread winding through the great mass of feature stories in this year's Global 500 edition. Please read on and let us know what you think.

CLIFTON LEAF
Editor-in-Chief, Fortune
@CliftonLeaf


RARE FORM
THE LEXUS LS 500.
The LS 500 redefines what a luxury sedan can be. With intense styling like the F SPORT bolstered 28-way power front seats featuring leather trim with an exclusive perforated L-motif design. The LS 500 is also powered by exhilarating twin turbochargers, delivering 416 horsepower[1] with a thrilling 4.6-second 0–60 time.[1,2] And the Lexus Multistage Hybrid system in the LS 500h delivers seamless acceleration and torque, without requiring a charge. This level of craftsmanship isn't just rare. It's simply beyond measure.
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LS 500 F SPORT shown with options. 1. Ratings achieved using the required premium unleaded gasoline with an octane rating of 91 or higher. If premium fuel is not used, performance will decrease.
2. Performance figures are for comparison only and were obtained with prototype vehicles by professional drivers using special safety equipment and procedures. Do not attempt. ©2020 Lexus

Before being tapped to lead the Swiss giant, Schneider was CEO of a German health care company.

The Conversation
MARK SCHNEIDER

In 2017, Mark Schneider became Nestlé's first "outsider" CEO in nearly a century. Since then, he's been on a dealmaking kick, transforming the company from a consumer goods stalwart into a health, wellness, and nutrition empire. We talked with Schneider about leading the world's largest food company through a global crisis and how the pandemic is changing the way we eat. INTERVIEW BY **BETH KOWITT**

THIS EDITED Q&A HAS BEEN CONDENSED FOR SPACE AND CLARITY.

"We knew that uninterrupted supply of food and beverage was going to be key. People wanted to see the shelves stocked."

PHOTOGRAPH BY **SEBASTIEN AGNETTI**

LEADING THE LOCKDOWN

Let's start with COVID, since that's what everyone is thinking about these days. Nestlé was one of the first companies to halt employee travel back in February. What sparked that decision?
SCHNEIDER: The first few weeks of February, like everyone else, I was at the edge of my seat just watching. We had firsthand experience through our extensive Chinese operations, which is the second-largest market for Nestlé after the U.S.

There's one specific date that made the difference for me: Friday, Feb. 21. A colleague e-mailed me some pictures from northern Italy where people were panic buying. One look, and it was very clear: This is out of control, and we will no longer be able globally to contain it. This is when several emails went out to the entire company, saying, "Get your inventory levels up, no matter what. Don't try to be smart—just be sure that we're fully prepared, because you don't know exactly which raw material might be in short supply or which supply chain might be under fire." We knew that in this context, uninterrupted supply of food and beverage was going to be key. People wanted to see the shelves stocked. And some of the initial panic buying was exactly because people were doubting that.

On Feb. 25, we went out with the travel restrictions. I was actually on the road in the U.S. That was my last big cross-border trip. I wanted to be sure that I was the first one to comply with these rules.

How do you see the pandemic changing the industry long-term?
The biggest shift clearly was from out-of-home consumption to in-home consumption. And that is against the prior trend, because for years people had started to consume more food and beverage out-of-home. Around the world, apartment sizes, kitchen sizes, pantry sizes have been shrinking because people consume more and more on the go and on the

road. And now all of a sudden, you have this crash reverse. [1]

It'll take some years for things to return to a pre-crisis level. I think it will take a vaccine that will give people peace of mind.

Single-use plastic has seen a resurgence during the pandemic. Will sustainability still be a consumer priority post-COVID-19?

It's understandable that people used more single-use plastics when they had nothing else at their disposal. But just because the crisis happened doesn't mean we have more time on this. If anything, we're facing a steeper challenge because all this money that went into addressing the pandemic is going to be missing in the public domain when it comes to funding these other challenges and hence, the degree of difficulty has gone up, unfortunately.

CANDY MAN NO MORE

You've done something like 50 deals [2] since becoming CEO, including selling off the U.S. confectionery business. Are those simply business decisions or are they also about the kinds of products that you want to sell as a company?
It's dealmaking that positions the company with a portfolio that's higher growth, higher margin, and appeals more to health and sustainability—themes that we have been patiently pursuing over many years. If you want to sum it up, my tagline is, "Good for you, good for the planet." I think these are two very appealing consumer propositions these days.

Plant-based meat alternatives are what we call a no-compromise sector, and we've been very active there. [3] We are providing plant-based alternatives that taste the same, offer better nutritionals, and have a much better environmental footprint. That to me is sort of the lighthouse, but obviously the same principles apply to quite a few of the categories we're in.

You've also announced that you're exploring a sale of the U.S. water business. What's driving that?
Nestlé was one of the pioneers when it came to the global bottled water business. Since the late 1980s, when the world was still busily debating who's going to win the cola wars, we were betting on water as a healthy form of hydration. To make water available in a safe and convenient manner to lots of people, I think that was a very worthwhile endeavor and something we stand strongly behind.

A major part of our U.S. water business is in a segment that is quite undifferentiated and that is basically purified water and regional spring water. We see a better opportunity in premium waters and also what we call functional water, which has micronutrients added for some additional health benefits. [4]

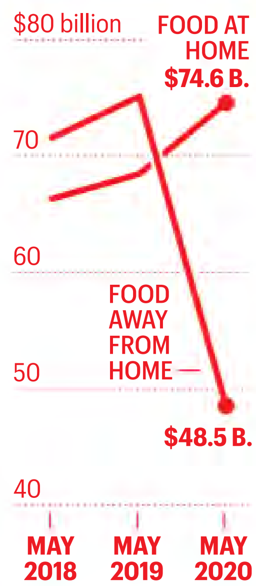
Bottled water is an area that's gotten a lot of criticism over its use of plastics. [5] Has that played a role in your decision?
We have sustainability concerns that we need to face and overcome. We don't want to run away from anything. But with these two segments, the functional water and premium waters, you are at a better price point that allows you to also go for more ambitious environmental solutions like better and more interesting container strategies.

SAFETY FIRST

You used to spend something like 50% of your time on the road. Is that changing how you think about leadership and working with your teams all over the world?
All the long-distance stuff had to be

BETWEEN THE LINES

(1) SALES OF FOOD, U.S.



SOURCE: USDA

(2) Wheeling and dealing: Schneider has promised to replace 10% of Nestlé's portfolio by 2021. His deals so far include joint ventures for its lunch meat and U.S. ice cream businesses, the purchase of vitamin maker Atrium, and a stake in coffee chain Blue Bottle.

(3) Plant power: Nestlé acquired Sweet Earth in 2017 and released its plant-based Awesome Burger last year. The company also launched the soy protein–based Sensational Burger in Europe in 2019.

(4) Back to the well: Nestlé may put U.S. water brands like Poland Spring on the block, but is doubling down on premium lines like Perrier and S. Pellegrino.


AI

"I'm not cheering you on from the safety of my home office—I'm actually here with you because I believe this factory is a safe place to work."

replaced by virtual meetings. But staying as close as possible to the people at the front line of the business has not changed. I toured our Swiss factories in March when we were in a rush to keep them safe and keep up supply.

I spent some time on the shop floor to learn firsthand, what is the best practice and how is it being implemented—but also to signal to our frontline workers, "Look, if we tell you that this is a safe place, then I'll be here with you. I'm not cheering you on from the safety of my home office—I'm actually here with you because I believe this factory is a safe place to work." That messaging and giving people that comfort and being with them physically, that's one of those principles that I just wanted to uphold.

The wife of one of the workers at a factory I visited was pregnant and eight weeks from her due date. She kept telling her husband every morning, "If you go to that factory and get infected, you may miss the birth of your first child." He turned to me and asked, "Is it safe to come here?"

What did you say?
I told him I was here because I wanted to make it as safe as humanly possible. I can't give blanket assurances, but I wanted to be sure that no stone was unturned if we sent hundreds and thousands of people to work every day. The same thing here when it comes to headquarters. Switzerland never had a hard lockdown. We never shut down this headquarters building. I did not miss a single day of work here. I've been down to the entrance to review the entry procedures probably 10 times, just to be sure we get it absolutely right. Canteen operations, each and every elevator. To this day, I go around with my smartphone taking pictures to then share with the building people to be sure we have all these details ironed out.

POWERING THROUGH A PANDEMIC

Some of your competitors threw out their guidance for the year, but Nestlé did not. 6 Why not?
It was important to me that one of the ways as a company we can contribute to stability is by fully meeting our commitments. In Europe there was a debate that some companies should delay or reduce the dividends. We didn't do that, because it's someone else's income. We stayed away whenever possible from taking government support because we were able to do this ourselves. We were giving people idled by some temporary lockdowns job security; where we have had to impose short-term shutdowns, we paid full wages for up to 12 weeks.

How long do you feel like we're going to be operating under the constraints of the pandemic?
I hope I'm not coming across as too pessimistic, but it's very clear to me that until there is a vaccine and it's widely applied, we're going to be in this strange limbo situation where you loosen up a little bit, and a few weeks later, you get punished with cases up again. And yet, you can't stay in lockdown for 12 to 18 months. You have to somehow adapt and loosen up a little bit, then tighten a bit again. I believe this is the way we will have to live in 2020 and probably for most of 2021. This is why it was so important to me that we find ways where we can go about our jobs and lead our lives as much as possible with an acceptable risk level. We can't just all go into hibernation until it's over. ■

(5) Plastic, not so fantastic: Nestlé has come under fire from environmental groups for the use of plastic in its packaging. The company has committed to making 100% of its packaging recyclable or reusable by 2025 and to reduce its use of virgin plastics by one-third by 2025.

(6) NESTLÉ PERFORMANCE

After a rough spring, Nestlé's stock is trading near all-time highs.

SOURCE: BLOOMBERG


WHAT CONNECTS US
IS STRONGER THAN
WHAT DIVIDES US.
For millions of Americans, connectivity is their lifeline.
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Let's connect, not divide.
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Veterinarian
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At **KAUST**, a futuristic city on the glittering shores of the Red Sea, a multidisciplinary team of international researchers is putting the finishing touches on cutting-edge innovations that are expected to change the face of urban life forever.

THE SMARTEST CITY

Part of the city's autonomous shuttle fleet

> KAUST IS A LIVING LABORATORY THAT IS PUSHING THE BOUNDARIES OF INNOVATION AND TESTING NEW IDEAS FOR URBAN TRANSFORMATION
>
> —
>
> **JASON ROOS,** CIO, KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY (KAUST)

Thousands of years after the world's first great cities emerged in the fertile lands of the ancient Middle East, the region is playing a starring role in a new chapter in urban civilization.

On the shores of the Red Sea, about 50 miles north of the historic city of Jeddah, international researchers at King Abdullah University of Science and Technology (KAUST) are developing and testing technologies that have the potential to transform city living globally. Here, futuristic concepts such as drones that deliver groceries and fully autonomous vehicles are no longer the fantasies of science fiction. For the thousands of people who live and work on the KAUST campus, they are becoming part of the fabric of everyday life.

"KAUST is unique because it is not just a university," explains Jason Roos, the institution's chief information officer. "It is an entire city that contains within it a research park, the offices of numerous Fortune 500 companies, and a thriving community of homes, hospitals, schools, restaurants, and malls, all connected to one state-of-the-art fiber optic network.

"We are a living laboratory that is unlike anywhere else in the world. That means we can develop and demonstrate the digital innovations that will transform what it means to live, work, and play in a city."

Just 10 years after welcoming its first students, KAUST today is a thriving community that residents from over 100 different nationalities call home. This multicultural and open-minded community gives KAUST an edge when it comes to developing innovations for the cities of tomorrow.

"Unlike technology companies, we do not just put different components together and hope it results in a positive experience," Roos says. "We start by thinking about the experience that a resident wants, and only then do we consider the technology required to make that happen."

Compared to large cities, the community's manageable size gives it a significant advantage when rolling out new technologies, explains Mohamed Abdel-Aal, head of digital experience and innovation at KAUST.

"We are not a major metropolis, so we do not need perfection. We can afford to test prototypes with the community and make changes based on the feedback of residents," Abdel-Aal says. "We try things that might not work. We can experiment with the established patterns of the way people live here. We can tolerate risk and test solutions that other cities do not dare to."

The benefits of the KAUST approach to new technologies are clear to see in its deployment of self-driving vehicles. Since the start of the year, students and staff have been using two driverless electric shuttles to move around the central campus. The vehicles are still in the prototype stage, with human operators onboard. Nevertheless, the shuttles are proving popular with KAUST's residents, and insights from their usage in the real world are paving the way to their next stage of development. Based on passenger feedback and on the vast volumes of data accumulated by the shuttle sensors, KAUST scientists are refining the service with the aim of allowing the vehicles to operate entirely autonomously.

"The shuttles will not only provide our community and visitors with an eco-friendly and easy-to-use transport service, they will also give us a new platform for innovation and collaboration that will help advance autonomous vehicle technology in general," says Abdel-Aal. "We will be testing the vehicles on our streets for the next two to three years. That will generate numerous opportunities for researchers and students at KAUST to design and develop some of the underlying technologies for autonomous vehicles, in fields such as AI, electronics, sensors, and nanomaterials."

KAUST's focus on real-world testing and the needs of residents is shaping its approach to other smart city technologies. Researchers are currently exploring the possibilities of using drones to transport and deliver household goods. To prepare the community for this technology, KAUST scientists plan to equip smart houses with modules to receive incoming drones, and drone corridors will be established to preserve the privacy of residents. Researchers are also building a "digital twin" of the city to help model future flight patterns.

In addition to the university's own researchers, many enterprises are benefiting from KAUST's hyper-connected urban ecosystem. An increasing number of startups, global technology leaders, and local business partners are congregating here to test the technologies of tomorrow in a city that exists today.

"At KAUST, we can roll out innovative ideas in the real world and quickly determine which ideas have the potential to be scaled up," Roos says. "Our greatest value proposition is the city itself."

Q&A with Jason Roos – CIO, KAUST

Why has KAUST become a center of smart city innovation?
We are a living city where startups and business partners can test new ideas in a unique real-world ecosystem. With our state-of-the-art infrastructure and our centralized management, we can quickly demonstrate the experiences that can be achieved with new digital technologies.

What is different about the culture at KAUST?
We are not afraid of failure or of taking risks. The people who live in our community are eager to participate in testing new services and refining new ideas. And we can move quickly without waiting for permission.

Why have the driverless shuttles become so popular?
KAUST is the ideal environment for testing and developing autonomous vehicles in the community. We have put regulations in place to ensure that we can roll out these capabilities in a safe and controlled manner while growing the ecosystem needed to support them.

What is it like to live and work at KAUST?
The work-life balance is great. My commute takes five minutes. KAUST has created a community that caters to people who are into health and fitness. There are running tracks, golf courses, tennis courts, fitness centers, and a beach. Some of the world's best scuba diving is in the Red Sea. The architecture and the infrastructure are outstanding. KAUST has all the resources you need to work and to have fun.


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THE PGA TOUR'S
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THE NORTHERN TRUST
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THE BRIEF

BUSINESS. DISTILLED.

INNOVATION

Losing Connection

Working from home is a necessary reality in the pandemic. But companies from Goldman Sachs to Google know what's missing when we Zoom—the creative spark that leads to true innovation. **BY GEOFF COLVIN**

PHOTO ILLUSTRATION BY **SELMAN DESIGN**

ORIGINAL PHOTOS: FORTUNE MAGAZINE; ALISTAIR BERG—GETTY IMAGES; WSFURLAN—GETTY IMAGES

In a time of social distancing and remote work, Goldman Sachs CEO David Solomon raised a surprising topic during his latest earnings call with Wall Street analysts: togetherness. “Our firm has always had a team-oriented apprenticeship culture, and we benefit from being and working together,” he explained. While many CEOs seem in no hurry to refill their office buildings, and several have told employees they need never return to the office, Solomon made it clear that he wants his colleagues back in the office as soon as is safely possible. He himself has never stopped going to the office through the pandemic.

Solomon’s desire to bring his employees back together physically even as the coronavirus continues to rage around the globe, particularly in the U.S., isn’t rooted in any simple calculation of efficiency. Facebook, Fujitsu, Nationwide, Otis, Siemens, Twitter, and other major companies have announced that large portions of their workforces may or must work remotely from now on. It saves money and may increase productivity, managers say. Many employees prefer it. A recent survey by Korn Ferry found that 64% of workers feel that they’re more productive at home.

But a group of hyper-successful contrarians—Apple, Amazon, Goldman, Google, and others—have pointedly not offered the indefinite-WFH option. They want employees back physically together. Considerable evidence supports their stance. It also shows that when employers offer indefinite WFH, they’re messing with something more powerful than they may realize.

Allowing or requiring employees to leave the workplace was clearly the right thing to do when the pandemic arrived, and for many companies it will remain the right thing for some time to protect the health of their people. Google, acknowledging the likely timing of vaccine development and distribution, recently extended its voluntary WFH policy until July 2021. Some closings are imperative for public health. But employers who have a choice should keep in mind that the costs of WFH are high and may not be obvious.

The stiffest penalty may be lost creativity and innovation. Every company is desperate for good ideas in this environment, and it would be hard to design a worse policy for finding them than unnecessarily requiring or encouraging employees to stay apart.

FACE-TO-FACE MATTERS

In one of the most revealing studies of creativity in the workplace to date, researchers from MIT, Northeastern University, University of Cologne, University of Bamberg, and Aalto University studied several teams working on projects involving computer science, economics, psychology, and other fields; their findings were published in the *International Journal of Organisational Design and Engineering* in 2012. The subjects wore small badges called sociometers to record interactions within the teams, and the creativity and quality of the teams’ ideas were rated by peers on a scale of one to five. The results show strikingly what a deeply human experience it is to be creative in a group. The more that group members faced each other, the more creative was their output. The more they looked into each other’s eyes, the more creative they were. The more willing they were to confide in one another, the more creative they were.

Facing each other, looking into the eyes, confiding—all those behaviors reflect and build trust. The researchers measured trust within the groups and found that it was crucial to the whole process. Their conclusion: “There is no substitute for face-to-face interaction to build up this trust.”

Those high-achieving contrarian employers have understood all this for years. For example, Google’s free top-quality cafeteria meals aren’t merely a perk. They’re a way to bring together employees who might otherwise never see each other, and to make them wait in lines, where they’ll talk. Long, narrow cafeteria tables increase the odds of sitting next to or across from—and thus talking with—strangers. Such chance interactions are where successful innovations often originate. Gmail, Google News, and

Street View came from engineers chatting at lunch.

Apple's Steve Jobs obsessed over face-to-face meetings. "There's a temptation in our networked age to think that ideas can be developed by email and iChat," he told Walter Isaacson, author of a bestselling Jobs biography. "That's crazy. Creativity comes from spontaneous meetings, from random discussions." When asked by *Fortune* to recount the birth of the iPhone, Jobs said the earliest ideas arose from informal gabbing: "We all had cell phones. We just hated them, they were so awful to use." That "watercooler talk" is the "one part of the iPhone mythology that everyone tends to agree on," author Brian Merchant reports in his book *The One Device.*

MISSING SPARKS

But with today's technology, does optimal interaction really have to be in person? Won't a Zoom meeting work almost as well? No, it won't. We are hardwired from our development as humans to value the physical presence of others. It's deeper than most of us think.

Consider something we're not supposed to do now: shaking hands. Job applicants who shake hands get rated more highly by evaluators than those who don't, even when everything else about them is the same. We judge people who shake hands to be more trustworthy and more competent than those who don't. Shaking hands is literally an electric experience: Brain imaging shows that we energize the region associated with reward sensitivity—that is, we feel rewarded—by shaking hands, or merely by seeing other people shake.

There is a similar physical response when we converse with someone face-to-face. The pupils of our eyes constrict and dilate in parallel with the other person's. Neither of us is aware it's happening, but it builds trust. When we're physically together, we unconsciously mimic one another's posture, gestures, and tone of voice, which builds trust and empathy.

Video is far inferior. Posture and gestures are partly or entirely invisible. People never look each other in the eye; they can't look directly into the screen and the camera simultaneously. In video meetings, you can't turn from one person to face another; everyone is facing the camera. Natural conversational responding, turn-taking, and interrupting become maddeningly awkward.

HIDDEN COSTS

Togetherness is in our deepest nature. "Natural selection mandated us to be in groups in order to survive," Michael S. Gazzaniga, a leading researcher in cognitive neuroscience, has written. Reached recently at his home—his office at the University of California at Santa Barbara is closed—he's feeling the loss of physical presence with others. "In the academic world I get a sense that the excitement and enthusiasm one can gin up on an intellectual question is harder to sustain," he says. "It's humanity influencing the rational thing, and it gets lost on Zoom."

Much of the most revealing work on team performance in the past decade has been conducted by MIT's Alex Pentland, who developed the sociometer badges mentioned earlier. Asked what's being lost as millions of workers remain at home, he says: "The feeling of connection and being a member of a team, and all the incidental conversations and nonlinguistic cues that get people on the same page and aligned, as well as the serendipity that is the source of most innovation."

His outlook for organizations and their people: "Completely standardized tasks work well. You can rely on existing social ties to align people for a while. But that is expiring about end of summer."

Companies adopting large-scale indefinite work-from-home policies will certainly save some money—an important consideration now—and they may get along just fine for quite a while. The downside will accumulate only slowly and will be harder to appreciate fully. What these companies gain can be quantified much more easily than what they lose. But while they may take time to show up on the P&L, the losses could be much greater. ■

THREE WAYS TO STAY CREATIVE WHILE WFH

Physical presence is by far the best foundation for creativity and innovation. But when it isn't possible, teams can still up their game.

1 EXPAND YOUR DIGITAL CONVERSATIONS

Members of the most effective and innovative teams continually connect with people outside their discipline, industry, or location, getting truly new perspectives and ideas. Then they and the rest of the team exchange what they've heard.

2 PAY ATTENTION TO HOW MUCH EVERYBODY TALKS

In meetings of the most effective teams, in person or on video, no one dominates. That practice maximizes interaction and gets lots of ideas on the table.

3 GET PHYSICALLY TOGETHER AT LEAST ONCE IF YOU CAN

That's how trusted relationships and group social norms get established. Research shows that digital interactions can then reinforce them.

PLAYING THROUGH

The **PGA TOUR** has kept up its charitable efforts despite the impact the coronavirus has had on its tournament schedule.

THE PGA TOUR PRODUCES MANY REMARKABLE numbers. Last season, Cameron Champ averaged 317.9 yards per drive. Jon Rahm made 98.42% of putts inside five feet. Aaron Baddeley made 13 consecutive sand saves. But the number the TOUR's most proud of is its all-time charitable donations: $3.05 billion and counting.

Despite the TOUR being forced to take a break and cancel or reschedule 13 weeks of events due to the unprecedented nature of the COVID-19 pandemic, the PGA TOUR and its players stepped up to continue their charitable fundraising efforts. The Charities for Tournaments Relief Fund, for instance, is helping to raise money for communities where the TOUR couldn't compete this season. And with THE PLAYERS getting canceled midstream as the dangers of the novel coronavirus became fully apparent, Florida's First Coast Relief Fund will be the beneficiary of another TOUR endeavor, THE PLAYERS Championship Relief Fund. At a national level, the PGA TOUR Relief Fund is assisting in raising money for coronavirus relief efforts by the American Red Cross and the Center for Disaster Philanthropy. And two high-profile, made-for-TV charity matches, featuring Tiger Woods, Phil Mickelson, Rory McIlroy, and others, raised $25 million for COVID-19 relief efforts during the regular season's shutdown.

"We're extremely proud that the PGA TOUR still has been able to make a positive impact on tournament communities, even if the virus has made us rethink how that can be achieved," said Allison Keller, chief administrative officer for the PGA TOUR. "Commissioner [Jay] Monahan challenged our constituents who rely on us to 'hold us accountable.' We're doing our best to continue our long tradition of giving back."

It's both good business and good philanthropy to communicate one's key charitable efforts, so the TOUR focused its marketing efforts on telling that story. The TOUR's "A Message to Our Fans" campaign features inspirational content created by TOUR players with the theme "We Miss You." Another campaign, "Back on the Tee," celebrates the return of competition with player introductions by athletes, entertainers, and other celebrities. The campaign also includes a rebranding of the "Impact" portion of the TOUR's website (PGATOUR.com/impact); new public-service announcements and banner placements on network television; dedicated radio spots; and fresh digital creative, such as social media overlays and banner ads, to share with internal and external stakeholders.

A key part of the TOUR's strategy this spring centered on its internal "Storytelling Team," which worked throughout the pandemic to collaborate closely with the players as well as tournaments, fans, and sponsors. The resulting "Looking for the Helpers" campaign focuses on showcasing local and personal good deeds, underscoring that nowadays there are no small gestures, and that one person's daily endeavors in his or her community can be as impactful as big dollars.

This proactive outreach to players and partners has yielded a great deal of inspirational content. A few noteworthy examples: Webb Simpson, this year's Waste Management Phoenix Open (WMPO) and RBC Heritage champion, took to Twitter to announce a $1 million emergency assistance donation by the Thunderbirds—the local philanthropic organization that runs the WMPO—to support the Boys & Girls Club, St. Mary's Food Bank, and the Society of St. Vincent de Paul, an international nonprofit dedicated to serving the poor. (This money came on top of the $14 million the February 2020 event raised for the community.) And when the PLAYERS Championship was canceled, veteran pro Billy Horschel, who was scheduled to compete, spent that weekend with his family loading food intended for the tournament into trucks for delivery to the Feeding Northeast Florida food bank.

And dozens of players have followed Horschel's lead by giving back to local communities during the crisis and the pause in tournament play. Four-time major champion Brooks Koepka committed $100,000 through his eponymous charity to support Florida's Community Foundation for Palm Beach & Martin Counties.

"WE'RE EXTREMELY PROUD THAT THE PGA TOUR STILL HAS BEEN ABLE TO MAKE A POSITIVE IMPACT ON TOURNAMENT COMMUNITIES, EVEN IF THE VIRUS HAS MADE US RETHINK HOW THAT CAN BE ACHIEVED."

ALLISON KELLER
CHIEF ADMINISTRATIVE OFFICER, PGA TOUR

Marc Leishman and his wife, Audrey, donated meals to ICU workers via their charity, Begin Again Foundation. And Ryan Palmer volunteered to spearhead Pros for a Purpose (prosforapurpose.org), which encourages players, officials, fans, and the general public to donate money to canceled PGA TOUR tournaments, so that local charities receive at least a portion of their usual grants. In the face of a crisis, it's clear that the TOUR and the pros know how to keep a strong and steady approach.

The coronavirus has impacted people everywhere—and the TOUR proved to be no exception. Veteran pro Nick Watney's positive test, despite a multitude of precautions and protocols, at the RBC Heritage in June, underscored the reach of the virus, as did a handful of positive tests for other players and caddies.

Once again, the TOUR and its players saw an opportunity to give back. At the Charles Schwab Challenge, the TOUR honored 148 frontline workers by including one of their names on each caddie's bib. And when PGA TOUR Latino-américa player Victor Lange was diagnosed with and then recovered from COVID-19, he and the TOUR decided to make it a teachable moment. Lange shared his experience, proper medical protocols, and his future hopes on PGATOUR.com to educate and inspire others.

"We all have to keep cool heads and do what the health professionals are telling us to do, and it's our job to get on top of this and slide down the infection rate and get the society healthy again so we can all get back to doing the things we love to do," Lange wrote. "For me, that thing is golf."

To which all golf fans say: Amen. ■

TOP: FOLLOWING THE CANCELLATION OF THE PLAYERS CHAMPIONSHIP, PGA TOUR PRO BILLY HORSCHEL AND HIS FAMILY WENT RIGHT TO WORK, HELPING LOAD AND DELIVER FOOD INTENDED FOR THE TOURNAMENT TO THE FEEDING NORTHEAST FLORIDA FOOD BANK. **LOWER LEFT:** MARC LEISHMAN AND HIS WIFE, AUDREY, PROVIDED MEALS TO ICU WORKERS VIA THEIR CHARITY, BEGIN AGAIN FOUNDATION. **LOWER RIGHT**: UPON ITS RETURN TO PLAY AT THE CHARLES SCHWAB CHALLENGE, THE PGA TOUR HONORED FRONTLINE WORKERS BY INCLUDING THEIR NAMES ALONGSIDE THOSE OF THE PLAYERS ON THE TOURNAMENT'S CADDIE BIBS.

MICHAEL MALORNY—GETTY IMAGES

COVID-19

It's Time to Hire a Chief Health Officer

Employee safety is taking center stage, no matter what industry you're in. BY ERIKA FRY

ADAM ARON, CEO and president of AMC Theatres, the world's largest chain of cinemas, remembers the early days of the pandemic as a blur. As the novel coronavirus spread around the world, he and his team scrambled to talk with health officials—first in Milan, then in Spain, then pretty much everywhere else the company operated, trying to sort out what to do with its 1,000 or so theaters in the middle of a fast-unfolding global health crisis.

The picture and the pace at which it was changing were dizzying. Over the course of a few days in mid-March, AMC announced plans to fill its theaters to only half capacity; then—prompted by an official's remark on a Sunday morning talk show—AMC limited screenings to groups of 50 or fewer; and finally, on March 16, it closed cinemas altogether.

"We had no experts on retainer internally," says Aron, who admits when it came to understanding epidemiology and infection control and how to factor it into business, he and AMC's senior execs were amateurs. "We were trying to make the best and smartest decisions we could under the circumstances."

Of course, AMC was hardly the only company confronted with big business decisions—and little public health expertise in the C-suite to help make them—when the coronavirus hit.

With no quick or easy end to the pandemic (nor to a host of other public health problems) in sight, figures from both the business and public health worlds say it's time to bridge the gulf that has traditionally separated the two sectors. Some, including Michelle Williams, dean of the Harvard School of Public Health, envision a world where public health considerations are regularly integrated into business plans and where maybe even a new brand of executive, a chief public health officer, has a seat at the table.

"CEOs are now recognizing the primacy of public health," says Williams, who has noticed an unprecedented thirst for knowledge from the business community in recent months. As a jumping-off point, she hosted a series of online symposia and plans to launch a curriculum this fall for business executives to help them understand the foundations of public health and how to apply them in business.

Korn Ferry, the global organizational consulting firm, has also noticed interest from companies in adding health expertise to their leadership teams.

"Health concerns are top of mind for the executives I work with," says Radhika Papandreou, a senior client partner who specializes in the travel, hospitality, and leisure sectors. She notes that the companies she works with have typically had health and safety officers at the property level—say, at an individual hotel or casino—rather than a high-level executive thinking strategically. As a result, large companies had "a very patchwork" response to COVID-19.

"There wasn't a process," says Papandreou, who notes some businesses leaned upon HR officers or formed working groups of leaders across the company to respond to the pandemic; others tried to form partnerships with health institutions like Johns Hopkins. "There hasn't been one person driving the process."

She and her colleagues, early into the pandemic, began holding focus groups to develop a prototype for a corporate chief health and safety officer, a role that would involve mitigating risk of disease spread and promoting health and safety more generally across the organization, says Mindy Kairey, a senior client partner at the firm.

Such a role would not be totally unprecedented in corporate history, says Christy Ford Chapin, an associate professor of history at the University of Maryland Baltimore County. Around the turn of the 20th century, as the second Industrial Revolution ramped up and the progressive era began, American corporations developed "industrial medicine" departments aimed at preventing accidents and stopping the spread of infectious disease. This period coincided with spreading awareness of germ theory, Chapin explains. While business wanted to keep employees healthy for the sake of their operations, they also were looking to counter union power, negative publicity, and calls for regulation, says Chapin, who suspects today's corporations will be similarly motivated to develop more robust public health efforts to avoid bad PR and lawsuits.

Industrial medicine went away with the transition to a more white-collar, service-oriented economy as well as improving public health conditions nationwide. While occupational health and safety departments still exist, they're "just not as big a deal" and often focused on OSHA compliance, Chapin says.

As companies think about how to move forward, Harvard's Williams expects businesses will start to think more broadly about issues such as racism and structural inequality. "I think the chief public health officer brings a lens of assessing the social determinants of health," she says. "They bring modeling and appreciation and understanding of health and social justice to the table where these can inform practices like wage determination."

They would also, of course, help companies make more science-based decisions about reopening. Tyson Foods recently created a chief medical officer position to manage COVID-19 risks. Aron, the CEO of AMC, sought out Williams's counsel in the early stages of the pandemic. She referred him to Joe Allen, a Harvard School of Public Health faculty member and the coauthor of *Healthy Buildings: How Indoor Spaces Drive Performance and Productivity*. Allen, with current and former faculty and graduates, has been advising AMC on issues like air filtration, electrostatic sprayers, and cleaning protocols.

"The only way people are going to go to movie theaters is if people trust operators to run their theaters safely and cleanly," says Aron. "[We needed to] seek out the best experts on the planet to advise us." ■

WELCOME TO THE "CAT BOND" MARKET, WHERE PANDEMICS AND HURRICANES CAN MEAN BIG RETURNS—OR A TOTAL WIPEOUT

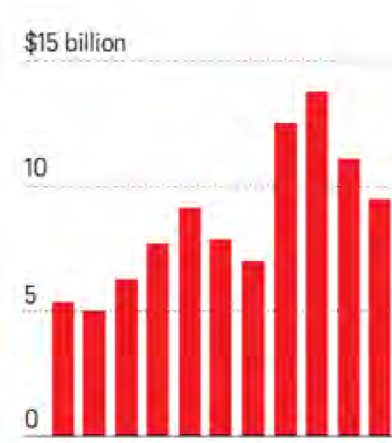
By Jeremy Kahn

MOST INVESTORS view catastrophes such as hurricanes or pandemics as, well, catastrophic. Not so in an obscure corner of the market known as "cat" bonds.

Created in the early '90s after Hurricane Andrew to help insurers and reinsurers hedge risk, they're designed so that if a specific event occurs within a specified time frame, creditors forfeit their principal, which insurance companies use to pay claims. In exchange for taking on that risk, investors earn an unusually high interest rate—between about 7% and 12% for many bonds. They're actually less risky than, say, junk bonds, or many equities, says Shiv Kumar, the CEO of MMC Securities and president of GC Securities, both of which are part of insurance services firm Marsh & McLennan Companies.

So far this year, cat bonds worth $9.2 billion have been sold in 34 different transactions, according to data from tracking firm Artemis. That puts 2020 well on the way to exceed the record $13.8 billion issued in 2018. When it comes to catastrophe, 2020 is certainly one for the books.

YEARLY VALUE OF CATASTROPHE BOND AND INSURANCE-LINKED SECURITIES ISSUED



SOURCE: ARTEMIS.BM


THE GREAT
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BATTERY POWER.
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The FSA 57 is built in the United States with domestic and foreign components.
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FINANCE

Small Bank, Big Money

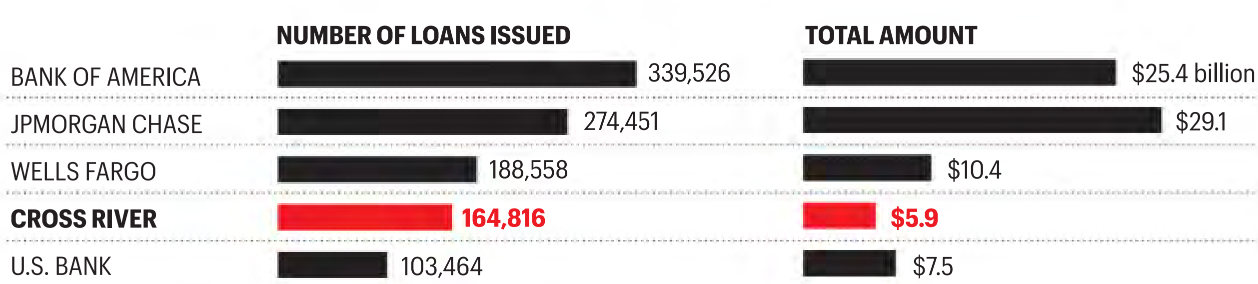
Relatively tiny Cross River punched way above its weight in PPP lending—and shows a way forward for fintechs. **BY JEN WIECZNER**

JUST AS THE GREAT RECESSION changed the makeup of Wall Street's powerhouses, the pandemic has also given rise to new financial heavyweights. When the U.S. Treasury released data on its small-business rescue package, the Paycheck Protection Program, we also got a look at the banks that have had the biggest hand in doling out the money. The top PPP lenders are the usual suspects: JPMorgan Chase has made more than $29 billion in loans to some 274,000 businesses, while Bank of America has loaned more than $25 billion to nearly 340,000 borrowers.

Not far behind, though, punching far above its weight, is a little-known New Jersey institution called Cross River Bank. A community bank with only $2.5 billion in assets, Cross River has made nearly $5.9 billion in PPP loans to about 165,000 businesses, making it the fourth-top lender by number of loans, just behind Wells Fargo, and 12th in dollar terms. In the past few months, Cross River—which has just a single brick-and-mortar branch—has managed to make more PPP loans than behemoths like U.S. Bank, lending more money than Citizens Bank and BMO Harris. Citi—whose assets dwarf Cross River's nearly 900 times over—didn't even make the top 15 lenders: It disclosed in July that it had made about $3.4 billion in PPP loans.

Until recently, Cross River was known for being the bona fide bank behind fintech companies such as cryptocurrency firm Coinbase, payment processor Stripe, and consumer financing lender Affirm. In all of last year, Cross River made just $50 million in Small Business Administration–backed loans.

TOP PPP LENDERS



SOURCE: U.S. SMALL BUSINESS ADMINISTRATION

To scale up its small-business lending quickly after the government unveiled the PPP in March, Cross River turned to other fintechs to originate even more loans. That turns out to be a more efficient way to serve lots of small businesses than just lending under your own banner, particularly in a pandemic. After building a platform to automate PPP loan applications in less than 10 days, Cross River could then partner with more fintechs—now more than 30 in total—to funnel in their customers who wanted the stimulus funds, from nonbank lending companies like BlueVine and Kabbage to payroll software company Gusto. Its largely automated application portal welcomed many businesses overlooked by bigger banks: Cross River's average loan size is less than $36,000—by far the tiniest figure among the top bank lenders. "PPP demonstrated that fintech is the great equalizer," says Phil Goldfeder, Cross River's senior vice president of public affairs.

Moreover, Cross River's example may be a bellwether of what the future of finance and lending looks like. Whereas a Citi spokesperson blamed its relatively minor PPP lending on the fact that it has fewer than 700 U.S. branches—"and small businesses are typically served through branches"—the Cross River and fintech model throws that out the virtual window. Digital players can acquire customers nationally through slick technology and partnerships.

That new paradigm is fueling the next generation of fintechs—such as Rocket Mortgage, whose parent company just filed for an IPO. "It's a totally different model in terms of how financial services scale," says John Pitts, head of policy for Plaid, which powers the data connection between fintech companies and banks, including Cross River. "They're not going to be tethered to geography."

GLOBAL TECH

Walking a Tightrope in Taiwan

Taiwan Semiconductor Manufacturing Co. has attained global dominance by making chips for tech titans in both the U.S. and China. Will an escalating trade war end its reign? **BY EAMON BARRETT**

WHAT A DIFFERENCE two months can make. In May, Taiwan Semiconductor Manufacturing Co. (TSMC), the world's largest chipmaker, lost the business of Huawei Technologies—its biggest Chinese customer and the source of 13% of its revenue—as a casualty of geopolitical jockeying between superpowers. But TSMC shareholders took the loss

An engineer transports silicon wafers at a Taiwan Semiconductor "fab" in Hsinchu, Taiwan.

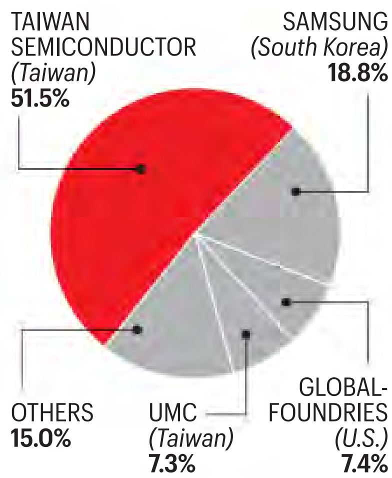
COURTESY OF TSMC

in stride. And by late July, after a stumble by rival Intel (see the accompanying story), TSMC's stock had risen almost 50% since May, making it one of the world's 10 most valuable companies.

May's low and July's high have something in common: They both reflect TSMC's distinctive role in the global tech economy. Although far from a household name, TSMC controls roughly half of the world's contract chip manufacturing. Brand-name companies that design their own chips—most notably Apple—rely on TSMC's world-class production so they don't have to spend tens of billions to build their own factories. Crack open your iPhone and you'll find a chip from TSMC. If you could crack open an American guided missile, you'd likely find one there too. Its prowess has elevated TSMC to No. 362 on the Global 500, with $35 billion in revenue. Today it gets 60% of sales from the U.S. and about 20% from mainland China.

But TSMC's central place in the silicon ecosystem makes it particularly sensitive to the counterpunches of Sino-American trade tensions. As relations between China and the U.S. deteriorate, each is determined to insulate its supply of semiconductors from attack by the other—which means redefining their relationships with TSMC. As the chipmaker charts its course between the antagonists, the stakes

CHIP FOUNDRY MARKET SHARE, Q2 2020



SOURCE: TRENDFORCE

for both countries and the broader tech industry are substantial.

"Semiconductors are such a big weapon because they're one of the clearest choke points in the global technology trade," says Matt Sheehan at MacroPolo, the Paulson Institute's China-focused think tank. "There are good substitutes to a lot of other tech, but there's not a good substitute for TSMC."

Still, being irreplaceable doesn't make a company invulnerable. TSMC chairman Mark Liu admits to *Fortune* that trade headwinds are creating headaches. "Our work relies on the free flow of knowledge and the free flow of trade," he says, "which has no doubt been suppressed."

FOUNDED IN 1987, TSMC initially provided overflow capacity to chipmakers like Intel that had their own foundries or "fabs." When demand for chipsets boomed in the 1990s along with personal computers, TSMC's revenue soared as it served "fabless" U.S. companies like Nvidia and Qualcomm. But the company's biggest breakthrough came in 2011, when it began partnering with Apple. Apple now accounts for roughly 23% of TSMC's business, and TSMC is the sole manufacturer of processors for iPhones and iPads.

TSMC was attractive to Steve Jobs' juggernaut in part because of its reputation for protecting intellectual property. Apple and its previous chip manufacturer, Samsung, were exchanging bitter lawsuits over alleged IP theft when TSMC entered the scene. According to Richard Thurston, who served as TSMC general counsel from 2002 until 2014, Apple audited TSMC's trade-secrets protocols and found "we were doing things even they weren't doing."

At TSMC, employees, customers, and suppliers all sign nondisclosure agreements. The company's 16 manufacturing sites in Taiwan are firewalled from each other, preventing hackers from finding a singular point of access. Even low-tech theft is heavily guarded against. In some fabs, printer paper is lined with metallic strips that activate airport-style gate sensors at the exits if an employee tries to leave with notes in a pocket.

The company also has a reputation for flawless execution. Each semiconductor contains billions of transistors; for the chip to work, each transistor needs to be made perfectly. Although the manufacturing equipment TSMC uses is available commercially, the processes TSMC developed to utilize it are virtually inimitable. Philip Wong, vice president of corporate research, puts it this way: "I could buy the same tennis racket as Serena Williams, but I'm not going to play as well as her."

China would dearly love to up its game. TSMC is China's biggest contract supplier, making chips for the likes of smartphone giant Xiaomi, computer manufacturer Lenovo, and electric-vehicle makers. Recently Beijing has accelerated its push for silicon independence. China's Semiconductor Manufacturing International Corp. (SMIC), a company founded in 2000 with gov-

"I COULD BUY THE SAME TENNIS RACKET AS SERENA WILLIAMS, BUT I'M NOT GOING TO PLAY AS WELL AS HER."

PHILIP WONG, VP, CORPORATE RESEARCH, TSMC ernment support, secured $2.5 billion in state funding this May and raised another $6.6 billion in July through a share offering in Shanghai. But SMIC's technological capabilities remain generations behind TSMC's. So do its sales: In 2019, SMIC had revenue of roughly $3 billion, while TSMC sold $7 billion worth of chips in mainland China alone.

Without a cutting-edge chip manufacturer, China's tech economy remains vulnerable, and this spring the U.S. exploited that vulnerability by severing TSMC from Huawei, the telecom equipment manufacturer. The White House has long pressured allies and companies to block Huawei's development, arguing that Huawei can intercept sensitive data with its communications gear and share it with China's government. (Huawei has denied that it would do so.) In May, the U.S. Commerce Department issued a regulation that effectively prohibited TSMC from selling chips to Huawei if it wanted to keep doing business with U.S. firms; TSMC obliged.

The timing of the Huawei ban was intriguing. Just hours before it was issued, TSMC had announced it would invest $12 billion in building a fab in Arizona. Alex Capri, a visiting senior fellow at the National University of Singapore, sees that plant as "a concession," with TSMC expanding production in the U.S. to gain political leverage in Washington.

Leaders in Beijing may have seen it that way too. They sent fighter jets to buzz Taiwan's airspace a total of eight times in June, upping the pressure on TSMC's home base—an island the Beijing government claims sovereignty over. The flyovers were a sobering reminder that an escalating Trump-vs.-China trade war could result in something hotter. A major disruption of TSMC's fabs would have enormous ripple effects in tech—not least, jacking up the price of an iPhone.

But for now, investors seem to be betting that TSMC will be buoyed by the giants on either side of the Pacific whose chips it has built for so long. "Huawei is one big customer, of course," says Liu, "but we have 499 customers." ■

WHAT THE HECK IS HAPPENING AT INTEL?

THE COMPANY'S LATEST PRODUCT DELAYS ARE SHAKING UP THE CHIP INDUSTRY. BUT INTEL'S DESIGN PROWESS COULD STILL HELP IT STAY ON TOP. **By Aaron Pressman**

IT WAS, as Yogi Berra used to say, déjà vu all over again when Intel reported earnings in July.

At first glance, the news looked good, even very good: Second-quarter revenue jumped 20% year over year, to almost $20 billion, and profits did even better. But hiding in plain sight at the top of Intel's news release was quite the line: "7nm product transition delayed versus prior expectations."

That short sentence about tiny transistors ("nm" stands for "nanometer") sent fund managers leaping to sell their shares, execs at PC makers grabbing for their Rolaids, and likely more than a few folks at rival Advanced Micro Devices popping Champagne corks. (Within a week, Intel's stock was down 21%, while AMD's was up 31%.)

The reaction reflected memories of bad news past. In July 2015, then-CEO Brian Krzanich announced that Intel's move to 10 nanometers was behind schedule. Flash-forward to 2020: We're still awaiting some of those products, while Krzanich is long gone, replaced by his former CFO, Bob Swan.

Swan promised only short delays. But his announcement shed light on other unsettling recent events at Intel, including Apple's decision to dump Intel chips from its Mac computers and the departure of star designer Jim Keller. More turmoil followed the 7nm bombshell, as two top engineering executives left the company.

The success of the tech industry has relied on chipmakers' ability to cram more and more transistors on a silicon wafer. (The principle, first highlighted by Intel cofounder Gordon Moore in 1965, is known as Moore's Law.) It's what has enabled computers to go from the size of a house to tinier than a smartwatch.

But Moore's Law has slowed down as companies push transistors to ever-smaller scales. The 7nm scale Intel was aiming for is about 1/10,000th the width of a human hair. The processor in Apple's iPhone 11, made at 7nm scale by Taiwan Semiconductor, fits 8.5 billion transistors on a chip smaller than a dime.

Swan upended 50 years of Intel tradition when he revealed that its contingency plan, if delays worsened, was to outsource manufacturing to rivals. That's a shift with unpredictable consequences. "We see an enormous number of risks to successfully pull it off," noted Bernstein tech analyst Stacy Rasgon. But if Intel can't be the best chip manufacturer, it could still be the best chip designer—and outsourcing may ultimately save its market share.

SHARE PRICE CHANGE IN U.S. DOLLARS JULY 23–30

INTEL
-20.6%

TSMC
+13.9%

MARKET VALUE AS OF JULY 30

INTEL
$204 B

TSMC
$383 B

SOURCE: BLOOMBERG


WE ARE BEING TESTED.
AND WE WILL TEST BACK.
This virus is testing us—and testing people on the front lines most of all. Abbott is getting new tests into their hands to deliver the critical results they need. And until this fight is over, we will never quit. Because they never quit.
Abbott

LOGISTICS

Future Bound and Hammer Down

An electric revolution is coming to American trucking—and for some, the opportunity to claim a crucial piece of the U.S. economy is too good to pass up. BY DAVID Z. MORRIS

Nikola's Two (left) and Tre hydrogen-electric semitrucks. The company also hopes to create a global hydrogen-fueling network.

THE VIDEO WAS candid, narrow, shaky, and without fanfare—its first frames capturing not much more than asphalt. But in the span of 14 minutes, Trevor Milton, the founder and executive chairman of Nikola Motor, a Phoenix startup committed to making electric semi-trucks, energized investors enough to send his company's stock up 35% in a single day.

The clip reveals a hydrogen fuel-cell electric semi rolling around a blisteringly hot Arizona parking lot. Milton jogs after the truck on foot, pointing out the various components of its unusual powertrain and swiping at critics who believe the company's technology is fake.

"These damn trolls," he says between gulps of air. "I wonder if they're going to go apologize to everyone for the lies they spread."

Founded in 2014, Nikola is named after famed 19th-century inventor Tesla (just like that other controversial electric-vehicle concern). Though Nikola has yet to deliver a single truck to a customer—hence the critics—investors have valued the company at as much as $20 billion.

The tech world, it seems, has a growing fascination with trucking. Entrepreneurs, and the investors backing them, are convinced that replacing greenhouse gas–spewing diesel semis with cleaner electric versions is a huge opportunity to make a profit while also making the world a better place.

"There's a lot of hype and excitement," says Ben Hartford, a Baird equities analyst focused on logistics.

The American Trucking Associations like to say that the industry is the lifeblood of the U.S. economy, and they have a point. Freight trucks carry nearly 73% of all cargo transported in the U.S. But those vehicles are still overwhelmingly powered by fossil fuels. Medium- and heavy-duty trucks account for about 6.4% of all U.S. greenhouse gas emissions, according to the U.S. Environmental Protection Agency.

To cut their contribution, truck operators

COURTESY OF NIKOLA

"ONCE BATTERY PRICING COMES DOWN AND RANGE INCREASES, WE THINK THERE WILL BE A COST BENEFIT TO RUNNING ELECTRIC."

would need to spend lots of money on less polluting trucks. A firm nudge came in June with a new California regulation requiring that, beginning in 2024, at least 5% of medium- and heavy-duty trucks sold in the state produce zero emissions. (The share jumps to 30% in 2030, then 100% by 2045. Short-haul trucks, used to deliver cargo between ports, rail yards, and warehouses, are subject to an even more aggressive timetable.) Since the state is uniquely influential in this area—a dozen states have adopted California's motor vehicle emission regulations—pressure could quickly build for truck operators.

Regulation isn't the only factor driving electrification. Elon Musk's Tesla, which has promised to deliver its own electric semi in 2021, says a battery-electric truck costs about half as much to fuel per mile as its diesel counterpart. Maintenance costs for electric trucks are also expected to be lower because they have fewer moving parts.

The upstarts face a stiff challenge from established truckmakers. Toyota, the world's largest automaker by sales, and Paccar's Peterbilt, the No. 2 semi manufacturer behind Daimler-owned Freightliner, have publicly committed to a zero-emissions trucking future. Renault already produces medium-duty battery-electric trucks in Europe. In the U.S., Volvo and Freightliner have put dozens of electric trucks on the road for testing. Like Nikola and Tesla, the goal is to start selling them next year.

"How does it integrate into a fleet? How does the charging work? We're trying to figure out the practical things," says Keith Brandis, a Volvo business development executive.

Midsize trucking and warehouse operator NFI Logistics has been operating 10 Freightliner electric trucks in California for nearly a year as part of a pilot program. NFI will soon add trucks from Volvo's program, dubbed Lights, which deployed its first test trucks in June. Bill Bliem, head of fleet services at NFI, says his company's top motivator in leading the electric-trucking charge is its commitment to sustainability. But he admits competitiveness is also a factor.

"We're hoping that battery pricing will come down and range will increase," says Bliem. "Once that happens, we think there will be a cost benefit to running electric."

In their present form, electric trucks have a key shortcoming: limited range versus their diesel counterparts. Tesla, for example, says its top-range model will go 500 miles on a single charge, compared with 800 miles for a diesel truck on one tank of fuel.

So electrification is happening first on short-haul routes. NFI is using its Freightliner test trucks to deliver cargo from the ports of Los Angeles and Long Beach to its warehouses east of L.A., a 100-mile roundtrip.

The cost advantage for hydrogen-electric trucks, like the Nikola Two model in Milton's video, is less clear. Refueling with liquid hydrogen is quicker than recharging a battery, and hydrogen can carry more energy for its weight than a battery—more practical for long-haul trucking. But liquid hydrogen fuel, which is produced by using electricity to split water into oxygen and hydrogen, is generally more expensive than charging batteries directly.

Speaking of expensive: Nearly everyone agrees that electric trucks will cost more than diesel semis, which can go for as much as $150,000. So far Tesla is the only manufacturer to have hinted at pricing, saying its electric trucks will start at between $150,000 and $200,000. Other manufacturers are expected to charge more because Tesla is believed to be producing batteries for less than its competitors.

Nikola plans to use a different business model for its hydrogen fuel-cell semis. Instead of selling trucks, it plans to lease them as part of a package that includes hydrogen fueling and maintenance.

And then there's the cost of building new charging stations—necessary when it can take several hours to recharge a large truck battery. While some states, e.g., California, offer

BY THE NUMBERS

April 2020 Class 8 (semi) U.S. sales:

DAIMLER	38.1%
PACCAR	30.4%
VOLVO	15.9%
NAVISTAR	15.5%

Notes: Daimler makes the Freightliner and Western Star brands; Paccar, Kenworth and Peterbilt; and Volvo, Volvo and Mack.

SOURCE: WARD'S

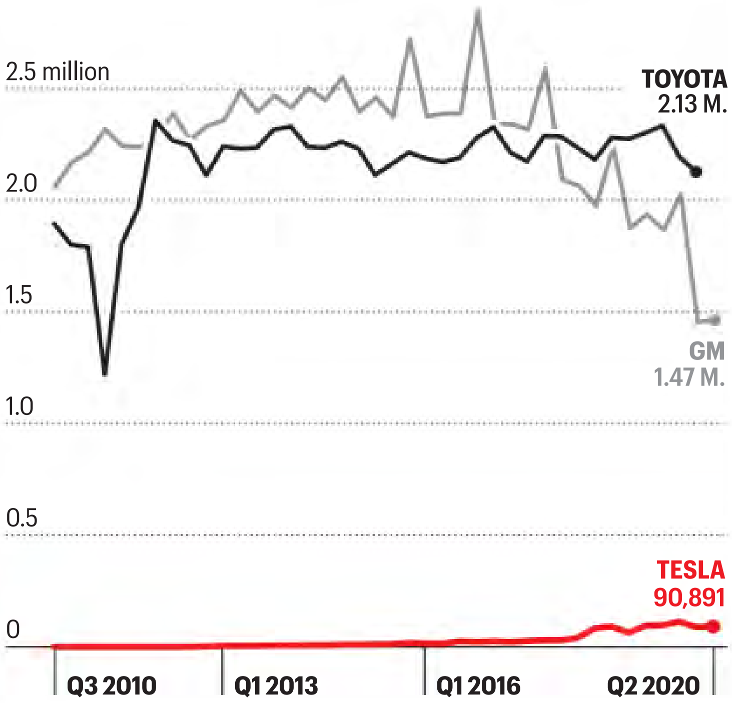
grants to soften the financial blow, others do not. "We've got customers that want us to run electric in the Northeast," Bliem says. "But unfortunately those states right now do not have the funding where it would make sense to run even one electric tractor—if you could get one."

That's a dealbreaker for many operators. Of an estimated 1.9 million U.S. trucking firms, as many as 94% have fleets of 20 trucks or fewer. Moreover, roughly 9% of all truckers are independent owner-operators who drive a truck they own. Smaller operators just can't afford the sizable investments it would take to go electric, says Glen Kedzie, who leads energy and environmental policy issues at the American Trucking Associations.

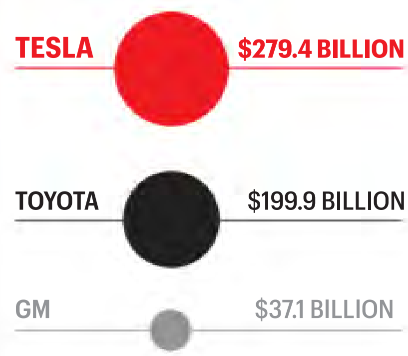
Though operators have years before they're forced to give up diesel trucks, the market dynamics of electrification are already falling into place. "You start to raise the barriers to entry for the smallest carrier," says Baird's Hartford. Next stop: consolidation of a fragmented industry.

Provided your startup isn't trying to upend it, that is. Nikola's Milton says he understands the skepticism about his company's chances but points out that carmakers said the same thing about Tesla early on. "Now Tesla is worth more than most of them combined," he says. "We don't mind being the underdog." ■

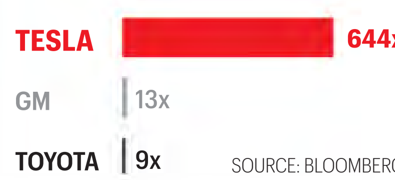
GLOBAL QUARTERLY VEHICLE SALES



MARKET CAPITALIZATION
AS OF 7/29/20



P/E RATIO LAST 12 MONTHS



SOURCE: BLOOMBERG

TESLANOMICS:

HOW MANY VEHICLES MUST THE ELECTRIC-AUTO MAKER SELL BEFORE IT CAN JUSTIFY BEING THE WORLD'S MOST VALUABLE CAR COMPANY?

By Andrew Nusca and David Z. Morris

You could practically see Elon Musk smile. On July 1, after an impressive rally of its stock price, Tesla—the 17-year-old electric-car company for which Musk serves as CEO—became the world's most valuable automaker, worth an eye-watering $209 billion. Barely a month later, it's worth $279 billion—more than quadruple the combined value of American icons General Motors and Ford, even though the California company sold just 4% of the vehicles the Detroit duo did last year.

How substantial must Tesla's actual sales be to meet its investors' outsize expectations? We asked Joe Osha, a JMP Securities analyst who specializes in energy and industrial tech—and a frequent Tesla bull—to show his math. By his calculation Tesla needs to sell 2.5 million vehicles per year, or almost seven times what it managed last year, by 2025 to justify its lofty valuation.

How did Osha arrive at that number? The analyst estimates that the global EV market—of which Tesla controls nearly a third today—will represent 6 million vehicles per year by 2025, or about 8% of the total global vehicle market. If a substantial share of the EV market goes to low-cost Chinese vehicles, he says, that leaves upwards of 4.5 million units to Tesla and its peers. Osha believes Tesla will capture the lion's share of this portion—2.5 million per year—because "they're ahead of the competition on product."

Tesla, of course, requires the production capacity to support that kind of output. The automaker itself says its factories in Berlin (under construction), Shanghai, and Fremont, Calif., will support 1.1 million vehicles by the end of 2021. But Osha believes that "continued expansion to 2.5 million units is plausible even if we don't have specific locations or plans" for new factories.

In the meantime, Osha says Tesla's Ebitda margin will reach 20% (including stock-based compensation—about 2% for Tesla) by 2025, requiring a GAAP gross margin between 21% and 25%. The company's current gross margin—21% in its latest quarter—includes factory depreciation, labor, and materials; Osha believes it will improve with modest economies of scale.

Add it all up using the ubiquitous 20X Ebitda multiple, and Tesla will be an automaker worth somewhere in the ballpark of $400 billion in 2025, Osha says—or about $300 billion today, taking risk and opportunity cost into consideration.

"Tesla may or may not end up as successful as we think it will be," he says. "But this company went from barely existing to selling half-a-million units a year. It should be valued like a growth company."

Expanding Global Opportunities for the State-Owned Enterprise

Shenzhen Investment Holdings Co., LTD. strives to serve technological innovation and industry development in China and beyond.

"Our mission is to gather innovation resources, foster emerging industries, and serve the modern cities of China. Ultimately, we seek to create value for our society."

WANG YONGJIAN
CHAIRMAN
SHENZHEN INVESTMENT HOLDINGS CO.

SINCE ITS FOUNDING IN 2004, Shenzhen Investment Holdings Co., LTD. (SIHC) has risen to exemplify the success of China's state-owned enterprise (SOE) reforms. SIHC has set itself apart from singularly focused companies by building an ecosystem comprised of three connected industry clusters: Its financial services cluster offers comprehensive financial services for innovative technology companies; its science and technology parks cluster provides office space for entrepreneurs and businesses; and its emerging and high-end service industries cluster is dedicated to investing in technological advancements.

"Our mission is to gather innovation resources, foster emerging industries, and serve the modern cities of China," says Wang Yongjian, chairman of SIHC. "Ultimately, we seek to create value for our society."

Since the beginning of the COVID-19 crisis, SIHC has served the public welfare in several ways. For one, the company has granted relief loans and liquidity support to a large number of small- and medium-size enterprises. It has also significantly cut prices and lowered rents in its industrial parks. And it has leveraged its supply chain resources to deliver medical supplies and basic necessities across China.

The persistence of a pandemic coupled with the trend of a global economic slowdown creates a challenging environment for international business. With that in mind, SIHC plans to execute a global growth strategy while managing risk.

"China is vigorously deepening its financial reform," says Yongjian. "A new round of financial opening up will help to attract international capital, talents, and other resources, and it will also enable us to build a tech-enabled financial investment holding platform and accelerate international development."

It's no coincidence that SIHC first made its mark in Shenzhen, China's high-tech epicenter and the birthplace of its SOE reforms. The holding company has already introduced nearly 1,000 innovative enterprises and organizations within Shenzhen Bay's science and technology parks, and it has taken the lead to push ahead with key national projects, such as the Shenzhen–Hong Kong Science and Technology Innovation Cooperation Zone.

"As a *Fortune* Global 500 company, we seek to transform into a competitive, innovative, and influential global corporation, to support technological innovations and business growth outside of Shenzhen and beyond China," says Yongjian. "We will continue to deliver satisfying results to our shareholders, business partners, clients, and the general public."

DESIGN

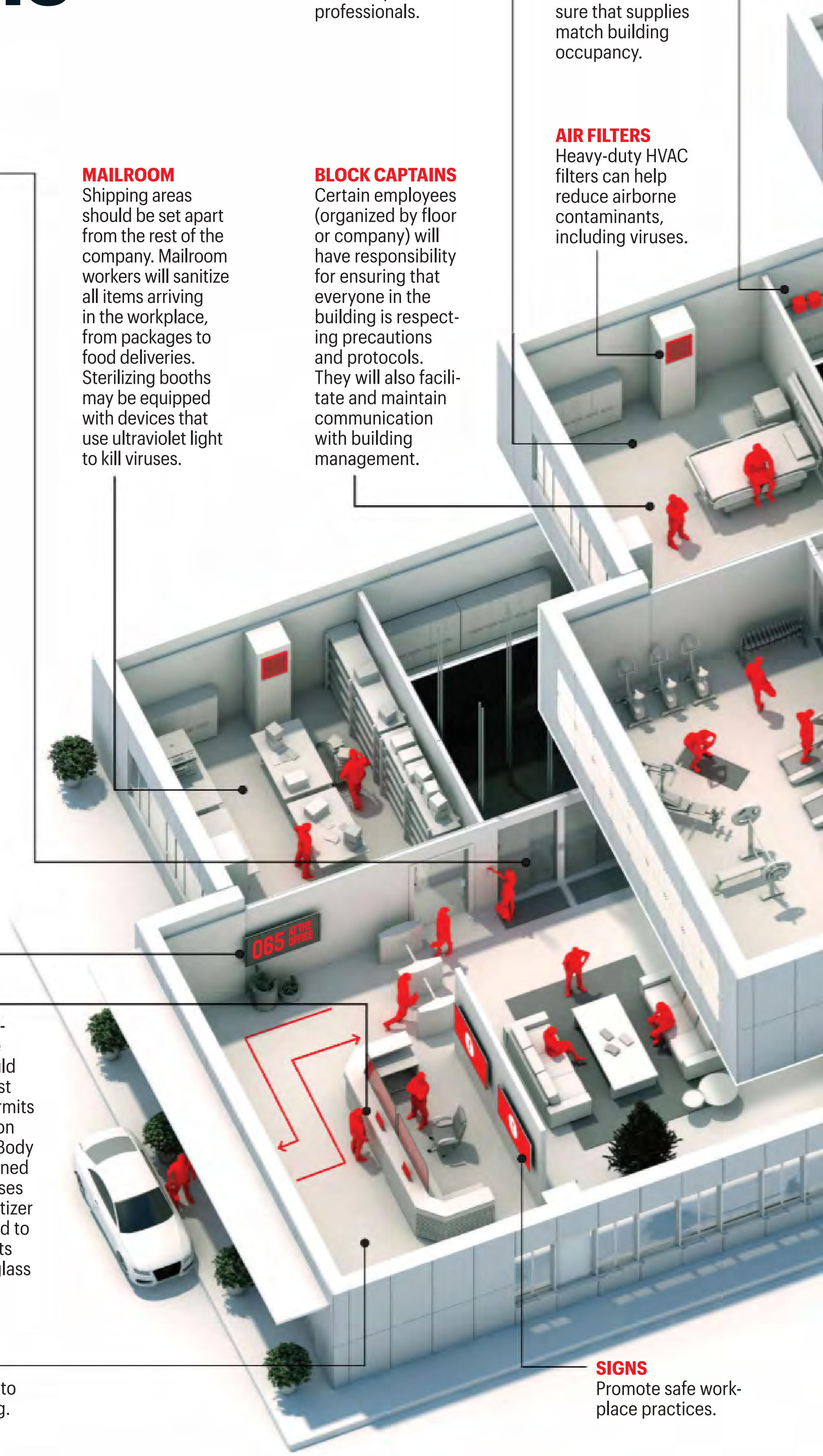
Reimagining the Office for the Pandemic Era

The days of crowded collaboration spaces are long gone. What else is changing? Here's a preview.

INFOGRAPHIC BY NICOLAS RAPP

FOR MANY OF US, the old reality of trekking to work at an office every day has begun to feel like a distant memory. Months of working from home—necessary to stem the spread of the coronavirus—have forced us into new routines. And the idea of going back to our desks feels a little scary—literally. In a recent poll by consulting firm Korn Ferry, 50% of respondents said they were afraid to return to their offices. As more companies experiment with reopening, there is mounting pressure to convey a sense of safety to employees. That is spurring a reimagining of the workplace in the pandemic era. "Right now, to start to bring people back to the office, it's all about reorienting circulation and reorganizing space," CEO Andrew Cogan of office and home design firm Knoll recently told *Fortune*.

To better understand what the new office experience might be like, we studied the latest guidelines from commercial real estate firms such as Cushman & Wakefield and CBRE Group. What's out: crowded open-office work areas and collaboration spaces, touching door handles, and communal coffee machines. (Getting your caffeine fix pre-commute will be key.) What may be in: density monitoring, to limit the number of employees in the office on a given day; going to meetings from your desk via videoconference; heavy-duty air filters; and interior design elements, such as new carpeting, that help reinforce social distancing. —*Brian O'Keefe*



ISOLATION ROOM
A specific enclosed room should be designated to isolate any person who experiences symptoms of an illness. A "quarantine marshal" will coordinate the response and notify medical professionals.

PPE STOCKS
Offices should obtain, store, and manage supplies of all required personal protective equipment (PPE). And keeping a careful inventory of cleaning materials is critical to ensure that supplies match building occupancy.

AIR FILTERS
Heavy-duty HVAC filters can help reduce airborne contaminants, including viruses.

ELEVATORS
Elevator attendants manage flow and prevent overcrowding of carriages. Floor stickers establish distancing zones and describe where to stand. There should be ongoing cleaning of high-touch surfaces such as buttons.

MAILROOM
Shipping areas should be set apart from the rest of the company. Mailroom workers will sanitize all items arriving in the workplace, from packages to food deliveries. Sterilizing booths may be equipped with devices that use ultraviolet light to kill viruses.

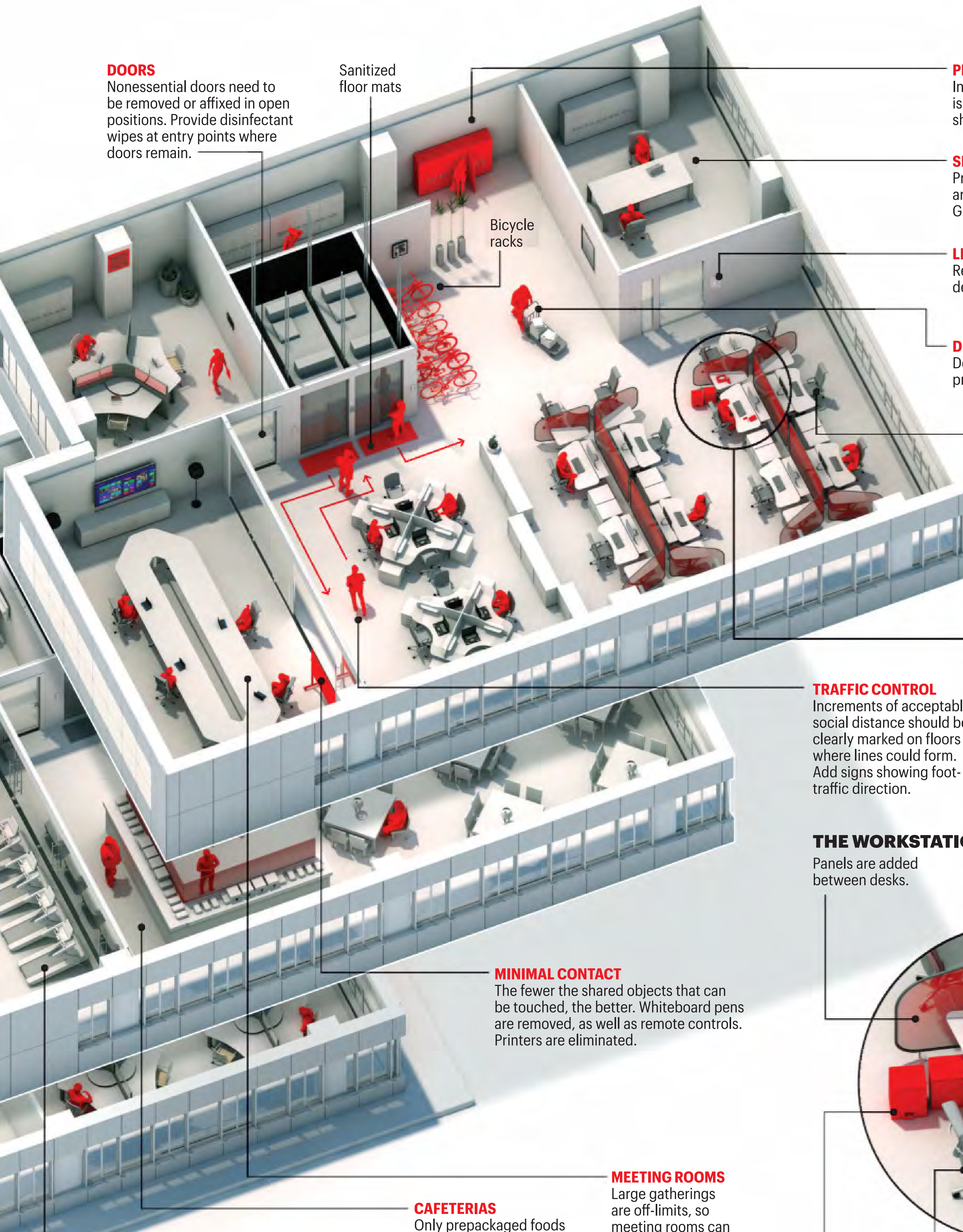
BLOCK CAPTAINS
Certain employees (organized by floor or company) will have responsibility for ensuring that everyone in the building is respecting precautions and protocols. They will also facilitate and maintain communication with building management.

DENSITY MONITORING
Sensors are used to track how many people are using common spaces. Dashboards at entries display attendance. Workers may use an online reservation system to see how many people will be in each day.

RECEPTION
To control and monitor access, only one entrance point should be used. A new guest check-in system permits touchless registration using a cell phone. Body temperature is scanned to filter potential cases of illness. Hand sanitizer and PPE are provided to guests. Receptionists are protected by a glass partition.

WAITING AREA
Chairs are removed to discourage lingering.

SIGNS
Promote safe workplace practices.



DOORS
Nonessential doors need to be removed or affixed in open positions. Provide disinfectant wipes at entry points where doors remain.

Sanitized floor mats

Bicycle racks

PERSONAL EFFECTS
Individual storage for clothes is provided. Nonessential items should not be stored at desks.

SMALLER ROOMS
Private offices and small spaces are for single-occupant use only. Groups are prohibited.

LIGHT SWITCHES
Remain always on or movement detectors are used.

DELIVERY CLERKS
Deliver sanitized mail as well as pre-requested office supplies.

DISTANCING
Workers should sit only at every other desk. The alternate desks should be off-limits or removed altogether.

TRAFFIC CONTROL
Increments of acceptable social distance should be clearly marked on floors where lines could form. Add signs showing foot-traffic direction.

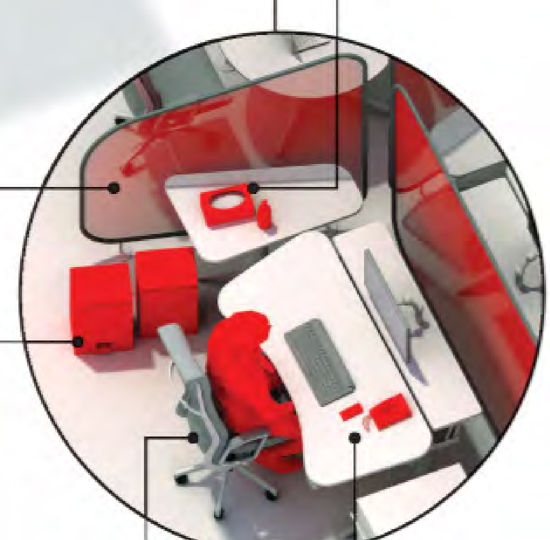
MINIMAL CONTACT
The fewer the shared objects that can be touched, the better. Whiteboard pens are removed, as well as remote controls. Printers are eliminated.

MEETING ROOMS
Large gatherings are off-limits, so meeting rooms can be converted to host workstations and desaturate existing open spaces. Use of virtual collaboration tools such as videoconferencing is encouraged, even for those physically present in the office.

CAFETERIAS
Only prepackaged foods should be offered. Plexiglas dividers separate service providers and diners. Queuing areas need clear signage, and self-service should be avoided. Coffeepots are removed. Furniture is rearranged to promote social distancing.

HEAVY-USAGE AREAS
Determine which areas require thorough and more frequent cleaning owing to heavy usage, such as office gyms, conference rooms, and restrooms. If fitness facilities are reopened, the equipment should be rearranged to achieve social distancing; wearing masks is required.

THE WORKSTATION



Panels are added between desks.

Workers receive disposable wipes to clean their own work surface as well as disposable place mats.

No-touch trash cans as well as PPE-specific trash cans are provided.

Fabric-upholstered chairs should be replaced with easily cleaned plastic chairs.

There's no borrowing of phones or any desk equipment. Use of mobile phones is encouraged.

MARILYN VOLAN—GETTY IMAGES

INVEST

Real Estate Heads for Gain—Then Pain

These five forces will shape the overall market during the pandemic—and for the months and years to come.

BY SHAWN TULLY

IN HIS 17 YEARS as a Seattle real estate broker, Sam Mansour had never witnessed a marvel to match the shopping frenzy that took flight in the first days of reopening. "We were shut down by shelter-in-place orders in early March," recalls Mansour. "When we returned to work, we saw a surge in buyers that continues, with no end in sight. Many customers have condos in the city, but now both husband and wife are working at home, so to get more space and enjoy a backyard, they're buying second homes. On top of that, we have young renters who are rushing to buy because rates are so low." He's putting roughly 10 houses into contract a month, compared with seven this time last year, and his customers are paying record prices—around 8% more for the same ranch or colonial as in 2019.

This housing boom that Mansour sees building in Seattle exemplifies the trend that's sweeping the country from Austin to Jacksonville, from Raleigh to Portland, Ore. In an America where the COVID-19 pandemic has tripled the jobless rate since February, to 11.1%, and caused the deepest sudden drop in GDP since the Great Depression, it would seem to be a giant—and astounding—piece of positive economic news. "The single-family housing market is going gangbusters, though some areas are hurting," says Ed Pinto, the former chief credit officer at Fannie Mae who heads the American Enterprise Institute's Housing Center. On average, prices are rising 7% to 8% nationwide over this time last year, and they're notching new records by the week. At the same time, data from April shows an alarming spike in mortgage delinquencies.

This scenario—where the economy is tanking while housing romps—makes it an unusually confusing moment to weigh whether it's a good or bad time to buy or sell a home. Brokers like Mansour, as well as economists looking at the broad macro picture, such as Yale's Robert Shiller, see several trends emerging. Mansour reckons that 30% of his buyers are families either selling their city condos or purchasing second homes, and most of that demand is new. And Shiller tells *Fortune:* "What strikes me out of the whole coronavirus experience is that the pleasure of living in a nice city is diminished by the fear of being close to other people. That appears to be causing an outflow to the suburbs and far-flung places even beyond the suburbs."

Most experts say in

the near term they're expecting to see drops in big cities like L.A. and New York, and declines in Detroit, a metro with persistently high unemployment and low incomes. According to Pinto, sections of south and southeast Cleveland and the South Side of Chicago, encompassing around 20% of their respective populations, will also get hit. These areas have a high proportion of low-paying service jobs and will likely suffer from elevated unemployment rates that will last a lot longer than for the nation as a whole, driving down prices. Miami, Phoenix, and Las Vegas, heretofore flourishing cities thrown into recession by vanishing dollars from tourism and vacationers, will see prices fall. Because those declines will be counterbalanced by gains in the Sunbelt areas that will keep roaring, it's hard to predict how much prices will fall nationwide, if they fall at all.

Research firm CoreLogic takes a pessimistic view, forecasting a decline of 6% on average nationwide in the next 12 months. "We were surprised at how quickly a V-shaped recovery happened, post the stay-at-home orders," says Selma Hepp, an economist at CoreLogic. But timing a market characterized by temporary demographic shifts, pent-up demand, record-low rates, and prices that don't match up with economic reality is an extremely tricky recipe. Here's everything we know about the current forces being brought to bear on markets across the country.

"WHAT STRIKES ME OUT OF THE WHOLE CORONAVIRUS EXPERIENCE IS THAT THE PLEASURE OF LIVING IN A NICE CITY IS DIMINISHED BY THE FEAR OF BEING CLOSE TO OTHER PEOPLE." ROBERT SHILLER, YALE

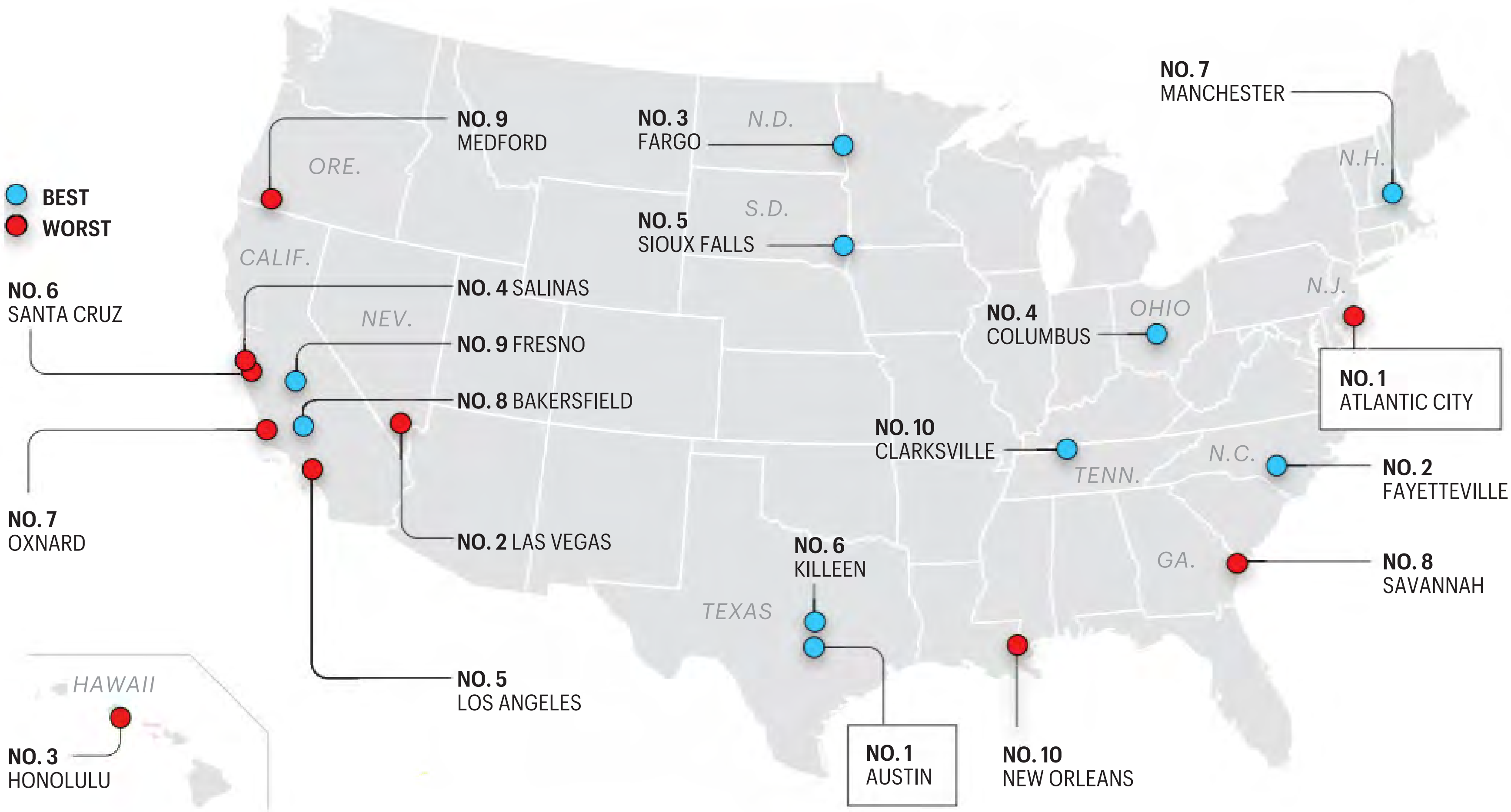
PENT-UP DEMAND

To see just how much demand built up during the spring stay-at-home orders, the best metric is the survey of homes in contract that just "locked in" an interest rate with their lender, conducted by the AEI Housing Center headed by Pinto. Those rate-lock transactions account for the vast bulk of all future sales. "The lock-in date generally comes 45 to 50 days before the closing or recorded sale," says Pinto. Hence, the rate locks recorded in May will translate into July sales, and those in June progress to closings in August.

Pinto's rate-lock data shows that housing entered 2020 in a sprint. For the first 11 weeks through mid-March the number of houses that secured rate commitments averaged 15% above 2019's already strong levels. The volume of new contracts then entered a corridor of sorrows, trailing the 2019 trend by a wide margin. What followed is likely the most epic leap in the annals of housing. By the first week in April, buyers were getting rate locks on over 45,000 homes, well above the 35,000 from the same week last year. And the total kept jumping week after week, hitting 63,000 in early June before settling at around 50,000, then jumping back to 62,000 for the week ended July 10.

Over the past seven weeks, rate locks have exceeded the numbers from last year by over 40%, at roughly 35,000 to 55,000. In the week ended June 27, contracts jumped 62% ahead of last year's pace. All told, total volumes for the year are 21% ahead of 2019, despite the falloff in March. "The strong sales pattern from 2019 suddenly got back on track, but with an extra boost," says Pinto. "That extra boost came from the big decline in rates." The towering contract numbers posted in June, says Pinto, should send sales on an annualized basis well above 6 million in August, the highest number since 2007.

The Pinto data also tracks the trend in prices. From early 2019 through the start of the lockdown, they've been tracing a steady upward trajectory, going from 3.5% annual appreciation to 7.3% at the pre-pandemic peak. Prices showed remarkable resilience—they never dropped, and at the low point in April stood 3.7% higher than in April of 2019. From there, prices went on a moonshot, passing 7% in mid-June vs. a year earlier and exploding to 9.8% year over year for



SOURCES: U.S. BUREAU OF ECONOMIC ANALYSIS, U.S. CENSUS BUREAU, REALTOR.COM, AND THE BROOKINGS INSTITUTION

THE BEST AND WORST PLACES TO INVEST IN REAL ESTATE DURING THE PANDEMIC

CAN YOU STILL MAKE MONEY IN REAL ESTATE? Yes—if you know where to look. To that end *Fortune* scoured the 200 largest metro areas for the markets that are poised to appreciate most. In all, we weighted 10 metrics, including price appreciation, availability of pandemic-friendly second homes, affordability, millennial populations, population growth, and jobs impacted by the pandemic. The winners? Housing markets such as Austin (No. 1) that are packed with younger millennials and reasonably priced real estate. Almost all of the top 10, including No. 2 ranked Fayetteville, N.C., and No. 3 ranked Fargo, N.D., have the same combination of prime-age buyers and affordable homes. In No. 4 ranked Columbus, the median home price is just 6.4 times as great as the median household income; that compares with a ratio of 14.3 times in Los Angeles. Like they always say in real estate: location, location, location. —**LANCE LAMBERT**

the week ended July 17, the most recent result.

FEWER AFFORDABLE OPTIONS

▸ First-time buyers are typically millennials in their late twenties through late thirties who are moving from apartments, often because their first child is nearing school age. Those maiden purchasers are crucial to a strong market because they power the "daisy chain" that enables owners of existing homes to move up to bigger, pricier properties. The entry-level cohort mostly buys inexpensive used homes, providing a nice capital gain for sellers, who can use the extra cash as a down payment on a more costly, move-up abode.

The rub is that the surge in prices that accelerated in 2019, then resumed with even greater fervor in May and June, is eroding affordability for all buyers, but especially for first-timers. Year after year, the outsize increase in what Americans pay for houses has been outrunning the modest ascent in their incomes. "Remember, incomes have been rising nicely at over 3% for the past couple of years," says Pinto. "But from around 2012 to 2020, prices were increasing many points faster, just below 6%."

But it's a tale of two markets. The high end appreciated a lot more slowly, and hence faces less danger. Over those eight years, prices bounced around but averaged gains of about 4.5%. "I'm not worried about the high end," says Pinto. "Owners have a lot more resources to fall back on. Many own their homes free and clear, and those with loans are a lot less leveraged. So the chances of foreclosure or forced sale by the affluent are relatively low.

"Prices are rising fastest for entry-level buyers, and they're exactly the ones most hurt by the trend," says Pinto. The relatively low-price entry level that accounts for 27% of the total market has been appreciating at 7.6%—far faster than the 6% average nationwide and 4.5% for high-end properties. This continuing escalation means that affordability will hit a wall for first-timers in many markets despite lower rates.

MORE DEBT

The affordability problem caused by prices rising faster than incomes is forcing purchasers to take on bigger and bigger amounts of debt relative to their paychecks. New homeowners—particularly low-earning Federal Housing Administration (FHA) borrowers, account for 20% of the purchasers who get loans. And it's that already highly leveraged group that forms the riskiest part of the market. Pinto says that the FHA could well keep allowing debt-to-income to spike ever higher and support the trend toward even more unsustainable prices. "That's why prices still have room to move higher," he says. But eventually the increase in supply brought on by high prices will push down values, causing the FHA and Fannie Mae and Freddie Mac to tighten credit standards, further chilling sales. That's what killed the market from 2007 to 2011.

In many markets, from Los Angeles to Denver, homes are already unaffordable for first-time buyers and for that reason alone are likely to fall. Even in formerly inexpensive locales such as Charlotte and Dallas, they're reaching levels that are pricing out new buyers, and hence leaving little or no room for appreciation.

DEARTH OF NEW CONSTRUCTION

The reason that prices for first-time buyers are rising so much faster than for the affluent is the dearth of construction of inexpensive homes. "It's new construction that holds down prices," says Pinto. "But except in markets such as Raleigh and Jacksonville, where there's a lot of available land and plenty of construction, land is much too expensive for builders to offer the $120,000 or $150,000 homes that young buyers can afford." Hence, he says, few if any inexpensive houses are coming on the market to compete with the low end of the existing homes. So first-timers are stuck: That fixed supply of older homes, in the lowest-price tier, is practically their only choice. "Since the inventory of those $150K existing homes for sale tends to be lowest of any level, the first-timers bid up the prices a lot faster than for $400,000 or $500,000 homes where in, say, Dallas or Atlanta, you have plenty of construction," says Pinto.

He says that the combination of "latitude" from federal lenders to allow more leverage "has combined with falling rates to empower them to buy the same houses at much higher prices."

PRICES CAN'T CONTINUE TO OUTPACE INCOMES

For a while, it looked as if a normalization in rates would cool the huge run-up in prices where it matters most, on the low end. Rates on 30-year mortgages hit 5% in November of 2018, and the Fed expected a rise to 6%. At that point, according to Pinto, it looked like the house-price boom on the low end especially would have a soft landing. Then, the trade war and a slowdown in Europe and what looked like a looming bust on the high end prompted the Fed to slash rates once again, sending prices skyward on the low end.

The dynamic of prices rising faster than pay that's reigned for years simply cannot last—although low rates can keep it going for a while.

In many markets where the gap's been growing fastest, such as Las Vegas, Phoenix, and Miami, prices will have to fall relatively soon before they can resume rising again. Then they're likely to increase modestly in tandem with incomes. That same reckoning, meaning flat or declining prices, will probably happen in all but the still-bargain Midwestern metros. What's clear is that this new and surprising spike makes the already inevitable descent back to normal even steeper.

BY THE NUMBERS

21%
Rate at which total volumes for mortgages "locked in" have exceeded 2019, despite the falloff in March

3.7%
Gain in home prices at the low point in April vs. April 2019

2.6%
Increase in household income per year from 2012 to 2020

7%
Increase in home prices, on average, from 2012 to 2020

SOURCE: AEI HOUSING CENTER

LET'S MANUFACTURE A BETTER FUTURE.

Let's reboot the maker mentality in this country. Let's refurbish the old and put up new plants to manufacture in and distribution centers to send our goods on their way. Let's restore and reshore. Let's keep people employed and contributing right here at home so that we can begin to strengthen local economies and our sense of community. Let's make it here.

CLEAN AND GREEN IS GOOD FOR BUSINESS.

American factories are the cleanest and greenest in the world, particularly when it comes to manufacturing products made of steel. We know firsthand. We've spent hundreds and hundreds of millions putting up manufacturing facilities of our own that keep the air clean, protect the people that work in them, and actually leave the water cleaner than it was when we set up shop. Waste and inefficiency are not only damaging to the environment, they simply can't compete in the U.S. marketplace. Resources here are called "precious" for a reason.

HOW WE GOT STARTED

The Family Jewels

How two beatniks from the Bronx created a designer jewelry brand. As told to DINAH ENG

DAVID YURMAN, one of the first designer names in fine jewelry, nearly sold his company for $30,000 as a wedding gift to his wife, Sybil. But she refused to let him sell, and the two, now 77, went on to build a multimillion-dollar brand.

David Yurman: I grew up in the Bronx, and my father owned a trimming company. My mother was a housewife. I was dyslexic and had ADD, but I didn't know it until 1975 or so.

Sybil Yurman: I grew up 10 blocks from David but did not know him. My father was a poet and writer, and made furniture and drapery. My mother ran the family insurance brokerage. I also had ADD, and my language was visual.

David: At 16, I learned welding and brazing. I made little animals and sculpted the sign language alphabet that deaf people use. I sold them for $5 to $15 at school.

Sybil: I left school at 15½ because the principal told my father I was a poor student and would never graduate. I ran away from home and made enough money to move to California. I lived and worked at Hyphen House in San Francisco, where I was exposed to people like Jack Kerouac and Philip Whalen. My life was about being in the moment, painting, Zen, doing whatever interested me.

David: In 1964 I was apprenticing with [Cubist sculptor] Jacques Lipchitz, who knew Picasso and Modigliani, making $150 a week. It was the height of the beatnik era. Then I opened my own studio in Greenwich Village while working for [abstract sculptor] Hans Van de Bovenkamp.

Sybil: I moved back to New York and met David at Hans's, where I worked. We liked each other right away. One day he made a necklace for me, and

COURTESY OF DAVID YURMAN

David and Sybil Yurman at home. The couple have been together since 1969.

Mixed metal bracelets and a starburst pendant necklace with garnet and diamonds. All are in the latest David Yurman collection.

I wore it to a gallery. A woman admired it and said she could sell them. David said no. I said yes. I left the necklace with her, and by the time we got home she had sold four of them. That was the beginning of his making sculptural jewelry.

David: We created the business so that we wouldn't have to work for someone else. In 1972 we moved to Putnam Valley, N.Y., where I had a studio in a former mill. I made jewelry that we'd sell at craft fairs …

Sybil: … and sold at galleries. As it started getting bigger and bigger, we went to a retail jewelry show in New York. When the Bloomingdale's buyer came up, I said, "Someone else placed an order first, so we can't make any more jewelry unless you pay for it first." He asked, "Who placed the order?" It was Saks Fifth Avenue.

David: I told him he could pay half upfront and half on delivery. He looked at me like we were from the woods.

Sybil: But he agreed to do it. Then life became more complicated. No banks would lend us money for the materials or to pay our suppliers. Going into the mainstream was extremely difficult, so we decided to sell the business.

David: In 1979 we got married, had a luncheon with friends, then went to see a man in the jewelry district. I said, "Selling the business is my wedding present to my wife, so we can just go back to doing our art." He gave a number, and before I could say anything …

Sybil: … I said, "That's too low." He offered $30,000.

David: I made that much at a good craft fair.

Sybil: So we left, and we incorporated the business in 1980. Back then the stores wielded an incredible amount of power. A major retailer once canceled an order two days before delivery, putting us on the brink of bankruptcy. A doctor friend gave us $50,000 to keep us in business. So we drew up guidelines that retailers had to sign so that we wouldn't get in that position again.

David: The difficult part was we wanted to use our name in the stores.

Sybil: At the time, amethyst rings, gold necklaces, or watches would all be in the case together, sold by category. We wanted the stores to buy our collections—the earrings, necklaces, and rings—all together.

David: You told them, "We're American craftspeople, we're designers. This is our art form, and it has a personality to it."

Sybil: They wanted what we did, so they agreed.

David: There were times when the economy was in a slump, and we couldn't pay people. We'd call them and say, "We'll pay you 20% this month, and some more next month." It made all the difference.

Sybil: At one point, a man in a drugstore gave me 50¢ when he saw that I didn't have enough to buy diapers for our son.

David: But we kept growing the company.

Sybil: In the '90s, we were one of the major vendors at Neiman Marcus. We opened our first boutique in November 1999 in New York.

David: We were very profitable in the U.S., but then we went to Paris and my ego got the best of me. I thought, If we can sell an American jewelry brand to Parisians, it would be like selling ice to Eskimos. And we did it. Within two to three years of selling in Printemps, we gained their most loyal group of customers.

Sybil: Our success is due to trust and forming relationships with people who helped us along the way. It's about taking a risk and being willing to work all night for it.

David: In our 50 years of being together, I've learned it's better to be kind than right. Creating a business is like creating a family. The jewelry is just the by-product.

DAVID AND SYBIL'S BEST ADVICE

Envision possibilities together. We both were brought up as existentialists in the beatnik era. Whenever we asked a store for something, we'd say, "How do we make this happen? If we partner together, we can fulfill your need in the marketplace, and our need to create."

FROM TOP: COURTESY OF DAVID YURMAN; JEROD HARRIS—GETTY IMAGES FOR DAVID YURMAN

JAPAN: PROVEN RESILIENCE

Japan's performance during the coronavirus pandemic is the latest example of its resilience. As the government rolls out a massive economic rescue package, the Japanese people are drawing upon their age-old sense of community and harnessing the latest innovations, with the goal of reopening the country for the Olympic and Paralympic Games in 2021.

Standing Tough

Japan's performance during the coronavirus pandemic is the latest example of its resilience.

THIS SUMMER WAS SUPPOSED TO BE a massive party in Japan. The 2020 Tokyo Olympic and Paralympic Games were set to kick off in July, drawing millions of people to Japan for its first Summer Games in 56 years. New sports venues were built, elite athletes pushed themselves to perform for their countries, and Japan was putting the final touches on preparations to host the world's top competitors. Then the novel coronavirus struck. The pandemic sent Japan into a state of emergency, slammed the domestic economy, and forced a postponement of the Games until July 2021.

A Legacy of Resilience

Located on the Ring of Fire amid numerous tectonic plates and in the western Pacific Ocean's Typhoon Alley, this island chain has seen plenty of adversity, both natural and manmade, in the century leading up to the coronavirus outbreak. In 1923, the Great Kanto Earthquake hammered the Tokyo region, claiming the lives of more than 105,000 people and turning entire neighborhoods into rubble and ash. World War II was a nationwide catastrophe, with the Allied bombing of Tokyo leaving more than 100,000 dead and one million homeless. Of the many postwar natural disasters that have assailed the archipelago, two stand out. The 1995 Great Hanshin Earthquake that struck the Kobe area took at least 6,434 lives and displaced hundreds of thousands. The 2011 Great East Japan Earthquake was the most powerful quake ever recorded in the country and, along with a series of tsunamis, left more than 18,000 dead or missing and caused reactor meltdowns at the Fukushima Daiichi Nuclear Power Plant, leading to hundreds of billions of dollars in damages and cleanup costs.

Observers, however, were astonished

at how the Japanese people reacted with composure to the disaster, with thousands of office workers in Tokyo walking many kilometers to get home when rail services were suspended, and with communities in the more heavily damaged Tohoku region quickly pulling together to speed recovery and reconstruction.

“I learned that the local grassroots response to tragedy and displacement was often remarkably measured and assured,” says David McNeill, a veteran journalist based in Tokyo and the coauthor of *Strong in the Rain*, an eyewitness account of the tragedy. “Obviously, the fact that Japan has been plagued by natural disasters for millennia has something to do with the well-drilled corps of local citizens, and the resilience and stoicism that many [displayed] at the time.”

“Obviously, the fact that Japan has been plagued by natural disasters for millennia has something to do with the well-drilled corps of local citizens, and the resilience and stoicism that many [displayed] at the time.”

DAVID McNEILL
Veteran Journalist and Coauthor, *Strong in the Rain*

The old Japanese aphorism *Nana korobi ya oki* translates roughly as “Fall down seven times, get up eight.” As Japan gets back on its feet, the country is finding that it will have to be more resilient than ever to achieve a sustainable recovery.

Adapting to a New Kind of Adversity

By mid-July 2020, Japan had seen some 20,000 COVID-19 infections and approximately 1,000 deaths attributed to the virus. That’s an unusually good outcome for a country of 126 million with a large proportion of elderly people and some of the world’s most densely populated cities. Indeed, as of the time of this writing, in two dozen of Japan’s 47 prefectures, there have been fewer than 100 cases.

Numerous theories have circulated about why Japan fared so well before its case numbers began rising again in late June. It relied on a strategy of contact tracing with limited testing and no lockdowns, as leaders like Tokyo Governor Yuriko Koike urged citizens to stay home but did not compel them. Some theories cite societal traditions like the Japanese aversion to shaking hands, kissing, or hugging when greeting; not wearing shoes indoors; routinely wearing face masks; and routinely inoculating children against tuberculosis. None of these theories, however, has conclusively proven why COVID-19 has been so much less devastating in Japan than in some other countries. Still, some observers are convinced that some essentially Japanese characteristics have played a role.

“The spirit of *jishuku* [self-restraint] is perhaps the greatest element contributing to the management of socioeconomical factors contributing to the mitigation of coronavirus,” says Ken Mogi, a neuroscientist and author of *The Little Book of Ikigai: The Secret Japanese Way to Live a Happy and Long Life*. “After natural and artificial disasters, the Japanese are remarkably good at changing tacks and starting anew. For example, after the Second World War, the Japanese rapidly adopted American culture, and even regarded General MacArthur as some kind of hero. Such a change can occur literally overnight.”

“The spirit of *jishuku* [self-restraint] is perhaps the greatest element contributing to the management of socioeconomical factors contributing to the mitigation of coronavirus.”

KEN MOGI
Neuroscientist and Author, *The Little Book of Ikigai*

Coronanomics

That kind of flexibility will help Japan’s economy. Like many other countries, Japan was smashed by a dramatic business slowdown as individuals and businesses curbed their activities, exports and consumer confidence wilted, and inbound tourism, which brought in more than 31 million people in 2018, fell to virtually nil. The economy was already weak, following a consumption tax hike from 8% to 10% last fall and a powerful typhoon that caused widespread damage. In May,

Ready for Tomorrow's World

Attuned to society's changing needs, and focused on health, comfort, and sustainability, diversified chemicals maker **Asahi Kasei** is well positioned for a post-pandemic world.

WHEN ASAHI KASEI PURCHASED ZOLL, a Boston-based developer of medical devices and software solutions, for $2.2 billion in 2012, it marked a decisive step into the critical care arena. Flash-forward to the present, and that acquisition has placed Asahi Kasei on the forefront of the fight against COVID-19. Ventilators, the crucial machines that help patients with severe symptoms breathe, are among the products ZOLL makes, and the company is increasing production from around 400 units per month to 10,000.

"We're putting our products to work to battle the virus worldwide," says company president Hideki Kobori. Asahi Kasei–made blood purification devices treat patients with acute kidney injury, one of COVID-19's complications. On the pandemic prevention side, the company is boosting its output of nonwoven fabrics for face masks and disinfectant wipes, as well as ultraviolet LED modules for sterilization. "Caring for people is a big part of who we are," Kobori explains. "Our employees are united and hugely motivated."

Positioned for the Long Term

Asahi Kasei is a highly diversified company. Its Health Care sector, which accounts for around 16% of sales, is only one of three sectors in which the company is active, along with Homes (house building and construction materials, 33%) and Material (chemicals, textiles, plastics, and electronics, 51%). This broad business mix comes into its own in volatile times, with two of the three sectors—Health Care and Homes—showing great resilience amid the turmoil. In the less stable Material space, the outlook is dependent on timing. For example, factory and shop closures have hit apparel-related sales in the short term, but a renewed awareness of health issues will drive up the sales of hygiene-related materials over the medium and long term. The longer-term outlook for electronics is equally bright, with the advent of 5G technology likely to boost demand.

Mobility—one of five areas Asahi Kasei is prioritizing for growth—also follows this pattern. "The auto industry is undergoing a once-in-a-century change," says Kobori. The virus is crushing global car sales now, a shock that in the future will speed up sector consolidation, transform car makers' approach to development, and accelerate the shift to CASE (Connected, Autonomous, Shared, Electric).

That shift is good news for Asahi Kasei. In addition to making lightweight engineering plastics and synthetic rubber for tires, the company is the world's leading manufacturer of separators for the lithium-ion batteries (LIB) used in hybrids and electric vehicles (EVs). Kobori aims to quintuple LIB separator production capacity by 2025 (vis-à-vis 2016 levels) to coincide with the broad-based adoption of EVs.

"Society is going through a dramatic process of transformation. We must be proactive about seizing the opportunity."

HIDEKI KOBORI
PRESIDENT, ASAHI KASEI

Currently, COVID-19 is making people anxious about the hygiene of car interiors, particularly with regard to ridesharing. Asahi Kasei's products—seat fabrics with antimicrobial properties and CO_2 sensors that monitor and regulate the amount of fresh air in vehicles—can help allay those concerns. Asahi Kasei's $700 million acquisition of South Carolina–based Sage Automotive Interiors in 2018 not only strengthened the company's automotive fabrics business but also provided it with better access to tier-one suppliers and original equipment manufacturers.

A similar story of evolving values and needs is occurring in Asahi Kasei's Japan-centered house-building business. With more Japanese women entering the workforce in recent years (the country's female labor force participation rate is now around 53%, in line with the average for high-income countries), childcare is in greater demand. Due to cultural norms, the Japanese are reluctant to reach outside of the family for help, meaning grandparents are often the babysitters of choice—which could lead to a boost in demand for multigenerational housing. Likewise, the COVID-19 lockdown has shown the Japanese business community that working from home is a viable alternative to the office. "Our Homes business needs to start addressing these new forms of demand and using new digital channels for sales," says Kobori.

ASAHI KASEI AFFILIATE ZOLL IS CURRENTLY RAISING VENTILATOR OUTPUT BY 25 TIMES, FROM 400 UNITS PER MONTH TO 10,000.

Digital. Sustainable. Responsible.

Indeed, the country's shrinking population makes digital transformation a matter of particular urgency for Japan-based businesses. Here, Kobori is pushing ahead on multiple fronts. On the manufacturing side, Asahi Kasei is using artificial intelligence to develop catalysts and new plastic compounds faster and IoT technology to streamline production and improve quality control. On the strategy side, it is using IP landscaping, a big-data visualization technique, to pinpoint the competitive strengths and weaknesses of its patent portfolio.

ASAHI KASEI'S CO_2 SENSORS **(RIGHT)**, WHICH MONITOR AND REGULATE THE ATMOSPHERE INSIDE VEHICLES, AND ULTRA-VIOLET LED LIGHTS **(BELOW)**, USED TO DISINFECT SURFACES, ARE HELPING ALLAY MANY CONSUMERS' HYGIENE CONCERNS IN THE FACE OF THE COVID-19 CRISIS.

Kobori also wants to leverage data to create new business models. Case in point: The company's engineering arm recently teamed up with a shipping line to trial a diagnostic technology that monitors ship equipment vibration data, detecting and analyzing abnormalities and proposing preemptive solutions to minimize maintenance. If the trial succeeds, the service will be commercialized for the shipping industry.

Asahi Kasei's commitment to "Creating for Tomorrow" applies to sustainability as well as its digital technology initiatives. The company is actively promoting the shift from fossil fuels to clean energy, not just with existing products like the LIB separators for eco-friendly cars but also with innovations like an alkaline water electrolysis system that converts renewable energy into hydrogen for vehicle and industrial use. Policy-wise, Asahi Kasei has set itself ambitious targets for reducing greenhouse gas emissions, is exploring new ways of reducing plastic waste through partnerships with university research institutes, and signed on to the Task Force on Climate-related Financial Disclosures (TCFD), the entity responsible for developing a framework for the disclosure of climate-related financial risk, in mid-2019.

This vision gives Kobori confidence in the company's ability to weather the COVID-19 crisis. "Society is going through a dramatic process of transformation. We must be proactive about seizing the opportunity," he says. "Everyone at Asahi Kasei must work as a team to generate sustainable enterprise value and contribute to making society more sustainable." ■

> "From an economic perspective, a disaster is a good thing because you must rebuild. What I call 'coronanomics' will be an opportunity for innovation in business practices in Japan, including telecommuting."
>
> JESPER KOLL
> Senior Advisor
> WisdomTree Investments

the government announced that the economy contracted by an annualized rate of 3.4% from January to March of 2020, plunging Japan into a recession for the first time since 2015. As the third-largest economy in the world, it became the biggest to officially enter a recession.

"Even if the epidemic is resolved, a 'new lifestyle' will be in place, so things will not return to normal until the vaccine is widely put into practical use," says Toshihiro Nagahama, chief economist of Dai-ichi Life Research Institute. "It's possible that this new lifestyle will make it difficult for demand to return to its original level, leading to long-term deflationary stagnation."

There is some encouraging news, however. The unemployment rate in Japan has risen only slightly, to 2.9% in May. That contrasts with spiking unemployment in places like South Korea and Hong Kong. It may also reflect a traditional aversion to layoffs and putting priority on continuity over profit among Japanese businesses. To cushion the fallout from the virus, Prime Minister Shinzo Abe's administration unveiled a $1.1 trillion stimulus package that included cash payouts of 100,000 yen ($935) to every resident of Japan. All of this has left some analysts very optimistic about Japan's prospects.

"From an economic perspective, a disaster is a good thing because you must rebuild. What I call 'coronanomics' will be an opportunity for innovation in business practices in Japan, including telecommuting," says Jesper Koll, senior advisor at asset manager WisdomTree Investments. "Japanese companies went into the crisis with an absolutely enormous cash war chest, basically $6.5 trillion. Because of the virus, assets have become very cheap, and I think we'll see that war chest being put to work in mergers and acquisitions."

Forging an Auspicious Future

Japan is reframing the Olympics, now planned for 2021, as a chance to mark victory over the coronavirus. It wouldn't be the first time the country has overlaid catastrophe with a silver lining. One part of the legacy of the 2011 Great East Japan Earthquake is the Sendai Framework for Disaster Risk Reduction 2015–2030, adopted at the United Nations' Third World Conference on Disaster Risk Reduction, which was held in Sendai, a city that had been devastated in the cataclysm. The Sendai Framework is designed to motivate countries around the world to better understand and prepare for disaster risk, with targets such as substantially reducing global disaster mortality and economic losses by 2030.

"Japan has developed its expertise, advanced policies, and technologies in the area of disaster risk reduction from its long history and experiences with many types of natural hazards," says Yuki Matsuoka, head of the United Nations Office for Disaster Risk Reduction in Kobe, whose main focus is the implementation of the Sendai Framework. "As the COVID-19 pandemic demonstrates, Earth is one system—a system of systems. Systems thinking and being able to adopt a systemic perspective when making decisions is obvious and essential."

And as the threat of climate change looms ever larger, increasingly devastating disasters seem inevitable across the globe. If Japan can lead the world with its deep disaster recovery experience and know-how in cultivating resilience, we will all be best positioned to weather future storms. ■

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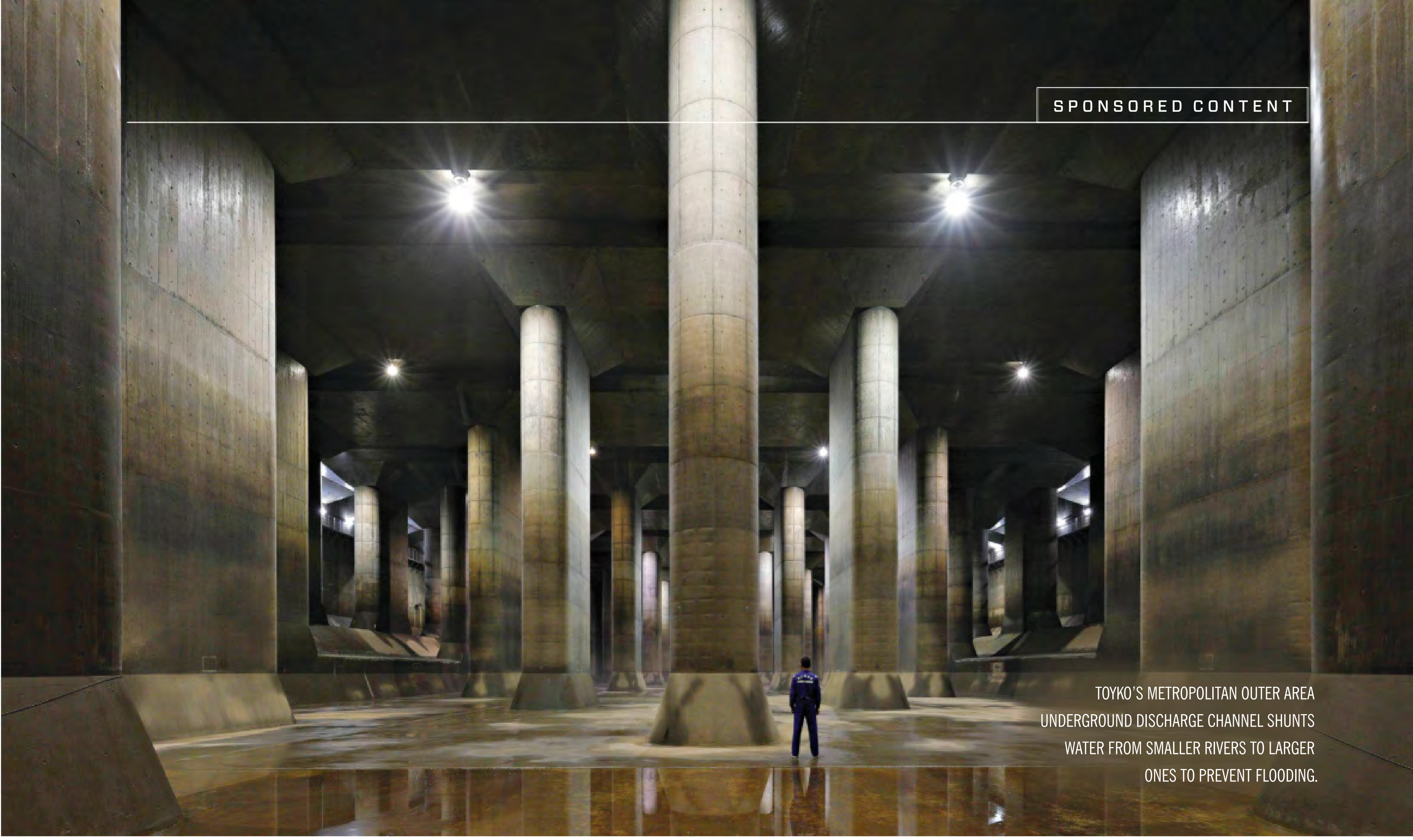
>
> YUKI MATSUOKA
> Head
> UNDRR Office, Japan



TOYKO'S METROPOLITAN OUTER AREA UNDERGROUND DISCHARGE CHANNEL SHUNTS WATER FROM SMALLER RIVERS TO LARGER ONES TO PREVENT FLOODING.

Digging Deep

Tokyo's flood-control bulwark is a marvel of engineering.

WITH A POPULATION OF OVER 30 MILLION, the Tokyo metropolitan area is one of the largest in the world. To many visitors, what's not apparent is that its sleek skyscrapers sit atop land that used to be an estuary. The ancient fishing village of Edo that gave rise to the modern metropolis was in a vast marshland shot through with rivers. These waterways still empty into Tokyo Bay, but every year they threaten Tokyo and its satellite cities with flooding. Typhoons have inflicted staggering damage and loss of life in the region over the past century. The risk has increased amid urban sprawl, which reduces the land's ability to absorb rain, and global warming, which can magnify sea surges and storm power.

Part of Tokyo's response is an astonishing underground defense system that looks like a vast buried cathedral. Officially known as the Metropolitan Outer Area Underground Discharge Channel (MOUDC), it's a tunnel system that shunts water from smaller rivers to larger ones to prevent flooding. At 6.3 kilometers (3.9 miles) long, 10 meters in diameter and 50 meters deep, MOUDC is one of the largest underground discharge channels in the world. It can direct water from flood-prone waterways, including the Naka and Ayase rivers, into the Edo River, which flows southward into the Pacific Ocean.

Completed in 2006, the channel is famed for its surge tank. Nicknamed the Underground Temple, it's an otherworldly subterranean space measuring 177 meters long by 78 meters wide—about two soccer fields—with an 18-meter-high ceiling. At the end of the channel is the Showa Drainage Pump Station, whose four massive gas turbine pumps can drain up to 200 cubic meters—the equivalent of a 25-meter-long swimming pool—per second.

What difference does all this make? Comparing flood damage is revealing. In 1982, a typhoon caused 19.5 cm (7.7 in.) of rainfall over 48 hours, flooding 29,457 homes, but in 2017, only 43 homes were flooded when another typhoon unleased a similar downpour over the same period. The operators estimate that MOUDC has prevented approximately 148.4 billion yen ($1.38 billion) in damages, representing some 44% of its construction cost, over 18 years, during which it was used 121 times. Meanwhile, more than 500,000 visitors, including foreign officials, have toured the facility since 2003.

"People who have never experienced floods can come here to learn about the basin and the importance of flood-control measures," says Nobuyuki Akiyama, chief of the Metropolitan Outer Floodway Management Office. "We can't completely eliminate flood damage, but by continuing to implement measures, we can reduce the places where it can occur." ■

Full Charge Ahead

NGK Insulators seeks to make products not just for the world as it is now but also for the world as it will be in several decades' time.

WITH THE COVID-19 CRISIS DRAMATICALLY accelerating digitalization, businesses such as video conferencing and cloud computing are booming while much of the traditional economy suffers. Nonetheless, the virtual world still depends on physical IT infrastructure—putting the companies that help make this infrastructure in a strong position.

Japan-based NGK Insulators is one such company. From its 1919 origins as a manufacturer of ceramic insulators, the company diversified into ceramic substrates for automotive emissions control systems in the 1970s, then semiconductor production equipment (SPE) in the late 1990s. "Our antennae are always out, hunting for new possibilities," says company president Taku Oshima. "Everything we do is based on a century's worth of expertise in ceramics."

That know-how is precisely what enables NGK to create products capable of delivering outstanding temperature uniformity and withstanding the corrosive plasma and gases used in semiconductor manufacturing. The company specializes in electrostatic chucks (which keep silicon wafers flat during etching) and ceramic heaters (which support and heat silicon wafers during film deposition). Oshima is bullish about semiconductor demand and, by extension, demand for NGK's SPE products. "All the new technologies—5G, IoT, A.I.—depend on semiconductors," he says.

NGK's involvement with industry 4.0 doesn't end there. The company also dominates the market for ultraprecise piezoceramic actuators (devices that move the read/write head arm of the hard-disk drives used in data centers). Meanwhile, in mobile telephony, the company makes bonded wafers for surface acoustic wave (SAW) filters, a key component that filters out specific frequencies.

Small Batteries, Big Possibilities

For the Internet of things, NGK is pinning its hopes on EnerCera®, a series of lithium-ion rechargeable batteries as small as a coin and as thin as a postage stamp. Already in use as an embedded power source for smart cards, EnerCera has sparked the interest of auto manufacturers because of its high heat resistance. "Cars get hot, especially around the engine compartment, so we're aiming to raise EnerCera's beyond its current heat resistance of 85° C," says Oshima. "Modern cars are full of sensors that collect and transmit data. As a wire harness–free power source, EnerCera is the perfect solution for automobile sensors."

"Our antennae are always out, hunting for new possibilities. Everything we do is based on a century's worth of expertise in ceramics."

TAKU OSHIMA
PRESIDENT, NGK INSULATORS

Further down the road, Oshima sees energy harvesting—deriving energy from ambient sources such as heat and vibration—as another opportunity for EnerCera. He gives the structural health monitoring of a bridge as a use-case example. The sensors embedded in the structure to monitor its condition could be powered by EnerCera batteries that self-recharge from the vibrations of passing traffic. The result? Real-time remote monitoring with a minimal amount of cables or maintenance.

EnerCera was the brainchild of the Ceramic Battery Project, one of two NGK companywide projects that pull in staff from throughout the company—not just from engineering but also from sales and marketing, purchasing, and legal—to speed up the development of priority products.

Thanks in part to this coordinated effort, NGK now has a broad battery offering, extending from the coin-size EnerCera to shipping-container-size NAS® batteries. NAS batteries—high-capacity sodium-sulfur batteries that help to stabilize the output of inherently volatile energy sources such as wind and solar—are poised to play an increasing role as the world shifts decisively from fossil fuels to renewables.

In addition to NAS and EnerCera, NGK is developing a medium-size zinc rechargeable battery. In a world first for storage batteries, its marketing claims—including no thermal runaway or fire by surface heating—have been verified by UL, an independent safety-testing lab in the United States. (This level of safety stands in sharp contrast to lithium-ion batteries, whose proneness to internal fires and overheating makes them too risky for use indoors.) "In the coming years, power generation is going to become more decentralized with more resilient and flexible microgrids," says Oshima. "Our zinc rechargeable battery can be the optimal distributed-energy solution for indoor installations."

In a sign of its commitment to the clean-energy future, in April 2020 NGK launched a new division that will focus on the energy storage business, in particular the creation of synergies between NAS and zinc rechargeable batteries. "We believe in our battery business. We want to create energy-storage solutions that are of real benefit to society," Oshima says.

ABOVE: NGK'S ENERCERA BATTERIES ARE SMALL ENOUGH TO FIT INTO SMART CARDS AND IOT DEVICES. **LEFT:** AN ENERCERA BATTERY ON A CONTROL MODULE.

Looking Ahead

Founded with a mission of electrifying Japan's economy, NGK has social contribution in its DNA. The company's focus was on the national good in the early 20th century; now it applies the same altruistic mindset to global challenges. For example, it was the air pollution bedeviling major American cities in the 1970s that inspired NGK's move into the business of automobile emissions control with ceramic substrates and particulate filters for gasoline and diesel engines, an area where it is now the global frontrunner.

But here too the company is not resting on its laurels. To reduce first-minute emissions from automobile cold starts (which produce the most toxic emissions of the whole engine operating cycle), NGK is seeking to develop preheating technology for catalytic converter substrates. It is also developing all-solid-state ceramic battery technology for electric vehicles to protect against the possibility of any abrupt shift away from internal combustion engines to cleaner hybrids, plug-in hybrids, and EVs.

History suggests that however the world evolves, NGK will stay one step ahead. Since 2017, the company has set for itself the ambitious target of generating 30% of total sales from new products. Oshima attributes the company's success in innovation to a three-pronged, three-speed strategy rooted in in-house R&D, market-driven responses to customer needs, and new ideas being generated organically by each business unit. Says Oshima: "Our approach is to envision the world as it will be in 20 or 30 years' time, ask ourselves how we can contribute to that world's needs, and develop products accordingly."

A Daily Necessity for the Ages

Buttressed by more than three centuries of history, soy sauce manufacturer **Kikkoman** has maintained production throughout the COVID-19 crisis.

SOY SAUCE MANUFACTURER KIKKOMAN traces its roots back to the late 1600s. Over the past three and a half centuries, the company has weathered its share of challenges, from the 1923 Great Kanto Earthquake to the economic devastation that followed the Second World War. The current novel coronavirus pandemic, however, is in a category of its own. "We don't know the full extent of this particular crisis, so we can't yet compare it to anything else," says Yuzaburo Mogi, honorary CEO and chairman of the board of Kikkoman.

COVID-19, Mogi points out, looks likely to linger, having a negative impact on the economy for several years. The fact that the virus is invisible also makes it harder to address. Says Mogi: "I'm afraid that the coronavirus problem will not be solved completely until a vaccine or a treatment is discovered."

Unlike its Southeast Asian neighbors, Japan remained untouched by previous coronavirus outbreaks such as the severe acute respiratory syndrome (SARS) virus in 2003 or the Middle East respiratory syndrome (MERS) outbreak in 2015. According to Mogi, COVID-19 thus represents a learning opportunity that will help Japan better prepare for similar kinds of threats in the future.

Kikkoman, which is defined as an essential business, has kept its global network of highly automated factories that produce soy sauce and other food products running throughout the crisis. "The food products we make are daily necessities and we have a responsibility to supply them," Mogi explains. "That's why we have maintained production."

During the lockdown, people all around the world have sought comfort in familiar foods and flavors. In Japan, where soy sauce is an essential ingredient in so many everyday dishes, household consumption has risen as people stay home and cook for themselves, and instances of purchasing food from restaurants have fallen. The same trend is visible in Europe and the United States.

Food consumption patterns are not the only things that have been upended by the virus. As chair of the Japan Productivity Center, Mogi has long shone a light on Japan's relative slowness to embrace digital transformation in the workplace. But the virus has finally compelled the country to introduce remote working and more sophisticated digital tools. "At Kikkoman, around 30% of employees came to the office, and 70% worked from home—and it worked fine. Even after the coronavirus has been solved, we will try to promote this trend," Mogi says.

Of course, not everything can be shifted to digital. Finding the right balance between traditional and remote working is just one of the challenges presented by the virus that corporate leaders will have to come to grips with. What's more, the crisis has also been a sharp learning curve for rank-and-file employees.

"The best training to cope with problems in a complex, globalized world is experience," Mogi says. He takes an equally broad view of Kikkoman's mission: "Our first priority and our most important social responsibility as a food company is to continuously provide high-quality products to consumers, even in such a tough world." ■

"The best training to cope with problems in a complex, globalized world is experience."

YUZABURO MOGI
HONORARY CEO AND
CHAIRMAN OF THE BOARD
KIKKOMAN

POWER STEERING
Ride-hailing giant Didi Chuxing is among the companies working with China's government to test-drive the e-yuan.

China's Drive for Digital Currency Dominance

China's central bank has taken the lead in the race to launch an exclusively electronic currency. If the e-yuan catches on, the implications for consumers, China's neighbors, and Uncle Sam could be enormous.

By ROBERT HACKETT

I

IN THE 13TH CENTURY, Kublai Khan, the Mongolian emperor who founded China's Yuan Dynasty, upended monetary convention with a magisterial edict: *Accept my money, or die.*

The threat of execution was not so novel back then, of course. The Khan's true innovation lay in his refashioning of money itself. The grandson of fearsome Genghis realized he could finance his realm untethered to finite supplies of precious metals. No longer would his geopolitical reach depend on backbreakingly mined and smelted ores hauled along the Silk Road. Instead, he could tap a boundless, lightweight resource—and make money grow on trees.

Mulberry trees, to be exact. In a contemporary account, Marco Polo, the wandering merchant of Venice, marveled at "how the great Khan causeth the bark of trees, made into something like paper, to pass for money overall his country." The banknotes were issued, he wrote, "with as much solemnity and authority as if they were of pure gold or silver."

Medieval Europeans were dumbfounded by Polo's report. But the emperor was ahead of his time. Fiat currencies—descendants of Kublai Khan's *chao,* backed by government edict rather than hard assets—are standard everywhere today.

Fast-forward to this century, and China once again is remaking money.

QILAI SHEN—BLOOMBERG VIA GETTY IMAGES

Except this time, it is paper currency that's getting tossed; China is going digital. And while things didn't end well for the Mongols—they printed themselves into hyperinflation, and lost the throne—China's current leaders have something far more stable and enduring in mind.

China is further along than any other large country in its development of a national digital currency—in this case, a purely electronic yuan based on technology inspired by blockchains, the record-keeping databases that underlie cryptocurrencies like Bitcoin. President Xi Jinping issued a ringing endorsement of blockchains in an October speech, making him the first major world leader to get behind the technology. Xi vowed to "seize the opportunity" that would let China "take the leading position" in the field.

The futuristic money, clunkily dubbed the "digital currency/electronic payment," or DC/EP, is a dramatic step in that direction. The government aims for the currency, now in a pilot phase, to be ready for broader rollout by the time Beijing hosts the Winter Olympics in February 2022—allowing China to demonstrate its fintech prowess on a global stage.

Chinese officials publicly tout the currency's many benefits: lower operational and transaction costs; greater financial inclusion; and, for the state, enhanced crime-fighting capabilities and expanded influence abroad. The innovation is set to strengthen the Communist Party's control of China's monetary system, while restoring the government's power over China's tech giants, especially Tencent's WeChat and Alipay, run by Alibaba's IPO-bound Ant Group division.

Some observers even believe the e-yuan could spell the beginning of the end for the U.S. dollar as the de facto conduit of international commerce. For Westerners who think China's digital mulberry tree will bear fruit, that's a startling possibility—one that would diminish America's ability to defend its economic and political interests. "Letting China win this race to be at the center of payments for the next century is a far greater threat to our national security than the perceived threats" that Westerners attribute to digital currencies, says Kathryn Haun, a partner at venture capital firm Andreessen Horowitz who sits on the board of the Libra Association, a blockchain consortium assembled by Facebook.

For now, however, the perceived threats Haun alludes to—notably, balancing privacy, law enforcement, and economic stability—have hindered digital-currency development outside China. Out of 66 central banks surveyed in a recent study by the Bank for International Settlements, 80% reported

CURRENCY CONTESTANTS

From PayPal's Venmo to M-Pesa in Africa, the private sector has dominated digital payments. Now central banks are exploring national digital currencies of their own, often with corporate partners—though none has progressed as far as China.

SWEDEN

Sweden's Riksbank, the world's oldest central bank, has talked about launching a digital currency since 2016. It's now working with consulting firm Accenture to develop the technology behind an e-krona that it plans to test next year.

SINGAPORE

In July, the Monetary Authority of Singapore said it "successfully" concluded a trial with JPMorgan Chase and state-backed giant Temasek that settled payments in different currencies on a blockchain-based network. The bank's managing director has said he would welcome cooperation with China.

THE BAHAMAS

The Bahamas started its "project sand dollar" pilot in its Exuma district on Dec. 27, 2019. The trial attracted more than 1,000 testers in a month, and the nation plans to expand the program across all 700 of its islands before year's end.

VENEZUELA

In 2018, Venezuela launched the petro, a cryptocurrency (allegedly backed by oil reserves) designed to help citizens cope with international sanctions and the dysfunctional nation's hyperinflation. The petro has been a flop, and the U.S. is offering a $5 million bounty for information leading to the capture of the initiative's leader, who has been indicted for drug trafficking and sanctions violations.

KAROL SEREWIS—SOPA IMAGES/LIGHTROCKET VIA GETTY IMAGES having begun investigating the feasibility of a digital currency. But only 10% were anywhere close to minting one; the Federal Reserve is not among them. (For more, see the sidebar.)

The upshot: China is sprinting ahead in a race that few others realize they're running.

"Every day that passes, it gets harder and harder for Western-backed projects to keep up."

KATHRYN HAUN, GENERAL PARTNER, ANDREESSEN HOROWITZ

A

A CASUAL OBSERVER visiting a railway station in Suzhou, a canal-sluiced city northwest of Shanghai, might notice nothing out of the ordinary. Train cars are thronged with masked passengers. At entryways, commuters queue up and show guards their green-colored smartphone codes, indicating bills of good health for COVID-19.

But some passengers have another feature on their phones: an officially approved digital currency. China began testing an e-yuan in the real world in May, as municipal workers in Suzhou started receiving half their monthly transit subsidy in the form of DC/EP. Similar trials, some involving local merchants, are taking place in Shenzhen, Chengdu, and Xiong'an, near Beijing.

The transactions are small, but they send a big message: While most countries were distracted by a pandemic, China staged a technological coup. Matthew Graham, CEO of investment firm Sino Global Capital, conveyed the significance after posting leaked images of "beta" DC/EP wallets on Twitter. "Americans [are] still trying to figure out if they should put on a face mask while China pushes out a revolutionary technology," he commented.

Beijing has said little about the pilot program since announcing it. Big companies operating in China have been reluctant to talk about DC/EP—not unusual in a country where businesses are loath to get out ahead of the government. But they're watching the situation with interest, and homegrown stars such as ride-hailing service Didi Chuxing and food deliverer Meituan-Dianping, along with foreigners McDonald's and Subway, have been reported to be preparing for the trials. (Didi confirmed its participation; Meituan declined to comment; McDonald's and Subway did not reply to requests for comment.)

More than 80% of Chinese people already use smartphone apps like Alipay and WeChat Pay to conduct payments. Cosmetically, DC/EP apps resemble those omnipresent e-wallets. Yet technologically, there's a wide divide between the two types of digital money. The DC/EP, in one key innovation, will be usable everywhere, even among parties who are otherwise "offline." But the biggest difference lies in who logs the debits and credits. Unlike its private-sector counterparts, the e-yuan is intrinsically linked to a centralized ledger maintained by the People's Bank of China (PBOC), the nation's central bank.

The ramifications are manifold. China's gambit could help bring 225 million "unbanked" people into its economic fold; all they'll need is a smartphone, not even a traditional bank account. E-yuan wallets could be used to distribute stimulus payments, subsidies, and tax refunds. But most fundamentally, the digital money will grant the government unparalleled oversight and fine-tuned control of China's economy. As with the Khan's ancient cash, the biggest benefits are likely to accrue to the state.

W

WHEN EDITH YEUNG, a Chinese national and investor at VC firm Race Capital, caught a Chinese state television segment on blockchain technology a couple of years ago, something seemed off. "It tried to teach the masses in layman's terms what blockchain was all about," she recalls. But "the word 'decentralization'"—the antiestablishment mantra of cryptocurrency boosters—"was not mentioned at all," she says. *That's not really blockchain,* Yeung remembers thinking.

The omission is in keeping with the Communist Party's focus on centralized authority. When the PBOC first started considering a digital currency, in 2014, Bitcoin was just breaking into the mainstream consciousness. Libertarians loved how it permitted the creation and transfer of value, independent of government. But many banks and states saw in the blockchain's distributed ledger technology something equally attractive: the potential to track financial activity with incredible precision.

China, ever wary of capital outflows that could weaken its currency, preemptively barred banks from handling cryptocurrencies starting in 2013. But the country's leadership studied and cherry-picked aspects of blockchain technology for the DC/EP project—keeping its innate transparency, while scrapping its potential to sideline authorities.

Meanwhile, China's fintech sector, lofted by a fast-rising middle class, was taking off. Transaction volume on mobile payment apps in China rose from a negligible amount in 2013 to as much as 350 trillion renminbi, or $50 trillion, in 2019. Today, Ant Group's Alipay and Tencent's WeChat Pay command 55% and 39%, respectively, of that market. Phones displaced physical cash; China's ratio of cash use to household financial assets, an increasing share of which is held in fintech apps, is among the lowest in the world, at 4%. (In the U.S., it's 24%.)

The PBOC viewed this flight of deposits from state-controlled banks into a rising, under-regulated duopoly as too much, too fast. "Those big tech companies bring to us a lot of challenges and financial risks," Yi Gang, governor of the PBOC, explained at a conference last year. "In this game, winners take all." So, in 2017, the government started requiring Alipay and WeChat to store customer funds in non-interest-bearing accounts at the central bank. The PBOC also set up a clearinghouse for online payments, a checkpoint allowing it to scrutinize the giants' money flows.

With an e-currency, China will gain even greater visibility into, and command over, the money sloshing around the system. Digital transactions won't have to be routed through a checkpoint; transparency will be inherent in the all-seeing, back-end ledger. That could also enable the country to keep closer tabs on investment risks, potentially helping avert the debt crises that periodically disrupt China's economy, explains Nathan Chow, senior economist at DBS Holdings, a Singapore-based multinational bank. Say authorities deem a "ghost town" mega–housing project to be unsalvageable: The nation's fiscal engineers could restrict—literally, by tweaking e-yuan code—investors from plowing more money into it. Rather than address problems after the fact, an e-yuan will let China "have everything under control in advance, preprogrammed," says Chow.

But skeptics fear more insidious outcomes. Mu Changchun, head of the PBOC's digital currency research institute, has promised the DC/EP will offer "controllable anonymity." But many people consider the phrase to be an Orwellian oxymoron. More likely, the digital currency will grant the state financial omniscience. With an e-yuan, China will be able to monitor the transactions of suspected criminals and terrorists, loose labels that could be applied to dissidents and ethnic minorities. It doesn't take a great stretch of the imagination to envision how the technology could be combined with China's nascent "social credit" system, granting privileges to upstanding citizens and revoking financial access for anyone deemed disloyal.

Marta Belcher, a tech-focused attorney at law firm Ropes & Gray, notes how Hong Kong pro-democracy demonstrators often wait in long lines at subway stations to purchase tickets with cash, so authorities can't place them at the scene of a protest. If an e-yuan displaced its hard-copy forebear, that world would dramatically shrink. "A cashless society is a surveillance society," Belcher warns.

"This design will have difficulty gaining traction outside of China, given the weak privacy controls," says Chad Cascarilla, CEO of Paxos, a U.S.-based cryptocurrency company. But privacy concerns may not stop DC/EP from attracting a global following.

A

AFTER FACEBOOK announced its plans for Libra in 2019, CEO Mark Zuckerberg warned Congress that the free world risked losing its edge to China. Libra has since scaled back its ambitions after early stumbles, while the PBOC has accelerated its timeline. And China stands to gain more than just a technological edge: The e-yuan represents its best chance yet to challenge the dollar as the global reserve currency, plastering the visage of Mao Zedong over the face of George Washington.

The U.S. has benefited enormously from the greenback's status as the global reserve currency since World War II. Exporters sell to the U.S. more cheaply, and lenders ask for lower interest rates, because they get paid in a globally prized currency. The U.S. also faces less risk from fluctuating exchange rates and wields greater sway over lesser economies' monetary policies.

All money systems are subject to network effects—gaining greater value as more people use them. Today, the renminbi

BITCOIN IS BACK! (MAYBE)

The volatile cryptocurrency that helped inspire the e-yuan has surged lately. Investors can thank a global climate of economic anxiety—and a ruling by regulators allowing U.S. banks to hold Bitcoin for customers.

SOURCE: BLOOMBERG; AUG. 3 PRICE AS OF 4 P.M. (ET)

makes up only 2% of global foreign-exchange reserves, while the U.S. dollar accounts for more than 60% (and the euro 20%). But if the DC/EP ever attains critical mass, it will likely be thanks to China's "Belt and Road" global trade and infrastructure initiatives.

Belt and Road, the centerpiece of Xi Jinping's foreign policy, is helping China cinch together a network of economically dependent client states from Southeast Asia to Egypt to Ecuador. If China can lure those countries into the e-yuan ecosystem, that could help the currency become a serious counterweight to the dollar. China has considerable leverage over these nations—many have borrowed heavily from Beijing. But China also has enticements to offer. Transaction fees can make cross-border trade and borrowing slow and costly in developing nations. Because digital currencies require fewer intermediaries, an e-yuan could "minimize transaction lag while lowering barriers to entry," says Da Hongfei, CEO and cofounder of Neo, a Shanghai-based blockchain project.

The DC/EP could cause problems for the U.S. even without attaining global-reserve status. Thanks to the dollar's dominance, the U.S. is a global financial gatekeeper: It can effectively decide who is approved for or blacklisted from using the SWIFT network, the international bank money-wiring system. That enables the U.S., for example, to "inflict very targeted sanctions on specific Russian oligarchs in response to bad behavior," says Aditi Kumar, executive director of the Belfer Center for Science and International Affairs at Harvard Kennedy School.

A Chinese digital currency threatens that power. "One of the built-in functions for DC/EP is direct remittance, which would bypass SWIFT," notes Jennifer Zhu Scott, founder of investment firm Radian Partners in Hong Kong. Wider adoption of DC/EP could reduce America's ability to punish adversaries and criminals—and give anyone embroiled in a policy dispute with the U.S. an alternative place to do business.

L

LAST DECEMBER, Treasury Secretary Steven Mnuchin told Congress that he and Fed Chairman Jerome Powell considered digital currency a low-priority issue. "In the next five years, we see no need for the Fed to issue a digital currency," Mnuchin said. The pandemic has revived interest on Capitol Hill—in part because Washington has struggled to issue stimulus benefits quickly through traditional channels—but progress remains slow.

The inertia may reflect a deep-seated disbelief that China can overtake America. Hank Paulson, former secretary of the Treasury and founder of a think tank focused on U.S.-China relations, regards DC/EP as "not a serious concern," as he wrote in an op-ed for *Foreign Affairs* in May. Beijing's approach to governance is too illiberal for its currency to win widespread adoption, Paulson argued.

But others believe the naysayers miss the bigger picture. "I think of it as analogous to the debate we're having about 5G," Kumar says. "The U.S. has had a tough time urging allies not to use the 5G tech Huawei is providing," she says, referring to the controversial Chinese telecom giant. While the U.S. alleges that the company poses espionage risks, customers argue that they can't pass up a chance to get high-quality tech at low cost. Haun, the Libra board member, laments: "Every day that passes, it gets harder and harder for Western-backed projects to keep up."

China's government, meanwhile, is seizing the chance to become an integral part of the world's digital fabric for decades to come. Yifan He, CEO of Red Date Technology, a state-supported company that aims to offer blockchain-based cloud services, likens all this work to "building the next Internet." The *current* Internet, of course, owes its existence to Pentagon-funded research. It's a reminder that technologically ambitious governments can reshape economic history in profound ways. Just ask Kublai Khan.

STAYING CYBER-SECURE IN A MULTICLOUD WORLD

Why it pays to invest in cloud-native security solutions—and how they can help you prevent cybercrime.

MULTICLOUD OPERATING ENVIRONMENTS ARE THE FUTURE OF BUSINESS. Ninety-eight percent of organizations expect to move to multicloud setups by 2021, according to researchers at IBM. But the greater flexibility and scale that these solutions provide also bring additional security concerns. To successfully protect these complex environments, enterprises must look to threat detection and response solutions that can provide visibility across the whole attack surface, not just a single cloud.

As Jesse Rothstein, chief technology officer and cofounder of leading network detection and response provider ExtraHop, explains, "Using cloud provider tools alone was one thing when most organizations used only one IaaS [infrastructure as a service] provider, but that's not the case anymore. As organizations adopt different clouds to serve different needs, it's not practical or sustainable to look at different tooling for each environment."

Gaining a complete understanding of the multicloud environment, however, is challenging. According to statistics provided by ExtraHop, most enterprises' efforts to migrate to the cloud stall after less than 20% completion—often due to security concerns. Cloud provider tools offer visibility only into workloads running on their own infrastructure. Traditional on-premises solutions often don't work in the cloud. And as cloud providers make it easier to spin up resources, the friction associated with traditional security models feels increasingly out of step with modern digital business, at a time when cyber threats have never been greater.

According to Rothstein, the solution is to use threat detection and response systems that are cloud-native from the get-go. "It's important to think in multiple dimensions," he says, "and implement detection and response systems that can protect your business everywhere it operates."

That's why the ExtraHop team built Reveal(x) 360 to be cloud-native from the start. Reveal(x) 360 uses machine learning and artificial intelligence to apply millions of models to petabytes of data to detect threats within the network's traffic and across multiple cloud environments. That same data set can also be used to address those threats quickly by investigating their source and initiating a response via integrations with cloud service providers as well as third-party technologies like CrowdStrike and ServiceNow.

As more organizations adopt cloud computing to scale their operations, enable remote workers, and support Internet of things (IoT) deployments, a cloud-native approach to security is going to be required, according to Rothstein. "With cloud and IoT, the attack surface now exists well beyond the traditional perimeter, rendering the old prevention and protection model obsolete," he says. "You have to be able to detect threats and respond to them quickly, anywhere and everywhere that they may be hiding. And because network traffic is observed, threats can't hide there. The wire doesn't lie."

Najoh Tita-Reid took an international assignment and moved her family from New Jersey to Europe seven years ago.

AMERICA'S BLACK BRAIN DRAIN

WHY AFRICAN-AMERICAN PROFESSIONALS ARE MOVING ABROAD—AND STAYING THERE

BY BETH KOWITT

PHOTOGRAPH BY **GABI VOGT**

IT WAS 2013, and Najoh Tita-Reid, then an executive at pharmaceutical giant Merck, was in the midst of the interview process for a job that would send her on her first international assignment. During a break in the conversation, "a white gentleman pulled me aside," she says, and told her that all of the white men up for the role were "selling that they'd conquered the moon"—while she was focused on explaining what she saw as the weak spots in her résumé. If Tita-Reid wanted the position, he said, she would need to turn everything she had into an asset.

So she went back into the interview and laid out her biggest selling point: She was the best person for the job because she was a Black woman in the United States. She was used to being the only person in the room who looked like her. The "cultural competency" the hiring managers were looking for was not a skill she'd had to learn for work; it was something she'd had to master to just get by in her everyday life. "I can get the nuances of every culture because this is what you have to do as an African-American," she told them. "You have to shape-shift to survive." She sold it, she says, "and it was all true."

Tita-Reid got the promotion, running Western Europe for the company out of London. Seven years later, she's still living and working abroad—now in Switzerland, where she holds a global marketing job for Logitech. And, at least for now, she has no plans to return to the U.S.

Like many of corporate America's ladder climbers, Tita-Reid first went after an international role with the goal of enhancing her career. But in the years since she made that first move to London, she's become part of a cohort of Black American expats who have chosen to stay abroad because they've found that the professional benefits of working overseas are far more profound than the usual résumé-building check mark. Working in Europe, Tita-Reid says, has been like wearing an oxygen mask. It's allowed her to breathe—to lead and perform without feeling the crushing weight of America's dysfunctional racial dynamics at every moment.

With her friends, Tita-Reid calls it the "James and Josephine effect"—a hat tip to James Baldwin and Josephine Baker, Black Americans who fled the racial persecution of the U.S. during the first half of the 20th century and ended up with thriving careers in Europe. "It's not a new phenomenon at all," she says. "I feel like part of that legacy."

The decision to work and live abroad has been brought into sharp relief for many Black American expats this spring and summer as they watch a national movement take hold back home in the aftermath of the police killing of George Floyd. There's a sense of guilt at not being on the front lines, mixed with affirmation of why they did not want to return.

Working abroad, these executives say they left behind the fatigue that many described as routine for Black people in corporate America: the exhaustion brought about by being asked to solve your company's diversity issues; living by the unwritten rules that dictate how you present yourself at work; having to prove every day that you deserve to be in your role. Once abroad, with the weight of their companies behind them, many Black expatriates said they felt instantly valued and treated with a level of respect and deference from their colleagues they had not known in the U.S.

The benefits extend far beyond the office. The prevailing message in more than a dozen interviews with Black Americans who are working or have worked overseas: Their international experience was the first time race was not the primary frame of reference through which they were viewed. "You're an American, you're not African-American," says Shaundra Clay, who lived in Europe for eight years as a health care executive. "You are not made to feel like you are carrying the burden of anything. You are carrying the power of something." It was a level of privilege she had never experienced before in her life. In the U.S., Nancy Armand, an executive at HSBC Bank USA, was always conscious of her gender and race, she says. In the U.K., she was always conscious of her nationality first. "I'd never been an American first and then Black," Armand says. "It's a refreshing change."

And yet these jobs can be isolating. Rarely does Tita-Reid see another Black woman at her level. "On a day-to-day basis," she says, "I am alone." That's in part because the expat universe is running 20 to 30 years behind the larger corporate world in terms of diversity and inclusion, says Adrian Anderson, a partner in KPMG's global mobility services. He has both personal and professional experience here: For more than 25 years, Anderson has worked in the industry, which helps multinational organizations manage their workforces' foreign assignments; he has also lived abroad as a Black American executive. Most of these coveted international roles come through word-of-mouth networks, which have historically boxed out Black employees. Or they are reserved for developing those expected to move into the executive suite—a space that has also long passed over Black talent. Anderson says most global organizations prefer that executives have international experience in order to move into top-level roles, making the lack of access to the expat world a systemic barrier that has kept Black employees from

NANCY ARMAND, an HSBC Bank USA executive

I'D NEVER BEEN AN AMERICAN FIRST AND

Adrian Anderson helps companies manage their expat execs—and he's been one himself.

PHOTOGRAPH BY NANCY NEWBERRY

reaching the top echelons of corporate America.

Black executives who pack their bags and leave the U.S. behind are quick to point out that they are by no means moving to any sort of utopia. "I'm very clear that wherever I go, I'm perceived as a Black man," says Warren Reid, Tita-Reid's husband and founder and CEO of Nemnet Minority Recruitment, a diversity recruitment and consulting firm that works with educational institutions. "Unfortunately, in the overwhelming majority of the globe, I don't have a positive brand image. I'm mindful and not naive about that." Despite such awareness, Reid and others interviewed for this story said they had not realized how heavily the stress of being Black in America weighed on them until they left. Even when they faced bias abroad, they never feared for their lives or their children's the way they did in the U.S. Says Ini Archibong, a designer and business owner originally from California who now lives in Switzerland: "The brand of racism in America is unique."

IN CORPORATE AMERICA, Black executives are used to having to tell people they're the boss. Otherwise, says Tita-Reid: "When you walk into a room in the U.S. and you are five levels above your sales rep who's a white man, they look at him and shake his hand and give you the bag." But soon after transferring to the U.K., she had a meeting with a client who immediately identified her as the person in charge. "You're a Black American female, and you're here, so you have to be the best," she recalls him saying. It was the first time anyone had labeled her the "best" at anything, she says. "I almost cried." Reid distills the dynamic this way: In the U.S., he says, the question is always, How did you get in the room, and who let you in? In the U.K., the assumption is that if

77% SHARE OF COMPANIES THAT SAY INTERNATIONAL EXPERIENCE IS A CRITICAL SKILL FOR MOVING INTO LEADERSHIP

Experts say Black executives have less access to global assignments, contributing to the systemic bias Black professionals face in corporate America.

SOURCE: PWC

THEN BLACK. IT'S A REFRESHING CHANGE.

41% SHARE OF EMPLOYERS THAT SAID THEY HAVE SPECIFIC DIVERSITY AND INCLUSION OBJECTIVES AS PART OF THEIR GLOBAL MOBILITY STRATEGY

Some employers are now focusing on ensuring that international assignments don't exclude women and people of color, but it's still a long way from being a top priority for most.

SOURCE: KPMG

you've made it into the room you deserve to be there.

But working in Europe means adjusting to more subtle forms of racial prejudice—which often intersect with a strong vein of classism, say many Black execs who have done tours abroad. Arlene Isaacs-Lowe, a 22-year vet of Moody's, transferred to the U.K. in 2015 to run relationship management for Europe, the Middle East, and Africa for the ratings agency. The day she met her new U.K. team, she recalls being repeatedly introduced as an alumna of Howard University and a board member of its business school, followed by a recitation of Howard's famous alumni. It stuck her as odd, she says, until she realized it was a way of establishing the bona fides of the historically Black university—and by extension, proving her "pedigree" as fellow member of the upper class.

In 2017, Tita-Reid joined a health food company as global CMO, and the family moved to Switzerland. In her new home, nationalism was the dominant force, she says. Swiss people support Swiss people first, she says: "If you don't happen to be of that culture, it has nothing to do with you." She recalls a conversation with a German businessman, who felt that there was bias against his nationality throughout the country. To Tita-Reid, it was a relief that everyone was considered an outsider. "We're all equal-opportunity excluded," she says. "To me, that's amazing. It's the first time I've ever been equally excluded." She explained to the businessman that unlike when he returned to Germany and felt accepted, when she went back to the U.S., she still felt like an outsider. "The negativity of being an American in Europe is not as bad as being a Black American in America," she says.

Three years ago, Tita-Reid had a chance at a job that would take her back to the U.S., but she turned it down. It wasn't just a career decision but one for her family. "The stress that I felt in the U.S. and concern for my husband and son was gone," she says. "It was more of a weight than I had ever realized."

I spoke to Reid over Zoom, where he sat outside their Zurich home on a sunny day with birds chirping in the background. He told me about the family's first night in London when they were living in temporary housing. He was going back and forth between the hotel and the flat late at night when he saw two police officers walking toward him. "I remember in that moment, I went through my mental checklist of no sudden moves, communicate, make sure you're seen." The police officers walked past him with nothing more than a good night. "That blew my mind," he said.

After we talked, Reid sent me a follow-up email, quoting James Baldwin: "To be a Negro in this country and to be relatively conscious is to be in a state of rage almost, almost all of the time." Living abroad, Reid was free of that rage, he said: "It does not consume or preoccupy me in the way that it did and does when I return home."

INI ARCHIBONG, a designer living in Switzerland

ONCE THAT FEAR LIFTED FROM ME, I REALIZED I WAS NEVER GOING TO MOVE BACK.

FOR DIMITRY LÉGER, the narrative of the Black American expat who thrives abroad holds true—until you want to get hired by a European company. If you have the wealth of America behind you, "you are welcomed with open arms," he says. "When you ask for a job, things change."

Léger made the move abroad 15 years ago. His then-wife is Swedish and wanted to live closer to her family, and Léger had always been intrigued by the idea of an international career. In 2004, he left journalism behind to get a graduate degree in international relations at Harvard, and the following year ended up in Geneva with the World Economic Forum as a partnership and communications manager. (Léger worked at *Fortune* from 1999 to 2002, but we never overlapped.)

Over a decade, Léger says he tried repeatedly to secure a full-time role with the UN, or as a corporate communications executive with a multinational company. Léger, who is Haitian-American and speaks both English and French, says at the UN he was repeatedly passed over; the jobs ended up going to Brits who were not perfectly bilingual—a supposed prerequisite for those roles. In the corporate world, interviews abounded, but he says the leads would turn cold once he showed up in person. One would-be employer went as far as explicitly citing his race as an issue, he says, telling him, "Our investors will have a problem with a Black spokesperson." Eventually Léger started following the European practice of putting his photo on his résumé to spare himself the grief. Once he did, even the interviews dried up.

Léger attributes part of his struggle to a lack of formal or informal support structures. The number of top Black executives in the U.S. is woeful, but in Europe Léger found the situation to be far worse. "There are no senior Black executives anywhere," he says, "so there's no network of us to look out for each other." Several Black men, including Léger, told me it was often assumed that they were visitors, because otherwise how could they be eating in this fancy restaurant in this nice part of town?

Now, with his oldest child thinking about attending college in the U.S., Léger was back in New York, living in Midtown Manhattan. When we spoke in June, he was regularly encountering the Black Lives Matter protests in the city and feeling nervous every time he saw a police car. "I did not miss that," he says. But he was still glad to be home. "I like my odds of finding a stable full-time job in media," he says, "of getting the job that eluded me in Europe, even in the middle of a pandemic and the ongoing fight for racial justice here."

ONE OF THE MAJOR DOWNSIDES of transferring abroad is the struggle that comes with moving back. All of a sudden, executives' worlds felt much smaller, their jobs narrower. Clay returned to the U.S. in 2016 after eight years in Europe. She described the experience as akin to going back to your hometown after decades away, and having your successes celebrated but no one fully understanding how much you have grown and changed.

But for Black Americans, repatriation also came with unique baggage. Clay said the racism she had always seen and experienced in the U.S. now emerged with a different sense of clarity. "The longer you're away, the more stinging and shocking it becomes," she said. "All the burdens become your burdens again, and they feel heavier because you've lost the muscle of carrying them." She and others I spoke to said they now had less tolerance for the racism they regularly experienced.

Those who have remained abroad have faced their own new personal struggles this spring and summer, describing feelings of deep conflict in the wake of the police killing of George Floyd and protests that have followed. Reid says by being abroad he's meeting his primary obligation to provide a safe and affirming environment for his family; his children have not had to wrestle with some of the issues he did as a Black kid growing up in the U.S. "That's been the good side," he says. "The other side is there is a movement that's going on, and I'm removed from it. There's a little guilt that goes along with it: How could I bring to bear my education, resources, and network to move the movement forward?"

Archibong, the American designer based in Switzerland, says it's difficult not to be in the U.S. right now. But while Switzerland has its own problems, he says, it's not enough to make him want to go back. The power of escaping that constant existential fear described by so many of the Black American executives I spoke to is too strong. "Once that fear lifted from me, I realized I was never going to move back," he says. Not being constantly concerned with his physical safety has allowed him to "clear up space" in his head and be more creative in his work. A few years into his move to Europe, Archibong stopped wearing the collared shirts he'd long worn every day—even if it meant being overdressed for the occasion. The formal look had started as an aesthetic choice, he says, but at some point he realized it had become a kind of armor. In the U.S., he'd felt safer when he was dressed up, he says, and the dressier clothes had helped him command the same professional respect that other, non-Black designers got even when casually attired. In Switzerland, he no longer feels the need; now he pulls out the suit and tie only when he's in the mood.

Tita-Reid struggled to articulate what it's been like watching the current movement in the U.S. from afar. She, like her husband, says she feels somewhat guilty that she's an ocean away. It has been both sad and validating to see all of the concerns that had kept her from wanting to return bubble up to the surface. It's also made her acutely aware of all the good things she had left behind. "You do give up something, which is having your culture, your people, your friends and family," Tita-Reid says. "It's at a cost." ■

20% SHARE OF COMPANIES THAT SAID THEY WERE LIKELY TO SEE A DECREASE IN INTERNATIONAL MOVES AS A RESULT OF COVID-19

This shift could have an outsize impact on Black executives, who are already less likely to land foreign assignments because of the informal way they are doled out.

SOURCE: PWC

FORTUNE

WORLD'S LARGEST COMPANIES

▼G500

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GLOBAL

ILLUSTRATION BY **SERGI DELGADO**

AND THEN THERE WERE TWO

By GEOFF COLVIN

The U.S. is no longer the world's only economic superpower. And as China passes a new milestone on the Global 500, the competition between the nations is intensifying. Here's why the rivalry is at a crucial turning point—and what it means for business.

RARELY DO RELATIONS between great powers degenerate as quickly as they did when the U.S. and China skirmished in late July. When the U.S. ordered China to close its consulate in Houston within 72 hours, it looked like punishment for alleged theft of COVID-19 research and other valuable information by Chinese hackers; the Justice Department had announced charges that same day. Or perhaps it was a further response to Beijing's crackdown on Hong Kong, for which the U.S. had already revoked the city's special status in trade relations.

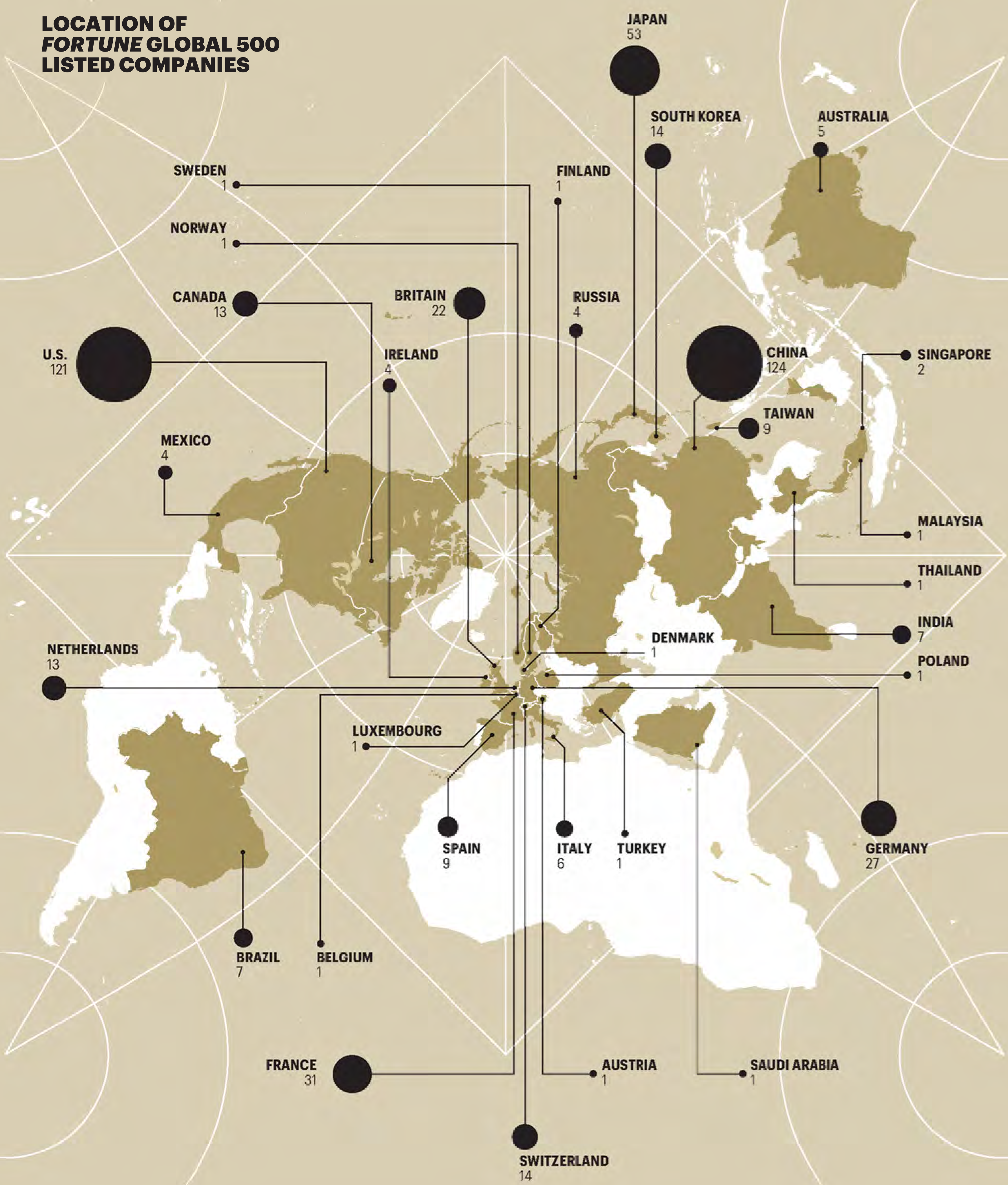
But the State Department said the real reason was what it asserted were years of "massive illegal spying and influence operations." So why close the consulate at that moment? Virtually all analysts say the timing reflects the presidential election, as President Trump and former Vice President Joe Biden vie to appear the tougher man on China. Certainly this was not routine diplomacy theater. It was unprecedented. In the 41 years of formal relations between the two countries, the U.S. had never ordered the closure of a Chinese diplomatic facility.

Both sides replaced boilerplate umbrage with vituperation. The U.S. "will not tolerate the PRC's violations of our sovereignty and intimidation of our people," declared a State Department spokeswoman. A Chinese foreign ministry spokesperson shot back that the shutdown was "an outrageous and unjustified move which will sabotage relations between the two countries." A day later, Secretary of State Mike Pompeo said the U.S.-China relationship should be based on a principle of "distrust and verify" and dismissed "the old paradigm of blind engagement with China." The day after that, China ordered the U.S. to close its consulate in Chengdu, a major business hub in southwest China, another unprecedented move.

And to think that just last December, when the U.S. and China signed a phase 1 deal to start unwinding the trade war, President Trump said the U.S.-China relationship "might be the best it's been in a long, long time."

The consulate confrontation marks a particularly clear and dramatic advance in a trend the whole world will feel: the intensifying competition between the world's two largest economies. It adds heavily to a broader uncertainty, a combination of highly consequential unknowns that together will redirect our future. They're distilled in two big questions, both of which arose in the late-July collapse of relations: Where will the U.S.-China rivalry take us? Which country will emerge from the COVID-19 pandemic with the least long-term economic and social damage? Both questions, moreover, are intertwined with a third: Which of two starkly different presidential candidates will America choose? Together, their answers will mark a turning point in the world's progress.

New data, presented in *Fortune*'s 2020 Global 500 ranking of the world's biggest corporations, reveals a landmark change in the U.S.-China rivalry. For the first time, there are more Global 500 companies based in mainland China, including Hong



A NEW LOOK AT THE TOP

For the first 29 years that *Fortune* compiled our Global 500 ranking of the world's biggest companies, the U.S. never failed to finish No. 1. Well, the winning streak is finally over. This year's list features 124 companies based in mainland China, including Hong Kong. Add in Taiwan, and there are 133 in Greater China. The U.S. falls to No. 2, with 121.

INFOGRAPHIC BY **NICOLAS RAPP**

Kong, than in the U.S.—124 vs. 121. If you include Taiwan, the total for Greater China is 133.

The reversal of leadership reflects long-running trends. The number of U.S. companies in the ranking has been declining every year since 2002, when it was 197. The number of Chinese companies has been increasing every year since 2003, when mainland China placed 11 on the list.

Of the three questions in the triple turning point, the future of the U.S.-China relationship arguably holds the greatest world-historical significance. Harvard China expert Graham Allison frames the relationship as "an inherent, deep, structural rivalry," a rising power threatening a solidly dominant power. The U.S.-China rivalry is dangerous, Allison tells *Fortune*, in large part because it's deeply emotional, particularly for those Americans who feel that the nation's rightful and only place is to be "No. 1" in the world order. Allison has famously called it "Thucydides's trap" after the ancient Greek historian's recounting of how Sparta's response to the threat of Athens's rise led to a 30-year war.

WHILE THE U.S. and China are a long way from that, the current situation is bad and deteriorating fast. "Every topic that matters is getting worse," says Ian Bremmer, founder and president of the Eurasia Group consulting firm. "Huawei, Hong Kong, the South China Sea, Taiwan, the U.S. withdrawal from the WHO over China, you name it."

Most experts agree that over the past year the relationship has fallen into a self-reinforcing downward spiral. "I'm sitting in Washington, and it feels as if we're in the center of this hurricane and there's only one direction we're heading in," says Scott Kennedy, an expert on Chinese business and economics at the Center for Strategic and International Studies. As Beijing aggressively pushes territorial claims on the Indian border, over Taiwanese airspace, and in the South China Sea—actions intended as messages to the U.S., diplomats say—the U.S. has pressured allies to ban telecom equipment from Huawei (No. 49 on the Global 500) and has even pondered banning U.S. travel by members of the Chinese Communist Party and their families, an estimated 270 million people, including the CEOs of nearly every important Chinese company.

The shift in the Global 500 is significant because this rivalry is founded on economic might. Analysts can quibble over which country's economy is biggest. The U.S. remains well ahead when the comparison is based on currency exchange rates, with 2019 U.S. GDP of $21.4 trillion vs. China's $14.3 trillion. But based on purchasing power parity, a measure that adjusts for the countries' differing price levels, China is slightly ahead of the U.S.—$21.4 trillion vs. $20.5 trillion as of 2018, the most recent year for which the World Bank has data. The gap is probably wider now and continuing to widen. That's the measure that counts, says Allison, because it shows "who can build the most drones" or fund the most research.

It also makes China the world's largest market for increasing numbers of products and services. It "will be the first market where new products are launched," says Kennedy, "so Chinese consumers will have a greater say in the direction of industries. The American market may not be large enough to be where products are scaled up."

For that and other reasons, U.S. companies will be highly unlikely to leave China. A billion prospering consumers cannot be forsaken by any business that hopes to remain globally competitive. In addition, few companies will want to remove China from their supply chains entirely. While trade tensions and the pandemic have shown many companies worldwide that they were too reliant on Chinese suppliers, Chinese companies often have manufacturing expertise that can't be found elsewhere. Besides, foreign companies that ditch China—in favor of India and Vietnam, for example—may find that China becomes less welcoming when those companies want to sell to the Chinese market.

China's economic strengths are sobering, but to understand this rivalry fully, GDP alone is too gross a measure. The critical field of conflict is technology, the foundation of economic growth and national security. Since the founding of the People's Republic, Chinese leaders, including the President, have declared a national policy to "catch up and surpass" the developed world's technology. For China's leaders, "technological progress is not only a means to economic and military prowess," writes Harvard's Julian Baird Gewirtz, "but also an ideological end in itself—offering final proof of China's restoration as a great power after decades of struggle."

AND TECH is where the two countries are most noticeably decoupling. Huawei is the world's No. 1 maker of 5G networking equipment and, as of this year's second quarter, the No. 1 maker of phones. But its products are virtually outlawed in the U.S., and its CFO has been under house arrest in Canada for 18 months on U.S. charges of bank fraud, wire fraud, and theft of trade secrets, charges she and the company vigorously deny. For its part, China has effectively banned some of America's most ubiquitous tech giants, including Google and Facebook. "We've gone from a more integrated world to a Splinternet," says Bremmer. "Tech is by far the crux of the competition right now, the most important piece and the most dangerous."

The technology war is being fought on many fronts—A.I., 5G, voice recognition, facial recognition, fintech, and others. A.I. is the most important because it turbocharges all the rest. A recent article coauthored by Allison and an anonymous U.S. tech industry leader argues that China is far more advanced in A.I. than the U.S. national security community realizes—noting the advantages China gains by having a population four times the size of the U.S. "In A.I., brainpower matters more than computing power," they write, and China graduates 1.3 million STEM students annually vs. America's 300,000, and 185,000 computer scientists vs. America's 65,000. Even in the U.S., of every 10 computer science Ph.D.s graduating, three are American and two are Chinese; most Chinese postdocs will eventually return home.

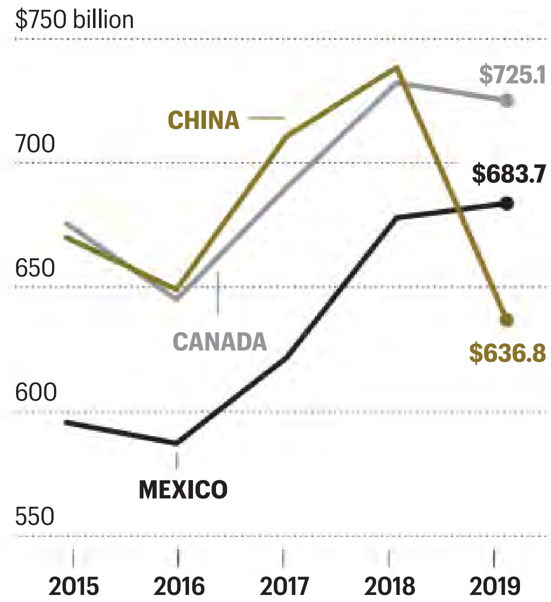
But if China seems like an economic and technological steamroller about to squash the U.S., it isn't. A closer look shows that despite China's strengths, this rivalry's future remains highly uncertain.

Start with those 124 mainland Chinese companies in the Global 500. Though they outnumber U.S. companies, they're smaller, accounting for only 25% of total Global 500 revenue vs. America's 30%. A large majority of the Chinese companies—68%—are state-owned enterprises; they didn't get big by winning in the rough-and-tumble competition of open markets. While the list includes Chinese tech behemoths that compete internationally—Alibaba Group, Huawei, Lenovo—it also includes many purely domestic businesses; several are coal miners or electric utilities.

The nature of these companies makes a big difference to their power in the strategic rivalry. The key question is this: How have they grown so large? "Was it by innovation, smart managerial practices, and good corporate governance," asks Kennedy, "or have they gotten there through the power of the Chinese mercantilism and largesse from Chinese state-owned banks?"

Even China's eventual accession to

VALUE OF GOODS AND SERVICES TRADED, TOP U.S. PARTNERS



SOURCE: U.S. DEPARTMENT OF COMMERCE

the title of World's Largest Economy may not be as inevitable, or at least not as imminent, as many people believe. If both countries were to continue to grow their GDP (calculated at market exchange rates) at their 2019 nominal rates, China wouldn't pull even with the U.S. until about 2050, writes Ruchir Sharma, Morgan Stanley Investment Management's chief global strategist, in a recent *Foreign Affairs* article. If China's growth slowed by just one percentage point, it wouldn't catch up until 2090, meaning "few Americans alive today are likely to be around to see the United States fall to second place."

The most probable future is what some analysts are calling Cold War II. It won't be like the first cold war; the USSR was a much weaker economy than the U.S. and scarcely traded outside Eastern Europe. But it's a conflict, already underway, in which the adversaries field every weapon but bombs and bullets while also interacting civilly on some issues of mutually beneficial trade. "In commodities such as liquefied natural gas and agriculture," says Bremmer, "the U.S. and China will be doing business with each other." Just as they did last year, when the U.S. exported $13.8 billion of agricultural products and $3.1 billion of oil and gas to China.

THE NEXT FRONT in the standoff may be the phase 1 trade deal. "Can it hold until the election?" Bremmer asks. "Trump will be blaming China an awful lot. It may be tempting to break the deal," even though consumers, the finance industry, the agriculture industry, and others would suffer.

Which raises another of the great questions, the identity of the next President. Policy analysts agree that under a President Biden, the tone of the U.S.-China relationship would change. If he were able to lower the temperature, both sides could gain room to negotiate. He would also be more likely than Trump to enlist European and Asian allies, say Eurasia Group analysts, to present a united front in negotiations with China. At the same time, the U.S. policy stance would likely remain confrontational. Politically, says Bremmer, "the only policy issue on which there's broad bipartisan agreement is that there should be a tougher line on China."

At this triple turning point, we're left without answers—only with the certainty of a less stable world. Relations between the two great powers are fraying, leading who knows where. But the scenarios aren't all bad. Maybe China and the U.S., rationally pursuing self-interest, will manage their relationship as corporate-style competition. Multiple effective vaccines—from the U.S., China, and elsewhere—could vanquish COVID-19 in less than a year. In that scenario, economies would revive, people could hug each other again, and global anxiety would unclench at least a bit.

In an unstable world, even the extreme scenarios—good and bad—seem plausible. Planning is harder; bets are riskier. In all of our lives, there's less room for error.

CHANGE AGENTS

SHINING A LIGHT ON SAUDI DESIGN

One of Saudi Arabia's most celebrated jewelry designers, **Nourah Al Faisal** is the founder of the Adhlal platform for emerging Saudi designers.

The initiative aims to develop a thriving design ecosystem in the Kingdom by supporting local workshops, and to turn Saudi Arabia into a regional powerhouse for design and manufacturing.

Just six years after launching her brand, Nuun Jewels, Saudi jewelry designer Nourah Al Faisal has earned an international reputation, and she is using her celebrity to help support the Kingdom's fast-growing design community.

"Designers like me who have the good fortune to work outside Saudi Arabia understand what a strong and confident design ecosystem should look like," says Nourah, who owns a boutique in Paris. "We want to create our own Saudi identity as designers, develop the local marketplace, and encourage talent and creativity across our design industry."

Nourah's own success is testament to the international appeal of the abstract shapes and geometrical lines that are among the prominent characteristics of the Kingdom's visual arts.

Nourah made her debut as a jewelry designer with two very different collections. The more traditional collection, "Light," made extensive use of colors, flowers, and classic designs inspired by nature. The second collection, "Shadow," deconstructed the same motifs into two-dimensional lines and shapes using only black and white, and heralded the arrival of a major new talent on the international jewelry scene.

"With the first collection, I wanted to pay tribute to classic jewelry looks and show what I was capable of in that style," Nourah says. "With the second collection, I let loose and showed what I really wanted to do."

The road to success for Nourah was as intricate and unusual as some of her pieces. After studying interior design after graduating, she often designed jewelry for friends and family, but gave little thought to turning her

CULTURE OF CREATIVITY

hobby into a profession. But when an international expert saw her sketches and helped her win an apprenticeship in a jewelry workshop, she gained the skills and acumen to set out on her own.

A familiar figure at international exhibitions, Nourah encourages and supports other talented Saudis across the design industry, and she recently founded the Adhlal initiative to help Saudi Arabia fulfil its potential as a regional hub for design, manufacturing, and marketing. “Adhlal’s job is not to teach design but to give the designers the tools they need to succeed,” she says. “I will do anything I can to help the young generation of Saudi men and women express themselves to the world.”

What would you say are the main inspirations for your work?
For me, it is balance rather than symmetry that is important. I am very influenced by geometry and by the organic shapes in nature. In nature everything is balanced, not symmetrical. Symmetry can be boring but balance can be quirky and exciting. The fact that something is not perfect is what makes it beautiful. My sweet spot is looking at things from a different angle and trying to capture that balance.

Which stones are your favorites?
I always work with asymmetrical stones. There are entire universes within opals. They are miraculous to me. Currently I am obsessing over colored gemstones like tanzanite, which has lovely, almost edible shades of lavender and gray, and pink spinel. These kinds of stones do nearly all the work for a designer.

> “THE BEST WAY TO GET TO KNOW A PEOPLE AND UNDERSTAND THEIR VALUES IS BY EXPLORING THEIR ARTS, THEIR DESIGNS, AND THEIR CULTURE
>
> —
>
> **NOURAH AL FAISAL,** FOUNDER AND CREATIVE DIRECTOR, NUUN JEWELS”

The Nuun Jewels boutique in Paris

Why did you establish Adhlal?
Adhlal aims to boost and promote the local design industry in Saudi Arabia by supporting and amplifying the abilities and voices of local designers. I believe that Saudi Arabia can develop a locally and globally competitive design industry. We just need to grow our expertise and develop our knowledge base. Until now, Saudi designers have had to do everything by themselves. With Adhlal, we are building a community and an ecosystem that will give them the support they need to design and manufacture in their home country.

How fast is life changing in Saudi Arabia?
The speed at which change is happening is unbelievable, especially for artists and for women. Young women now have so much confidence and so many aspirations. It is a pleasure to work with them and to help them achieve their goals. And as Vision 2030 becomes a reality, the voices of our young and talented artists and designers will help make connections with the outside world, share our values, and build a new level of cultural dialogue and understanding.

AstraZeneca

COUNTRY

U.K.

2019 REVENUE

$24.4 BILLION

CEO Pascal Soriot helped AstraZeneca, once a research laggard, build the best R&D shop in Big Pharma. Now the company faces its biggest challenge yet: mass-producing a vaccine to stop a global pandemic.

A REBORN PHARMA GIANT TAKES THE LEAD AGAINST COVID-19

By JEREMY KAHN

ON A WEDNESDAY morning in late June, Junior Mhlongo arrived at the Chris Hani Baragwanath hospital in Soweto, the predominantly Black township outside Johannesburg, South Africa. Sitting inside an examination room, he unzipped the purple jacket he wore to guard against winter in the southern hemisphere. But he kept on the red cloth mask he wore to guard against the spread of COVID-19.

Mhlongo slipped his left arm from his coat sleeve and hiked up the cuff of his shirt. He winced as a nurse stuck a needle into his arm and injected him with a syringe of clear liquid. "I feel a little bit scared, but I want to know what is going on with this vaccine, so that I can tell my friends and others," he told the reporters who had come to watch.

It's not just Mhlongo: The whole world is awaiting an answer. The young volunteer is among the first of some 2,000 patients in South Africa—and thousands more in the U.K., the U.S., and Brazil—participating in clinical trials for a vaccine for COVID-19, pioneered by scientists at the University of Oxford in England.

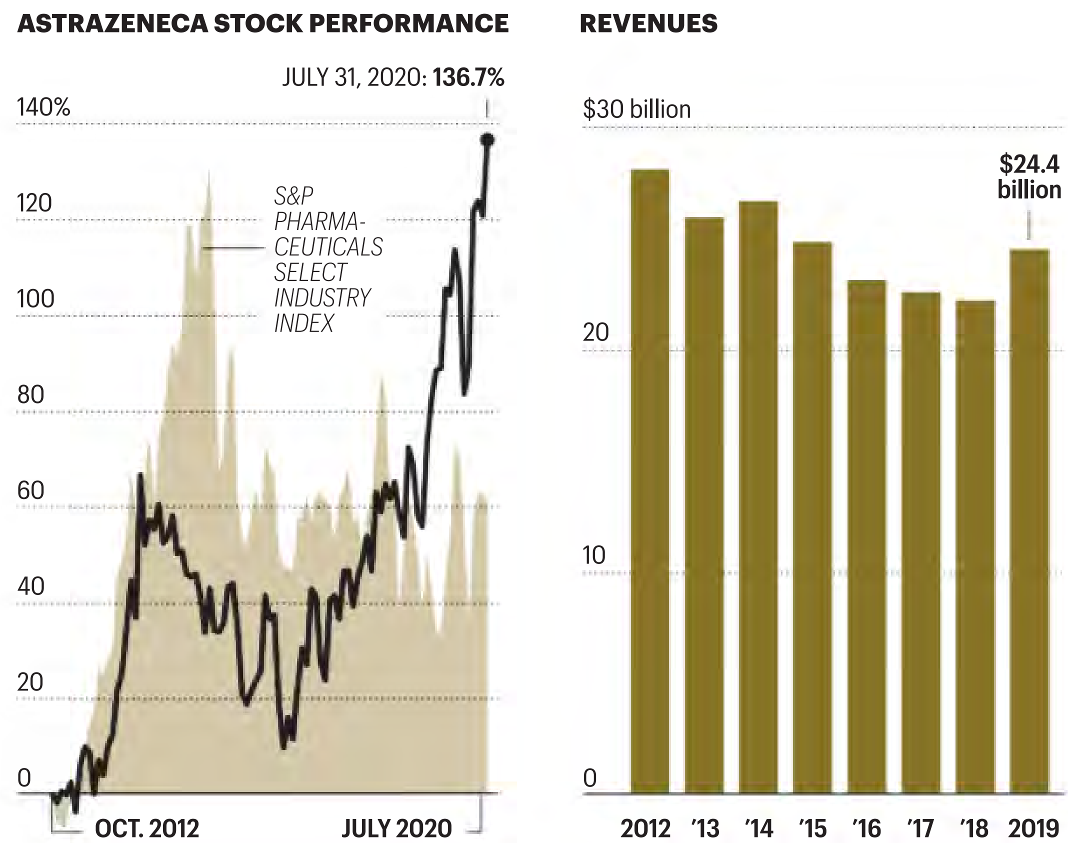
A vaccine is the key to ending the long, global nightmare of the coronavirus pandemic. It can unlock economies and save countless lives. Without it, millions more could die, and business and government will remain hostage to the virus.

As of late July, there were at least 168 different vaccine candidates in some stage of development, according to the World Health Organization. But the Oxford vaccine is arguably the furthest along in human testing. Preliminary human trials have been promising. In anticipation of success, the U.S. government has preordered 300 million doses at a cost of $1 billion. The U.K. has ordered 100 million; the European Union, 400 million. Deals have been struck to provide the developing world with more than 1.3 billion doses.

Still, vaccine development is always a gamble—a 2018 MIT study

PUTTING PROFITS IN SHARPER FOCUS

Under Pascal Soriot, AstraZeneca has pivoted away from so-called primary-care drugs and toward more profitable "specialty care" therapies. That shift has enabled the company to yield impressive returns for shareholders, even as its overall revenue declined.



SOURCES: BLOOMBERG; S&P GLOBAL

John Bell | Professor of Medicine, University of Oxford

> In under a decade, AstraZeneca improved its drug-development success rate from 4% to almost 20%—three times the industry average. **"It's one of the great turnaround stories in pharmaceutical companies over the past 20 years."**

A SHOT AT SALVATION
A volunteer receives an injection at a hospital in Soweto, South Africa, as part of clinical trials for the COVID-19 vaccine developed at Oxford's Jenner Institute. If the trials succeed, AstraZeneca has committed to producing billions of doses.

PREVIOUS SPREAD: ZACH GIBSON—BLOOMBERG VIA GETTY IMAGES; THIS PAGE: FELIX DLANGAMANDLA—BEELD/GALLO IMAGES VIA GETTY IMAGES

found that 66% of vaccine candidates for infectious diseases fail. And no one has staked more on the Oxford vaccine than Pascal Soriot, chief executive officer of AstraZeneca, the British pharma giant. Soriot scored a coup in late April when AstraZeneca swept in to become Oxford's commercial partner on its COVID-19 vaccine, displacing rivals with better track records in vaccine development to seize the lead in this global race.

The Oxford partnership has drawn unprecedented attention to AstraZeneca. But it's only the latest in a series of bold collaborations, strategic shifts, and calculated risks at the company over the past eight years—moves that have elevated AstraZeneca from one of Big Pharma's least successful drug developers to its most dependable. Soriot is the engineer of that metamorphosis. Born in France, the 61-year-old pharma lifer has spent most of his career abroad but still speaks in French-inflected English. He has jet-black hair that contrasts with the crisp white dress shirts he favors, and he speaks with a directness rare in executives of any nationality. Soriot tells *Fortune* he believes in "casual intensity." "We have to take what we do seriously, but we should not take ourselves too seriously," he says.

Of course, few pharma CEOs have faced a challenge as existentially serious as COVID-19. The Oxford partnership is risky, requiring AstraZeneca to commit hundreds of staffers to expanded clinical trials and manufacturing—long before the vaccine is even proven. Whether the vaccine is truly effective won't be known until sometime this fall. But if clinical trials show a positive result, U.S. and U.K. regulators are expected to approve the vaccine on an emergency basis, and Soriot has promised to have doses ready as soon as late September so mass vaccination programs can begin.

On average, developing a new vaccine takes more than a decade. In this case, it is being done in about six months. Even if it works, AstraZeneca, which brought in $24.4 billion in revenue last year, will make no money at first. It has agreed to provide most of those initial 2 billion doses, and perhaps billions more, at cost. The vaccine will boost AstraZeneca's bottom line only if COVID-19 proves to be an endemic, seasonal menace, like the flu, for which people require regular vaccinations. Still, AstraZeneca (or AZ, as it is informally known) has seen a stock market bump. On the day the Oxford deal was announced, its shares soared to an all-time peak. They have since traded as high as 97 pounds ($124), up 38% from their pre-pandemic price, and AZ now commands the highest market capitalization on London's FTSE 100 index.

How AstraZeneca got the inside track on the Oxford vaccine is a story, like all business stories, about relationships. But it's also about COVID-19's fraught geopolitics. And it's a tale of a remarkable corporate turnaround—one that holds lessons for any business trying to profit at science's cutting edge, and for any executive trying to lead through a radical cultural transformation.

WHEN NEWS of a mysterious respiratory illness in Wuhan, China, surfaced in December, AstraZeneca was quick to take notice. More than any other Western pharmaceutical firm, AZ has bet big on China. Almost a quarter of its 61,500 people are based there, and last year its Chinese revenues were some $4.8 billion. Beginning in late December, Soriot held almost daily video calls with AstraZeneca's Chinese executives, tracking the outbreak as it inched toward becoming a pandemic.

"Then we quickly thought, 'What can we do to help?'" Soriot recalls. AstraZeneca bought 9 million FFP3 respirators, which can filter out the virus, and donated them to health care workers worldwide. It began investigating whether any of its existing drugs—including a leukemia treatment that fights inflammation and a diabetes drug that can protect the heart and kidneys—could be repurposed to battle COVID-19. It is collaborating with Vanderbilt University on synthetic antibodies that might treat the disease. And after it became apparent that the U.K. lacked adequate COVID-19 testing capacity, AstraZeneca teamed up with its British rival, GlaxoSmithKline (GSK), and the University of Cambridge to set up a new test-processing lab.

One thing was conspicuously absent from AstraZeneca's response: a vaccine. AZ is not a significant player in that field. It currently sells just one vaccine, a nasal spray that protects against seasonal influenza. But events taking place not far from its Cambridge, England, headquarters, in a rival college town, were about to change that.

Amid a cluster of research labs in Oxford, the Jenner Institute is housed in a low-slung modern office building with smoky glass windows and green cladding. Named for Edward Jenner, the 18th-century physician who first inoculated people against smallpox, it has emerged in the past two decades as one of the world's foremost centers for vaccine development.

Oxford was able to leap out in front in the sprint for a coronavirus vaccine because of similarities between SARS-CoV-2, the coronavirus that causes COVID-19, and those that cause severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). Sarah Gilbert, a Jenner researcher, had been working on a MERS vaccine, and she realized almost immediately it might be possible to use the same method for SARS-CoV-2.

The majority of vaccines are made using a weakened version of the virus they target. Gilbert's vaccine is different: It takes a harmless chimpanzee virus and genetically modifies it to produce the surface spike protein found on SARS-CoV-2, allowing the body to develop a potentially effective immune response. Vaccines produced this way have at least one major advantage: They don't have to be kept at subfreezing temperatures, which is especially important in developing countries that lack reliable cold transport and storage.

The Oxford scientists knew from previous work that the modified chimpanzee virus was safe. And they knew it could be manufactured in large quantities. But John Bell, the professor who helps oversee the Oxford medical-science division's work with external partners, says the university also knew it would need help

LEADERS OF THE VACCINE PACK

At least 168 COVID-19 vaccine candidates are now in development—a fact that hopefully increases the likelihood that one or more will succeed. Here are six that look particularly promising. All are in Phase II or Phase III trials, which means they did well in early studies and are now being tested in larger groups for safety and efficacy.

HONING AN EARLY EDGE
A scientist at work at the Jenner Institute, whose research on vaccines for the MERS coronavirus has given it a head start in the COVID-19 vaccine race.

JOHN CAIRNS—UNIVERSITY OF OXFORD

OXFORD/ ASTRAZENECA

This vaccine uses a modified chimpanzee virus to produce a protein found on the surface of SARS-CoV-2, the virus that causes COVID-19. That antigen prompts the body to develop an immune response. In early trials, it increased production of antibodies and T cells; Phase II and III trials are underway.

SINOVAC

This Chinese biopharma company bases its vaccine on an inactivated version of SARS-CoV-2 (the approach used in the majority of vaccines). The drug has appeared safe and produced antibodies in two rounds of trials. Sinovac recently launched Phase III studies in Brazil, where the virus has spread rapidly.

PFIZER/BIONTECH

U.S. pharma giant Pfizer and Germany's BioNTech are developing a vaccine that relies on messenger RNA (mRNA), bits of genetic code that instruct cells to make proteins. The goal: Modify mRNA so it prompts cells to make proteins that look like COVID-19, eliciting an immune response. Early trial results led the U.S. government to put up $1.95 billion to secure doses if the vaccine works.

MODERNA

The Cambridge, Mass., startup also uses a vaccine based on mRNA. (AstraZeneca owns a 9% stake in Moderna.) The project has been backed by $950 million in U.S. government funding. The vaccine provoked an immune response in all 45 patients tested in a Phase I trial; a study involving 30,000 volunteers launched in late July.

CANSINO

A Chinese company that specializes in vaccines and is partly backed by U.S. drugmaker Eli Lilly, Cansino is testing a vaccine based on a genetic mutation of an adenovirus (the kind that causes colds). The Chinese military has approved the vaccine for use in its ranks; wider safety trials are in progress.

MURDOCH CHILDREN'S RESEARCH INSTITUTE

This Australian institution is experimenting with the bacillus Calmette-Guérin (BCG) vaccine—a drug introduced in the 1920s to fight tuberculosis. Studies have suggested that BCG protects against other respiratory infections; Phase III trials are underway to see whether that immune response extends to COVID-19.

from Big Pharma. "Making billions of doses of vaccine for the whole world, let's be clear, that's not what universities could or should be doing," says Bell, an athletic 68-year-old Canadian who habitually keeps his eyeglasses propped atop his silver-gray hair.

Oxford set out to find a partner with proven vaccine expertise—but politics made negotiations difficult. Oxford balked at some U.S. companies' insistence on exclusive worldwide manufacturing rights. The Trump administration was prepared to offer large sums to guarantee the American public was first in line for a vaccine. Various governments, including those of the U.S., France, and Germany, vowed to block exports of vaccines made in their countries. Ultimately, Bell says, the British government, which steers millions of pounds in funding to Oxford each year, grew anxious that it could wind up without adequate vaccine access, and in April it told Oxford to find a British partner.

There were only two U.K. companies with sufficient manufacturing capability: GSK and AstraZeneca. GSK might seem like the obvious choice. It is the world's top vaccine producer, with a portfolio of more than 30, including inoculations for measles, meningitis, and pneumonia. But GSK was already working on its own COVID-19 vaccine efforts, including one with French drug giant Sanofi and another with Chinese biotech firm Clover Biopharmaceuticals. (The project with Clover is now in early-stage human testing.)

AstraZeneca had virtually no vaccine track record. But it had experience with a manufacturing process similar to the one Gilbert uses for her modified chimp virus. (AZ uses it to make synthetic antibodies.) What's more, Bell had a personal connection to Soriot: Until last year, Bell served on the board of Swiss drugmaker Roche, where Soriot had been a fast-rising star, serving as chief operating officer for two years before taking the top job at AZ. "I knew Pascal was somebody who was absolutely committed to the highest-quality science, but also prepared to take risks," Bell says. "And, to be crystal clear, this vaccine is a big risk."

Oxford also had another important factor in mind: AstraZeneca's remarkable R&D rebound under Soriot's leadership. "It's one of the great turnaround stories in pharmaceutical companies over the past 20 years," Bell says. Michael Leuchten, an equity analyst for Swiss bank UBS, says of AstraZeneca's recovery: "It's remarkable. I've never seen anything like that before, and I don't think we will again anytime soon."

WHEN SORIOT took the helm of AstraZeneca in 2012, the company faced a bleak future. Its bestselling medicines—Crestor for high cholesterol, Nexium for acid reflux, and antipsychotic drug Seroquel IR—were about to plunge off the industry's dreaded "patent cliff." As soon as they lost intellectual-property protection, generic drug manufacturers would be able to sell cheap copies. Half of AZ's annual sales—$17 billion in total—were likely to disappear in the next five years.

Worse, the company, having underinvested in R&D, had no pipeline to replace its blockbusters. "At the time, the company was run like a spreadsheet," Soriot says. "It was all about cost savings, increase the profit and use that for a buyback, and mechanically increase the share price. But the company was on the road to nowhere." Many investors agreed. "He has to rethink the strategy," Stephanie Maher, a fund manager at asset management firm AGF, said when Soriot was appointed.

Pascal Soriot, CEO, AstraZeneca

In 2012, AstraZeneca **"was run like a spreadsheet. It was all about cost savings, increase the profit and use that for a buyback. But the company was on the road to nowhere."**

The minute Soriot took over, he stopped the buybacks and plowed money back into science. AZ's R&D spending as a percentage of sales was 16% in 2011, the year before Soriot was appointed; in 2019, it was 26%, the highest percentage of any of its peers. And reviving the drug pipeline wasn't just a case of throwing money at a problem: It involved refocusing the entire company.

A decade ago, AZ's R&D operation was extremely inefficient: Just 4% of its drug candidates made it to market. "We were spending $5 billion a year on R&D and not delivering any medicine," says Mene Pangalos, who heads AZ's biopharmaceuticals R&D. A damning 2012 analysis from the InnoThink Center for Research in Biomedical Innovation, a consultancy, found that AZ was spending, on average, $11.8 billion in R&D for every drug that received U.S. Food and Drug Administration approval, the worst record in the industry.

Soriot's predecessor, David Brennan, hired Pangalos to revive the research division. After Soriot took over, he accelerated the effort to restock the medicine cabinet. In one early leadership meeting, a sales executive said a researcher's presentation "had been a bit technical and over my head." Soriot publicly upbraided him. "If you want to be a senior leader in our organization, you need to be interested and engaged in the science that we do and the patients that we are treating," Pangalos recalls Soriot saying. "There was stunned silence and quite a few gulps. But if you were an R&D person in the room, it was the best we'd ever felt."

The fledgling overhaul was almost smothered in its nest. In the spring of 2014, the larger U.S. drugmaker Pfizer launched a hostile takeover attempt. Investment bankers initially told Soriot the company had a less than 10% chance of remaining independent, the CEO recalls. Soriot

SKY-HIGH ASPIRATIONS
The courtyard of AstraZeneca's new R&D center, under construction in Cambridge, England. The building puts AZ scientists close to top academic labs in biology and in stem cell and cancer research, in hopes of enabling more collaboration.

CHARLES ABBOTT—COURTESY OF ASTRAZENECA

repelled the effort with hefty promises to investors—pledging to sustain dividend growth and boost revenue to a lofty $40 billion, a 75% increase, by 2023. In retrospect, Soriot says, the takeover attempt galvanized his strategy, making it crystal clear to the entire company that its survival depended on more effective, and thus more profitable, R&D.

AstraZeneca had been focused on primary-care drugs, medications for chronic conditions such as allergies and high blood pressure. Soriot shifted its emphasis to specialty care—drugs that command high reimbursements from insurers and better profit margins, even though their market size is smaller.

Nowhere has that change in priorities been more dramatic than in oncology. Under Soriot's predecessor, AstraZeneca had been divesting from cancer treatments. But early on, leading oncologists outside the company told the CEO that AZ was about to write off a potential blockbuster in Lynparza, a drug for late-stage ovarian cancer that had shown promise in clinical trials. Soriot reversed course and revived the drug.

It was a momentous decision. Lynparza emerged as a pioneer in a class of drugs called PARP inhibitors. These drugs target enzymes critical to cell repair; by blocking them, they keep cancer cells from rejuvenating. It soon emerged that Lynparza could treat some pancreatic, breast, and prostate cancers, too. It's now the bestselling PARP inhibitor: In 2019, it generated $1.2 billion in revenue, with sales growing 85% year over year. Its versatility also makes it attractive to corporate partners. In 2017, Merck agreed to pay AZ up to $8.5 billion to share in Lynparza's development.

Lynparza is the flagship example of AstraZeneca's oncology strategy, which has yielded highly specialized medications that merit premium prices. Tagrisso, which targets a specific, highly dangerous mutation of lung cancers, has become AZ's brightest star: It brought in $3.2 billion last year. Imfinzi, an immunotherapy treatment for lung, urinary, and bladder cancers, made $1.5 billion in 2019. (AZ has also struck partnerships for oncology drugs, including two multibillion-dollar deals with Japan's Daiichi Sankyo in as many years. In July, it agreed to pay as much as $6 billion for the right to codevelop a Daiichi drug that could limit chemotherapy's side effects.) Oncology now accounts for 37% of AZ's annual product sales, more than any other area, and up from just 12% five years ago.

In addition to oncology, Soriot reorganized AstraZeneca around drugs for cardiovascular, renal, and metabolic disease, respiratory illness, and immunology. Across all those categories, Soriot and Pangalos instituted a rigorous process for assessing drug candidates. Known as "the five R framework," it mandates that before the company commits to developing a drug it must be satisfied it has identified five "rights": the right target, the right patient group, the right body tissue, the right safety regime, and, crucially, the right commercial opportunity. The checklist sounds like Pharma 101, but it's the kind of discipline AstraZeneca had once lacked.

Disciplined deployment of the framework has drastically reduced the number of compounds AstraZeneca had under development. But it has lifted its success rate in moving promising molecules from preclinical investigation through to completion of late-stage clinical trials. Once a paltry 4%, that rate is now 20%, three times the industry average.

AZ has also used new digital technologies to reinvent its approach to clinical trials. Software called Merlin enables AZ to select trial sites 70% faster than before, according to Cristina Duran, chief digital health officer for the R&D division. Merlin produces trial cost estimates in minutes (it used to take days). In a research ecosystem where trial volunteers often skew disproportionately male and white, Merlin helps select trial populations that better reflect real-world demographics. Another software system, called Control Tower, allows managers to get a visual snapshot of all AZ's trials on a single dashboard, helping them predict problems in patient recruitment. "We've taken systems that the company was using for 20 years, and in the past two years we changed them—which is either insane or brave, but it has been successful," Duran says.

To cement its science-led ethos, in 2016 Soriot moved both AZ's corporate headquarters, which had been in London, and its research headquarters, which had been in Macclesfield, to Cambridge. Here Soriot is overseeing construction of a signature, $1.2 billion strategic R&D center, a round glass doughnut to showcase the work of AZ's scientists. The building is steps from the government molecular biology lab known as "the Nobel factory"—its scientists have won 12 of them—as well as top-flight cancer and stem cell research labs. Since moving, AZ has increased its collaborations with Cambridge University to more than 130, up from fewer than 10 five years ago.

AstraZeneca is a smaller company today than it was before its reinvention, thanks largely to the loss of sales from those older blockbusters that fell off the patent cliff. AZ's revenues last year were 27% lower than in 2011. But investors seem to think the company has made up in drug quality for what it lacks in sales quantity. AZ's stock price has risen 137% in dollar terms since Soriot took over, trouncing the 61% increase in the S&P Pharmaceuticals Select Industry Index over the same period.

Mene Pangalos | Head of Biopharmaceuticals Research, AstraZeneca

> At an early leadership meeting, Soriot upbraided a top sales executive for being uninterested in the details of AstraZeneca's research. **"If you were an R&D person in the room, it was the best we'd ever felt."**

AZ'S DEAL to produce Oxford's vaccine was brokered in a flurry of Zoom calls during the last week of April. Oxford had two main conditions: that AstraZeneca forgo any profit on the vaccine until the pandemic is over, and that it commit to making the vaccine as widely available as possible. AZ agreed to both.

For AstraZeneca, the vaccine is a showcase project where it can demonstrate its ability to be a partner for academic groups and biotech companies at the forefront of science. That's worth more than bragging rights: Those relationships are critical to feeding AZ's pipeline of winning medicines. The speed of the vaccine project, meanwhile, is a key test of the systems AstraZeneca has built to run clinical trials more efficiently.

To condense testing that would normally take years into months, Oxford took unprecedented steps: Rather than recruiting just a few dozen patients for Phase I trials, which are designed to show a drug is safe by testing it on a small cohort, Oxford recruited 1,100 and accelerated the pace of inoculations. Phase II trials, which test for safety and efficacy on a much larger number of volunteers, and Phase III trials, which aim to prove that a drug is effective, would normally take place sequentially. Instead, they are happening simultaneously. Oxford is recruiting 10,000 people in the U.K. for this testing, plus 5,000 in Brazil and 2,000 in South Africa, while AZ is enrolling 30,000 volunteers in the U.S.

Results are expected anytime between September and November, Soriot says. But the pandemic's urgency means large-scale vaccine production must start even before testing concludes. With funding from governments and international agencies, AZ has licensed manufacturing—again, at no profit—to firms across the globe, including a landmark deal with the Serum Institute of India, a private biotechnology company, to provide 1 billion doses for low- and middle-income countries.

IN EARLY JUNE, AstraZeneca's soaring stock was momentarily rattled. Bloomberg News, citing anonymous sources, reported that AZ had approached the U.S. pharmaceutical company Gilead about a supernova-scale merger—one that would be the largest in the sector's history. The pandemic has made Gilead a household name, thanks to its production of remdesivir, one of the few drugs that has been shown to reduce hospitalization time for severely ill COVID-19 patients.

Gilead declined to comment on the report, as did Soriot. But, speaking in general terms to *Fortune,* he implied that initiating merger talks would make little sense in the current climate. "I would just invite you and everybody else to look at the facts," he says. Figuring out how to execute clinical trials under pandemic conditions is an all-consuming undertaking, he says. So too is working on the vaccine. "It is energizing everybody, but it is a big job for a number of us." Plus, given travel restrictions and quarantine measures, negotiating teams would be unable to meet face-to-face. "Imagine the biggest merger in the history of the industry, done by Zoom? I mean, come on," he says.

Industry and stock market analysts, on the whole, discounted the possibility of a tie-up. Except, some noted, there was a possible scenario where the merger made sense—and it was a scenario that turned investors' blood cold: What if AstraZeneca had to do a deal because it was running out of cash?

Gilead is sitting on a cash hoard of $24 billion. AZ, for all its recent success and highly valued stock, is cash poor. Last year the company didn't generate enough net cash from operations to cover its $3.5 billion in dividend payouts—the ones Soriot promised to keep growing during his fight with Pfizer. In fact, the company had to raise $3.5 billion through an additional share offering, its first in 20 years, in order to meet that and other obligations.

AZ's cash issues stem in part from its reinvention push. The company has taken restructuring charges to discontinue legacy projects, made lump-sum upfront payments to new drug-development partners, and taken on debt to fund R&D—all strategies that hurt cash flow today. Naresh Chouhan, an analyst at London's Intron Health, an equity research boutique focused on health care, says the company has used "a lot of creative accounting"—legal but aggressive tactics, such as amortizing those lump-sum payments over the life of the partnership—to keep these transactions from depressing the non-GAAP "core earnings per share" figure AstraZeneca tells investors to pay attention to.

That high-wire act has left some investors wary. UBS's Leuchten admires AZ's turnaround, but he is also one of three analysts (out of 24 that cover AZ) to have a sell rating on the shares. Leuchten calls the company "a concept stock." He says that investors have convinced themselves that AZ has a "platform" for churning out a succession of blockbusters, but that so far, its performance doesn't justify its outsize valuation, currently 106 times its trailing earnings per share.

Soriot accuses critics like Leuchten of "looking at their shoes instead of looking at the horizon." He says, "The question people have to decide about is, 'Do I believe in the future of this company?'" He defends AZ's dividends, saying they reward shareholders for their patience. Cash flow will eventually improve, he says. "And soon enough the people who say, 'You should cut the dividend' will move to another criticism: They will say, 'Why won't you increase the dividend?'"

FOR NOW, any debate about AstraZeneca's long-term financial health is superseded by a single question: Will the Oxford vaccine work?

On July 20, the first glimmer of an answer emerged when medical journal *The Lancet* published the results of Oxford's Phase I trials. The headlines were positive. ("First human trials of Oxford coronavirus vaccine show promise," Reuters declared.) Yet AstraZeneca's stock price fell 5.9% on the news, its largest one-day drop since March, and subsequently drifted lower still.

Phase I trials are designed to prove a vaccine doesn't threaten users' health, but they also offer clues to its effectiveness. The AZ-Oxford vaccine appeared to succeed on both counts. The drug showed no serious side effects. Of the 25 volunteers vaccinated with a single dose whose blood was analyzed in detail, 91% produced antibodies capable of neutralizing the virus. In 10 volunteers who also received a second booster dose, 100% produced antibodies—and in those subjects, antibody levels equaled those found in patients who recover from COVID-19.

So what unnerved the markets? In part, it was that booster-dose group. The disparity between their results and the first group's may indicate that Oxford's vaccine will require two doses. As Pangalos pointed out at the time, most competing vaccine efforts are also looking at two-dose protocols. Still, the need for multiple shots would make any global vaccination program more fiendishly complicated and expensive. If another vaccine could confer immunity with a single dose, it could become the preferred option, negating AZ's first-mover advantage.

The Oxford candidate could also lose out to a rival two-dose vaccine. Analysts noted after the *Lancet* report that initial trials of some competing vaccines—notably, one that Pfizer is developing with biotechnology firm BioNTech (see box)—indicated higher levels of antibody production than Oxford's. Another question hovering over the effort: Whether it will confer "sterilizing immunity," which would keep inoculated people from spreading the virus to the unvaccinated.

For those reasons and more, Oxford's Bell has put his vaccine's odds of success at no better than 50/50. "This is not a slam dunk, at all," he says.

Still, the Phase I study provided reason to believe AZ and Oxford could score. The antibody counts were encouragingly high. And COVID-19 antibodies may not be the only key to any eventual vaccine's effectiveness (indeed, an increasing number of studies indicate that those antibodies may fade rapidly). AstraZeneca and Oxford were keen to note that their vaccine also prompted a strong response from T cells, which seek out and destroy pathogens. Thanks in part to these cellular warriors, Pangalos told reporters, he is "increasingly confident" Oxford's vaccine will provide immunity for at least a year.

As for its strength relative to other vaccines, Oxford and AstraZeneca researchers note that, so far, no two of the trials have used an identical blood sample assay, making apples-to-apples comparisons impossible. What's more, Soriot observes, there's room for more than one winner: Safely inoculating the entire world will certainly require multiple vaccines.

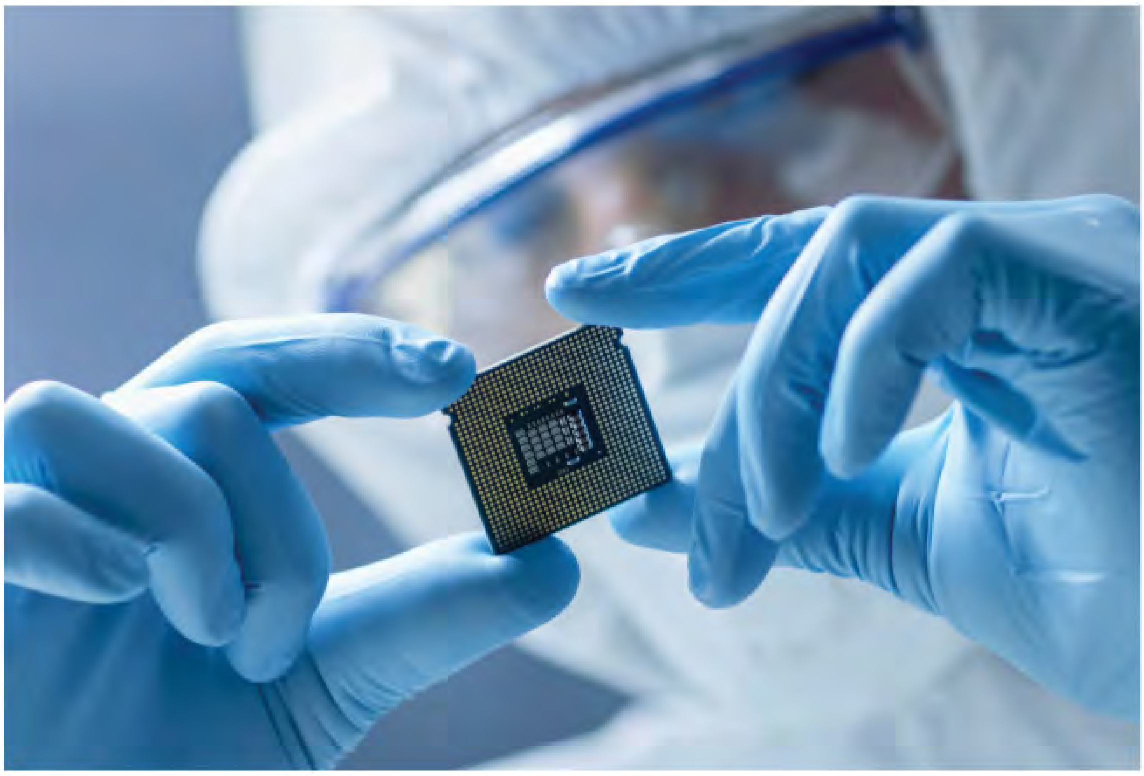
And as it turns out, Oxford is not AZ's only ticket in the COVID-19 vaccine sweepstakes. Shortly after Soriot became CEO, AstraZeneca invested $240 million in a biotechnology startup in Cambridge, Mass., called Moderna; AZ later invested a further $140 million, upping its stake to 9%. Moderna is developing a vaccine based on messenger RNA (mRNA), which carry instructions from a cell's nucleus to parts of the cell that manufacture proteins. Modify mRNA and you can get the cell to produce whatever proteins you want—including ones that (hopefully) elicit an immune response. Moderna's vaccine is now entering large-scale human testing, and its stock has soared on the news—inflating the value of AstraZeneca's stake to more than $3 billion.

With a bit of luck, both vaccines might succeed. Now all eyes are on those later-stage trials. The testing needs to happen in places where coronavirus infections are rampant, so that scientists can make a comparison between inoculated individuals and a control group. That's why Oxford researchers are racing to hotspots where cases are still surging—to Junior Mhlongo's hospital in South Africa, as well as to Brazil and India and, yes, to the still-stricken U.S. Oxford is also contemplating a controversial "challenge trial"—where healthy young volunteers will be inoculated and then purposefully infected with the coronavirus to see if the vaccine works.

If both vaccines fail, AstraZeneca may not be materially worse off. But the world will be that much further away from obtaining the get-out-of-lockdown card it so desperately needs.

66%

OF VACCINE CANDIDATES FOR INFECTIOUS DISEASES FAIL **to make it through clinical trials, according to a 2018 MIT study. Those odds have often helped deter pharmaceutical companies from vaccine research, but the urgent need for a COVID-19 vaccine has changed the equation.**



DIVERSE GLOBAL SUPPLY CHAINS EQUAL SUCCESS FOR U.S. CHIP MAKERS

Why a global mindset is key to increased revenue and market success for U.S. semiconductor manufacturers.

WHEN WE USE LAPTOPS AND SMARTPHONES, we tend not think about their central processing units or computer chips—or how they are made. Yet, we wouldn't have these devices, or any number of industrial processes, without semiconductor manufacturers. And now that a rise in connectivity and the demand for smart devices have shortened production cycles from years to months, the complex design and manufacturing processes that were once behind the scenes are taking center stage.

Producing more sophisticated chips at a faster rate requires unique, highly specialized supply chains that provide equally sophisticated components for fabrication, assembly, and testing. As such, semiconductor manufacturers that have numerous supply chains at their disposal are better equipped to avoid disruptions, such as cyberattacks—or a global pandemic.

Few imagined the current manufacturing disruptions and labor slowdowns due to both COVID-19 and international trade restrictions, but these events highlight the importance of sustaining global semiconductor supply chains. Yet as the trade war with China intensifies, the U.S. government is encouraging chip manufacturers to establish domestic supply chains, a decision that could cause U.S. companies to risk a 37% drop in revenue, according to Boston Consulting Group (BCG).

As it stands, the U.S. semiconductor industry derives 22% of its revenue from Chinese device manufacturers, according to BCG, and this relationship is a key contributor to American leadership in the global semiconductor market. To offset these potential losses, Congress has proposed expanding federal investment in semiconductor research and development (R&D) and adding incentives to increase U.S. manufacturing. But an entirely local supply chain could inflate manufacturing and consumer costs, and prices for supplies in the U.S. could be higher than those sourced abroad.

What's more, a completely local supply chain could adversely affect R&D, hamper innovation, and slow the rollout of new technologies in the U.S., affecting areas like the Internet of things (IoT), artificial intelligence (A.I.), robotics, and 5G.

Conversely, a diverse global supply network enables manufacturers to scale instantly to meet market demands while driving down costs. It also helps bring new technologies to market in a matter of months: Consider how quickly IoT-enabled products have become commonplace, from home-based smart speakers and thermostats to smart city traffic lights and infrastructure.

The complexity of chip manufacturing at this scale renders complete domestic self-sufficiency across the value chain nearly impossible. And while new innovations in machine learning, A.I., and robotics may help manufacturers maintain production levels, risks remain substantial across the board. Now, as the effects of unprecedented disruption echo around the world, it's never been more important to maintain a global mindset—or risk falling behind. ■

HUAWEI

WINDS OF CHANGE
A worker on a wind turbine at the Cedar Creek II wind farm near New Raymer, Colo. The power facility is a joint venture between AEP Renewables and BP Wind Energy.

G500

RANK

8

BP

COUNTRY

BRITAIN

2019 REVENUE

$283 BILLION

IS BP FINALLY READY TO 'THINK OUTSIDE THE BARREL'?

With his industry's business model under siege and shareholders agitating for change, new CEO Bernard Looney has a bold plan to move BP into clean energy and out of oil. Some critics say they've heard it all before.

By VIVIENNE WALT

YESENIA RODRIGUEZ—COURTESY OF BP

FOR MONTHS, BP HAD PLANNED this year's annual general meeting as a sleek presentation. The company's brand-new CEO would be onstage at London's ExCeL convention center, trumpeting his green revolution to hundreds of shareholders. But this being 2020, nothing went as planned. When the day of the meeting finally arrived in late May, there was no audience, and no applause. Instead, Bernard Looney, head of one of the world's biggest oil companies, sat in a bare room in BP's deserted London headquarters, next to a board member and a company official, talking into a camera. By then, the pandemic had killed more than 38,000 people in Britain. And rather than hosting BP's big event, the ExCeL center had been transformed into a triage hospital for coronavirus patients. Looney, on a brief outing from months of lockdown at home, looked less like the head of an iconic 111-year-old giant than the captain of a troubled spaceship beaming bad news down to Earth. "Today's challenge is of a different scale than any experienced before," he told the invisible investors logged on for the meeting. He called it a "brutal environment."

Just three months earlier, Looney had begun his tenure as CEO with a bang by unveiling a drastic overhaul for BP. He committed to "net-zero" carbon emissions by 2050—a strategy that promises to radically transform the company, and which several of his competitors then rushed to match.

Yet Looney barely had time to elaborate before COVID-19 hit the global economy with seismic force. Planes and cars sat grounded for months, with lockdown orders forcing billions of people indoors, including Looney and his team. From their homes, BP executives watched global oil demand collapse in the steepest drop since the Second World War. With no place left to store millions of barrels of unsold oil, futures prices of crude briefly dropped below $0 in April for the first time in history.

It was "brutal" indeed. BP's first-quarter earnings showed debt of more than $6 billion and losses of $4.4 billion, compared with almost $3 billion in profits for the same period the year before. In June, the company announced 10,000 layoffs, equal to one in seven employees in its global workforce, and cast the bad news as being part of its net-zero restructuring. That same month it warned of a coming write-down in the value of its assets of up to $17.5 billion. (The actual figure turned out to be $17.4 billion.) And in early August, there was still more grim news: BP reported losses of $16.8 billion for the second quarter and slashed its dividend in half.

It didn't take a pandemic to cause a crisis in the oil industry, however. Even before the virus began its rampage across the planet, oil companies' stocks were lagging badly behind others on the major global indexes, as operating costs rose and crude prices remained low. And yet, oil super-majors like BP are hardly on the verge of collapse. Proof of that, if any is needed, is this year's Global 500 list, in which five of the top 10 are oil and gas companies. BP sits at No. 8, with $283 billion in revenues and $4 billion in profits for 2019.

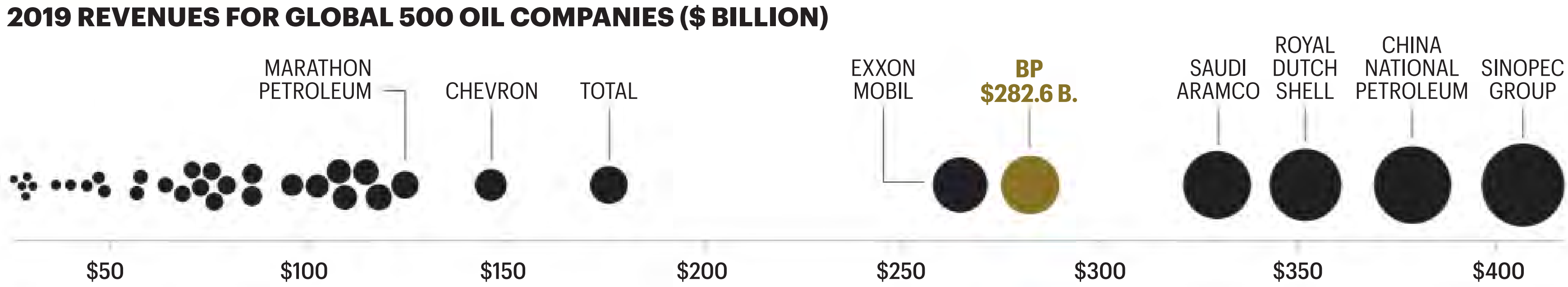
Yet for all their hundreds of billions of dollars in sales, a sense of unease has steadily grown inside these companies as they assess their prospects in a world increasingly committed to going green. And a combination of factors has ratcheted up the external pressure for change: a fast-worsening climate crisis; an angry and motivated younger generation; and, perhaps most critically, growing numbers of shareholders who are threatening to move their money out of oil and gas stocks unless they see serious change.

In last year's climate marches, millions of youth railed against oil companies for causing global warming; scientists estimate that about one-third of greenhouse gases in

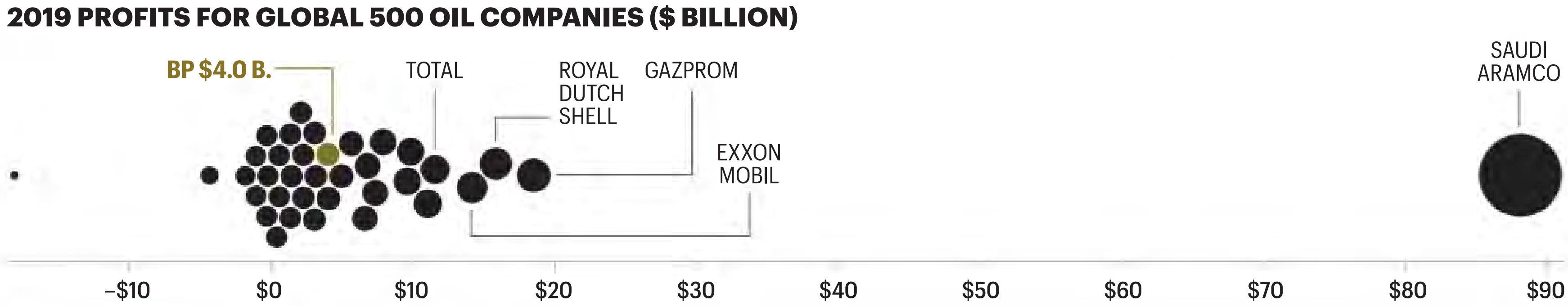
NOT A BLOWOUT YEAR FOR BIG OIL

With prices weaker, total profits for oil companies in the Global 500 fell 33% from 2018, and BP's earnings plummeted 57%. Even profit king Saudi Aramco saw net income slide 21%. The pandemic will deal another hit to next year's earnings.

2019 REVENUES FOR GLOBAL 500 OIL COMPANIES ($ BILLION)



2019 PROFITS FOR GLOBAL 500 OIL COMPANIES ($ BILLION)



SOURCE: COMPANY FINANCIALS

the atmosphere today can be connected to the oil and gas industry. Protesters threw beetroot juice on delegates to the Oil & Money conference in London last October. And on Looney's first day as CEO in February, Greenpeace activists barricaded BP's London offices, forcing a temporary shutdown. Wisely, Looney opted to spend the day visiting a BP refinery in Germany.

Ducking beetroot juice and barricades is relatively simple. However, the bigger problems are no longer possible for oil companies to sidestep. To avoid a precipitous collapse in their core business in decades to come, they will need to execute the most dramatic pivot in their long history. At least, that's the conclusion from many outside the industry. In January, shortly before Looney began as CEO, Larry Fink, founder and CEO of BlackRock, the world's biggest asset management fund with more than $7 trillion under management, stunned investors by writing in his annual letter that "climate change has become the defining factor in companies' long-term prospects." That, he said, would become increasingly true as the new generation grow up to be investors and CEOs themselves. Simply put: Companies can either join the fight for climate, or slowly wither and die.

For the energy giants, that choice is painful indeed. Taken logically, it could well mean leaving in the ground, undrilled and unexplored, billions of barrels of oil and trillions of metric tons of gas. That seems to run contrary to their very DNA. "The oil industry has an existential challenge," says Fred Krupp, president of the nonprofit Environmental Defense Fund. "Nothing will be easy about it."

The message has not been lost inside BP. By the time Fink published his BlackRock letter, Looney had reached the same conclusion. On Feb. 12, one week after taking over, he announced his dramatic shift in the company under the clunky title, "Reimagining Energy, Reinventing BP." The core promise to zero out carbon emissions by 2050 or sooner mirrors what climate scientists believe is needed to avert environmental catastrophe.

DANIEL LEAL-OLIVAS—AFP/GETTY IMAGES

Bernard Looney | CEO, BP

"THE DIRECTION IS SET, WE ARE MOVING TO NET ZERO. THERE IS NO TURNING BACK."

Among both oil analysts and environmentalists, the reaction was a mix of hope and eye-rolling. In interviews, several pointed to BP's last major rebrand in the late 1990s and the accompanying slogan "Beyond Petroleum," which became symbolic of the industry's unfulfilled promises to explore clean energy. Now BP is nominally leading the charge again, and Looney insists that this time his company is all in. "The direction is set," Looney said in February. "We are moving to net zero. There is no turning back."

If that is the case, Looney's plan is a staggering shift for BP, whose driving purpose since 1909 has been to pump oil and gas out of the ground and oceans, and to refine and sell it at gas stations around the world. Now, within 30 years tops, it needs to account for all the 415 million metric tons of carbon it adds to the atmosphere every year by offsetting it with non-carbon renewables like wind turbines or solar plants; cutting methane emissions leaking out of oil facilities; capturing carbon and storing it deep underground; protecting forests, and—the hardest of all—simply not producing some of that carbon in the first place.

Looney told investors in early August that BP would cut its oil and gas production by 40% within a decade and stop exploring for fossil fuels in new countries. After more than a century in business, BP, he says, will now become an "integrated energy company." Seeing that transformation through could prove to be an epic challenge. But BP's new boss insists there will be no reversal. "I really think this direction is unstoppable," Looney told *Fortune* in a long interview. "I really do."

WITH HINDSIGHT, the rush to switch directions seems like an inevitable development, given the intense investor pressure. The impact of that has been "massive, massive. There is no question," says Oswald Clint, senior research analyst at Sanford C. Bernstein in London. He believes oil execs have become far more concerned about the climate themselves, rather than being dragged into taking action. "Perhaps the companies have been forced to buckle," Clint says. "But they are not buckling today. It is full embracement, a cultural change."

That BP could be in the vanguard of this historic shift will seem unlikely to many. Early on, the company was built by capitalizing on political upheaval in what is now Iran, Iraq, Libya, and elsewhere. And more recently, BP earned notoriety for unsafe operating conditions that went unattended—with disastrous results. Americans probably best remember BP for two major accidents, both found to have been the result of slipshod practices: the explosion at a BP refinery in Texas City, Texas, in 2005, in which 15 workers died; and the Deepwater Horizon explosion in 2010 off the coast of Louisiana, which killed 11 people and wreaked mammoth damage to the Gulf of Mexico. (See box.) It was the worst oil spill in U.S. history, for which BP is still paying out billions to local communities.

Looney's ascent as CEO finally gives the company a chance for a very new role. In the weeks following his net-zero decision, BP's competitors in Europe rushed to do the same, perhaps sensing that if they failed to do so they would be cast as climate villains. Within weeks of Looney's speech, Royal Dutch Shell, the Italian oil major ENI, and France's Total all announced goals for net-zero carbon emissions by 2050. The Spanish oil company Repsol and Norway's Equinor had made similar pronouncements earlier, promising to boost investments in renewables and increase energy efficiency in oil production.

The plan Looney unveiled in August would radically change BP by increasing its investment in low-car-

A REFORMER RETURNS
Onetime BP engineer Jo Alexander, 39, quit the company because of climate concerns. Now she's back, hoping to engage employees in "reimagining energy."

bon energy sources 10-fold by 2030, and eventually cutting oil and gas exploration by about 75% from its peak levels. "We know this will not be easy, but we are confident that this is the right thing for all our stakeholders," he said. The plan would steadily determine all BP's decisions. "You will see low carbon increasing, and fossil fuels in the long term decreasing," says Giulia Chierchia, who joined BP in April, as its new executive vice president for strategy and sustainability, to help manage the net-zero transition. "We will make choices, and those choices will be low carbon."

For Looney, 49, the decision came after much thought. In an hour-long video interview in late June, he said he came to realize that there was no way to square the growing alarm over climate change with his company's business of pumping out 3.8 million barrels of oil and gas a day. Something had to give. "It became increasingly apparent over the last few years that we were in many ways swimming against the tide," Looney says, sitting in a black T-shirt in his home office, back from a three-mile run around his London neighborhood. I ask him what would happen if BP and other big oil companies do not zero out their carbon footprint. "Without action," he says, "it is a rather bleak future for the world."

Looney says two groups of people had weighed heavily on his mind in thinking of BP's future: his employees, and the investors. Both groups, it was clear, were deeply perturbed. "The sense that investors were really beginning to push, and question our purpose, started to weigh on the financial performance of our sector," he says. "And our employees were becoming anxious about what I would describe as their personal purpose being misaligned with our corporate purpose."

One of those anxious employees was Jo Alexander. A geoscientist with a long mane of red hair, she joined

ABOVE: U.S. COAST GUARD/REUTERS

HOW THE DEEPWATER HORIZON DEBACLE CHANGED BP

Ten years ago, the explosion at a BP well caused the biggest oil spill in U.S. history. The company is still paying the price.

On April 20, 2010, the Deepwater Horizon rig was drilling into an ultra-deep oil prospect off the coast of Louisiana named Macondo, after the setting for Gabriel García Márquez's epic novel *One Hundred Years of Solitude*. And then it turned into an epic disaster.

Gas ripped through the well and blew up 1.5 miles undersea in the Gulf of Mexico, killing 11 platform workers. It sent up a plume of fire visible from space and wreaked mammoth damage on the Gulf's fishing stocks and wetlands. About 3.2 million barrels of oil poured into the Gulf over 87 days, and another 810,000 barrels were soaked up by BP, in the biggest oil spill in U.S. history. Ten years on, the Trump administration has rolled back several key oversight regulations that were introduced after Deepwater Horizon, including independent inspections and safety requirements such as backup systems to prevent blowouts.

The incident cast a shadow for years over BP's trustworthiness, which it is only now beginning to shake off. "It was a desperately difficult experience," says current CEO Looney, back then a senior BP executive who helped oversee the cleanup effort. In court, BP was found to have cut corners on safety, and President Barack Obama accused the company of "recklessness." BP is still paying the remainder of the $69 billion or so in settlements and grants to local communities and states along the Gulf, including about $2.4 billion paid last year. The company predicts it will pay about $1 billion a year for the next 13 years.

Despite the disaster, BP still invests heavily in deepwater drilling in the Gulf of Mexico, and aims to pump about 400,000 barrels a day from its waters by the mid-2020s—about the same amount it produced in 2009, before the explosion. But Looney says Deepwater Horizon forever changed the company. He says safety conditions are now the primary consideration in BP's operations, and that the company has learned not to get too attached to one particular project—a charge that critics leveled against BP after the 2010 accident. "We will never forget, and we must never forget," he says. "We walked away with a lot of humility, which I personally believe is good for all seasons." For BP and for the Gulf Coast, it was a very costly lesson. —*V.W.*

PHOTOGRAPH BY **PETER DENCH**

BP after graduating from Oxford University in 2003, then spent a decade working on major oil projects, including in Libya and Australia. It was a life of adventure and travel, she says. But her growing distress over the environment finally made the work feel untenable. She took a buyout from BP in 2015 and joined ShareAction, a nonprofit in London focusing on responsible investment.

At BP's annual meeting last year, Alexander stood up to speak. She told the executives that many inside BP felt the same frustration that had driven her to leave the company. "I asked them, 'When is BP going to give them jobs that are meaningful?'" she says. The execs were taken aback. After the meeting, Looney came to find her and said, "Promise me you'll come talk to me about this," she says. She spent months quietly gauging the views of people she knew within BP. Then late last year, she met with Looney at BP headquarters. Looney, who headed BP's upstream division, was already rumored to be the next CEO, succeeding Bob Dudley. Alexander shared a presentation she had prepared with data about the views of BP's employees. Then Looney told her that he was about to unveil a drastically different strategy. Alexander knew in an instant she wanted to be involved. "I said, 'You cannot do that without me,'" she says. "It was the cheekiest thing I had ever said."

Her boldness worked. Looney hired Alexander, 39, creating a job for her titled "purpose engagement manager," with a brief to engage BP staff in the new purpose of "reimagining energy." Looney now mentions her at every turn, including in his "net-zero" speech in February and in his interview with me. Alexander insists she is not there just to make Looney look good. "I am not naive. I do not think it is a slam dunk," she says of BP's net-zero plan. Still, she says, "everyone is on board with our purpose. A sense of pride has really returned."

DRILLING DOWN: A LOOK AT THE NUMBERS REVEALS THE SCOPE OF BP'S CHALLENGE

$17.4 BILLION
Write-down that BP took in the second quarter, sharply adjusting the value of its assets downward because it expects oil prices to be lower than previously projected in coming decades

10,000
Number of employees that BP said it would lay off, equal to one-seventh of its workforce, after the company lost $4.4 billion in the first quarter

3.8 MILLION
Barrels of oil and gas that BP produces each day

415
Metric tons of carbon that BP adds to the atmosphere each year

$15.2 BILLION
BP's total capital investment in 2019, less than 3% of which was spent on renewables

That optimism has not been shared equally by all BP alumni. Consider Mike Coffin, another engineer who, like Alexander, quit BP over environmental concerns. Coffin, 34, joined BP in 2008 as a geologist, right out of Cambridge University. Like Alexander, he spent a decade working on BP's exploration projects and says the job offered him much of what he wanted: interesting work, and a solid career path that would enable him to buy a house and start a family. "Ten, 12 years ago, it was a very attractive proposition," he says.

But Coffin grew increasingly uneasy about the environmental damage from oil production. He worried whether BP could even survive the energy transition, and that, even if it did, exploration engineers like him, hunting for big new finds, could become extinct. "I felt there was not necessarily a future in oil and gas," he says.

Early last year, Coffin finally left BP and became an oil and gas analyst for Carbon Tracker Initiative, a nonprofit organization in London that researches oil companies' climate impact on financial markets. With the stunning fossil-fuel cuts Looney announced over the summer, Coffin says, "BP is now the industry leader in responding to climate change." Even so, he still harbors strong doubts about whether oil companies can truly reinvent themselves as dramatically as they claim. He also questions whether Big Oil will abandon its long practice of pegging bonuses to fossil-fuel production. (BP says from now on, it will increase the environmental weighting in bonus considerations.)

As activist investors have grown more organized, so has the movement to dump energy stocks from portfolios—both from environmental concern and for reasons of financial risk. "Investors maybe do not care about climate at all," says Andrew Grant, head of oil, gas, and mining for Carbon Tracker Initiative. "But they are getting pressure from their clients," he says. "At this point, the financial imperative has really lined up with the environmental imperative."

In the U.S. and Europe, dozens of pension funds and governments have begun pulling billions of dollars' worth of stocks from fossil-fuel companies. According to the activist organization Fossil Free, institutions with a total of more than $14 trillion in assets have now committed to divestment. "Investors have gotten more and more savvy about these companies," says Kathy Mulvey, accountability campaign director at the Union of Concerned Scientists, a research and advocacy organization in Cambridge, Mass. She adds that environmentalists fear that companies will use "corporate gymnastics," rather than real carbon emission cuts, to reach net-zero targets. "There is quite a bit of work to be done to hold their feet to the fire," she says.

Shareholders have also sought to drive change from within the companies. Since 2016, activists have pushed climate resolutions at the annual meetings of several big oil companies by grouping shareholders together, in order to meet the required threshold for a vote.

In 2016, Mark van Baal, a Dutch mechanical engineer turned activist, founded the shareholder group Follow This, specifically to put pressure on oil companies to commit to environmental policies via shareholder resolutions. "People said, 'Oh, you want to change Shell? Dream on,'" he says. His first resolution, at Shell's 2016 annual shareholder meeting, was blunt: "We told the company they should not explore oil and gas." That was a tough sell, considering that the oil giant's sole purpose was to do just that. "It's a miracle the resolution got 2.6% support," he says.

The group's strategy has since grown more sophisticated and now includes directly negotiating with oil executives. Last November, van Baal hopped the Eurostar train from Amsterdam to meet Looney at BP's London headquarters. Looney had by then been named as the next CEO. The two holed up in a closed room, where Looney revealed to van Baal that big changes were coming. "He was quite convinced he would need to make a big announcement when he took the helm, and that he would need shareholder support," van Baal says. Van Baal agreed not to push an activist resolution at Looney's first shareholder meeting in late May and to rather work with Looney on a joint resolution for next year's meeting, committing BP to net-zero strategies. "If implemented properly, it would be a radical shift," he says.

Van Baal has succeeded in getting resolutions to a vote in Shell, Total, Equinor, and BP; in the U.S., the Securities and Exchange Commission has blocked similar activist resolutions, including at the annual shareholder meetings of Exxon Mobil and Chevron, claiming that investors were trying to interfere with the companies' management decisions. Van Baal is sanguine, confident that the oil industry must bow to reality. "I used to dream about a big oil CEO having an epiphany, a sleepless night about his children's future," he says. "That is not going to happen. Looney was woken up by his shareholders. He's an oil and gas guy."

Yet van Baal believes BP's "oil and gas guy" is finally a CEO he can work with. And he believes that the plan Looney outlined in August could be a landmark moment for the industry. "This is the first oil major to walk the walk instead of just talking about 2050. Cutting oil production by 40%, that's really immense," says van Baal. "If one oil major breaks ranks and shareholders reward them for it, others will follow."

WHEN LOONEY describes his early life, it seems extraordinary that he could emerge as a game changer of any kind. He feels hugely grateful to BP. "It has given me an opportunity I never could have dreamed of, coming from where I came from," he says. "I didn't come from the right school or the right background."

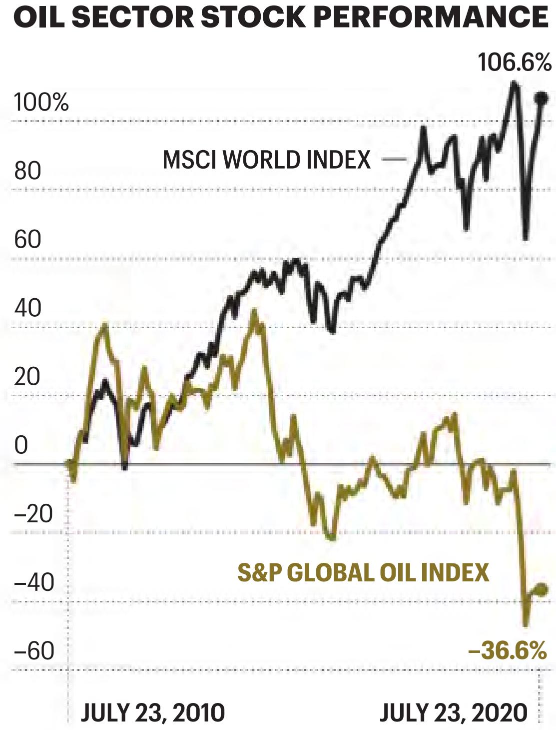
That is an understatement. Looney's parents left school at age 11 and raised their five children on a dairy farm with 14 cows in rural County Kerry, Ireland. Money was tight. He says he and his brothers learned at a young age how to work for extra cash. When I ask Looney about the green toy tractor sitting on his bookshelf at home in London, he says it is a nod to his childhood. "We never had good machinery, and we always wanted good stuff," he says. "We made money buying old tractors and selling them. Anything to make a few pounds."

His strongest memory was of being

A LONG DRY SPELL

It's been a tough 10 years for investors in oil stocks. Over the past decade, oil and gas companies in the Global 500 averaged sales growth of just 3.7% annually. And the 120 stocks in the S&P Global Oil index vastly underperformed equities overall.

OIL SECTOR STOCK PERFORMANCE



SOURCE: BLOOMBERG

different from his peers. "Boys were good at hurling [a traditional Irish sport somewhat similar to lacrosse] and rugby, and to be honest with you, I was pretty useless," he says. "I was not good with my hands, on a farm where everything is about your hands."

Looney was the first in his family to go to college. He joined BP as a drilling engineer immediately after graduating from University College, Dublin, and spent years working on projects in Britain's North Sea, Alaska, Norway, and the U.S. He was eventually handpicked by former CEO Lord John Browne as a "turtle"—an executive assistant (named for the Ninja Turtles) on a likely track to the top. In preparation, Browne sent him for a year to Stanford Graduate School of Business.

Even now, Looney says his childhood has indelibly marked him. He believes it left him with a heightened need to include people who feel different or disrespected. One of the few interviews since his appointment to CEO was with transsexual activist and filmmaker Jake Graf, telling him that if any BP employees do not support LGBTQ+ rights, "they don't belong in our company." Amid the explosive Black Lives Matter protests, he wrote to BP's worldwide staff on June 1, urging them to "call out" racism in their lives as well as inside BP. Wrenching video meetings with staff followed, with "people in tears, people crying," he says.

As CEO, Looney has made mental health BP's main charitable cause, with the company donating heavily to Mind, a British mental-health organization. He sees it as a critical issue within corporations and thinks it has been "turbocharged" by the pandemic. But it is clear that the issue is also personal. "I have had my own relationship challenges. I have had counseling and all of those things," he says, without offering details. "I believe it affects each and every one of us." Under lockdown, Looney offered BP employees access to Headspace, a meditation app, which he says he now uses every night. "It's next to my bed," he says. "I put on waves rolling in. It is calming."

Looney does not sound much like the typical head of a giant corporation, and he seems to recoil from being depicted as one. "Bernard," as he is called on BP's official website, has a new Instagram account whose few dozen posts include Pride rainbows and rain forests amid the regular corporate photos, where he is typically dressed in blue jeans, and rarely in a tie, not even at the shareholder meeting in May.

The new CEO has urged workers to reach out, and some have taken him up on the offer, using the coronavirus lockdown as a chance to catch time with him online. On one video call, gas-station attendants in Britain spoke to Looney about their difficulties in working low-paying jobs through the pandemic as essential frontline workers; Looney afterward raised their wages. In Toledo, Jose Rodriguez, operations coordinator for the BP-Husky oil refinery, pinged Looney on a whim, using the company's internal social network Yammer, and invited him to join one of their staff meetings. Rodriguez was stunned to hear back. Looney quickly set a date and chatted by video to the refinery workers for 20 minutes.

"It made us feel like he actually cared about us," Rodriguez says with amazement, adding that Looney was unlike the four former BP CEOs during his 29 years at the company. "One plant manager's mom had just died," Rodriguez says. "Bernard said, 'Don't forget about your dad. He might be hiding his feelings.'" Rodriguez and Looney have since kept in touch.

It is tempting to dismiss this all as part of BP's image-making, at a moment when the company is promising a drastic shift in direction. But by all accounts it appears to reflect Looney's actual management style and personality.

Even so, the CEO will have trouble winning over doubters on the outside with long memories. The company's "Beyond Petroleum" rebrand, launched in 1997, was a $200 million PR campaign designed by Ogilvy Public Relations Worldwide. The company, the world was told, would "think outside the barrel." For emphasis, then-CEO Browne changed the company's name from British Petroleum to BP.

To some, Looney's "Reimagining Energy" does not sound all that different. "We've heard this before from BP with 'Beyond Petroleum,'" says Mulvey, from the Union of Concerned Scientists. "People were pretty hopeful at that time. It felt like it was

$14.38 TRILLION

VALUE OF ASSETS UNDER MANAGEMENT at institutions that have divested from the fossil-fuel industry, according to the divestment-focused nonprofit Fossil Free a breakthrough." Environmentalists fear being let down again, she says.

Browne says his efforts represented serious progress at the time, signaling the company's real worries about carbon emissions, in a break from other oil majors. "The industry felt very threatened by it, telling us we were leaving the church," he says. "We had no intention of greenwashing."

The campaign coincided with BP's $8 billion investment in solar panels in the U.S., an expenditure that cost it dearly when China began mass-producing panels at a fraction of the price; BP later took a 50% share in Lightsource, a solar company in Britain, with which it builds and operates solar plants, without manufacturing the panels. Browne says oil companies were well aware, as far back as the 1990s, that their carbon emissions were wreaking severe damage on the world's climate. Yet there was still little sense of urgency. "We were nowhere near the position we are in today," Browne says. "We had plenty of time."

Looney has no such luxury. To reach net-zero in 30 years, he must race to change BP, starting now. What is more, far more than in the 1990s, investors will reject any hint of hypocrisy, Browne says. "You cannot just say you are offsetting," he says, referring to the practice of balancing carbon emissions with, for example, planting trees or protecting existing forests. "You have to do something real."

INVESTORS AND ACTIVISTS are finally hearing Looney's plan for "something real." (And, he says, it doesn't depend on carbon offsets.) Chierchia, BP's new head of strategy, says that the pandemic has made the need for change feel more immediate. "If anything, it's showed us the exposure we have to an environment that is very volatile," she says. "It reinforced our need to diversify." She says she quit her previous position at McKinsey & Co. earlier this year, after Looney convinced her BP was fully committed to cutting emissions and would not make compromises. "I thought, 'Wow these guys are actually serious about it,'" she says. "I thought if we could be successful, others would follow."

Krupp, head of the Environmental Defense Fund in New York, has met several times with Looney to discuss BP's net-zero plans, including by video during the pandemic. He says BP will need to deploy myriad solutions, starting this year, in order to meet its 2050 target. Krupp has advised Looney to rapidly shift from fossil fuels to low-carbon energy production; reduce pollutants like methane around oil facilities; and neutralize whatever carbon emissions remain, including by protecting existing tropical forests. All of those, he says, should be done on a massive scale. "They have to shift away from investing in more oil and gas," he says. "We have challenged Bernard to find the milestones in that shift."

One crucial question towers over all: Just how much oil and gas will the energy giants be willing *not* to drill? BP says it will use its oil and gas production to fund investment in low-carbon energy. Right now it has 19.3 billion barrels in reserves on its books.

But in a net-zero strategy, millions of barrels will likely need to remain in the ground forever, becoming so-called stranded assets, in finance-speak. Environmentalists fear that BP might be tempted to increase drilling as world prices rise—just as oil companies and OPEC's oil-rich countries have done for decades. BP invested less than 3% on renewables last year out of its $15.2 billion capital expenditure, according to the company. The industry overall is currently projected to devote about 9% of its spending on clean energy over the next five years, says Matthew Fitzsimmons, vice president of energy service research at the market intelligence firm Rystad Energy. Those figures are hardly reassuring to environmentalists. "The industry has been kicking the can down the road for the past 20 years," says Sophie Marjanac, a lawyer for ClientEarth, a London NGO. "Hopefully, the game is up now."

Changing that dynamic while still finding a way to deliver the profits that shareholders demand is the ultimate challenge for Looney and his Big Oil peers. One thing seems almost certain: BP and others are likely to continue their oil and gas production for many years. "It is simply not possible to transform a company of 110 years old by shutting off the taps," Looney said when unveiling his plans in August. And even if they invest heavily in solar power, electric vehicles, and wind turbines, oil demand is projected to continue rising for at least a decade, as wealth rises in emerging countries, according to the International Energy Agency in Paris.

When I ask Looney if BP might inevitably become less profitable as the company moves away from fossil-fuel production, he says that on the contrary, he believes BP will gain hugely from the energy transition. Governments are rolling out gargantuan investments to facilitate the energy shift, including the European Union's trillion-dollar pandemic recovery plan. With thousands of engineers and a global supply chain, the oil majors could position themselves to be part of that rollout. "Trillions of dollars will be spent rewiring and replumbing the world's energy system," Looney says. "That presents an enormous opportunity for a company of our skills."

Besides just identifying a financial opportunity, Looney is also increasingly sounding like a true climate believer. "There's a tendency to take position. I am not into positions," he says. "I want us to do what I think is right for the world." The trick will be making what's right for BP, and right for all of us, one and the same.

KEEPING FIRST RESPONDERS COMMUNICATING DURING COVID-19

FirstNet, a one-of-a-kind mobile network, helps first responders to talk to one another—and create better outcomes in emergencies.

IN JANUARY, WHEN COVID-19 WAS BEGINNING TO MAKE U.S. headlines, Jason Porter, senior vice president of the FirstNet Program at AT&T, learned the U.S. military needed help setting up a communications network for new quarantine centers. The centers would house people returning to the U.S. from China for 14-day isolation periods, and the doctors, nurses, and police and military service members working there needed to stay connected with one another without worrying about their cellular networks going down.

Porter, a former U.S. Army captain, leads FirstNet, a communications network built specifically for first responders. It's similar to normal mobile networks, but the cell phones, computers, and other devices first responders use have priority and preemption across the network. That's like giving public safety the "lights and sirens" treatment on the communications highway.

With COVID-19 cases rising in the U.S., FirstNet had to ensure that the quarantine bases—and later, field hospitals—across the country could get cell coverage. So the company made capacity adjustments to existing cell phone towers and has deployed portable ones dedicated for public safety use. "We're on naval ships, tribal lands in Wisconsin, and we've carried devices into neonatal clinics," says Porter. "We want to be wherever first responders are working."

Communication Innovations

The idea for FirstNet was born in the aftermath of 9/11, when first responders had trouble communicating through New York City's jammed cell phone and radio networks. It is built with AT&T in public-private partnership with the First Responder Network Authority (FirstNet Authority)—an independent government agency within the U.S. Department of Commerce and part of FEMA's national response center. Legislation was passed in 2012 to create FirstNet, and in 2017 the FirstNet Authority awarded AT&T the contract to build, manage, and develop the mobile network.

The system was created with natural disasters and terrorist attacks in mind, but it has proved useful during the COVID-19 crisis and even in the search for missing children. In Alabama, 200 first responders used FirstNet to search for—and locate—a 4-year-old.

A Public-Private Success

Jay English, chief technology officer at APCO International, the world's largest organization of public safety community professionals, helped brainstorm FirstNet and says it proves that public-private partnerships can work despite competing business and government interests. "It's incredibly important to have these capabilities in the hands of America's emergency responders, allowing them to do their jobs better, safer, and faster," he says.

FirstNet already covers 99% of the U.S. population today, and Porter is confident that the system is ready for anything. "We're battle-hardened," he says. "FirstNet has proven its worth, and now we learn and get better every time."


MANAGING
THE UNEXPECTED

RANK
▼
183

Alimentation Couche-Tard

COUNTRY
▼
CANADA

2019 REVENUE
▼
$59.1 BILLION

PUMPED UP

Couche-Tard has quietly built one of Canada's biggest companies by buying thousands of gas-station convenience stores around the world, especially in the U.S. Now it's going shopping again—and it really wants to make your breakfast.

By PHIL WAHBA

THERE ARE FEW RITUALS more American than a stop at a gas-station convenience store. It starts with the badly needed fill-up or bathroom break, then progresses to an impulse food-and-beverage buy—the jumbo soft drink, the bag of chips, maybe something more substantial like a pizza slice, whatever it takes to replenish yourself for the interstate.

But what few drivers know is that this American road-trip ritual is increasingly likely to involve a huge Canadian company. CST Corner Stores in Texas and the Southeast, Holiday gas stations across the Northern Tier, and above all, Circle K just about ev-

A FANCIER FILL-UP
A new Couche-Tard in Mirabel, Quebec. The company is banking on upscale food, better coffee, and even wine to help boost profits.

TO EXPAND

erywhere in the U.S.: These familiar brands and others—making up 7,300 U.S. stores in all—belong to Alimentation Couche-Tard, a convenience-store giant headquartered in Laval, Quebec, outside Montreal.

Having started in 1980 as a single store, Couche-Tard (pronounced "koosh-tar," it means "late sleeper" or "night owl" in French) now owns or licenses more than 14,500 "c-stores" in a network that spans North America and Northern Europe, with outposts in Latin America, the Middle East, and Southeast Asia. Couche-Tard took in $54 billion in sales in its 2020 fiscal year, making it Canada's third-biggest company. But the U.S. accounts for 70% of its revenue, and its stateside footprint could get bigger. In late July, the company reportedly made an offer to buy the 3,900-store Speedway chain from Marathon Petroleum. Although that bid was unsuccessful, Couche-Tard has signaled that it's still on the hunt.

Couche-Tard built this gas-station Goliath with savvy M&A—including 33 acquisitions big and small in the 2010s alone. The company aims to buy well-run retailers that it can help improve, rather than acting as turnaround artists. "They're never looking for fixer-uppers or things that are broken," says Moody's senior analyst Louis Ko of Couche-Tard's leaders.

But they are looking to keep growing. Brian Hannasch, an Iowa native who became Couche-Tard's CEO in 2014, tells *Fortune* that the company's ambitions were stymied by high valuations in recent years. "The market was frothy. Things traded at multiples that didn't make sense to us," says Hannasch. That has changed: The travel pullback resulting from the COVID-19 pandemic has hurt Couche-Tard's sales, but it has also driven other chains' values down to an affordable range.

At the same time, Couche-Tard is relying on food to make its existing empire more profitable. The company posits that gas-station retail can

COURTESY OF COUCHE-TARD

be quality retail, with higher-margin merchandise: It doesn't have to be day-old coffee and endless beef jerky. At hundreds of stores in the U.S. and Canada, the company is bringing in fresher food, installing espresso machines, and stocking wines that cost up to $50 a bottle. In Canada, where recreational marijuana use is legal, Couche-Tard is even exploring cannabis retail. "Couche-Tard is attracting a customer into their stores who's not necessarily going in to fill up their gas tank," says Derek Dley, an analyst at Canaccord Genuity.

Whichever strategies pay off, Couche-Tard has room to grow in a fragmented North American landscape. According to Euromonitor International, only two c-store brands command more than 5% of the U.S. market: Couche-Tard's Circle K, with 5.7%, and 7-Eleven (owned by Japan's Seven & I Holdings), with 10.7%. It was Seven & I that snared Speedway, for $21 billion, far more than Couche-Tard has ever spent on an acquisition. But the country is full of smaller chains that are ripe for takeovers and of hard-pressed energy companies eager to divest from gas-station retail—dynamics that should help Couche-Tard keep climbing the U.S. leaderboard.

QUEBEC HAS ITS OWN bustling convenience store culture. There, they're called *dépanneurs*, from *dépanner*, to get someone out of a bind. Alain Bouchard, a native of Quebec's remote Saguenay region, got his first c-store job as a preteen in the 1960s, helping his brother operate a location of a retailer called Perrette. He later worked at Provi-Soir, then the biggest Quebec chain, before striking out on his own in 1980, with his first Couche-Tard store.

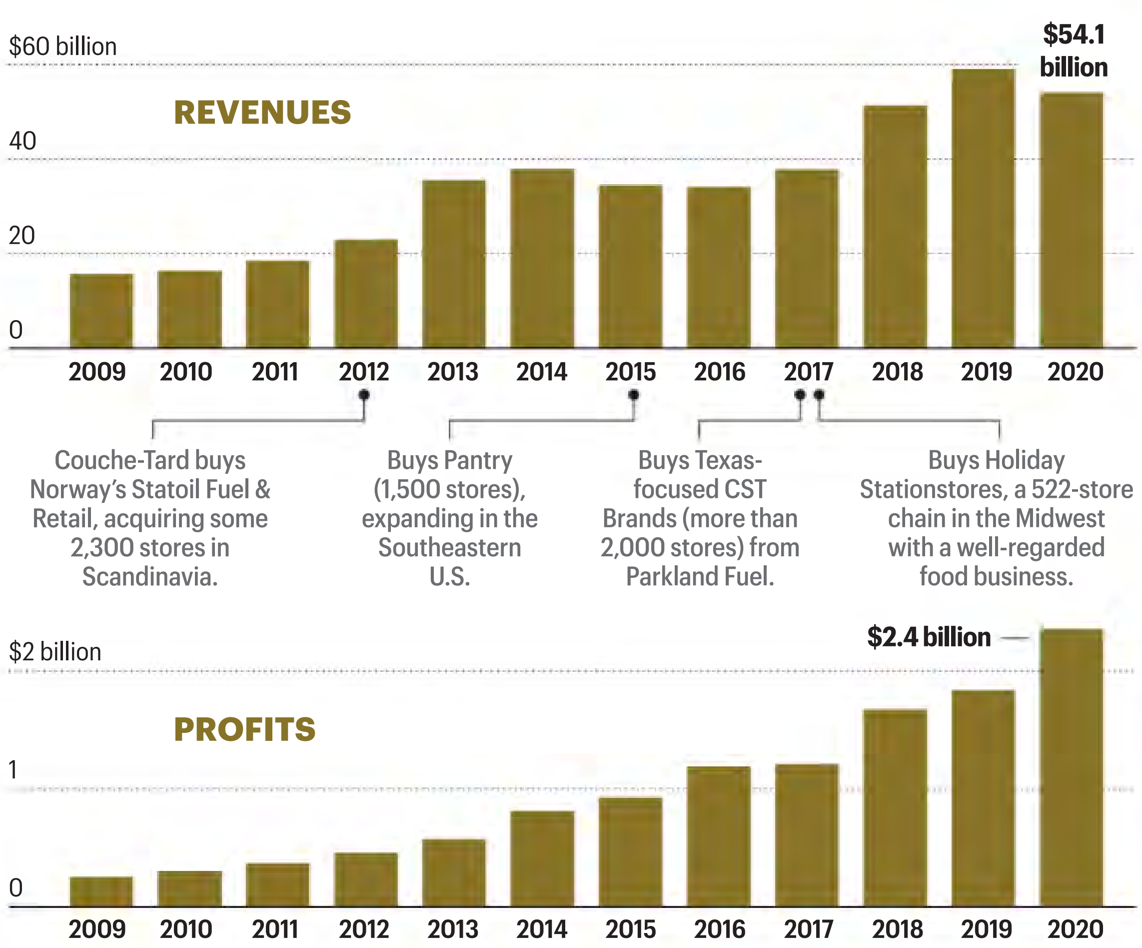
M&A quickly became part of Couche-Tard's MO. Bouchard gradually expanded in Quebec, culminating with the 1997 acquisition of Provi-Soir, whose winking-owl logo Couche-Tard adopted. The company then turned its attention south, cannily purchasing a few operations in the Midwest, where competition was lighter than in the Northeast. (One of those chains was Indiana-based Bigfoot, where Hannasch worked at the time.) In 2003 came the deal that made Couche-Tard a major U.S. player: It bought Circle K, with its 2,300 stores, for $821 million from ConocoPhillips, beating Blackstone and Morgan Stanley for the prize.

As a dealmaker, Couche-Tard developed an M&A discipline that helped it avoid the ill-considered mergers that have helped decimate the retail sector. Couche-Tard has been ultra-strict about not overpaying. It uses its own internal M&A SWAT team, rather than relying on costly, sometimes self-interested help from investment banks. (Bouchard, now chairman, still joins that team for big deals.) Before agreeing to the Circle K acquisition, Couche-Tard execs insisted on visiting 460 of the chain's stores—to learn its strengths and weaknesses, to see what sold well where, and why, and to meet and win over the rank and file. When Circle K initially balked, Couche-Tard threatened to walk away.

Once a chain becomes part of Couche-Tard, it's likely to retain its identity (though not its brand name: Since 2015, Couche-Tard has rebranded most of its stores outside

THE SUN NEVER SETS ON THE NIGHT OWL

Alimentation Couche-Tard, best known in the U.S. for its Circle K convenience stores, has more than doubled its store count and more than tripled sales over the past decade, thanks to a spree of more than 30 acquisitions. It now operates in 24 countries.



SOURCE: S&P GLOBAL.; FISCAL YEARS END APRIL 30

Brian Hannasch | CEO, Alimentation Couche-Tard

Couche-Tard is organized into 26 highly decentralized operating units, so local chains don't lose touch with their customers. **"We don't import a bunch of Canadians or a bunch of Americans,"** says its CEO, an Iowa native.

Quebec as Circle K). The company is organized into 26 operating units that are highly decentralized, so local chains don't lose touch with their customers. Local managers tend to stay on, too. "We don't import a bunch of Canadians or a bunch of Americans," Hannasch says. Not that Couche-Tard lacks a unifying culture: When Hannasch joined the corporate team, his initiation included a fishing trip with Bouchard and his deputies where he had to sing traditional Québécois folk songs around a campfire, despite not speaking a lick of French.

Couche-Tard's emphasis on autonomy makes the company unusually nimble for a retailer of its size. When COVID-19 struck Ireland in March, the government required home-improvement stores and nurseries to stay closed, leaving Emerald Isle green thumbs stranded as spring began. But Circle K gas stations were considered essential—and they spotted an opportunity. By April, the 406 Irish stores were selling plants, shrubs, and gardening tools to relieved horticulturists. Local management acted on its own, says Hannasch: "If we had waited for [headquarters in] Laval to say, 'This is okay,' we'd never have gotten it done."

Couche-Tard has pulled off the balancing act to which all big retailers aspire: catering to local tastes while operating at massive scale. When Hannasch visited Latvia, he was put off to see soda stocked in Circle K aisles rather than refrigerated—until he learned that many Latvians like their soft drinks warm. "It's not a chain of 9,000 locations," says Louis Hébert, a professor at HEC Montreal business school who has studied Couche-Tard's North American stores. "It's 9,000 chains of one location."

Ideas still flow downward from the parent company, of course. Couche-Tard advises store managers about product selection, often based on hyper-detailed analysis of store-by-store data. It is also testing dynamic pricing technology, which sets prices specific to a given store based on demand and local purchasing power. "It's easier to charge $1.69 for a Pepsi at every store," says Hannasch. "But if you take a couple of pennies here, a couple of pennies there, across 10,000 locations, it adds up quickly."

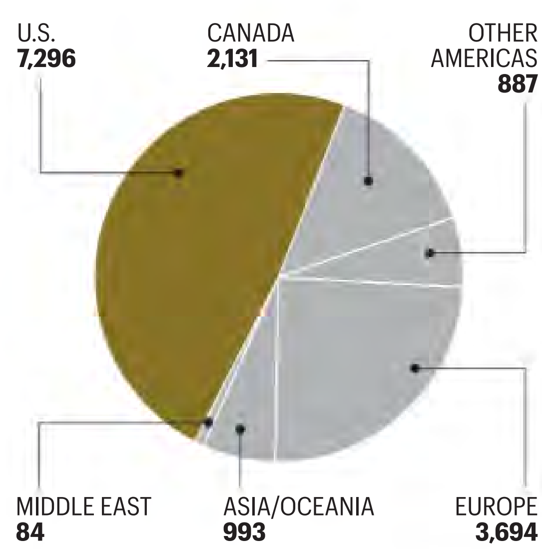
THESE DAYS, Couche-Tard is hunting for more pennies in the food-and-beverage aisles. Management has set an ambitious goal to double earnings before interest, taxes, depreciation, and amortization (Ebitda) to some $6 billion by 2023. Fuel generates 72% of company sales, but its margins are low. Nonfuel services and merchandise like food, on the other hand, represent 27% of sales but more than half of gross profit.

Food was the driving force behind one of Couche-Tard's last big deals, the 2017 acquisition of Minnesota-based Holiday Stationstores. Holiday has a reputation for offering far better breakfast and sandwich fare than you'd expect from a gas station—think fresh food from offsite providers, rather than microwaved mush—and Couche-Tard is working to absorb its dining DNA.

Back home in Canada, Couche-Tard is exploring a business line that isn't compatible with driving at all. It has teamed up with Canopy, a leading cannabis supplier, to open a proof-of-concept retail store in Ontario. And last year it bought a 9% stake in pot retailer Fire & Flower, with an option to become a majority owner. For Hannasch, this is about getting ready for an inevitable new opportunity: "Eventually it will be legalized in most of the U.S.," he says.

Underlying Couche-Tard's bustle is an awareness that it can't stand pat: After all, its top-selling product, fossil fuel, is in a long-term decline. In Norway, where Couche-Tard bought the retail business of state oil company Statoil in 2012, half of all new cars sold are electric. Today, Circle Ks in that nation are rapidly rolling out electric-vehicle charging hubs. They're also doubling down on lattes and upscale baked goods, so that drivers have something to enjoy while they wait 20 minutes for a recharge. The takeaway: Couche-Tard wants to keep its gas-station empire thriving, even if gas stations stop selling gas.

COUCHE-TARD STORE LOCATIONS



SOURCE: THE COMPANY

The Haier Smart Home All-Scenario Solution is just one part of the company's global ecosystem.

HAIER SMART HOME:

PIONEER OF THE GLOBAL ECOSYSTEM BRAND

For the third year in a row, Haier Smart Home has been named to the *Fortune* Global 500 list.

HAIER SMART HOME (SHANGHAI: 600690), a subsidiary of Haier Group, is building an ecosystem. This ecosystem has many partners and aims to serve hundreds of millions of users worldwide by providing innovative products and services through its global brand strategy.

With excellent performance and highly favorable responses from users, Haier Smart Home has been listed on the *Fortune* Global 500 list for three consecutive years. Haier has also been ranked once again as one of the BrandZ™ Top 100 Most Valuable Global Brands in 2020. What's more, it was the only Internet of things (IoT) brand on the list, showing how significantly the brand value of Haier Smart Home has grown.

In the digital era, user needs are changing continually, and Haier Smart Home has set an industry milestone about how traditional brands can successfully transform by relying on an IoT ecosystem.

Winning as Global Brands

Haier's success is inseparable from its strong global brand strategy. With localized brands across different market segments—GE Appliances in the U.S., Fisher & Paykel in New Zealand, AQUA in Japan, and Candy in Italy—Haier Smart Home leads the global appliance market with innovative products and by focusing on smart home services.

In the IoT era, Haier Smart Home is giving new meaning to premium appliances: They have to work well but also be smart devices that can solve users' pain points. Haier's Casarte brand has set the benchmark with high-quality appliances that can be upgraded as needed.

Such innovations have enabled Haier to expand its market share despite the overall industry downturn resulting from the COVID-19 pandemic. For example, Haier's laundry division launched a "sterilization air wash" cycle during the pandemic that cleans and sterilizes laundry at 140°F (60°C) for 30 minutes. Users can upgrade their washing machines by simply installing the cycle on the Haier Smart Home app.

In China, Haier Smart Home recorded 4.4% growth in market share while overall industry sales were down 47.5% in the first quarter. In the U.S., GE Appliances doubled its sales of big-volume refrigerators and laundry units. In Italy, Haier's revenue grew 30% year over year, and multi-door refrigerator sales have increased fourfold over the past year. In Germany, Haier reported 60% growth in revenue in the first quarter. In Russia, where the market is heading downward, Haier kitchen products generated triple revenue in the first quarter year over year. And in Japan, Haier and AQUA brands hold the largest share of the market.

All-Scenario Smart Home Solution

Consumers want a holistic solution with smart devices for their home instead of standalone appliances. That's why, in the past six months, a growing number of global users have become active users on the Haier Smart Home platform.

Haier Smart Home's IoT scenario-based service model has highly flexible customization options, from kitchen design and construction to the purchase, delivery, and installation of whole suites of appliances, all of which are covered under the service scope. Haier also offers smart solutions for the living room, bedroom, and outdoor spaces that cater to all aspects of user needs.

On May 1, 2020, Haier's Internet of Clothing platform launched the "Transform One Balcony a Day" project in China, which aims to create 10,000 balconies tailored to lifestyle needs, whether it's helping people stay fit, raise children, or care for pets. In Japan, AQUA smart washing machines save time, monitor progress in the home, and help improve performance for thousands of community-based laundry businesses.

Ecosystems Matter

Haier has a long history as one of the top home appliance brands. Changing the name to Haier Smart Home reflects one of the brand's biggest transitions: from selling products to building an ecosystem.

Haier Smart Home believes that future competition will not be among companies but among ecosystems. As a result, the company concentrates on creating scenario-focused brands and brands with ecosystems.

Haier's ecosystems allow more companies and Internet entrepreneurs to become partners and collaborate on overall smart home solutions. For example, Haier's Internet of Clothing platform covers 13 industries, including apparel, home textiles, and laundry detergent, and provides users with a full-cycle clothing care solution.

Scenario-based ecosystem services have become globalized. On June 15, Haier Smart Home livestreamed its "Better Life" solution, which covers clothing, food, housing, and entertainment for 12 countries, during the online Canton Fair. In a multi-country livestreaming session on smart community washing, Japan AQUA invited local departments, IoT partners, and Japanese users to share insights about how to make appointments, conveniently check the washing process by using smart washing machines, and improve the operating efficiency of hundreds of community laundries. Some of the most interesting examples of home appliances are the future kitchen of GE Appliances in North America, the social kitchen of Fisher & Paykel in New Zealand, and the connected home appliances of Candy in Europe.

IN THE DIGITAL ERA, user needs are changing continually, and Haier Smart Home has set an industry milestone about how traditional brands can successfully transform by relying on an IoT ecosystem.

Innovations like the full suite of Haier Smart Kitchen Gourmet Solutions have enabled the company to expand market share despite an overall industry downturn.

Haier's expanding ecosystem is reaching new users and offering richer experiences in more parts of the world every day.

From smart refrigerators to the Internet of Food, smart washing machines to the Internet of Clothing, smart air conditioners to the Internet of Air, smart water heaters to the Internet of Water, and smart TVs to the Internet of Entertainment, Haier has embarked on a journey from the home to beyond.

Haier Smart Home's strategy is making hundreds of millions of users' dreams come true in more than 160 countries. ■

RANK

96

Reliance Industries

COUNTRY

INDIA

2019 REVENUE

$86.3 BILLION

Birthed by Mukesh Ambani, head of Indian petrochemical heavyweight Reliance Industries, Jio Platforms plans to be much more than a mobile phone operator. Global financiers and the titans of Silicon Valley have taken notice.

CAN JIO BE THE NEXT TECH GIANT?

By VIVIENNE WALT

MAMMOTH TECHNOLOGY COMPANIES tend to blossom slowly. Google grew quietly out of a garage, Facebook from a dorm room, Amazon in a car rolling across the country. The investments in such upstarts amount to grubstakes, relatively paltry sums from risk-seeking investors who know it could all come to naught.

Yet when two of these giants (Facebook and Google) plunk down billions of dollars to back an emerging competitor to the third (Amazon), a new tech colossus can be crowned nearly instantaneously. That company, Jio Platforms, is a four-year-old mobile phone company controlled by India's richest man, Mukesh Ambani. It has attracted so much capital so quickly that while the rest of the world is focused on a global pandemic, Jio suddenly has staked its claim to becoming the first global tech giant to get its start in India.

The scramble began when Facebook inked a $5.7 billion deal with Jio in April for a 9.9% stake in the company. That ignited a cascade of investors grabbing a slice of Jio, which is controlled by Ambani's family business, the petrochemical conglomerate Reliance Industries. In May, U.S. private equity heavyweights Silver Lake, Vista Equity Partners, General Atlantic, and KKR together plowed nearly $5 billion into Jio. In June, Jio collected more than

DEBARCHAN CHATTERJEE—ZUMA WIRE

FOOT TRAFFIC
JioMart, Reliance's retail outfit, supports tens of thousands of mom-and-pop shops that view Amazon and Walmart as threats.

$4 billion from other U.S. tech investors and sovereign wealth funds in Saudi Arabia and the United Arab Emirates. And in July, after selling slices of Jio to U.S. chipmakers Intel and Qualcomm, Jio sealed a $4.5 billion deal with Google for 7.7% of the company. For good measure, Reliance, which funded Jio from its own balance sheet, raised nearly $7 billion more in a rights offering.

By mid-July, Jio had amassed more than $20 billion, leaving Reliance and Jio net debt-free and positioning the mobile offshoot for an eventual IPO. What's more, by spinning up Jio as a high-growth offshoot of an old-line energy company, Ambani has solidified his place as one of the world's top business titans. Already Asia's richest man—his 27-story Mumbai mansion has a 168-car garage; nine elevators; and a room with artificial snow, a handy feature in the tropical heat—Ambani now is one of the five richest people on the planet. If his ambitions for Jio succeed, it will join the ranks of global e-commerce "superapps" of the magnitude of China's Alibaba and Tencent.

To do that, Jio and its many new non-Indian partners will wage an all-out battle with two American behemoths that have invested heavily in Indian retail: Walmart and Amazon. The prize is nothing short of a market that, by all rights, should be among the top tier in international commerce—but which until now has frustrated many of those who have tried to capitalize on it. "India is no longer a regional player," says Mathew Oommen, the Indian-born president of Jio Platforms and a former U.S. telecom executive. That is why, he says, investors rushed in. Despite its youth, Jio is now in a position to pick and choose among its eager suitors. Oommen says Jio's top criterion has been partners who appear to have India's interests at heart. "You would be surprised, the number of investors we have turned down," he says.

JIO'S EXTRAORDINARY season of fundraising might never have happened had it not been for a persistent complaint by Ambani's teenage twins that will sound familiar to any parent: The Internet was too slow to adequately run the sites other kids were consuming every day. Ambani had inherited Reliance from his father, and he expanded the Mumbai-based oil-refining and petrochemical outfit into supermarkets, gas stations, and thousands of convenience stores. Reliance has shopped for assets abroad as well, more recently buying the British toy retailer Hamleys. Already immensely rich by the 2000s, Ambani, now 63, lacked one crucial segment in his portfolio: telecommunications. That was all too clear

ALL IN THE FAMILY
Mukesh Ambani (front right), India's richest man, with (from left) his wife, Nita, daughter, Isha, and sons, Anant and Akash, having just voted in Mumbai in national elections in April 2019. Mukesh took over Reliance Industries from his father and credits twins Isha and Akash with the idea for Jio Platforms.

DHIRAJ SINGH—BLOOMBERG VIA GETTY IMAGES

Egon Durban | co-CEO, Silver Lake

Ambani made a huge bet on Jio. Now it is the world's greatest private tech company hidden in plain sight."

to his daughter, Isha, and son Akash as they struggled (albeit in the lap of luxury) with India's creaky 2G networks. "Growing up, they expressed to many people, and to their dad, their frustration not being able to use mobile data," says Oommen, the Jio president. "Isha had a large influence on her dad, persuading him that this was a big opportunity."

Few realized just how big. Won over (or worn down) by his children, Ambani purchased a failing phone company in 2010, giving him licenses over some of India's wireless spectrum. At the time, hundreds of millions of Indians had never used a mobile phone, let alone logged on to the Internet. Ambani plowed about $35 billion into laying fiber lines and erecting about 200,000 towers for a modern 4G network in every corner of the vast country. The new company's catchy name, Jio, looks a bit like "oil" spelled backward. It was a fitting inside joke. Fossil fuels had made Ambani rich. Now, he concluded, he could future-proof his wealth by pegging it to data.

Jio's trajectory has been jaw-dropping. When it launched in September 2016, only about 28 million Indians owned smartphones, out of a population of more than 1.3 billion. Within 18 months Jio had signed 100 million people to its network, and by the end of July had nearly 400 million subscribers. The newcomer's trick was cheap data. Before Jio, mobile data cost $4.50 per gigabyte, painful in a country with per capita annual income at the time of $5,760. Jio offered a gigabyte for just 15¢ and made voice calls free. This unleashed a price war that entrenched operators like Vodafone and Bharti Airtel were destined to lose.

Two years after offering free calls and inexpensive data, Jio unveiled a $20 Android handset called the Jio Phone, loading it up with Google-owned apps like YouTube, included free with mobile plans. With that one product, Indians began to consume as much data as all of the Americas combined. It was a boon not only for Indians but for global tech giants too. Facebook's WhatsApp now operates in all 23 official Indian languages and has 400 million users, making India WhatsApp's biggest market. And in a country with widespread illiteracy, Google's YouTube acts as the default search engine for many. To other emerging countries with high-priced Internet, India now offers a prime example of the accelerator effect cheap data can have on businesses, education, and rural development. "Broadband connections have skyrocketed," says Nikhil Pahwa, founder and editor of the Indian tech analysis site MediaNama. Ambani, he says, is "someone who dreams big."

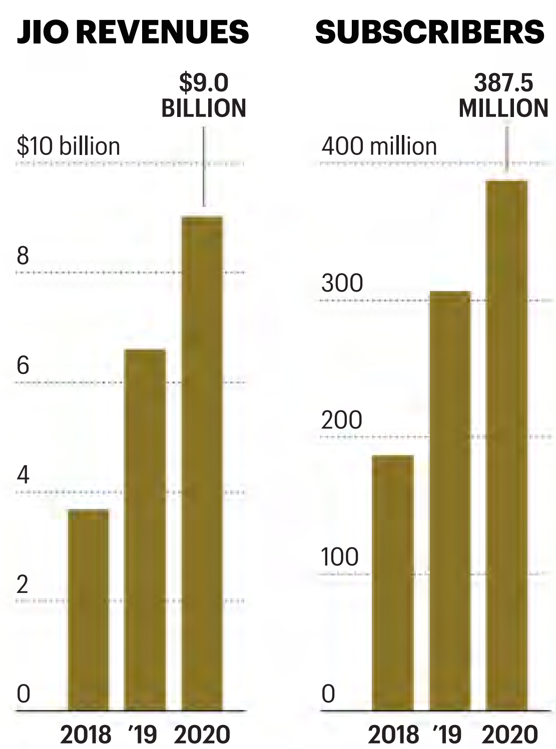
Ambani's dreams are far bigger even than telecommunications. Jio has rapidly displaced its cell phone competition, but it still has little presence in huge swaths of the Internet, including mobile payments and e-commerce. Says Oommen: "What we're seeing is only a small piece of the larger, bigger opportunity."

To grab those opportunities, Jio needed global partners, which created a virtuous investment circle. The investors got a stake in a fast-growing company that generated cash on its core business. Reliance was able to wipe clean its balance sheet ahead of its stated timetable. And Jio gains the globe's savviest tech players as allies. "Ambani made a huge bet on Jio," says Egon Durban, co-CEO of technology investment firm Silver Lake, who led the firm's Jio investment. Jio, he says, "is the world's greatest private tech company hidden in plain sight."

DRIVING AWAY from the sprawling megalopolis of Mumbai, across the bridge spanning the Arabian Sea, you reach the quieter exurb of Navi Mumbai and eventually arrive at the leafy, cordoned-off, 550-acre campus that is headquarters to Reliance Industries. Set around the

SCALING MOBILE HEIGHTS

Hundreds of millions of Indians had never used the Internet before Jio came along. Cheap cell phone data and fast connections showed the country what it could do.



SOURCE: THE COMPANY

complex of office buildings, both old and new, are neat footpaths connecting tennis courts, soccer fields, and a cricket pitch, as well as basketball, volleyball, and badminton courts and a full-service gym. At the center of this idyll sits Jio, whose building has blue-tinted glass walls shielding the interior from the blistering sun, with soothing shadows across its sleek offices.

Nearby sits the Jio Experience center, a building spotlighted in soft pinks and purples that represents the company's vision for its future. It imagines Jio not as a mobile phone carrier but a "digital lifestyle company," as a staff member puts it, a business embedded in Indians' daily habits. The whizbang toys on display include Jio TVs streaming, among other offerings, Bollywood hits and cricket matches—addictive Indian pastimes—via voice commands into a set-top box. "Our story has been about digital services as a platform from the beginning," says Oommen, who was chief technology officer of U.S. mobile operator Sprint before returning home to join Reliance in 2011. "It has never been an afterthought."

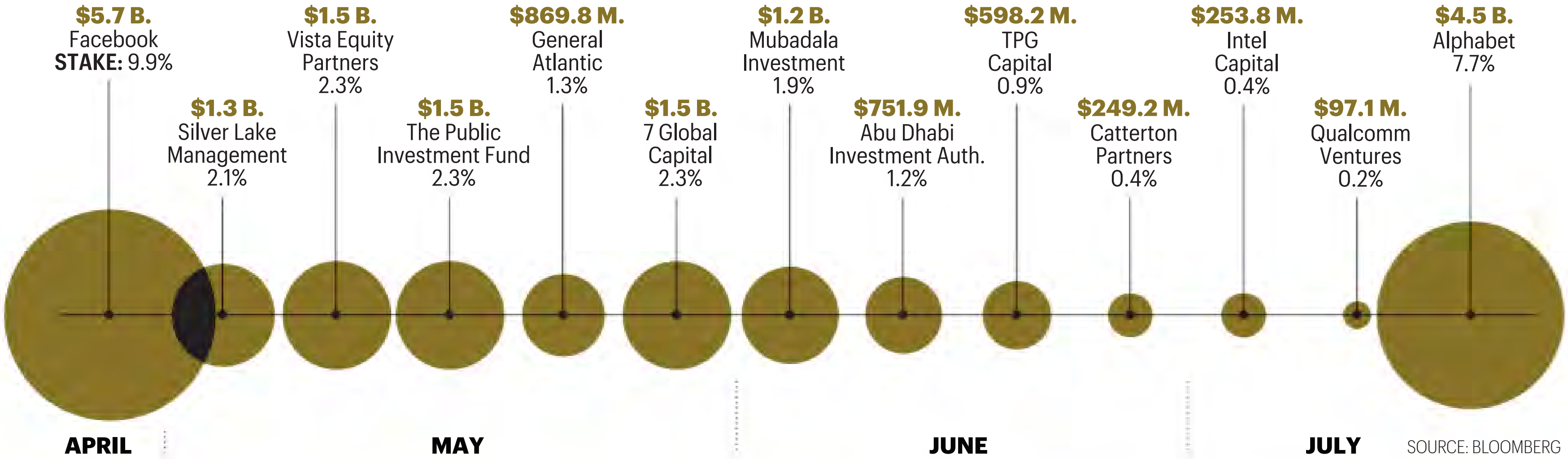
Perhaps not. But by earlier this year, Jio was still not offering its gargantuan number of mobile users an array of other paying services. And it trailed badly behind competitors in the "digital lifestyle" offerings it had envisioned. Amazon began spending billions in India in 2012. And even as Jio was giving away its handsets, Walmart muscled into India in 2018, buying control of the homegrown online-shopping company Flipkart for $16 billion.

To continue growing while beefing up its offerings, Jio began to look outward, which had the added benefit of cleaning up its balance sheet. The outsiders were eager for a way into the Indian market with a partner who knew how to operate there. Facebook's investment in Jio was India's single biggest foreign tech investment ever and Facebook's biggest investment since buying WhatsApp in 2014 for $14 billion. One big draw was Jio's ability to maneuver through India's labyrinth of government regulations—something that has entangled Amazon. In January, one day before Bezos flew to New Delhi to invest $1 billion more into Amazon India, the government announced the company was under investigation, along with Walmart-controlled Flipkart, for antitrust violations. Jio, adept at working the halls of power in New Delhi, has faced few such problems. "They've shown evidence they can execute well on initiatives that solve for both scale and complexity, which is hard to do well in any country," says Ajit Mohan, Facebook's top executive in India.

Ambani and Zuckerberg cast their partnership almost as a patriotic act, saying it would be crucial to protecting the millions of small mom-and-shop shops, called "kirana stores," that for decades have been the backbone of Indian commerce, and whose future has looked increasingly precarious as online shopping takes off. In a YouTube address from his mansion, Ambani said he and Zuckerberg shared the goal of "serving all Indians," saying that WhatsApp had built an "intimate relationship with Indians," and whose partnership aligned with Prime Minister Narendra Modi's digital strategy for the country.

INVESTOR HIT PARADE

Facebook's investment in April unleashed an unprecedented drumbeat of giant dealmaking for Jio, all of which went to pay down the debt of parent Reliance Industries. The deals have left Jio debt-free and with a bevy of the world's top technology and investing firms as partners. Jio says it turned other investors away, but it almost certainly will do an initial public offering of its shares.



SOURCE: BLOOMBERG

Under the deal, Jio's e-commerce site, JioMart, which launched in June, will be linked to WhatsApp, which will include an online payment option for the first time. The idea is that the payments will be for orders from 40 million or so kirana stores, which would deliver a far wider range of goods by combining their catalogs and delivery. Amazon and Walmart constitute a mortal threat to these family-owned shops, putting Jio in the role of a nationalist savior. "The big traditional e-commerce players are eradicating them," Oommen says. He sees the quintessential JioMart-WhatsApp customer as his mother, 84, who lives in India's southern state of Kerala. "My mom is not the most proficient with online things," he says. "But she knows the guy down the street who delivers most of her items."

Facebook will also be able to use its Jio deal as a prototype for its global market. In the same way, Google first rolled out its online payment system in India, before expanding the app into the U.S. and elsewhere. Google says it is now working on a low-cost Android operating system for Jio phones, which positions it yet again to test prototypes in India for use elsewhere in the world. In statements after his April deal, Zuckerberg made it clear Facebook has similar designs.

It is Jio's prospect for huge revenue growth that has ignited the frenzied dealmaking, as investors, almost all American, raced to buy slivers of the company while they could. "Companies are coming to the realization that India is a unique market," says Diego Piacentini, a former Amazon executive who oversaw the company's multibillion-dollar move into India. Piacentini now is an adviser to KKR, though he wasn't involved with the private equity firm's Jio investment. For investors, he says, "the approach is, 'better be sorry I made the wrong investment, than I missed a huge opportunity.'"

In fact, the potential to launch its e-commerce business with Facebook was, for Jio, a game changer. "Reliance may be able to disrupt India's e-commerce space the way it did within the telecom sector," Pranav Bhavsar, India consumer analyst for ASA Capital, told an Indian journalist. Western investors, he says, are "buying into the promise of changing India's retail landscape."

WHILE JIO has proved adept at building a subscriber base, its success in offering new services is not entirely assured. Under the pandemic, Jio began testing its fiber services in 50,000 homes, for example. But on

VYING FOR THE INDIAN MARKET

Western players have now lined up either with or against Jio Platforms. The three big tech and software companies are partners; America's two biggest retailers are foes.

FACEBOOK
CEO Mark Zuckerberg led the Western parade of investments in Jio Platforms with a $5.7 billion stake in April. Facebook's WhatsApp is huge in India and has a higher-income clientele than Jio's users.

GOOGLE
Sundar Pichai, CEO of Google and its parent company, Alphabet, appeared by video at the Reliance annual meeting in July to unveil a $4.5 billion investment in Jio. Google has focused intently on India for its untapped market and sees Jio as a way to navigate treacherous governmental waters.

MICROSOFT
Jio has partnered with the software giant through the project that is CEO Satya Nadella's crowning achievement, Microsoft's cloud-computing Azure business. The two companies have formed a joint venture to sell cloud services in India.

AMAZON
Jeff Bezos, the boss of Amazon, has invested billions to make India a winning market for the Seattle-based e-commerce giant. JioMart and its tie-up with WhatsApp constitute a threat to Amazon.

WALMART
CEO Doug McMillon bet big on India, buying a controlling stake in e-commerce champion Flipkart. Walmart has been stymied by regulations that favor local retailers.

PHOTO ILLUSTRATION BY FORTUNE, ORIGINAL PHOTOS, BEZOS: ANDREJ SOKOLOW—PICTURE ALLIANCE VIA GETTY IMAGES; NADELLA: SIMON DAWSON—BLOOMBERG VIA GETTY IMAGES; ZUCKERBERG: CHESNOT—GETTY IMAGES; MCMILLON: QILAI SHEN—BLOOMBERG VIA GETTY IMAGES; PICHAI: GEERT VANDEN WIJNGAERT—BLOOMBERG VIA GETTY IMAGES

LOCAL CONNECTION
Jio Platforms president Mathew Oommen was a senior executive with Kansas-based mobile carrier Sprint Communications. He returned to his native India to help Reliance, an oil refiner, jump into telecommunications.

several fronts, the company is racing to catch up with the Western competition. Walmart and Amazon already each have many millions of customers in India. And Google, Jio's newest investor, launched its online payment system in India in September 2017. "Google Pay has a significant head start over Facebook in terms of online payments," MediaNama's Pahwa says. "I doubt they will be able to compete."

There are other issues, too, which could lead Zuckerberg to question his $5.7 billion investment at times. Not the least of those issues is the sheer complexity of operating in a country with multiple languages and religions, whose government regulations still heavily favor local businesses. When I ask Piacentini, the former Amazon executive, what challenges Western tech investors face in the country, he replies, "How many hours do you have?" He cites as one example trade regulations among India's 28 states, which make online commerce convoluted. "In India you make investments for the long term. That means 30 years, not five years," he says. "You need a lot of capital and great people. Execution is incredibly hard."

For all that, there could be huge prospects ahead, which Reliance is already eyeing. Just as the WhatsApp payments system is likely to expand quickly to Facebook's markets in the rest of the world, so too might Jio ultimately use its home country as a place to build a platform of services that it could then replicate in other countries. That would catapult Jio, and by extension, Reliance, into the ranks of global companies. Jio president Oommen says he believes even parts of the U.S. and Europe might be potential markets for Jio. "We will not rule out going global at the right time," he says. Market watchers expect a Jio IPO in the not so distant future, although Oommen says the company has "not officially deliberated a timeline" for going public. But he says, "It is a possibility."

In classic Jio style, those plans could unfold quickly and on a huge scale—potentially making Jio the world's next big tech giant, and India's first. In July, Ambani told shareholders Jio is set to roll out its own 5G technology next year in India, and also expand into big data, machine learning, blockchain, and health care platforms. All of them, he says, would be readily exportable to markets across the world. "Each of these solutions, once proven in India, has the potential to be a global solution," Ambani said. His U.S. investors will be along for the ride.

VIVEK SINGH FOR FORTUNE

A HANDS-OFF APPROACH TO BUSINESS

Biometric technologies are powering a wave of no-touch, high-impact business innovations.

IN THE WAKE OF COVID-19, biometric technologies have quickly become a go-to resource for enterprise leaders. These contactless solutions—which use physical characteristics such as iris patterns or facial features to verify identity and control high-tech devices—offer a safer, more accurate, and more convenient alternative to traditional workplace interactions. Already, we are seeing the technology's impact in hospitals and factories, which can screen and identify employees on sight, as well as in laboratories and assembly lines, where equipment can be unlocked with a passing glance.

Poised to be a $46 billion global market by 2024, according to market researcher Frost & Sullivan, these biometric technologies underscore the enterprise market's push toward touchless and user-friendly experiences. "Demand for contactless technologies and simpler security solutions is growing rapidly," says Mohammed Murad, VP of global business development and sales for iris recognition technology leader Iris ID. "Biometrics offers ready-made answers for any firm looking to innovate in the wake of changing times and trends."

Looking ahead, Murad says, commercial and government leaders in every field will use smart, cost-saving solutions like Iris ID offers. These solutions scan people's eyes for unique physical identifiers in order to authenticate staff, monitor work hours, and provide hands-free alternatives to key cards. (They also work seamlessly with the personal protective equipment now mandated for health care workers, first responders, and others in the COVID-19 era.) With worldwide demand for biometric tools expected to grow by 19.6% annually, Murad notes, the future of commerce rests in smarter, more secure, and increasingly convenient customer interactions.

"Everywhere you turn, biometric technology promises to play a growing role," says Murad. "It offers more opportunities to pioneer creative new business solutions." ■

SHANGHAI PHARMA DELIVERS FOR INVESTORS AND THE PUBLIC

FORTUNE GLOBAL 500 2020

SPH 上海医药 SHANGHAI PHARMA

AS THE WORLD GRAPPLES WITH THE WORST pandemic in a century, pharmaceutical companies are marshaling their talent, research, and resources to find solutions to this global health emergency. In China, Shanghai Pharmaceuticals Holding Co., Ltd. (SPH) is at the forefront of those endeavors. A leader in research and development, manufacturing, distribution, and sales and services, Shanghai Pharmaceuticals is a vertically integrated, dual-listed company. With its nation-wide logistics network, SPH is the second-largest pharmaceutical distributor in China, and the largest distributor of imported drugs.

During the COVID-19 pandemic, SPH has joined forces with Grade-A Class-3 hospitals to provide online diagnostics and treatments through its Shanghai Pharmaceuticals Grand Health Cloud Commerce Co. Ltd. This alliance represents the dawn of a new era for virtual medical care in China. SPH is uniquely placed to leverage its strengths in the pharmaceutical value chain to expand and enhance its online platform to provide service and care for even greater numbers of people. In 2019, SPH's online platform served more than 3 million patients, electronically issuing more than 10 million prescriptions.

Whether responding to global pandemics or government policies, pharmaceutical firms need to be agile and adaptable to thrive. In 2019, China's government implemented several new policies that significantly transformed the Chinese pharmaceutical industry. It introduced a centralized drug procurement scheme, mandated improvement in drug quality, imposed cost controls to ensure drugs are more affordable for patients, and created incentives for potential substitutes for imported drugs. This changing landscape drove SPH to improve its core businesses and launch new and vital projects. The company invested in optimizing its manufacturing processes to develop innovative products, extended its nationwide network, and grew its international

"In 2019, SPH's online platform served more than 3 million patients, electronically issuing more than 10 million prescriptions."

footprint. As a result, SPH met all its operating goals and completed all its key tasks in 2019.

SPH is committed to innovation, research, and development. The company devotes substantial resources to developing high-end generic drugs, advancing traditional Chinese medicine, and synthesizing various technologies. But SPH doesn't work alone—the firm values partnerships. SPH utilizes the superior resources of a full range of partners in health and medicine, including colleges and universities, hospitals, and scientific research institutes. Together, they collaborate in the research and development of new products and processes, trials of new therapies, and talent cultivation. To stay competitive and become more sustainable, SPH is engaged in a reconfiguration of the research and development system, improving the efficiency of clinical research of innovative drugs, exploring cutting-edge pharmaceuticals with global potential, and promoting the rapid introduction of new and beneficial products.

In the past 10 years, SPH has comprehensively revised critical production tasks, perfected its quality management system, deepened industry chain management, reduced costs, and enhanced overall efficiency. The company has achieved all this by exercising more refined and intensive control over production and marketing as well as fostering greater experience and more advanced practices throughout its group of companies. Meanwhile, SPH is continually extending its business network and raising its regional market share. The firm builds and embraces synergies between research and development, advanced manufacturing, extensive distribution, and market intelligence. This approach has laid a solid foundation for improving operating results.

Those results have delighted investors. In 2019, the company recorded revenue of $27.04 billion, an increase of 17.27% year over year.

In both business and in public health, numbers are a measure of success, and SPH's balance sheet

	FY 2019 (USD bn)	YoY Growth
Revenue	27.04	17.27%
- Manufacturing	3.4	20.70%
- Distribution & Retail	23.63	16.80%
Net profit before deduction	0.59	5.15%
- Manufacturing	0.3	24.50%
- Distribution & Retail	0.32	26.75%
- Shareholding enterprises	0.11	18.14%
Net profit after deduction*	0.5	30.49%

*NOTE: Exchange Rate as of July 27, 2020: 1 US$ = 6.9 CNY

makes one thing abundantly clear: The company is providing outstanding returns for investors. One of the most important lessons of the COVID-19 pandemic is that we all need to be invested in public health. With its focus on innovation and full integration, Shanghai Pharma is delivering on that investment too. ■

THE LIST

For a seventh straight year, mega-retailer **Walmart** took the top spot on our annual list of the world's largest companies ranked by revenue. (See page F8 for the full methodology behind the rankings.) **Saudi Aramco,** after completing a long-awaited IPO in December, held steady at No. 6 and was once again the most

RANK 2019	2018	Company	Country/Territory	REVENUES $millions	% change from 2018
1	1	WALMART[1]	U.S.	523,964.0	1.9
2	2	SINOPEC GROUP[G]	CHINA	407,008.8[E]	(1.8)
3	5	STATE GRID[G]	CHINA	383,906.0	(0.8)
4	4	CHINA NATIONAL PETROLEUM[G]	CHINA	379,130.2[¶,E]	(3.5)
5	3	ROYAL DUTCH SHELL[†,2]	NETHERLANDS	352,106.0[E]	(11.2)
6	6	SAUDI ARAMCO[†,G]	SAUDI ARABIA	329,784.4	(7.3)
7	9	VOLKSWAGEN[†]	GERMANY	282,760.2	1.6
8	7	BP[†]	BRITAIN	282,616.0[E]	(7.0)
9	13	AMAZON.COM	U.S.	280,522.0	20.5
10	10	TOYOTA MOTOR[§,3]	JAPAN	275,288.3	1.0
11	8	EXXON MOBIL	U.S.	264,938.0[E]	(8.7)
12	11	APPLE[4]	U.S.	260,174.0	(2.0)
13	19	CVS HEALTH	U.S.	256,776.0	32.0
14	12	BERKSHIRE HATHAWAY	U.S.	254,616.0	2.7
15	14	UNITEDHEALTH GROUP	U.S.	242,155.0	7.0
16	17	MCKESSON[3]	U.S.	231,051.0	7.8
17	16	GLENCORE[†,5]	SWITZERLAND	215,111.0	(2.1)
18	21	CHINA STATE CONSTRUCTION ENGINEERING[G]	CHINA	205,839.4	13.4
19	15	SAMSUNG ELECTRONICS[†]	SOUTH KOREA	197,704.6	(10.8)
20	18	DAIMLER[†]	GERMANY	193,346.1	(2.1)
21	29	PING AN INSURANCE[†]	CHINA	184,280.3	12.6
22	25	AT&T	U.S.	181,193.0	6.1
23	27	AMERISOURCEBERGEN[4]	U.S.	179,589.1	6.9
24	26	INDUSTRIAL & COMMERCIAL BANK OF CHINA[†,G]	CHINA	177,068.8	4.8
25	20	TOTAL[†]	FRANCE	176,249.0[E]	(4.3)
26	23	HON HAI PRECISION INDUSTRY[†]	TAIWAN	172,868.5	(1.6)
27	22	TRAFIGURA GROUP[†,4]	SINGAPORE	171,474.1	(5.1)
28	24	EXOR GROUP[†]	NETHERLANDS	162,753.5[¶]	(7.0)
29	37	ALPHABET	U.S.	161,857.0	18.3
30	31	CHINA CONSTRUCTION BANK[†,G]	CHINA	158,884.3	5.1
31	30	FORD MOTOR	U.S.	155,900.0	(2.8)
32	229	CIGNA	U.S.	153,566.0	215.7
33	35	COSTCO WHOLESALE[6]	U.S.	152,703.0	7.9
34	46	AXA[†]	FRANCE	148,984.4	18.6
35	36	AGRICULTURAL BANK OF CHINA[†,G]	CHINA	147,313.1	5.6
36	28	CHEVRON	U.S.	146,516.0[E]	(11.9)
37	38	CARDINAL HEALTH[7]	U.S.	145,534.0	6.4
38	41	JPMORGAN CHASE	U.S.	142,422.0	8.4
39	34	HONDA MOTOR[†,3]	JAPAN	137,331.5	(4.2)
40	32	GENERAL MOTORS	U.S.	137,237.0	(6.7)
41	40	WALGREENS BOOTS ALLIANCE[6]	U.S.	136,866.0	4.1
42	33	MITSUBISHI[†,3]	JAPAN	135,940.2	(6.4)
43	44	BANK OF CHINA[†,G]	CHINA	135,091.4	5.8
44	43	VERIZON COMMUNICATIONS	U.S.	131,868.0	0.8
45	51	CHINA LIFE INSURANCE[G]	CHINA	131,243.7	13.0
46	45	ALLIANZ[†]	GERMANY	130,358.8	2.8
47	60	MICROSOFT[7]	U.S.	125,843.0	14.0
48	72	MARATHON PETROLEUM	U.S.	124,813.0[E]	28.5
49	61	HUAWEI INVESTMENT & HOLDING[†]	CHINA	124,316.3	14.0
50	55	CHINA RAILWAY ENGINEERING GROUP[G]	CHINA	123,324.0	10.0
51	47	KROGER[1]	U.S.	122,286.0	0.9
52	39	SAIC MOTOR[G]	CHINA	122,071.4	(10.5)
53	49	FANNIE MAE[8]	U.S.	120,304.0	0.2
54	59	CHINA RAILWAY CONSTRUCTION[G]	CHINA	120,302.2	8.9
55	42	GAZPROM[†,G]	RUSSIA	118,009.1[E]	(10.1)
56	53	BMW GROUP[†]	GERMANY	116,637.8	1.4
57	50	LUKOIL[†]	RUSSIA	114,621.2[E]	(3.8)
58	58	BANK OF AMERICA	U.S.	113,589.0	2.7
59	62	HOME DEPOT[1]	U.S.	110,225.0	1.9
60	52	JAPAN POST HOLDINGS[G,3]	JAPAN	109,914.7	(4.6)
61	54	PHILLIPS 66	U.S.	109,559.0[E]	(4.1)
62	64	NIPPON TELEGRAPH AND TELEPHONE[†,3]	JAPAN	109,447.7	2.1
63	75	COMCAST	U.S.	108,942.0	15.3
64	63	CHINA NATIONAL OFFSHORE OIL[G]	CHINA	108,686.8	0.5
65	56	CHINA MOBILE COMMUNICATIONS[G]	CHINA	108,527.3	(3.2)
66	92	ASSICURAZIONI GENERALI[†]	ITALY	105,920.9	20.1
67	91	CRÉDIT AGRICOLE[†]	FRANCE	104,971.8	18.8
68	79	ANTHEM	U.S.	104,213.0	13.1
69	69	WELLS FARGO	U.S.	103,915.0	2.8
70	71	CITIGROUP	U.S.	103,449.0	6.5
71	57	VALERO ENERGY	U.S.	102,729.0[E]	(7.8)
72	65	ITOCHU[†,3]	JAPAN	100,521.8	(3.9)
73	99	HSBC HOLDINGS[†]	BRITAIN	98,673.0	14.6
74	70	SIEMENS[†,4]	GERMANY	97,936.7	(0.9)
75	97	PACIFIC CONSTRUCTION GROUP	CHINA	97,536.4	12.6
76	86	ROSNEFT OIL[†,G]	RUSSIA	96,312.7[E]	6.9
77	48	GENERAL ELECTRIC	U.S.	95,214.0	(20.8)
78	93	CHINA COMMUNICATIONS CONSTRUCTION[G]	CHINA	95,096.2	7.9
79	80	CHINA RESOURCES[G]	CHINA	94,757.8	3.0
80	372	PRUDENTIAL[†,9]	BRITAIN	93,736.0	181.9
81	84	DELL TECHNOLOGIES[1]	U.S.	92,154.0	1.7
82	76	NESTLÉ[†]	SWITZERLAND	92,106.9	(1.5)
83	66	NISSAN MOTOR[3]	JAPAN	90,863.2	(13.0)
84	94	HYUNDAI MOTOR[†]	SOUTH KOREA	90,739.9	3.1

DEFINITIONS, EXPLANATIONS, AND FOOTNOTES ARE ON PAGE F8.

profitable company in the Global 500, with net income of $88 billion in 2019. Warren Buffett's **Berkshire Hathaway** fell a couple of rungs to No. 14, but trailed only Aramco with $81.4 billion in profits, thanks to enormous (though unrealized) gains on the company's stock investments—an accounting quirk that Buffett himself dislikes. Online retailer and cloud-storage leader **Amazon** continued its remarkable rise, cracking the top 10 for the first time at No. 9. Oil colossus **Exxon Mobil,** on the other hand, fell three spots to No. 11. And **Sinopec, State Grid,** and **China National Petroleum** gave China three companies in the top five.

1-168 / 500

RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
85	•	LEGAL & GENERAL GROUP[†]	BRITAIN	90,615.2[¶]	—
86	90	DEUTSCHE TELEKOM[†]	GERMANY	90,134.9	0.9
87	89	ENEL[†]	ITALY	89,906.6	0.7
88	•	AVIVA[†]	BRITAIN	89,646.6	277.6
89	87	CHINA FAW GROUP[G]	CHINA	89,417.1	(0.4)
90	101	CHINA POST GROUP[G]	CHINA	89,346.8	4.3
91	119	AMER INTERNATIONAL GROUP	CHINA	88,862.1	16.4
92	112	CHINA MINMETALS[G]	CHINA	88,357.4	10.3
93	85	BANCO SANTANDER[†]	SPAIN	88,256.8	(2.5)
94	98	SOFTBANK GROUP[†,3]	JAPAN	87,439.5[¶]	1.0
95	77	BOSCH GROUP[†]	GERMANY	86,989.8	(6.1)
96	106	RELIANCE INDUSTRIES[3]	INDIA	86,269.9[E]	4.8
97	73	SK HOLDINGS[†]	SOUTH KOREA	86,163.0[¶,E]	(10.2)
98	81	CARREFOUR[†]	FRANCE	85,905.2[¶]	(6.6)
99	104	BNP PARIBAS[†]	FRANCE	85,058.0	1.3
100	82	DONGFENG MOTOR[G]	CHINA	84,048.5	(7.6)
101	96	PEUGEOT[†]	FRANCE	83,643.2	(4.3)
102	139	JD.COM[§,10]	CHINA	83,504.8	19.6
103	103	TESCO[†,11]	BRITAIN	82,699.7	(1.9)
104	109	JOHNSON & JOHNSON	U.S.	82,059.0	0.6
105	111	CHINA SOUTHERN POWER GRID[G]	CHINA	81,978.1	1.3
106	102	HITACHI[†,3]	JAPAN	80,639.0	(5.7)
107	181	HENGLI GROUP	CHINA	80,588.3	43.4
108	107	CHINA ENERGY INVESTMENT[G]	CHINA	80,498.0	(1.8)
109	88	SINOCHEM GROUP[G]	CHINA	80,376.2	(10.1)
110	110	ELECTRICITÉ DE FRANCE[†,G]	FRANCE	80,277.6[¶]	(1.4)
111	149	CHINA BAOWU STEEL GROUP[G]	CHINA	79,932.0	20.5
112	121	PEOPLE'S INSURANCE CO. OF CHINA[†,G]	CHINA	79,788.1	5.9
113	83	ENI[†]	ITALY	79,513.2[E]	(12.4)
114	108	STATE FARM INSURANCE	U.S.	79,395.3	(2.9)
115	118	AEON[11]	JAPAN	78,930.3	2.3
116	123	AIRBUS[†]	NETHERLANDS	78,883.0	4.9
117	122	TARGET[1]	U.S.	78,112.0	3.7
118	114	INTERNATIONAL BUSINESS MACHINES	U.S.	77,147.0	(3.1)
119	148	RAYTHEON TECHNOLOGIES[12]	U.S.	77,046.0	15.9
120	74	PETROBRAS[†,G]	BRAZIL	76,589.0[E]	(19.9)
121	68	BOEING	U.S.	76,559.0	(24.3)
122	116	SONY[§,3]	JAPAN	75,972.3	(2.8)
123	105	ENEOS HOLDINGS[†,3,13]	JAPAN	75,897.0[E]	(8.3)
124	•	AEGON[†]	NETHERLANDS	75,343.9	204.6
125	128	FREDDIE MAC[8]	U.S.	75,125.0	2.1
126	137	CITIC GROUP[G]	CHINA	75,115.4	6.3
127	168	CENTENE	U.S.	74,639.0	24.2
128	127	ROYAL AHOLD DELHAIZE[†]	NETHERLANDS	74,162.0	0.1
129	132	UNITED PARCEL SERVICE	U.S.	74,094.0	3.1
130	125	NIPPON LIFE INSURANCE[3]	JAPAN	74,047.9	(0.2)
131	78	UNIPER[†]	GERMANY	73,651.6	(20.2)
132	182	ALIBABA GROUP HOLDING[§,3,10]	CHINA	73,165.9	30.3
133	95	PEMEX[†,G]	MEXICO	72,820.4	(16.7)
134	129	BEIJING AUTOMOTIVE GROUP[G]	CHINA	72,553.6	(0.2)
135	145	MUNICH RE GROUP[†]	GERMANY	72,536.8	7.9
136	134	COFCO[G]	CHINA	72,148.8	1.3
137	133	LOWE'S[1]	U.S.	72,148.0	1.2
138	135	INTEL	U.S.	71,965.0	1.6
139	238	ZURICH INSURANCE GROUP[†]	SWITZERLAND	71,792.0	52.2
140	130	PTT[G]	THAILAND	71,501.6	(1.1)
141	136	U.S. POSTAL SERVICE[G,4]	U.S.	71,154.0	0.7
142	124	DEUTSCHE POST DHL GROUP[†]	GERMANY	70,894.9	(2.4)
143	115	BASF[†]	GERMANY	70,722.5[¶]	(10.2)
144	184	FACEBOOK	U.S.	70,697.0	26.6
145	169	SINOPHARM[G]	CHINA	70,689.5	17.9
146	120	ARCELORMITTAL[†]	LUXEMBOURG	70,615.0	(7.1)
147	177	COUNTRY GARDEN HOLDINGS[†,10]	CHINA	70,335.3	22.7
148	152	FEDEX[14]	U.S.	69,693.0	6.5
149	142	METLIFE	U.S.	69,620.0	2.5
150	170	WALT DISNEY[4]	U.S.	69,570.0	17.1
151	117	INDIAN OIL[G,3]	INDIA	69,246.4[E]	(10.8)
152	138	CHINA EVERGRANDE GROUP[†,10]	CHINA	69,127.1	(1.9)
153	131	PANASONIC[†,3]	JAPAN	68,896.6	(4.5)
154	140	CHINA NORTH INDUSTRIES GROUP[G]	CHINA	68,714.4	(0.1)
155	180	BROOKFIELD ASSET MANAGEMENT[†]	CANADA	67,826.0	19.5
156	146	PROCTER & GAMBLE[7]	U.S.	67,684.0	1.3
157	161	POWERCHINA[G]	CHINA	67,371.2	10.0
158	141	CHINA TELECOMMUNICATIONS[G]	CHINA	67,365.3	(2.0)
159	126	ENGIE[†]	FRANCE	67,220.4	(9.3)
160	154	PEPSICO	U.S.	67,161.0	3.9
161	166	MITSUBISHI UFJ FINANCIAL GROUP[3]	JAPAN	67,135.0	11.1
162	150	BANK OF COMMUNICATIONS[†]	CHINA	66,564.4	1.4
163	151	AVIATION INDUSTRY CORP. OF CHINA[G]	CHINA	65,909.0	0.6
164	144	CHEMCHINA[G]	CHINA	65,766.7	(2.4)
165	153	DAI-ICHI LIFE HOLDINGS[3]	JAPAN	65,433.6	1.0
166	179	HUMANA	U.S.	64,888.0	14.0
167	156	PRUDENTIAL FINANCIAL	U.S.	64,807.0	2.9
168	155	ARCHER DANIELS MIDLAND	U.S.	64,656.0	0.5

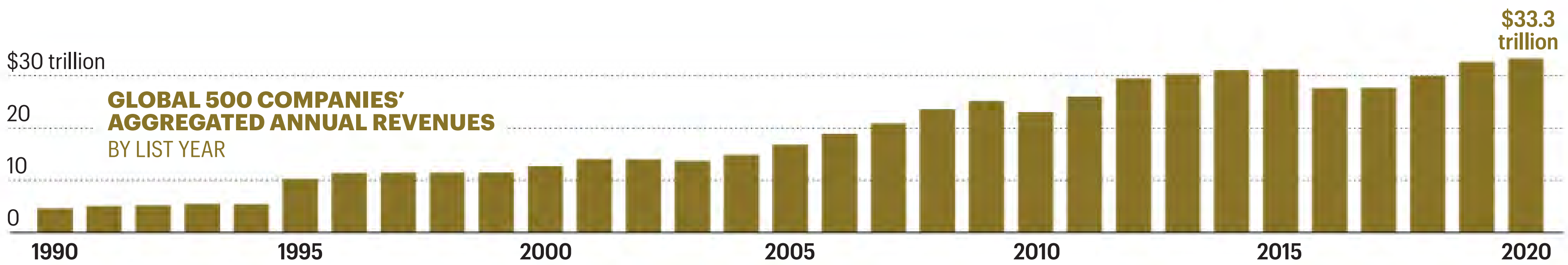
169-336 /500

Over the past decade, the world's biggest companies have grown their combined sales by more than $10 trillion. That's after total revenue grew 2% in 2019 to reach a new high of $33.3 trillion, equal to one-third of global GDP. Leading the way in sales growth was **Aviva** (No. 88), the U.K.-based insurer, which saw its revenue skyrocket 278%, thanks to strong returns from its equity portfolio combined with low interest rates. Given the impact of the pandemic, expect the Global 500's overall sales to dip next year. —*BRIAN O'KEEFE*

RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
169	113	EQUINOR[†,G]	NORWAY	64,357.0[E]	(19.1)
170	353	LLOYDS BANKING GROUP[†]	BRITAIN	64,297.4	82.4
171	163	ROCHE GROUP[†]	SWITZERLAND	63,433.5	4.3
172	157	MITSUI[†,3]	JAPAN	63,326.7	0.9
173	147	MARUBENI[†,3]	JAPAN	62,798.9	(5.9)
174	165	ALBERTSONS[11,15]	U.S.	62,455.1	3.2
175	143	RENAULT[†]	FRANCE	62,160.2	(8.3)
176	202	GREENLAND HOLDING GROUP	CHINA	61,965.1	17.5
177	162	TOYOTA TSUSHO[†,3]	JAPAN	61,570.3	0.9
178	159	SEVEN & I HOLDINGS[11]	JAPAN	60,951.8	(0.9)
179	172	SYSCO[7]	U.S.	60,113.9	2.4
180	187	CHRISTIAN DIOR[†]	FRANCE	60,070.5	8.7
181	418	MANULIFE FINANCIAL[†]	CANADA	59,968.9	99.4
182	197	LOCKHEED MARTIN	U.S.	59,812.0	11.3
183	210	ALIMENTATION COUCHE-TARD[†,16]	CANADA	59,117.6[E]	15.0
184	173	HP[17]	U.S.	58,756.0	0.5
185	167	UNILEVER[†]	BRITAIN/NETH.	58,179.0	(3.3)
186	158	PETRONAS[†,G]	MALAYSIA	58,027.0[E]	(6.8)
187	203	CHINA NATIONAL BUILDING MATERIAL GROUP[G]	CHINA	57,625.6	9.5
188	178	TOKYO ELECTRIC POWER[G,3]	JAPAN	57,407.0	0.4
189	188	CHINA MERCHANTS BANK[†]	CHINA	57,252.1	4.0
190	160	OIL & NATURAL GAS[G,3]	INDIA	57,170.7[E]	(6.9)
191	242	CHINA POLY GROUP[G]	CHINA	57,147.4	23.7
192	174	SOCIÉTÉ GÉNÉRALE[†]	FRANCE	56,851.6	(2.6)
193	199	CHINA PACIFIC INSURANCE (GROUP)	CHINA	55,799.6	4.2
194	171	POSCO[†]	SOUTH KOREA	55,591.9	(6.1)
195	206	VINCI[†]	FRANCE	54,787.6	4.7
196	164	AUCHAN HOLDING[†]	FRANCE	54,672.4[¶]	(10.0)
197	237	TENCENT HOLDINGS[†,10]	CHINA	54,612.7	15.5
198	186	NIPPON STEEL CORPORATION[†,3]	JAPAN	54,464.6	(2.3)
199	248	CNP ASSURANCES[†]	FRANCE	54,365.4	19.6
200	194	ENERGY TRANSFER[P]	U.S.	54,213.0	(0.4)
201	176	TELEFÓNICA[†]	SPAIN	54,196.7	(5.7)
202	204	GOLDMAN SACHS GROUP	U.S.	53,922.0	2.7
203	218	MORGAN STANLEY	U.S.	53,823.0	7.2
204	190	CATERPILLAR	U.S.	53,800.0	(1.7)
205	192	ANHEUSER-BUSCH INBEV[†]	BELGIUM	53,723.0[¶,E]	(1.6)
206	189	GUANGZHOU AUTOMOBILE INDUSTRY GROUP[G]	CHINA	53,662.1	(2.5)
207	185	LG ELECTRONICS[†]	SOUTH KOREA	53,464.3	(4.1)
208	254	CHINA VANKE[†]	CHINA	53,252.7	18.6
209	196	AMÉRICA MÓVIL[†]	MEXICO	52,323.1	(3.1)
210	249	WUCHAN ZHONGDA GROUP[G]	CHINA	51,954.1	14.3

RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
211	225	CISCO SYSTEMS[18]	U.S.	51,904.0	5.2
212	211	SHANDONG ENERGY GROUP[G]	CHINA	51,892.5	1.3
213	219	JBS[†]	BRAZIL	51,858.5	4.3
214	240	BAYER[†]	GERMANY	51,807.1[¶]	10.9
215	198	PFIZER	U.S.	51,750.0	(3.5)
216	191	ITAÚ UNIBANCO HOLDING[†]	BRAZIL	51,728.3	(5.4)
217	251	ALUMINUM CORP. OF CHINA[G]	CHINA	51,649.4	13.8
218	214	HBIS GROUP[G]	CHINA	51,345.1	0.8
219	241	HCA HEALTHCARE	U.S.	51,336.0	10.0
220	216	SHANGHAI PUDONG DEVELOPMENT BANK[†]	CHINA	51,313.4	1.5
221	236	STATE BANK OF INDIA[G,3]	INDIA	51,090.9	8.0
222	213	INDUSTRIAL BANK	CHINA	50,945.1	(0.1)
223	256	ROYAL BANK OF CANADA[†,17]	CANADA	50,863.1	14.0
224	212	LENOVO GROUP[†,3]	CHINA	50,716.3	(0.6)
225	201	NOVARTIS[†]	SWITZERLAND	50,486.0[¶]	(5.0)
226	224	TOKIO MARINE HOLDINGS[3]	JAPAN	50,269.6	1.8
227	193	KOREA ELECTRIC POWER[†,G]	SOUTH KOREA	50,256.7	(7.9)
228	217	VODAFONE GROUP[†,3]	BRITAIN	49,960.2	(1.1)
229	227	KIA MOTORS[†]	SOUTH KOREA	49,894.4	1.3
230	205	CONTINENTAL[†]	GERMANY	49,782.8	(5.0)
231	235	AMERICAN INTERNATIONAL GROUP	U.S.	49,746.0	5.0
232	208	DEUTSCHE BAHN[†,G]	GERMANY	49,728.6	(4.4)
233	332	SWISS RE[§]	SWITZERLAND	49,314.0	33.1
234	277	XIAMEN C&D[G]	CHINA	49,170.2	15.1
235	244	CHINA MERCHANTS GROUP[G]	CHINA	49,126.0	7.0
236	354	IDEMITSU KOSAN[3]	JAPAN	48,892.0[E]	39.3
237	209	SUMITOMO MITSUI FINANCIAL GROUP[3]	JAPAN	48,879.7	(5.5)
238	231	SUMITOMO[†,3]	JAPAN	48,746.3	1.2
239	232	CHINA MINSHENG BANKING[†]	CHINA	48,528.3	1.1
240	255	SBERBANK[†,G]	RUSSIA	48,340.3	7.7
241	245	KDDI[†,3]	JAPAN	48,170.6	5.1
242	223	GROUPE BPCE[†,C]	FRANCE	47,910.9	(3.3)
243	220	ZHEJIANG GEELY HOLDING GROUP	CHINA	47,885.9	(3.6)
244	226	SAINT-GOBAIN[†]	FRANCE	47,650.1	(3.3)
245	200	REPSOL[†]	SPAIN	47,543.8[E]	(7.6)
246	222	MS&AD INSURANCE GROUP HOLDINGS[3]	JAPAN	47,537.2	(4.2)
247	230	DENSO[†,3]	JAPAN	47,400.3	(2.0)
248	215	THYSSENKRUPP[†,4]	GERMANY	47,357.5	(6.9)
249	228	ORANGE[†]	FRANCE	47,275.2	(3.2)
250	388	AIA GROUP[†]	CHINA	47,242.0	45.9
251	270	AMERICAN EXPRESS	U.S.	47,020.0	8.6
252	260	DELTA AIR LINES	U.S.	47,007.0	5.8

DEFINITIONS, EXPLANATIONS, AND FOOTNOTES ARE ON PAGE F8.



RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
253	289	CHINA EVERBRIGHT GROUP[G]	CHINA	46,957.0	12.1
254	234	BANCO BILBAO VIZCAYA ARGENTARIA[†]	SPAIN	46,892.4	(1.5)
255	348	E.ON[†]	GERMANY	46,861.1[¶]	31.3
256	285	MERCK	U.S.	46,840.0	10.7
257	257	AMERICAN AIRLINES GROUP	U.S.	45,768.0	2.8
258	264	CHARTER COMMUNICATIONS	U.S.	45,764.0	4.9
259	253	VOLVO[†]	SWEDEN	45,689.9	1.6
260	233	WOOLWORTHS GROUP[†,7]	AUSTRALIA	45,523.9[¶]	(4.8)
261	246	BHP GROUP[†,7]	AUSTRALIA	45,139.0[¶]	(1.5)
262	207	FINATIS[†]	FRANCE	45,044.5[¶]	(13.8)
263	308	ALLSTATE	U.S.	44,675.0	12.2
264	279	CHINA COSCO SHIPPING[G]	CHINA	44,655.1	4.8
265	263	SHAANXI YANCHANG PETROLEUM (GROUP)[G]	CHINA	44,564.4[E]	1.6
266	286	CHINA HUANENG GROUP[G]	CHINA	44,501.9[¶]	5.3
267	295	TORONTO-DOMINION BANK[†,17]	CANADA	44,501.6	8.0
268	221	BANCO BRADESCO[†]	BRAZIL	44,490.7	2.9
269	259	PEGATRON[†]	TAIWAN	44,206.7	(0.6)
270	268	NEW YORK LIFE INSURANCE	U.S.	44,116.6	1.6
271	282	TALANX[†]	GERMANY	44,020.4	3.8
272	271	NATIONWIDE	U.S.	43,982.0	1.6
273	281	SHAANXI COAL & CHEMICAL INDUSTRY[G]	CHINA	43,797.8	3.3
274	272	ACS[†]	SPAIN	43,705.9	1.0
275	276	BEST BUY[1]	U.S.	43,638.0	1.8
276	293	UNITED AIRLINES HOLDINGS	U.S.	43,259.0	4.7
277	261	HANWHA[†]	SOUTH KOREA	43,258.4	(2.4)
278	278	LIBERTY MUTUAL INSURANCE GROUP	U.S.	43,228.0	1.3
279	298	ACCENTURE[§,6]	IRELAND	43,215.0	5.4
280	303	RIO TINTO GROUP[†]	BRITAIN	43,165.0	6.5
281	250	SINOMACH[G]	CHINA	43,122.2	(5.1)
282	296	GLAXOSMITHKLINE[†]	BRITAIN	43,072.5	4.8
283	•	DOW[19]	U.S.	42,951.0	—
284	291	XIAMEN ITG HOLDING GROUP[G]	CHINA	42,790.1	3.3
285	258	WILMAR INTERNATIONAL[†]	SINGAPORE	42,640.5	(4.2)
286	287	BOUYGUES[†]	FRANCE	42,543.0	0.9
287	306	TYSON FOODS[4]	U.S.	42,405.0	5.9
288	269	BANCO DO BRASIL[†,G]	BRAZIL	42,179.9	(2.7)
289	288	SANOFI[†]	FRANCE	42,118.8	0.0
290	262	CHINA UNITED NETWORK COMMUNICATIONS[G]	CHINA	42,052.1	(4.4)
291	239	DEUTSCHE BANK[†]	GERMANY	41,779.6	(11.0)
292	317	TJX[1]	U.S.	41,717.0	7.0
293	274	UBS GROUP[†]	SWITZERLAND	41,482.0	(3.4)
294	267	METRO[†,4]	GERMANY	41,370.7[¶]	(4.8)
295	318	YANKUANG GROUP[G]	CHINA	41,323.4	6.3
296	301	CEDAR HOLDINGS GROUP	CHINA	41,276.7	1.6
297	247	BUNGE[§,20]	U.S.	41,140.0	(10.1)
298	338	XMXYG[G]	CHINA	41,135.4	12.7
299	•	M&G[†,21]	BRITAIN	41,075.5[¶]	—
300	300	MITSUBISHI ELECTRIC[†,3]	JAPAN	41,045.0	0.7
301	280	JARDINE MATHESON[†,22]	CHINA	40,922.0	(3.8)
302	266	ZF FRIEDRICHSHAFEN[†]	GERMANY	40,873.0	(6.2)
303	292	IBERDROLA[†]	SPAIN	40,783.4	(1.5)
304	284	LUFTHANSA GROUP[†]	GERMANY	40,767.8	(3.6)
305	283	CHINA NATIONAL AVIATION FUEL GROUP[G]	CHINA	40,487.2	(4.4)
306	297	TIAA	U.S.	40,454.4	(1.5)
307	312	MIDEA GROUP	CHINA	40,440.4	2.2
308	273	SHANDONG WEIQIAO PIONEERING GROUP	CHINA	40,426.0	(6.0)
309	275	BHARAT PETROLEUM[G,3]	INDIA	40,409.8[E]	(5.9)
310	315	INTESA SANPAOLO[†]	ITALY	40,359.3	3.4
311	327	DAIWA HOUSE INDUSTRY[3]	JAPAN	40,288.0	7.8
312	304	EDEKA ZENTRALE[C,23]	GERMANY	39,824.1	(1.6)
313	313	FRESENIUS[†,P]	GERMANY	39,631.8	0.2
314	307	ORACLE[14]	U.S.	39,506.0	(0.8)
315	299	MAGNA INTERNATIONAL[§]	CANADA	39,431.0	(3.4)
316	362	STATE POWER INVESTMENT[G]	CHINA	39,406.8	15.1
317	343	GENERAL DYNAMICS	U.S.	39,350.0	8.7
318	326	SNCF GROUP[†,G,24]	FRANCE	39,308.3	(0.0)
319	329	DEERE[17]	U.S.	39,258.0	5.1
320	294	MAERSK GROUP[†]	DENMARK	39,198.0[¶]	(5.0)
321	392	DZ BANK[†,C]	GERMANY	39,143.8	22.4
322	341	NIKE[14]	U.S.	39,117.0	7.5
323	391	PROGRESSIVE	U.S.	39,022.3	22.0
324	333	SUNING.COM GROUP	CHINA	38,971.0	5.2
325	342	PUBLIX SUPER MARKETS	U.S.	38,462.8	5.7
326	305	CAIXA ECONÔMICA FEDERAL[G]	BRAZIL	38,407.4	(4.6)
327	320	BARCLAYS[†]	BRITAIN	38,337.0	0.2
328	352	CK HUTCHISON HOLDINGS[†,25]	CHINA	38,165.5	7.9
329	361	TSINGSHAN HOLDING GROUP	CHINA	38,011.7	11.0
330	325	GEORGE WESTON[†]	CANADA	37,765.2	0.8
331	346	ENBRIDGE[§]	CANADA	37,735.1	5.4
332	322	CHINA AEROSPACE SCIENCE & INDUSTRY[G]	CHINA	37,604.3	(0.7)
333	336	VALE[†]	BRAZIL	37,570.0	2.4
334	324	MEIJI YASUDA LIFE INSURANCE[3]	JAPAN	37,465.9	(0.7)
335	395	COCA-COLA	U.S.	37,266.0	17.0
336	314	MASSACHUSETTS MUTUAL LIFE INSURANCE	U.S.	37,253.4	(5.1)

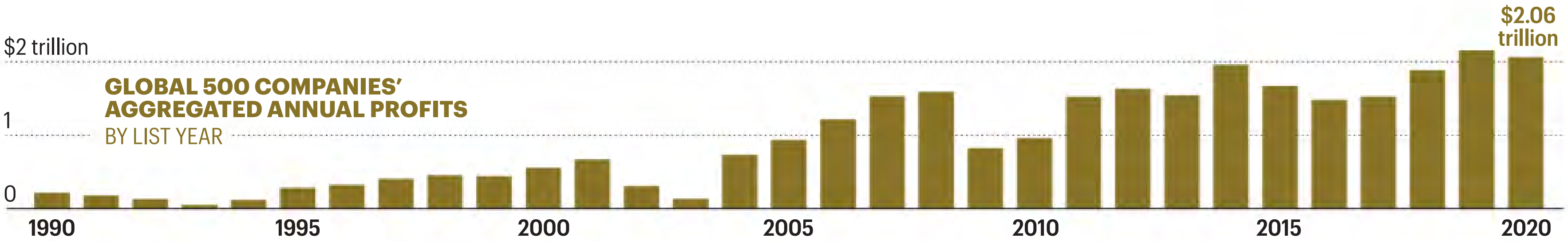
337-500 /500

A year after crossing the $2 trillion mark for the first time, cumulative profits for the Global 500 took a small step back as total net income fell 4%. Aerospace and defense profits sank 37%, owing to slower airplane sales, and lower oil prices hurt the oil and gas sector, which saw earnings plunge 33%. Even mighty **Apple** (No. 12) had an off year. The iPhone maker's profits slid 7% last year to a still-astounding $55 billion. Earnings at Big Tech peer **Microsoft** (No. 47), meanwhile, rocketed up 137% to $39.2 billion. —*BRIAN O'KEEFE*

RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
337	265	TATA MOTORS[3]	INDIA	37,241.9	(14.6)
338	•	PHOENIX GROUP HOLDINGS[†]	BRITAIN	37,215.4	—
339	334	MITSUBISHI HEAVY INDUSTRIES[†,3]	JAPAN	37,171.5	1.1
340	328	ABB[§]	SWITZERLAND	37,015.0¶	(0.9)
341	330	TECH DATA[1,33]	U.S.	36,998.4	(0.6)
342	310	ING GROUP[†]	NETHERLANDS	36,990.3	(6.6)
343	358	JIANGXI COPPER[G]	CHINA	36,979.7	6.1
344	321	J. SAINSBURY[†,3]	BRITAIN	36,830.9	(3.2)
345	309	WORLD FUEL SERVICES	U.S.	36,819.0	(7.4)
346	331	POWER CORP. OF CANADA[†]	CANADA	36,809.6	(0.8)
347	290	HONEYWELL INTERNATIONAL	U.S.	36,709.0	(12.2)
348	319	CONOCOPHILLIPS	U.S.	36,670.0	(5.3)
349	350	MIZUHO FINANCIAL GROUP[3]	JAPAN	36,668.6	3.6
350	355	POSTE ITALIANE[†,G]	ITALY	36,666.9	4.6
351	340	JIANGSU SHAGANG GROUP	CHINA	36,488.3	0.1
352	323	CHINA AEROSPACE SCIENCE & TECHNOLOGY[G]	CHINA	36,208.6	(4.0)
353	364	CHINA ENERGY ENGINEERING GROUP[G]	CHINA	36,110.5	5.7
354	368	YANGO LONGKING GROUP	CHINA	35,909.4¶	7.5
355	400	UNITED SERVICES AUTOMOBILE ASSN.	U.S.	35,617.4	13.5
356	349	FUJITSU[†,3]	JAPAN	35,483.0	(0.5)
357	360	CREDIT SUISSE GROUP[§]	SWITZERLAND	35,473.4	3.5
358	398	BANK OF NOVA SCOTIA[†,17]	CANADA	35,100.5	11.1
359	339	AISIN SEIKI[†,3]	JAPAN	34,809.6	(4.5)
360	316	LYONDELLBASELL INDUSTRIES[§]	NETHERLANDS	34,727.0	(11.0)
361	359	CRRC GROUP[G]	CHINA	34,704.2	0.1
362	363	TAIWAN SEMICONDUCTOR MANUFACTURING[†]	TAIWAN	34,619.7	1.2
363	377	SOMPO HOLDINGS[3]	JAPAN	34,586.9	5.3
364	344	EXELON	U.S.	34,438.0	(4.3)
365	356	JFE HOLDINGS[†,3]	JAPAN	34,305.0	(1.8)
366	382	CHUBB[§]	SWITZERLAND	34,186.0	4.5
367	441	ANHUI CONCH GROUP[G]	CHINA	33,916.4	19.0
368	416	NORTHROP GRUMMAN	U.S.	33,841.0	12.4
369	369	JINCHUAN GROUP[G]	CHINA	33,824.4	1.3
370	386	CHINA HUADIAN[G]	CHINA	33,808.4	4.3
371	302	LOUIS DREYFUS[†]	NETHERLANDS	33,786.0¶	(16.7)
372	387	CAPITAL ONE FINANCIAL	U.S.	33,766.0	4.3
373	366	PLAINS GP HOLDINGS[P]	U.S.	33,669.0	(1.1)
374	455	CATHAY FINANCIAL HOLDING[†,26]	TAIWAN	33,510.9	10.3
375	396	L'ORÉAL[†]	FRANCE	33,436.2	5.2
376	351	MITSUBISHI CHEMICAL HOLDINGS[†,3]	JAPAN	33,417.8¶	(5.6)
377	365	QUANTA COMPUTER[†]	TAIWAN	33,313.4	(2.3)
378	381	ABBVIE	U.S.	33,266.0	1.6

RANK 2019	2018		Country/Territory	REVENUES $ millions	% change from 2018
379	384	BRITISH AMERICAN TOBACCO[†]	BRITAIN	33,020.9[E]	1.1
380	345	CANON[§]	JAPAN	32,960.9	(7.9)
381	370	CHINA ELECTRONICS TECHNOLOGY GROUP[G]	CHINA	32,948.4	(1.1)
382	379	SCHLUMBERGER[§,27]	U.S.	32,917.0	0.3
383	449	STONEX GROUP[4,28]	U.S.	32,897.0	19.1
384	337	ENTERPRISE PRODUCTS PARTNERS[P]	U.S.	32,789.2	(10.3)
385	393	HYUNDAI MOBIS[†]	SOUTH KOREA	32,649.3	2.2
386	375	CHINA ELECTRONICS[G]	CHINA	32,447.1	(1.8)
387	374	BRIDGESTONE	JAPAN	32,339.9	(2.2)
388	429	NORTHWESTERN MUTUAL	U.S.	32,293.6	10.9
389	380	3M	U.S.	32,136.0	(1.9)
390	357	SUZUKI MOTOR[3]	JAPAN	32,085.7	(8.1)
391	378	SUMITOMO LIFE INSURANCE[3]	JAPAN	32,063.1	(2.3)
392	451	CHINA TAIPING INSURANCE GROUP[G]	CHINA	31,912.0	16.1
393	408	ABBOTT LABORATORIES	U.S.	31,904.0	4.3
394	383	CHS[C,6]	U.S.	31,900.5	(2.4)
395	403	COMPASS GROUP[†,4]	BRITAIN	31,735.7	2.8
396	390	COMPAL ELECTRONICS[†]	TAIWAN	31,722.5	(1.2)
397	397	CRH[†]	IRELAND	31,681.7¶	0.2
398	406	INDITEX[†,1]	SPAIN	31,584.4	2.9
399	413	TRAVELERS	U.S.	31,581.0	4.3
400	389	MAZDA MOTOR[3]	JAPAN	31,550.9	(1.9)
401	385	ANSTEEL GROUP[G]	CHINA	31,468.7	(3.5)
402	371	TOSHIBA[§,3]	JAPAN	31,179.2	(6.4)
403	471	FUBON FINANCIAL HOLDING[†]	TAIWAN	31,012.6	18.0
404	427	SAP[†]	GERMANY	30,838.9	5.8
405	440	SUBARU[†,3]	JAPAN	30,758.2	8.1
406	347	JIZHONG ENERGY GROUP[G]	CHINA	30,666.1	(14.2)
407	•	COLES GROUP[†,7,29]	AUSTRALIA	30,601.0¶	—
408	419	MEDTRONIC[§,16]	IRELAND	30,557.0	2.0
409	394	CPC[†,G]	TAIWAN	30,545.9[E]	(4.3)
410	412	PHOENIX PHARMA[†,1]	GERMANY	30,508.9	0.7
411	401	AIR FRANCE-KLM GROUP[†]	FRANCE	30,431.5	(2.8)
412	407	VEOLIA ENVIRONNEMENT[†]	FRANCE	30,431.2	(0.5)
413	411	SCHNEIDER ELECTRIC[†]	FRANCE	30,396.8	0.1
414	•	TAKEDA PHARMACEUTICAL[†,3]	JAPAN	30,271.5	60.0
415	•	CMA CGM[†]	FRANCE	30,254.2	28.9
416	373	COMMONWEALTH BANK OF AUSTRALIA[†,7]	AUSTRALIA	29,966.6¶	(9.7)
417	436	MEDIPAL HOLDINGS[3]	JAPAN	29,921.0	4.3
418	•	SUN LIFE FINANCIAL[†]	CANADA	29,904.6	43.6
419	450	ANGLO AMERICAN[†]	BRITAIN	29,870.0	8.2
420	443	CFE[†,G]	MEXICO	29,868.8	5.0

DEFINITIONS, EXPLANATIONS, AND FOOTNOTES ARE ON PAGE F8.



RANK 2019	2018		Country/Territory	REVENUES $millions	% change from 2018
421	422	PHILIP MORRIS INTERNATIONAL	U.S.	29,805.0[E]	0.6
422	468	XIAOMI[†,10]	CHINA	29,795.2	12.7
423	•	SHANGHAI CONSTRUCTION GROUP	CHINA	29,745.7	15.4
424	498	TAIKANG INSURANCE GROUP	CHINA	29,502.1	18.3
425	415	COOP GROUP[C]	SWITZERLAND	29,485.4	(2.5)
426	434	KB FINANCIAL GROUP[†]	SOUTH KOREA	29,469.5	1.6
427	417	SUNCOR ENERGY[†]	CANADA	29,384.5[E]	(2.3)
428	420	KANSAI ELECTRIC POWER[3]	JAPAN	29,288.0	(1.8)
429	402	SHOUGANG GROUP[G]	CHINA	29,273.6	(5.9)
430	497	BANK OF MONTREAL[†,17]	CANADA	29,159.8	16.6
431	404	HEWLETT PACKARD ENTERPRISE[17]	U.S.	29,135.0	(5.6)
432	405	BT GROUP[†,3]	BRITAIN	29,097.0	(5.4)
433	428	LA POSTE[†,G]	FRANCE	29,081.7	(0.2)
434	367	CHINA SOUTH INDUSTRIES GROUP[G]	CHINA	29,063.0	(14.3)
435	448	HAIER SMART HOME	CHINA	29,060.4	4.9
436	414	GREE ELECTRIC APPLIANCES	CHINA	29,023.6	(4.0)
437	463	CJ CORP.[†]	SOUTH KOREA	28,986.0	8.0
438	410	PKN ORLEN GROUP[†]	POLAND	28,976.6[E]	(4.7)
439	399	JOHNSON CONTROLS INTERNATIONAL[§,4]	IRELAND	28,969.0[¶]	(7.7)
440	311	CENTRICA[†]	BRITAIN	28,933.7	(26.9)
441	421	ARROW ELECTRONICS	U.S.	28,916.8	(2.6)
442	•	SHENZHEN INVESTMENT HOLDINGS[G]	CHINA	28,854.5	166.0
443	439	XINJIANG GUANGHUI INDUSTRY INVESTMENT	CHINA	28,710.9	0.5
444	•	LINDE[§,30]	BRITAIN	28,677.0[¶]	87.6
445	437	SUMITOMO ELECTRIC INDUSTRIES[3]	JAPAN	28,577.6	(0.3)
446	435	INTERNATIONAL AIRLINES GROUP[†,31]	BRITAIN	28,547.8	(0.9)
447	376	GS CALTEX[†]	SOUTH KOREA	28,541.3[E]	(13.6)
448	431	MIGROS GROUP[C]	SWITZERLAND	28,540.1	(1.9)
449	442	HUAXIA LIFE INSURANCE	CHINA	28,494.2	0.0
450	470	NEC[†,3]	JAPAN	28,469.2	8.3
451	493	SAFRAN[†]	FRANCE	28,423.5	12.8
452	424	WISTRON[†]	TAIWAN	28,416.2	(3.7)
453	432	DANONE[†]	FRANCE	28,302.7	(2.7)
454	453	CHUBU ELECTRIC POWER[3]	JAPAN	28,199.8	3.0
455	•	SHENGHONG HOLDING GROUP	CHINA	27,869.6	28.5
456	461	TONGLING NONFERROUS METALS GROUP[G]	CHINA	27,819.4	3.6
457	•	VIACOMCBS[32]	U.S.	27,812.0	91.6
458	456	FINANCIÈRE DE L'ODET[†]	FRANCE	27,805.5	2.3
459	•	SHANDONG IRON & STEEL GROUP[G]	CHINA	27,754.7	17.8
460	489	DOLLAR GENERAL[1]	U.S.	27,754.0	8.3
461	494	ACHMEA[†]	NETHERLANDS	27,593.1	9.6
462	495	RAJESH EXPORTS[3]	INDIA	27,589.6	9.7
463	464	DATONG COAL MINE GROUP[G]	CHINA	27,556.6	3.2
464	452	MAPFRE GROUP[†]	SPAIN	27,520.0	0.4
465	438	CHINA DATANG[G]	CHINA	27,464.0	(4.2)
466	486	U.S. BANCORP	U.S.	27,325.0	6.0
467	426	SAMSUNG LIFE INSURANCE[†]	SOUTH KOREA	27,290.7	(6.9)
468	473	HAILIANG GROUP	CHINA	27,209.1	3.6
469	425	UNICREDIT GROUP[†]	ITALY	27,168.9[¶]	(7.4)
470	458	EAST JAPAN RAILWAY[3]	JAPAN	27,102.4	0.1
471	423	KOÇ HOLDING[†]	TURKEY	27,052.8	(8.6)
472	478	MICHELIN[†]	FRANCE	27,013.3	3.9
473	•	SHANGHAI PHARMACEUTICALS HOLDING[†]	CHINA	27,005.4	12.3
474	467	HEINEKEN HOLDING[†]	NETHERLANDS	26,827.5[E]	0.8
475	•	X5 RETAIL GROUP[†]	NETHERLANDS	26,807.8	9.8
476	447	LAFARGEHOLCIM[†]	SWITZERLAND	26,588.9	(5.3)
477	485	CHINA GENERAL TECHNOLOGY[G]	CHINA	26,558.8	3.0
478	•	STARBUCKS[4]	U.S.	26,508.6	7.2
479	446	RANDSTAD[†]	NETHERLANDS	26,499.5	(5.7)
480	481	ADIDAS[†]	GERMANY	26,459.2	2.1
481	444	SAMSUNG C&T[†]	SOUTH KOREA	26,396.1	(6.8)
482	488	FOMENTO ECONÓMICO MEXICANO[†]	MEXICO	26,319.3[E]	2.5
483	459	OMV GROUP[†]	AUSTRIA	26,258.9[E]	(3.0)
484	445	ADECCO GROUP[§]	SWITZERLAND	26,220.8	(6.9)
485	465	SHANXI COKING COAL GROUP[G]	CHINA	26,178.9	(1.9)
486	484	HENAN ENERGY & CHEMICAL[G]	CHINA	26,162.5	1.5
487	•	BRISTOL-MYERS SQUIBB	U.S.	26,145.0	15.9
488	466	NOKIA[†]	FINLAND	26,095.5	(2.0)
489	462	SHANXI LUAN MINING GROUP[G]	CHINA	26,077.6	(2.8)
490	•	GUANGXI INVESTMENT GROUP[G]	CHINA	26,059.8	24.2
491	433	WESTPAC BANKING[†,4]	AUSTRALIA	26,000.9	(10.4)
492	430	NATURGY ENERGY GROUP[†]	SPAIN	25,991.4[¶]	(10.8)
493	•	CHINA NATIONAL NUCLEAR[G]	CHINA	25,974.9	12.7
494	•	US FOODS HOLDING	U.S.	25,939.0	7.3
495	480	MONDELEZ INTERNATIONAL	U.S.	25,868.0	(0.3)
496	•	CHINA NATIONAL COAL GROUP[G]	CHINA	25,846.4	14.0
497	•	PACCAR	U.S.	25,599.7	9.0
498	•	THERMO FISHER SCIENTIFIC	U.S.	25,542.0	4.9
499	469	YANGQUAN COAL INDUSTRY GROUP[G]	CHINA	25,490.8	(3.0)
500	482	SHANXI JINCHENG ANTHRACITE COAL MINING GROUP[G]	CHINA	25,385.6	(1.8)
		TOTAL		33,294,144.9	

WINNERS AND LOSERS

NEWCOMERS AND RETURNEES

		500 rank 2019
1	AEGON*	124
2	AVIVA*	88
3	BRISTOL-MYERS SQUIBB*	487
4	CHINA NATIONAL COAL GROUP	496
5	CHINA NATIONAL NUCLEAR	493
6	CMA CGM	415
7	COLES GROUP	407
8	DOW	283
9	GUANGXI INVESTMENT GROUP	490
10	LEGAL & GENERAL GROUP*	85
11	LINDE	444
12	M&G	299
13	PACCAR*	497
14	PHOENIX GROUP HOLDINGS	338
15	SHANDONG IRON & STEEL GROUP	459
16	SHANGHAI CONSTRUCTION GROUP	423
17	SHANGHAI PHARMACEUTICALS HOLDING	473
18	SHENGHONG HOLDING GROUP	455
19	SHENZHEN INVESTMENT HOLDINGS	442
20	STARBUCKS	478
21	SUN LIFE FINANCIAL*	418
22	TAKEDA PHARMACEUTICAL	414
23	THERMO FISHER SCIENTIFIC	498
24	US FOODS HOLDING*	494
25	VIACOMCBS*	457
26	X5 RETAIL GROUP	475

* A RETURNEE TO THE *FORTUNE* GLOBAL 500 LIST.

DISPLACED FROM LIST

		500 rank 2018
1	AIR LIQUIDE	500
2	AUSTRALIA & NEW ZEALAND BANKING GROUP	457
3	CECONOMY	477
4	CHINA DEVELOPMENT BANK†	67
5	CHINA SHIPBUILDING INDUSTRY†	243
6	DUPONT	100
7	EMIRATES GROUP	476
8	FLEX	474
9	FORMOSA PETROCHEMICAL	492
10	KRAFT HEINZ	472
11	LG CHEM	490
12	MACY'S	487
13	MICRON TECHNOLOGY	409
14	NATIONAL AUSTRALIA BANK	479
15	NUCOR	496
16	ONEX	491
17	PBF ENERGY	454
18	PERTAMINA†	175
19	RABOBANK GROUP	483
20	RAYTHEON	460
21	RWE	183
22	SABIC	252
23	SK HYNIX	335
24	ULTRAPAR HOLDINGS	499
25	WESFARMERS	195
26	XINXING CATHAY INTERNATIONAL GROUP†	475

† COMPANY DID NOT PROVIDE REQUIRED FINANCIALS FOR INCLUSION IN THE *FORTUNE* GLOBAL 500.

THE 35 BIGGEST MONEY LOSERS

	Revenues rank	Loss $ millions
PEMEX	133	18,038.7*
SCHLUMBERGER	382	10,137.0
SOFTBANK GROUP	94	8,844.3
U.S. POSTAL SERVICE	141	8,813.0*
NISSAN MOTOR	83	6,173.7
DEUTSCHE BANK	291	6,032.8
GENERAL ELECTRIC	77	4,979.0*
REPSOL	245	4,271.1
NIPPON STEEL CORPORATION	198	3,968.9
ARCELORMITTAL	146	2,454.0
KOREA ELECTRIC POWER	227	2,012.7*
JFE HOLDINGS	365	1,818.8
MARUBENI	173	1,816.1
ENEOS HOLDINGS	123	1,728.7
TATA MOTORS	337	1,702.5*
VALE	333	1,683.0
AUCHAN HOLDING	196	1,637.5*
AIRBUS	116	1,524.4
CONTINENTAL	230	1,371.1
DOW	283	1,359.0
CENTRICA	440	1,305.4
BUNGE	297	1,280.0
CHEMCHINA	164	1,250.9*
TOSHIBA	402	1,054.4
VODAFONE GROUP	228	1,022.0*
SNCF GROUP	318	896.5
BOEING	121	636.0
FINATIS	262	615.6*
GLENCORE	17	404.0
THYSSENKRUPP	248	342.8
HENAN ENERGY & CHEMICAL	486	305.8*
CMA CGM	415	229.1
IDEMITSU KOSAN	236	211.0
ANSTEEL GROUP	401	208.9*
ARROW ELECTRONICS	441	204.1
TOTAL OF ALL 45 COMPANIES WITH LOSSES		101,460.6
MEDIAN LOSS		1,250.9

* ALSO LOST MONEY IN 2018.

UPS AND DOWNS

20 THAT CLIMBED

Company	2019 rank	Rank gain from 2018
PRUDENTIAL	80	292
MANULIFE FINANCIAL	181	237
CIGNA	32	197
LLOYDS BANKING GROUP	170	183
AIA GROUP	250	138
IDEMITSU KOSAN	236	118
SWISS RE	233	99
ZURICH INSURANCE GROUP	139	99
E.ON	255	93
CATHAY FINANCIAL HOLDING	374	81
ANHUI CONCH GROUP	367	74
HENGLI GROUP	107	74
TAIKANG INSURANCE GROUP	424	74
DZ BANK	321	71
FUBON FINANCIAL HOLDING	403	68
PROGRESSIVE	323	68
BANK OF MONTREAL	430	67
STONEX GROUP	383	66
COCA-COLA	335	60
CHINA TAIPING INSURANCE GROUP	392	59

20 THAT STUMBLED

Company	2019 rank	Rank loss from 2018
CENTRICA	440	-129
TATA MOTORS	337	-72
GS CALTEX	447	-71
LOUIS DREYFUS	371	-69
CHINA SOUTH INDUSTRIES GROUP	434	-67
NATURGY ENERGY GROUP	492	-62
JIZHONG ENERGY GROUP	406	-59
WESTPAC BANKING	491	-58
HONEYWELL INTERNATIONAL	347	-57
EQUINOR	169	-56
FINATIS	262	-55
BOEING	121	-53
UNIPER	131	-53
DEUTSCHE BANK	291	-52
BUNGE	297	-50
KOÇ HOLDING	471	-48
BANCO BRADESCO	268	-47
ENTERPRISE PRODUCTS PARTNERS	384	-47
PETROBRAS	120	-46
REPSOL	245	-45

FIVE STAR WEALTH MANAGERS under 40

A wealth manager is more than someone who manages portfolios — it's someone who helps clients plan for their future and their children's future. The advisor-client relationship is a vital piece of the puzzle, which is why it's important to find the right wealth manager to work with for the long haul.

Five Star Professional has been researching and recognizing outstanding wealth managers for more than a dozen years. In that time, Five Star has identified a need to help people find a wealth manager who is a great personal fit. To further assist people in finding their ideal wealth managers, Five Star is now recognizing Five Star Wealth Manager award winners under 40. (Each of the featured advisors was under the age of 40 as of Jan. 1, 2020.)

What makes these wealth managers so unique is that they are part two exclusive groups. First, they're all Five Star Wealth Manager award winners, meaning they have been vetted by a third-party research process that includes 10 objective criteria. On top of satisfying those criteria, the winners below have the distinction of winning the Five Star Wealth Manager award while under the age of 40.

Congratulations to our Five Star Wealth Managers Under 40!

FIVE STAR PROFESSIONAL

RESEARCH DISCLOSURES

In order to consider a broad population of high-quality wealth managers, award candidates are identified by one of three sources: firm nomination, peer nomination or prequalification based on industry standing. Self-nominations are not accepted. Award candidates were identified using internal and external research data. Candidates do not pay a fee to be considered or placed on the final lists of Five Star Wealth Managers.

- The Five Star award is not indicative of a professional's future performance.
- Wealth managers may or may not use discretion in their practice and therefore may not manage their clients' assets.
- The inclusion of a professional on the Five Star Wealth Manager list should not be construed as an endorsement of the professional by Five Star Professional or *Fortune*.
- Working with a Five Star Wealth Manager or any professional is no guarantee as to future investment success, nor is there any guarantee that the selected professionals will be awarded this accomplishment by Five Star Professional in the future.
- Five Star Professional is not an advisory firm and the content of this article should not be considered financial advice. For more information on the Five Star Wealth Manager award program, research and selection criteria, go to fivestarprofessional.com/research.

DETERMINATION OF AWARD WINNERS

Award candidates who satisfied 10 objective eligibility and evaluation criteria were named 2020 Five Star Wealth Managers. **Eligibility Criteria – Required:** 1. Credentialed as a registered investment adviser or a registered investment adviser representative. 2. Actively employed as a credentialed professional in the financial services industry for a minimum of five years. 3. Favorable regulatory and complaint history review. 4. Fulfilled their firm review based on internal firm standards. 5. Accepting new clients. **Evaluation Criteria – Considered:** 6. One-year client retention rate. 7. Five-year client retention rate. 8. Non-institutional discretionary and/or non-discretionary client assets administered. 9. Number of client households served. 10. Education and professional designations.

Regulatory Review: As defined by Five Star Professional, the wealth manager has not: been subject to a regulatory action that resulted in a license being suspended or revoked, or payment of a fine; individually contributed to a financial settlement of a customer complaint; been convicted of a felony. Within the past 11 years the wealth manager has not: been terminated from a wealth management or financial services firm; filed for personal bankruptcy; had more than a total of three settled or pending complaints filed against them (and no more than five total pending, dismissed or denied) with any regulatory authority.

Five Star Professional conducts a regulatory review of each nominated wealth manager using the Investment Adviser Public Disclosure (IAPD) website. Five Star Professional also uses multiple supporting processes to help ensure that a favorable regulatory and complaint history exists. Data submitted through these processes was applied per the above criteria; each wealth manager who passes the Five Star Professional regulatory review must attest that they meet the definition of favorable regulatory history based upon the criteria listed above. Five Star Professional promotes via local advertising the opportunity for consumers to confidentially submit complaints regarding a wealth manager.

A Trusted Advisor

Antonio Loffreda-Mancinelli

Financial Consultant

Antonio Loffreda-Mancinelli is an investment consultant with Wealth Management Partners, LLC. As a licensed insurance agent and investment consultant, Antonio enjoys helping clients create a comprehensive financial plan by assisting them with asset management, retirement needs and estate planning.

Wealth Management Partners, LLC

790 Holiday Drive • Pittsburgh, PA 15220
Phone: 412-539-0015 • Cell: 412-651-0371
aloffreda@cfnmail.com • www.mywealthmanagement.com

Securities and advisory services offered through Commonwealth Financial Network®, Member FINRA/SIPC, a Registered Investment Adviser. Fixed insurance products and services offered through Wealth Management Partners, LLC or CES Insurance Agency. Antonio is licensed to assist clients in Pa., Va., W.Va., Md., Fla., Ill., Calif. and Ohio.

Wealth Manager Award Winner

Jeff A. Christie

Director, Private Client Services

Jeff Christie combines his passion for building long-term relationships with the sophisticated strategies of Lido Advisors to provide robust financial, estate and legacy planning for high net worth clients so they can navigate the uncertainty of today's investment climate. Jeff's knowledge is a resource clients and families continue to depend on. He is a 2012 – 2020 Five Star Wealth Manager award winner.

LIDO ADVISORS

3655 Nobel Drive, Suite 630 • San Diego, CA 92122
Phone: 858-485-0404
jchristie@lidoadvisors.com • www.lidoadvisors.com

Lido Advisors, LLC is an SEC-registered investment adviser. For complete information on the services we provide and our fees, please review our Form ADV at adviserinfo.sec.gov, call 310-278-8232, or mail us at 1875 Century Park East, Suite 950, Los Angeles, CA 90067.

Wealth Manager Award Winner

For more information on the Five Star award and the research/selection methodology, go to fivestarprofessional.com. 1,886 Pittsburgh-area wealth managers were considered for the award; 224 (8% of candidates) were named 2020 Five Star Wealth Managers. 2,018 San Diego-area wealth managers were considered for the award; 219 (11% of candidates) were named 2020 Five Star Wealth Managers.

FIVE STAR WEALTH MANAGERS — Under 40

Jason Snipe

Principal, Lic. 4685949

Independent, Collaborative and Innovative

Jason's true passion lies with people. This is undergirded by his intellectual enthusiasm for finance and the intricacies of how a dollar grows. Jason works closely with small businesses and executives and has over 17 years of experience.

Odyssey Capital Advisors

111 Presidential Boulevard • Bala Cynwyd, PA 19004
Phone: 484-278-4497 • jsnipe@odysseyadvice.com
www.odysseyadvice.com

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Wealth Manager Award Winner

Martin A. Campbell

Managing Partner, Principal

Martin A. Campbell currently holds his Series 7, 24 and 66 securities registrations. He is a registered principal with LPL Financial and a managing partner and principal with HighPoint Planning Partners and HighPoint Advisor Group. Martin and his business partner, Craig Ibrahim, started their firm in 2009 and are continually looking for the right advisors and teams to take the independent leap and join their OSJ-RIA.

HIGHPOINT

2001 Butterfield Road, Suite 1000 • Downers Grove, IL 60515
Phone: 630-719-9222 • martin.campbell@hiptpartners.com
www.highpointplanningpartners.com

Securities offered through LPL Financial, Member FINRA / SIPC. Investment Advice offered through HighPoint Advisor Group, a registered investment advisor. HighPoint Advisor Group and HighPoint Planning Partners are separate entities from LPL Financial.

Wealth Manager Award Winner

Ronald Gestiehr

CExP™, Director of Wealth Management

Ronald specializes in working with families, young professionals, high income and high net worth individuals, as well as privately held businesses. Ronald and his team work with clients on comprehensive financial strategies to help them create, maximize and protect their wealth. He is a 2017 – 2020 Five Star Wealth Manager award winner.

LFG LUTTNER FINANCIAL GROUP LLC

244 Boulevard of the Allies • Pittsburgh, PA 15222
Office: 412-391-6700 • rgestiehr@luttner.com
www.ronaldgestiehr.com

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Wealth Manager Award Winner

Joshua J. Paradis

CFP®, RICP®, AIF®

2018 – 2020 Five Star Wealth Manager

Joshua J. Paradis is a Certified Financial Planner™ professional with Equitable Advisors. He is a member of the NFLPA Financial Advisor Registration Program and enjoys helping families and small business owners secure financial freedom.

WEALTHBRIDGE LEGACY PARTNERS

63 Cedar Avenue, Suite 11 • East Greenwich, RI 02818
Phone: 401-884-7292, ext.103
joshua.paradis@mywealthbridge.com • paradiswealth.com

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Wealth Manager Award Winner

2013 – 2020
Award Winner

Andrew Cleary

Financial Advisor, CFP®, CLU®, AIF®

With over 15 years in the financial services industry, Andrew Cleary co-founded SFP Wealth with Dan Cappucci in 2007. They created a team of financial experts who deliver thoughtful advice with a highly personalized client experience. Fundamental to the team's success, Andrew employs a common-sense approach to complex challenges and always puts clients' interests first. He is an eight-year Five Star Wealth Manager award winner and four-year Financial Times 401 Retirement Advisers recipient.

SFP WEALTH

100 William Street, Suite 300 • Wellesley, MA 02481
Phone: 781-239-2017
acleary@sfpwealth.com • www.sfpwealth.com

Andrew Cleary is a registered representative of and offers securities, investment advisory and financial planning services through MML Investors Services, LLC. Member SIPC. SFP Wealth is not a subsidiary or affiliate of MML Investors Services, LLC, or its affiliated companies. 200 Clarendon Street, 19th and 25th Floors. Boston, MA 02116. 617-585-4500. CA Ins, Lic No. 0H00925.

Wealth Manager Award Winner

Michael Velin

Senior Advisor, CPWA®, CFP®, MBA

Independence. Collaboration. Expertise.

Over the past decade, Mike Velin has built a team of independent experts who specialize in helping high net worth families and business owners with multigenerational planning. As the client's personal CFO, Mike and his team collaborate with their trusted advisors to provide unified and objective advice on their key business decisions, investment management and philanthropic goals.

NFP®

505 Highway 169 N, Suite 1100 • Plymouth, MN 55441
Phone: 651-231-3556
michael.velin@nfp.com • www.nfp.com

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Wealth Manager Award Winner

The Five Star Wealth Manager award, administered by Crescendo Business Services, LLC (dba Five Star Professional), is based on 10 objective criteria. Eligibility criteria – required: 1. Credentialed as a registered investment adviser or a registered investment adviser representative; 2. Actively licensed as a registered investment adviser or as a principal of a registered investment adviser firm for a minimum of 5 years; 3. Favorable regulatory and complaint history review (As defined by Five Star Professional, the wealth manager has not; A. Been subject to a regulatory action that resulted in a license being suspended or revoked, or payment of a fine; B. Had more than a total of three settled or pending complaints filed against them and/or a total of five settled, pending, dismissed or denied complaints with any regulatory authority or Five Star Professional's consumer complaint process. Unfavorable feedback may have been discovered through a check of complaints registered with a regulatory authority or complaints registered through Five Star Professional's consumer complaint process; feedback may not be representative of any one client's experience; C. Individually contributed to a financial settlement of a customer complaint; D. Filed for personal bankruptcy within the past 11 years; E. Been terminated from a financial services firm within the past 11 years; F. Been convicted of a felony); 4. Fulfilled their firm review based on internal standards; 5. Accepting new clients. Evaluation criteria – considered: 6. One-year client retention rate; 7. Five-year client retention rate; 8. Non-institutional discretionary and/or non-discretionary client assets administered; 9. Number of client households served; 10. Education and professional designations. Wealth managers do not pay a fee to be considered or placed on the final list of Five Star Wealth Managers. Award does not evaluate quality of services provided to clients. Once awarded, wealth managers may purchase additional profile ad space or promotional products. The Five Star award is not indicative of the wealth manager's future performance. Wealth managers may or may not use discretion in their practice and therefore may not manage their clients' assets. The inclusion of a wealth manager on the Five Star Wealth Manager list should not be construed as an endorsement of the wealth manager by Five Star Professional or this publication. Working with a Five Star Wealth Manager or any wealth manager is no guarantee as to future investment success, nor is there any guarantee that the selected wealth managers will be awarded this accomplishment by Five Star Professional in the future. For more information on the Five Star award and the research/selection methodology, go to fivestarprofessional.com. 3,910 Philadelphia-area wealth managers were considered for the award; 437 (11% of candidates) were named 2019 Five Star Wealth Managers. 5,430 Chicago-area wealth managers were considered for the award; 429 (8% of candidates) were named 2019 Five Star Wealth Managers. 1,886 Pittsburgh-area wealth managers were considered for the award; 224 (8% of candidates) were named 2020 Five Star Wealth Managers. 614 Rhode Island-area wealth managers were considered for the award; 132 (22% of candidates) were named 2020 Five Star Wealth Managers. 3,580 Boston-area wealth managers were considered for the award; 463 (13% of candidates) were named 2020 Five Star Wealth Managers. 3,606 Twin Cities-area wealth managers were considered for the award; 589 (16% of candidates) were named 2020 Five Star Wealth Managers.

FIVE STAR WEALTH MANAGERS — Under 40

Eric T. Norman

Private Wealth Advisor, MBA, CRPC®

Putting Your Wealth To Work For You

With significant wealth comes great opportunity and increased complexity. You need a trusted advisor. Over the past 12 years, Eric has developed a practice that delivers exceptional financial guidance and service. He works with his clients to manage their wealth and empower them to pursue their aspirations.

Five Star Wealth Manager award winner, 2016 – 2020.

IFG Investors Financial Group, LLC
A Registered Investment Advisor

9800 Shelard Parkway, Suite 220 • Plymouth, MN 55441
Office: 612-331-8161
eric.norman@lpl.com • www.eric-norman.com

Securities offered through LPL Financial, member FINRA/SIPC.

Wealth Manager Award Winner

To see the full list of winners, visit fivestarprofessional.com

Atlanta

3,197 Atlanta-area wealth managers were considered for the award; 285 (9% of candidates) were named 2019 Five Star Wealth Managers.

Justin Dwight Burgess · IFG Advisory · 770-353-6361

Baltimore

1,898 Baltimore-area wealth managers were considered for the award; 234 (12% of candidates) were named 2020 Five Star Wealth Managers.

Joe Joseph Breslin · Armstrong Dixon · 443-563-1111

Jared W. Knowles · Wealth Enhancement Group · 301-543-6014

Boston

3,580 Boston-area wealth managers were considered for the award; 463 (13% of candidates) were named 2020 Five Star Wealth Managers.

Andrew Cleary · SFP Wealth · 781-239-2017 *Page 2*

Matthew P. Greene · Summit Financial · 781-761-1629

Alexander Edward Nabhan · Merrill Lynch · 617-946-4369

William G. Scotti III · Axial Financial Group · 508-771-4992

Nicholas A. Silva · Eagle Strategies · 781-392-1767

Chicago

5,430 Chicago-area wealth managers were considered for the award; 429 (8% of candidates) were named 2019 Five Star Wealth Managers.

John A. Bantug · LPL Financial · 847-466-7428

Martin A. Campbell · Highpoint Planning Partners · 630-495-9378 *Page 2*

Krzysztof Garlewicz · ProsperiFi · 847-292-4475

Nicholas A. Latko · Clear Perspective Advisors · 630-780-1713

Kevin Jeffrey Phillips · Savant Capital Management · 630-357-2224

Justin M. Terzo · Lake Street · 312-579-4342

Cleveland

1,548 Cleveland-area wealth managers were considered for the award; 62 (4% of candidates) were named 2020 Five Star Wealth Managers.

Nathan Blake Wilmot · Lincoln Financial Advisors · 440-617-6692

Connecticut

3,147 Connecticut-area wealth managers were considered for the award; 289 (9% of candidates) were named 2019 Five Star Wealth Managers.

Craig D. Breitsprecher · Tenpath Financial Group · 860-606-0977

Dallas-Fort Worth

4,374 Dallas-Fort Worth-region wealth managers were considered for the award; 335 (8% of candidates) were named 2020 Five Star Wealth Managers.

Kevin M. Curley · Global Wealth Advisors · 214-356-1922

Brett W. Ginn · Ginn Wealth Managment · 817-473-7100

Denver

2,146 Denver-area wealth managers were considered for the award; 262 (12% of candidates) were named 2019 Five Star Wealth Managers.

Steven William Harp · Colorado Wealth Group · 720-729-2500

Jacob Brian Ray · Colorado Wealth Group · 720-729-2504

Detroit

3,105 Detroit-area wealth managers were considered for the award; 284 (10% of candidates) were named 2020 Five Star Wealth Managers.

Daniel J. Milan · Cornerstone Financial Services · 248-519-5502

Milwaukee

1,092 Milwaukee-area wealth managers were considered for the award; 172 (16% of candidates) were named 2020 Five Star Wealth Managers.

James Edward Bitter · Robert W. Baird & Co. · 414-765-3500

Nathan Robert Derks · Landolt Securities · 414-429-8585

Eric T. Norman · Investors Financial Group · 612-331-8161 *Page 3*

Philadelphia

3,910 Philadelphia-area wealth managers were considered for the award; 437 (11% of candidates) were named 2019 Five Star Wealth Managers.

Peter Friedrich Gaertner · Affinity Wealth Management · 302-652-6767

Daniel Scott Melville · Cambridge Investment Research · 215-256-7845

Jason Snipe · Odyssey Capital Advisors · 484-278-4497 *Page 2*

Pittsburgh

1,886 Pittsburgh-area wealth managers were considered for the award; 224 (8% of candidates) were named 2020 Five Star Wealth Managers.

Gregory A. Furer · Beratung Advisors · 412-357-2002

Ronald A. Gestiehr · Luttner Financial · 412-391-6700 *Page 2*

Antonio Loffreda-Mancinelli · Wealth Management Partners · 412-539-0015 *Page 1*

Richmond

979 Richmond-area wealth managers were considered for the award; 77 (8% of candidates) were named 2019 Five Star Wealth Managers.

Tom Andrew Love · The Main Street Group · 804-270-4470

Rhode Island

614 Rhode Island-area wealth managers were considered for the award; 132 (22% of candidates) were named 2020 Five Star Wealth Managers.

Joshua J. Paradis · Equitable Advisors · 401-884-7292 *Page 2*

Sarasota

602 Sarasota-area wealth managers were considered for the award; 60 (10% of candidates) were named 2019 Five Star Wealth Managers.

Evan Robin Guido · Avantax Advisory Services · 941-500-5122

San Diego

2,018 San Diego-area wealth managers were considered for the award; 219 (11% of candidates) were named 2020 Five Star Wealth Managers.

Jeff A. Christie · Lido Advisors · 858-485-0404 *Page 1*

Southwest Florida

687 Southwest Florida wealth managers were considered for the award; 74 (11% of candidates) were named 2020 Five Star Wealth Managers.

Eric Armstrong Williams · BB&T Securities · 215-237-6218

St. Louis

2,481 St. Louis-area wealth managers were considered for the award; 185 (7% of candidates) were named 2019 Five Star Wealth Managers.

Michael Dewayne Clark · Visionary Wealth Advisors · 618-726-3011

Matthew M. Rose · Waddell & Reed · 314-567-6700

Twin Cities

3,606 Twin Cities-area wealth managers were considered for the award; 589 (16% of candidates) were named 2020 Five Star Wealth Managers.

Michael Velin · NFP · 651-287-6215 *Page 2*

Washington, D.C.

1,956 Washington, D.C.-area wealth managers were considered for the award; 122 (6% of candidates) were named 2019 Five Star Wealth Managers.

Brett Adam Friedman · Peak Investment Advisors · 240-361-2700

Matthew E. Gaffey · Corbett Road Wealth Management · 703-748-5836

The Five Star Wealth Manager award, administered by Crescendo Business Services, LLC (dba Five Star Professional), is based on 10 objective criteria. Eligibility criteria – required: 1. Credentialed as a registered investment adviser or a registered investment adviser representative; 2. Actively licensed as a registered investment adviser or as a principal of a registered investment adviser firm for a minimum of 5 years; 3. Favorable regulatory and complaint history review (As defined by Five Star Professional, the wealth manager has not; A. Been subject to a regulatory action that resulted in a license being suspended or revoked, or payment of a fine; B. Had more than a total of three settled or pending complaints filed against them and/or a total of five settled, pending, dismissed or denied complaints with any regulatory authority or Five Star Professional's consumer complaint process. Unfavorable feedback may have been discovered through a check of complaints registered with a regulatory authority or complaints registered through Five Star Professional's consumer complaint process; feedback may not be representative of any one client's experience; C. Individually contributed to a financial settlement of a customer complaint; D. Filed for personal bankruptcy within the past 11 years; E. Been terminated from a financial services firm within the past 11 years; F. Been convicted of a felony); 4. Fulfilled their firm review based on internal standards; 5. Accepting new clients. Evaluation criteria – considered: 6. One-year client retention rate; 7. Five-year client retention rate; 8. Non-institutional discretionary and/or non-discretionary client assets administered; 9. Number of client households served; 10. Education and professional designations. Wealth managers do not pay a fee to be considered or placed on the final list of Five Star Wealth Managers. Award does not evaluate quality of services provided to clients. Once awarded, wealth managers may purchase additional profile ad space or promotional products. The Five Star award is not indicative of the wealth manager's future performance. Wealth managers may or may not use discretion in their practice and therefore may not manage their clients' assets. The inclusion of a wealth manager on the Five Star Wealth Manager list should not be construed as an endorsement of the wealth manager by Five Star Professional or this publication. Working with a Five Star Wealth Manager or any wealth manager is no guarantee as to future investment success, nor is there any guarantee that the selected wealth managers will be awarded this accomplishment by Five Star Professional in the future. For more information on the Five Star award and the research/selection methodology, go to fivestarprofessional.com.

NOTES

DEFINITIONS AND EXPLANATIONS

METHODOLOGY

Companies are ranked by total revenues for their respective fiscal years ended on or before March 31, 2020. All companies on the list must publish financial data and report part or all of their figures to a government agency. Figures are as reported, and comparisons are with the prior year's figures as originally reported for that year. *Fortune* does not restate the prior year's figures for changes in accounting.

REVENUES

Revenue figures include consolidated subsidiaries and reported revenues from discontinued operations, but exclude excise taxes. For banks, revenue is the sum of gross interest income and gross noninterest income. For insurance companies, revenue includes premium and annuity income, investment income, realized capital gains or losses, and other income, but excludes deposits. Revenue figures for non-U.S. companies have been converted to U.S. dollars at the average exchange rate during each company's fiscal year (ended Dec. 31, 2019, unless otherwise noted).

CREDITS

This year's *Fortune* Global 500 was prepared under the direction of list editor Scott DeCarlo. Financial statements and annual reports were reviewed by reporter Douglas Elam, accounting specialist Rhona Altschuler, and markets editor Kathleen Smyth. Zhang Dan provided figures for Chinese companies. The data verification process was aided substantially by S&P Global Market Intelligence and Refinitiv.

FOOTNOTES

[†] Figures prepared in accordance with International Accounting Standards.

[§] Figures prepared in accordance with U.S. Generally Accepted Accounting Principles.

[¶] Includes revenues from discontinued operations.

[C] A cooperative.

[E] Excise taxes have been deducted.

[G] Government owned 50% or more.

[P] A partnership.

[1] Figures are for fiscal year ended Jan. 31, 2020.

[2] Company is incorporated in Britain. Executive offices are in the Netherlands.

[3] Figures are for fiscal year ended March 31, 2020.

[4] Figures are for fiscal year ended Sept. 30, 2019.

[5] Company is incorporated in Jersey. Executive offices are in Switzerland.

[6] Figures are for fiscal year ended Aug. 31, 2019.

[7] Figures are for fiscal year ended June 30, 2019.

[8] Company's senior preferred stock is owned by the U.S. Treasury, which also holds a warrant to purchase 79.9% of the common stock.

[9] Spun off M&G (2019 rank: 299), Oct. 21, 2019.

[10] Company is incorporated in the Cayman Islands. Executive offices are in China.

[11] Figures are for fiscal year ended Feb. 29, 2020.

[12] Changed name from United Technologies, April 3, 2020.

[13] Changed name from JXTG Holdings, June 25, 2020.

[14] Figures are for fiscal year ended May 31, 2019.

[15] Went public, June 26, 2020.

[16] Figures are for fiscal year ended April 30, 2019.

[17] Figures are for fiscal year ended Oct. 31, 2019.

[18] Figures are for fiscal year ended July 31, 2019.

[19] Spun off from DuPont (2018 rank: 100), April 1, 2019.

[20] Company is incorporated in Bermuda. Executive offices are in the U.S.

[21] Spun off from Prudential (2019 rank: 80), Oct. 21, 2019.

[22] Company is incorporated in Bermuda. Executive offices are in Hong Kong.

[23] Figures include operations for entire cooperative, including members.

[24] Changed name from SNCF Mobilités, Jan. 1, 2020.

[25] Company is incorporated in the Cayman Islands. Executive offices are in Hong Kong.

[26] Prior year rank is for the company's subsidiary, Cathay Life Insurance. Parent company is listed this year with consolidated figures.

[27] Company is incorporated in Curaçao. Executive offices are in the U.S.

[28] Changed name from INTL FCStone, July 6, 2020. Company reports sale of physical commodities on a gross basis.

[29] Spun off from Wesfarmers (2018 rank: 195), Nov. 21, 2018.

[30] Company is incorporated in Ireland. Executive offices are in Britain.

[31] Company is incorporated in Spain. Executive offices are in Britain.

[32] Acquired Viacom and changed name from CBS, Dec. 4, 2019. The merger has been accounted for as a transaction between entities under common control, and therefore company financials have been presented on a combined basis for 2019.

[33] Went private, June 30, 2020.

Company	Country/Territory	Global 500 rank
ABB	SWITZERLAND	340
ABBOTT LABORATORIES	U.S.	393
ABBVIE	U.S.	378
ACCENTURE	IRELAND	279
ACHMEA	NETHERLANDS	461
ACS	SPAIN	274
ADECCO GROUP	SWITZERLAND	484
ADIDAS	GERMANY	480
AEGON	NETHERLANDS	124
AEON	JAPAN	115
AGRICULTURAL BANK OF CHINA	CHINA	35
AIA GROUP	CHINA	250
AIRBUS	NETHERLANDS	116
AIR FRANCE-KLM GROUP	FRANCE	411
AISIN SEIKI	JAPAN	359
ALBERTSONS	U.S.	174
ALIBABA GROUP HOLDING	CHINA	132
ALIMENTATION COUCHE-TARD	CANADA	183
ALLIANZ	GERMANY	46
ALLSTATE	U.S.	263
ALPHABET	U.S.	29
ALUMINUM CORP. OF CHINA	CHINA	217
AMAZON.COM	U.S.	9
AMÉRICA MÓVIL	MEXICO	209
AMERICAN AIRLINES GROUP	U.S.	257
AMERICAN EXPRESS	U.S.	251
AMERICAN INTERNATIONAL GROUP	U.S.	231
AMER INTERNATIONAL GROUP	CHINA	91
AMERISOURCEBERGEN	U.S.	23
ANGLO AMERICAN	BRITAIN	419
ANHEUSER-BUSCH INBEV	BELGIUM	205
ANHUI CONCH GROUP	CHINA	367
ANSTEEL GROUP	CHINA	401
ANTHEM	U.S.	68
APPLE	U.S.	12
ARCELORMITTAL	LUXEMBOURG	146
ARCHER DANIELS MIDLAND	U.S.	168
ARROW ELECTRONICS	U.S.	441
ASSICURAZIONI GENERALI	ITALY	66
AT&T	U.S.	22
AUCHAN HOLDING	FRANCE	196
AVIATION INDUSTRY CORP. OF CHINA	CHINA	163
AVIVA	BRITAIN	88
AXA	FRANCE	34
BANCO BILBAO VIZCAYA ARGENTARIA	SPAIN	254
BANCO BRADESCO	BRAZIL	268
BANCO DO BRASIL	BRAZIL	288
BANCO SANTANDER	SPAIN	93
BANK OF AMERICA	U.S.	58
BANK OF CHINA	CHINA	43
BANK OF COMMUNICATIONS	CHINA	162
BANK OF MONTREAL	CANADA	430
BANK OF NOVA SCOTIA	CANADA	358
BARCLAYS	BRITAIN	327
BASF	GERMANY	143
BAYER	GERMANY	214
BEIJING AUTOMOTIVE GROUP	CHINA	134
BERKSHIRE HATHAWAY	U.S.	14
BEST BUY	U.S.	275
BHARAT PETROLEUM	INDIA	309
BHP GROUP	AUSTRALIA	261
BMW	GERMANY	56
BNP PARIBAS	FRANCE	99
BOEING	U.S.	121
BOSCH GROUP	GERMANY	95
BOUYGUES	FRANCE	286
BP	BRITAIN	8
BRIDGESTONE	JAPAN	387
BRISTOL-MYERS SQUIBB	U.S.	487
BRITISH AMERICAN TOBACCO	BRITAIN	379
BROOKFIELD ASSET MANAGEMENT	CANADA	155
BT GROUP	BRITAIN	432
BUNGE	U.S.	297
CAIXA ECONÔMICA FEDERAL	BRAZIL	326
CANON	JAPAN	380
CAPITAL ONE FINANCIAL	U.S.	372
CARDINAL HEALTH	U.S.	37
CARREFOUR	FRANCE	98
CATERPILLAR	U.S.	204
CATHAY FINANCIAL HOLDING	TAIWAN	374

CEDAR HOLDINGS GROUP CHINA	296
CENTENE U.S.	127
CENTRICA BRITAIN	440
CFE MEXICO	420
CHARTER COMMUNICATIONS U.S.	258
CHEMCHINA CHINA	164
CHEVRON U.S.	36
CHINA AEROSPACE SCIENCE & INDUSTRY CHINA	332
CHINA AEROSPACE SCIENCE & TECH. CHINA	352
CHINA BAOWU STEEL GROUP CHINA	111
CHINA COMMUNICATIONS CONSTR. CHINA	78
CHINA CONSTRUCTION BANK CHINA	30
CHINA COSCO SHIPPING CHINA	264
CHINA DATANG CHINA	465
CHINA ELECTRONICS CHINA	386
CHINA ELECTRONICS TECHNOLOGY GROUP CHINA	381
CHINA ENERGY ENGINEERING CHINA	353
CHINA ENERGY INVESTMENT CHINA	108
CHINA EVERBRIGHT GROUP CHINA	253
CHINA EVERGRANDE GROUP CHINA	152
CHINA FAW GROUP CHINA	89
CHINA GENERAL TECHNOLOGY CHINA	477
CHINA HUADIAN CHINA	370
CHINA HUANENG GROUP CHINA	266
CHINA LIFE INSURANCE CHINA	45
CHINA MERCHANTS BANK CHINA	189
CHINA MERCHANTS GROUP CHINA	235
CHINA MINMETALS CHINA	92
CHINA MINSHENG BANKING CHINA	239
CHINA MOBILE COMMUNICATIONS CHINA	65
CHINA NATIONAL AVIATION FUEL GROUP CHINA	305
CHINA NATIONAL BLDG. MATERIAL GROUP CHINA	187
CHINA NATIONAL COAL GROUP CHINA	496
CHINA NATIONAL NUCLEAR CHINA	493
CHINA NATIONAL OFFSHORE OIL CHINA	64
CHINA NATIONAL PETROLEUM CHINA	4
CHINA NORTH INDUSTRIES CHINA	154
CHINA PACIFIC INSURANCE CHINA	193
CHINA POLY GROUP CHINA	191
CHINA POST GROUP CHINA	90
CHINA RAILWAY CONSTRUCTION CHINA	54
CHINA RAILWAY ENGINEERING CHINA	50
CHINA RESOURCES CHINA	79
CHINA SOUTHERN POWER GRID CHINA	105
CHINA SOUTH INDUSTRIES GROUP CHINA	434
CHINA STATE CONSTR. ENGINEERING CHINA	18
CHINA TAIPING INSURANCE GROUP CHINA	392
CHINA TELECOMMUNICATIONS CHINA	158
CHINA UNITED NETWORK COMM. CHINA	290
CHINA VANKE CHINA	208
CHS U.S.	394
CHUBB SWITZERLAND	366
CHUBU ELECTRIC POWER JAPAN	454
CIGNA U.S.	32
CISCO SYSTEMS U.S.	211
CITIC GROUP CHINA	126
CITIGROUP U.S.	70
CJ CORP. SOUTH KOREA	437
CK HUTCHISON HOLDINGS CHINA	328
CMA CGM FRANCE	415
CNP ASSURANCES FRANCE	199
COCA-COLA U.S.	335
COFCO CHINA	136
COLES GROUP AUSTRALIA	407
COMCAST U.S.	63
COMMONWEALTH BANK AUSTRALIA	416
COMPAL ELECTRONICS TAIWAN	396
COMPASS GROUP BRITAIN	395
CONOCOPHILLIPS U.S.	348
CONTINENTAL GERMANY	230
COOP GROUP SWITZERLAND	425
COSTCO WHOLESALE U.S.	33
COUNTRY GARDEN HOLDINGS CHINA	147
CPC TAIWAN	409
CRÉDIT AGRICOLE FRANCE	67
CREDIT SUISSE GROUP SWITZERLAND	357
CRH IRELAND	397
CRRC GROUP CHINA	361
CVS HEALTH U.S.	13
DAI-ICHI LIFE JAPAN	165
DAIMLER GERMANY	20
DAIWA HOUSE INDUSTRY JAPAN	311
DANONE FRANCE	453
DATONG COAL MINE GROUP CHINA	463
DEERE U.S.	319
DELL TECHNOLOGIES U.S.	81
DELTA AIR LINES U.S.	252
DENSO JAPAN	247
DEUTSCHE BAHN GERMANY	232
DEUTSCHE BANK GERMANY	291
DEUTSCHE POST DHL GROUP GERMANY	142
DEUTSCHE TELEKOM GERMANY	86
DIOR (CHRISTIAN) FRANCE	180
DISNEY (WALT) U.S.	150
DOLLAR GENERAL U.S.	460
DONGFENG MOTOR CHINA	100
DOW U.S.	283
DZ BANK GERMANY	321
EAST JAPAN RAILWAY JAPAN	470
EDEKA ZENTRALE GERMANY	312
ELECTRICITÉ DE FRANCE FRANCE	110
ENBRIDGE CANADA	331
ENEL ITALY	87
ENEOS HOLDINGS JAPAN	123
ENERGY TRANSFER U.S.	200
ENGIE FRANCE	159
ENI ITALY	113
ENTERPRISE PRODUCTS U.S.	384
E.ON GERMANY	255
EQUINOR NORWAY	169
EXELON U.S.	364
EXOR GROUP NETHERLANDS	28
EXXON MOBIL U.S.	11
FACEBOOK U.S.	144
FANNIE MAE U.S.	53
FEDEX U.S.	148
FINANCIÈRE DE L'ODET FRANCE	458
FINATIS FRANCE	262
FOMENTO ECONÓMICO MEXICANO MEXICO	482
FORD MOTOR U.S.	31
FREDDIE MAC U.S.	125
FRESENIUS GERMANY	313
FUBON FINANCIAL HOLDING TAIWAN	403
FUJITSU JAPAN	356
GAZPROM RUSSIA	55
GENERAL DYNAMICS U.S.	317
GENERAL ELECTRIC U.S.	77
GENERAL MOTORS U.S.	40
GLAXOSMITHKLINE BRITAIN	282
GLENCORE SWITZERLAND	17
GOLDMAN SACHS GROUP U.S.	202
GREE ELECTRIC APPLIANCES CHINA	436
GREENLAND HOLDING GROUP CHINA	176
GROUPE BPCE FRANCE	242
GS CALTEX SOUTH KOREA	447
GUANGXI INVESTMENT GROUP CHINA	490
GUANGZHOU AUTO. INDUSTRY GROUP CHINA	206
HAIER SMART HOME CHINA	435
HAILIANG GROUP CHINA	468
HANWHA SOUTH KOREA	277
HBIS GROUP CHINA	218
HCA HEALTHCARE U.S.	219
HEINEKEN HOLDING NETHERLANDS	474
HENAN ENERGY & CHEMICAL CHINA	486
HENGLI GROUP CHINA	107
HEWLETT PACKARD ENTERPRISE U.S.	431
HITACHI JAPAN	106
HOME DEPOT U.S.	59
HONDA MOTOR JAPAN	39
HONEYWELL INTERNATIONAL U.S.	347
HON HAI PRECISION INDUSTRY TAIWAN	26
HP U.S.	184
HSBC HOLDINGS BRITAIN	73
HUAWEI INVESTMENT & HOLDING CHINA	49
HUAXIA LIFE INSURANCE CHINA	449
HUMANA U.S.	166
HYUNDAI MOBIS SOUTH KOREA	385
HYUNDAI MOTOR SOUTH KOREA	84
IBERDROLA SPAIN	303
IDEMITSU KOSAN JAPAN	236
INDIAN OIL INDIA	151
INDITEX SPAIN	398
INDUSTRIAL BANK CHINA	222
INDUSTRIAL & COMMER. BANK OF CHINA CHINA	24
ING GROUP NETHERLANDS	342
INTEL U.S.	138
INTERNATIONAL AIRLINES GROUP BRITAIN	446
INTERNATIONAL BUSINESS MACHINES U.S.	118
INTESA SANPAOLO ITALY	310
ITAÚ UNIBANCO HOLDING BRAZIL	216
ITOCHU JAPAN	72
JAPAN POST HOLDINGS JAPAN	60
JARDINE MATHESON CHINA	301
JBS BRAZIL	213
JD.COM CHINA	102
JFE HOLDINGS JAPAN	365
JIANGSU SHAGANG GROUP CHINA	351
JIANGXI COPPER CHINA	343
JINCHUAN GROUP CHINA	369
JIZHONG ENERGY GROUP CHINA	406
JOHNSON CONTROLS INTERNATIONAL IRELAND	439
JOHNSON & JOHNSON U.S.	104
JPMORGAN CHASE U.S.	38
KANSAI ELECTRIC POWER JAPAN	428
KB FINANCIAL GROUP SOUTH KOREA	426
KDDI JAPAN	241
KIA MOTORS SOUTH KOREA	229
KOÇ HOLDING TURKEY	471
KOREA ELECTRIC POWER SOUTH KOREA	227
KROGER U.S.	51
LAFARGEHOLCIM SWITZERLAND	476
LA POSTE FRANCE	433
LEGAL & GENERAL GROUP BRITAIN	85
LENOVO GROUP CHINA	224
LG ELECTRONICS SOUTH KOREA	207
LIBERTY MUTUAL INSURANCE GROUP U.S.	278
LINDE BRITAIN	444
LLOYDS BANKING GROUP BRITAIN	170
LOCKHEED MARTIN U.S.	182
L'ORÉAL FRANCE	375
LOUIS DREYFUS NETHERLANDS	371
LOWE'S U.S.	137
LUFTHANSA GROUP GERMANY	304
LUKOIL RUSSIA	57
LYONDELLBASELL INDUSTRIES NETHERLANDS	360
MAERSK GROUP DENMARK	320
MAGNA INTERNATIONAL CANADA	315
MANULIFE FINANCIAL CANADA	181
MAPFRE GROUP SPAIN	464
MARATHON PETROLEUM U.S.	48
MARUBENI JAPAN	173
MASSACHUSETTS MUTUAL LIFE U.S.	336
MAZDA MOTOR JAPAN	400
MCKESSON U.S.	16
MEDIPAL HOLDINGS JAPAN	417
MEDTRONIC IRELAND	408
MEIJI YASUDA LIFE INSURANCE JAPAN	334
MERCK U.S.	256
METLIFE U.S.	149
METRO GERMANY	294
M&G BRITAIN	299
MICHELIN FRANCE	472
MICROSOFT U.S.	47
MIDEA GROUP CHINA	307
MIGROS GROUP SWITZERLAND	448
MITSUBISHI JAPAN	42
MITSUBISHI CHEMICAL HOLDINGS JAPAN	376
MITSUBISHI ELECTRIC JAPAN	300
MITSUBISHI HEAVY INDUSTRIES JAPAN	339
MITSUBISHI UFJ FINANCIAL GROUP JAPAN	161
MITSUI JAPAN	172
MIZUHO FINANCIAL GROUP JAPAN	349
MONDELEZ INTERNATIONAL U.S.	495
MORGAN STANLEY U.S.	203
MS&AD INSURANCE JAPAN	246
MUNICH RE GERMANY	135
NATIONWIDE U.S.	272
NATURGY ENERGY GROUP SPAIN	492
NEC JAPAN	450
NESTLÉ SWITZERLAND	82
NEW YORK LIFE INSURANCE U.S.	270
NIKE U.S.	322
NIPPON LIFE INSURANCE JAPAN	130
NIPPON STEEL CORPORATION JAPAN	198
NIPPON TELEGRAPH AND TELEPHONE JAPAN	62
NISSAN MOTOR JAPAN	83
NOKIA FINLAND	488
NORTHROP GRUMMAN U.S.	368
NORTHWESTERN MUTUAL U.S.	388
NOVARTIS SWITZERLAND	225
OIL & NATURAL GAS INDIA	190
OMV GROUP AUSTRIA	483
ORACLE U.S.	314
ORANGE FRANCE	249
PACCAR U.S.	497
PACIFIC CONSTRUCTION GROUP CHINA	75
PANASONIC JAPAN	153
PEGATRON TAIWAN	269
PEMEX MEXICO	133
PEOPLE'S INSURANCE CO. OF CHINA CHINA	112
PEPSICO U.S.	160
PETROBRAS BRAZIL	120
PETRONAS MALAYSIA	186
PEUGEOT FRANCE	101
PFIZER U.S.	215
PHILIP MORRIS INTERNATIONAL U.S.	421
PHILLIPS 66 U.S.	61
PHOENIX GROUP HOLDINGS BRITAIN	338
PHOENIX PHARMA GERMANY	410
PING AN INSURANCE CHINA	21
PKN ORLEN GROUP POLAND	438
PLAINS GP HOLDINGS U.S.	373
POSCO SOUTH KOREA	194
POSTE ITALIANE ITALY	350
POWERCHINA CHINA	157
POWER CORP. OF CANADA CANADA	346
PROCTER & GAMBLE U.S.	156
PROGRESSIVE U.S.	323
PRUDENTIAL BRITAIN	80
PRUDENTIAL FINANCIAL U.S.	167
PTT THAILAND	140
PUBLIX SUPER MARKETS U.S.	325
QUANTA COMPUTER TAIWAN	377
RAJESH EXPORTS INDIA	462
RANDSTAD NETHERLANDS	479
RAYTHEON TECHNOLOGIES U.S.	119
RELIANCE INDUSTRIES INDIA	96
RENAULT FRANCE	175
REPSOL SPAIN	245
RIO TINTO GROUP BRITAIN	280
ROCHE GROUP SWITZERLAND	171
ROSNEFT OIL RUSSIA	76
ROYAL AHOLD DELHAIZE NETHERLANDS	128
ROYAL BANK OF CANADA CANADA	223
ROYAL DUTCH SHELL NETHERLANDS	5
SAFRAN FRANCE	451
SAIC MOTOR CHINA	52
SAINSBURY (J.) BRITAIN	344
SAINT-GOBAIN FRANCE	244
SAMSUNG C&T SOUTH KOREA	481
SAMSUNG ELECTRONICS SOUTH KOREA	19
SAMSUNG LIFE INSURANCE SOUTH KOREA	467
SANOFI FRANCE	289
SAP GERMANY	404
SAUDI ARAMCO SAUDI ARABIA	6
SBERBANK RUSSIA	240
SCHLUMBERGER U.S.	382
SCHNEIDER ELECTRIC FRANCE	413
SEVEN & I HOLDINGS JAPAN	178
SHAANXI COAL & CHEMICAL INDUSTRY CHINA	273
SHAANXI YANCHANG PETROLEUM CHINA	265
SHANDONG ENERGY GROUP CHINA	212
SHANDONG IRON & STEEL GROUP CHINA	459
SHANDONG WEIQIAO PIONEERING CHINA	308
SHANGHAI CONSTRUCTION GROUP CHINA	423
SHANGHAI PHARMACEUTICALS HOLDING CHINA	473
SHANGHAI PUDONG DEVEL. BANK CHINA	220
SHANXI COKING COAL GROUP CHINA	485
SHANXI JINCHENG ANTHRACITE COAL CHINA	500
SHANXI LUAN MINING GROUP CHINA	489
SHENGHONG HOLDING GROUP CHINA	455
SHENZHEN INVESTMENT HOLDINGS CHINA	442
SHOUGANG GROUP CHINA	429
SIEMENS GERMANY	74
SINOCHEM CHINA	109
SINOMACH CHINA	281
SINOPEC GROUP CHINA	2
SINOPHARM CHINA	145
SK HOLDINGS SOUTH KOREA	97
SNCF GROUP FRANCE	318
SOCIÉTÉ GÉNÉRALE FRANCE	192
SOFTBANK GROUP JAPAN	94
SOMPO HOLDINGS JAPAN	363
SONY JAPAN	122
STARBUCKS U.S.	478
STATE BANK OF INDIA INDIA	221
STATE FARM INSURANCE U.S.	114
STATE GRID CHINA	3
STATE POWER INVESTMENT CHINA	316
STONEX GROUP U.S.	383
SUBARU JAPAN	405
SUMITOMO JAPAN	238
SUMITOMO ELECTRIC INDUSTRIES JAPAN	445
SUMITOMO LIFE INSURANCE JAPAN	391
SUMITOMO MITSUI FINANCIAL GROUP JAPAN	237
SUNCOR ENERGY CANADA	427
SUNING.COM GROUP CHINA	324
SUN LIFE FINANCIAL CANADA	418
SUZUKI MOTOR JAPAN	390
SWISS RE SWITZERLAND	233
SYSCO U.S.	179
TAIKANG INSURANCE GROUP CHINA	424
TAIWAN SEMICONDUCTOR TAIWAN	362
TAKEDA PHARMACEUTICAL JAPAN	414
TALANX GERMANY	271
TARGET U.S.	117
TATA MOTORS INDIA	337
TECH DATA U.S.	341
TELEFÓNICA SPAIN	201
TENCENT HOLDINGS CHINA	197
TESCO BRITAIN	103
THERMO FISHER SCIENTIFIC U.S.	498
3M U.S.	389
THYSSENKRUPP GERMANY	248
TIAA U.S.	306
TJX U.S.	292
TOKIO MARINE HOLDINGS JAPAN	226
TOKYO ELECTRIC POWER JAPAN	188
TONGLING NONFERROUS METALS GROUP CHINA	456
TORONTO-DOMINION BANK CANADA	267
TOSHIBA JAPAN	402
TOTAL FRANCE	25
TOYOTA MOTOR JAPAN	10
TOYOTA TSUSHO JAPAN	177
TRAFIGURA GROUP SINGAPORE	27
TRAVELERS U.S.	399
TSINGSHAN HOLDING GROUP CHINA	329
TYSON FOODS U.S.	287
UBS GROUP SWITZERLAND	293
UNICREDIT GROUP ITALY	469
UNILEVER BRITAIN/NETHERLANDS	185
UNIPER GERMANY	131
UNITED AIRLINES HOLDINGS U.S.	276
UNITEDHEALTH GROUP U.S.	15
UNITED PARCEL SERVICE U.S.	129
UNITED SERVICES AUTO. ASSN. U.S.	355
U.S. BANCORP U.S.	466
US FOODS HOLDING U.S.	494
U.S. POSTAL SERVICE U.S.	141
VALE BRAZIL	333
VALERO ENERGY U.S.	71
VEOLIA ENVIRONNEMENT FRANCE	412
VERIZON COMMUNICATIONS U.S.	44
VIACOMCBS U.S.	457
VINCI FRANCE	195
VODAFONE GROUP BRITAIN	228
VOLKSWAGEN GERMANY	7
VOLVO SWEDEN	259
WALGREENS BOOTS ALLIANCE U.S.	41
WALMART U.S.	1
WELLS FARGO U.S.	69
WESTON (GEORGE) CANADA	330
WESTPAC BANKING AUSTRALIA	491
WILMAR INTERNATIONAL SINGAPORE	285
WISTRON TAIWAN	452
WOOLWORTHS GROUP AUSTRALIA	260
WORLD FUEL SERVICES U.S.	345
WUCHAN ZHONGDA GROUP CHINA	210
X5 RETAIL GROUP NETHERLANDS	475
XIAMEN C&D CHINA	234
XIAMEN ITG HOLDING GROUP CHINA	284
XIAOMI CHINA	422
XINJIANG GUANGHUI INDUSTRY CHINA	443
XMXYG CHINA	298
YANGO LONGKING GROUP CHINA	354
YANGQUAN COAL INDUSTRY GROUP CHINA	499
YANKUANG GROUP CHINA	295
ZF FRIEDRICHSHAFEN GERMANY	302
ZHEJIANG GEELY HOLDING GROUP CHINA	243
ZURICH INSURANCE GROUP SWITZERLAND	139

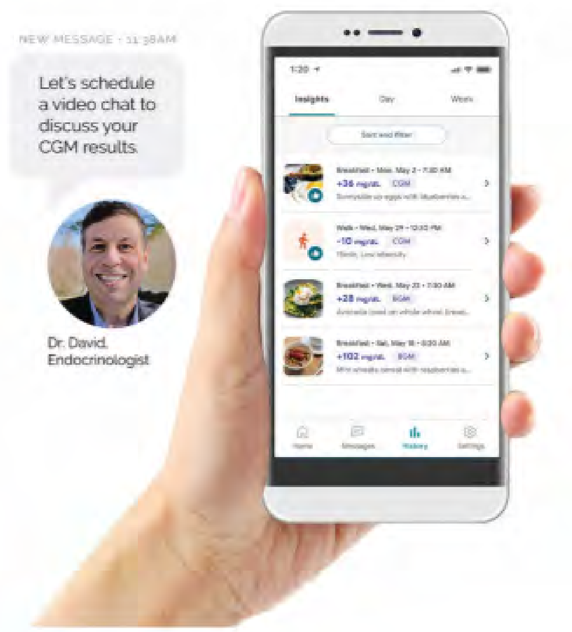
DIABETES IN THE AGE OF COVID-19

Why investing in diabetes prevention and management is more important than ever.

DIABETES IS ALREADY A REALITY FOR 34 million Americans—but as cases of COVID-19 increase across the United States, managing and preventing the condition has become even more of a concern for patients and practitioners alike.

"Unfortunately, it is the case that those with chronic diseases like diabetes have seen some of the worst health care outcomes with COVID-19 infections," says Dr. Vindell Washington, MD, MHCM, chief executive officer of Onduo, a virtual care program offering behavior change support and remote clinical interventions for those living with chronic conditions, including diabetes. "It's crucial that people in high-risk groups follow recommendations for controlling their risk with this disease."

According to Washington, Onduo is creating a new standard of care to do just that. Using smart sensors (like blood glucose meters and continuous glucose monitoring systems for diabetes), Onduo collects data directly from members and provides interventions for managing their condition before a complication develops. The interventions, Washington says, range from education about a patient's condition with health coaching to clinical support with a licensed provider who can authorize medication changes, if needed. This virtual care model is delivering the right care to the right person at the right time, while still being able to integrate with the traditional health care ecosystem.



"The novelty of this approach is our ability to collect important data about a member that are invisible to the traditional care delivery system," says Washington. "For practitioners, it helps them provide care for issues they may be unaware of. For payors, we are extending the appropriate level of care to their members where they are. And for patients with diabetes and other conditions, they can get the care they need and deserve." ■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PASSIONS

Manchester, England's Private White V.C. specializes in locally woven cotton, as with this rainproof jacket in Ventile.

STYLE

Fewer, Finer

In a fashion world that's increasingly unsustainable, these menswear brands prove that integrity is always in style. **BY EMILIE HAWTIN**

COURTESY OF PRIVATE WHITE V.C.

1

COURTESY OF JOHN SPINKS

SUSTAINING THINGS over time is one of life's great joys: relationships, good health, suit measurements. Now more than ever is the time to reflect on what we have and maintain fewer, better things. The most admired chefs of our time, from Alice Waters to Eric Ripert to Dan Barber, compose seemingly simple dishes of impeccably sourced food that support an entire ecosystem. An indulgent meal at Barber's flagship restaurant Blue Hill at Stone Barns captures this perfectly: It's natural food on the highest level, sourced from the farm that is right outside.

We pay increasing amounts of attention to the sourcing of our food, but what about our attire? The ethos of farm-to-table dining mirrors one that is generations old but still practiced by a coterie of designers, tailors, and fabric mills who are fighting the good fight against the problematic manufacturing of fast fashion. These brands achieve sustainable style in its truest form: with respect for everyone, and everything, in the process. Aesthetics are at their height. Integrity is a given. And while sport coats, cashmere knits, bomber jackets, and made-to-measure trousers may be unassuming contenders for the future of clothing, many pioneering small brands around the world are quietly redefining it.

Having a cup of tea with the people you make clothes with is very important to Mike Stoll. So is driving to see them. These are two of the reasons why the fabric mills he's worked with over his 48 years of developing his impressively elegant brand, **Private White V.C.,** are no more than 30 minutes away. Before that, his father and grandfather were doing the same thing. So was the grandfather of James Eden, Stoll's business partner, who, Stoll says, focuses on the more "glamorous side of things."

The two are based in Manchester, England, in the same building where Private White V.C. began as a raincoat factory 150 years ago. Now they evolve an archive of 11,000 patterns and specs into modern classics for their London shop and with a rotation of collaborators including online clothing destinations Mr Porter and Permanent Style.

"We still weave our own cotton in Lancashire," says Stoll—the same source used for the jacket linings that kept pilots warm in World War II. Sixty percent of Stoll's textiles come from within 50 miles of his design shop in Manchester. "Our team improves garments with a gentle nudge," Stoll says. He keeps things natural and local with the exception of a seasonal highlight from Loro Piana, an Italian firm specializing in cashmere. Despite its heritage, Private White V.C. brings a refreshingly cool approach to every belted safari jacket, summer bomber, and linen shacket. The ideal, Stoll says, is for people to buy seven items over seven years—slowly and over time.

"We still weave our own cotton in Lancashire," says Mike Stoll—the same source used for the jacket linings that kept pilots warm in World War II. Sixty percent of Stoll's textiles come from within 50 miles of his design shop in Manchester.

Michael Hill is a world-class host. It's no surprise that as its creative director he's evolved **Drake's**—a brand that captures Britishness in the same way Ralph Lauren taps into Americana—from a well-respected tie and scarf maker into a red-hot menswear brand. All while preserving long-term relationships established by founder Michael Drake. That's exactly what Hill is in it for. "To be in it for the

2

3

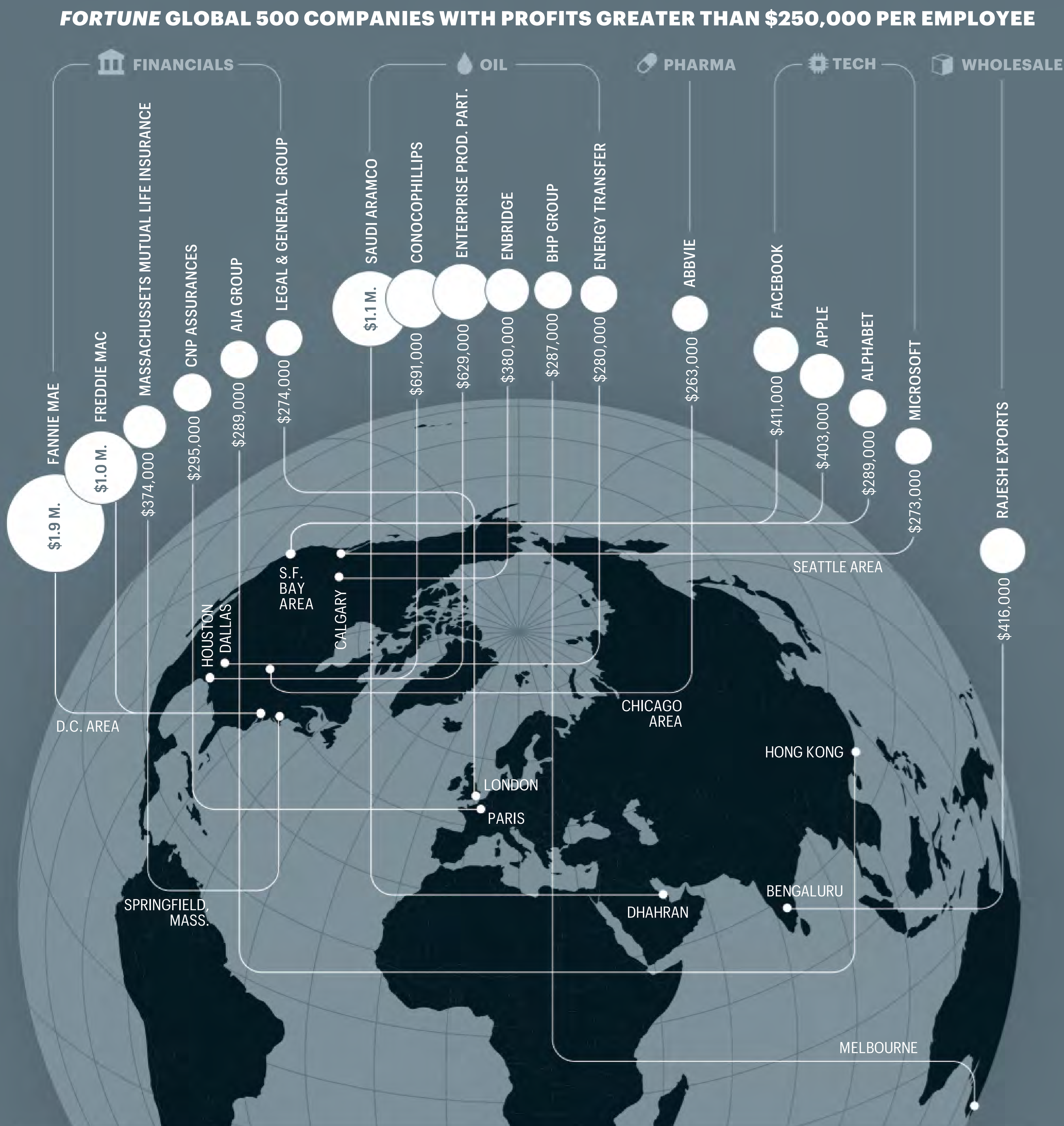
[1] Racing green cotton-nylon vest ($795), glen check tweed jacket ($1,415), and "fun" Oxford ($235) by Drake's. [2] Stòffa's asymmetric jacket in plongé leather. ($2,200). [3] Patterns for Stòffa's wool-based products, which are made in Biella, Italy.

COURTESY OF STÒFFA (2)

long run," he says, "we need to work with specialists whose product continues to stand the test of time." Drake's has two of its own factories in East London, where it's been since the 1970s. Its partner suppliers are nearly all family-owned enterprises with a rich history in their specialty, from printing near Manchester to indigo dyeing in Okayama, Japan. "In so many cases we've stuck by each other, right now more than ever. You want to work with people who love what they do and are dedicated to that."

Stòffa founders Agyesh Madan and Nick Ragosta do a lot to make less and do it well. The young duo keep things simple. They launched with three outerwear styles and two fabrics, a precise offering they have maintained for nearly two years. Their made-to-measure, made-to-order approach is beloved by the discerning creative set they dress. It applies the exacting style they developed while making tailored suits at Neapolitan label Isaia to refined clothes customized for clients' more casual endeavors. Their prevailing sensitivity to water usage and traceability from the makers they work with—all based in Italy—give them the confidence to produce less and originate more. It also builds the trust of those who wear Stòffa. "We thought it was a better way and made a difference in the enjoyment of clothes," Ragosta says. "Real luxury is about the most personal things and the specialness of materials. It's working with smaller mills and creating unique fabrics." The fabrics are highly specialized and edited, in naturally dyed colors that sit well together in a wardrobe. This helps clients feel confident when choosing their custom shirt jacket or a woven scarf that was knit on century-old looms. Whether it's during a visit to Stòffa's artful showroom or through principled collaborators like Drake's, there's an unspoken certainty each brand conveys—the kind you feel with a seasoned sommelier.

"In order to make a delicious meal we need the best possible ingredients," says Matteo Bozzalla of Valstar. The brand's sartorial approach to handmade outerwear has earned it a place in the wardrobes of elegantly understated men. For Bozzalla, sustainability means respect: for raw materials, for mills, for current and future generations. Circular production of natural fabrics is cemented in Valstar's process. While few heritage brands feel so modern, it's a quality he attributes to mixing older, experienced craftsmen with a younger generation of designers to bring the excellence his clients and family expect. His enduring recipe is undoubtedly a successful one, prepared thoughtfully and without a rush. ■



MAKING THE MOST OF THEIR WORKFORCE

THE WORLD'S 500 BIGGEST COMPANIES EMPLOY some 69.9 million people and together earned a total of $2.06 trillion last year. That translates to roughly $29,500 for each worker. But the 18 companies in the graphic above, concentrated in a handful of industries, proved vastly more efficient than average at making profits per employee. Fannie Mae and Freddie Mac, the U.S. government-sponsored mortgage lenders, earned a combined $21.4 billion with a total of just 14,300 workers. Meanwhile, Saudi Aramco, the profit leader in the Global 500 with $88 billion, has 79,000 employees. Bigger isn't always more profitable, though. Gold jewelry retailer Rajesh Exports of India produced $170 million in profits with the smallest workforce in the 500: a mere 409 employees. —**BRIAN O'KEEFE**

INFOGRAPHIC BY **NICOLAS RAPP**

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BOAT
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Add Extras
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CONDO
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