

THE 2019 FORTUNE 500 DOUBLE ISSUE

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Fortune 500
companies
by revenue.
For details,
see page 128.

RANKING AMERICA'S BIGGEST COMPANIES



TRIPLOCK WINDING CROWN



UNIDIRECTIONAL ROTATABLE BEZEL



ROLEX GLIDELock EXTENSION SYSTEM

THE SUBMARINER

The world of Rolex is filled with stories of perpetual excellence. Designed for the pioneers of professional diving, the Submariner expanded the world of underwater exploration. The first divers' wristwatch waterproof to a depth of 100 metres, its unidirectional rotatable bezel provides a reliable way to measure remaining dive time. It has continued to evolve to reach a depth of 300 metres, while becoming one of the most recognisable designs, on land and at sea. This is a story of perpetual excellence, the story of Rolex.

#Perpetual



DAVID DOUBILET



OYSTER PERPETUAL SUBMARINER DATE



๐ พ.ศ. 2562


ROLEX

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ILLUSTRATION BY
NICOLAS RAPP

JUNE 1, 2019

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The definitive benchmark of America's biggest companies.

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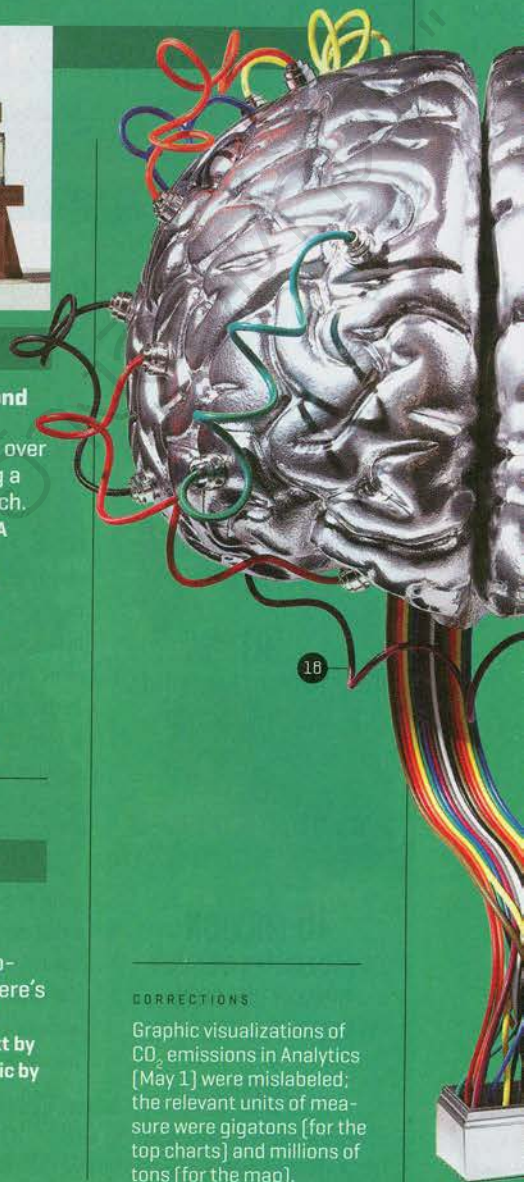
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With a sense of ecosystems in mind, here's a look at America's "corporatome." Text by CLIFTON LEAF; graphic by NICOLAS RAPP

CORRECTIONS

Graphic visualizations of CO₂ emissions in Analytics [May 1] were mislabeled; the relevant units of measure were gigatons [for the top charts] and millions of tons [for the map].

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CREATING A SUSTAINABLE PARADISE



The Red Sea Project in Saudi Arabia includes an archipelago of over 90 unspoiled islands and thriving coral reefs.

THE RED SEA PROJECT

28,000 KM²
AN EXQUISITE LUXURY
DESTINATION COVERING
28,000 KM²

90
AN ARCHIPELAGO OF MORE THAN
90 UNSPOILED ISLANDS

8
WITHIN 8 HOURS' FLIGHT TIME OF
85% OF THE WORLD'S POPULATION

15 MILLION
A 1-MILLION M² LANDSCAPE
NURSERY WILL GROW
15 MILLION PLANTS BY 2030

100%
THE DESTINATION WILL RELY
FULLY ON RENEWABLE ENERGY

3,100
PHASE 1 WILL FEATURE
14 HOTELS OFFERING
3,100 ROOMS ACROSS
5 ISLANDS AND 2 INLAND
RESORTS BY 2022

30%
THE PLAN FORECASTS A
POSITIVE CONSERVATION
IMPACT OF UP TO 30%
OVER TWO DECADES

In a world dominated by mass tourism, cheap flights, and millennials with bucket lists, the thrills of new adventure and exploration can be hard to come by for even the most sophisticated travelers.

Now, along Saudi Arabia's pristine Red Sea coast, a unique opportunity is arising to discover an untouched slice of paradise that boasts environmental wonders and a rich cultural heritage to rival any of the world's more crowded travel destinations. In the process, the Red Sea Project is reimagining the future of luxury tourism and grounding it firmly in authenticity and sustainability.

"We aren't building artificial islands of dredged sand," explains John Pagano, CEO of the Red Sea Development Company. "Modern luxury travelers are concerned about the environment, and they seek out authentic, diverse adventures in nature and culture.

"Here at the Red Sea, we are going to offer them a constellation of experiences that they won't be able to find anywhere else in the world."

Comprising more than 90 unspoiled islands and coral reefs teeming with marine life alongside dormant volcanoes, vast expanses of desert terrain, and the footprints of ancient cultures, the project's location embraces some of the world's most stunning—and most vulnerable—natural treasures. Since the starting flag came down on the 28,000 km² project in 2017, environmental preservation and enhancement have been the developer's foremost concern, and to avoid overcrowding, a strict cap will be

imposed on visitor numbers. "We want to have the lightest footprint possible," confirms Pagano.

Even before drawing up the first site designs, the company partnered with King Abdullah University

"Sustainability is at the core of what we are doing."

John Pagano
CEO, Red Sea
Development Company

of Science and Technology (KAUST) in a massive computer simulation to model the impact of the development on the natural environment. When biologists discovered that one of the most beautiful islands in the archipelago was also a favorite of the critically

We are showing that a sustainable ocean economy is within reach."

Carlos M. Duarte
Professor of Marine
Science, KAUST

endangered hawksbill sea turtle, Pagano had no hesitation in

ruling the location off-limits to development.

"As marine ecologists, we have been fully embedded in the design team in a co-leadership role," says Carlos M. Duarte, professor of marine science at KAUST.

Other environmental preservation measures include using only renewable energy to power the site. Such is the commitment to sustainability that the project will significantly enhance the existing ecosystem, and is forecast to increase biodiversity by up to 30% in the coming decades.

At the same time, the project is playing a starring role in Saudi Arabia's Vision 2030 strategy for reducing the economy's dependence on oil, while placing the country at the very center of the world's luxury tourism map. Close negotiations are underway between the developers and some of the world's leading luxury hotel brands. A special regulatory framework will operate in the area, enhancing the Red Sea Project's appeal to international hospitality businesses and real estate investors.

"I believe that what we are creating here is something truly unique in global tourism," Pagano says.



The region's unique and varied landscape offers a wealth of experiences.

THE
WORLD IN

7

PAGES

BRIEFING



In the Land of Giants

America's corporate colossi are using their positional advantage to get even larger. Why competitors, workers, and consumers should be worried. By Erika Fry

POWER

IT'S WELL UNDERSTOOD in the United States that in recent decades, the spoils of the nation's economic growth have gone disproportionately to the wealthiest few. But a similar phenomenon exists among U.S. corporations. More and more of their collective revenues are concentrated in a relatively small number of large firms: the corporate giants.

Look no further than the *Fortune* 500 in this issue. Last year, America's 500 largest corporations tallied a record \$13.7 trillion in revenues, a figure equivalent to more than two-thirds of the U.S. economy. Of those trillions and trillions of sales, 47.7% of them belonged to the list's top 50 firms, up from

BRIEFING

46.9% last year, 43.7% 15 years ago, and 41% in 1995.

It's quite possible that next year they'll account for a solid half, given recent developments in this land of giants: CVS Health, the drugstore chain-cum-pharmacy benefits manager (No. 8 this year), late last year gobbled up Aetna, which as one of America's largest insurers ranked No. 49 on the *Fortune* 500 in 2018.

AT&T (No. 9), meanwhile, swallowed up Time Warner, a \$31.3 billion morsel from the entertainment industry (HBO, Turner Broadcasting, Warner Bros.) that ranked No. 98 last year. And Marathon Petroleum (No. 31) scooped up Andeavor, a *Fortune* 100 oil refinery.

Is this the natural evolution of an economy in which innovation and business acumen are duly rewarded? Or are there more worrisome forces afoot?

Economists cite varying reasons for increasing industry concentration—the extent to which industries are dominated by a few large firms—but agree it's on the rise. (One need not be an economist to notice: Your Rite Aid is now a Walgreens; you can no longer fly US Air or Continental; you buy almost everything—including your Whole Foods groceries—from Amazon.)

"It's unmistakable that

concentration has been growing at a national level," says James Bessen, an economist at Boston University whose research has looked at why the top tier of companies is pulling ahead of the pack. Bessen points to the role of information technology. Firms that have invested most heavily in proprietary software (incidentally, often the biggest firms) have emerged as clear winners in the current economy, experiencing productivity, sales, and labor force gains, he says.

Fiona Scott Morton, an economics professor at Yale who once worked in the Department of Justice's antitrust division, homes in on the role of data, which she says "has a natural concentrating" effect. Data-rich companies can achieve economies of scale cheaply and further benefit from feedback and network effects—the more data you have, the better and more attrac-

tive to customers your product becomes, she explains.

As technology and data have reshaped the economy, she and others argue that antitrust enforcement—which may have blocked mergers of big players and helped spur innovation in the past—has all but disappeared. "We've been walking backwards at least 40 years, at the same time that there's been this springing forward."

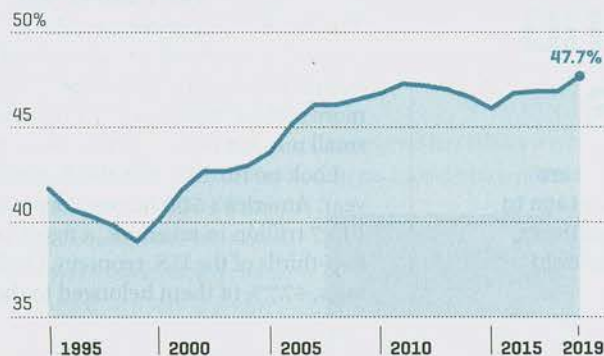
Meanwhile, anti-competitive practices protecting the position of the largest firms have proliferated, adds Herbert Hovenkamp, a law professor and antitrust expert at the University of Pennsylvania. He points to the conduct of large firms that force employees into noncompete agreements, which effectively suppress wages by making it difficult for even rank-and-file workers to change jobs. He also

singles out the tendency of Big Tech to buy up potential competitors as soon they come along: like Amazon snapping up Quidsi, the parent of Diapers.com, in 2010. "These startups are acquired before they can ever emerge as vibrant competitors themselves."

Should we be concerned about all this? Economists warn there are significant costs to a top-heavy economy, in which the lion's share of financial resources are concentrated into the coffers of a relative few: lower output, higher prices, reduced choice, and stifled innovation. Plus, that economic might often translates into political power that can enable the leaders to entrench themselves even further.

That the biggest corporate giants keep getting bigger has drawn notice, inspiring a burgeoning anti-monopoly movement. Much of the attention is focused on Big Tech; everyone from Elizabeth Warren to Facebook cofounder Chris Hughes has called for the breakup of Facebook this year. But the book might not be closed on CVS either: In April, months after the government approved its merger with Aetna, a federal judge ruled that he wanted to hear from parties that opposed it. "This is a matter of great consequence to a lot of people," he said.

REVENUES OF THE FORTUNE 500 TOP 50 COMPANIES AS A SHARE OF REVENUES OF ALL 500

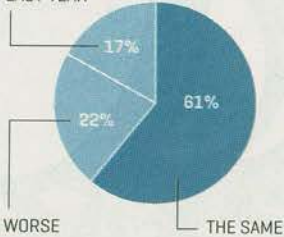


ANALYTICS Seeing Trends in the Data

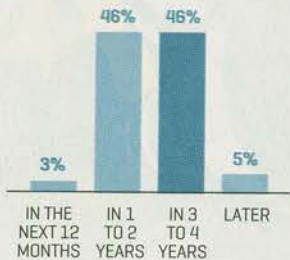
WHERE THE GLOBAL ECONOMY IS HEADED

Last year, the CEOs of the *Fortune* 500 were ebullient about global prospects, with 40% of CEOs believing the global economy would improve. Now just 17% have such high hopes for the next 12 months. But our CEOs are not doomsayers. Most expect things to stay relatively stable in the next year.

IN THE NEXT 12 MONTHS, THE GLOBAL ECONOMY WILL BE BETTER THAN LAST YEAR



THE NEXT RECESSION WILL COME:



TWO YEARS FROM NOW, RESPONDENTS' FIRM WILL HAVE MORE EMPLOYEES



POLITICS AND REGULATION

President Trump's tough stance on China has gotten more popular in the past year. In 2018, a little over half of CEOs approved of the President's trade spat with Beijing. Now four-fifths approve of the posture. Meanwhile, the Federal Reserve seems to have hit the right balance on interest rates.

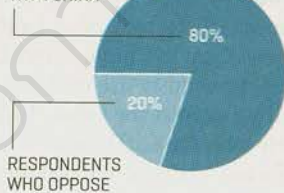
IN THE PAST YEAR, THE FEDERAL RESERVE HAS BEEN TOO SLOW IN RAISING RATES

TOO AGGRESSIVE

JUST RIGHT



RESPONDENTS WHO FAVOR THE TRUMP ADMINISTRATION'S TRADE ACTION WITH CHINA



RESPONDENTS WHO OPPOSE

SOME COMPANIES HAVE GROWN SO LARGE AND INFLUENTIAL THAT THEY ARE IN NEED OF ADDITIONAL REGULATION, NOTABLY:

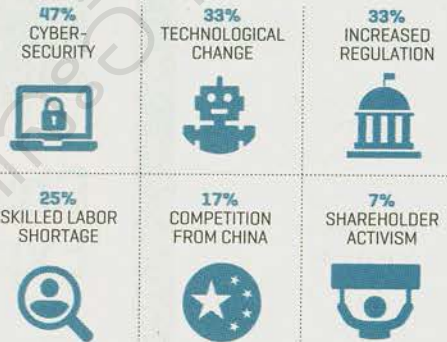


2019 CEO SURVEY: THE RESULTS ARE IN

The CEOs of the *Fortune* 500 are feeling increasingly cautious. A growing number fear the global economy will worsen in the next year, and close to half are preparing for a recession within the next two years. Despite those worrying signs, they still plan to increase employee headcount and invest in A.I. They also think America is the best place to invest your money. The poll was administered by email between May 1 and May 10, and the response rate was 18%. —ALAN MURRAY

VERY BIG CHALLENGES

The CEOs were asked to rank the issues below on how big a challenge they pose to their business. The percentages represent the share that identified each as "very big."



A.I. TO THE RESCUE

Artificial intelligence isn't the future; it's the now. Already more than half of *Fortune* 500 CEOs say their company is using these technologies to improve efficiency.



BEST REGION FOR INVESTMENT OPPORTUNITY IN THE NEXT TWO YEARS



SAY CAPITALISM IS NOT IN CRISIS BUT WOULD BENEFIT FROM SOME TWEAKING TO BETTER SERVE SOCIETY.



42%

BELIEVE THEIR COMPANY SHOULD ACTIVELY SEEK WAYS TO ADDRESS MAJOR SOCIAL PROBLEMS AS PART OF THEIR CORE BUSINESS STRATEGY.

▽
BY THE
NUMBERS

MEASLES

\$21

The CDC's contract price for a pediatric measles, mumps, and rubella (MMR) vaccine in 2019.

\$75

The private sector price for a pediatric MMR vaccine.

UP TO
\$142,000

Cost of responding to a single case of measles, according to a paper in the *Journal of the American Medical Association*

839

CASES IN 2019
SO FAR

In 2000 the disease was considered eliminated in the United States.

—ERIKA FRY



*COST VARIES ACCORDING TO THE NUMBER AND LOCATION OF CONTACTS THAT MUST BE TRACED, THE AMOUNT OF POSTEXPOSURE PROPHYLAXIS THAT MUST BE ADMINISTERED, AND THE NUMBER OF PEOPLE QUARANTINED.



China's Slowdown Explains '996'

Chinese tech firms are pushing their workers into incredibly long hours. A slowing economy is to blame. By Eamon Barrett

CHINA **HUSTLE CULTURE**, the top-heavy work/life balance favored by Silicon Valley elites, is under review. Even in China, where hustle has a different name, previously tireless tech engineers are rebelling against the exhausting expectations of their jobs. On GitHub, the Microsoft-owned forum where tech developers share code, a post from an anonymous Chinese user recently criticized the so-called 996 work schedule China's techies endure—slogging away from 9 a.m. to 9 p.m., six days a week. “If you work 996, you’ll be in the ICU sick,” wrote the user, adding, “Developers’ lives matter.”

Smartly billing itself as a legal gripe, the GitHub post says 996 culture contravenes China’s labor laws, which mandate a workweek of 44 hours with overtime capped at 36 hours a month. On a 996 schedule, workers burn through most of their month’s overtime allowance in under a week. Few are justly compensated.

“The reason why the 996 protests arose now is

because China’s Internet industry, which had been continuously growing at very high speed for the past decade, is feeling the stress of the economy slowing down,” says Li Chen, a social sciences professor at the Chinese University of Hong Kong. In 2017 the economy entered a “new normal,” with annual GDP increases slowing to 6.6%, compared with decades of 7% to 10% growth. *People’s Daily*, a newspaper aligned with China’s ruling party, called the legitimacy of a 996 workweek “clearly questionable” and said it should be reviewed. But that unofficial support might not manifest as government policy.

○ CLOCKS: VCG VIA GETTY IMAGES; VACCINE: JUSTIN SULLIVAN—GETTY IMAGES

BOARDS

GENERAL MOTORS
FLIPS THE RATIO

WOMEN WILL MAKE UP more than half of GM's board next month, after two male directors retire, leaving six female directors—including chair Mary Barra—to five men. That's a big milestone for one of the *Fortune* 500's biggest companies, but GM isn't alone. Five others have boards of directors with more women than men.

Another five are at the 50% threshold exactly, and more than two dozen are close to it, above the 40% mark. Some of these companies—like CBS, with five men and six women, and Wynn Resorts, with five men and four women—have #MeToo upheavals to thank for their newly gender-diverse slates of directors. Others, like Michele Buck's Hershey and Jill Soltau's J.C. Penney—each with six men and five women—have been proactive in diversifying the gender makeup



From left: Michele Buck, Hershey president; Shari Redstone, CBS & Viacom vice chair; Mary Barra, GM chair.

of their boards. In 2018 women still held only 22.5% of *Fortune* 500 board seats, according to Alliance for Board Diversity and Deloitte—

and more than three dozen companies still have only one or zero women in their boardrooms.
—EMMA HINCHLIFFE



Why Can't Drugstores Quit?

Rite Aid and Walgreens have raised the age to buy tobacco products to 21 from 18. But why are they selling them at all? By Phil Wahba

RX RETAIL **EVER SINCE CVS HEALTH** ditched tobacco products in 2014—sacrificing \$2 billion in sales to bolster its image as a health company—Rite Aid and Walgreens have been facing pressure to follow suit.

The companies recently raised their minimum tobacco sales age from 18 to 21—aiming to reduce

minors' access to them. But the moves came soon after a lashing in March from the FDA, which found both chains, with a combined fleet of 15,000 stores, to be among 15 major retailers selling cigarettes to minors.

Beyond the brickbats and bad PR, declining sales would be a valid reason to

exit the category: Cigarette sales fell to 252.7 billion sticks in 2017, from 292.7 billion in 2012, according to Euromonitor International.

Cigarettes are a modest and declining business for U.S. drugstore chains—total sales of about \$1.6 billion based on Euromonitor International data—but they're a desperately needed source of foot traffic for Walgreens and Rite Aid. Both chains have seen comparable non-pharmacy sales fall in the past four quarters.

But in contrast, sales at CVS were up 0.5%, showing that there can be a healthy retail life after dropping a bad habit cold turkey.

Capturing the Valley From Above

By Alex Scimecca

PHOTOGRAPHY

“WHAT’S REALLY INTERESTING to me is that Apple has this spaceship aura amongst the greenery,” aerial photographer Cameron Davidson recently told *Fortune*. “It’s typical Apple [with] their attention to detail.” Silicon Valley’s tech campuses house some of the world’s brightest minds, solving its hardest problems. Davidson sees those big ideas translating to the buildings that house them—architecture as a reflection of a company’s mission and characteristics. But not every design earns his praise. He describes Facebook’s sprawling Menlo Park campus as “meandering fingers.”



CHARRED

APP IN MY GRILL

AMERICANS’ love of grilling is as strong as ever, crossing cultures and generations. But these days, a growing number of backyard barbecue chefs are clutching a smartphone app alongside their tongs. Thanks to a new generation of “smart grills,” it’s possible to tend slow-roasting

slabs of meat from inside your house or even from your car. Traeger, a Salt Lake City-based maker of wood-pellet-powered grills that start at \$800, promises “digitally controlled convection” heating. According to CEO Jeremy Andrus, app-based cooking offers convenience and even a social networking element: “There’s a gamification angle. You can check in and see who in the neigh-

borhood is cooking the most ribs.” Traeger is not the only one targeting high-tech grill-meisters. Luxury barbecue maker Lynx, whose high-end model tops \$10,000, offers a SmartGrill app for iOS and Android, while Char-Broil, whose charcoal cookers are a backyard fixture—is offering digital grills that come with a SmartChef Smoker app. —JEFF JOHN ROBERTS

SMART SHOP

AMAZON'S A "GO" FOR PRIME TIME

AMAZON and New York City are friends again. After Amazon abandoned plans to locate its HQ2 campus in the city, an Amazon Go store quietly appeared in Manhattan one morning in May. The 11th location of what seems like a typical convenience store—albeit one with no cashiers—is actually a sophisticated data-mining operation. Shoppers scan an app to enter the store, where overhead cameras monitor their movements and record what they take from the shelves. Then they simply walk out with their goods charged to a card on file. The experimental Go stores provide Amazon with more data to fuel its retail dominance and undercut competitors [e.g., cans of Amazon-brand seltzer water sell at a discount to brands like LaCroix]. If the stores prove to be more than an experiment, it's yet another reason for Amazon's retail rivals to worry. —J.J.R.



JUST
WALK
OUT
SHOPPING



A Euro Solution for American Gridlock

Traffic jams plague almost every U.S. metropolitan area. Could congestion pricing help eliminate them? By Tamara Warren

TRANSIT

CONGESTION CHARGES—fees paid by drivers to enter highly trafficked areas in peak times—are coming to America. As part of the state budget, New York lawmakers have approved a daily charge on motor vehicles entering Manhattan below 61st Street. The plan is scheduled to go into effect in 2021, with the proceeds used to fix N.Y.C.'s ailing subway lines.

Drivers in London, Stockholm, Milan, and a handful of other international cities have been subject to similar charges for years. Since 2003, the number of private cars in central London has declined by 30%, according to transit authority Transport for London, and in its first three years, the tax was credited with a 17% reduction of nitrous oxide emissions. But its success has been tempered by the explosion of for-hire vehicles from services such as Uber and Lyft, which continue to create congestion for Londoners.

Experts point out that New York's plan is distinct, and its impact is hard to estimate. "London is a very different city from New York," says Mitchell L. Moss,

director of NYU's Rudin Center for Transportation. "It's a much larger area than what's [taxed] in London."

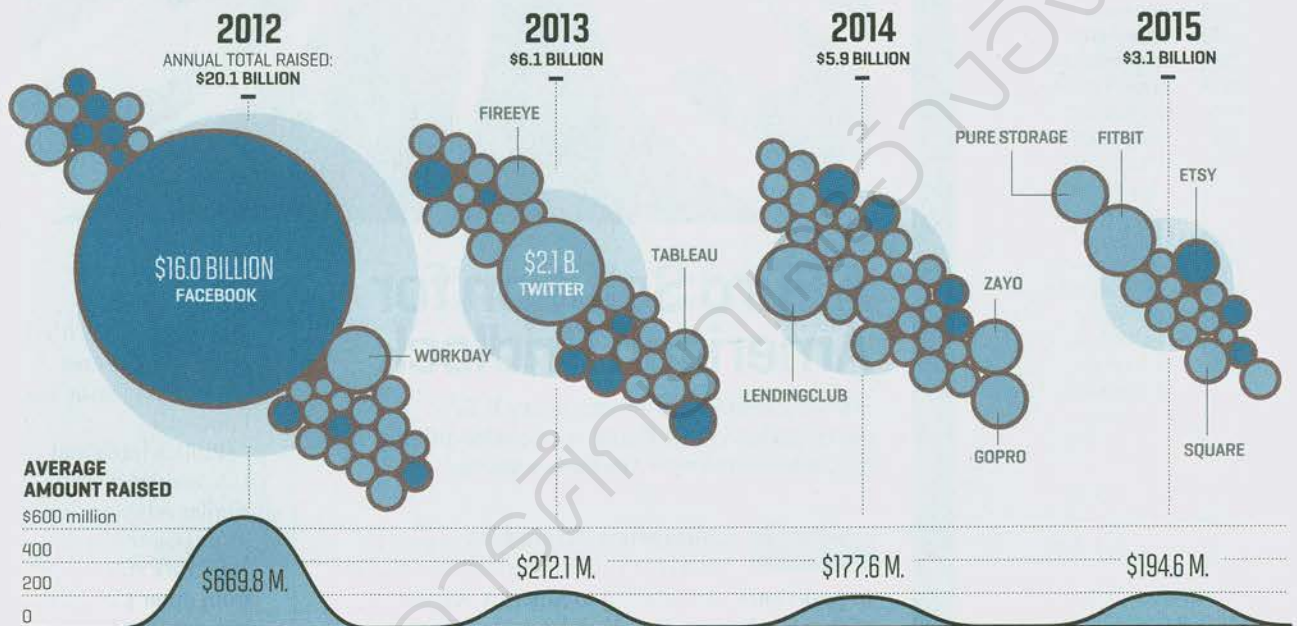
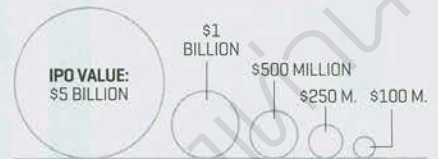
Philadelphia and L.A. are considering similar schemes, but Moss points out that New York stands out from other U.S. cities because its 24-hour subway system makes it less dependent on cars: "The real reason you can do it in New York is five times as many people come in by mass transit as come in by car."

But when it comes to shifting commuters back to overcrowded subways, the city and state could face a chicken-and-egg scenario, if lawmakers don't act quickly to make updates to the aging transit system.

FOCUS

EIGHT YEARS OF TECH IPOs

A wave of high-profile tech IPOs by the likes of Uber, Lyft, and Pinterest is making this a standout year. On average, individual tech companies are raising far more in 2019 than in any of the previous seven years.

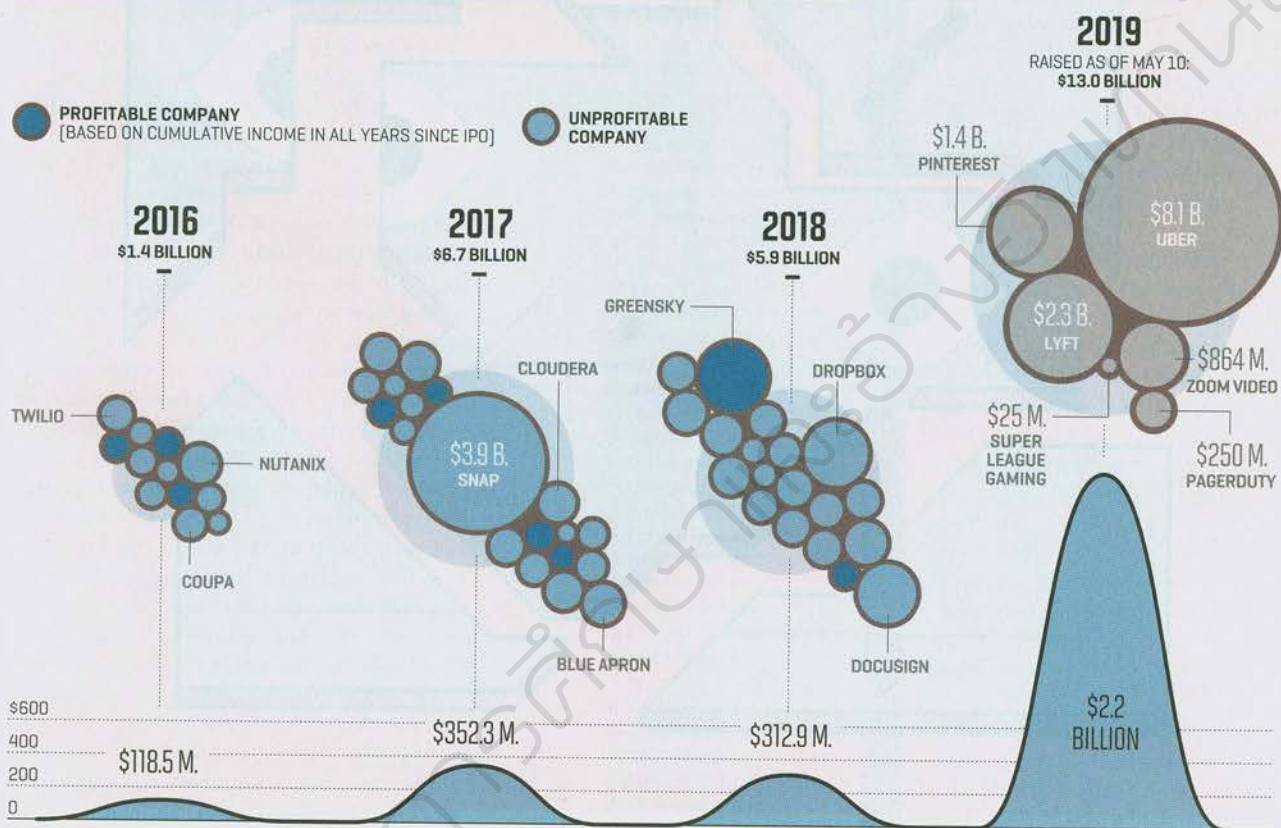


TECH'S UNICORNS FEAST AT THE IPO TROUGH

All signs point to a record-breaking year for U.S. tech IPOs, as hot companies like Uber, Lyft, and Pinterest cash in.
By Robert Hackett

WELCOME TO THE YEAR of the giant tech IPO. A cavalcade of so-called unicorns, privately held companies valued at \$1 billion or more, is galloping toward supersize initial public offerings. Uber alone raised \$8.1 billion in its May debut. The 10-year-old company is so big that it would have ranked No. 280 on this year's *Fortune* 500, based on revenue, if it had released its financials earlier.

Ride-hailing app Lyft and online bulletin board Pinterest are just some of the other boldface names that have also held huge stock offerings. Meanwhile, workplace-messaging service Slack filed for a direct listing, bypassing the cumber-



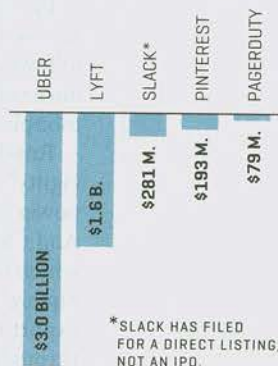
some underwriting process but also forgoing any immediate proceeds.

In all, six U.S.-based, venture-capital-backed tech companies had made a 2019 debut by *Fortune's* press time, reaping \$13 billion. Investors gave some, like Uber, a cool reception out of the gate. In terms of absolute numbers, it's a relatively slow year for tech IPOs. What makes this year so remarkable, though, is the money that individual companies are raising. On average, they've collected \$2.2 billion each through their IPOs, more than in any of the prior seven years.

In fact, Kathleen Smith, cofounder of IPO-tracker Renaissance Capital, expects

LARGEST LOSSES AMONG 2019'S IPO COMPANIES

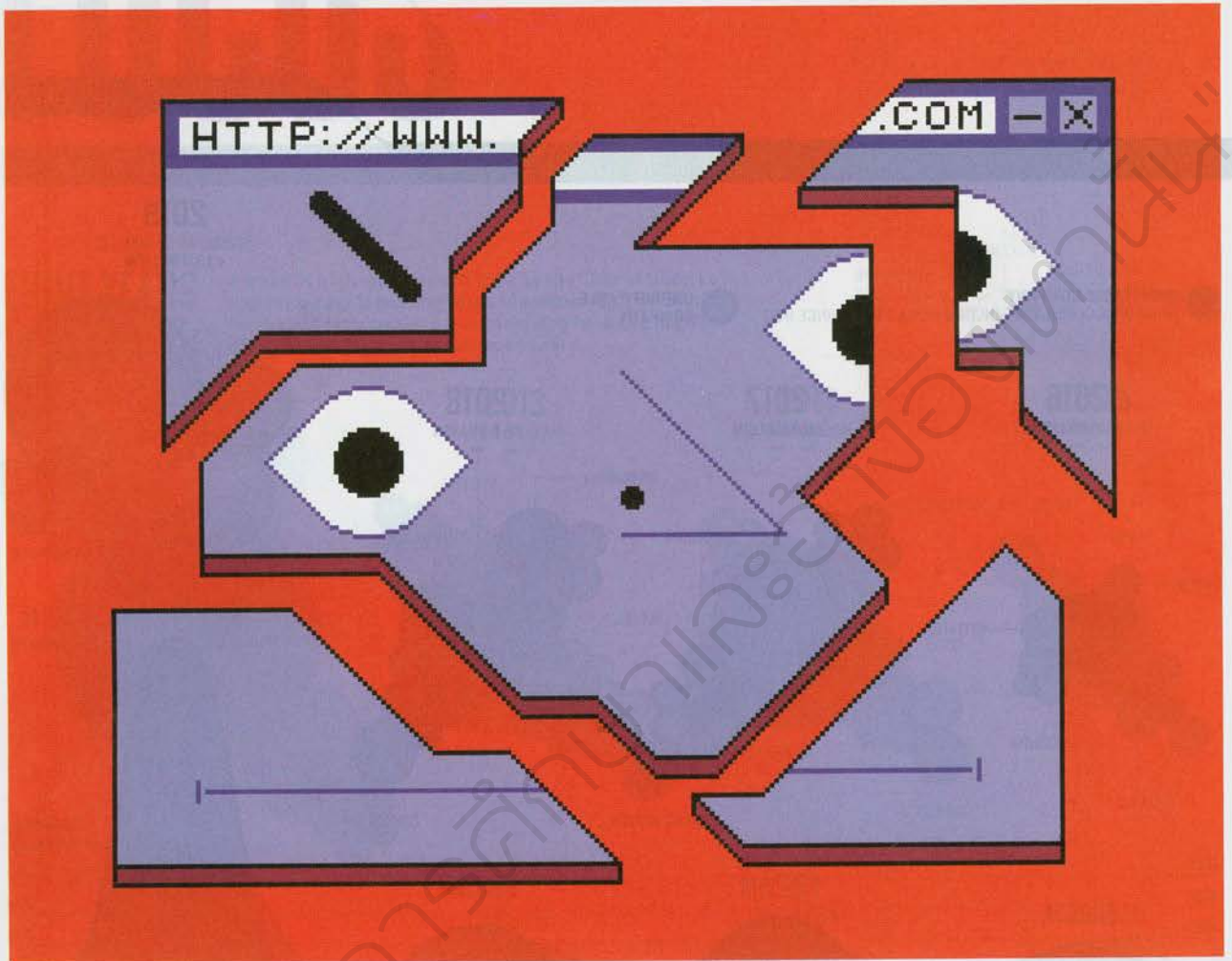
[OVER THE TWO FISCAL YEARS BEFORE THEIR FILINGS]



a record-setting 2019. U.S.-listed IPOs across all industries, not just tech, may raise more than \$100 billion this year, eclipsing the \$97 billion collected in 2000 during the dotcom bubble.

Like then, there's a red flag to consider when it comes to the current crop of tech companies going public: They're hemorrhaging cash. Combined, they lost \$5 billion in the two years leading up to their IPOs. And that's not even including office landlord WeWork, delivery service Postmates, and home hotelier Airbnb, which are also eyeing the public market.

We're only at the half-year mark, after all. More unicorns are on the way. ■



WHERE THE SPLINTERNET THRIVES

Countries are increasingly censoring the Internet, creating a balkanized version that puts U.S. tech companies in a difficult position. By Jeff John Roberts

"THE NET INTERPRETS censorship as damage and routes around it," said Internet pioneer John Gilmore in a 1993 *Time* magazine article about a then-ungoverned place called "cyberspace." How times have changed.

In April, Sri Lankan authorities blocked its citizens' access to social media sites like Facebook and YouTube following a major terrorist attack. Such censorship, once considered all but inconceivable, is now commonplace in a growing number of countries.

Russia, for instance, approved an "Internet sovereignty" law in May that gives the government broad power to dictate what its citizens can see online. And China is not just perfecting its "Great Firewall," which blocks such things as searches for "Tiananmen Square" and the *New York Times*, but is seeking to export its top-down version of the web to countries throughout Southeast Asia.

This phenomenon, colloquially called “splinternet,” whereby governments seek to fence off the World Wide Web into a series of national Internets, isn’t new. The term, also known as cyberbalkanization, has been around since the 1990s. But lately the rupturing has accelerated, as companies censor their sites to comply with national rules and governments blot out some sites entirely.

“It feels like a chunk of the Internet is gone or different. People feel the Internet is not as we knew it,” says Venkat Balasubramani, who runs a cyber law firm in Seattle.

Technology is one reason for the change. According to Danny O’Brien of the digital civil rights group Electronic Frontier Foundation, the sort of censorship tools deployed by China were enormously expensive and labor-intensive. But now, as the tools become cheaper and more efficient, other countries are willing to try them too. Meanwhile, there is a new political will among governments to try to control websites—especially following events like the Arab Spring, during which Facebook and Twitter helped fuel political uprisings.

It’s not just authoritarian countries trying to bend the global web to national values. The same social media companies that gave rise to unrest in the Middle East have come under fire in the West for allowing their services to be used to promote hatred and terrorism. In response, England and Australia have recently passed laws demanding tech firms provide easier access to web users’ communications.

When it comes to censorship, the process is more complicated in democratic countries than in dictatorships. In places like Iran and Venezuela, autocrats can order the Internet service provider—there’s typically only one—to block sites that displease them or tell a phone company to shut down an app. Democracies require the force of law, upheld by a judge, before governments can tamper with a website. Nonetheless, more countries are doing just that—often with worldwide effects.

“Fragmentation is becoming a problem. Countries are not abiding by traditional rules for international law and are willing to legislate beyond their borders—the effect on other jurisdictions be damned,” says Allen Mendelsohn, an attorney who teaches Internet law at McGill University in Montreal. He points to the European Union data privacy law known

ONLINE CENSORSHIP: A GLOBAL GUIDE

More governments are subjecting the Internet to national laws. Here are some examples:

RUSSIA

The Kremlin signed a law in May to create a “sovereign Internet,” which will require ISPs to force all web traffic through special nodes controlled by the national censor.

FRANCE

After requiring Google to remove thousands of search results under a “right to be forgotten” law, France is leading an EU copyright push that many fear will prompt websites to ban users from uploading files.

SRILANKA

After a terrorist attack, officials ordered ISPs to block social media sites. Shortly after restoring them in May, they ordered a new blackout to curb ethnic tensions.

as the GDPR and to so-called right to be forgotten laws in France and Germany that creep beyond national borders.

The splintering of the Internet is likely to accelerate as many countries tighten their grip on power and as nations like Sri Lanka and New Zealand—whose Prime Minister pledged to take action against social media after a shooter there broadcast a mass killing—struggle to contain extremism.

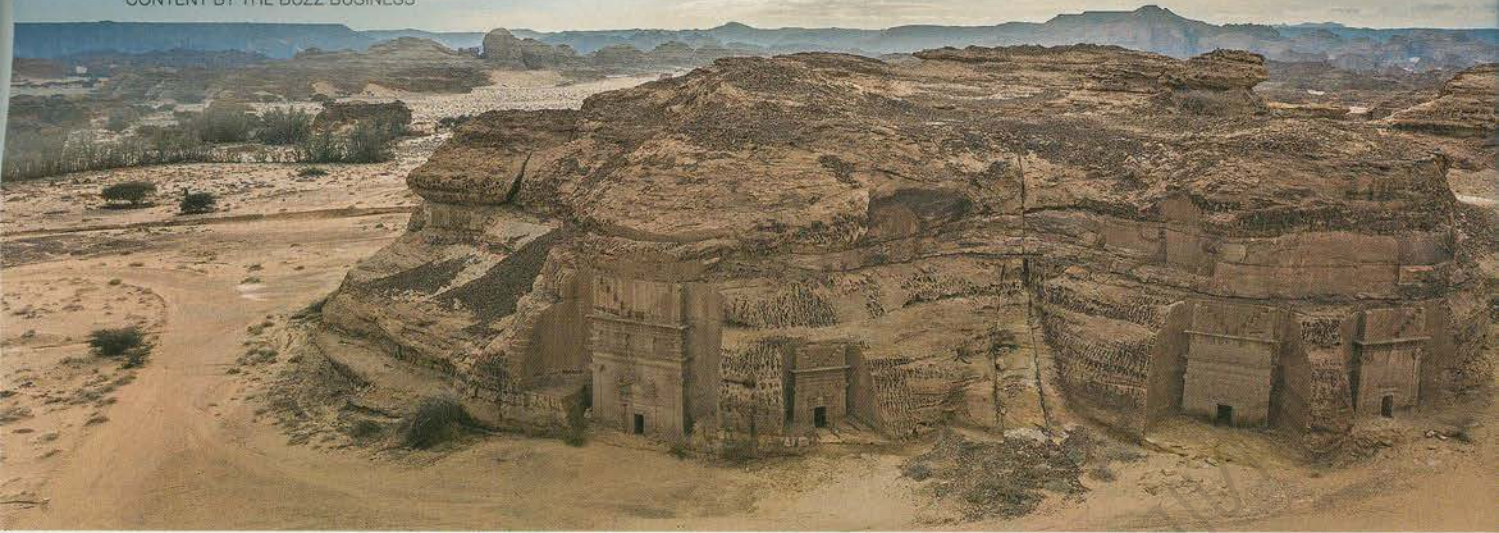
For U.S. tech companies, the fracturing of the web has become both a geopolitical land mine and a source of regulatory frustration. According to the general counsel of an Internet infrastructure company, who spoke on the condition of anonymity because he wasn’t authorized to do so for attribution, many in Silicon Valley see protectionism as driving some local rules, especially in Europe.

“There’s a bit of ‘If we can’t beat them, regulate them.’ I don’t know if this was brought about by Trump, but people have turned on the open Internet,” he says.

For Ed Black, who heads the Computer and Communications Industry Association in Washington, D.C., the current state of the web is troubling—and one policymakers might have mitigated had they acted sooner. He believes the U.S. should have

done more to promote a “digital bill of rights” and other measures to preserve free speech online. Black also worries that each step by governments to restrict the web will normalize censorship and move the world further away from unfettered cyberspace.

Says Black: “It’s death by a thousand cuts. We now face a situation where we have Chinese and authoritarian models being aggressively proselytized around the world, and we haven’t done enough to counter that.” ■



An epic adventure through time, space, and the senses

In Saudi Arabia, in a desert oasis 200 miles to the north of Madinah, amid vast sandstone mountains under a night sky glittering with stars, the landscape reverberates with the soaring sounds of Italian opera and popular songs.

In this most stunning of settings, visitors to the first Winter at Tantora festival enjoyed more than just a magical night of music from legendary tenor Andrea Bocelli. In the ancient town of AlUla, they became privileged spectators to the unveiling of one of the world's most mysterious and unspoiled ancient landscapes.

"Here, every rock is a witness. Every road is a pathway into history that spans millennia. And every citizen has a story to tell," says Amr AlMadani, the CEO of the Royal Commission for AlUla (RCU), established

in 2017 to develop the region and share its heritage with the world.

The human story of this desert region is long. Rock art and carved inscriptions testify to the presence of men and women dating back thousands of years. It was here that the first great kingdoms of Northern Arabia developed: the Dadanites of biblical fame, then the Lihyanites, and finally the Nabataeans, best known for the famed city of Petra, who chose this region for their second and most southerly capital, Hegra.

Their legacy is etched in the landscape of AlUla, from the ancient tombs carved into the cliffs near Dadan to the sophisticated irrigation systems, intricate rock tomb carvings, and multilingual inscriptions left by the Nabataeans before the Roman annexation of Northern Arabia in 106 CE.

Today, international teams of archaeologists work with their local Saudi counterparts, using cutting-edge technology to explore, map out, and discover AlUla's rich heritage and history through exceptional archaeology programs, developing a growing center of excellence in the area. Local communities are also deeply involved in the plans for the region. And through an RCU program, students have embarked on international scholarships to study tourism, history, archaeology, and architecture, which will prepare them to become custodians of this World Heritage Site.

A new chapter is beginning for AlUla. "We are offering visitors who come to AlUla the opportunity to travel through time in a truly awe-inspiring destination," AlMadani says. ■

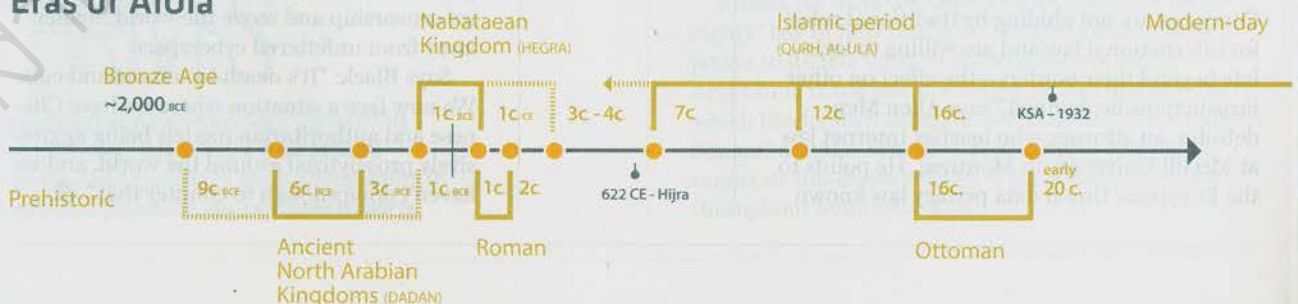
"The world wants to discover AlUla. We are developing the platforms and expertise to make this region a living museum for tourists."

Amr AlMadani
CEO, Royal Commission for AlUla

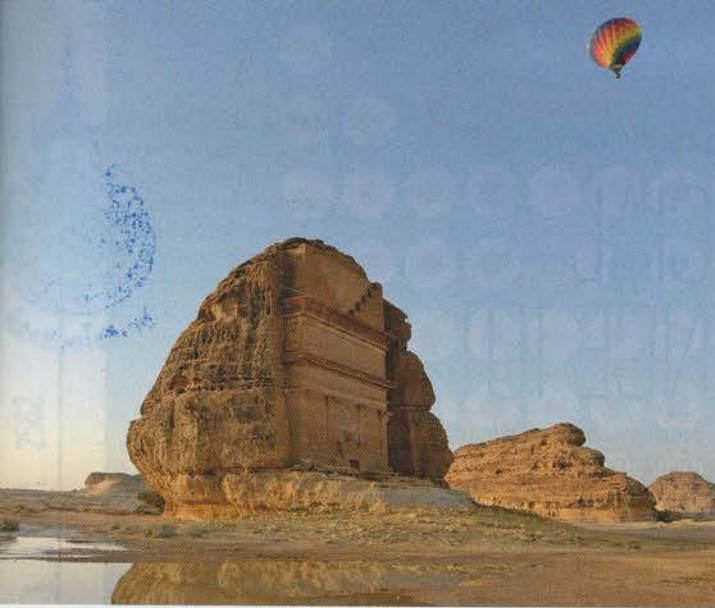
"The location is rooted in the history of the land and the history of the Nabataeans."

Jean Nouvel
Architect

Eras of AlUla



PHOTOS: (L) View of the AlUla valley in Saudi Arabia; (R) The ancient Nabataean site of Hegra.



Investing in a rejuvenated sanctuary for heritage, nature, and the arts

From the caravans and camels of the ancient incense trade to the early pilgrims, adventurers, and explorers of more recent centuries, the rugged terrain and fertile oases of northwestern Arabia have a rich tradition of hosting travelers from far and wide. In this new phase of its story, AIUla is preparing to welcome a new generation of visitors from around the world, as the Royal Commission for AIUla (RCU) embarks on a long-term plan to transform the region into one of the Middle East's—and the world's—most important archaeological and cultural destinations.

Working with the local community and international experts in heritage conservation and master planning, RCU aims to develop the required infrastructure and visitor facilities while protecting AIUla's natural beauty and preserving its ancient and historic sites.

AIUla's planned development is likely to attract investments of between \$16 and \$20 billion over the next 16 years, and eventually lure two million visitors per

year. With its master plan nearly complete, the Commission has begun talks with a range of global and regional investors, and will soon accelerate the launch of international tenders for the development of hotels, transport facilities, and cultural experiences.

The Commission has selected Jean Nouvel, the celebrated French architect of the Louvre Abu Dhabi, to design a visionary resort deep inside the Sharaan Nature Reserve. It will include residential villas, restaurants, and a luxury spa, all in support of a spectacular summit center, where business leaders and luminaries from around the world will be able to connect with a truly unique combination of heritage, nature, and art.

As the pace of development speeds up, so will the opportunities for investment in the region. And in this way, the mysterious shared history of AIUla, preserved through millennia in this ancient landscape, will be brought to life for future generations. ■

Amr AlMadani

CEO, Royal Commission for AIUla

Q&A

How pleased are you by the first edition of the Winter at Tantora festival?

Winter at Tantora showcased AIUla to the world and showed international visitors a vision of the region's future. It was a rich and fulfilling experience for guests, with international artists performing, helicopter tours to secret sites, fine dining in picturesque canyons, and new surprises every weekend. They experienced the very best that we offer: heritage, nature, local hospitality, and culture. It helped develop our credibility as a premier destination and was such a success that we are already preparing a second season.

What makes the AIUla brand unique?

As a destination containing Saudi Arabia's first UNESCO World Heritage Site, and many other important heritage sites, we are presenting AIUla as an oasis of civilization, and we have a clear understanding of where our brand fits in a competitive global landscape. We work to apply best practices as custodians of AIUla's unique site. Our initial target areas are markets within six hours of AIUla, including travelers from Europe, Russia,

and China, and from the main hubs in the Gulf area.

How will you transform this region into a living museum?

Celebrating AIUla as a place of heritage for the world is something I am hugely passionate about. We will use unique technologies to create an entirely curated experience from arrival to departure.

What will this project mean for the local community of AIUla?

The local community is the heart and soul of AIUla and we are working to nurture local entrepreneurship, enable employment in high-quality jobs, and develop professional initiatives based on local need.

Last year, we launched our international scholarship program and now have 168 students studying tourism, history, archaeology, and architecture at top institutions in the U.K., France, and the U.S. In addition, we created Hammayah, a community advocacy and engagement program where locals learn to become stewards of AIUla's cultural and natural heritage. ■



Amr AlMadani visiting a site at AIUla.

USEFUL LINKS: www.winterattantora.com • www.rcu.gov.sa

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ARTIFICIAL INTELLIGENCE 101

REINFORCEMENT LEARNING

This A.I. technique is like training a dog with treats. The software learns by successfully executing a task and, on the flip side, from failure. This fusion of reinforcement learning with deep learning has led to tremendous breakthroughs, like computers beating humans at complicated video and board games. **Example: Facebook's targeted notifications**

Artificial intelligence is having its moment. Business leaders can't stop talking about it. New tech products invariably include it. And news headlines incessantly chronicle the buzz around it. But for many people, artificial intelligence remains a mystery. To help, we've created a guide that explains some of the key terms associated with the technology, an increasingly useful tool for businesses that improves as it crunches more data.

By Jonathan Vanian

NEURAL NETWORKS

A.I.'s rise can be traced to software developed decades ago that was intended to approximate how the human brain learns. Inside a neural network are layers of interconnected nodes where calculations take place that help computers sift through data in minute detail. By doing so, the software can learn to recognize patterns that even the most intelligent humans may overlook. **Example: Baidu search**

DEEP LEARNING

Mixing neural networks with machine learning makes for deep learning, a powerful technology that can crunch enormous amounts of data, like vast archives of audio clips. A.I.'s biggest breakthroughs—such as recognizing snow leopards in photos—can be traced to the technology. **Example: Nvidia's 3D A.I.-generated faces**

MACHINE LEARNING

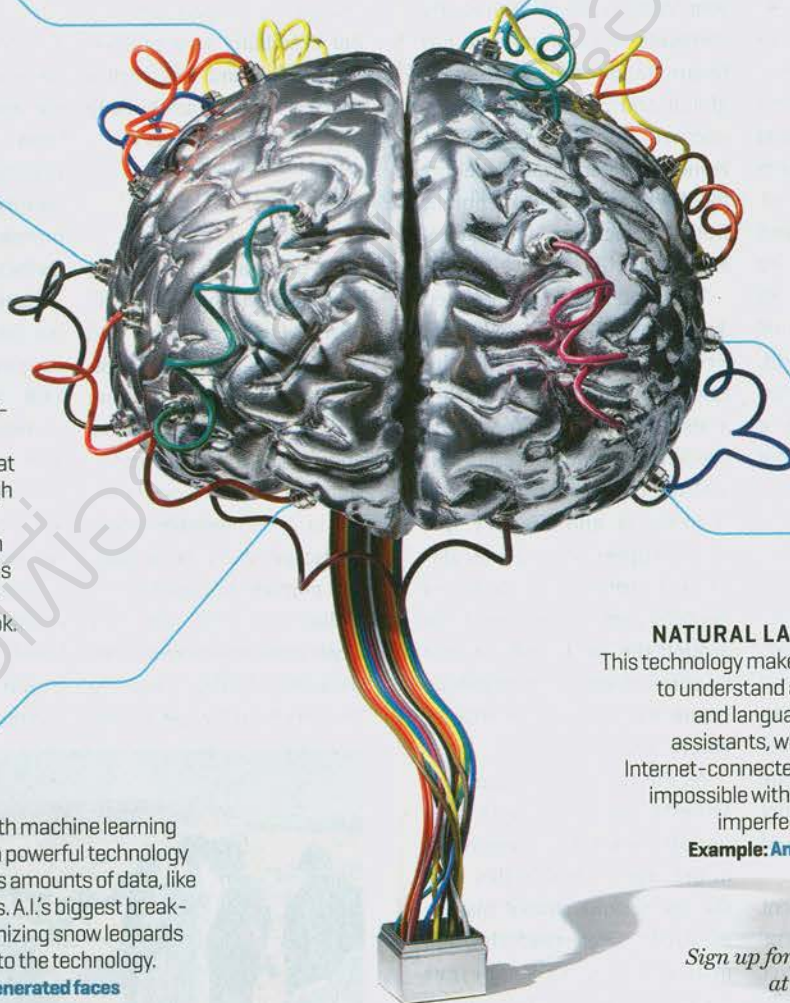
You can thank machine learning for recommending how to respond to your boss when she emails asking whether an important document is in order ("Looks good to me") or whether you can meet at noon ("Let's do it!"). This is just a taste of how algorithms help computers "learn." The chief attraction: Companies don't need humans to program the technology for each specific task it handles. **Example: Google Gmail**

COMPUTER VISION

Devices using computer vision are able to see and understand their surroundings almost like a human. Think of facial-recognition technology that can automatically unlock your iPhone or the systems that help navigate self-driving cars without crashing them into trees. The problem seems easy to solve. But in reality, it's very difficult. **Example: Waymo's autonomous vehicles**

NATURAL LANGUAGE PROCESSING

This technology makes it possible for computers to understand and react to human speech and language. Voice-controlled digital assistants, which take dictation or power Internet-connected home speakers, would be impossible without it. The technology is still imperfect, but it's improving quickly. **Example: Amazon Alexa digital assistant**



Sign up for our Eye on A.I. newsletter at fortune.com/GetEyeonAI



WARBY PARKER IN HINDSIGHT

How a group of Wharton MBA students took on Big Eyewear and made a difference. Interview by Dinah Eng

VENTURE Dave Gilboa and Neil Blumenthal are cofounders and co-CEOs of Warby Parker—the eyewear company that disrupted the industry by drastically lowering prices for stylish frames. It now operates more than 90 physical stores in the U.S. and Canada and is reportedly valued at \$1.7 billion.

DAVE GILBOA: Both my parents are doctors. I wanted to make a positive impact on the

Dave Gilboa (left) and Neil Blumenthal at Warby Parker's Manhattan showroom in April.

world, and I thought it would be helpful to learn about business. But after working in financial services for a while, I decided to go simultaneously for a master's in biotechnology at the University of Pennsylvania and an MBA at Wharton. I thought I'd find a scientist working on something great and help to commercialize it.

NEIL BLUMENTHAL: My mom was a nurse, and my dad was a CPA. I went to a small Quaker

school in Manhattan that was very mission-driven. I ended up working for a nonprofit that trained women in foreign countries on how to start their own businesses selling eyeglasses to people in need. People underestimate folks with a nonprofit background, and I thought that having an imprimatur from Wharton would help my career. That's where I met [cofounders] Jeff Raider, Andy Hunt, and Dave, and we became best friends.

GILBOA: In the summer of 2008, before starting school, I took a few months to backpack around the world and lost my glasses on a plane. I went most of the first semester without glasses because I was shocked at the cost. I could buy a new phone for \$200, but a pair of [designer] glasses cost \$700. I started complaining to anyone who'd listen that I couldn't believe glasses were so expensive.

BLUMENTHAL: Andy asked, why aren't people buying glasses online? I knew the margins were big and knew where we could get glasses produced.

GILBOA: So we agreed to meet at a local bar one night to kick around ideas, and when we got home at 2 a.m., one of us sent out a three-page email about the business idea. The rest of us responded and were really excited from the get-go.

BLUMENTHAL: The biggest challenges were how could we move fast enough, thoughtfully enough, and balance our priorities. For a fashion accessory and health care product, we wanted to have a quality product and a brand that would influence culture.

GILBOA: Each of us took the lead on something. I took point on building the website, setting up our supply chain, hiring our first employee, setting up a phone system, and the customer service system.

BLUMENTHAL: I worked on branding, looking at our values and mission. We spent a lot of time getting feedback from customers and focus groups. We wanted to understand the business model of Luxottica [the 800-pound gorilla of the eyewear industry] and the large optical retailers. We were scared and awed. But we knew we could lower the cost of a pair of glasses from \$500 to \$99.

GILBOA: The four of us each put in \$30,000, so that we'd have equal stakes. We launched in February 2010 while we were still in school. The process of starting a business was all-

BEST ADVICE

DAVE GILBOA, 39
COFOUNDER
AND CO-CEO OF
WARBY PARKER

Never outsource critical components of your business

None of us were qualified to build the website, so we solicited proposals and got a handful of bids from agencies. We chose the cheapest option, but a few months in, we realized it was a mistake. Their execution wasn't what they promised, so we ended up firing them.

Now we develop most of the technology we use in-house to ensure we maintain as much control over the customer experience as possible. We've developed our website, a point-of-sale system that we call POE (or point of everything), and both of our apps internally.

business. They saw that we tried to make them happy. With 2,000 employees now, that's a lesson we continue to practice in our corporate culture.

BLUMENTHAL: Once we graduated, Jeff went back to the private equity fund he had worked for, then went on to found Harry's. Andy went on to start Elephant, his own venture capital firm. Warby Parker moved to a loft space in New York, and customers came to try on glasses there. We sold millions of dollars' worth of glasses through our office and a pop-up store in SoHo, which gave us the confidence to sign a long-term lease for our first store in April 2013.

GILBOA: We're still at the top of the first inning. As we open more stores, we're hiring optometrists to make it easy for people to get their prescriptions. We're using telemedicine so people can do vision checks from home. We've expanded our social mission. Five million people around the world have gotten free glasses through our Buy a Pair, Give a Pair program, and we're now giving free eye exams and free glasses to students in New York City and Baltimore.

BLUMENTHAL: The best businesses solve real problems. We've created an example of a business that can scale, be profitable, and do good in the world without charging a premium for it. ■

consuming. I had to drop my second degree program.

BLUMENTHAL: We thought that we'd have to beg friends and families to buy glasses from us.

GILBOA: We spent all our money on getting the website built and the initial inventory. We hired a fashion publicist because we knew we needed to get into established publications to develop credibility and relationships. We ended up getting articles in *GQ* and *Vogue*, and social media picked us up.

BLUMENTHAL: *GQ* referred to our Home Try-On frames, but within 48 hours of launch, all our glasses were out with customers, so we had to suspend that. We hit our first-year target in three weeks and ran out of inventory. People started calling to complain. We would apologize profusely and explain that the company just got started. We found that the more vulnerable and transparent you are, the deeper the relationship you build with customers.

GILBOA: The customers became champions of the

PASSIONS

TIME
WELL SPENT

STYLE

ORMAIE
Unisex
fragrances
produced
entirely with
natural
ingredients:
a harder
task than
you might
think.



BEAUTY BEYOND THE COUNTER

By eschewing the rules of the cosmetics game, newcomer French brands are winning over customers who seek a more personal touch. **By Lindsey Tramuta**

STYLING BY EMILY + TONY MULLIN



Glossier—the direct-to-consumer brand valued at \$1.2 billion—have positioned themselves as powerful challengers to heritage brands operating with traditional retail strategies and opaque supply chains. With declining trust in the products we buy—from food to fashion—an increasing number of consumers are looking beyond the conglomerates like L'Oréal and LVMH in search of ultra-transparent and sustainable alternatives. Should they get the formula right, niche newcomers have a rich opportunity.

“Most beauty brands don’t even know who you are because their client is the retailer,” Glossier founder Emily Weiss told *How I Built This* host Guy Raz in 2018. “Beauty brands build products for the needs of Macy’s and Sephora. Those are shelf-space needs and seasonality needs and margin needs that have nothing to do with you as the customer.” That results, she says, in a subpar brand experience and relation-

ship. Succeeding as an independent beauty or cosmetics label in today’s market requires Glossier-style disruption—in retail experience, product composition, packaging, or story. Above all, it requires listening to what consumers want.

In Desforges de Caulières’s case, that meant looking close to home to shore up the brand’s vision. For 250 years, his ancestors have carried on an agricultural tradition, including his parents, who produce sunflower, rapeseed, and linseed oils at the family estate in the Loire Valley. Originally produced for medicinal purposes, a switch to cold-pressing the oils for culinary use revealed their more cosmetic virtues: His father’s calloused hands became silky smooth. That discovery became the foundation of the brand’s line of body care, from bath oils to lotions, all with ingredients tied to the four seasons.

“We wanted the level of top quality of product that you would typically find only in a spa and translate that into the in-room

STYLE

“BEAUTY WASN’T the initial idea, it was family,” says Xavier Desforges de Caulières, the 36-year-old founder of Maison Caulières—one of the most successful, under-the-radar independent beauty brands out of France. In four years, his body-care line has earned a prominent home within Rosewood luxury hotel properties around the world, from the spa at Paris’s Hôtel de Crillon to the 413 rooms at the group’s new flagship in Hong Kong. That’s all in addition to its loyal VIP following, which included Queen Elizabeth II shortly after the brand launched. But if personalities like actor Marion Cotillard and fashion designer Isabel Marant won’t travel without their Maison Caulières hand cream today, it’s for more than its skin nourishing properties. It’s also for the ancestral know-how, transparency in production, and a compelling story—intangibles that can catapult a small brand to stardom.

In the \$450 billion global beauty industry, cult favorites like Tata Harper, Sachajuan, and

MAISON CAULIÈRES

Bath oils, exfoliating scrubs, and moisturizers are made using oils produced at the family farm in France’s Loire Valley.

experience,” says Rosewood Hong Kong managing director Marc Brugger, who adds that the seasonality of the product was also a key selling point. After signing the deal with the hotel, the family-run operation has seen production mushroom from 5,000 per item to 700,000. And that’s saying nothing of their expanded reach.

L’Officine Universelle Buly, a five-year-old company with 19th-century apothecary-style boutiques in locations from Paris to Kyoto, has found success in offering a personal service that giant corporations would struggle to match. Beauty and aromatherapy experts offer tailored advice and easy navigation through what is essentially an old-world cabinet of curiosities with nearly 700 products: botanical-based creams, powders, essential oils, and perfumes. Sundries including combs, silk bristle acetate toothbrushes, and candles come in exquisitely illustrated plastic-free bottles and tubes that clients can personalize with their initials and keep as collectibles.

Meanwhile, the philosophy behind Ormaie, an all-natural unisex perfume line that eschews plastics and impure materials, hinges on two insights: Scents should be an extension of nature, and the bottles they come in should be works of art worthy of the mantle, even when empty. Producing such a concoction took its founders, mother-son duo Marie-Lise Jonak and Baptiste Bouygues, two years to perfect, largely because they had to convince leading noses in Grasse, the town on the French Riviera that’s the nation’s perfume capital, that it was even possible to create a truly natural fragrance that actually smelled good. “Most perfumes are 95% synthetic, and brands dilute their formulas to keep costs down,” says Bouygues, who previously worked for Louis Vuitton and Givenchy. “The benefit of being small is that we can push ourselves creatively and don’t have the same pressures of

L’OFFICINE UNIVERSELLE BULY

This Parisian purveyor of old-timey curiosities sells goods including badger-bristle toothbrushes and almond shaving cream.

profitability as a big group. We’re not in this because natural is trendy or to yield huge margins—it’s because we believe in the elegance of nature to create a special olfactive experience.”

That experience, which U.S. consumers can find online or at Barneys New York, comes in seven different scents and is eminently sustainable, inside and out. The bottles are made from recycled glass, and the colored-wood tops, inspired by the work of sculptor Constantin Brancusi, are sourced from renewable forests in France and are hand-carved and polished. Entering the market at 190 euros a bottle (about \$215), Ormaie is poised to compete with the industry’s luxury mainstays. Given the climate of transparency, the duo hope to convert customers who traditionally wear big-name synthetic fragrances. Bouygues is optimistic: “It’s like the electric car—if you want people to buy it, it has to be better than the alternative.” ■





Christian Navarro, president, Wally's Wine & Spirits, at the Santa Monica store.

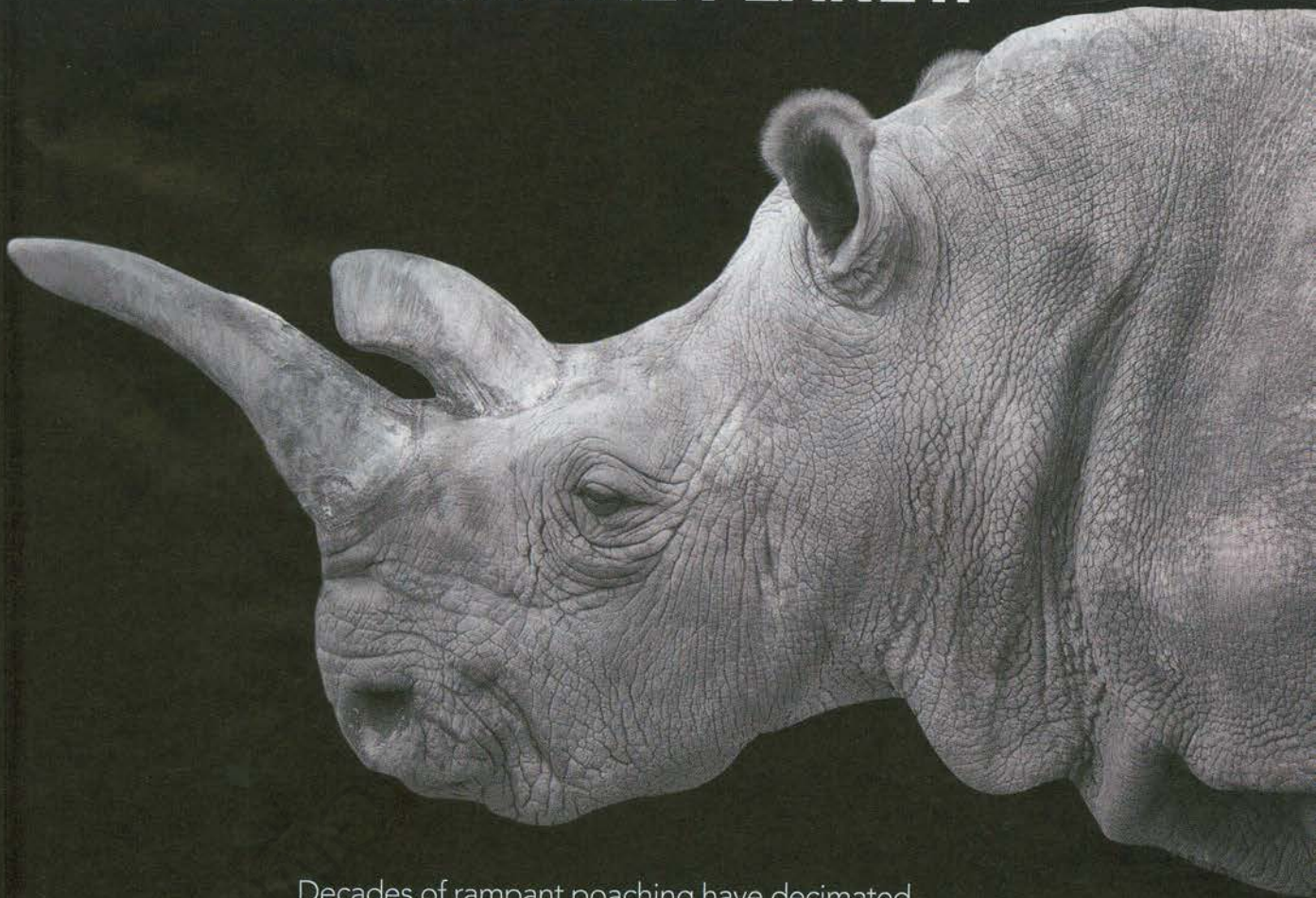
HOLLYWOOD'S WINE SELLER

Meet the man who keeps the stars stocked with the best vintages. By Sheila Marikar

DRINK

CHRISTIAN NAVARRO CAN BARELY stride 10 paces down the big, breezy corridors of the Four Seasons Resort in Maui without stopping to clap a shoulder or kiss a cheek. Though this Hawaiian luxury hub plays host to many traditional celebrities—the Oscar-winning actor Mahershala Ali hangs out by the lobby, awaiting a car—on this weekend, the first in March, 52-year-old Navarro, the president of Los Angeles' preeminent wine seller, Wally's Wine & Spirits, is top dog. He's organized the resort's first annual wine and food classic, convening high-end produc-

THERE ARE ONLY 2 NORTHERN WHITE RHINOS LEFT ON THE PLANET.



Decades of rampant poaching have decimated this species to the brink of extinction. But there's hope.

San Diego Zoo Global is leading the fight to save these gentle giants. And your support to the San Diego Zoo Global Wildlife Conservancy creates action and impact. Will you join us?

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NAVARRO'S GUIDE TO BUILDING A CELLAR

Say I'm a casual wine drinker, and I want to invest in a cellar.

Where should I start?

Buy wines that have ageability: good quality Cabernet Sauvignon, Pinot Noir. Something with stamina. You don't want to take a Chenin Blanc from Santa Barbara, put it in a wine cellar, and three years later think it's going to be better. That generally doesn't happen.

Are there particular vintages that are a good value right now?

Get in on inexpensive Bordeaux and really nice California Cabs. I'd recommend the 2015 Château Giscours (about \$65), the 2014 Jonata Todos (\$50), and 2014 Daou Reserve Cabernet Sauvignon (\$60).

Is there a wine region that hasn't quite peaked yet, where it would be good to start buying from?

The central coast of California is probably the most under-the-radar area in the world right now, from Santa Barbara to San Luis Obispo and Paso Robles. Those wines have very good quality, very high value, and they're waiting to be discovered.

Do you recommend any apps for managing a wine collection?

CellarTracker is great. You can see what your peers are thinking about a product and get a communal rating, instead of some dusty old guy south of London determining when you open something.

Is it true that if you're planning to cellar a particular wine, you should buy multiple bottles of it?

Absolutely. Here's what happens: You

buy wine, you put it in your cellar, you take it out, you discover, "This is amazing. It just needs two more years." Two years later, you have another bottle set aside. It's the journey you take with the wines, that's the fun.

Where should I get the wine that's going in my cellar? A vineyard, an auction, a website, my local wine store?

First, discover what you like, and then you should probably have a relationship with all of the above. It's crucial to develop a relationship with a merchant to find out what the best varietals are for you, how long you want to age them, and what you're looking for as far as taste profile. A good merchant will have a lot of selection. Wally's has 8,000 unique bottles. I guarantee we have 500 items in your price range. —S.M.



Navarro's picks for starting your cellar: robust reds from California and Bordeaux.

ers from France, Italy, California, and 200 wine connoisseurs for four days that might best be described as oenophiles gone wild.

By the adults-only pool, there's a "glassology" class taught by a Riedel representative who decries the ubiquitous balloon-shaped glass as "the enemy of all red wine." (He instructs note-taking attendees to pour a New Zealand Sauvignon Blanc from a narrow glass into a paper cup, asks his co-instructor what it smells like in that lesser vessel, and nods

gravely at her response: "tragedy.") On a lawn overlooking the ocean, the "Discovery of Pinot Noir" seminar devolves into a debate about the merits of making Pinot in California vs. France. ("They can have hail in July," says a Napa loyalist. "We have an embarrassment of sunshine.") On the balcony of a penthouse suite, it's time to saber a magnum of vintage Billecart-Salmon Champagne, but the sharpest tool in the room is a butter knife. No matter! An assistant rushes down to the

lawn to shoo passersby away from potential flying cork and glass, but a suave Frenchman does the job quickly, cleanly, and seemingly effortlessly as Navarro whoops and shoots a video on his phone. As the host, isn't he a bit anxious?

"Look, we're in Hawaii," he says. I think I see his eyes roll behind his shades; a diamond-encrusted cross glints below his neck. "For me, it's easy. People showed up; these guys are professionals. I just have to go around, shake hands, and remember everybody's name. If I can do that, it's all good."

Navarro's swagger and carefree attitude belie his unlikely ascent to the top of the high-end wine world. His mother brought him to the U.S. when he was a toddler, fleeing violence in their native Mexico City. They settled in Palm Springs, but Navarro "never went to school," he says, and at 18 he hitchhiked to Los Angeles with dreams of making it as an artist and friends who let him crash with them, to a point. "I was homeless," he says. "I lived on the street and needed to get a job." He applied for one at a frozen yogurt chain called Penguin's and another at Wally's, a wine shop in the Westwood neighborhood of L.A. "Penguin's didn't hire me because I didn't have a high school diploma," he says, "but the wine store needed a floor sweeper."

He struck up a friendship with the founder of Wally's, Steve Wallace, who got curious about his floor sweeper's palate after he wafted a Pinot Noir under Navarro's nose and Navarro correctly identified its aroma as strawberry. "I sat down and started tasting wine, and I found, even though I couldn't read very well, I can't do math very well, I'm probably a little dyslexic, that I could remember everything I smelled and tasted, and then was able to articulate it back," he says. During the 1980s he was Wallace's right-hand man, nurturing relationships with famous clients who came in to build their cellars, like Tom Cruise, Jack Nicholson, financier Michael Milken, and Michael Ovitz, cofounder of Creative Artists Agency. "Those two guys [Milken and Ovitz] took me under their wing and introduced me to everybody," Navarro recalls. "They kept saying I'm the best. Even if I'm not the best, if they say I'm the best, now I'm the best."

Because of his deep virtual Rolodex of wine

DRINK

"BOOKED
A PRIVATE
ROOM AT
WALLY'S/
WAITER
TWISTIN'
THE CORK."
—DRAKE,
"DIPLOMATIC
IMMUNITY"

buyers and sellers, if Navarro gets, say, an allocation of a particularly coveted Bordeaux, he very likely knows collectors who have been waiting to pounce on it. These days he texts with clients like Drake, who rap-bragged about booking a private room at Wally's in his 2018 song "Diplomatic Immunity": "Booked a private room at Wally's/Waiter twistin' the cork." Drake was referring to the Beverly Hills location of Wally's, a hybrid bar, restaurant, and wine shop; a similar outpost opened in Santa Monica last year.

In 2013, when Wallace retired, Navarro bought Wally's with Paul and Maurice Marciano, the brothers behind the Guess clothing line who have long trusted him to steer them in the right direction when it comes to wine. "He has a passion for wine, a knowledge for wine, that I haven't seen in many people," says Maurice. "He also has great, great contacts. He develops relationships. There is no price for that. Either you have it or you don't."

In 2016, the Maui Four Seasons entrusted Navarro with the task of elevating its wine lists. (Guests in "elite suites" can choose from a rarefied menu that includes a 2012 Château Pétrus and a 2009 Cristal.) "He also said, 'It can't be me picking the wines, and you leave it at that,'" says Mark Simon, the resort's director of marketing. "You need to invest in your people."

At Navarro's suggestion, the resort established a program that pays for sommelier training for any employee who's interested. It now has 20 people in the sommelier program and one master sommelier. "Three years ago, we only had two somms on property, total," Simon notes.

Somms greet Navarro with bear hugs. Throughout the weekend, well-wishers buzz around him. But he continues to insist he's nothing special. When asked if there was a moment when he realized that he's pretty good at this wine thing, he says, "I still don't think that. Because of my youth and my past, I've never really looked in the rearview mirror. If I stop to think about it, it kind of scares me." Plus, he says, gesturing at the bubbling Billecart-Salmon, there are more pressing matters at hand. "You can come here and have a world-class gastronomic experience. In the Pacific, there's nothing like this." ■

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500 RANK

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ALPHABET

REVENUES

\$136.8 BILLION

PROFITS

\$30.7 BILLION

EMPLOYEES

98,771

TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

21.1%

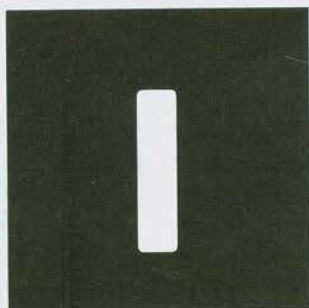
GOOGLE'S CIVIL WAR

Some employees say Google is losing touch with its "Don't be evil" motto. What happens when an empowered tech workforce rebels?

By BETH KOWITT







T STARTED IN TOKYO ON Nov. 1, 2018, when 100 employees walked out of Google's office at 11:10 a.m. local time. Thirteen hours later, the elevators at the company's New York City headquarters were so packed that workers took the stairs down to the street to protest. Google employees in Austin observed two minutes of silence for victims of sexual assault as part of their dem-

onstration. In San Francisco, hundreds of employees gathered across from the historic Ferry Building and chanted "Time's Up at Google" and held signs with slogans like "Workers' Rights Are Women's Rights" and "Free Food ≠ Safe Space."

After Googlers in Sydney walked out, 25 hours after Asia had kicked things off, 20,000 Google employees in 50 cities around the world had joined their colleagues to protest the company's handling of sexual harassment.

The spark that ignited the walkout was a *New York Times* article that had appeared a week earlier, reporting that Google paid former executive Andy Rubin a \$90 million exit package, despite facing a sexual misconduct accusation Google deemed credible. (In a statement to the *Times*, Rubin said the story contained "numerous inaccuracies about my employment.")

It was the first time the world had seen such a massive worker protest erupt out of one of the giants of the technology industry—and certainly the first time outsiders got a glimpse at the depth of anger and frustration felt by some Google employees. But inside the Googleplex, the fuel that fed the walkout had been collecting for months. Tensions had been on the rise as employees clashed with management over allegations of controversial business decisions made in secret, treatment of marginalized groups of employees, and harassment and trolling of workers on the company's internal platforms. "It's the U.S. culture war playing out at micro-scale," says Colin McMillen, an engineer who left the company in February.

To many observers, the tech workforce—notoriously well-paid and pampered with perks—hardly seems in a position to complain. And it's a surprising tune to hear from employees of one of the titans of Silicon Valley, a place that has long worshipped at the altar of meritocracy and utopian techno-futurism. But in the past few years, the industry's de facto mission statement—change the world (and make money doing it!)—has been called into question as examples of tech's destructive power multiply, from election interference to toxicity on social media platforms to privacy breaches to tech addiction. No one is closer to tech's growing might, as well as its ethical quandaries, than the employees who help create it. "People are beginning to say, 'I don't want to be complicit in this,'" says Meredith Whittaker, who leads Google's Open Research group and is one of the walkout organizers. Workers are beginning to take responsibility, she says: "I don't see many other structures in place right now that are checking tech power."

As the so-called techlash has cast a pall over the entire sector, organized employee pushback is slowly becoming part of the landscape: Amazon workers are demanding more action from the company on battling climate change; at Microsoft, employees say they don't want to build technology for warfare; at Salesforce, a group has lobbied management to end its work with the U.S. Customs and Border Protection agency. Meanwhile, there's not a company in the sector that isn't grappling at some level with the ways bro-gramming culture has made tech a toxic space for women and employees of color.

But nowhere has the furor been as loud, as public, and as insistent as it has been at Google. That's no surprise to Silicon Valley insiders, who say Google was purpose-built to amplify employee voices. With its "Don't be evil" mantra, Google was a central player in creating the rosy optimism of the tech boom. "It has very consciously cultivated this image," says Terry Winograd, a professor emeritus of computer science at Stanford who was Google cofounder Larry Page's grad school adviser and would go on to serve on the company's technical advisory board. "It makes them much more prone to this kind of uprising." Page, now 46, and cofounder Sergey Brin, 45, intentionally created a culture that encouraged the questioning of authority and the status quo, famously writing in their 2004 IPO letter that Google was not a conventional company and did not intend to become one.

Some workers say Google's promise to remain unconventional is in question. Interviews with 32 current and former employees revealed a demarcation between what several called "Old Google" and "New Google." Whether there's a clear-cut line between these eras—the company got its start in a Menlo Park, Calif., garage in 1998, when Page and Brin were still Ph.D. students at Stanford—depends on whom you ask. But there is a pattern in how they describe the change: At Old Google, employees say they had a voice in how the company was run. At New Google, the communication and trust between the rank and file and executives is in decline. Decision-making power, some say, is now concentrated at the



MAKING CHANGE FROM THE INSIDE
Walkout organizer Meredith Whittaker has also protested some Google business decisions.

very top of a company run by executives who are increasingly driven by conventional business metrics.

Now Google finds itself in the awkward position of trying to temper the radical culture that it spent the past 20 years stoking. Boasting more than 100,000 employees between Google and its parent company, Alphabet, executives acknowledge that the company is struggling to balance its size with maintenance of the principles, like employee voice, that were so foundational. "You can't go through that kind of growth without the culture needing to evolve," says Jen Fitzpatrick, a Google SVP and a member of CEO Sundar Pichai's leadership team. (Pichai declined *Fortune's* requests for an interview.) The company says it is trying to manage its ballooning diversity of perspectives and projects, as well as do

LOKMAN TSUI: Google's former head of free expression in AsiaPac



WHO DECIDES WHAT GOOGLE IS? IS IT LEADERSHIP OR EMPLOYEES?"

a better job predicting the kinds of issues for which employees will demand full transparency. However, it adds that the activist employees are a small but vocal group, and that their opinions don't represent those of employees at large.

"Twenty-eight was a different year for us—the magnitude and the nature of some of these issues is just different," says Brian Welle, VP of people analytics at Google. The tumult was reflected in the results of the annual companywide Googlegeist survey, which was leaked to the press in February. Key metrics were down double-digit percentage points over 2017. For instance, while 74% of respondents said they had confidence in Pichai and the management team, that's an 18 percentage point drop from the previous year.

Most challenging to Google is employees' refusal to keep their discontent within the company's walls, a strategy that's been bolstered

by activists' sophisticated use of the media and the world's fascination with the iconic company. The scene that played out at the walkout was, on one level, as familiar as a factory strike—a labor force flexing its collective power to send a message to The Man (in this case, CEO Pichai). But even as activists inside Google are relying on traditional labor organizing tactics, their demands are not just the typical wage or benefits ask. It's about much more than a paycheck; employees, it's clear, want a say in and control over the products they build.

Google has already transformed so many aspects of the way we work today. The walkout was an inflection point, a sign that the company is now poised to disrupt something even more foundational to our economic system: the relationship between labor and capital. It's a shift that could perhaps begin only in Silicon Valley, a place that has long believed itself above such traditional business concerns—and, more to the point, only at this company, one that hired and retained employees on the premise of do no evil. Now employees seem determined to view that manifesto through their own lens and apply it without compromise, even at the cost of the company's growth. "Who decides what is the soul of Google and what Google is?" asks Lokman Tsui, formerly Google's go-to executive on issues of free expression and censorship in Asia and the Pacific. "Is it leadership or employees? There's a real battle for the soul of these companies right now."

GOOGLÉ'S BROAD MISSION of organizing the world's information and making it more accessible has led the company to digitize books, mount cameras on the top of cars in order to map the world through images, and design virtual reality viewers made of cardboard.

But as the company has grown ever larger, so have its ambitions. In 2018, as Google employees found out about two new secretive projects that were underway, some questioned whether the tech giant had stretched too far beyond the bounds of its mandate in the name of expansion.

The first was the Pentagon's Project Maven, which uses artificial intelligence to help analyze drone footage. Google became a sub-

contractor to the Department of Defense for Maven in 2017, but most people inside the company didn't learn about it until the following year, when an employee wrote an unsanctioned post about the clandestine project on Google's internal social media platform. Executives told worried employees that Maven was defensive rather than offensive. Still, some workers were concerned that Google's technology could ultimately be used to make drone strikes more lethal, and that Maven would lead to additional deals between Google and the military. What's more, some say management's argument that the contract was in support of "our" military did not always resonate with a global workforce.

For Laura Nolan, then a Google engineer working in Ireland, "It was such a betrayal," she says. "We're pretending to be a happy company that does lovely information organizing, and then you're building several steps toward killer drones flying around." Nolan, who says her work would have enabled future stages of Maven, quit the company over it. Employees like Nolan didn't expect Google to be a defense contractor like Raytheon—or even like Amazon, which has been open and unapologetic about working with the military.

Even before the bulk of the company learned about Maven, several senior engineers were escalating their concerns internally. Once Maven became more widely known, the resistance spread, with a group of employees writing a letter to Pichai asking that he cancel the project. In March

HEY, GOOGLE, WHAT HAPPENED NEXT?

From clandestine projects to leaks to walkouts, it's been an eventful couple of

JULY 2017

DAMORE MEMO

Google engineer James Damore posts an internal memo arguing against the value of diversity in tech; Google ultimately fires him.

FEBRUARY 2018

PROJECT MAVEN LEAKS

Most employees learn for the first time that the Pentagon was using the company's A.I. to analyze drone footage.

JUNE 2018

MAVEN DISCONTINUED

Google announces it will not renew its contract for Project Maven and releases a set of A.I. principles to guide its use of the disruptive technology.

AUGUST 2018

DRAGONFLY LEAKS

The Intercept reports that Google is working on a censored search engine in China; it's the first most employees are hearing of the project.

OCTOBER 2018

PAYOUT REVEALED

The Times reports that Google paid former exec Andy Rubin \$90 million despite a sexual misconduct accusation. [Rubin contested the reporting.]



JACK POULSON:
Former Google research scientist

WHAT ARE GOOGLE'S RED LINES AROUND CENSORSHIP AND SURVEILLANCE? I STILL DON'T KNOW."

2018 the company tried to address concerns at its weekly all-hands meeting, known as TGIF. The gathering has been core to Google's culture since its early days, in large part because it gives anyone the chance to question senior management. At the meeting, an employee told executives she used to work for the Department of Defense but left to avoid contributing to military technology. What, she asked, were her avenues for letting management know this was not okay? The fact that you can ask that question here is a powerful voice, Brin told her. At some companies this would have been a sufficient answer. At Google it was not.

Management continued to put together forums to try to address employee concerns and explain why they believed Maven was a worthwhile project, holding three town halls to discuss the ethics of A.I.

A group of organizers kept up the pres-



"NOT OK, GOOGLE": Globally, 20,000 Google employees participated in the November 2018 walkout.

sure, making sure there was a Maven question every week at TGIF. They tracked the number of employees who quit over the issue, handed out stickers, and made mocking memes about Maven on Google's internal meme creator. The debate turned public in April 2018 when the original letter sent to Pichai, which would eventually garner nearly 5,000 employee signatures, was leaked to the *New York Times*.

In June, Google announced that it would not renew its contract for Maven and released a set of A.I. principles laying out guidelines for the future of the technology—including a vow not to use it to create weapons. Most of the employee activists viewed the announcement as a win, but speaking at a *Times* conference later that year, Pichai played down the influence of the internal pressures. "We don't run the company by referendum," he said. He explained that he had listened to people actually working on building A.I. in making the decision. He stressed, however, that the company continued to do work with the military in areas like cybersecurity.

Then, in August, just as the tensions over Maven were beginning

years at Google.

**NOVEMBER 2018
GOOGLE WALKOUT**
Twenty thousand employees in 50 cities around the globe demonstrate to protest the company's handling of sexual harassment.

**DECEMBER 2018
DRAGONFLY DISCONTINUED**
By the end of the year, all Dragonfly employees were informed that they were being reassigned.

**FEBRUARY 2019
FORCED ARBITRATION ENDS**
Google says it will no longer require current or future employees to arbitrate any employment disputes.

**APRIL 2019
A.I. ADVISORY COUNCIL DISBANDS**
Google disbands the group after employees protest the inclusion of the head of the Heritage Foundation.

**MAY 2019
RETALIATION CLAIMS**
Employees stage a sit-in after two Googlers accuse the company of retaliating against them for their organizing efforts. Google denies the accusations.

**GOODBYE,
GOOGLE**
A longtime
Google activist,
engineer Liz
Fong-Jones,
quit after the
walkout.



to dissolve, The Intercept published a story revealing that Google was working on a censored search engine for China—code-named Dragonfly—that would block information related to topics like human rights and democracy. For most employees, this was the first they had heard of it. (Google says the project was exploratory and was therefore still confidential.)

Jack Poulson says he was the sixth or seventh employee to cite Dragonfly as a reason for quitting. “It was crossing a line for what it was I felt I wanted to do with my life,” says Poulson, who was a senior research scientist at Google. “I was literally profiting from a company suppressing political speech.” When, the following month, the U.S. Senate’s Commerce Committee called on Google’s chief privacy officer to testify at a hearing about data privacy, Poulson sent his own letter to the committee: “I am part of a growing movement in the tech industry advocating for more transparency, oversight, and accountability for the systems we build.”

Google had previously operated a search engine in China but pulled out in 2010 after the company got hacked. At the time, management had taken what some viewed as a moral stand, with Brin saying he saw “earmarks of totalitarianism” in the country. With Dragonfly, some employees supported the return. But for those who described the 2010 decision as a defining moment for Google’s culture, the reversal was galling. “I wondered what the heck had changed in the eight years since then,” says McMillen.

Pichai was asked that question at the *New York Times* conference. His response: “Our mission is to serve everyone in the world. As part of that, it’s natural we would think about users in China as well.” He added that Dragonfly was an experiment, and “nothing was imminent.”

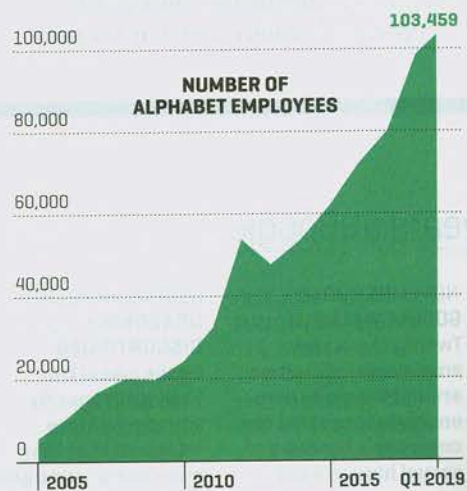
Then a new employee, McMillen recalls the company’s 2010 decision to pull out of search in China as foundational—the literal

embodiment of Google’s “don’t be evil” ethos. “As part of the perks, Google offered you the self-satisfaction of doing good in the world,” says Whittaker, who was involved in the employee resistance to both Maven and Dragonfly. “That was profound for a lot of people.” Paul Buchheit, a one-time Google engineer who’s credited with coining the mantra in the early 2000s, says “Don’t be evil” was not a magical, black-and-white standard. It was a way to pause and be reflective about the work. How did the company decide whether a given project met the criteria? “Any arbitrary employee was empowered to ask,” he says.

Because Dragonfly began in secret, some employees believed they’d been robbed of that opportunity. Nor were they convinced that Google management had asked itself the hard questions. “There was never any communication that they had thought through the ethical ramifications,” says McMillen. Workers should be able to make their own well-informed ethical decisions about giving their labor to Google, he says. Some workers indirectly involved in Dragonfly hadn’t even known what they were

SEARCHING FOR GROWTH

The company’s workforce has more than tripled since 2011, reaching a scale that some say has strained its corporate culture.



SOURCES: BLOOMBERG; ALPHABET

working on. "What are Google's red lines around censorship and surveillance?" asks Poulson. "I researched this as much as I could as an employee and still didn't know."

While Maven, Dragonfly, and even the Rubin payout that gave rise to the walkout angered employees for different reasons, there's at least one connecting thread: secrecy. The company that was built around the value of information sharing had hit a threshold where a growing number of decisions were made behind closed doors. "We've always had confidential projects as a company," said Pichai at a TGIF, according to a transcript of the meeting provided to *Fortune*. "I think what happened when the company was smaller, you had a higher chance of knowing about it."

BUT WHERE GOOGLE management has increasingly used confidentiality as a tool to maintain control of decision-making, some of Google's activist employees have gone in the opposite direction—turning to the media to amplify their concerns.

That's a dramatic cultural shift for a company at which talking to the press without approval once guaranteed you'd be "viewed as a pariah," says Liz Fong-Jones. A former Google site reliability engineer, Fong-Jones had never had a problem criticizing Google, provided it stayed within the company's (virtual) walls.

But in January 2018, her perspective changed. The catalyst: Google engineer James Damore's infamous July 2017 memo, an internally published 10-page document arguing that women are underrepresented in the industry owing to biological differences rather than societal factors like bias, and that the company's diversity efforts were discriminatory. The posting by Damore, who was ultimately fired, created a furor on Google's freewheeling message boards and mailing lists. These internal communication channels are one of the oddities of Google's culture: The company has tens of thousands of them dedicated to everything from engineering to all things cats—run by the so-called Mewglers.

Things got even uglier when Damore sympathizers leaked comments made on

POWER TO THE PROGRAMMERS?

When it comes to employee activism, Silicon Valley is at a crossroads. At some tech giants (Apple, Facebook, Oracle), workers are still largely toeing the company line. But others are contending with employees who seem to be following the Google playbook:

MICROSOFT

Beginning in 2018, employees at the software powerhouse have protested the company's work with Immigration and Customs Enforcement, its contract to provide the U.S. Army with augmented-reality headsets, and its treatment of female employees.

AMAZON

Workers last year demanded that the company stop selling facial recognition tools to the U.S. government. In April, more than 4,500 Amazonians urged the company to take action on climate change—including ending cloud services for oil and gas companies.

SALESFORCE

Last year, workers at the cloud-computing company called on their employer to reconsider Salesforce's contracts with U.S. Customs and Border Protection, citing the Trump administration's family separation policy; more than 650 employees signed the letter.

the message boards by Fong-Jones, a trans woman, and other Google diversity advocates to right-wing news sites. As a result, Fong-Jones says, the group was besieged by harassment and violent threats, which, despite their repeated pleas for help, management was unable to halt. "We were asking them to stop these malicious leaks," she says. Fong-Jones had a proven track record of getting management to listen to her. She'd successfully spearheaded an effort to get the company to end its policy requiring people to use their real names on its social media site Google Plus, convincing executives that such a policy would expose the most vulnerable users to trolling and worse. But now she felt like the lines of communication between management and employees had broken down.

It was enough for her to decide that this was a problem that would not be solved internally. In October 2017, Fong-Jones and a group of other targeted employees met with Coworker.org, an organization that usually works with low-wage workers, to help think through a PR and internal organizing strategy. "It was clear to us the company wasn't going to do anything, and we needed to apply media pressure," Fong-Jones says. In January she and 14 other current and former employees talked about the harassment—and Google's response to the issue—with *Wired*.

Understanding that going to *Wired* without company approval had broken a Google taboo, members of the group published an internal post explaining their motivation—and making clear that they drew a distinction between discussing working conditions (a protected right under labor law) and leaking information about Google products or other confidential company information, which they continued to believe was off limits. Unsurprisingly, not all of their fellow employees bought the justification: "I got some

negative comments along the lines of, this really sucks for you, but why did you air Google's dirty laundry?" says McMillen, one of the then-Google employees who spoke to *Wired*.

One reason Fong-Jones says she takes a hard line against product leaks is that they provide management with a strong justification for sharing less information with employees. Some point to what happened last August as a prime example. Brin and Pichai were addressing the weekly TGIF meeting when it became clear that someone in the room or watching the livestream of the event was leaking what was being said to a *New York Times* reporter—who was tweeting the discussion, in real time, to the world at large. One employee stood up and said "Fuck you!" to the anonymous leaker, to the applause of his colleagues. "That ruined TGIF forever," says McMillen. "Nothing of interest is going to be said at TGIF anymore."

When he left Google, Poulson says he was warned against talking to the media. "I was explicitly told that should I ever want to come back to the company, they could ignore my politics and focus on my technical contribution as long as I didn't do something as unforgivable as speak to the press," he told *Fortune*. "To be blunt, I don't think they will be happy I'm having this phone call with you."

A **HEAD OF THE WALKOUT**, Pichai sent out a memo to employees voicing his support and acknowledged at a conference that day that Google had not always gotten it right. "There's anger and frustration within the company," he said. "We all feel it. I feel it too." At headquarters in Mountain View, CFO Ruth Porat joined the walkout with her team. Other executives simply avoided the question of whether to participate. Fitzpatrick told *Fortune* she had been out of the office that day and declined to revisit it when asked if she would have participated had she been on campus.

Parts of the corporate response rubbed organizers the wrong way. They viewed executives' embrace as an attempt to recast the walkout as some sort of sanctioned company picnic. And if Porat supported the walkout, some asked, why didn't she use her power as a C-suite executive to implement their demands?

Both McMillen and Fong-Jones quit not long after, saying they found the company's response lackadaisical. For Fong-Jones, the biggest disappointment was the company's unwillingness to comply with the organizers' demand to put a worker representative on the board. "Employees are in a really good position to understand the issues," she says. She was happy people were staying to fight, but she was burned out.

Google management has shown a willingness to listen to employees—and, in some cases, to change. The company says it had become over-reliant on TGIF and is now too big and sprawling to address every issue in the weekly one-hour meeting. It's experimenting with adding different forums, like town halls focused on single topics, such as its recently published diversity report. "That was a realization that we came to as we started to see people raising their hands and saying, 'My voice isn't getting heard enough,'" says Fitzpatrick.



SUNDAR PICHAI: Google CEO

WE DON'T RUN THE COMPANY BY REFERENDUM."

And in an attempt to quell the increase in uncivil interactions on its internal platforms, its new "community guidelines" ban slurs and references to sex acts in any work document and require every online group to have a moderator, who must go through training. The company has also revamped internal reporting channels for issues like sexual harassment.

The Google organizers have taken to calling themselves the "entitled vocal majority," after one employee publicly referred to them as the "entitled vocal minority." No matter its size, there's no denying the group has been impactful, playing a role in Google's decision to not renew its contract for Project Maven. The company also has killed Dragonfly, saying there are no plans to launch search in China and that no work is being undertaken on such a project. Google has also pulled out of its sponsorship of the Conservative Political Action Conference—it irked the company's liberal employees to see the company's logo next to the NRA's—and disbanded its artificial intelligence ethics council after employees published an open letter contesting the appointment of the president of conservative think tank the Heritage Foundation.

Google employees have started to flex their power beyond the company too. The one walkout demand Google met was doing away with forced arbitration, which required employees settle their disputes with the company behind closed doors. A group of Googlers has taken the fight to Washington, where it is pushing for legislation that would ban the practice. "Congresspeople take meetings with Google workers that they didn't take with Chipotle workers," says Vicki Tardif, an ontologist at Google, who has been with the company for eight years. If they're able to help push something

DO NO EVIL?

Claire Stapleton is one of two Google employees who have accused the company of retaliation. [Google denies the allegations.]



through, she says, “then we’ve done that greater good that we came to Google to do.”

In April, the conflict inside the company reached a new level when Whittaker and Claire Stapleton, two women instrumental in planning the walkout, published an open letter accusing Google of retaliating against them for their organizing activities. Whittaker wrote that after the A.I. council was disbanded, she was told that in order to remain at the company, she would have to abandon her work on A.I. ethics at Google as well as at the AI Now Institute, an outside organization she cofounded. Stapleton said that after almost 12 years at Google, she was told two months after the walkout that she would be demoted and later that she should go on medical leave, even though she wasn’t sick. It wasn’t until she hired a lawyer that Google conducted an investigation and walked back her demotion, she wrote. “We’re tapping into something that’s an existential threat to Google,” Stapleton told *Fortune*. The company responded to their accusations that day with a statement saying there was no retaliation and that it prohibits “retaliation in the workplace and investigates all allegations.”

To some employees, the charges of retaliation are the most serious yet levied

against the company. Much of the organizing efforts have been led by site reliability engineers (SREs). Their remit is to operate the most critical services Google runs. When something breaks, they’re the ones who get paged to fix it. They troubleshoot and diagnose problems, and they are expected to have opinions and questions. “You have to go probe for weaknesses,” says Fong-Jones, who was an SRE, “and also challenge people when you think something that they’re trying to railroad through is not okay.” Within the SRE world, there’s a concept called blameless postmortem—it’s a way of looking back at mistakes made without throwing anyone under the bus. “It’s a fundamental part of the culture at Google,” says Tariq Yusuf, a privacy engineer who’s been with the company almost five years. “It’s an ability to say this is a thing that’s wrong.” Retaliation, he says, removes the core barrier of being able to safely raise issues. “The whole process breaks down.”

The organizers have started to label their tactics as labor organizing, which some had previously avoided, fearing that it would be off-putting to a workforce that had traditionally aligned itself more with management. During Maven, a few employees went on “interview strikes,” declining to participate in interviewing and recruiting candidates—a form of protest they accelerated in response to the retaliation claims. On May 1, International Workers’ Day, six months after the walkout, employees embraced another old-school labor organizing strategy, staging a sit-in to address retaliation. In New York, the mood was somber, almost vigil-like. A couple hundred employees gathered to talk about the different kinds of retaliation they said they had faced: for organizing, for reporting sexual harassment. Some cried. There was even talk of forming a union. “We’re not walking back our gains,” says Whittaker, “and we’re not going to shut up.” ■

500 RANK

9

AT&T

REVENUES

\$170.8 BILLION

PROFITS

\$19.4 BILLION

EMPLOYEES

268,220

TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

5.7%

AT&T'S HEAVY LIFT

Bellhead **Randall Stephenson**
has assembled a media empire.
Now comes the hard part.

By **GEOFF COLVIN**



ON THE THRONE:
CEO Randall Stephenson spent more than \$170 billion building a content and distribution colossus.



AT&T WAS NOT ACTUALLY ACQUIRED by a company called Game of Thrones Corp. earlier this year, though consumers could be forgiven for wondering. AT&T cell phone stores across the land seemed to have been taken over by a vaguely medieval industrial behemoth that had filled them with the heraldry of House Lannister, House Stark, and other Westerosi factions, plus

costumes, weapons, and *GOT*-emblazoned smartphone cases, wireless chargers, and water bottles. Viewers of *March Madness* on AT&T-owned TBS saw slightly weird *GOT*-themed promos for the college basketball tournament and *GOT*-themed tweets (“Send a raven—they’re on to the #Elite8. #MarchMadness”). Another sign of *GOT*’s ascendance: The Iron Throne itself—or rather, a seven-foot-high, 310-pound replica of it—sits prominently in the lobby of AT&T headquarters in Dallas.

AT&T chief Randall Stephenson walks past that throne every day, but he doesn’t think much about the Lord of the Seven Kingdoms. In his world, *Game of Thrones* symbolizes something else: the first faint glimmers of how his costly vision for AT&T will work. Using company properties to publicize the show’s final-season premiere on AT&T-owned HBO is a minor example of the synergies he foresees; AT&T wireless customers with top-tier plans can also get HBO for free, for example. That’s a result of another titanic battle, the end in February of AT&T’s fight with the U.S. Department of Justice to win legal clearance to fully integrate operations with the Time Warner A-list media properties AT&T had agreed to buy more than two years earlier: most prominently, HBO, Warner Bros., CNN, TBS, and TNT.

Stephenson’s strategy is breathtaking in scale and scope, the largest transformation underway at any company in the *Fortune* 500. AT&T’s main traditional competitor, Verizon, has chosen an entirely different path, and Stephenson’s new rivals are in markedly different businesses. Back when AT&T was Ma Bell, after all, it was proudly staid, reliable, and boring. Stephenson marvels, “I spend as much time thinking about Amazon and Netflix as I do thinking about Verizon and Comcast now.”

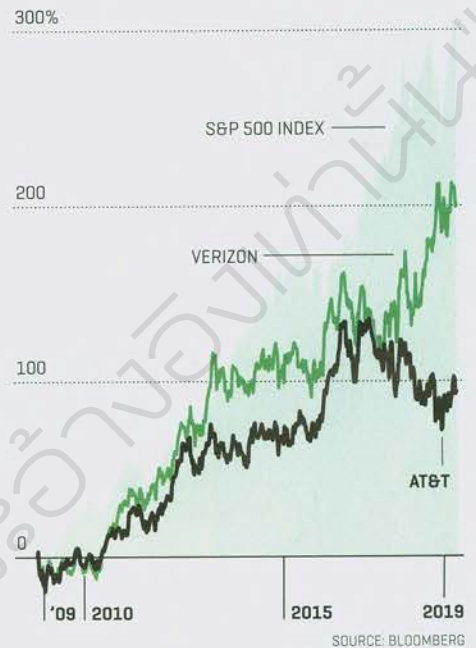
Stephenson also must think about the phone business, though, because it remains his biggest business by far—and it’s not growing, putting AT&T’s stock price and its financial future under

CRAIG MOFFETT : Wall Street telecoms analyst



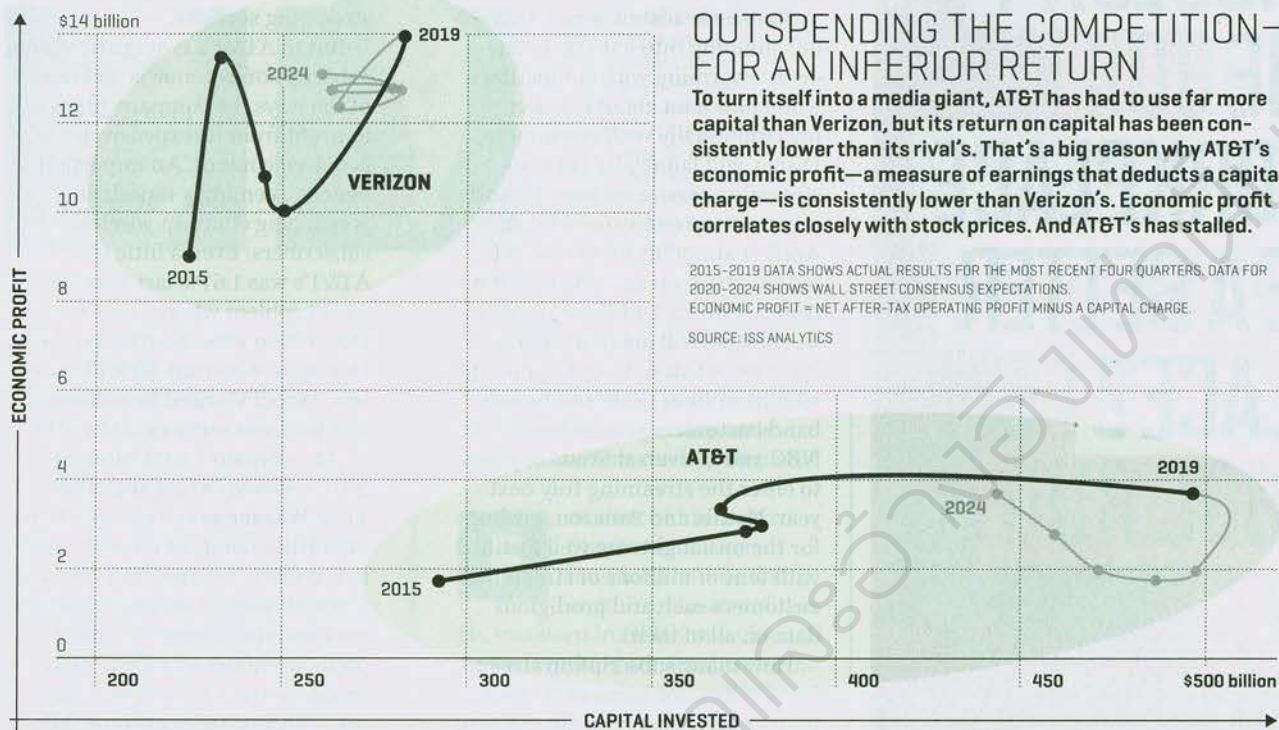
ITS GOAL IS NOTHING LESS THAN A COMPLETE REINVENTION OF THE MEDIA ECOSYSTEM.”

STOCK TOTAL RETURNS SINCE JAN. 1, 2009



pressure. That explains the company’s buying spree—and its massive debt load. Buying DirecTV in 2015 for \$67 billion and Time Warner in 2018 for \$104 billion has made AT&T the most heavily indebted nonfinancial company in America. Including lease obligations, which the accountants say must now be counted as debt, the company owes over \$200 billion. That’s about the size of the external debt of Taiwan. Such massive debt merely matches Stephenson’s audacity. “AT&T’s ambition in acquiring Time Warner goes far beyond transforming a storied American company,” says Craig Moffett, a long-time telecom analyst and an AT&T critic. “Its goal is nothing less than a complete reinvention of the media ecosystem.”

Whatever the outcome of the strategy, Stephenson owns it. He has been CEO since 2007, and now, at age 59, he has time to see it through. How his gigantic bet turns out will define his career and determine the future of one of America’s most



distinguished corporate names and largest companies, No. 9 on the *Fortune* 500. Right now, AT&T's stalled stock price suggests that investors are far from convinced.

THE GRAND VISION begins with combining all the major elements of the media and telecom businesses, which no company has ever done before. Time Warner's film and TV studios make some of the most successful and honored entertainment anywhere. Its cable networks—including TBS, TNT, CNN, Cartoon Network, and Turner Classic Movies—are distribution powerhouses. DirecTV carries those networks and others into homes through its satellite system. Add in AT&T's wireless and landline customers, and Stephenson boasts that AT&T has "170 million distribution points we can push this through."

With such a combination of media assets, the theory goes, AT&T can achieve unprecedented advantages. It can differen-

tiate its fast-commoditizing wireless network by offering customers deals on its proprietary content. It can expose its content to vast audiences through all its networks. Because it collects staggering volumes of customer data through its wired, wireless, and satellite networks, it can enable advertisers to target their messages with new precision and, in some cases, even track customers who have seen specific ads and thus gauge how the ads performed—services for which advertisers will gladly pay a big premium.

The immediate next step in the transformation, likely the biggest and most visible step, will be to introduce a video-on-demand Internet streaming service—a Netflix competitor—in this year's fourth quarter. AT&T says the new service eventually will include original content, HBO, movies from multiple studios, and library content from HBO and Warner Bros.

Making that all happen is the job of John Stankey, a 34-year phone company man who's now in charge of the former Time Warner, rechristened WarnerMedia. At the heart of the grand plan, he says, is something the old phone company wouldn't have known much about: emotion. Cell phones have become so indispensable that people are emotionally attached to them, and "our ability to now place content with that connectivity is another way to keep it emotionally relevant," says Stankey, sitting in a sunlit conference room on the executive floor of the Time Warner Center in Manhattan.

SHOULDN'T THE WORKPLACE BE A BETTER PLACE?

Stankey is acutely aware that he's jumping into a market suddenly swarming with competitors who know a lot about connecting emotionally with consumers. Disney will launch its Disney+ streaming service on Nov. 12, and investors were so wowed by an April 11 announcement that they bid the stock up 12% the next day. Apple, with its 1.4 billion devices worldwide, will debut a streaming service this fall. And Comcast, with 31 million cable and broadband customers plus ownership of NBC and Universal Studios, plans to enter the streaming fray next year. Netflix and Amazon, girding for the onslaught, are well fortified with tens of millions of streaming customers each and prodigious data on all of them.

How many subscription streaming services can survive? "I think it's someplace between 10 and two, and it's probably on the lower side of that scale," Stankey says. "A good outcome for a company like ours is that there are four or five. I think we've got a position where we can be one of those."

Whether that expectation is realistic remains to be seen. "We know that Netflix has the highest satisfaction score of any U.S. TV [streaming] service, with Amazon and [Disney-controlled] Hulu close behind, placing all three in relatively secure positions," notes Toby Holleran of Ampere Analysis. "This makes Disney+ most likely to displace the niche

streaming services."

But in AT&T's synergistic vision, subscription revenue is just one of the ways the company plans to profit from its expensively acquired content. An important benefit, seemingly mundane, is reducing churn in wireless subscribers. Even a little churn—AT&T's was 1.67% last year—is a big problem when you've got 153 million subscribers, says John Donovan, who runs AT&T's wireless, DirecTV, wired broadband, and business services units—79% of the company's \$171 billion in 2018 revenue (which included Time Warner as of June 15, 2018). "Ten basis points of churn is a billion dollars," he says, and company research shows that giving customers the right exclusive content on their phones can slow churn significantly. A customer might say, "This thing's awesome. My spouse took me out shopping, and I sat and watched football. It only takes one impactful video viewing per month for someone to say, 'I am never giving up AT&T on this phone,'" Donovan says. And when that happens, "you have 30 basis points less churn—3 billion bucks. It's real money."

Adding strength to the whole proposition is AT&T's unique aggregate customer data trove and its value in addressable advertising over DirecTV and AT&T's direct-to-consumer streaming services; ads can also be directed less precisely through the former Turner

JOHN STANKEY: CEO, WarnerMedia



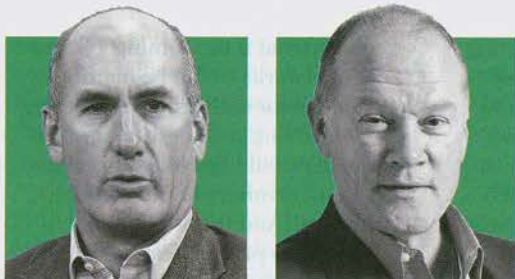
A GOOD OUTCOME FOR A COMPANY LIKE OURS IS IF THERE ARE FOUR OR FIVE [STREAMING SERVICES]. I THINK WE CAN BE ONE OF THOSE."

FORTUNE

RACEAHEAD

Every company is tackling diversity and inclusion in different ways. Ellen McGirt's newsletter follows their progress and those who hold them accountable.

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LORDS OF THE REALM: Key Stephenson lieutenants John Stankey (left) and John Donovan need to execute the boss's strategy. Stankey runs WarnerMedia. Donovan oversees phones and satellite TV services.

networks. "Say you and your neighbor are both DirecTV customers and you're watching the same live program at the same time," says Brian Lesser, who oversees the vast data-crunching operation that supports this kind of advertising at AT&T. "We can now dynamically change the advertising. Maybe your neighbor's in the market for a vacation, so they get a vacation ad. You're in the market for a car, you get a car ad. If you're watching on your phone, and you're not at home, we can customize that and maybe you get an ad specific to a car retailer in that location."

Such targeting has caused privacy headaches for Yahoo, Google, and Facebook, of course. That's why AT&T requires that customers give permission for use of their data; like those other companies, it anonymizes that data and groups it into audiences—for example, consumers likely to be shopping for a pickup truck—rather than targeting specific individuals. Regardless of how you see a directed car ad, say, AT&T can then use geolocation data from your phone to see if you went to a dealership and possibly use data from the automaker to see if you signed up for a test-drive—and then tell the automaker, "Here's the specific ROI on that advertising," says Lesser. AT&T claims marketers are paying four times the usual rate for that kind of advertising.

Combine all the elements that Stephenson has assembled, and

"AT&T can no longer be called a telecom company," says Moffett. Stephenson doesn't object to the characterization. He now calls AT&T "a modern media company."

FOR MOST of his career, Stephenson never imagined he'd be doing anything like any of this. He was born in Oklahoma City and started working for Southwestern Bell Telephone in 1982, when he was still in college. After getting a master's degree in accounting at the University of Oklahoma in 1986, he became a fast-rising star in finance jobs at Southwestern Bell, at one point being posted to Mexico City to oversee the company's stake in Telmex, where he worked closely with another big investor, eventual billionaire Carlos Slim. In 2005, Southwestern Bell (renamed SBC) bought AT&T, the remnant left after the 1984 breakup. The combined companies took the AT&T name, one of the best known and most valuable in America. Two years later, at age 47, Stephenson became CEO.

Today he occupies an understated fourth-floor office in AT&T's high-rise in the heart of old downtown Dallas, kitty-corner from the 1912 Adolphus Hotel and a block down from the original Neiman Marcus store. Until recently, he recalls, remaking the media industry in the way he's now attempting to do was supposed to be technologically impossible. "I re-

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ARE
NOT GOING
TO STEAL
OUR JOBS.
YET.**

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THEY SAY
 "DRESS FOR
 THE JOB
 YOU WANT."
 WE SAY
 "READ THIS."

member in the early 2000s asking, 'Do you ever think voice will just move off those landlines and onto mobile predominantly?' and a lot of people said, 'No way. There just isn't enough capacity, not enough spectrum.' And lo and behold, look what happened." When he later asked about accessing the Internet through the cell network, "it was the exact same reply: 'No way! It can never happen.' And along came the iPhone. Then we asked, 'What is now becoming the most desired application on these devices?' Video. 'And could you ever accommodate video?' 'No, there's no way.'"

He was learning a lesson: When the engineers tell you it's impossible, don't believe them. "Full video transportability we just believed was going to be important," he recalls. Crucially, he also decided he wanted to do more than just offer a wireless network that could handle video; he wanted to offer video itself. But there was a problem: "We couldn't get the rights to do any of it." The solution: "DirecTV was available," and like cable companies, it had rights to carry a lot of video programming. So AT&T bought DirecTV in 2015, and "within months we were able to take that full portfolio of content that DirecTV had the rights to, and we were porting it to the mobile device."

Buying rights merely whetted Stephenson's appetite. Thinking about the future, his team con-

cluded that if the coming 4G and 5G networks would be mainly vehicles for delivering video, then "controlling your destiny to some degree would be really important—that is, owning premium content," he says. "And that's what took us down this path of desiring to own a big portfolio of premium content." It was a \$104 billion decision.

THE FUTURE was particularly appealing to Stephenson because the past, AT&T's phone business, had been looking so bleak. Lost in the drama over the Time Warner acquisition is AT&T's financial reality: Though it generates tons of cash, its overall business is in decline. Operating revenues in wireless and landline phones and broadband plus DirecTV, accounting for 71% of the total, were all lower last year than they were two years earlier, despite a robust economy. What's worse, the declines are accelerating unexpectedly. Wall Street has been lowering its consensus forecast of AT&T's 2019 Ebitda, a measure of operating cash flow that subtracts debt-service and other expenses, for years. The latest forecast, including a full year of WarnerMedia results, is less than the consensus forecast from mid-2016, before a possible Time Warner deal had ever been mentioned.

Even while shrinking, the com-

JOHN DONOVAN: CEO, AT&T Communications



IT ONLY TAKES ONE
 IMPACTFUL VIDEO VIEWING
 PER MONTH FOR SOMEONE
 TO SAY, 'I AM NEVER GIVING UP
 AT&T ON THIS PHONE.'"

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pany's core businesses produced some \$44 billion of cash last year after all the bills had been paid—that is, AT&T had almost a billion dollars coming in the door each week. Last year it spent about \$21 billion of it on capital investments, mainly building and maintaining its nationwide wireless network, upgrading it to 5G, and installing fiber for home and business customers in much of the country. It sent another \$13 billion to shareholders as dividends; at the recent stock price of about \$30, the dividend yield is 6.7%, one of the most generous dividends paid by any major company in America. (High yields are the result of big payouts and low stock prices, a reflection of a lack of investor confidence.)

In fact, AT&T's stock price was recently no higher than where it was eight years ago. Concern about the debt is a big part of the reason. The day after AT&T closed on its purchase of Time Warner last June, Moody's downgraded AT&T's debt rating to two notches above junk. The rating agency's rationale was enough to chill any AT&T stockholder's blood: "Moody's continues to believe AT&T will need to reduce its cash dividends in order to remain competitive with its new peer group that includes other media and technology giants, many of which have very lean balance sheets." (AT&T expects to pay down debt with excess cash and is looking to sell assets worth up to \$8 billion for the same reason.)

Prior to buying Time Warner, the danger for AT&T was that its revenue declines would accelerate in the age of wireless video. All the previous uses of the cell network—talking, texting, accessing the Internet—are active uses in which customers create their own experiences. Video is different. It's passive; someone else creates the

experience, and if it's good enough, customers will pay for it beyond what they're already paying for connectivity. Stephenson and his team feared that the value in the business of wireless connectivity could migrate from the owner of the network to the owner of the content. That's why he framed the purchase of Time Warner as necessary for AT&T to control its destiny.

Investors aren't buying it. Their unwillingness to price the stock higher than it was in 2011 reflects weak confidence in the company's growth. In fact, the stock was much higher in the summer of 2016, hitting \$43 not long before the deal for Time Warner was announced that October. Most Wall Street analysts now rate the stock a "hold" at around \$30.

Skeptics contend that AT&T's strategy is not a well-conceived long-term plan so much as a response to near-term problems. "They're buying sales growth, not generating sales growth organically," notes Bennett Stewart, a senior adviser to the shareholder advisory firm ISS. It had long seemed unlikely that antitrust authorities would let AT&T buy another phone company, so it has been forced to look elsewhere for acquisitions. "The DirecTV deal was never driven by an analysis of what AT&T needed in order to succeed, but rather by what the company would be allowed to buy," argues Craig Moffett, the Wall Street analyst. "That's a terrible way to approach strategy."

Moffett even questions the need for AT&T to own content at all. "Did that mean that they planned to make Time Warner content exclusive to AT&T distribution? No. They promised not to" during the antitrust trial. He questions the whole concept of synergies from combining Warner content with AT&T distribution, such as offer-

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ing HBO free to wireless customers with top-tier plans. "AT&T's strategy for delivering an integrated offering to consumers has heretofore amounted to simple discounting, and to devastating effect," he says. Moffett also doubts AT&T can achieve the \$1.5 billion in annual cost savings it has promised investors. John Stephens, AT&T's chief financial officer, says those cost-saving plans "remain on target."

Another skeptic believes AT&T wasn't rigorous enough in thinking it all through. Making a vertical acquisition in order to control your destiny isn't necessarily a bad idea, says Roger Martin, a longtime strategy consultant who has advised Verizon in the past. "If you can buy into a part of the industry upstream or downstream and you can have competitive advantage there, it's kind of a no-brainer," he says. The key is whether you can acquire a company that holds true competitive advantage—"because if you can't, it'll just be the anchor around your neck."

It's clear to Martin that WarnerMedia cannot hold a competitive advantage in content creation. "Others are dropping unprecedented levels of spending into the business," he says. Analysts estimate Disney will spend \$21 billion on content this year, Netflix \$15 billion, and AT&T \$14 billion. (None of the companies will comment on those estimates.) "If you're AT&T, where do you stand?" Martin asks. "You're spending less on content than Netflix and Disney, and you won't beat Verizon on 5G. Where does that leave you?" The answer, he believes, is the dreaded locale identified by strategy authority Michael Porter as the worst place for any company to be strategically: caught in the middle.

Even Warren Buffett quails at the prospect of competing in such a powerful field of rivals. "Everybody has just got two eyeballs, and they've got x hours of discretionary time ... maybe four or five hours a day," he said recently at a charity event, speaking generally about the entertainment industry. "You've got some very, very, very big players that are going to fight over those eyeballs. The eyeballs aren't going to double. You have very smart people with lots of resources trying to figure out how to grab another half-hour of your time." His assessment: "I would not want to play in that game myself. That's too tough for me."

Any business that Buffett wants to avoid sounds unpromising, but Stephenson rejects the legendary investor's premise. Acknowledging that "there are only 16 waking hours in the day," he says, "Well, we haven't filled up the 16 hours yet." He nods toward his office window over Commerce Street with its busy traffic, which he says will ease when 5G networks enable autonomous cars. "When you have the lion's share of those cars autonomous, for the average person that's another two hours of availability of screen time, consuming video."

THE LARGER REALITY, the fact that makes one's head spin trying to grasp AT&T's future, is the long-heralded arrival of what for years the telecom industry called "convergence." Virtually all data—a text, your location history, a CT scan, *Casablanca*—is digital and available almost instantly to almost anyone, anywhere, anytime. Any company



WARREN BUFFETT: CEO, Berkshire Hathaway

EVERYBODY HAS JUST GOT TWO EYEBALLS, AND THEY'VE GOT X HOURS OF DISCRETIONARY TIME."

can start a streaming service, and any consumer can watch it. It's an endlessly, constantly fluid environment to a degree that has never existed before.

That reality may comfort Stephenson as he faces the many skeptics. Their logic is moored to old assumptions about a world that no longer exists, one could argue. He may find further comfort in knowing he can combine WarnerMedia's killer content with something no other media company has or is likely to have, a nationwide wireless network that will be 5G in a few years. But three other wireless networks (two, if Sprint and T-Mobile merge) are available for rent, and in a fluid, digital world, who knows what Buffett's "very smart people with lots of resources" might do?

The uncertainties, the challenges, and the competition all seem daunting. But it's possible, maybe necessary, to take a different attitude. "It's not daunting—it's exciting," says Donovan, Stephenson's lieutenant who runs AT&T's nonmedia operations. "These are the best of times. The greatest gift that Randall has given to this corporation is the inspiration of knowing that people believe that it's difficult, believe that we may be wrong. It's so amazing to wake up and say, 'We have all these tools and weapons, and the world thinks we might be wrong.' That is motivation."

It's a cheerful, hopeful perspective. But Donovan and his boss know AT&T isn't the only content-plus-distribution army with powerful weapons. Come to think of it, it calls to mind the twisted, bloody plotlines in a certain medieval fantasy series. Except for AT&T, the stakes are quite real. ■

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SKUNKWORKS

A look inside the labs of three *Fortune 500* innovators.

By **JOHN PATRICK PULLEN** Photographs by **SPENCER LOWELL**



500 RANK

57

FACEBOOK

At the Facebook AI Research lab, the online publisher is teaching robots how to learn. It promises to share the results with its friends.

DAISY, A HEXAPOD ROBOT BORN IN Facebook's new artificial intelligence lab, scuttles across the verdant roof of the company's Menlo Park, Calif., headquarters with a message to deliver: The future belongs to those who teach—and learn.

That concept sits at the center of Facebook's AI Research lab, a previously unrevealed open-source project that launched in late 2018, even as the company endured repeated black eyes over privacy concerns related to its advertising products. The lab's purpose is to use robotics as a vehicle for developing better A.I. "Having embodied intelligence is a really important problem because it creates constraints to the kinds of algorithms that you can use," says Roberto Calandra, one of Facebook's robotics research scientists. "You need to have algorithms that can be robust, efficient, and applicable in the real world."

That's why Daisy's stroll along a dusty path is so significant. Introducing the A.I. to "noise"—like bumps in the road—not only helps the robot walk better but, more important, also helps Daisy learn how to learn.

Touch, posits Calandra, is key to learning. But the lab's goal isn't merely to create more tactile robots. This is Facebook, after all. So starting at the recent International Conference on Robotics and Automation, what Facebook learns, it shares with others.

500 RANK

500

LEVI'S

The jeansmaker's Eureka Innovation Lab in San Francisco uses lasers, pigments, and ingenuity to keep it technologically fashion-forward.

HOUSED IN A SMALL PROTOTYPING factory in San Francisco's Telegraph Hill neighborhood, Levi's Eureka Innovation Lab churns out not a stitch of denim. Instead, it solves big problems for the 166-year-old apparel maker, which recently relisted its shares publicly and returns to the *Fortune* 500 for the first time in seven years.

For instance, in one corner of the 18,000-square-foot space, a team works on the company's Screened Chemistry Program, which seeks to replace chemicals that are hazardous to human health and the environment with safer alternatives. In another corner, a crew experiments with lasers to make Levi's supply chain more agile during the denim's "finishing" process.

"Forty years ago, there were only three finishes: dark stonewash, medium stonewash, and light stonewash," says Bart Sights, Levi's vice president of technical innovation. "Fast-forward to today, we do about a thousand different finishes every season. Just our company." Using the new laser-finishing treatment, the company has essentially gone back to the future, producing only the three base styles, then letting far-flung Levi facilities finish the jeans locally.

Eureka's 30-person crew includes tailors, software developers, and other experts. All have one thing in common: Everyone knows how to produce the company's legendary 501 jeans.



FORD

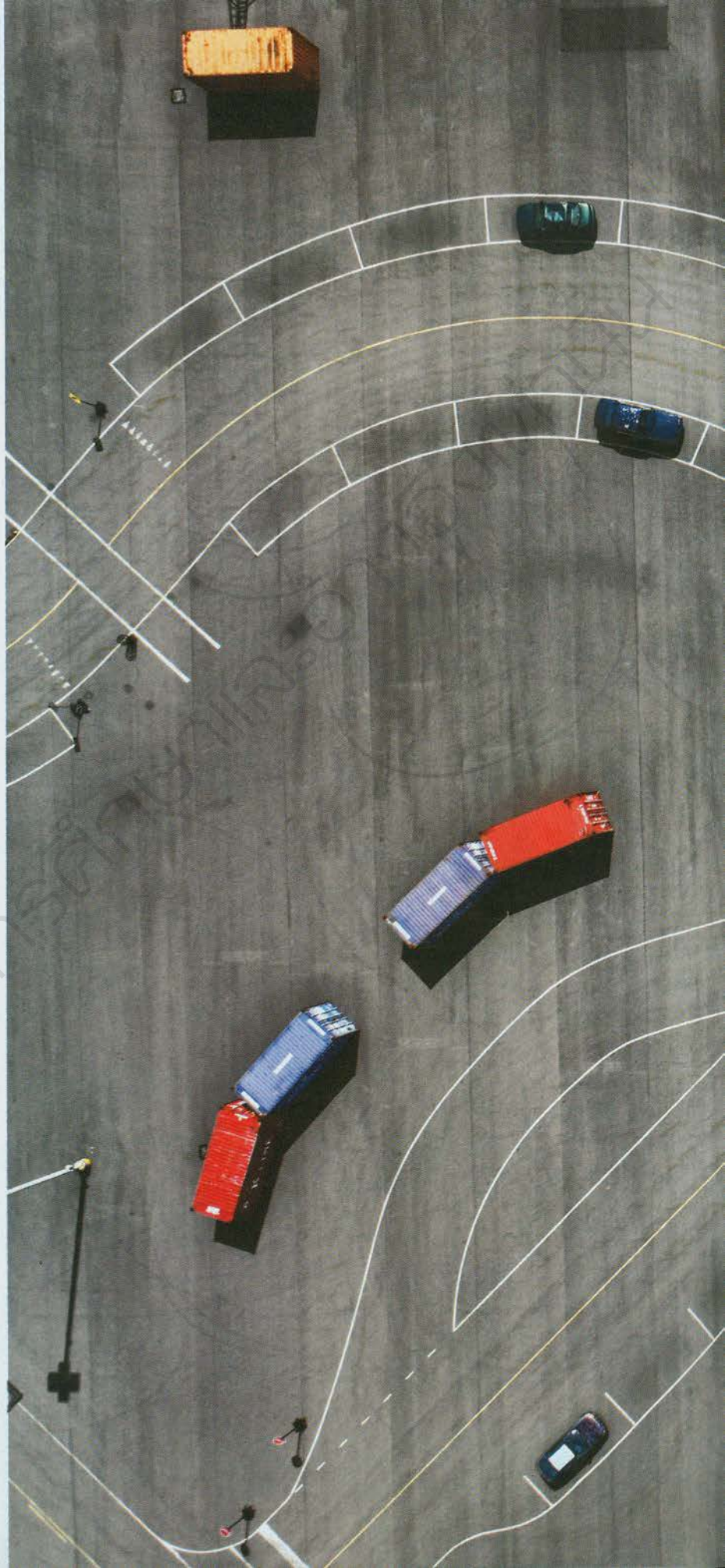
At the Pittsburgh-area test track of Argo AI, majority shareholder Ford is running its first self-driving cars through their paces.

A BABY STROLLER ROLLS INTO traffic. A blind corner hides a rush of cars around the bend. The blazing, early evening sun outshines a frantically blinking stoplight. At its test-track facility in New Stanton, Pa., Argo AI aims to re-create real-world hazards to get Ford's autonomous vehicles ready to hit the road—and dodge its dangers—by 2021. That's when the automaker wants to launch its ambitious autonomous ride-hailing and delivery services in select U.S. cities.

Argo is developing a self-driving technology platform that's being engineered into cars produced by Ford, which invested \$1 billion in 2017 for a majority stake in the private company.

Argo's 20-acre closed course, located in a semi-decommissioned industrial plant where Sony once built big-screen televisions, is the ideal controlled environment for testing robotic vehicles. And at the company's depot in nearby Pittsburgh, software gets tweaked, and cars can even be localized to match driving behaviors inherent to particular cities.

Ford's Argo-powered autonomous cars are currently being tested in five U.S. cities, including on the paved-over colonial-era horse paths around Pittsburgh's Carnegie Mellon University. Researchers there are helping the company refine its computer vision and machine-learning systems. ■





500 RANK

311

LEIDOS

REVENUES

\$10.2 BILLION

PROFITS

\$581 MILLION

EMPLOYEES

32,000

TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

5.5%

ADVENTURE ON THE HIGH SEAS

Sea Hunter is the first of a new class of warships that use artificial intelligence in place of a crew. How **defense contractor Leidos** could radically change naval warfare, one small ship at a time.

By AARON PRESSMAN



NO CREW, NO PROBLEM
Sea Hunter can spend weeks at sea, tracking enemy submarines and clearing mines, without checking into port.



HE SWELLS in the middle of the North Pacific were reaching nine feet when one of two engines on the diesel-powered U.S. naval ship called Sea Hunter shut down. About 1,500 nautical miles from its home base in San Diego, the 132-foot-long craft, which had been cruising at 10 knots, couldn't send a member of its crew to check out the problem—because it didn't have a crew.

Sea Hunter's sleek, spiderlike silhouette, with a narrow hull and two outriggers, is a prototype of what could be a new class of autonomous warships for the U.S. Navy. Its artificial intelligence-based controls and navigation system, designed by Leidos Holdings, a defense contractor based in Reston, Va., were seven years in the making. And this maiden voyage—a more than 4,000-mile roundtrip to the giant Pearl Harbor naval station—was its first major proof of concept.

Nothing like this had ever been attempted before. And while the A.I. systems that keep the ship on course and help it avoid collisions with other vessels were working exactly as advertised, a glitch in its mechanical systems threatened to scuttle the trip—a reminder to tech geeks that no matter how advanced the technology, mundane mechanical problems can bring a project down.

A group of 14 support staff in a trailing escort ship sprang into action. Keith Crabtree, a systems engineer with Leidos, and other staff jumped into a rigid inflatable boat and zipped over to Sea Hunter. Crabtree, who had helped put the ship through its paces in the calmer waters of San Diego Bay, says he wasn't worried about the swells as he rode across the waves to Sea Hunter. The triple-hulled design of the prototype, inspired by the Polynesian *waka* canoe, offered a more stable perch than the bouncing journey aboard the escort ship.

"We were in for a smoother ride than what we had been enduring," Crabtree recalls. A simple software fix corrected the problem,

and after docking at Pearl Harbor, Sea Hunter completed the 10-day return trip without incident.

Sea Hunter, it bears noting, is the first autonomous ship to make an ocean crossing and, remarkably, the first Navy ship designed from scratch by Leidos.

Little known outside government contracting circles, Leidos, then dubbed Science Applications International Corp. (SAIC), was founded 50 years ago by Robert Beyster, a brilliant and entrepreneurial physicist who had worked on the hydrogen bomb at the Los Alamos National Laboratory. An avid sailor and a friend of yacht-racing captain Dennis Conner, Beyster tasked SAIC to develop software to model improved hull designs after Conner's squad lost the America's Cup to an Australian team led by Alan Bond in 1983—the first American loss in the race's 132-year history. Conner regained the Cup the following year.

That expertise came in handy on future projects with the Navy but didn't publicly reemerge until 2012, when a \$59 million contract win to develop an autonomous ship put the software front and center once again. For Sea Hunter, the company also drew on expertise gained from many loosely related projects, including developing underwater sensors for the Navy, performing coastline surveys for the National Oceanic and Atmospheric Administration, and conducting A.I. work to process satellite imagery.

That's exactly the kind of eclectic mix of tech-savvy competencies that have under-

NO HANDS ON DECK

The specs for the Navy's Sea Hunter, and the expectations that surround it.

LENGTH
132 FEET

The boat is designed to test a range of missions carried out by medium-size craft, such as tracking submarines with towed arrays of sensors or acting as a communications relay equipped with long antennas.

TOP SPEED
27 KNOTS

Not as fast as some of the Navy's newest manned ships, but speedy enough to keep up with a sub. For some missions, like clearing mines, speed is less important than the fact that the ship carries no crew.

RANGE
10,000 NAUTICAL MILES

Some of the largest savings achieved by unmanned vessels come from long missions. Sea Hunter could remain at sea for weeks, voyaging from California to Hawaii and back almost twice without returning to base.

WEIGHT
135 TONS

The fiberglass hulled boat isn't meant for the front lines of battle but could serve as a prototype for future autonomous ships built with a variety of materials and missions in mind.

ROBOSHIP AT REST
The Sea Hunter
docked in San Diego,
its home-base harbor.



pinned Leidos's five-decade existence as an under-the-radar but important Pentagon contractor. With \$10.2 billion in revenues last year, the company is ranked 311 on the *Fortune* 500 for 2019—its third straight appearance on this list.

While defense and intelligence work generates nearly half of revenues, Leidos has its hands in virtually every aspect of the federal government's technological and logistical efforts, including running the Frederick National Laboratory for Cancer Research, designing a microwave system for military vehicles to detect IEDs, and building a digital medical records system for the Defense Department. Analysts expect the firm's revenue to rise 5% this year, to \$10.7 billion, with earnings climbing 8%, to \$627 million.

For now, Sea Hunter isn't even a blip on Wall Street's radar screen, but it could become a big growth driver if Leidos wins a major role in the Navy's upcoming plans to add a dozen or more autonomous ships.

That's a big if. Just because Leidos designed the prototype for Sea Hunter doesn't guarantee it a role in the multibillion-dollar contracts to come. In the ruthless world of defense contracting, lawsuits and protests are common; Leidos was bumped from one \$2 billion bidding battle for a Justice Department IT contract in 2018 when a competitor complained that a pricing spreadsheet had some blank cells. "What keeps me up at night is someone else claiming they can do better," says Rus Cook, Sea Hunter's senior program manager. "That would just be a huge waste of the taxpayers' money."

The A.I. software it has developed so far could give Leidos a big leg up. No other company has publicly demonstrated anything close. "They've got the archetype out there in the water, doing its thing on the open ocean," says Bryan McGrath, a retired 21-year Navy veteran who is now deputy director of the Center for American Seapower at the Hudson Institute. "It's really exciting for the future."

LONG A WELL-REGARDED government contractor, Leidos predecessor SAIC suffered from almost 10 years of problems after the 2004 ouster of founder and CEO Beyster, who opposed taking the company public. The Obama-era defense budget cuts hammered the company's revenue growth and contributed to the first-ever operating loss in Leidos history. And most damaging, a massive scandal involving a New

York City payroll project landed two executives in jail and resulted in fines and restitution costs totaling more than \$500 million. At the same time, the federal government tightened its conflict-of-interest rules, prompting big contractors like Northrop Grumman and Lockheed Martin to spin off their services divisions.

So in 2012, the company moved to shrink itself by splitting in two. A technical services unit, which performed tasks like upgrading military vehicles and assembling flight simulators, was spun off under the SAIC name. The larger information technology and sciences unit went forward as Leidos. The name was created by lopping off the front and the back of the word kaleidoscope.

To run the new operation, Leidos hired Roger Krone, now 62, an aerospace engineering graduate from Georgia Tech who holds an MBA from Harvard. Before joining Leidos in 2014, he served in senior positions of finance and project management at Boeing, McDonnell Douglas, and General Dynamics.

In a well-tailored navy suit with an on-brand purple tie, the Leidos corporate color, and a distinguished shock of silver hair, Krone could fit in easily on Capitol Hill among the senators and lobbyists at any hearing. But the CEO is a computer nerd at heart, recounting stories of his earliest programming days growing up near Cincinnati with a TRS-80 home computer that he upgraded himself and writing programs on punch cards for an IBM 360 mainframe at nearby Xavier University. The part-time punch-card job, which paid \$7 an hour, came after his programming teacher caught him working the ovens at Pizza Bob's in Cincinnati and challenged him to put his skills to better use. But finding the bugs and rewriting code didn't suggest a satisfying career path, so he went into aerospace engineering, eventually helping design airplanes, helicopters, and spacecraft.

A year after taking over as CEO, a bargain of sorts fell into Krone's lap. Defense giant Lockheed Martin had spent \$9 billion to acquire Sikorsky Aircraft and decided to raise some money by selling its IT businesses, a jumble of units with total sales of about \$5 billion. For \$4.6 billion, paid mostly in stock, Krone gobbled up businesses whose work included designing a next-generation air-traffic control system, billions of dollars of IT programs for the Social Security Administration, and a host of military projects.

The deal, which nearly doubled Leidos's revenue, closed in the summer of 2016, coinciding almost perfectly with the arrival of the Trump administration and major increases in defense spending to combat the growing military presence of China and smaller threats from North Korea and Russia.

Having successfully integrated the acquisition, Leidos is on the upswing; revenue last year was twice the \$5.1 billion the company booked for the 12 months before the merger. And in the first quarter of this year, the Leidos backlog of business grew to a record \$21.5 billion, aided by a \$3 billion contract to run NASA's IT network for up to 10 years. Leidos's share price, at \$75 recently, has returned 207% since Krone took over in July 2014. That compares with a 60% rise in the S&P 500 index and a 106% gain for the Dow Jones U.S. Select Aerospace and Defense index.

In addition to defense and intelligence work, Leidos is deeply involved in a wide range of critical research on cancer and vaccines.



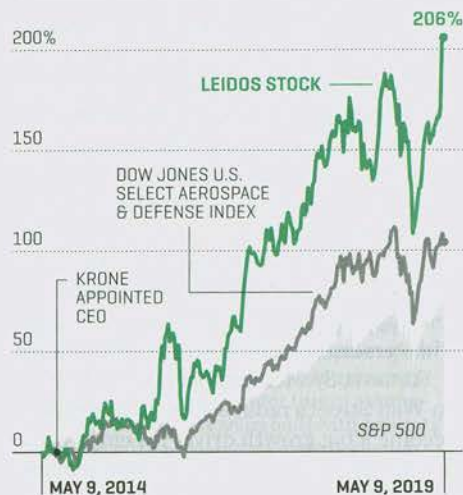
ROGER KRONE: CEO, Leidos

BECAUSE WE WEREN'T A SHIPBUILDER, WE REALLY CAME AT [THE SEA HUNTER] WITH A VERY FRESH LOOK."

It also runs the supply and logistics network for the government's remote McMurdo Station research outpost in Antarctica, moving people and supplies back and forth from the U.S. for a residential population that can exceed 1,000 in the summer. CEO Krone learned firsthand just how remote the base can be when he got stuck there over Thanksgiving in 2017.

Souvenirs of that longer-than-expected stay are the hundreds of photographs he took of the seals there, one of which adorns the wall opposite the desk in his office. Nearby, a somewhat cluttered bookcase contains mementos of aircraft he helped design and the Lockheed Martin deal, alongside childhood artwork from his three now-grown children.

CUMULATIVE GROWTH IN TOTAL RETURN



SOURCES: BLOOMBERG; S&P GLOBAL

W

HEN IT WAS FIRST put in the water in 2016, Sea Hunter was a slick gray beast, fierce-looking and intentionally tough to board.

The ship lacked not just the interior amenities to house a crew, like sleeping quarters, a galley, and bathrooms, but also handrails along the sides and padding on the deck for traction. The Navy, after all, had asked for an autonomous ship that could track enemy submarines and resist boarders. But when the testers from Leidos launched its very first trips along the Columbia River in Oregon, it became apparent that they needed to add handrails and an anti-skid coating on the deck for safer human boarding. There's also a small, bolted-on pilot's cabin for shelter and some metal rails for connecting gear. Cook, the senior program manager, says some of the additions make him cringe. "It's like a roof rack on a Corvette," he says.

But without them, it would have been all but impossible for the engineers to come aboard and fix the engine two years later, while tossing on the high seas. In under an hour, Crabtree and the Navy engineers restarted the craft, tracing the problem to an easily corrected software setting.

While the airborne drones commonly used by the military are piloted by remote control, and some autonomous underwater craft use computer-controlled collision avoidance programs, Sea Hunter was designed to achieve an even higher level of self-control—a challenge not unlike that designing autonomous vehicles. Though sea traffic is nowhere near that of highway driving, the stakes of an error are significantly higher. And there are no road signs, traffic lanes, or dividing lines for the software to track. Cook, a self-described "autonomy snob," says, "I think a [self-driving] car is easier."

Leidos designed Sea Hunter to meet the fundamental rules of human ship-to-ship encounters, which require that a ship follow different procedures depending on its features and functions. Typically, one ship is to stay on course and the other is to give way. But the priorities differ for sailboats vs. powerboats, the direction of the wind, and many other criteria. Sea Hunter uses sensor

COMPUTER-NERD CEO
Krone, an engineer by training, began his career writing programs on IBM punch cards.



data from cameras and radar to assess any other craft it encounters and properly choose the correct maneuver.

It was the Navy that sought the big test—an ocean crossing with "no human hands on"—to prove that the concept of unmanned vessels was ready for a much bigger push. After Sea Hunter passed with flying colors, the Navy Department issued requests in April for the design of truly combat-ready medium-size and large-size (up to 300 feet long) unmanned surface vessels. Says Rear Adm. Ronald Boxall, director of surface warfare for the Navy: "We're looking for a mix of ships that gives us the most lethality per dollar." Unmanned ships are "in a research and development phase right now, but they could cross into an operational procurement phase relatively quickly when we think we're ready."

For now, autonomous vessels are part of the Navy's strategy to address the twin threats of the expanding Russian and Chinese navies. China is building a vast armada of surface and underwater craft as it tries to win dominance in the Pacific. The Russian military doesn't have the same resources but is building a fleet of quieter and more efficient subs that could sneak around the world to deliver conventional or nuclear payloads. Sea Hunter, which carries no weapons, is designed to monitor these fleets, as well as to clear mines and provide a secure communications relay for the Navy's largest warships.

In December 2017, the Navy ordered a second Sea Hunter from

Leidos, being built in Gulfport, Miss. Next, the company will compete for a part in the 2020 medium and large unmanned vessel programs. It's likely to partner with other contractors more expert in the world of shipbuilding, such as General Dynamics and Huntington Ingalls. That would be similar to Leidos's work building imaging and sensor instruments for planes and guidance systems for cruise missiles, which are built by others.

Boeing and Lockheed Martin, for their part, have concentrated on underwater unmanned craft, avoiding the complications of navigating amid other vessels on the surface. And Rolls-Royce Holdings showed off renderings of an autonomous naval vessel somewhat like the Sea Hunter in 2017 but never produced a craft. It has since sold its commercial boating business to Norway's Kongsberg Gruppen ASA. Kongsberg has so far focused on developing civilian unmanned craft. It has a refit ferry that navigated its way on a journey of a few miles around Finland's Turku Archipelago and is also working with shipbuilder Vard Holdings to build a huge autonomous container ship that should be ready to sail next year.

Autonomous vessels will save a ton of money for the Navy. According to a study produced for the Defense Advanced Research Projects Agency, or DARPA, which initially oversaw the autonomous vessel program, Sea Hunter can operate for \$20,000 per day, compared with \$700,000 to run a fully manned destroyer performing similar missions. And with no sailors at risk, an autonomous fleet could serve as "pawns" for tracking subs, clearing mines, and acting as communications relays while manned vessels remain the "king" and "queen" pieces for large-scale battles in the Navy's ocean-borne chess match against China and Russia.

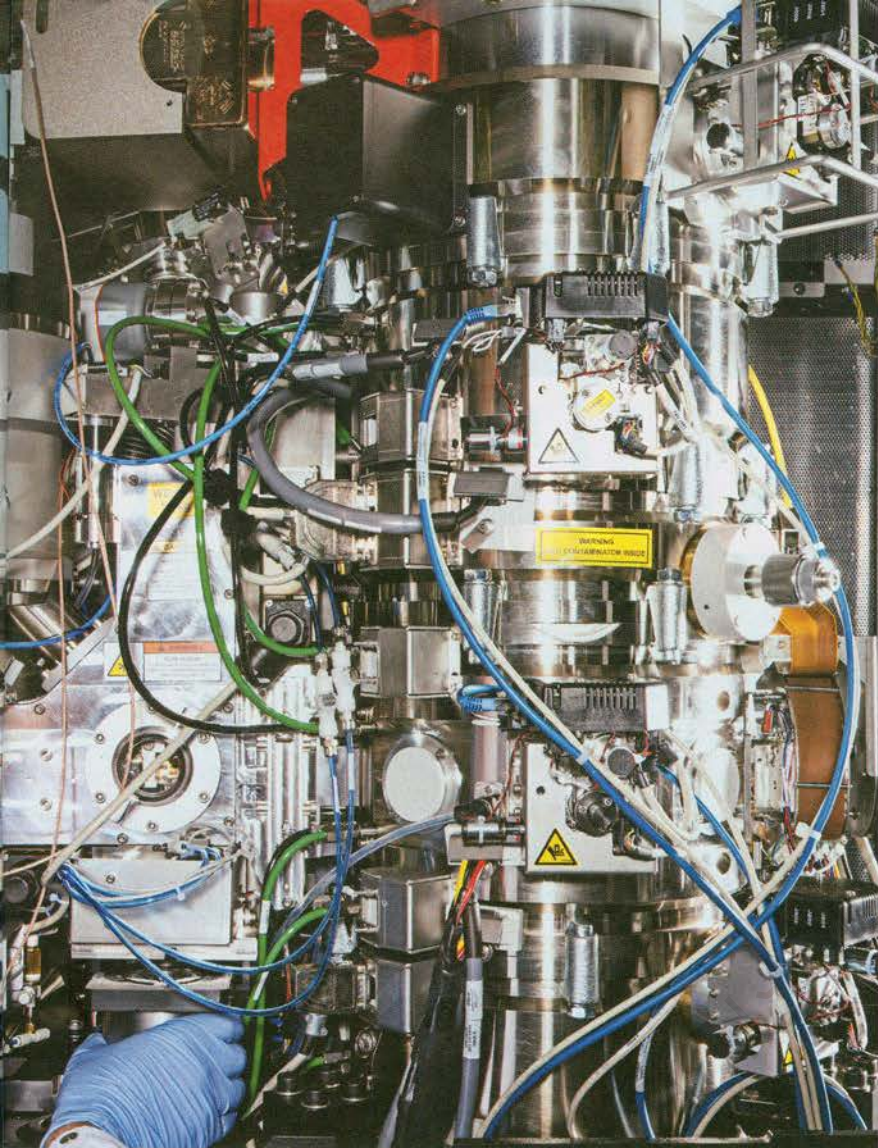
For the unmanned Navy project, Leidos engineers ran simulations of more typical single- and twin-hull designs, as well as some submersible possibilities. But to their surprise, they found that a main hull with two outriggers was more stable, faster, and cheaper to maintain. "I think because we weren't a shipbuilder, we really came at it with a very fresh look," says Krone.

ALL THREE LEIDOS DIVISIONS are in healthy shape. Defense revenue grew a robust 7% in the first quarter of this year; the civilian unit, which makes up a third of revenue, was up 2%; and health care was the strongest segment, posting a 9% revenue gain. This unit, which contrib-



utes 18% of revenue, targets Medicare fraud and provides disability exams, but the crown jewel of the business is the management of the Frederick National Laboratory for Cancer Research in Maryland, which sports a \$540 million annual budget.

The gleaming national lab sits on a serene hillside at the foot of the Catoctin Mountains, 45 miles north of Washington, D.C. Split off from nearby Fort Detrick, home of the nation's bioweapons research, by President Nixon in 1972, the lab's charge is to focus on cancer, AIDS, and other areas that have proved too tough or too uncertain to be profitable for the private sector. Leidos won a \$5 billion contract in 2008 to run the lab and added a \$1.5 billion extension in 2015.



A CLOSER LOOK

From left: A scientist at the Leidos-run National Cryo-Electron Microscopy Facility; it houses a \$7 million microscope used in cancer research.

given up pursuing it on its own.

With a trim white beard and black glasses, and wearing jeans under his lab coat, Turbyville is full of energy as he bounds across the lab to explain that by tracking the dancing molecules, measuring their speed, and creating computer models for how they move, the project aims to uncover new vulnerabilities in mutant RAS that could be attacked with drugs. In another part of the lab, a \$1 million robotic setup is injecting different compounds into test plates of RAS proteins.

Leidos scientists also operate a \$7 million cryo-electron microscope that cancer researchers all over the country can use for free. Another project is focused on finding a way to lower the required dosage—and cost—of administering the HPV vaccine.

“It’s the perfect example of what a national lab should be doing,” says Len Freedman, chief scientist at Leidos’s biomedical research subsidiary. “RAS is behind some of the most common cancers, but despite thunderous efforts, nobody has gotten close to [designing] an inhibitor.” Still, the lab’s efforts are starting to bear fruit. Clinical trials for humans are starting this year for several promising

drugs to address some RAS-related cancers, though it’s unknown whether the trials will succeed.

In one darkened lab room in the bowels of the 330,000-square-foot facility, “Tommy’s dancing molecules” are getting zapped with laser light in a high-powered microscope. Appearing as zigzagging dots across a black display, the molecules are RAS proteins inside of cancer cells. Mutations of the gene that encodes the instructions for making the protein are at the root of 30% of all human cancers. “Tommy” is Tommy Turbyville. A scientist working for Leidos, he is trying to figure out if there’s a way to directly target the mutant proteins, which cause some of the deadliest forms of the disease, including cancer in the pancreas, colon, and lungs. The discovery of a drug that inhibits RAS could save millions of lives, but the private sector, which has come up empty after 30 years, has largely

BACK IN SAN DIEGO, SEA HUNTER spends most of its time these days in dock, going out to test new tweaks to its hardware and software about once a month. In person, the ship is larger than it looks in pictures—nearly half the length of a football field—and more fierce, with its two pointed outriggers and sharp bow. There’s a small plastic “good luck” hula girl in the cockpit but almost no other human touches. Visitors without clearance aren’t allowed to see what’s below deck, although it’s obviously not crew quarters. “That’s where the unobtainium time machine is,” CEO Krone jokes later.

The biggest threat to the ship these days is the occasional loafing sea lion that clammers onto one of the outriggers and won’t be moved. “You just have to wait until they get off,” says Cook, smiling in the California sunshine, while giant destroyers and cargo ships ply the blue waters of the bay and cruise past the famed Point Loma Lighthouse nearby. ■

SECTOR PROFILE ▸

TECHNOLOGY

REVENUES

\$1.4 TRILLION

PROFITS

\$229.6 BILLION

EMPLOYEES

2,759,943

TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

18.7%

BUSINESS BETS ON A

CLEAN ENERGY

A "clean room" for assembling components of a quantum computer at IonQ, an Alphabet-backed startup.

A QUANTUM LEAP

Quantum computing could help companies address challenges ranging from supply chains to climate change. And it's finally moving from theory to practice.

By ROBERT HACKETT





IT WAS A MARVEL of engineering, a harbinger of a future of unimaginable computational power.

It also bore a striking resemblance to a garbage can.

Q System One was a quantum computer. The machine was the culmination of a year—or decades, depending on how one measures—of labor and ingenuity from IBM scientists. The researchers had assembled this

stalactite of nested canisters in the recesses of the company's neofuturistic research center in Yorktown Heights, N.Y. The white, refrigerated contraption dangled from a nine-foot, cubic, aluminum and steel frame. In the innermost chamber: a special processor whose progeny could help solve some of the world's most intractable science and business problems. This particular generation featured the firepower of 20 quantum bits, or "qubits," the powerful data units upon which these dream machines operate.

The machine was incredibly impressive, in theory; the qubits were unusually high-quality, and its error rates were relatively low—crucial advantages in the quest to make a quantum computer viable for real-life problem-solving. Granted, the thing was a little underwhelming in person, shielded in that drab receptacle. (At one meeting last November, IBM CEO Ginni Rometty remarked that it looked like a trash can.) But the scientists had a plan to get it ready for its close-up. IBM had hired a boutique London designer to shield the Q System hardware in a shiny, black metallic shell. Already, the entire contraption had been set in an air- and temperature-controlled, borosilicate glass enclosure designed by Goppion, the Milanese firm known for making display cases for the *Mona Lisa* and the crown jewels at the Tower of London.

By the time IBM unveiled its creation this January, at the Consumer Electronics Show in Las Vegas—a venue normally reserved for the debuts of flashy consumer gadgetry like virtual-reality headsets and phones with foldable screens—it had a supercomputer that looked super. The press and public ate it up. A "gleaming monolith from a sci-fi blockbuster," gushed *MIT Technology Review*. "It looks like a computer from the future," effused *The Verge*.

"Everybody takes selfies with the quantum computer," says Dario Gil, head of IBM's research division, who calls the technology an "object of fascination."

Such allure, at the moment, is grounded more in hope than in results. Quantum computers can't do much of commercial value yet; they're still inching their way toward usefulness. The technologies that make them so potentially fast and powerful also make them, in their current iterations, unstable and error-prone compared with the so-called classical computers we rely on every day. IBM calls the Q System the "first integrated quantum computing system for commercial use," but "use," in this case, is highly abstract: Companies can obtain access, via the Internet, to the quantum platform at IBM's facilities, running experiments and kicking the tires as they

wait for the technology to mature.

Still, recent advances—from Silicon Valley to China, not to mention Yorktown Heights—have convinced much of the corporate world that this technology will soon move off the theoretical wish list. Companies across all industries are hoping to exploit quantum computing to surmount obstacles that have thwarted them for years. Nation-states are mobilizing, too, pouring billions of dollars into research in the hopes of gaining an edge in an area that could someday separate the world's economic—and military—haves and have-nots. Quantum information science, which is still early in attracting private industry investment, "screams at you that it is the exact place where federal R&D dollars are best utilized," says Michael Kratsios, President Trump's top tech adviser and his nominee to be chief technology officer of the U.S.

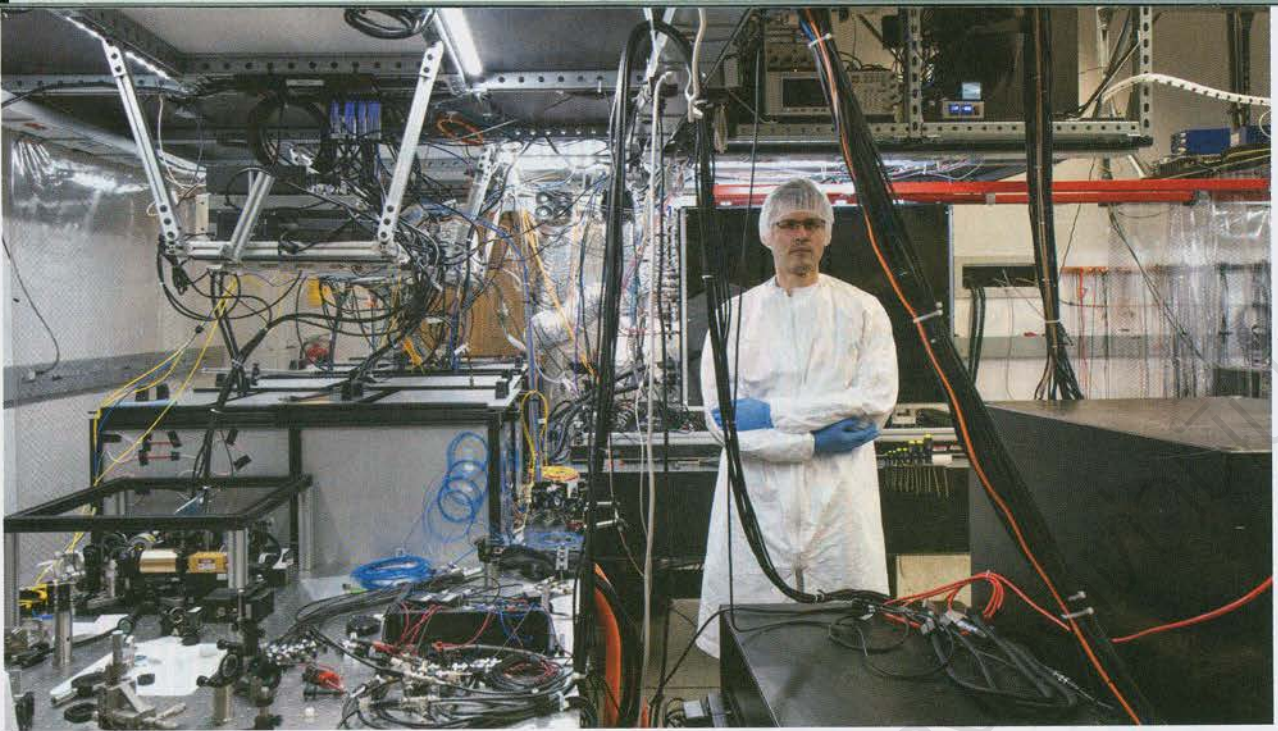
The reason: The quantum computer may be our best hope of overcoming the limitations of ordinary computing. Moore's law, the guiding principle of the tech industry, states that computing power should double roughly every two years as a result of the increase in the number of transistors a microchip can contain. But scientists are reaching the limit on how close together they can smooch transistors on silicon chips. Everyone has been thinking, "What the heck comes after Moore's law?" Gil says. He and many others think that quantum computing, especially in conjunction with artificial intelligence, provides an answer.

A milestone test is not far ahead. Google believes it will reach "quantum supremacy"—a stunt-like demonstration of a machine's superiority over a traditional computer—in the very near term. Chinese scientists say they're on a similar timeline. Once that bar is cleared, "businesses and technologists will look at that and realize it's not just some promising technology in the future, but something powerful working right now," says John Martinis, who leads Google's quantum efforts.

FANCY FREEZER

The Q Dilution Refrigerator cools IBM's quantum-computing system to the near-absolute-zero temperatures at which it operates.





Even in the absence of that confirmation, there's a land grab underway. IBM is jockeying with Google, Intel, Microsoft, and a host of other tech giants and upstarts to dominate the territory. If these companies can convince people that they have the right approach, they will win over more developers, more prospective customers, and more market share. Not coincidentally, many of these companies rent out or host software and services "in the cloud" for other computer users: A quantum breakthrough would give them another potentially profitable service to offer.

"I get a lot of questions from customers about when is quantum coming and when is this applicable to my business," says Julie Love, Microsoft's quantum business development leader. "Increasingly, we're saying 'Today.'"

THE POTENTIAL IS SO ENTICING because a quantum computer is not just another ultrafast computer: It's a new beast entirely. Instead of computing one thing after another, plodding along brute-force style as regular computers do, quantum computers could potentially consider all scenarios simultaneously, like a monk who has attained nirvana through meditation.

To understand the kinds of problems quantum computers are theoretically suited to solving, imagine standing in the Alps, looking at the mountaintops. Ask yourself: Which one has the highest peak? A simple scan of the horizon yields the answer (and centuries-old trigonometry can confirm it). Now try to imagine a universe with thousands of dimensions—or better yet, hundreds of thousands—rather than the standard three with which we're familiar. Discovering any given minimum or maximum point in this kaleidoscopic hellscape is effectively impossible.

More companies these days find themselves in the thousand-dimensional Alps. They're awash in data, to be sure. But even the most powerful computers can't solve some kinds of problems, because they involve too many kinds of data—too many variables.

Consider Amazon, which seeks to ship everything to everyone

as efficiently as possible. Someone trying to "optimize" that effort has to deal with countless questions involving routing and logistics, inventory, weather, traffic, local laws, and whatever else the universe throws at them. Humans and traditional computers wrestle with the chaos as best they can: A quantum computer might tame it. And boosters see even more potential for the tech in tandem with A.I.: As self-teaching machines take on more responsibilities, quantum computing could turbocharge machine-learning processes.

The possibilities are seemingly endless, and also unproven, which is why the tech lends itself to the inflationary churn of the hype machine. But that isn't stopping companies from coding up software so they will be prepared when the real deal, a so-called universal quantum computer, comes online.

JPMorgan Chase and Goldman Sachs are exploring quantum applications to manage risk in investment portfolios. Daimler Mercedes-Benz hopes to use the technology to boost battery performance in electric vehicles. Pharmaceutical giant Biogen has run quantum-driven tests to find new candidate drugs to treat neurodegenerative diseases such as Alzheimer's and Parkinson's. It's easy to see why so many companies are so invested in this burgeoning market; perhaps no other emerging technology spans so many different disciplines with so many potential applications.



SMALL WORLD

From left: A scientist at IonQ's University of Maryland lab; an image of an atom being manipulated in an ion-trap computing system.

"We're getting in on the ground floor," says Vijay Swarup, vice president of research and development at Exxon Mobil. The energy giant announced a partnership with IBM in January in Las Vegas, in tandem with the Q System's splashy debut. Swarup's company sees applications in making environmental predictions, optimizing energy grids, and generating breakthroughs in carbon-capture technologies. "Quantum computing can take our understanding of nature and chemistry to a granularity that has never been able to be done before because the computations are just too hard," Swarup says.

THE IDEA for a quantum computer has been around since at least the '70s. Today, the most optimistic practitioners will tell you that the obstacles are increasingly engineering-related, as scientists try to figure out how to make the machines work reliably and at scale. As Pedram Roushan, a member of Google's quantum unit, puts it, "People are still puzzled by the principle of quantum mechanics, but they're going to live with it and try to put it to some use."

In 1995, Peter Shor, a mathematician then at Bell Labs in New Jersey, proved that a fully functional quantum computer could do something remarkable: It could crack RSA encryption, a popular means of securing private communications. He

7 WAYS TO WIN THE QUANTUM RACE

There are multiple ways that quantum computing *could* work. Here's a guide to which companies are backing which tech.

SUPERCONDUCTING

Uses an electrical current, flowing through special semiconductor chips cooled to near absolute zero, to produce computational "qubits."

Google, IBM, and Intel are pursuing this approach, which has so far been the front-runner.

ION TRAP Relies on charged atoms that are manipulated by lasers in a vacuum, which helps to reduce noisy interference that can contribute to errors. Industrial giant Honeywell is betting on this technique. So is IonQ, a startup with backing from Alphabet.

NEUTRAL ATOM

Similar to the ion-trap method, except it uses, you guessed it, neutral atoms. Physicist Mikhail Lukin's lab at Harvard is a pioneer.

ANNEALING

Designed to find the lowest-energy (and therefore speediest) solutions to math problems. Canadian firm D-Wave has sold multimillion-dollar machines based on the idea to Google and NASA. They're fast, but skeptics question whether they qualify as "quantum."

SILICON SPIN Uses single electrons trapped in transistors. Intel is hedging its bets between the

more mature superconducting qubits and this younger, equally semiconductor-friendly method.

TOPOLOGICAL Uses exotic, highly stable quasi-particles called "anyons." Microsoft deems this unproven moonshot as the best candidate in the long run, though the company has yet to produce a single one. **PHOTONICS** Uses light particles sent through special silicon chips. The particles interact with one another very little (good), but can scatter and disappear (bad). Three-year-old stealth startup Psi Quantum is tinkering away on this idea.

showed that his quantum algorithm could do in minutes what might take a regular computer the lifetime of the universe to unravel. A year later, Lov Grover, also a Bell Labs scientist, came up with a quantum algorithm that would allow people to swiftly search unstructured databases. Scientists piled into the field, and advances in hardware soon followed the breakthroughs in code.

By the mid-2000s, a team led by Robert Schoelkopf of Yale, whose lab would eventually seed the quantum field with executives and scientists, devised an approach to quantum computing upon which the tech world's greatest hopes hang today. Schoelkopf helped pioneer a so-called superconducting qubit, which uses supercooled silicon and electrical currents to work its magic. IBM's machines are a direct descendant of Schoelkopf's lab. Rigetti Computing, a California startup led by Chad Rigetti, a Schoelkopf lab alumnus who formerly played a key role in the quantum computing effort at IBM, builds machines of this type, including a 128-qubit one it plans to debut later this year. Google's and Intel's foundations also rest on this technology.

One reason the approach is so popular is because it builds atop decades of advances in the semiconductor industry. These qubits are created inside specially designed silicon devices; they're generated by an electrical current flowing between superconducting electrodes separated by a thin insulating barrier. (This works only in cryostatic, ultracold chambers, which helps explain why quantum computers will live for the foreseeable future in labs and data centers, not on desktops.)

When someone operating a quantum computer enters certain commands, they can link two qubits together, entwining them in a state called "entanglement." If something happens to one entangled qubit, its mate instantaneously reacts. By stitching together networks of such qubits, a programmer can run massively parallel operations, meaning a huge number of operations at once. This is what enables quantum computing's exponential speedups.

"Superposition," a related concept, is the other key to quantum computing. Whereas bits, the building blocks of classical computing, are limited to representing information as "zeroes" and "ones," qubits can assume any combination of gradations between zero and one. Think of this as the difference between a coin at rest on a table, displaying heads or tails, vs. one spinning, ballerina-like, on its edge. The result: Superposition allows qubits to store vast amounts of data compared with regular bits.

Together, superposition and entanglement give quantum computing its kick—amplified memory tackling complex problems at remarkable speeds. (The trick only works while no one is watching, a bizarre but fundamental fact of quantum science. As soon as someone observes the system, everything collapses.) The act of measurement causes a cascade of tipped-over qubits that produces a final state. If the math is right and the machine well-designed, then that system should tend toward the most probable, most optimal state—the solution.

Each qubit adds exponential power. But as the quantity of qubits grows, quality becomes a limiting factor. As with a spinning coin, even the most minor disturbances, such as heat or vibrations, can shake up the system, causing errors that manifest as wrong answers. And in today's machinery, as the number of qubits increase, so do error rates. Indeed, some practitioners fear there may be a fundamental law, as yet unknown, prohibiting these machines from working at scale—like Jenga towers, they may be doomed to tumble when they get too high. Some skeptics, such as Gil Kalai, a professor at Hebrew University in Israel, believe that the technology will never work as hoped: "My analysis suggests that efforts to build quantum computers are going to fail," Kalai says.

That tension explains why IBM and Google are so eager to demonstrate that they've fortified their qubits and lowered their error rates. It also explains why other scientists are exploring the possibility of a better way forward.

CHRIS MONROE, A PHYSICS PROFESSOR at the University of Maryland, remembers the cold-call email in February 2014 that changed his professional destiny. The correspondent was an investor who sought a meeting.

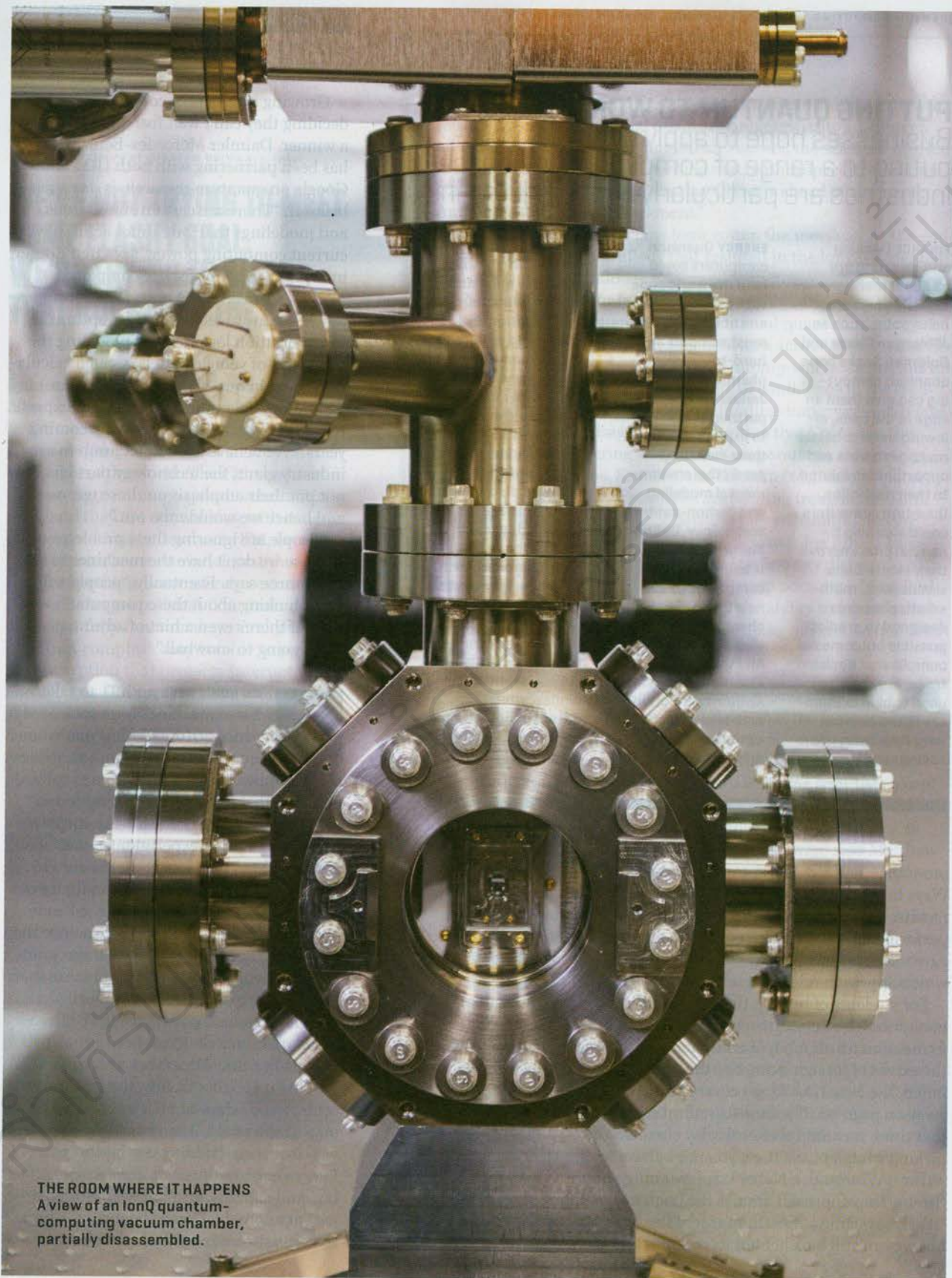
Monroe had published a paper that month in a prominent physics journal, effectively outlining a road map for how certain devices could help quantum computing leap forward. When the visitor showed up at Monroe's office, he brought the article with him. This wasn't just a science paper, the man said, waving the document in the air. "This is a business plan!"

That investor was Harry Weller, a partner at the venture capital firm New Enterprise Associates (NEA), a legendarily successful early backer of shopping site Groupon and a passel of software startups. Monroe, who had been contentedly sustaining his academic research with grants from the U.S. intelligence community, wasn't interested at first. Eventually, though, he came around and accepted Weller's funding proposal, founding IonQ in 2015. (Weller died in 2016.)

IonQ is working on an approach to quantum computing, described in Monroe's paper, called the "ion-trap" method. It activates the qubits in its system by manipulating ions, or charged atoms, with laser beams. In the ion-trap method, unlike with superconducting qubits, physical wires are not needed to send control signals into the machine. That means the qubits are better protected from "noise," or disturbances that contribute to error, Monroe says. They sit suspended in a vacuum cushion, like a maglev train hovering on its tracks. GV, the venture capital arm of Google parent Alphabet, joined NEA as an IonQ investor in 2017. In May, the company added the former director of engineering of Amazon Prime as its CEO.

The ion-trap idea has some prominent converts. Honeywell, the industrial conglomerate, last year debuted an ion-trap approach that it had been working on in secret for years—a major point of validation for Monroe's startup. Honeywell found that its expertise in areas like vacuum systems, lasers and optics, microelectronics fabrication, and other disciplines all converged in the new field. "If you put all those things together, you can build a quantum computer," says Tony Uttley, who leads Honeywell's 100-person quantum efforts.

The ion-trap method is only one of



THE ROOM WHERE IT HAPPENS
A view of an IonQ quantum-computing vacuum chamber, partially disassembled.

PUTTING QUANTUM TO WORK

Businesses hope to apply quantum computing to a range of complex issues; these industries are particularly eager to jump in.

FINANCE Banking and investing are all about managing risk. Wall Street behemoths such as JPMorgan Chase and Goldman Sachs hope quantum computing can give them an edge in the odds, allowing them to better manage threats and opportunities related to their portfolios. Quantum computers could also help financial pros improve their Monte Carlo simulations, mathematical models designed to predict possible outcomes of complicated decision trees; they're often used to help customers figure out how long their retirement savings will last.

ENERGY Quantum computers could help the world cope with climate change, one of the world's most complex and hard-to-predict phenomena. In January, Exxon Mobil partnered with IBM to explore applications including predictive environmental modeling and carbon-capture technology. Daimler Mercedes-Benz is using quantum computing to test new types of battery chemistry to improve electric vehicles. And the Dubai Electricity and Water Authority is working with Microsoft to optimize its energy grid management.

MEDICINE One day, your health may depend on a quantum leap. Pharmaceutical giant Biogen teamed up with consultancy Accenture and startup IQBit on a quantum computing experiment in 2017 aimed at molecular modeling, one of the more complex disciplines in medicine. The goal: finding candidate drugs to treat neurodegenerative diseases. Microsoft is collaborating with Case Western Reserve University to improve the accuracy of MRI machines, which help detect cancer, using so-called quantum-inspired algorithms.

more than half a dozen approaches to quantum computing. (See "7 Ways to Win the Quantum Race.") It has produced promising early results. In this nascent field, of course, it's difficult to compare the performance of one technology with another; scientists even disagree about where to begin to do so. And it's far too early to predict which approach might become dominant.

For students of history, the transistor provides an instructive metaphor. The device, invented in 1947, went on to become the foundation for all modern computers, but few could have predicted the extent of its significance at the time. When the transistor debuted, the *New York Times* covered it in a very brief article tucked away on page 46. The front-running technologies in computing at that time: vacuum tubes and relay circuits. And if you had been picking winners back then, you might have ignored the transistor.

Dave Wineland, a Nobel Prize-winning scientist who coined the ion-trap approach, frames the issue with a different metaphor. "It's like starting a marathon race. Maybe ion traps are in the lead, but we can still look behind us and see the starting line."

Growing numbers of corporations are deciding they can't wait five or 10 years for a winner. Daimler Mercedes-Benz, which has been partnering with both IBM and Google on quantum research, is one such believer. "There are certain simulations and modelings that we cannot achieve with current computing power," says Ben Boeser, innovation director for the company's North American R&D unit. Daimler hopes to use quantum techniques for optimizing transportation logistics and modeling the chemistry of vehicle batteries. Such calculations remain out of reach for quantum computers today, but Boeser's team expects the technology to get there in the coming years. "We believe if we don't jump in as an industry giant, the technology partners may not put their emphasis on those use cases, and hence we would miss out."

"People are ignoring these problems now because we don't have the machines to do it," Monroe says. Eventually, "people will start thinking about these computations more if there's even a hint of advantage, and that's going to snowball."

YOU DON'T NEED a Ph.D. to take these machines for a spin. Since 2016, IBM has made two quantum computers accessible to the public via a website with a graphical interface that looks like a musical score. Scientists inside and outside the corporate world are running experiments via similar portals. They're exploring approaches to optimization problems, trying to figure out what sorts of questions they can ask and how they'll frame those questions once the technology is further along. In three years, 120,000 people have performed more than 10 million experiments and published more than 190 research papers using IBM's so-called quantum cloud service.

During a mid-December visit to IBM's Yorktown Heights facility, the research center's staff showed off a time-lapsed heat map of the world. The geography reveals who has been dabbling on the computers. Everywhere, enthusiasts are learning, coding, and experimenting. Except for an apparent anomaly: On the heat map, China remains surprisingly dark, despite its size,



JIM CLARKE: Head of quantum hardware, Intel

WE'RE NOT TRYING TO MEET SOME FLASHY GOAL. WE'RE TRYING TO BUILD THAT ROCKET TO THE MOON."

influence, and interest in the technology.

Here be dragons...

Dario Gil, the research center's chief, acknowledges the paucity of activity on the other side of the world. The Chinese have their own government-spearheaded initiatives, and they are not working with American corporations, at least not IBM, he says.

Gil's remark is a reminder that the quantum competition is not merely commercial—it's also geopolitical. The first country to build a fully functional, general-purpose quantum computer may be able to pierce the encryption that protects Internet traffic and secures all variety of data, an invaluable tool for spies. Countries at the forefront of the technology may also be able to eavesdrop-proof their communications, an obvious advantage in a geo-rivalry.

The competition heated up in 2016, when Chinese scientists blasted a satellite into low-earth orbit. Within a year, these scientists used the spacecraft, nicknamed Micius after an ancient Chinese philosopher, to successfully transmit so-called quantum entangled particles more than a thousand kilometers between the skies overhead and the Tibetan mountains on Earth. The world marveled at the feat, and spines tingled: Had America lost its lead in this contest so soon, just as it had once seemingly fallen behind the Soviet Union in the space race?

China has activated a highly secure "quantum key" communications line, between Beijing and Shanghai. Since 2013, the Chinese have published nearly 500 more papers than their American counterparts on quantum science: 2,986 vs. 2,494, by Boston Consulting Group's count. More-

over, China's government is said to be spending \$10 billion over the next five years on a national quantum program. Anton Zeilinger, an Austrian physicist who taught Pan Jianwei, the scientist who led the Micius expedition, tells *Fortune* that, with respect to quantum communication, "it's safe to say that China is ahead of the game. And not just by a small increment."

Back in the U.S., politicians have gotten the message. At the end of 2018, just before a gridlock that resulted in the longest-ever federal government shutdown, Congress, with near unanimity, passed the National Quantum Initiative, a bill authorizing more than \$1 billion to kick-start an American national quantum strategy. The initiative coordinates funding activities across major research agencies. It's as yet undecided how the money will be spent, but the injection of federal funds is both a vote of confidence in the technology and a powerful motivator for funding-hungry research labs.

Many Americans disagree with the notion that China has the edge, given the pioneering work of U.S. corporations, universities, scientists, and startups. Kratsios, the U.S. chief technology officer designate, says that other countries are pouring tremendous sums of money into quantum science because they're behind, "playing catch-up." Regardless of who's currently leading, Joe Broz, a theoretical physicist who leads the advanced technology division at SRI International, an influential laboratory group born out of Stanford University, says the act will give the U.S. the ability to nurture the nascent industry and prevent it from "escaping offshore to our detriment, where it's only to be sold back to us."

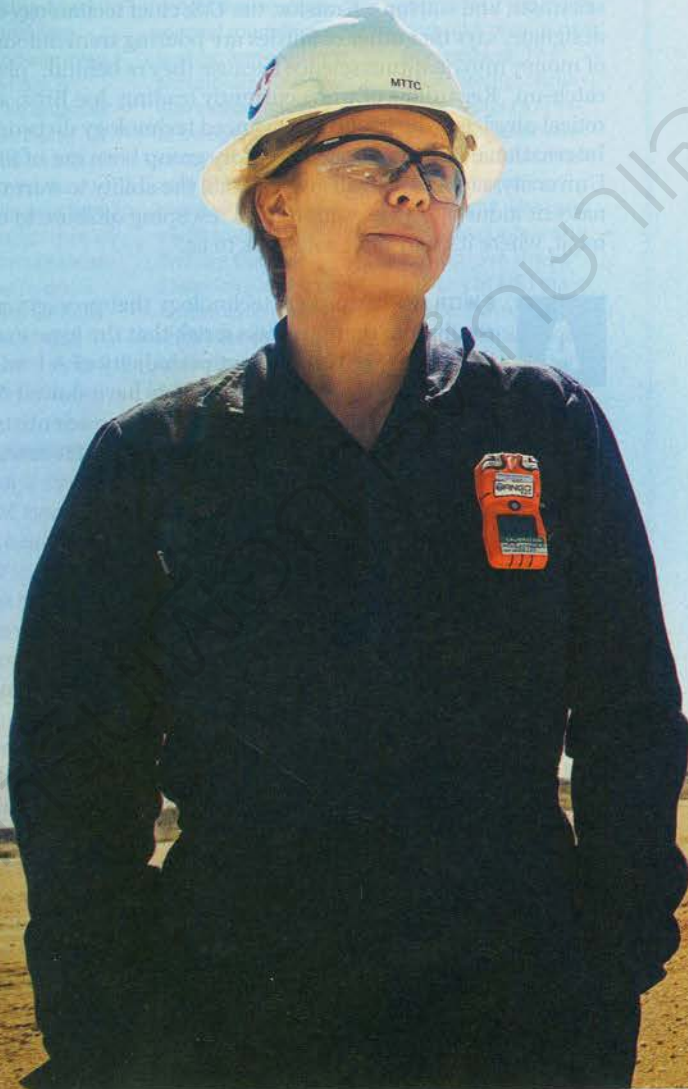
AS WITH ANY early-stage technology that presages a revolution, there's always a risk that the hype exceeds the hope. (See the frequent periodicity of A.I. winters, when advances in that technology have slowed drastically, dampening enthusiasm along with it.) Some scientists worry that investment will run dry once investors encounter extended timelines and delays on the product road map. "There's a joke in quantum computing that it's always five years away," says Matthew Brisse, a Gartner analyst, pointing to decade-old headlines that claim a breakthrough is just around the corner.

If this time turns out to be different, it may be because so many companies are putting their shoulders to the wheel. "We're on the heels of a new industry forming," says SRI's Broz. "I can imagine how people felt in the '50s, '60s, and '70s with the semiconductor industry emerging."

As for timelines, Jim Clarke, the head of quantum hardware at Intel, draws an analogy to both the mission to put a man on the Moon and the development of modern electronic computers. Sputnik flew in 1957; Neil Armstrong touched down on the Moon in 1969. The first transistor came about in 1947; the first integrated circuit arrived in 1958. Such transformational leaps typically take a little over a decade, and the quantum computer will be no different, Clarke forecasts.

"We're not trying to meet some short-term, flashy goal, but we're trying to build that rocket ship to the Moon," he says. Nobody can quite agree on when the industry will see liftoff, but this could be the year scientists start the countdown. ■

UPPING THE STAKES
Occidental Petroleum
CEO Vicki Hollub has
just pulled off one
heck of a land grab in
the oil industry.



500 RANK

167

OCCIDENTAL PETROLEUM

REVENUES

\$18.9 BILLION

PROFITS

\$4.1 BILLION

EMPLOYEES

11,000

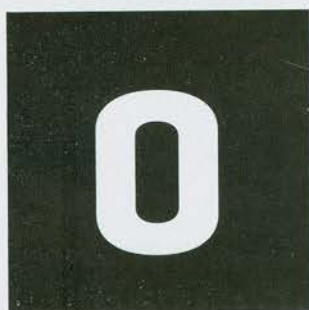
TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

3.8%



THE QUEEN OF TEXAS HOLD'EM

With \$10 billion worth of chips from Warren Buffett, **Occidental Petroleum's** Vicki Hollub just took the biggest poker hand in the American oil patch. She shouldn't count her winnings just yet. By JEN WIECZNER



IN THE LAST FRIDAY in April, Warren Buffett got a call from Brian Moynihan, the CEO of Bank of America, asking if he would back Occidental Petroleum's underdog bid for rival oil driller Anadarko. Two days later, Occidental CEO Vicki Hollub was making the pitch herself, having flown to Omaha to appeal directly to the world's most famous investor. It took Buffett only an hour to say yes.

That Sunday, the Berkshire Hathaway CEO promised \$10 billion in financing to Occidental if Hollub could get the deal done. There was, of course, one complicating factor: Anadarko had already pledged to sell itself to oil giant Chevron and would owe the latter \$1 billion if it broke their engagement. What followed was a remarkable coup d'état in America's own oil-soaked Emirate—the famous Permian Basin that stretches 86,000 square miles from Texas to New Mexico—and it all happened in hyperspeed.

Just a week and a half after Buffett and Hollub's meeting, a bidding war that had played out in daily headlines was over: Chevron (No. 11 on this year's *Fortune* 500) walked, and Occidental (No. 167) announced it would buy Anadarko (No. 237) for a total price tag of \$57 billion including debt. It's the largest U.S. oil and gas merger in more than 20 years (since Exxon bought Mobil) and would catapult the combined company into the *Fortune* 100 elite.

Buffett, in an interview discussing his investment, told CNBC, "It's a bet on oil prices over the long term more than anything else." Yet notably, what he didn't say was whether he was betting on oil prices to be higher. (He declined to comment to *Fortune* for this story.) "It's also a bet on the fact that the Permian Basin is what it's cracked up to be," Buffett added during the TV segment, without elaborating.

Of course, what the Permian is—quite literally—cracked up to be is one of the biggest oil reserves America has ever known. And it has made the U.S. the top oil-producing country in the world. Its thick shale deposits, hydraulically fractured and pumped for oil, have attracted not only Chevron, Occidental, and Anadarko, but also hundreds of other drillers, which have claimed a big chunk of West Texas (as well as a corner of New Mexico). The "fracking" boom, as it's known, is responsible for pushing U.S. crude production to a record of roughly 11 million barrels a day in 2018, surpassing Saudi Arabia and Russia for the first time since the end of the Cold War. As of the latest monthly data, the Permian alone produces more crude per day than the United Arab Emirates, Canada, or Iran; by next year, some expect it could also outpace Iraq, which would make the southwestern region the fourth-largest oil producer in the world, if it were its own country. "The Permian is the absolute 800-pound gorilla for shale," says Mike Morey, CIO of Integrity Viking Funds, who runs a top-performing energy stock fund.

The Permian is also one of the cheapest places to drill for oil, not only in the U.S., but in the world. Unlike costly deepwater and offshore rigs, drillers can make money on Permian oil as long as

it trades for at least \$50 a barrel. That's made the region an oasis for energy companies that have struggled ever since 2014, when West Texas crude prices collapsed from a peak of \$107. In the years since, prices have never come close to reaching triple digits and have dipped as low as \$26 a barrel.

So far this year, prices have generally been on the upswing, and are up some 35% in 2019—to around \$62 per barrel—despite concerns that a continuing trade war with China will slow demand. Still, it's hard to find a bull who thinks that oil has reason to rise much more. "Short of a real sustained geopolitical event—not the periodic flashes that have been impacting the markets—I don't know that anybody

BARRELING AHEAD

Thanks to the shale "fracking" boom in the Permian Basin, the U.S. now produces more crude oil than either Russia or Saudi Arabia.

AVERAGE DAILY CRUDE OIL PRODUCTION



OPENING SPREAD: TIM PANNELL—THE FORBES COLLECTION/CONTOUR BY GETTY IMAGES



AN ECONOMY IN ITS OWN RIGHT: The Permian alone now produces more crude per day than Iran or the United Arab Emirates.

thinks that there's an upside for commodity prices themselves," says longtime energy economist Michelle Michot Foss, a fellow at the Center for Energy Studies at Rice University's Baker Institute for Public Policy.

Indeed, even with production disruptions resulting from the reactivation of Iran sanctions in May—as well as turmoil in other OPEC exporters like Libya and Venezuela—the Permian has created such an abundance of supply that it can quickly make up for lost inventory. In the years between 2009, when the Great Recession ended, and 2014, there's been a paradigm shift in the industry, says Devin McDermott, an equity analyst at Morgan Stanley: "We've gone from a decade of resource scarcity, and the focus on peak oil supply—when do we run out of oil?—to more oil than we need." What's more, there's enough still in the Permian ground to last at least the next 20 years.

Now, after generations of seesawing crude cycles, companies are wondering whether the best they can hope for, in terms of prices, is flat. "The industry is realizing they can't count on higher prices," says Dan Pickering, president of Tudor, Pickering, Holt & Co., an energy investment bank

DAN PICKERING: Tudor, Pickering, Holt & Co.



WE'VE DETERMINED THE PRICE RANGE FOR CRUDE: OPEC IS CUTTING PRODUCTION AT \$50, AND TRUMP IS TWEETING AT \$70."

headquartered in Houston. He expects oil to trade between \$50 and \$75 a barrel for the foreseeable future. After all, he says, there are also political forces at play—with, on the one hand, the OPEC oil cartel ready to slash output if prices fall to unprofitable lows, and on the other, President Trump determined to ensure gas stays cheap to fuel the U.S. economy. "My view is, we've determined the price range for crude: OPEC is cutting production at \$50, and Trump is tweeting at \$70," adds Pickering. Since taking office, Trump has tweeted increasingly often about oil and gas prices—eight times so far in 2019, and three in April alone—generally calling on OPEC to pump more supply to market.

The price may not exactly be a gusher, but the drillers are figuring out how to live with it. In the past six months or so, U.S. energy companies have trimmed capital spending, and cut down on the number of rigs, boosting their profitability and allowing them to retain more of their cash flow. "We kind of use the phrase '\$60 is the new \$100,'" says Jonathan Waghorn, a onetime Shell drilling engi-



A TEXAS-SIZE GUSHER
Oil workers are all business in Midland, Texas, the heart of the Permian Basin, where many U.S. oil companies are doubling down.

neer who is now a portfolio manager for Guinness Atkinson.

The irony is, the good ole days for the oil patch weren't exactly that. Even when oil was \$100 a barrel a few years ago, companies weren't as profitable as they should have been, says Waghorn. In those heady days, and until last year, U.S. oil and gas exploration and production companies paid out more on capital expenditures and dividends than they had in cash flow, according to Morgan Stanley—and S&P 500 energy stocks have been consistent underperformers since the start of the shale oil revolution. "If we were looking into your crystal ball at this supernova birth [of shale] in the U.S., I think you would have surmised that these stocks would have done exceedingly well, but they haven't," says Bill Herbert, managing director and senior research analyst at Simmons Energy, the oil and gas investment banking arm of Piper Jaffray.

For years, the sector burned so many investors that many abandoned it. But the Occidental deal may have reignited interest. It's funny what \$10 billion from Warren Buffett will do.

W **HICH BRINGS US BACK** to Occidental's all-in, table-clearing bid for Anadarko, and the hunt for scale in the Permian. In the past few months, Occidental nudged past the much-larger Chevron to become the top Permian oil producer, but it was going to be hard to stay there: Chevron was rapidly upping its Permian ambitions, and had recently promised to grow its production there 53% by 2020.

That's why Chevron wanted Anadarko, too. The notion of marriage between the two oil producers promised some unique advantages: The parcels each company controls in the Permian run along the old Texas & Pacific rail line, meaning a merger would have united the land like a massive checkerboard, lowering costs further. Rival Occidental would be boxed out.

On its own, Occidental would likely find it nearly impossible to

hang on as the region's top producer. That's why it, too, had been coveting Anadarko—and indeed had been in talks with the company over a potential deal for almost two years. When Chevron announced its agreement to purchase Anadarko in mid-April for \$50 billion including debt, Occidental found itself between tight rock and a hard place: If it wanted Anadarko, it would have to somehow break up the Chevron deal and cover its billion-dollar dowry.

In the Permian Basin, there's virtually no risk of wasting money on "dry" wells because everyone knows that oil is in that "tight rock," as the shale formations are known. The proximity to the Gulf Coast also makes it convenient for companies to get the crude to market—especially now with new pipelines opening up. "This is

BATTLING FOR THE BASIN

Once it absorbs Anadarko, Occidental is likely to have a comfortable production lead in the Permian Basin.



TOP PERMIAN BASIN PRODUCERS
2019 ESTIMATES, THOUSANDS OF BARRELS OF OIL EQUIVALENT PER DAY

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really just an ideal situation for companies in a great number of respects," Foss says. "They've got a complete value chain from field to market, and with coastal access for exports right in the United States. They haven't had that for 30 to 40 years."

By gobbling up Anadarko, Occidental would get to solidify its position in this golden region even more. That said, it's paying a mighty big premium—\$11 more per share than what Chevron offered. And in exchange for his \$10 billion, Buffett has received 100,000 preferred shares in Occidental, with an 8% annual dividend. Not everyone thinks the price is justified. Occidental's stock plummeted 13% in the three weeks after it went public with the Anadarko bid, with its own shareholders criticizing the high cost of the purchase and the fact that Buffett got the sweeter end of the deal. T. Rowe Price, which holds 2.8% of Occidental shares, had (unsuccessfully) threatened to oust the company's board of directors at its May shareholder meeting, complaining that management should have let shareholders vote on the merger.

"We view the Permian as Occidental's crown jewel," says John Linehan, chief investment officer of equity at T. Rowe Price, adding that Occidental's assets here were the "core reason" he invested in the company in the first place. But the Anadarko deal, oddly enough, dilutes that rationale. While the combined company will have more acreage in the Permian Basin, he says, its overall production will be less concentrated there, because Anadarko has a larger share of its output outside the region. "This isn't the race to be the biggest," says Linehan. "It's the race to have the best total returns."

"We know the Permian. It's the foundation of our company," says Occidental CEO Vicki Hollub in a statement to *Fortune*. "But it's not size that matters to us. What really matters to us is not to be the biggest but to be the best. And I think we've proven that." With regard to bypassing a shareholder vote on the deal, Hollub said on a recent earnings call that the company did so to ensure that it "had a reasonable chance to make this happen," as the Chevron agreement did not require a vote. "We weren't playing on a level playing field," she said.

Chevron, on the other hand, is no worse for wear without Anadarko. "There are plenty more fish in the sea," says portfolio manager Waghorn. "There's no particular reason that Anadarko should stand out." In fact, now that the major oil conglomerate has tipped its hand in terms of its acquisition appetite, a slew of Permian producers look like potential targets. Analysts are eyeing Pioneer Natural Resources, Noble Energy, Apache Corp., Concho Resources, Parsley Energy, and Diamondback Energy, among others, as takeover candidates. "I think we're probably one deal away from a big consolidation wave," says Pickering. "If we see Exxon, Shell, BP, or Total do another big transaction, I think there will be a huge rush to find your dance partner, and there will be a significant amount of fear of missing out."

The signs of an imminent M&A wave in the still-nascent fracking industry remind Pickering, the investment banker, of the dotcom boom of the late '90s. Back then, investors chased high growth, throwing money at companies despite their lack of profits—before the market crash ultimately forced a consolidation of Internet startups. "That's happening in the oil patch now," Pickering says.

"\$60 IS THE NEW \$100"

The price of oil is up 35% year to date. But despite the occasional disruptions in overseas production, most analysts say, there's simply too much oil supply to push the price much higher than its current trading range.

MONTHLY CRUDE OIL PRICE (WTI)

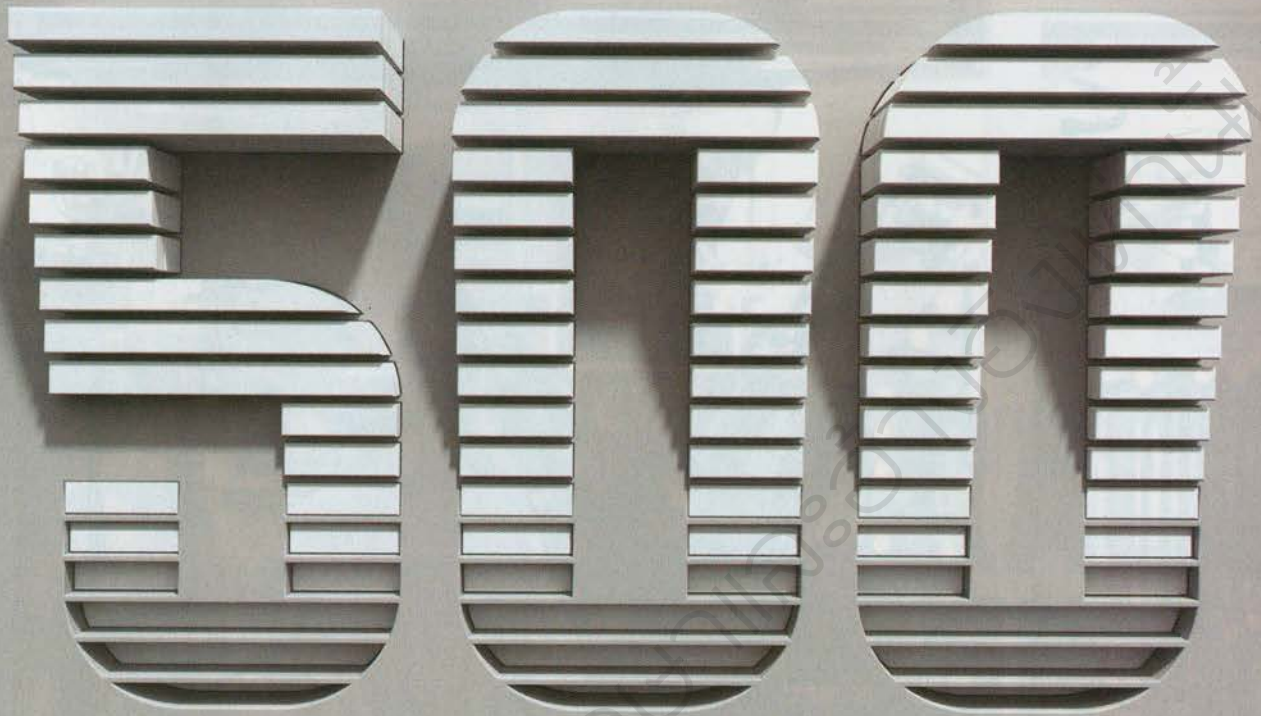


Inevitably, U.S. oil production growth, on the whole, will slow, as companies pull back on drilling. The trick for them, if oil prices do ultimately rise, will be not ramping production back up too aggressively, such that prices collapse again. "Hopefully this time the industry learns its lesson," says Integrity Viking's Mike Morey.

After all, Permian producers themselves may have an incentive to keep supply—and prices—in check. Because they can make money on cheaper oil than many drillers outside the U.S. can, they face less competition when prices are low. If the price of oil were to rise to \$80 a barrel, more foreign competitors would start pumping too, says John Musgrave, portfolio manager and co-CIO of Cushing Asset Management. "Theoretically, you almost wouldn't want crude oil prices to skyrocket higher."

As for Buffett, he's going to make money no matter where oil prices go, thanks to his preferred shares. That may be the most profitable move in the oil patch in years. ■

FORTUNE



DAILY

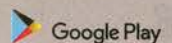
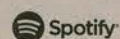
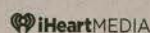


They're the biggest companies in the country, and they touch every part of your day—from powering the phone in your hand to providing the food on your plate. What can we learn from them? Get brilliant bites of knowledge each morning from our editors about the Fortune 500.

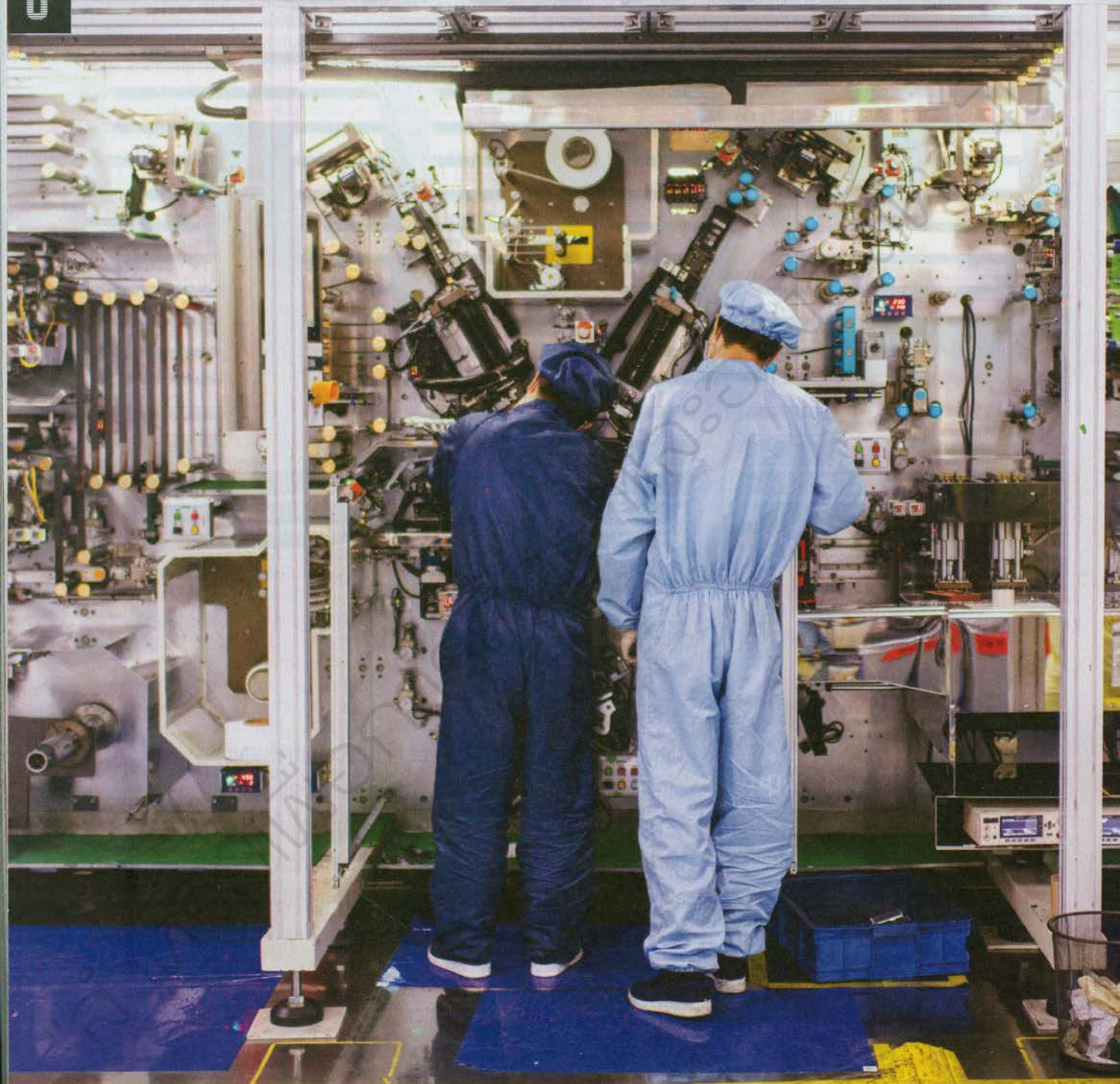
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POWER PLANT
At the Amprius factory
in Wuxi, China, workers
operate a machine that
winds together anodes and
cathodes to make batteries.



SECTOR PROFILE

N.A.

ENERGY

REVENUES

\$1.6 TRILLION

PROFITS

\$110.7 BILLION

EMPLOYEES

818,830

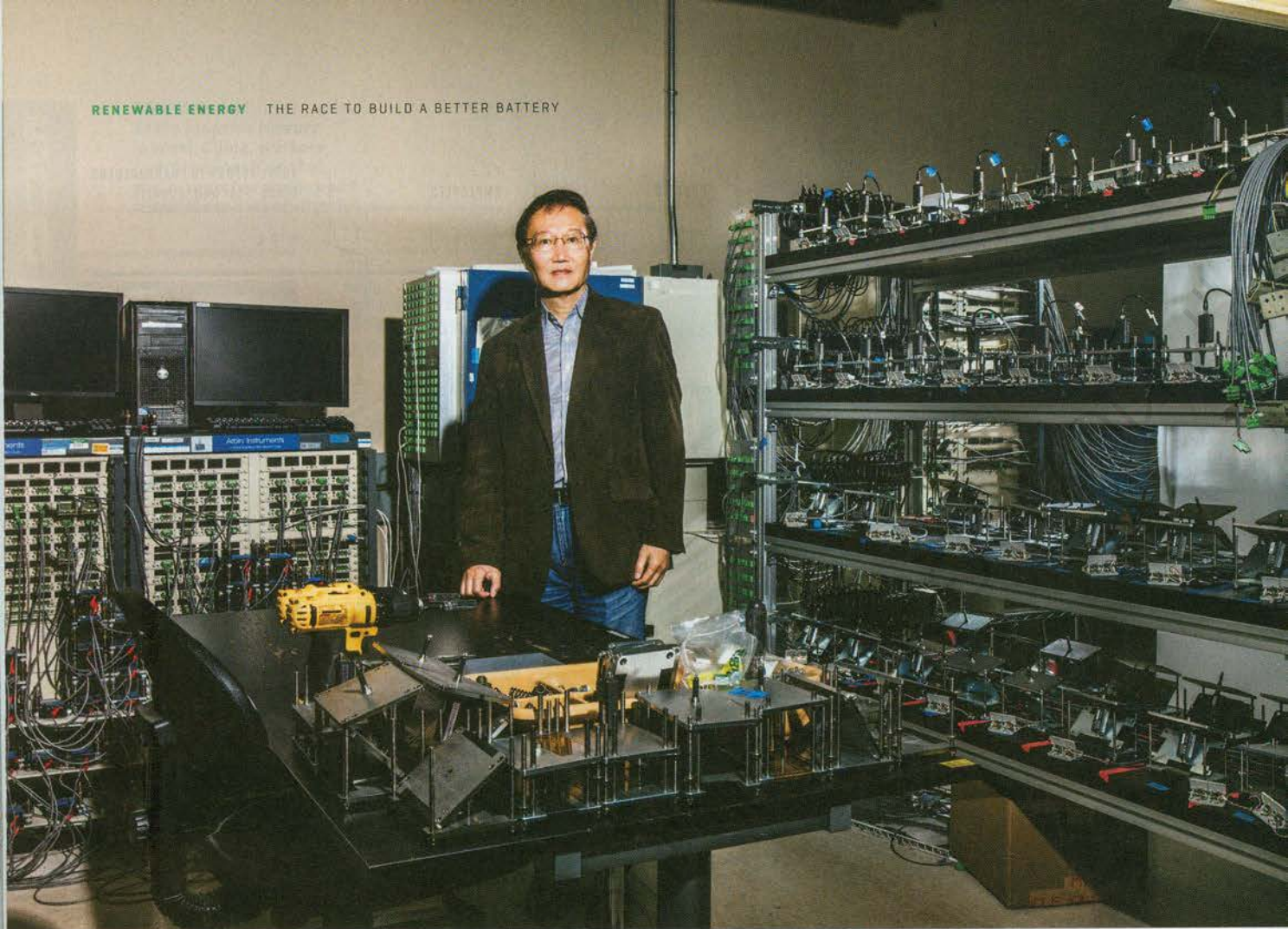
TOTAL RETURN TO SHAREHOLDERS
(2008-2018 ANNUAL RATE)

9.2%



THE RACE TO BUILD A BETTER BATTERY

Renewable energy could reshape the global economy—but only if it can be cheaply and safely stored. Meet the companies racing to crack the anode code. By **JEFFREY BALL**



T FIRST GLANCE, all seems serene on a spring morning at the research-and-development campus of SK Innovation, one of Korea's biggest industrial conglomerates. The campus sits in Daejeon, a tidy, planned city an hour's high-speed-train ride south of Seoul that the national government has built up as a technology hub. Dotted SK's rolling acres are tastefully modern glass-and-

steel buildings that wouldn't be out of place in a glossy architecture magazine. One contains a library, its tables stocked with rolls of butcher paper and Post-it notes to spur creativity. Another houses an espresso bar where engineers queue for caffeination. A cool breeze blows. Birds chirp. Pink cherry blossoms bloom.

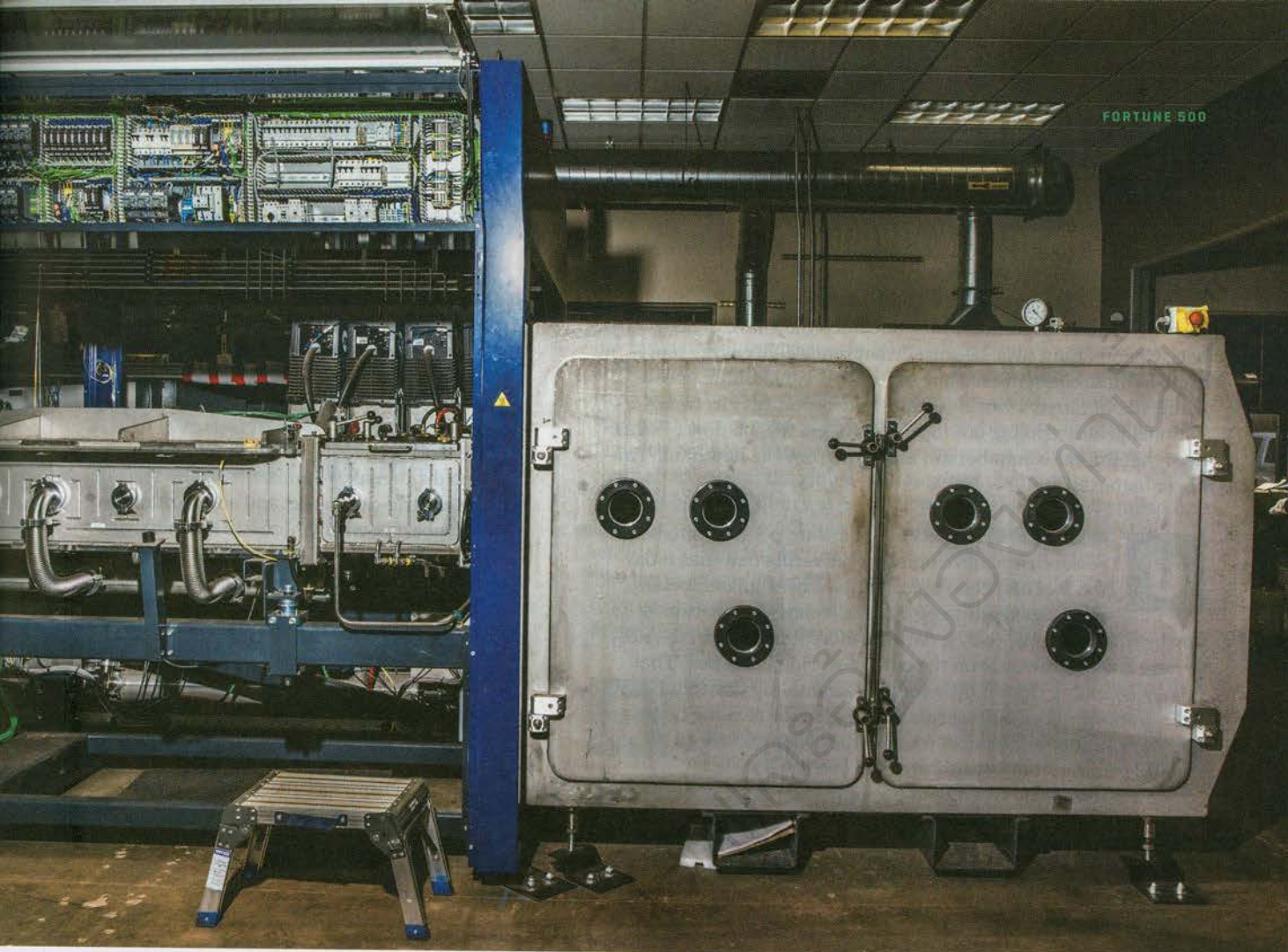
Then Jaeyoun Hwang, who directs business strategy for SK's R&D operation, steers the Kia electric car in which he is driving me around the campus to a stop at the top of a hill. In front of us looms K-8, a seven-story-tall cube of a building sheathed in matte silver siding and devoid of any visible windows. Its only discern-

GLOBAL PLAYER

CEO Kang Sun has helped Amprius raise money from both American and Chinese backers.

ible marking is, at the top corner of one wall, a stylized orange outline of a familiar object: a battery. K-8 appears whimsical, almost a bauble, until Hwang explains that four other buildings on the campus, plus another one under construction, also are for battery research—an activity at SK that employs several hundred people and counting. When I ask to go inside K-8 for a look, Hwang says it's out of the question. When I raise my camera to take a picture, he stops me. "In this area," he says, "photographs of the buildings are prohibited."

SK has a sprawling R&D campus because it has a storied technological pedigree—as Korea's oldest oil refiner. Now the petrochemical company is hitching its future to electric cars. It has inked deals



MANO A NANO

An Amprion machine that applies gases to metal to produce “silicon-nanowire” anodes.

to make batteries for some of the world’s largest automakers, notably Volkswagen AG, which, following a crippling scandal in which it was found to have deliberately and repeatedly violated pollution rules in producing its diesel vehicles, has pledged a green corporate rebirth, shifting much of its lineup to cars that run on electricity rather than oil. SK has made huge deals with VW and other automakers, including Daimler AG, which says it will sell 10 pure-electric car models by 2022, and Beijing Automotive Group, or BAIC Group, China’s largest maker of pure-electric cars. SK is racing to build massive battery plants in China, Europe, and the United States, including one an hour’s drive from Atlanta. It is moving by 2025 to balloon its battery produc-

tion, mulling investing some \$10 billion in the effort over that span. That’s a serious number even for a behemoth that in its various corporate incarnations, has spent more than a half-century processing black gold sucked from the ground. “These days,” Hwang says of SK’s battery business, “the order volume is huge.”

For years, the race to build a better battery was contained to consumer electronics. It was a growing business, but it wasn’t going to reorder capitalism. Now, amid an onslaught of electric cars on the road and renewable electricity on the power grid, the race is gearing up into a corporate and geopolitical death match. It suddenly has the dead-serious attention of many of the planet’s biggest multinationals, particularly auto giants, oil majors, and power producers. Having historically dismissed affordable energy storage as a pipe dream, they now view it as an existential threat—one that, if they don’t harness it, could disintermediate them. It also divides the world’s major economic powers, which see dominance of energy storage in the 21st century as akin to control of coal in the 19th century and of oil in the 20th. One clear sign: Battery-technology competition is deeply woven into the ongoing trade tensions between the U.S. and China.

Even Jeffrey Chamberlain, a battery geek, finds today’s shift breathtaking. For years he worked at Argonne National Labora-

tory, heading one of the U.S. government's top battery-research efforts. Now he leads a Chicago-based venture-capital fund, Volta Energy Technologies, that takes money from nervous power, oil, and other companies and invests it in energy-storage-technology startups. The corporations have concluded they have to hedge their bets, Chamberlain says, because "what renewable energy represents to these companies is massive destruction." China, meanwhile, has declared a world-leading battery industry a strategic national priority, doling out incentives to get the job done. "What does that imply?" Chamberlain asks. "Are they the new Saudi Arabia of batteries?"

UNPRECEDENTED BILLIONS of dollars are pouring into battery research and development, rendering batteries today the sort of technological target that semiconductors were a generation ago. A particularly fast stream is flowing into startups, each promising more brashly than the next to have cracked the code on the energy-storing black box. That money is coming from multinationals scrambling for technological fixes, from venture-capital firms looking for the next big home run, and from sundry billionaires who say they want to save the planet. And it's coming from both sides of the Pacific.

Some startups will win big; many more will implode. Either way, they are the leading edge of the battery race—the pack in which the jostling is most cutthroat, the daring is most on display, and the long-term breakthroughs are most likely to develop. They're also more talkative than the big players about what they're doing; that stands to reason because they're hungrier for investment.

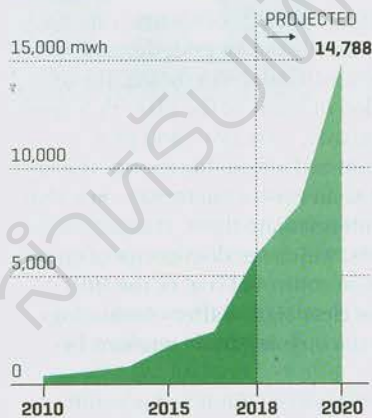
Today's global battery race has two main heats. One, already well underway, is for batteries for electric cars, whose market value the energy-data firm Wood Mackenzie projects will jump to \$41 billion in 2024, from \$13 billion in 2017. This is the market that has prompted Elon Musk's Tesla to build a massive battery plant—what Tesla calls a "gigafactory"—in Nevada. This is the market that's pushing essentially every global automaker—embarrassed by Tesla in the electric-car market and adamant not to be embarrassed anymore—to lob massive orders at SK and other major battery producers, almost all headquartered in Asia. It's also inducing them to invest in startups promising technological leaps.

The other heat, just beginning, is for batteries for the electric grid: factory-size devices designed to store massive amounts of energy, potentially for days or weeks at a time. Such technology could enable an epic transition from fossil fuels, such as coal and natural gas, which are altering the climate but can be fired on or off at will, to the sun and the wind, which are clean but don't always shine or blow. The market for them remains nascent and largely dependent on

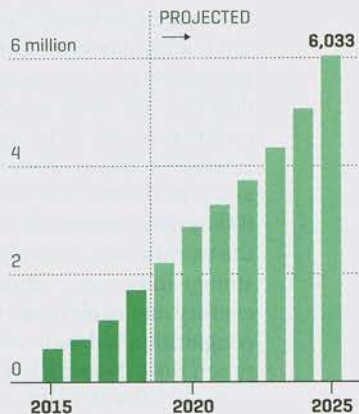
WHERE [ELECTRIC] POWER RESIDES

The electric-vehicle market has spurred investment in high-end battery manufacturing, especially in China. Grid storage, which could make sun and wind power more reliable, also is a major technical challenge: Today, there's not enough capacity in the entire world to power the tiny Falkland Islands.

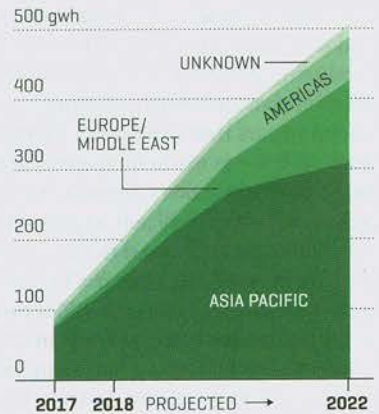
GLOBAL GRID-STORAGE CAPACITY



GLOBAL ELECTRIC-VEHICLE SALES



BATTERY-MANUFACTURING CAPACITY*



* INCLUDES LITHIUM-ION BATTERIES PRIMARILY FOR ELECTRIC VEHICLES AND GRID STORAGE. SOURCE: WOOD MACKENZIE



JEFFREY CHAMBERLAIN : CEO, Volta Energy Technologies

WHAT RENEWABLE ENERGY REPRESENTS TO UTILITIES AND OIL COMPANIES "IS MASSIVE DESTRUCTION."

government subsidies—which is to say that it's risky and anyone's to win. A swashbuckling band of technologists, bankrolled by deep-pocketed investors from a Bill Gates-backed fund to Saudi Aramco, are gunning to get their long-term energy-storage devices to market first.

At stake in both heats is more than the fate of some entrepreneurs and their speculative backers. At stake is the future of the global economy. Ever since Benjamin Franklin flew a key on a kite in a lightning storm, electricity has proved difficult to store in large quantities. That's why cars still run on oil, which can be stored easily in tanks. It's why transmission lines still are required to transport electricity hundreds or thousands of miles from where it's generated to where it's consumed. And it's why the vast majority of electricity still is produced by burning fossil fuels, which, for all their environmental downsides, are ruthlessly reliable. Flick a switch, the system springs to life, and the lights go on.

If electricity could be stored in large amounts at low cost, radical changes could follow. The electric car, which has fewer parts than a petroleum-powered vehicle and thus, at scale, should be cheaper to manufacture, could eclipse the internal-combustion engine. Sunlight could be stored as electricity during the day, and wind power at night, and renewable energy could, at acceptable cost, be made to behave like a constant, rather than as an intermittent, energy source. Given that transportation and electricity together account for about 40% of global greenhouse-gas emissions, humanity's carbon output—which scientists warn will have to crater

essentially to zero by mid-century to avoid particularly dangerous climate change—actually might start plummeting.

A grand reordering of economic winners and losers likely would result, with established players scrambling for new business models. Automakers would have to retool or die. Oil companies would have to reinvent themselves at least in significant part as renewable-energy providers or shrivel into oblivion. Utilities would have to pivot to a new and decentralized business in which they operated huge numbers of solar panels and wind turbines and batteries. Figuring out how to store electricity economically, in other words, could short-circuit the global economy and then rewire it.

Can it be done? I burned a lot of fossil fuel this spring trying to find out. I drove around Northern California and flew around the world. In Silicon Valley, Boston, China, and Korea, I found startups clawing their way up and corporations struggling not to fall down. All were nervous, though some were more forthcoming about that than others. Energy storage today is the mother of all frothy markets.

THE BATTERY IS, IN ITS BASIC architecture, a simple device. It contains four main parts: a positively charged electrode, called a cathode; a negatively charged electrode, called an anode; a substance that connects them, called an electrolyte, which typically is a liquid; and a membrane, known as a separator, that prevents certain particles from traveling from one electrode to the other in a "short circuit," which could spark a fire. A too-thin separator was implicated in a rash of fires in 2016 in some Samsung phones.

When a battery is powering a device, chemical reactions inside it break atoms into positively charged particles, called ions, and negatively charged particles, called electrons. The ions and electrons move simultaneously from the anode to the cathode, but they move in different streams. The ions move through the battery; the electrons create a circuit through the device, powering it.

In a conventional battery, when all its ions and electrons have moved from the anode to the cathode, the battery is dead. A rechargeable battery can be plugged in to receive new electricity, positioning ions and electrons in the anode to power the device again.

A major goal in battery research is maximizing "energy density": the amount of energy that can be shoved into a battery of a given volume or weight. That depends largely on the number of ions its anode can hold; the more ions, the more electrons the battery will have available to keep the device running. This primacy of ions and anode frames two crucial realities of today's battery quest.

One is that virtually all batteries today get their ions from the same element: lithium. Lithium is a particularly "light" element, which means its ions are particularly small, which means a particularly large number of them can be stuffed into an anode. So most electric devices today, from iPhones to Teslas, are powered by "lithium-ion" batteries.

The other reality is that a crucial part of today's battery quest is the bid to build a better anode: one that can accommodate especially massive quantities of lithium ions.

Among the many hopefuls trying to perfect a super-anode is

Amprius, a decade-old startup with headquarters in Silicon Valley, most of its operations in China, and investors in both countries that collectively have pumped about \$140 million into the company. They include Trident Capital and Kleiner Perkins, two Silicon Valley venture capital firms; SAIF Partners, a Chinese private-equity firm; and the Wuxi Industry Development Group, a government-owned investment company in Wuxi, the Chinese city in which Amprius has a sizable battery factory. Unlike many startups, Amprius is already producing batteries and selling them to prominent customers. Amprius had about \$50 million in revenue last year, says Kang Sun, the company's chief executive. But its technology remains buggy, and its future is hardly assured. "We're not out of the woods yet," he says.

Sun is a tech-industry lifer. He favors coiffed hair, pressed shirts, and straight talk. He grew up in China, earned a Ph.D. at Brown, worked his way up to vice president at Honeywell, and then went back to China to help build JA Solar, now one of the world's largest solar-panel makers. Today he lives near San Francisco, drives a Tesla, and flies seemingly constantly around the world.

His current gig as head of a transpacific battery startup is, he says, "the most difficult job I've had in my life." Over the hours I spent with him, one phrase kept popping out of his mouth, muttered almost subconsciously, as if a mantra: "not easy." As in: "Battery technology is not easy."

The source of his lament: the maddening elusiveness of the super-anode.

The anodes in most lithium-ion batteries are made of graphite, a substance that's cheap and plentiful. Amprius, like many other startups, is trying to make anodes from silicon, which, gram for gram, theoretically can hold 10 times as many lithium ions as graphite can. "Theoretically" is a colossal caveat. Silicon's upside as a lithium-ion hoarder has a major downside too: When silicon is stuffed with lots of lithium ions, it swells. That swelling can crack the anode material, dramatically shortening a supposed super-battery's life.

More than a decade ago, a Stanford materials-science professor, Yi Cui, developed a new technique to avert silicon swelling in an anode. It uses a structure of silicon that, at nanoscale, resembles a single bristle of an upturned brush. Lab experiments proved that, as each is stuffed with lithium ions, it has plenty of space to swell without knocking into another bristle and cracking the anode. Amprius is the company created to commercialize the concept, known as "silicon nanowire."

Sun soon signed on as CEO, figuring he'd spend a few years building Amprius and then flip it or take it public at a handsome profit. A decade later, he's still on the hot seat. "We have to scale up 30 times bigger," he says. "Otherwise, we cannot make money."

AMPRIUS'S INTELLECTUAL HUB, in Sunnyvale, Calif., the heart of Silicon Valley, is a bunker-like suite in an unremarkable industrial park. The walls are scuffed, the furniture looks rented even though it isn't, and one day when I visit, the floor under the men's-room urinals is lined with cardboard sheets pocked with stains. This summer, Amprius is moving



IN 2018, GLOBAL GRID STORAGE TOTALED 6,000 MEGAWATT-HOURS—LESS THAN HALF WHAT THE FALKLAND ISLANDS USE IN A YEAR.

to a different office; it's moving because its lease wasn't renewed, but it will pay lower rent. Money at Amprius isn't spent on creature comforts. It's spent on science and manufacturing.

In a lab of the Sunnyvale office is Amprius's crown jewel: a room-sized machine, designed by Amprius and built in Europe to its specifications, that applies a mix of silane gas and other gases to a metal substrate; the resulting chemical reaction creates the silicon nanowires. Visible through a peephole in the machine about the diameter of a silver dollar, the gas-application process is a purple haze. Everything about it is intricate and finicky: the composition of the gases; the pressure and temperature at which they're shot in; the speed at which the substrate moves along the conveyor belt inside the machine.

Once the anode material comes out of the machine, in a double-sided roll that's battleship gray, it packs about 200,000 silicon nanowires per square centimeter per side. It's cut and sent into a series of small lab rooms, where workers in white coats and blue surgical masks assemble batteries essentially by hand. Amprius says the best of these batteries have an energy density about 60% higher than that of conventional lithium-ion batteries. One downside is that they don't withstand as many discharges and charges as conventional batteries—something Amprius is working to improve.

Amprius's cutting-edge batteries have piqued the interest of the U.S. Army, which is testing them for use in clothing that soldiers might wear to power the devices they use in the field. By far the batter-

ies' biggest buyer is Airbus. As part of a program dubbed Zephyr, Airbus is testing them on unmanned planes known as high-altitude pseudo-satellites, or HAPS. Last December, the two companies announced that one of the Airbus vehicles powered by Amprius batteries flew for more than 25 days, "setting a new endurance and altitude record for stratospheric flight."

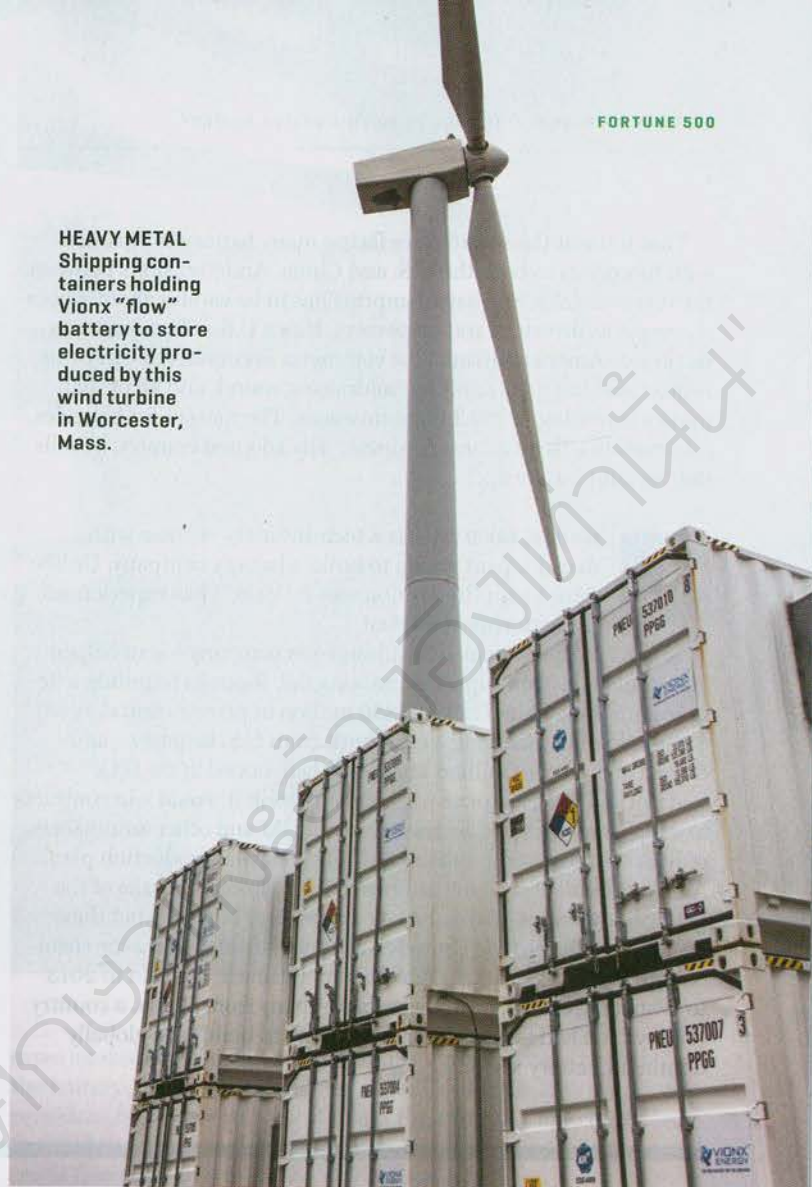
To Sun, the Airbus contract is both a lifeline and a yellow flag. "We charge them a crazy price" for the batteries, he says. "That kind of price is not sustainable." The batteries crafted in Sunnyvale, in other words, are akin to suits sewn on Savile Row: bespoke, expensive, and therefore at risk. "If it cannot scale up," Sun says of the California operation, "it will die."

Airbus has compelling reasons to pay Amprius's price. It is trying to outpace its rivals, including Boeing, in developing and commercializing both a less-expensive alternative to satellites and a viable fleet of electric-powered air taxis. "There are hundreds of startups out there" claiming they have the next big thing in batteries, says Mark Cousin, chief executive of A³ by Airbus, an innovation center the company has set up in Sunnyvale, not far from Amprius. But, other than Amprius, "we've not seen any evidence that any of the companies are close to having something that could potentially be mature enough to be integrated into a product in the short to medium term."

In China, meanwhile, Amprius is chasing a broader market. In Nanjing, the southern Chinese metropolis in which Sun grew up, Amprius has another laboratory where it's developing an anode material less rarefied than its silicon-nanowire technology but still more advanced than the industry norm. It's a nanoscale structure of silicon manufactured as a powder and then combined with traditional graphite powder. The resulting graphite-silicon mixture is run through a conventional battery plant. This modest silicon boost typically raises a battery's energy density by up to 15% beyond a traditional lithium-ion battery's. That's far less than the improvement from the silicon-nanowire material, but it's radically cheaper.

On the morning I visit Nanjing, dozens of bags of the silicon powder are stacked

HEAVY METAL
Shipping containers holding Vionx "flow" battery to store electricity produced by this wind turbine in Worcester, Mass.



on a metal shelf. To my untrained eye, they resemble ground coffee, differing only in their shade of brown. Some evoke French roast; others, a lighter blend. Amprius is supplying the material to various U.S., European, Japanese, Korean, and Chinese automakers for testing. It also trucks the powder to a factory in nearby Wuxi that was built for Amprius in 2016.

When I visit the Wuxi factory, it's cranking out batteries for children's smartwatches and for consumer battery packs. The factory also makes batteries for a Chinese dronemaker. Chuanxin Zhai, a scientist there who has been dispatched to walk me around, says he's particularly proud the factory won a recent contract for the watch batteries. It did so after an intense competition over energy density with Amperex Technology Ltd., or ATL, a Chinese company that's one of the biggest battery makers in the world. Zhai mentions another customer for which the Wuxi factory has made batteries: a firm that uses them to make cold-weather oxygen-supply machines. That firm, he says, sells the machines to the Chinese military, for medical use in Tibet.

That hints at the sensitivities facing many battery companies with footprints in both the U.S. and China. Amid tensions between the two countries, Sun says, Amprius has to be careful about whom it accepts as investors and customers. He's a U.S. citizen and says he prefers American living. But commerce is commerce: Amprius is just finishing a \$30 million fundraising round, and all of that money is coming from Chinese investors. The market for batteries, Sun explains, "is a Chinese business." His adopted country, he tells me, "needs to wake up."

LIKE SUN, DAVID VIEAU is a tech-industry veteran with decade spent trying to build a battery company. Unlike Sun, Vieau (he pronounces it "View") has experienced the bitterness of defeat.

In 2012, A123 Systems, the lithium-ion company Vieau helped create, filed for bankruptcy, a stunning fall. Since its founding a decade earlier, A123 had raised \$350 million in private capital, spent \$129 million in matching-grant funds from U.S. taxpayers, and earned about \$390 million in a much-ballyhooed 2009 IPO.

A123 had built factories on the assumption it would win contracts to supply batteries for electric cars from GM and other automakers, only to see those companies drastically dial back production plans. An A123 recall of certain batteries didn't help. In the wake of the bankruptcy, critics pilloried A123 as a poster child for what they deemed the folly of the United States subsidizing a domestic clean-energy industry. Most of A123's battery business was sold in 2013 to Wanxiang Group, an auto-parts company from China, a country that by then had initiated a national push to build up a globally dominant battery sector.

Chastened by the A123 implosion, Vieau figured he'd had enough of the battery business. Then he changed his mind. Today, he is again steering a battery startup that's fighting a crowded field. This time, though, he isn't trying to perfect lithium-ion technology. He's trying to beat it.

Vieau is a director and former CEO of Vionx Energy, a startup based in the Boston suburb of Woburn, Mass. Investors, primarily venture capital firms, have so far poured about \$130 million into Vionx and a predecessor company. Vionx—"stupid name, but they always are," Vieau tells me of the moniker, which is pronounced "Vy-on-ix"—seeks to scale up a wholly different kind of battery, one that can profitably store vast quantities of renewable energy for many hours. Vionx is one of a gathering stampede of companies developing grid-storage technologies that look less like batteries and more, in both function and size, like power plants.

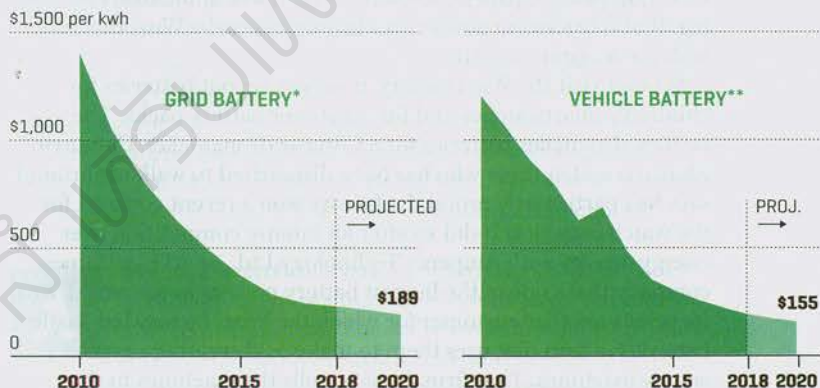
Rather than tweaking space-age materials at nanoscale, as lithium-ion contenders are doing, grid-storage hopefuls work with slabs of metal, industrial pumps and pipes, and chemical brews dumped thousands of gallons at a time into massive tanks.

Vionx's specific contraction is called a

FALLING PRICES RESHAPE THE MARKET

The costs of both vehicle and grid batteries have dropped, thanks to technical advances and economies of scale. At the same time, rising demand for big batteries is creating a bigger potential prize for innovators.

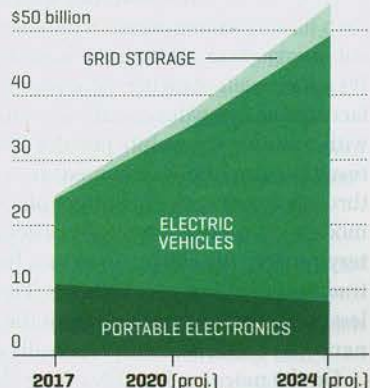
DECLINE IN BATTERY PRICES



* INCLUDES BATTERIES, RACKS, AND OTHER SUPPORTING EQUIPMENT

** FOR BATTERY PACKS

BATTERY MARKET VALUE



SOURCE: WOOD MACKENZIE



LIQUID ASSETS
A device used to test Vionx's flow batteries, which rely on tanks of chemicals to help store energy.

“flow battery.” If it works at scale, it could provide up to about 10 hours of economic storage—perhaps more, with bigger tanks. Over the years, flow batteries have become something of a joke in the energy world. Myriad efforts to scale them up have flopped, both because the technology has been glitchy and because the fossil-fueled grid hasn't needed much storage.

Vieau's bet today is that two fundamental changes—better technology and plummeting renewable-energy prices—mean past isn't prologue. Solar prices have fallen 70% over the past decade. That, plus newly cheap wind power, is boosting demand for energy storage. At the same time, according to Wood Mackenzie, the price of grid-scale-storage systems—the batteries and the rest of the kit necessary to set them up—has fallen 85% since 2010. (See sidebar at left.)

Serious power players are now investing in grid-storage technologies. One is Exelon, which had 2018 revenue of \$35.9 billion, is No. 93 on this year's *Fortune* 500, and has about 10 million customers. It is

experimenting with big batteries and is writing checks to Volta, the battery-tech investment firm. Chris Gould, Exelon's senior vice president for corporate strategy, says the company has concluded the shift to solar and storage will intensify and that Exelon can profit from it.

R **REALITY CHECK: SO FAR, STORAGE** provides only a tiny amount of power to the grid. In 2018, according to Wood Mackenzie, there was enough for about 6,000 megawatt-hours of electricity. That's for the whole world, and it's less than half the amount of electricity the Falkland Islands use in a year. Even if the grid-storage market achieves the eightfold increase in economic value between 2017 and 2024 that Wood Mackenzie expects, it still will be just one-tenth the value of the electric-car-battery market at that point.

Where it exists, grid storage typically is a creature of government subsidies and mandates. And even given that support, it tends to be concentrated in places, such as California and Hawaii, where renewable energy enjoys maximal economic advantage: places with particularly strong sun and wind and with particularly high fossil-fueled-power prices.

What little energy storage is on the grid today generally amounts to big racks of lithium-ion batteries. That's a problem for the world—and, Vieau hopes, an opportunity for Vionx. The lithium-ion battery has cornered the market for movable things—toys,

OUTFOX THE WOLVES ON WALL STREET.



watches, phones, electric cars—because it packs a lot of energy into a small package. But today's grid-scale lithium-ion installations typically can store only a few hours' worth of juice before they need a recharge. That's sufficient to stabilize a grid, in the event of an unexpected drop in solar or wind power, until more fossil-fueled electricity can be cranked up and wired out. But it's nowhere near enough to flip the global power system from fossil fuels to renewables.

Vionx contends its technology offers one possible answer. At three government-funded test sites in Massachusetts, Vionx has deployed prototype collections of shipping containers that house its flow batteries. They're mazes of pumps and pipes, of plastic and metal, that Vieau himself describes as "Rube Goldberg."

In Shirley, Mass., a Vionx battery is waiting to be hooked up to a field of Chinese-made solar panels. When it's up and running, it should be able to store enough energy to power about 160 homes. I visit the site on a late afternoon so cold my fingers, as I scribble notes,

WIRED FOR THE FUTURE
Vionx technician Cuong Tran builds a control unit for a flow battery stack.

feel numb. To my eyes, accustomed by now to lithium-ion batteries that would fit in my backpack if not in my pocket, the system looks gargantuan. Not to Vieau. Vionx's systems, he says, need to be the size of power plants to be viable. "Otherwise, it's a joke."

Vionx designs and assembles these systems at its headquarters in Woburn, which looks more like a commercial garage than a lab. Scattered around it are tubs big enough to take a dunk in, though, given that they're filled with battery acid, that would be unwise.

Shazad Butt, Vionx's vice president of engineering, gives me a tour. He's a car guy, having worked for years at Ford Motor before moving to A123 and later to Vionx. The lithium-ion battery is "the Ferrari of storage," he tells me in his flat Michigan accent. "This being the truck."

Vionx is based on technology developed by and licensed from United Technologies. It uses vanadium,

FORTUNE THE LEDGER

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a metal, as the energy carrier in its chemical soup. But the startup faces two fundamental challenges. One is supply. Vanadium is a global commodity with a fluctuating price. Right now, prices are high, undermining Vionx's economics. The other problem is demand. Government policies, which shape the grid-storage market, were written to support lithium-ion systems, which typically can provide about four hours of backup and which degrade and need to be replaced every few years. But Vionx's system is sized to be economically competitive for about 10 hours of storage—and to last 20 years or more with essentially no degradation. The system's beefiness brings higher initial capital costs that pencil out only when amortized over more hours of electricity sales. Buying a Vionx system to produce four hours of juice would be like buying a blowtorch to light a cigar.

"It's a big issue," says Vieau, reflecting over a dinner of oysters and fish at one of his favorite white-tablecloth restaurants in Boston. It's also a familiar one. He finds himself at Vionx today in much the same dilemma that he did at A123: with an energy-storage device that he's convinced is technologically ready but that the market doesn't want, at least not yet. "The question is, 'Can you get to a point where renewable energy plus storage is cheaper than coal?' And the answer is yes," he says, sipping a French Chardonnay. "I'm as convinced today that this is a reality as I was in 2004 that the electric car was going to happen. But the question is, *when* is it going to happen?"

VIONX IS but one of many grid-storage hopefuls wrestling with that dilemma. Another is Form Energy, a startup that grew in part out of the laboratory of Yet-

Ming Chiang, an MIT materials-science professor who worked with Vieau as the technological mind behind A123. Form has raised about \$11 million, plus a recent \$3.9 million grant from the U.S. Department of Energy. Among its other investors are Breakthrough Energy Ventures, a \$1 billion clean-energy-technology fund established by Bill Gates and a who's who of other global billionaires, and Saudi Aramco, the oil giant.

Form aspires to affordably produce radically long-term energy storage—enough not just for 10 hours but for several days or even weeks, which its executives argue will be necessary to reach percentages of renewable energy on the grid that really will phase out fossil fuels. The federal grant Form won was to build a system using sulfur as a key ingredient. Chiang, chatting in his sunny office in Cambridge, Mass., won't say whether the storage device Form hopes to commercialize will use sulfur. But, choosing his words carefully, he says that "sulfur appears to be one of the most attractive, earth-abundant molecules." Nonscientific translation of "earth-abundant": cheap.

A few blocks from Chiang's office, I visit Malta, a startup spun out last year from X, the skunkworks of Alphabet, Google's parent. Like Form, Malta, based on Stanford technology, plans to use giant tanks and pumps to store energy for several days or more. But its technology aspires to store energy as heat, an arrangement it sees as more economic. Malta's investors include Breakthrough Energy Ventures, a Swedish heat-exchange-equipment maker, and a Chinese renewable-energy producer. As if out of a startup documentary, the company is based in a shared workspace in Cambridge where cold-brew coffee

WHEN THE WORLD'S MOST POWERFUL WOMEN SPEAK, STOP TALKING.

FORTUNE

THE BROADSHEET

Our daily newsletter follows the career paths of female leaders, founders, owners, and entrepreneurs who are changing the face of business.

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THE HUMAN MIND, BODY & BIG DATA, COVERED WITH SOUL.

and kombucha flow freely and the conference rooms are named for grand projects of civil engineering throughout history. Ramya Swaminathan, Malta's chief executive, tells me she hopes to have a product on the market in about five years. What most worries her is that Malta is designing a complex piece of machinery for a market that doesn't yet exist. "It's the blind man and the elephant," she notes. "We're all feeling our way through."

THERE'S A PALPABLE difference between the grid-storage startups and the lithium-ion-battery companies I visit. The firms eyeing the electric-car market seem even more harried—because the market wants a better lithium-ion battery right now.

Back in Woburn, a handful of other battery startups sit not far from Vionx. One is Ionic Materials, the brainchild of Michael Zimmerman, a laconic materials scientist who, on the morning I visit, is wrapped in an L.L. Bean fleece jacket. He has spent his career—including several years at Bell Labs, the famed corporate-research outfit—burrowing away on plastics.

Zimmerman began tinkering with how to make better polymers for batteries nearly a decade ago. He has come up with a polymer that, at room temperature, allows ions to flow freely. That raises the possibility of affordably producing a battery that doesn't need a liquid electrolyte—a "solid-state" battery, which could be safer and, Zimmerman says, even more energy-dense.

Ionic Materials counts among its investors a potent list of multinationals, including the Renault-Nissan-Mitsubishi alliance; Total, the French oil company; and Hyundai, the Korean automaker. Other investors include Hitachi, the Japanese conglomerate whose

products include batteries; and Volta, the energy-storage fund.

Zimmerman's team of about 50 people is struggling to make the polymer thinner, stronger, more uniform, and cheaper—all in preparation, he hopes, for launching production over the next few years. "This is really hard," he says, sitting under a wall clock whose face reads, "In Science We Trust," and tapping the table with his empty coffee cup. "It's a headbanging process."

Less than a mile from Ionic Materials sits Solid Energy Systems, which is taking an arguably more daring approach. Qichao Hu, the company's founder, scoffs at the notion of a solid-state battery, saying it may be safer but won't pack enough energy. He considers a silicon anode similarly ho-hum. Hu, just 33, grew up in Wuhan, China, and got his bachelor's degree from MIT and his Ph.D. from Harvard. He's committed to commercializing what among battery researchers has long been seen as a Holy Grail: an anode that will dwarf even silicon in its lithium content because the anode itself is made of lithium metal.

The problem, for years, has been safety. Lithium-metal batteries have a particular propensity, during charging, for the buildup of substances on the anode that can pierce the separator, which can create a short circuit and cause a fire. Hu isn't worried. He's confident his battery, which he calls "beyond lithium-ion" and hopes to begin selling for drones next year, will be no more dangerous than those now on the market. "You have cars catching on fire, and still people buy them," he tells me. "So it's acceptable."

Hu talks and works fast. He's intent on taking his company public as soon as possible, because time is money. "Once the first beyond-lithium company goes public, it's going to suck up all the invest-

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DAVID VIEAU: CEO, Vionx

CAN YOU GET TO A POINT WHERE RENEWABLE ENERGY PLUS STORAGE IS CHEAPER THAN COAL? YES."

ment," he tells me. "Every one of us wants to be the first."

Hu has arrived at our 7:30 a.m. meeting in Woburn a few minutes late, a massive travel mug of tea in hand. Both are understandable, given that he has just driven 3.5 hours to the office from his home in New Jersey, a commute he makes weekly.

He's wearing rumpled blue chinos and dusty work boots—and he's wearing an identical outfit a week later, when I meet Hu in Shanghai to tour the factory that Solid Energy is building there, in Jiading, a district that also houses major auto factories. Trailing Hu as he walks through the site, the air heavy with the fumes of still-fresh paint, are representatives of several of the investors who in total have poured about \$90 million into Solid Energy. They include SAIC Motor, China's largest automaker, which is based in Shanghai; and Tianqi Lithium, a Chinese company that's one of the world's largest producers of lithium, a material that is mined. Among Solid Energy's other investors: GM and SK.

That many big companies pop up repeatedly across the battery-startup landscape indicates how urgent the technological quest has become. Back on SK's Korea campus, in the

R&D buildings that Hwang, the strategist, won't let me see, they're focusing, he says, on improving the cathode and on engineering a separator that's thin but still safe. SK feels the competitive heat, which is why it's hedging its bets by backing startups such as Solid Energy. "If we develop things all by ourself," Hwang says, "it has some risk."

VW, one of the world's biggest automakers, agrees. That's why it announced last year it was investing \$100 million in yet another Silicon Valley battery startup, called QuantumScape, an investment that augments VW's contracts with SK and other huge battery makers. As part of its green remaking, VW says 40% of the vehicles it sells will be battery-powered by 2030. "We need to make decisions right now—who and where is the partner—to secure this enormous quantity of batteries," says Stefan Sommer, VW's head of procurement. "It's the only way to ramp up this huge capacity in this short period of time."

And that points to a messy yet fundamental reality about the battery race. Despite mounting chest-thumping in national capitals that individual countries must dominate it to safeguard their national security, in practice the battery sector is an increasingly global web. More and more battery firms embody an international mix of intellectual property, investors, and suppliers, to say nothing of customers. Whether these firms are American, or Chinese, or something else is less and less clear. In so many ways, the battery race appears unlikely to stay within established lanes. For consumers and the planet, that may be a very good thing. For policymakers, investors, and the corporate giants of the fossil-fuel era, it will make the race increasingly hard to navigate. ■

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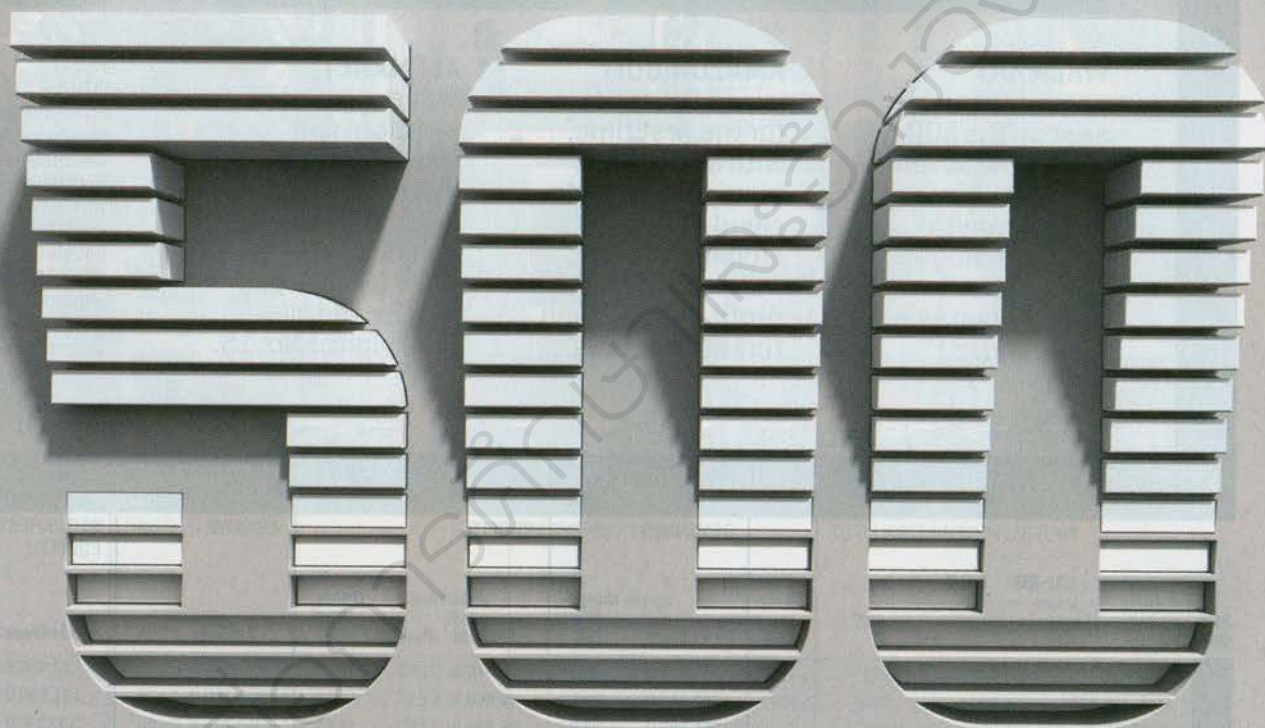
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THE 500 LARGEST
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LARGEST U.S. CORPORATIONS

500

WALMART

earned the top spot on the 500 list for the seventh straight year. Online growth and a thriving grocery business helped keep sales humming.

AMAZON.COM

joined the top five for the first time, with a 31% jump in revenue. And its cloud-software empire helped it notch an annual profit of \$10 billion for the first time.

ALPHABET

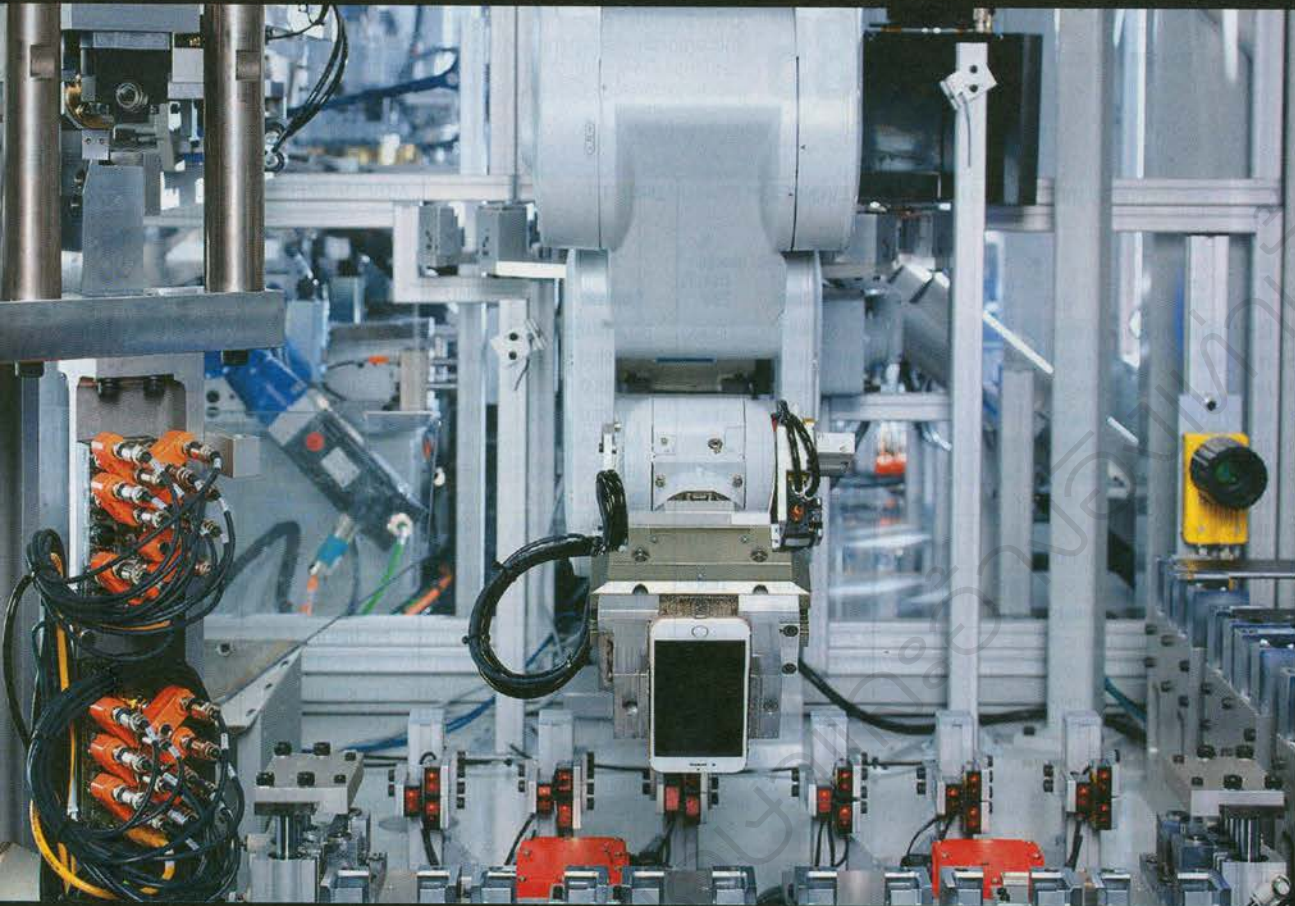
faced regulatory pressure and slowing ad sales at its Google unit, but still increased revenue 23%, to \$137 billion—and reached an all-time high of No. 15.

NO. 3 APPLE

Thanks largely to the iPhone, Apple was the 500's most profitable company for the fifth straight year. (At right, an iPhone recycling robot.) Apple's next challenge: earning more from services as phone sales ebb.

COURTESY OF APPLE

RANK		→ 1-20 500		REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
2018	2017			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
1	1	WALMART	Bentonville, Ark. ¹	514,405.0	2.8	6,670.0	40	(32.4)	219,295.0	38	72,496.0	18
2	2	EXXON MOBIL	Irving, Texas	290,212.0 ^E	18.8	20,840.0	8	5.7	346,196.0	20	191,794.0	6
3	4	APPLE	Cupertino, Calif. ²	265,595.0	15.9	59,531.0	1	23.1	365,725.0	18	107,147.0	10
4	3	BERKSHIRE HATHAWAY	Omaha, Neb.	247,837.0	2.4	4,021.0	74	(91.1)	707,794.0	10	348,703.0	1
5	8	AMAZON.COM	Seattle, Wash.	232,887.0	30.9	10,073.0	27	232.1	162,648.0	46	43,549.0	36
6	5	UNITEDHEALTH GROUP	Minnetonka, Minn.	226,247.0	12.5	11,986.0	20	13.5	152,221.0	55	51,696.0	28
7	6	MCKESSON	Irving, Texas ³	208,357.0	4.9	67.0	441	(98.7)	60,381.0	116	9,804.0	171
8	7	CVS HEALTH	Woonsocket, R.I. ⁴	194,579.0	5.3	(594.0)	486	(109.0)	196,456.0	42	58,225.0	22
9	9	AT&T	Dallas, Texas ⁵	170,756.0	6.4	19,370.0	9	(34.2)	531,864.0	13	184,089.0	7
10	12	AMERISOURCEBERGEN	Chesterbrook, Pa. ²	167,939.6	9.7	1,658.4	169	355.0	37,669.8	167	2,932.8	346
11	13	CHEVRON	San Ramon, Calif.	166,339.0 ^E	23.6	14,824.0	15	61.2	253,863.0	31	154,554.0	9
12	11	FORD MOTOR	Dearborn, Mich.	160,338.0	2.3	3,677.0	81	(51.6)	256,540.0	30	35,932.0	44
13	10	GENERAL MOTORS	Detroit, Mich.	147,049.0	(6.5)	8,014.0	34	—	227,339.0	36	38,860.0	40
14	15	COSTCO WHOLESALE	Issaquah, Wash. ⁶	141,576.0	9.7	3,134.0	92	17.0	40,830.0	157	12,799.0	130
15	22	ALPHABET	Mountain View, Calif.	136,819.0	23.4	30,736.0	3	142.7	232,792.0	35	177,628.0	8
16	14	CARDINAL HEALTH	Dublin, Ohio ⁷	136,809.0	5.3	256.0	402	(80.1)	39,951.0	161	6,059.0	244
17	19	WALGREENS BOOTS ALLIANCE	Deerfield, Ill. ⁸	131,537.0	11.3	5,024.0	60	23.2	68,124.0	105	26,007.0	62
18	20	JPMORGAN CHASE & CO.	New York, N.Y.	131,412.0	15.4	32,474.0	2	32.9	2,622,532.0	2	256,515.0	3
19	16	VERIZON COMMUNICATIONS	New York, N.Y.	130,863.0	3.8	15,528.0	13	(48.4)	264,829.0	28	53,145.0	24
20	17	KROGER	Cincinnati, Ohio ¹	121,162.0	(1.2)	3,110.0	94	63.1	38,118.0	166	7,886.0	209



MARKET VALUE 3/29/19		PROFITS AS % OF ...						EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018
\$ millions	Rank	Revenues		Assets		Stockholders' equity		2018	% change from 2017	2008-2018 annual growth rate		2008-2018 annual rate					
		%	Rank	%	Rank	%	Rank	\$		%	Rank	%	Rank				
279,880.3	11	1.3	420	3.0	309	9.2	338	2.26	(31.1)	(4.0)	258	(3.5)	170	7.8	313	24	1
342,172.0	9	7.2	256	6.0	207	10.9	302	4.88	5.4	(5.6)	268	(15.1)	251	1.5	373	47	2
895,667.4	2	22.4	52	16.3	32	55.6	34	11.91	29.3	31.6	7	(5.4)	183	30.8	16	11	3
493,870.3	5	1.6	412	0.6	432	1.2	427	2,446.00	(91.0)	(2.7)	254	2.8	132	12.2	238	37	4
874,709.5	3	4.3	324	6.2	203	23.1	153	20.14	227.5	29.7	12	28.4	20	40.2	4	38	5
237,255.5	18	5.3	298	7.9	145	23.2	151	12.19	13.7	17.6	38	14.5	57	26.7	29	25	6
22,455.1	204	0.0	454	0.1	451	0.7	429	0.32	(98.6)	(20.9)	292	(28.4)	355	12.0	240	68	7
69,951.6	76	(0.3)	462	(0.3)	461	(1.0)	441	(0.57)	(108.9)	—	—	(7.0)	195	10.4	271	27	8
228,444.7	21	11.3	145	3.6	285	10.5	312	2.85	(40.1)	2.8	207	(22.1)	317	5.7	340	57	9
16,785.9	241	1.0	427	4.4	256	56.5	33	7.53	359.1	25.6	16	(17.6)	273	17.0	139	68	10
234,049.7	20	8.9	204	5.8	216	9.6	330	7.74	59.6	(4.0)	259	(9.8)	215	7.8	312	47	11
35,028.0	151	2.3	394	1.4	381	10.2	318	0.92	(51.6)	—	—	(34.3)	395	16.3	155	43	12
52,291.7	98	5.4	293	3.5	290	20.6	173	5.53	—	—	—	(14.9)	249	—	—	43	13
106,512.6	53	2.2	397	7.7	151	24.5	138	7.09	16.6	9.4	126	10.6	78	17.5	124	24	14
816,824.2	4	22.5	51	13.2	52	17.3	215	43.70	142.8	20.7	26	(0.8)	152	21.1	81	38	15
14,349.5	260	0.2	451	0.6	425	4.2	403	0.81	(79.9)	(13.8)	285	(24.8)	337	8.4	304	68	16
59,691.7	90	3.8	337	7.4	160	19.3	184	5.05	33.6	8.8	132	(3.7)	172	13.0	227	20	17
331,451.5	10	24.7	40	1.2	393	12.7	273	9.00	42.6	20.7	25	(6.7)	192	14.5	185	9	18
244,327.9	14	11.9	134	5.9	214	29.2	101	3.76	(48.9)	5.2	180	11.1	76	11.3	252	57	19
19,630.8	220	2.6	383	8.2	134	39.4	69	3.76	79.9	14.7	65	2.1	137	9.4	287	20	20

→ 21-68 500

35

DOWDUPONT A chemicals giant with \$86 billion in sales in 2018, DowDuPont will metamorphose into three independent companies this year. A materials science business, Dow, spun off in April; an agricultural business (Corteva) and a specialty products business (DuPont) are scheduled to separate by midyear. —*Geoff Colvin*

RANK			REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
2018	2017		\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
21	18	GENERAL ELECTRIC Boston, Mass.	120,268.0 [†]	[1.6]	(22,355.0)	500	—	309,129.0	22	30,981.0	53
22	21	FANNIE MAE Washington, D.C. ⁸	120,101.0	8.9	15,959.0	12	547.9	3,418,318.0	1	6,240.0	241
23	28	PHILLIPS 66 Houston, Texas	114,217.0 ⁶	24.7	5,595.0	51	9.6	54,302.0	126	24,653.0	66
24	31	VALERO ENERGY San Antonio, Texas	111,407.0 ⁶	26.0	3,122.0	93	[23.2]	50,155.0	132	21,667.0	74
25	24	BANK OF AMERICA CORP. Charlotte, N.C.	110,584.0	10.3	28,147.0	4	54.4	2,354,507.0	3	265,325.0	2
26	30	MICROSOFT Redmond, Wash. ⁷	110,360.0	22.7	16,571.0	11	[21.8]	258,848.0	29	82,718.0	15
27	23	HOME DEPOT Atlanta, Ga. ¹	108,203.0	7.2	11,121.0	23	28.9	44,003.0	146	(1,878.0)	491
28	27	BOEING Chicago, Ill.	101,127.0	8.3	10,460.0	24	27.6	117,359.0	72	339.0	470
29	26	WELLS FARGO San Francisco, Calif.	101,060.0	3.4	22,393.0	5	0.9	1,895,883.0	6	196,166.0	5
30	32	CITIGROUP New York, N.Y.	97,120.0	10.4	18,045.0	10	—	1,917,383.0	5	196,220.0	4
31	41	MARATHON PETROLEUM Findlay, Ohio ⁹	97,102.0 ⁶	43.6	2,780.0	104	[19.0]	92,940.0	87	35,175.0	45
32	33	COMCAST Philadelphia, Pa.	94,507.0	11.8	11,731.0	21	[48.4]	251,684.0	32	71,613.0	19
33	29	ANTHEM Indianapolis, Ind.	92,105.0	2.3	3,750.0	80	[2.4]	71,571.0	99	28,541.0	57
34	35	DELL TECHNOLOGIES Round Rock, Texas ¹	90,621.0	15.2	(2,310.0)	495	—	111,820.0	75	(5,765.0)	495
35	47	DOWDUPONT Wilmington, Del.	85,977.0	37.2	3,844.0	77	163.3	188,030.0	44	94,571.0	12
36	36	STATE FARM INSURANCE COS. Bloomington, Ill.	81,732.2	4.3	8,788.4	30	298.3	272,518.4	25	100,877.7	11
37	37	JOHNSON & JOHNSON New Brunswick, N.J.	81,581.0	6.7	15,297.0	14	1,076.7	152,954.0	54	59,752.0	21
38	34	INTERNATIONAL BUSINESS MACHINES Armonk, N.Y.	79,591.0	0.6	8,728.0	32	51.7	123,382.0	68	16,796.0	97
39	39	TARGET Minneapolis, Minn. ¹	75,356.0	4.8	2,937.0	99	0.1	41,290.0	154	11,297.0	150
40	38	FREDDIE MAC McLean, Va. ⁸	73,598.0	[1.4]	9,235.0	29	64.2	2,063,060.0	4	4,477.0	289
41	44	UNITED PARCEL SERVICE Atlanta, Ga.	71,861.0	9.1	4,791.0	62	[2.4]	50,016.0	134	3,021.0	338
42	40	LOWE'S Mooresville, N.C. ¹	71,309.0	3.9	2,314.0	130	[32.9]	34,508.0	178	3,644.0	310
43	46	INTEL Santa Clara, Calif.	70,848.0	12.9	21,053.0	7	119.3	127,963.0	65	74,563.0	17
44	43	METLIFE New York, N.Y.	67,941.0	2.7	5,123.0	58	27.8	687,538.0	11	52,741.0	25
45	42	PROCTER & GAMBLE Cincinnati, Ohio ⁷	66,832.0	0.9	9,750.0	28	[36.4]	118,310.0	71	52,293.0	26
46	51	UNITED TECHNOLOGIES Farmington, Conn. ¹⁰	66,501.0	11.1	5,269.0	57	15.8	134,211.0	63	38,446.0	41
47	50	FEDEX Memphis, Tenn. ¹¹	65,450.0	8.5	4,572.0	63	52.6	52,330.0	130	19,416.0	89
48	45	PEPSICO Purchase, N.Y.	64,661.0	1.8	12,515.0	18	157.7	77,648.0	96	14,518.0	114
49	48	ARCHER DANIELS MIDLAND Chicago, Ill.	64,341.0	5.8	1,810.0	159	13.5	40,833.0	156	18,981.0	92
50	52	PRUDENTIAL FINANCIAL Newark, N.J.	62,992.0	5.5	4,074.0	72	[48.2]	815,078.0	9	48,617.0	32
51	61	CENTENE St. Louis, Mo.	60,116.0	23.8	900.0	254	8.7	30,901.0	192	10,917.0	155
52	53	ALBERTSONS COS. Boise, Idaho ¹²	59,924.6	0.4	46.3	446	—	21,812.3	242	1,398.2	416
53	55	WALT DISNEY Burbank, Calif. ^{5,13}	59,434.0	7.8	12,598.0	17	40.3	98,598.0	84	48,773.0	31
54	54	SYSCO Houston, Texas ⁷	58,727.3	6.1	1,430.8	190	25.2	18,070.4	274	2,507.0	365
55	58	HP Palo Alto, Calif. ¹⁴	58,472.0	12.3	5,327.0	55	110.9	34,622.0	177	(639.0)	485
56	56	HUMANA Louisville, Ky.	56,912.0	5.8	1,683.0	167	[31.3]	25,413.0	217	10,161.0	164
57	76	FACEBOOK Menlo Park, Calif.	55,838.0	37.4	22,112.0	6	38.8	97,334.0	85	84,127.0	14
58	65	CATERPILLAR Deerfield, Ill.	54,722.0	20.4	6,147.0	45	715.3	78,509.0	93	14,039.0	119
59	64	ENERGY TRANSFER Dallas, Texas ¹⁵	54,436.0 [†]	14.6	1,694.0	166	77.6	88,246.0	89	20,559.0	84
60	59	LOCKHEED MARTIN Bethesda, Md.	53,762.0	5.3	5,046.0	59	152.0	44,876.0	144	1,394.0	417
61	57	PFIZER New York, N.Y.	53,647.0	2.1	11,153.0	22	[47.7]	159,422.0	49	63,407.0	20
62	70	GOLDMAN SACHS GROUP New York, N.Y.	52,528.0	24.3	10,459.0	25	144.0	931,796.0	7	90,185.0	13
63	67	MORGAN STANLEY New York, N.Y.	50,193.0	15.0	8,748.0	31	43.2	853,531.0	8	80,246.0	16
64	62	CISCO SYSTEMS San Jose, Calif. ¹⁶	49,330.0	2.8	110.0	434	[98.9]	108,784.0	77	43,204.0	37
65	73	CIGNA Bloomfield, Conn. ¹⁷	48,650.0	16.9	2,637.0	110	17.9	153,226.0	53	41,028.0	38
66	60	AMERICAN INTERNATIONAL GROUP New York, N.Y.	47,389.0	[4.3]	(6.0)	457	—	491,984.0	14	56,361.0	23
67	63	HCA HEALTHCARE Nashville, Tenn.	46,677.0	[2.0]	3,787.0	79	70.9	39,207.0	163	(4,950.0)	494
68	71	AMERICAN AIRLINES GROUP Fort Worth, Texas	44,541.0	5.5	1,412.0	193	[26.4]	60,580.0	115	(169.0)	478



COURTESY OF DOWDOWPONT

MARKET VALUE 3/29/19		PROFITS AS % OF ...						EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018
\$millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank	2018 \$	% change from 2017	2008-2018 annual growth rate Rank	2018 %	Rank	2008-2018 annual rate Rank	2018 %	Rank	2018 %	Rank			
87,009.3	61	[18.6]	496	[7.2]	489	[72.2]	470	[2.62]	-	-	[55.1]	455	[4.0]	390	32	21	
3,242.6	419	13.3	112	0.5	437	255.8	6	0.57	-	-	[60.0]	460	3.4	364	13	22	
43,240.7	121	4.9	311	10.3	85	22.7	157	11.80	19.8	-	[12.3]	225	-	-	47	23	
35,426.1	149	2.8	375	6.2	202	14.4	241	7.29	[20.4]	-	[15.7]	257	17.2	129	47	24	
265,938.5	12	25.5	37	1.2	395	10.6	310	2.61	67.3	16.8	[14.9]	248	6.7	328	9	25	
904,860.9	1	15.0	93	6.4	192	20.0	175	2.13	[21.4]	1.3	227	20.7	31	20.9	85	10	26
211,828.0	25	10.3	171	25.3	6	-	-	9.73	33.5	21.9	21	[7.3]	199	25.2	39	56	27
215,304.7	23	10.3	169	8.9	116	3,085.5	1	17.85	32.9	17.1	43	11.6	74	25.6	36	2	28
219,467.1	22	22.2	54	1.2	397	11.4	295	4.28	4.4	19.8	27	[21.8]	313	7.3	320	9	29
145,625.4	32	18.6	70	0.9	410	9.2	339	6.68	-	-	-	[28.5]	356	[1.9]	386	9	30
40,258.2	135	2.9	371	3.0	311	7.9	362	5.28	[21.2]	-	-	[8.2]	203	-	-	47	31
180,948.0	29	12.4	124	4.7	252	16.4	225	2.53	[46.7]	19.4	31	[13.2]	232	17.0	137	57	32
73,826.6	71	4.1	327	5.2	233	13.1	264	14.19	[1.1]	11.5	102	18.2	42	21.6	74	25	33
42,170.5	124	[2.5]	480	[2.1]	481	-	-	-	-	-	-	-	-	-	-	11	34
120,201.4	43	4.5	320	2.0	350	4.1	409	1.65	81.3	10.3	115	[23.1]	326	17.3	127	8	35
-	-	10.8	156	3.2	299	8.7	348	-	-	-	-	-	-	-	-	36	36
372,228.9	7	18.8	69	10.0	92	25.6	128	5.61	1,093.6	2.1	211	[5.2]	182	11.3	251	48	37
125,560.1	39	11.0	153	7.1	173	52.0	39	9.52	55.0	0.6	231	[22.6]	321	5.8	339	33	38
41,440.9	131	3.9	336	7.1	172	26.0	125	5.51	3.4	6.8	154	4.7	117	9.6	282	24	39
1,748.7	443	12.5	123	0.4	438	206.3	8	1.12	-	-	-	[57.9]	459	3.8	360	13	40
96,116.3	55	6.7	266	9.6	101	158.6	10	5.51	[1.8]	6.5	163	[15.5]	254	9.1	291	39	41
87,685.5	60	3.2	359	6.7	183	63.5	27	2.84	[30.6]	6.7	157	1.2	142	17.8	120	56	42
241,488.9	16	29.7	21	16.5	30	28.2	109	4.48	125.1	17.2	42	4.1	124	16.0	159	54	43
40,751.0	133	7.5	248	0.7	420	9.7	328	4.91	35.6	1.7	218	[15.7]	258	5.5	342	35	44
260,289.4	13	14.6	100	8.2	133	18.6	192	3.67	[34.3]	0.1	239	3.5	127	7.4	319	31	45
111,146.0	49	7.9	232	3.9	273	13.7	251	6.50	14.0	2.9	205	[14.7]	246	9.7	280	2	46
47,270.8	111	7.0	259	8.7	118	23.5	145	16.79	51.7	16.6	48	[34.7]	397	10.4	270	39	47
172,094.7	30	19.4	67	16.1	34	86.2	16	8.78	159.8	10.6	112	[5.0]	179	10.5	268	21	48
24,156.7	192	2.8	374	4.4	254	9.5	331	3.19	14.3	1.3	224	5.3	113	6.1	336	22	49
37,517.7	142	6.5	272	0.5	435	8.4	350	9.50	[46.8]	-	-	[26.4]	345	13.4	213	35	50
21,939.7	207	1.5	417	2.9	312	8.2	357	2.26	[3.6]	17.0	46	14.3	60	27.9	23	25	51
-	-	0.1	453	0.2	446	3.3	417	-	-	-	-	-	-	-	-	20	52
199,589.9	27	21.2	59	12.8	58	25.8	127	8.36	46.9	13.9	70	3.5	128	18.7	113	18	53
34,278.8	158	2.4	390	7.9	142	57.1	31	2.70	29.8	4.1	195	5.4	109	14.1	198	67	54
29,795.9	167	9.1	200	15.4	37	-	-	3.26	120.3	0.0	240	[0.2]	150	3.7	363	11	55
36,079.6	147	3.0	369	6.6	186	16.6	223	12.16	[27.7]	12.2	93	16.2	50	23.5	53	25	56
475,731.6	6	39.6	7	22.7	12	26.3	124	7.57	40.4	-	-	[25.7]	341	-	-	38	57
77,980.3	67	11.2	146	7.8	146	43.8	56	10.26	714.3	6.1	171	[17.5]	272	14.3	191	12	58
40,260.0	134	3.1	363	1.9	353	8.2	358	1.15	38.6	10.6	111	[17.7]	274	19.6	101	49	59
84,887.6	64	9.4	191	11.2	72	362.0	4	17.59	155.3	8.4	139	[16.2]	260	15.8	162	2	60
235,785.1	19	20.8	60	7.0	175	17.6	208	1.87	[46.9]	4.5	187	24.7	26	13.8	208	48	61
70,414.9	75	19.9	65	1.1	402	11.6	287	25.27	180.5	18.9	32	[33.4]	391	8.5	302	9	62
72,110.8	74	17.4	76	1.0	408	10.9	301	4.73	54.1	12.6	91	[22.7]	322	11.1	256	9	63
237,665.5	17	0.2	448	0.1	452	0.3	434	0.02	[98.9]	[34.2]	295	16.5	48	12.7	231	44	64
61,058.9	87	5.4	296	1.7	363	6.4	383	10.54	20.2	25.9	15	[6.5]	189	27.5	24	25	65
37,440.1	144	[0.0]	456	[0.0]	456	[0.0]	436	[0.01]	-	-	-	[32.1]	384	5.2	345	37	66
44,787.0	119	8.1	228	9.7	98	-	-	10.66	79.2	-	-	43.4	6	-	-	26	67
14,262.0	261	3.2	360	2.3	340	-	-	3.03	[22.3]	-	-	[37.7]	411	-	-	3	68

→ 69-116 500

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TWENTY-FIRST CENTURY FOX The entertainment empire fired on all cylinders in 2018, growing revenue 7% thanks to its cable and sports divisions and films like *Bohemian Rhapsody* (at right). But its 15-year run on the 500 will soon end; in late March, Disney officially acquired the majority of Fox's assets. —*Aric Jenkins*

RANK		COMPANY	REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
2018	2017		\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
69	75	DELTA AIR LINES Atlanta, Ga.	44,438.0	7.7	3,935.0	76	10.0	60,266.0	117	13,687.0	123
70	74	CHARTER COMMUNICATIONS Stamford, Conn.	43,634.0	4.9	1,230.0	208	[87.6]	146,130.0	56	36,285.0	43
71	69	NEW YORK LIFE INSURANCE New York, N.Y.	43,425.3	2.7	880.0	256	[52.9]	311,449.3	21	21,006.5	79
72	86	AMERICAN EXPRESS New York, N.Y.	43,281.0	21.6	6,921.0	38	153.0	188,602.0	43	22,290.0	72
73	66	NATIONWIDE Columbus, Ohio	43,270.0	[1.5]	512.6	334	107.9	214,141.9	40	14,478.1	115
74	72	BEST BUY Richfield, Minn. ¹	42,879.0	1.7	1,464.0	187	46.4	12,901.0	331	3,306.0	327
75	68	LIBERTY MUTUAL INSURANCE GROUP Boston, Mass. ¹⁸	42,685.0 ¹	[0.0]	2,160.0	137	12,605.9	125,989.0	66	20,735.0	82
76	78	MERCK Kenilworth, N.J.	42,294.0	5.4	6,220.0	44	159.8	82,637.0	91	26,701.0	60
77	77	HONEYWELL INTERNATIONAL Morris Plains, N.J.	41,802.0	3.1	6,765.0	39	308.8	57,773.0	120	18,180.0	94
78	81	UNITED CONTINENTAL HOLDINGS Chicago, Ill.	41,303.0	9.5	2,129.0	140	[0.1]	44,792.0	145	9,995.0	166
79	84	TIAA New York, N.Y. ¹⁹	41,052.1	14.0	1,560.5	179	48.7	568,190.2	12	38,126.3	42
80	80	TYSON FOODS Springdale, Ark. ²	40,052.0	4.7	3,024.0	97	70.5	29,109.0	202	12,803.0	129
81	82	DRACLE Redwood City, Calif. ¹¹	39,831.0	5.6	3,825.0	78	[59.0]	137,264.0	61	45,726.0	34
82	79	ALLSTATE Northbrook, Ill.	39,815.0	3.4	2,252.0	132	[29.4]	112,249.0	74	21,312.0	77
83	91	WORLD FUEL SERVICES Miami, Fla.	39,750.3	18.0	127.7	430	—	5,676.9	437	1,815.4	394
84	93	MASSACHUSETTS MUTUAL LIFE INSURANCE Springfield, Mass.	39,267.2	17.2	397.9	364	[22.4]	265,812.6	27	15,609.8	101
85	85	TJX Framingham, Mass. ¹	38,972.9	8.7	3,059.8	96	17.3	14,326.0	313	5,048.6	272
86	95	CONOCOPHILLIPS Houston, Texas	38,727.0	18.9	6,257.0	43	—	69,980.0	102	31,939.0	51
87	102	DEERE Moline, Ill. ¹⁴	37,357.7	25.6	2,368.4	126	9.7	70,108.0	101	11,287.8	151
88	83	TECH DATA Clearwater, Fla. ¹	37,239.0	1.3	340.6	373	192.0	12,986.6	329	2,936.7	344
89	105	ENTERPRISE PRODUCTS PARTNERS Houston, Texas ⁹	36,534.2	24.9	4,172.4	69	49.1	56,969.8	121	23,853.5	68
90	89	NIKE Beaverton, Ore. ¹¹	36,397.0	6.0	1,933.0	149	[54.4]	22,536.0	239	9,812.0	170
91	88	PUBLIX SUPER MARKETS Lakeland, Fla.	36,395.7	4.5	2,381.2	124	3.9	18,982.5	268	14,958.3	108
92	99	GENERAL DYNAMICS Falls Church, Va.	36,193.0	16.9	3,345.0	86	14.9	45,408.0	141	11,732.0	139
93	92	EXELON Chicago, Ill.	35,985.0	7.3	2,010.0	145	[46.7]	119,666.0	70	30,764.0	54
94	115	PLAINS GP HOLDINGS Houston, Texas ⁹	34,055.0	29.9	334.0	379	—	26,830.0	210	1,846.0	391
95	97	3M St. Paul, Minn.	32,765.0	3.5	5,349.0	54	10.1	36,500.0	172	9,796.0	173
96	110	ABBVIE North Chicago, Ill.	32,753.0	16.1	5,687.0	50	7.1	59,352.0	118	[8,446.0]	498
97	96	CHS Inver Grove Heights, Minn. ^{5,5}	32,683.3	2.0	775.9	276	983.8	16,381.2	291	8,155.6	203
98	101	CAPITAL ONE FINANCIAL McLean, Va.	32,377.0	7.9	6,015.0	46	203.5	372,538.0	17	51,668.0	29
99	112	PROGRESSIVE Mayfield Village, Ohio	31,979.0	19.2	2,615.3	111	64.3	46,575.0	139	10,821.8	157
100	87	COCA-COLA Atlanta, Ga.	31,856.0	[10.0]	6,434.0	42	415.5	83,216.0	90	16,981.0	96
101	100	UNITED SERVICES AUTOMOBILE ASSN. San Antonio, Texas ¹⁹	31,367.8	4.5	2,291.9	131	[5.4]	158,506.8	50	31,179.4	52
102	107	HEWLETT PACKARD ENTERPRISE Palo Alto, Calif. ¹⁴	30,852.0	6.9	1,908.0	153	454.7	55,493.0	125	21,239.0	78
103	111	ABBOTT LABORATORIES Abbott Park, Ill.	30,578.0	11.6	2,368.0	127	396.4	67,173.0	106	30,524.0	55
104	109	TWENTY-FIRST CENTURY FOX New York, N.Y. ^{7,20}	30,400.0	6.7	4,464.0	65	51.2	53,831.0	129	19,584.0	88
105	150	MICRON TECHNOLOGY Boise, Idaho ⁶	30,391.0	49.5	14,135.0	16	177.8	43,376.0	151	32,294.0	50
106	106	TRAVELERS COS. New York, N.Y.	30,282.0	4.8	2,523.0	117	22.7	104,233.0	79	22,894.0	70
107	94	RITE AID Camp Hill, Pa. ¹²	30,215.4 ¹	[8.0]	943.5	250	23,178.3	8,989.3	388	1,601.0	404
108	118	NORTHROP GRUMMAN Falls Church, Va. ²¹	30,095.0	16.6	3,229.0	91	60.2	37,653.0	168	8,187.0	202
109	113	ARROW ELECTRONICS Centennial, Colo.	29,676.8	10.7	716.2	288	78.2	17,784.4	280	5,325.0	264
110	108	PHILIP MORRIS INTERNATIONAL New York, N.Y.	29,625.0 ⁶	3.1	7,911.0	35	31.1	39,801.0	162	[12,459.0]	500
111	104	NORTHWESTERN MUTUAL Milwaukee, Wis.	29,124.0	[0.7]	783.0	273	[23.0]	272,167.0	26	22,134.0	73
112	103	INTL FCSTONE New York, N.Y. ^{2,22}	27,622.7	[6.1]	55.5	443	767.2	7,824.7	403	505.3	462
113	135	PBF ENERGY Parsippany, N.J.	27,186.1 ¹	24.8	128.3	429	[69.1]	8,005.4	399	2,676.5	356
114	119	RAYTHEON Waltham, Mass.	27,058.0	6.7	2,909.0	102	43.7	31,864.0	191	11,472.0	144
115	114	KRAFT HEINZ Pittsburgh, Pa.	26,259.0	0.1	[10,229.0]	499	[193.0]	103,627.0	82	51,785.0	27
116	117	MONDELEZ INTERNATIONAL Deerfield, Ill.	25,938.0	0.2	3,381.0	85	15.7	62,729.0	111	25,637.0	63



MARKET VALUE 3/29/19	PROFITS AS % OF ...					EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018		
	\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank	2018 \$	% change from 2017	2008-2018 annual growth rate % Rank		2018 % Rank	2008-2018 annual rate % Rank						
35,067.8	150	8.9	205	6.5	189	28.7	107	5.67	14.5	-	(8.8)	208	16.8	145	3	69	
85,923.4	63	2.8	373	0.8	414	3.4	415	5.22	(84.7)	-	(15.2)	252	-	-	57	70	
-	-	2.0	400	0.3	443	4.2	405	-	-	-	-	-	-	-	34	71	
91,675.1	59	16.0	88	3.7	283	31.0	93	7.91	166.3	13.0	80	(2.6)	162	19.7	99	13	72
-	-	1.2	422	0.2	445	3.5	412	-	-	-	-	-	-	-	36	73	
19,030.2	224	3.4	354	11.3	70	44.3	53	5.20	59.5	8.1	142	(20.5)	295	9.5	284	56	74
-	-	5.1	307	1.7	364	10.4	315	-	-	-	-	-	-	-	37	75	
214,680.1	24	14.7	96	7.5	155	23.3	149	2.32	166.7	(4.4)	261	40.2	11	13.8	206	48	76
115,752.5	48	16.2	86	11.7	68	37.2	74	8.98	319.6	9.1	129	(8.4)	205	18.3	118	15	77
21,279.5	209	5.2	304	4.8	246	21.3	166	7.70	9.7	-	-	24.2	27	22.5	62	3	78
-	-	3.8	338	0.3	444	4.1	407	-	-	-	-	-	-	-	34	79	
25,360.5	185	7.6	247	10.4	82	23.6	144	8.19	71.0	42.3	1	(32.8)	387	21.2	79	22	80
183,562.2	28	9.6	184	2.8	318	8.4	351	0.90	(59.3)	(1.6)	252	(3.0)	164	11.1	257	10	81
31,264.3	161	5.7	288	2.0	352	10.6	311	5.96	(28.7)	-	-	(19.6)	289	12.3	237	37	82
1,940.6	438	0.3	446	2.2	344	7.0	378	1.89	-	0.4	235	(23.2)	327	2.0	371	16	83
-	-	1.0	426	0.1	449	2.5	424	-	-	-	-	-	-	-	34	84	
65,615.7	83	7.9	236	21.4	14	60.6	29	2.43	20.3	17.1	44	18.9	38	25.8	34	55	85
75,710.1	70	16.2	87	8.9	114	19.6	180	5.32	-	-	-	15.6	53	8.4	303	42	86
50,908.0	102	6.3	274	3.4	294	21.0	169	7.24	8.4	4.4	188	(3.0)	163	17.2	131	12	87
3,779.0	406	0.9	432	2.6	328	11.6	287	8.89	191.5	14.0	69	(16.5)	261	16.5	153	66	88
63,579.8	85	11.4	142	7.3	164	17.5	212	1.91	46.9	-	-	(1.3)	157	-	-	49	89
132,529.5	37	5.3	297	8.6	123	19.7	179	1.17	(53.4)	2.3	209	19.9	33	20.8	86	4	90
-	-	6.5	268	12.5	60	15.9	230	3.28	7.9	9.4	123	-	-	-	20	91	
48,883.0	105	9.2	195	7.4	161	28.5	108	11.18	16.9	6.1	172	(21.3)	306	13.1	225	2	92
48,623.7	106	5.6	290	1.7	367	6.5	381	2.07	(47.9)	(6.7)	271	18.2	40	2.2	367	63	93
3,974.4	404	1.0	428	1.2	392	18.1	201	2.11	-	-	-	(3.7)	173	-	-	49	94
119,659.8	44	16.3	84	14.7	42	54.6	37	8.89	12.1	6.2	168	(16.9)	265	15.6	167	69	95
119,125.3	45	17.4	77	9.6	100	-	-	3.66	10.9	-	-	(1.2)	155	-	-	48	96
-	-	2.4	392	4.7	248	9.5	333	-	-	-	-	-	-	-	22	97	
38,340.7	140	18.6	71	1.6	369	11.6	285	11.82	238.7	-	-	(22.8)	323	10.8	261	9	98
42,099.5	126	8.2	226	5.6	220	24.2	140	4.42	62.5	-	-	9.4	85	18.7	112	37	99
200,334.1	26	20.2	63	7.7	150	37.9	71	1.50	417.2	1.9	215	6.8	96	11.0	258	6	100
-	-	7.3	254	1.4	379	7.4	369	-	-	-	-	-	-	-	37	101	
21,144.9	211	6.2	280	3.4	292	9.0	343	1.23	485.7	-	-	(5.8)	185	-	-	11	102
140,412.2	34	7.7	238	3.5	289	7.8	363	1.33	392.6	(8.2)	275	29.0	19	13.9	201	40	103
-	-	14.7	98	8.3	131	22.8	156	2.40	50.9	2.9	206	40.6	9	20.8	88	18	104
45,739.4	116	46.5	3	32.6	2	43.8	57	11.51	161.0	-	-	(22.8)	324	28.2	22	54	105
36,126.7	146	8.3	221	2.4	338	11.0	298	9.28	26.6	6.8	155	(9.6)	213	13.0	228	37	106
685.7	456	3.1	361	10.5	81	58.9	30	18.00	23,584.2	-	-	(64.0)	462	8.6	298	20	107
45,821.0	115	10.7	158	8.6	124	39.4	68	18.49	61.2	-	-	(18.9)	282	22.7	61	2	108
6,564.4	365	2.4	391	4.0	269	13.4	259	8.10	80.8	-	-	(14.3)	239	13.9	203	66	109
137,516.7	35	26.7	30	19.9	18	-	-	5.08	30.9	4.3	189	(33.7)	392	9.0	292	59	110
-	-	2.7	378	0.3	442	3.5	413	-	-	-	-	-	-	-	34	111	
739.5	455	0.2	449	0.7	422	11.0	299	2.87	825.8	(0.3)	244	(14.0)	238	15.6	168	13	112
3,732.0	411	0.5	440	1.6	370	4.8	393	1.10	(70.5)	-	-	(5.1)	181	-	-	47	113
51,390.1	100	10.8	157	9.1	108	25.4	131	10.15	46.0	9.9	119	(17.0)	268	14.6	182	2	114
39,814.6	137	(39.0)	498	(9.9)	493	(19.8)	461	(8.39)	(193.7)	-	-	(42.2)	430	-	-	21	115
72,171.7	73	13.0	116	5.4	229	13.2	263	2.28	19.4	1.7	217	(4.4)	175	11.4	250	21	116

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TESLA Tesla's passionate fans have helped make the automaker one of the 500's fastest-growing companies. CEO Elon Musk is testing customers' and investors' patience, however, as Tesla continues to miss production targets and rely heavily on tax and regulatory credits to fuel sales. —Jeff John Roberts

RANK 2018	RANK 2017		REVENUES		PROFITS			ASSETS		STOCKHOLDERS' EQUITY	
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
117	122	U.S. BANCORP Minneapolis, Minn.	25,775.0	7.4	7,096.0	36	14.1	467,374.0	15	51,029.0	30
118	120	MACY'S Cincinnati, Ohio ¹	25,739.0	3.6	1,108.0	224	[28.4]	19,194.0	261	6,436.0	234
119	123	DOLLAR GENERAL Goodlettsville, Tenn. ¹	25,625.0	9.2	1,589.5	176	3.3	13,204.0	325	6,417.4	235
120	151	NUCOR Charlotte, N.C.	25,067.3	23.8	2,360.8	128	79.0	17,920.6	276	9,792.1	174
121	132	STARBUCKS Seattle, Wash. ²	24,719.5	10.4	4,518.3	64	56.6	24,156.4	226	1,169.5	431
122	374	DXC TECHNOLOGY Tysons, Va. ²	24,556.0	222.8	1,751.0	162	—	33,921.0	180	13,487.0	125
123	129	ELI LILLY Indianapolis, Ind.	24,555.7	7.4	3,232.0	90	—	43,908.4	148	9,828.7	169
124	144	THERMO FISHER SCIENTIFIC Waltham, Mass.	24,358.0	16.4	2,938.0	98	32.0	56,232.0	123	27,586.0	59
125	121	US FOODS HOLDING Rosemont, Ill.	24,175.0	0.1	407.0	362	[8.4]	9,186.0	382	3,229.0	333
126	125	DUKE ENERGY Charlotte, N.C.	24,116.0 ^e	4.0	2,666.0	107	[12.8]	145,392.0	58	43,817.0	35
127	146	HALLIBURTON Houston, Texas	23,995.0	16.4	1,656.0	170	—	25,982.0	213	9,522.0	178
128	149	CUMMINS Columbus, Ind.	23,771.0	16.4	2,141.0	138	114.3	19,062.0	266	7,348.0	219
129	130	AMGEN Thousand Oaks, Calif.	23,747.0	3.9	8,394.0	33	324.2	66,416.0	107	12,500.0	133
130	155	PACCAR Bellevue, Wash.	23,495.7	20.8	2,195.1	135	31.0	25,482.4	216	8,592.9	197
131	126	SOUTHERN Atlanta, Ga.	23,495.0	2.0	2,226.0	133	164.4	116,914.0	73	24,723.0	65
132	166	CENTURYLINK Monroe, La.	23,443.0	32.8	[1,733.0]	494	[224.8]	70,256.0	100	19,828.0	87
133	124	INTERNATIONAL PAPER Memphis, Tenn.	23,306.0	0.0	2,012.0	144	[6.2]	33,576.0	182	7,362.0	218
134	141	UNION PACIFIC Omaha, Neb.	22,832.0	7.5	5,966.0	47	[44.3]	59,147.0	119	20,423.0	65
135	134	DOLLAR TREE Chesapeake, Va. ¹	22,823.3	2.6	[1,590.8]	493	[192.8]	13,501.2	320	5,642.9	252
136	139	PENSKE AUTOMOTIVE GROUP Bloomfield Hills, Mich.	22,785.1	6.5	471.0	342	[23.2]	10,904.5	356	2,609.1	359
137	133	QUALCOMM San Diego, Calif. ²	22,732.0	2.0	[4,864.0]	496	[297.2]	32,686.0	187	928.0	444
138	145	BRISTOL-MYERS SQUIBB New York, N.Y.	22,561.0	8.6	4,920.0	61	388.6	34,986.0	176	14,031.0	120
139	116	GILEAD SCIENCES Foster City, Calif.	22,127.0	[15.2]	5,455.0	53	17.9	63,675.0	109	21,387.0	75
140	159	JABIL St. Petersburg, Fla. ⁶	22,095.4	15.9	86.3	439	[33.1]	12,045.6	340	1,950.3	386
141	149	MANPOWERGROUP Milwaukee, Wis.	21,991.2	4.5	556.7	323	2.1	8,519.8	391	2,624.9	358
142	142	SOUTHWEST AIRLINES Dallas, Texas	21,965.0	3.8	2,465.0	118	[29.3]	26,243.0	211	9,853.0	168
143	137	AFLAC Columbus, Ga.	21,758.0	0.4	2,920.0	100	[36.6]	140,406.0	59	23,462.0	69
144	260	TESLA Palo Alto, Calif.	21,461.3	82.5	[976.1]	491	—	29,739.6	200	4,923.2	276
145	138	AUTONATION Fort Lauderdale, Fla.	21,412.8	[0.6]	396.0	366	[8.9]	10,665.1	360	2,716.0	355
146	207	CBRE GROUP Los Angeles, Calif.	21,340.1	50.2	1,063.2	231	53.8	13,456.8	321	4,938.8	275
147	148	LEAR Southfield, Mich.	21,148.5	3.3	1,149.8	218	[12.5]	11,600.7	346	4,200.7	294
148	140	WHIRLPOOL Benton Harbor, Mich.	21,037.0	[1.0]	[183.0]	476	[152.3]	18,347.0	271	2,291.0	373
149	131	MCDONALD'S Chicago, Ill.	21,025.2	[7.9]	5,924.3	48	14.1	32,811.2	186	[6,258.4]	496
150	•	BROADCOM San Jose, Calif. ^{1a,23}	20,848.0	18.1	12,259.0	19	624.5	50,124.0	133	26,657.0	61
151	127	MARRIOTT INTERNATIONAL Bethesda, Md.	20,758.0	[9.3]	1,907.0	154	39.0	23,696.0	230	2,225.0	375
152	158	WESTERN DIGITAL San Jose, Calif. ⁷	20,647.0	8.1	675.0	294	70.0	29,235.0	201	11,531.0	142
153	161	VISA San Francisco, Calif. ²	20,609.0	12.3	10,301.0	26	53.8	69,225.0	103	34,006.0	47
154	230	LENNAR Miami, Fla. ²⁴	20,571.6	62.7	1,695.8	165	109.2	28,566.2	204	14,581.5	113
155	170	WELLCARE HEALTH PLANS Tampa, Fla.	20,414.1	20.0	439.8	352	17.7	11,764.7	343	4,240.0	291
156	157	KOHL'S Menomonee Falls, Wis. ¹	20,229.0	5.9	801.0	271	[6.8]	12,469.0	336	5,527.0	258
157	154	AECOM Los Angeles, Calif. ²	20,155.5	10.7	136.5	428	[59.8]	14,681.1	309	4,092.8	298
158	169	SYNNEX Fremont, Calif. ^{24,25}	20,053.8	17.6	300.6	387	[0.2]	11,480.4	347	3,432.1	320
159	165	PNC FINANCIAL SERVICES GROUP Pittsburgh, Pa.	19,993.0	10.9	5,301.0	56	[0.7]	382,315.0	16	47,728.0	33
160	162	DANAHER Washington, D.C.	19,893.0	8.5	2,650.9	109	6.4	47,832.5	137	28,214.4	58
161	156	HARTFORD FINANCIAL SERVICES GROUP Hartford, Conn.	19,827.0 ^a	3.1	1,807.0	160	—	62,307.0	112	13,101.0	127
162	154	ALTRIA GROUP Richmond, Va.	19,627.0 ^e	0.7	6,963.0	37	[31.9]	55,638.0	124	14,787.0	110
163	175	BANK OF NEW YORK MELLON CORP. New York, N.Y.	19,214.0	15.6	4,266.0	68	4.3	362,873.0	19	40,638.0	39
164	153	FLUOR Irving, Texas	19,166.6	[1.8]	224.8	407	17.5	8,913.6	389	2,963.2	341



MARKET VALUE 3/29/19		PROFITS AS % OF ...					EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018	
\$ millions	Rank	Revenues %	Rank	Assets %	Rank	Stockholders' equity %	Rank	2018 \$	% change from 2017	2008-2018 annual growth rate %	Rank	2018 %	Rank	2008-2018 annual rate %			Rank
77,116.5	69	27.5	25	1.5	375	13.9	247	4.14	17.9	9.9	118	[12.6]	226	8.6	300	9	117
7,388.4	351	4.3	325	5.8	218	17.2	216	3.56	[29.4]	—	—	24.1	28	14.2	193	24	118
30,960.6	163	6.2	278	12.0	65	24.8	134	5.97	6.0	—	—	17.5	45	—	—	56	119
17,784.0	232	9.4	189	13.2	54	24.1	141	7.42	81.0	2.2	210	[16.5]	262	4.3	356	41	120
92,449.2	57	18.3	73	18.7	21	386.3	2	3.24	64.5	31.2	8	14.7	56	31.6	14	23	121
17,252.5	237	7.1	257	5.2	235	13.0	268	6.04	—	—	—	[35.1]	401	—	—	33	122
134,355.9	36	13.2	114	7.4	162	32.9	87	3.13	—	—	—	40.3	10	15.5	171	48	123
109,215.3	50	12.1	130	5.2	234	10.7	308	7.24	29.5	12.2	94	18.2	41	21.1	80	69	124
7,597.8	348	1.7	411	4.4	255	12.6	274	1.87	[5.1]	—	—	[0.9]	154	—	—	67	125
65,488.1	84	11.1	151	1.8	357	6.1	385	3.76	[13.8]	1.6	220	7.3	92	11.9	241	63	126
25,565.5	183	6.9	261	6.4	196	17.4	213	1.89	—	1.1	229	[44.6]	435	5.3	344	45	127
24,839.1	189	9.0	202	11.2	74	29.1	103	13.15	120.3	13.1	77	[22.1]	315	20.1	96	32	128
118,220.4	47	35.3	12	12.6	59	67.2	22	12.62	369.1	12.5	92	15.1	55	14.8	178	48	128
23,630.4	185	9.3	192	8.6	121	25.5	129	6.24	31.4	8.4	138	[17.0]	267	10.2	273	12	130
53,466.3	96	9.5	186	1.9	355	9.0	341	2.17	158.3	[0.4]	245	[3.7]	174	6.8	327	63	131
12,946.6	280	[7.4]	490	[2.5]	483	[8.7]	459	[1.63]	[173.8]	—	—	1.8	139	2.2	368	57	132
18,518.9	227	8.6	211	6.0	209	27.3	117	4.85	[5.5]	—	—	[27.7]	350	17.0	135	46	133
120,865.2	42	26.1	34	10.1	89	29.2	102	7.91	[40.8]	13.3	75	5.3	112	21.7	73	51	134
25,021.0	186	[7.0]	488	[11.8]	495	[28.2]	466	[6.66]	[192.4]	—	—	[15.8]	259	20.6	90	56	135
3,756.8	409	2.1	399	4.3	260	18.1	203	5.53	[22.5]	—	—	[13.1]	231	20.0	97	5	136
69,023.7	78	[21.4]	497	[14.9]	496	[524.1]	474	[3.32]	[301.2]	—	—	[7.5]	200	7.5	318	54	137
77,895.0	68	21.8	56	14.1	45	35.1	78	3.01	393.4	1.4	223	[12.7]	227	12.3	236	48	138
82,881.0	65	24.7	41	8.6	126	25.5	130	4.17	18.8	14.8	64	[9.8]	216	10.4	269	48	139
4,113.9	402	0.4	443	0.7	421	4.4	399	0.49	[29.0]	[2.8]	255	[4.5]	176	15.9	161	54	140
4,964.7	392	2.5	384	6.5	188	21.2	168	8.56	6.5	12.0	95	[47.3]	443	8.6	299	58	141
28,690.1	170	11.2	147	9.4	104	25.0	132	4.29	[25.9]	33.4	5	[28.3]	354	19.1	108	3	142
37,442.5	143	13.4	109	2.1	349	12.4	275	3.77	[34.7]	11.1	107	6.2	104	10.0	277	35	143
48,337.8	107	[4.5]	486	[3.3]	485	[19.8]	462	[5.72]	—	—	—	6.9	93	—	—	43	144
3,216.9	420	1.8	406	3.7	280	14.6	236	4.34	[2.0]	—	—	[30.5]	371	13.7	210	5	145
16,607.0	243	5.0	308	7.9	143	21.5	165	3.10	52.7	—	—	[7.6]	201	24.9	42	52	146
8,470.4	338	5.4	295	9.9	94	27.4	116	17.22	[7.4]	—	—	[29.2]	365	—	—	43	147
8,454.6	339	[0.9]	470	[1.0]	471	[8.0]	458	[2.72]	[157.9]	—	—	[34.5]	396	12.8	229	15	148
145,333.8	33	28.2	24	18.1	24	—	—	7.54	18.4	7.2	148	5.8	107	14.5	184	23	149
119,034.7	46	58.8	1	24.5	8	46.0	50	28.44	607.5	—	—	2.2	136	—	—	54	150
42,117.1	125	9.2	196	8.0	136	85.7	17	5.38	49.0	18.6	33	[19.0]	285	21.0	83	30	151
13,978.3	263	3.3	357	2.3	341	5.9	389	2.20	64.2	[5.4]	266	[52.2]	453	14.2	194	11	152
343,774.2	8	50.0	2	14.9	41	30.3	96	—	—	—	—	16.5	49	26.9	28	19	153
15,513.8	249	8.2	225	5.9	211	11.6	286	5.44	60.9	—	—	[37.9]	414	17.2	130	29	154
13,569.0	272	2.2	398	3.7	279	10.4	316	9.29	11.8	—	—	17.4	46	33.8	10	25	155
11,220.9	299	4.0	332	6.4	191	14.5	238	4.84	[5.5]	5.3	178	26.7	22	9.1	289	24	156
4,631.3	397	0.7	434	0.9	411	3.3	416	0.84	[60.6]	[5.0]	264	[28.7]	358	[1.5]	383	17	157
4,885.1	393	1.5	416	2.6	330	8.8	347	7.19	[4.3]	11.1	108	[39.7]	420	22.2	66	66	158
55,640.1	94	26.5	32	1.4	384	11.1	297	10.71	3.4	15.8	52	[17.0]	269	11.5	249	9	159
94,485.9	56	13.3	110	5.5	223	9.4	334	3.74	5.9	6.6	158	11.8	73	17.3	128	40	160
17,872.9	231	9.1	199	2.9	313	13.8	250	4.95	—	—	—	[19.4]	288	12.5	234	37	161
107,648.6	52	35.5	10	12.5	61	47.1	47	3.68	[30.7]	4.5	186	[27.7]	349	18.5	115	59	162
48,152.7	109	22.2	53	1.2	399	10.5	313	4.04	8.6	12.9	81	[10.9]	220	7.2	322	9	163
5,137.6	388	1.2	423	2.5	334	7.6	367	1.59	16.9	[8.7]	276	[36.7]	405	[2.0]	387	17	164

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OCCIDENTAL PETROLEUM A long-term bet on fracking paid off nicely in 2018 for Houston-based "Oxy," as rising oil prices fueled a 43% jump in revenue, to \$18.9 billion. Under CEO Vicki Hollub, the company has designs on growing bigger still through acquisitions [see our feature in this issue]. —*Matt Heimer*

RANK 2018	2017	COMPANY	REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
185	128	AVNET Phoenix, Ariz. ⁷	19,036.9	[16.8]	[156.4]	474	[129.8]	9,596.8	376	4,685.1	283
186	136	ICAHN ENTERPRISES New York, N.Y. ⁸	18,979.0 ^{8E}	[12.7]	1,507.0	184	[38.0]	23,396.0	232	6,529.0	230
187	220	OCCIDENTAL PETROLEUM Houston, Texas	18,934.0	42.6	4,131.0	71	215.1	43,854.0	149	21,330.0	76
188	152	MOLINA HEALTHCARE Long Beach, Calif.	18,890.0	[5.0]	707.0	291	—	7,154.0	417	1,647.0	401
189	177	GENUINE PARTS Atlanta, Ga.	18,735.1	14.9	810.5	269	31.4	12,683.0	332	3,450.5	319
170	176	FREEMPORT-MCMORAN Phoenix, Ariz.	18,628.0	13.5	2,602.0	112	43.2	42,216.0	153	9,798.0	172
171	163	KIMBERLY-CLARK Irving, Texas	18,486.0	1.2	1,410.0	194	[38.1]	14,518.0	311	[287.0]	481
172	147	TENET HEALTHCARE Dallas, Texas	18,313.0	[11.2]	111.0	433	—	22,409.0	240	[119.0]	477
173	173	SYNCHRONY FINANCIAL Stamford, Conn.	18,253.0	9.3	2,790.0	103	44.2	106,792.0	78	14,678.0	111
174	174	CARMAX Richmond, Va. ¹²	17,976.8	8.1	664.1	296	5.9	17,486.3	284	3,316.8	325
175	206	HOLLYFRONTIER Dallas, Texas	17,714.7 ^E	24.3	1,098.0	226	36.3	10,994.6	352	5,918.6	245
176	171	PERFORMANCE FOOD GROUP Richmond, Va. ⁷	17,619.9	5.1	198.7	411	106.3	4,000.9	466	1,135.3	433
177	190	SHERWIN-WILLIAMS Cleveland, Ohio	17,534.5	17.0	1,108.7	223	[37.4]	19,134.3	264	3,730.7	303
178	178	EMERSON ELECTRIC St. Louis, Mo. ²	17,408.0	6.8	2,203.0	134	45.1	20,390.0	254	8,947.0	189
179	223	NGL ENERGY PARTNERS Tulsa, Okla. ^{8,3}	17,282.7	32.7	[70.9]	468	[151.7]	6,151.1	429	2,085.2	382
180	186	XPO LOGISTICS Greenwich, Conn.	17,279.0	12.3	422.0	360	24.0	12,270.0	337	3,575.0	312
181	270	EOG RESOURCES Houston, Texas	17,275.4	54.1	3,419.0	84	32.4	33,934.5	179	19,364.2	90
182	201	APPLIED MATERIALS Santa Clara, Calif. ¹⁴	17,253.0	18.7	3,313.0	87	[3.5]	17,773.0	282	6,839.0	225
183	168	PG&E CORP. San Francisco, Calif.	16,759.0	[2.2]	[6,851.0]	497	[516.2]	76,995.0	97	12,651.0	131
184	167	NEXTERA ENERGY Juno Beach, Fla.	16,727.0	[2.7]	6,638.0	41	23.4	103,702.0	81	34,144.0	46
185	193	C.H. ROBINSON WORLDWIDE Eden Prairie, Minn.	16,631.2	11.8	664.5	295	31.6	4,427.4	457	1,595.1	406
186	181	GAP San Francisco, Calif. ¹	16,580.0	4.6	1,003.0	243	18.3	8,049.0	397	3,553.0	313
187	205	LINCOLN NATIONAL Radnor, Pa.	16,424.0	15.2	1,641.0	172	[21.1]	298,147.0	23	14,350.0	118
188	179	DAVITA Denver, Colo.	16,368.6 ⁸	2.1	159.4	423	[76.0]	19,110.3	265	3,703.4	304
189	356	JONES LANG LASALLE Chicago, Ill.	16,318.4	105.7	484.5	338	90.6	10,025.5	371	3,691.5	305
190	194	WESTROCK Atlanta, Ga. ^{2,26}	16,285.1	9.6	1,906.1	155	169.1	25,360.5	218	11,469.4	145
191	189	CDW Lincolnshire, Ill.	16,240.5	6.9	643.0	302	22.9	7,167.7	416	975.2	440
192	185	AMERICAN ELECTRIC POWER Columbus, Ohio	16,195.7	5.0	1,923.8	151	0.6	68,802.8	104	19,028.4	91
193	195	COGNIZANT TECHNOLOGY SOLUTIONS Teaneck, N.J.	16,125.0	8.9	2,101.0	141	39.7	15,913.0	299	11,424.0	146
194	211	D.R. HORTON Arlington, Texas ²	16,068.0	14.0	1,460.3	188	40.6	14,114.6	316	8,984.4	188
195	251	BECTON DICKINSON Franklin Lakes, N.J. ²	15,983.0	32.2	311.0	384	[71.7]	53,904.0	128	20,992.0	80
196	183	NORSTROM Seattle, Wash. ¹	15,860.0	2.5	564.0	322	29.1	7,886.0	402	873.0	445
197	261	NETFLIX Los Gatos, Calif.	15,794.3	35.1	1,211.2	210	116.7	25,974.4	214	5,238.8	267
198	200	ARAMARK Philadelphia, Pa. ²	15,789.6	8.1	567.9	321	51.9	13,720.1	318	3,029.6	337
199	192	TEXAS INSTRUMENTS Dallas, Texas	15,784.0	5.5	5,580.0	52	51.5	17,137.0	286	8,994.0	187
200	182	GENERAL MILLS Minneapolis, Minn. ¹¹	15,740.4	0.8	2,131.0	139	28.6	30,624.0	195	6,141.1	243
201	180	SUPERVALU Eden Prairie, Minn. ^{12,27}	15,679.0 ⁸	[2.1]	45.0	448	[93.1]	4,387.0	458	505.0	463
202	184	COLGATE-PALMOLIVE New York, N.Y.	15,544.0	0.6	2,400.0	123	18.6	12,161.0	339	[102.0]	475
203	187	GOODYEAR TIRE & RUBBER Akron, Ohio	15,475.0	0.6	693.0	292	100.3	16,872.0	289	4,864.0	277
204	222	PAYPAL HOLDINGS San Jose, Calif.	15,451.0	18.0	2,057.0	143	14.6	43,332.0	152	15,386.0	105
205	191	PPG INDUSTRIES Pittsburgh, Pa.	15,374.0	2.7	1,341.0	197	[15.7]	16,015.0	296	4,630.0	285
206	188	OMNICOM GROUP New York, N.Y.	15,290.2	0.1	1,326.4	201	21.9	24,617.0	223	2,547.1	362
207	224	CELGENE Summit, N.J.	15,281.0	17.5	4,046.0	73	37.6	35,480.0	175	6,161.0	242
208	297	JACOBS ENGINEERING GROUP Dallas, Texas ²	14,984.6	49.5	163.4	421	[44.4]	12,645.8	333	5,854.3	247
209	209	ROSS STORES Dublin, Calif. ¹	14,983.5	6.0	1,587.5	177	16.5	6,073.7	431	3,305.7	328
210	212	MARSH & MCLENNAN New York, N.Y.	14,950.0	6.6	1,650.0	171	10.6	21,578.0	245	7,511.0	215
210	236	MASTERCARD Purchase, N.Y.	14,950.0	19.6	5,859.0	49	49.7	24,860.0	222	5,395.0	260
212	216	LAND O'LAKES Arden Hills, Minn. ²	14,936.2	8.7	254.5	403	[19.0]	9,124.4	384	2,894.4	348



MARKET VALUE 3/29/19		PROFITS AS % OF ...				EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018		
\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank	2018 \$	% change from 2017	2008-2018 annual growth rate %	2008-2018 annual rate Rank	2018 % Rank	2008-2018 annual rate Rank	2018 % Rank	2008-2018 annual rate Rank	Industry table number	RANK 2018			
4,702.5	396	[0.8]	469	[1.6]	479	[3.3]	449	[1.30]	[131.9]	-	[7.2]	196	8.0	308	66	185	
13,874.6	265	7.9	231	6.4	190	23.1	155	11.46	[22.6]	-	19.8	34	15.0	176	13	166	
49,509.5	104	21.8	55	9.4	103	19.4	183	5.39	217.1	[4.3]	260	[13.2]	233	3.8	361	42	167
8,890.9	330	3.7	341	9.9	95	42.9	58	10.61	-	21.6	23	51.6	4	25.8	35	25	188
16,350.1	245	4.3	323	6.4	194	23.5	147	5.50	31.6	6.5	161	4.2	122	13.3	219	65	169
18,678.4	226	14.0	102	6.2	204	26.6	120	1.78	42.4	-	-	[45.0]	436	0.7	375	42	170
42,635.2	123	7.6	244	9.7	97	-	-	4.03	[37.0]	[0.0]	241	[2.1]	159	12.4	235	31	171
2,968.6	423	0.6	435	0.5	436	-	-	1.07	-	18.3	35	13.1	68	14.1	199	26	172
22,644.6	202	15.3	90	2.6	331	19.0	188	3.74	54.5	-	-	[37.8]	413	-	-	13	173
11,690.0	294	3.7	343	3.8	276	20.0	176	3.60	10.4	15.8	53	[2.2]	160	23.1	58	5	174
8,413.6	340	6.2	279	10.0	93	18.6	194	6.19	36.9	17.9	36	2.1	138	24.5	45	47	175
4,170.2	401	1.1	424	5.0	240	17.5	211	1.90	104.3	-	-	[2.5]	161	-	-	67	176
39,918.5	136	6.3	275	5.8	217	29.7	100	11.67	[37.5]	11.3	105	[3.2]	166	22.4	63	8	177
42,083.0	127	12.7	121	10.8	78	24.6	137	3.46	47.2	1.2	228	[11.9]	224	8.3	305	32	178
1,740.2	444	[0.4]	464	[1.2]	476	[6.3]	455	[1.08]	[213.7]	-	-	[22.1]	316	-	-	16	179
5,868.1	374	2.4	389	3.4	291	11.8	281	2.88	17.6	21.8	22	[37.7]	412	28.6	20	60	180
55,209.9	95	19.8	66	10.1	90	17.7	207	5.89	32.1	1.9	212	[18.7]	280	10.8	260	42	181
37,652.9	141	19.2	68	18.6	23	48.4	45	3.23	1.9	16.5	49	[34.9]	399	14.8	179	54	182
9,390.6	319	[40.9]	499	[8.9]	491	[54.2]	469	[13.25]	[512.8]	-	-	[47.0]	442	[1.4]	382	63	183
92,439.3	58	39.7	6	6.4	193	19.4	182	13.88	22.0	13.1	78	14.3	61	17.0	140	63	184
11,948.8	290	4.0	330	15.0	40	41.7	81	4.73	32.5	8.6	135	[3.6]	171	6.6	329	60	185
9,911.7	311	6.0	283	12.5	62	28.2	110	2.59	21.0	6.8	152	[21.9]	314	9.5	286	55	186
11,992.0	288	10.0	177	0.6	434	11.4	294	7.40	[19.7]	42.1	2	[32.0]	382	12.1	239	35	187
9,033.9	326	1.0	430	0.8	416	4.3	402	0.92	[73.5]	[6.3]	270	[28.8]	360	7.6	317	26	188
7,033.9	359	3.0	367	4.8	244	13.1	266	10.54	89.9	15.8	54	[14.5]	245	16.9	142	52	189
9,793.5	312	11.7	135	7.5	156	16.6	221	7.34	165.0	21.2	24	[38.4]	417	11.6	247	46	190
14,172.1	262	4.0	333	9.0	112	65.9	23	4.19	26.6	-	-	17.9	43	-	-	33	191
41,312.8	132	11.9	133	2.8	316	10.1	321	3.90	0.5	1.3	226	5.3	111	13.1	224	63	192
41,665.9	129	13.0	117	13.2	53	18.4	196	3.60	42.3	17.5	39	[9.7]	214	21.7	71	33	193
15,452.2	250	9.1	201	10.3	84	16.3	228	3.81	39.1	-	-	[31.3]	377	18.5	114	29	194
67,193.2	81	1.9	403	0.6	431	1.5	426	0.60	[87.0]	[18.2]	291	6.6	97	14.8	177	40	195
6,879.0	363	3.6	350	7.2	170	64.6	26	3.32	28.2	6.1	170	1.2	144	16.9	141	24	196
155,673.6	31	7.7	243	4.7	251	23.1	154	2.68	114.4	30.4	11	39.4	13	51.3	1	18	197
7,278.1	356	3.6	348	4.1	266	18.7	190	2.24	50.3	-	-	[31.5]	378	-	-	14	198
99,559.2	54	35.4	11	32.6	3	62.0	28	5.59	54.8	14.4	67	[7.2]	197	22.7	59	54	199
30,987.4	162	13.5	106	7.0	176	34.7	79	3.64	31.4	7.0	149	[31.5]	379	5.9	337	21	200
-	-	0.3	447	1.0	407	8.9	345	1.18	[93.1]	[24.4]	293	-	-	-	-	20	201
58,931.4	91	15.4	89	19.7	19	-	-	2.75	20.6	4.2	192	[19.1]	286	8.2	306	31	202
4,215.6	400	4.5	319	4.1	268	14.2	243	2.89	110.9	-	-	[35.3]	403	13.8	205	43	203
121,826.1	41	13.3	111	4.7	247	13.4	261	1.71	16.3	-	-	14.2	63	-	-	19	204
26,648.8	177	8.7	209	8.4	130	29.0	104	5.47	[11.3]	12.9	82	[11.0]	221	19.6	102	8	205
16,327.2	246	8.7	210	5.4	230	52.1	38	5.83	25.4	6.3	165	3.9	125	13.3	218	1	206
66,242.2	82	26.5	33	11.4	69	65.7	24	5.51	51.4	-	-	[38.6]	418	8.8	295	48	207
10,490.3	305	1.1	425	1.3	390	2.8	422	1.17	[51.7]	[10.1]	278	[10.6]	218	2.2	369	17	208
34,501.8	156	10.6	163	26.1	5	48.0	46	4.26	20.0	22.0	20	4.8	116	28.7	19	55	209
47,660.1	110	11.0	152	7.6	152	22.0	162	3.23	12.5	-	-	[0.1]	149	15.5	170	13	210
241,550.3	15	39.2	8	23.6	9	108.6	14	5.60	53.4	-	-	25.3	24	30.0	18	19	210
-	-	1.7	409	2.8	317	8.8	346	-	-	-	-	-	-	-	-	21	212

COURTESY OF OCCIDENTAL PETROLEUM

→ 213-260 500

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BJ'S WHOLESALE CLUB In 2011, a consortium of private equity firms took the wholesaler private in a leveraged buyout. Last year, BJ's raised \$637.5 million in its IPO, returning to the 500 following a seven-year absence. Its \$1.3 billion in revenue proved that shoppers still love a bargain. —*Polina Marinova*

RANK 2018	2017		REVENUES		PROFITS			ASSETS		STOCKHOLDERS' EQUITY	
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
213	202	WASTE MANAGEMENT Houston, Texas.	14,914.0	3.0	1,925.0	150	(1.2)	22,650.0	235	6,275.0	240
214	204	ILLINOIS TOOL WORKS Glenview, Ill.	14,768.0	3.2	2,563.0	115	51.9	14,870.0	308	3,254.0	330
215	215	ECOLAB St. Paul, Minn.	14,668.2	6.0	1,429.1	191	(5.3)	20,074.5	256	8,003.2	206
216	229	BOOKING HOLDINGS Norwalk, Conn.	14,527.0	14.6	3,998.0	75	70.8	22,687.0	234	8,785.0	192
217	197	CBS New York, N.Y.	14,514.0	(1.3)	1,960.0	147	449.0	21,859.0	241	2,804.0	353
218	256	PARKER-HANNIFIN Cleveland, Ohio ⁷	14,302.4	18.9	1,060.8	232	7.9	15,320.1	304	5,859.9	246
219	210	PRINCIPAL FINANCIAL Des Moines, Iowa	14,237.2	1.0	1,546.5	181	(33.1)	243,036.1	34	11,390.0	147
220	232	DTE ENERGY Detroit, Mich.	14,212.0	12.7	1,120.0	219	(1.2)	36,288.0	173	10,237.0	162
221	237	BLACKROCK New York, N.Y.	14,198.0	13.7	4,305.0	67	(13.4)	159,573.0	48	32,374.0	49
222	246	UNITED STATES STEEL Pittsburgh, Pa.	14,178.0	15.7	1,115.0	221	188.1	10,982.0	353	4,202.0	293
223	160	COMMUNITY HEALTH SYSTEMS Franklin, Tenn.	14,155.0	(23.4)	(788.0)	490	—	15,859.0	300	(1,535.0)	490
224	218	KINDER MORGAN Houston, Texas	14,144.0	3.2	1,609.0	175	779.2	78,866.0	92	33,678.0	48
225	288	QURATE RETAIL Englewood, Colo.	14,070.0	35.2	916.0	252	(62.5)	17,841.0	278	5,624.0	253
226	217	LOEWS New York, N.Y.	14,066.0	2.4	636.0	305	(45.4)	78,316.0	94	18,518.0	93
227	225	ARCONIC New York, N.Y.	14,014.0	8.1	642.0	303	—	18,693.0	270	5,573.0	257
228	228	STANLEY BLACK & DECKER New Britain, Conn.	13,982.4	9.7	605.2	314	(50.6)	19,408.0	259	7,836.2	211
229	208	TEXTRON Providence, R.I.	13,972.0	(1.6)	1,222.0	209	298.0	14,264.0	315	5,192.0	269
230	227	LAS VEGAS SANDS Las Vegas, Nev.	13,729.0	6.6	2,413.0	122	(14.0)	22,547.0	238	5,684.0	251
231	258	ESTÉE LAUDER New York, N.Y. ⁷	13,683.0	15.7	1,108.0	224	(11.3)	12,567.0	334	4,688.0	282
232	203	DISH NETWORK Englewood, Colo.	13,621.3	(5.4)	1,575.1	178	(24.9)	30,587.0	196	8,595.7	196
233	240	STRYKER Kalamazoo, Mich.	13,601.0	9.3	3,553.0	82	248.3	27,229.0	207	11,730.0	140
234	226	KELLOGG Battle Creek, Mich.	13,547.0	4.8	1,336.0	200	5.3	17,780.0	281	2,601.0	360
235	245	BIOGEN Cambridge, Mass.	13,452.9	9.6	4,430.7	66	74.5	25,288.9	220	13,039.6	128
236	262	ALCOA Pittsburgh, Pa.	13,403.0	15.0	227.0	406	4.6	15,938.0	298	5,389.0	262
237	257	ANADARKO PETROLEUM The Woodlands, Texas	13,382.0	12.4	615.0	313	—	40,376.0	159	8,496.0	198
238	233	DOMINION ENERGY Richmond, Va. ²⁸	13,366.0	6.2	2,447.0	119	(18.4)	77,914.0	95	20,107.0	86
239	243	AUTOMATIC DATA PROCESSING Roseland, N.J. ⁷	13,325.8	7.6	1,620.8	174	(6.5)	37,088.7	170	3,459.6	316
240	285	SALESFORCE.COM San Francisco, Calif. ¹	13,282.0	26.7	1,110.0	222	770.7	30,737.0	193	15,605.0	102
241	231	L BRANDS Columbus, Ohio ¹	13,236.9	4.8	643.9	301	(34.5)	8,090.2	396	(869.1)	486
242	238	HENRY SCHEIN Melville, N.Y.	13,202.0	5.9	535.9	327	31.9	8,500.5	392	2,961.3	343
243	196	NEWELL BRANDS Hoboken, N.J.	13,033.1 ¹	(11.6)	(6,917.9)	498	(351.7)	17,716.4	283	5,243.0	266
244	239	GUARDIAN LIFE INS. CO. OF AMERICA New York, N.Y.	13,014.9	4.5	464.9	349	2.1	74,053.0	98	7,171.8	221
245	•	BJ'S WHOLESALE CLUB Westborough, Mass. ^{1,29}	13,007.3	2.0	127.3	431	153.0	3,239.3	478	(202.1)	479
246	250	BBGT CORP. Winston-Salem, N.C.	12,996.0	6.9	3,237.0	89	35.2	225,697.0	37	30,122.0	56
247	259	STATE STREET CORP. Boston, Mass.	12,973.0	10.2	2,599.0	113	19.4	244,626.0	33	24,790.0	64
248	221	VIACOM New York, N.Y. ²	12,943.0	(2.4)	1,719.0	164	(8.3)	23,783.0	228	7,407.0	217
249	252	AMERIPRISE FINANCIAL Minneapolis, Minn.	12,924.0	7.0	2,098.0	142	41.8	137,216.0	62	5,588.0	256
250	247	CORE-MARK HOLDING South San Francisco, Calif.	12,903.9 ⁹	5.6	45.5	447	35.8	1,666.1	498	567.0	457
251	234	REINSURANCE GROUP OF AMERICA Chesterfield, Mo.	12,875.7	2.9	715.8	289	(60.7)	64,535.2	108	8,450.6	199
252	242	VF Greensboro, N.C. ³⁰	12,862.3 ⁴	3.7	658.6	298	7.1	10,311.3	365	3,688.1	306
253	263	DISCOVER FINANCIAL SERVICES Riverwoods, Ill.	12,848.0	11.3	2,742.0	106	30.6	109,553.0	76	11,130.0	153
254	331	GLOBAL PARTNERS Waltham, Mass. ⁹	12,672.6	42.1	103.9	436	76.9	2,424.3	492	497.3	464
255	244	EDISON INTERNATIONAL Rosemead, Calif.	12,657.0	2.7	(423.0)	483	(174.9)	56,715.0	122	10,459.0	160
256	249	ONEOK Tulsa, Okla.	12,593.2	3.4	1,151.7	217	197.0	18,231.7	272	6,579.5	229
257	279	MURPHY USA El Dorado, Ark.	12,524.0 ⁶	15.4	213.6	409	(12.9)	2,360.8	493	807.3	449
258	248	BED BATH & BEYOND Union, N.J. ¹²	12,349.3	1.1	424.9	358	(38.0)	7,040.8	420	2,888.6	349
259	255	CONSOLIDATED EDISON New York, N.Y.	12,337.0	2.5	1,382.0	195	(9.4)	53,920.0	127	16,726.0	98
260	265	CSX Jacksonville, Fla.	12,250.0	7.4	3,309.0	88	(39.5)	36,729.0	171	12,563.0	132



MARKET VALUE 3/29/19		PROFITS AS % OF ...					EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018	
\$ millions	Rank	Revenues		Assets		Stockholders' equity		2018	% change from 2017	2008-2018 annual growth rate		2018	Rank	2008-2018 annual rate			
		%	Rank	%	Rank	%	Rank	\$		%	Rank	%	Rank	%	Rank		
44,128.7	120	12.9	120	8.5	126	30.7	95	4.45	0.9	7.3	147	5.3	110	14.0	200	64	213
46,922.6	113	17.4	78	17.2	28	78.8	19	7.60	56.4	10.1	117	[22.3]	319	16.5	151	32	214
50,908.2	101	9.7	182	7.1	171	17.9	204	4.88	(4.9)	10.5	113	11.1	77	16.8	144	8	215
78,543.2	66	27.5	26	17.6	25	45.5	51	83.26	77.7	35.5	4	[0.9]	153	37.1	6	38	216
17,727.3	233	13.5	107	9.0	113	69.9	21	5.14	484.1	—	—	[24.9]	338	20.2	94	18	217
22,201.7	205	7.4	251	6.9	178	18.1	199	7.83	8.0	3.5	202	[24.0]	332	15.5	169	32	218
13,968.6	264	10.9	155	0.6	426	13.6	253	5.36	[32.0]	12.6	89	[34.9]	400	10.0	276	35	219
22,854.2	200	7.9	233	3.1	307	10.9	300	6.17	[2.4]	6.3	166	4.2	121	16.6	150	63	220
67,538.1	80	30.3	19	2.7	323	13.3	262	26.58	[12.1]	16.2	51	[21.6]	308	14.2	195	53	221
3,378.5	416	7.9	235	10.2	88	26.5	121	6.25	185.4	[10.0]	277	[47.8]	445	[6.0]	393	41	222
433.5	462	[5.6]	488	[5.0]	487	—	—	[6.99]	—	—	—	[33.8]	393	[13.4]	402	26	223
45,294.8	117	11.4	143	2.0	351	4.8	394	0.66	6,500.0	—	—	[11.2]	222	—	—	49	224
6,961.7	361	6.5	271	5.1	238	16.3	227	—	—	—	—	[20.1]	293	—	—	38	225
14,920.6	255	4.5	317	0.8	417	3.4	414	1.99	[42.3]	[14.1]	286	[8.5]	206	5.5	341	37	226
8,658.4	333	4.6	316	3.4	293	11.5	292	1.30	—	—	—	[37.4]	409	[2.2]	388	2	227
20,610.3	214	4.3	322	3.1	306	7.7	365	3.99	[50.4]	0.2	237	[28.1]	352	16.0	158	28	228
11,846.7	292	8.7	208	8.6	125	23.5	146	4.83	323.7	9.5	122	[18.6]	279	13.2	221	2	229
47,247.2	112	17.6	75	10.7	79	42.5	60	3.07	[13.3]	—	—	[21.5]	307	28.5	21	30	230
59,790.5	89	8.1	229	8.8	117	23.6	143	2.95	[11.9]	9.4	125	3.4	129	25.2	40	31	231
14,827.5	256	11.6	138	5.1	236	18.3	197	3.00	[26.3]	4.2	190	[47.7]	444	10.6	264	57	232
73,695.7	72	26.1	35	13.0	56	30.3	97	9.34	248.5	12.9	83	2.4	135	16.2	157	40	233
19,722.6	218	9.9	178	7.5	157	51.4	42	3.83	5.8	2.5	208	[13.3]	234	5.8	338	21	234
46,498.0	114	32.9	14	17.5	26	34.0	84	21.58	81.0	23.3	18	[5.5]	184	21.2	78	48	235
5,224.1	385	1.7	410	1.4	382	4.2	404	1.20	3.4	—	—	[50.7]	450	—	—	41	236
22,828.2	201	4.6	315	1.5	374	7.2	370	1.20	—	[16.1]	290	[16.8]	264	2.1	370	42	237
61,281.9	86	18.3	72	3.1	304	12.2	278	3.74	[20.8]	1.7	219	[7.6]	202	11.6	248	63	238
69,587.5	77	12.2	127	4.4	257	46.8	49	3.66	[4.9]	4.6	185	14.2	64	17.4	126	14	239
122,103.3	40	8.4	220	3.6	286	7.1	375	1.43	741.2	32.2	6	34.0	15	32.8	12	10	240
7,589.9	349	4.9	312	8.0	139	—	—	2.31	[32.5]	13.5	72	[54.2]	454	17.5	122	55	241
9,100.9	325	4.1	328	6.3	198	18.1	200	3.48	35.8	10.1	116	12.4	70	15.7	166	68	242
6,490.1	366	[53.1]	500	[39.0]	500	[131.9]	473	[14.60]	[359.3]	—	—	[37.5]	410	9.0	293	28	243
—	—	3.6	349	0.6	428	6.5	382	—	—	—	—	—	—	—	—	34	244
3,776.6	407	1.0	429	3.9	272	—	—	1.05	—	—	—	—	—	—	—	24	245
35,541.0	148	24.9	39	1.4	380	10.7	304	3.91	42.7	3.7	200	[10.3]	217	7.9	310	9	246
24,919.6	188	20.0	64	1.1	406	10.5	314	6.40	22.1	4.1	196	[34.2]	394	6.4	333	9	247
11,530.7	296	13.3	113	7.2	168	23.2	150	4.27	[8.8]	4.6	183	[14.4]	243	5.0	349	18	248
17,345.1	236	16.2	85	1.5	373	37.5	72	14.20	50.4	—	—	[36.8]	407	18.8	110	13	249
1,703.2	445	0.4	444	2.7	321	8.0	361	0.99	37.5	9.2	127	[25.1]	339	16.8	146	67	250
8,922.0	329	5.6	291	1.1	403	8.5	349	11.00	[60.3]	15.0	62	[8.7]	207	14.1	196	35	251
34,382.1	157	5.1	305	6.4	195	17.9	205	1.64	7.9	1.9	213	[1.3]	156	20.8	87	4	252
23,215.1	196	21.3	58	2.5	336	24.6	136	7.79	43.7	15.0	63	[21.8]	311	21.8	69	9	253
668.4	458	0.8	433	4.3	261	20.9	170	2.95	69.5	7.7	144	7.8	91	13.5	212	65	254
20,174.2	216	[3.3]	482	[0.7]	468	[4.0]	452	[1.30]	[175.6]	—	—	[6.9]	194	9.2	288	63	255
28,746.9	169	9.1	197	6.3	197	17.5	210	2.78	115.5	6.5	160	6.2	103	20.9	84	49	256
2,755.6	427	1.7	408	9.0	109	26.5	122	6.48	[4.4]	—	—	[4.6]	177	—	—	56	257
2,335.7	432	3.4	353	6.0	206	14.7	235	3.04	[33.6]	3.8	199	[46.7]	440	[7.2]	394	56	258
27,230.6	176	11.2	149	2.6	333	8.3	356	4.42	[10.5]	0.1	238	[6.6]	191	11.7	244	63	259
60,805.2	88	27.0	29	9.0	111	26.3	123	3.84	[35.9]	13.2	76	14.5	59	21.6	75	51	260

COURTESY OF BJ'S

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MOLSON COORS BREWING What's a beer giant to do when consumers quit products like Miller Lite in favor of craft beer and fancy waters? After several quarters of sales declines by volume, CEO Mark Hunter is emphasizing brands like Blue Moon and Arnold Palmer Spiked to pursue "premiumization." —J.J.R.

RANK 2018	RANK 2017		REVENUES		PROFITS			ASSETS		STOCKHOLDERS' EQUITY	
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
261	235	J.C. PENNEY Plano, Texas ¹	12,019.0	(3.9)	[255.0]	479	—	7,721.0	405	1,170.0	430
262	300	LKQ Chicago, Ill.	11,876.7	20.6	480.1	339	[10.0]	11,393.4	348	4,782.3	279
263	219	FIRSTENERGY Akron, Ohio	11,864.0 ^{5E}	[12.9]	1,348.0	196	—	40,063.0	160	6,814.0	226
264	312	STEEL DYNAMICS Fort Wayne, Ind.	11,821.8	23.9	1,258.4	205	54.8	7,703.6	406	3,935.1	300
265	294	LITHIA MOTORS Medford, Ore.	11,821.4	17.2	265.7	397	8.4	5,384.0	441	1,197.2	428
266	280	MGM RESORTS INTERNATIONAL Las Vegas, Nev.	11,763.1	9.2	466.8	348	[76.2]	30,210.7	198	6,512.3	231
267	320	TENNECO Lake Forest, Ill.	11,763.0	26.8	55.0	444	[73.4]	13,232.0	323	1,726.0	399
268	306	NVIDIA Santa Clara, Calif. ¹	11,716.0	20.6	4,141.0	70	35.9	13,292.0	322	9,342.0	180
269	271	SEMPRA ENERGY San Diego, Calif.	11,687.0	4.3	1,049.0	234	309.8	60,638.0	114	14,853.0	109
270	253	FARMERS INSURANCE EXCHANGE Woodland Hills, Calif.	11,650.4	(3.5)	[70.5]	467	—	17,016.3	287	4,096.3	297
271	277	BALL Broomfield, Colo.	11,635.0	5.9	454.0	350	21.4	16,554.0	290	3,458.0	317
272	273	GROUP 1 AUTOMOTIVE Houston, Texas	11,601.4	4.3	157.8	424	[26.1]	5,001.1	449	1,095.7	435
273	267	UNUM GROUP Chattanooga, Tenn.	11,598.5	2.8	523.4	333	[47.4]	61,875.6	113	8,621.8	195
274	266	XCEL ENERGY Minneapolis, Minn.	11,537.0	1.2	1,261.0	204	9.8	45,987.0	140	12,222.0	135
275	305	RELIANCE STEEL & ALUMINUM Los Angeles, Calif.	11,534.5	18.7	633.7	306	3.3	8,044.9	398	4,671.6	284
276	282	HUNTSMAN The Woodlands, Texas	11,527.0 ⁵	8.8	337.0	376	[47.0]	7,953.0	401	2,520.0	363
277	284	NORFOLK SOUTHERN Norfolk, Va.	11,458.0	8.6	2,666.0	107	[50.7]	36,239.0	174	15,362.0	106
278	286	LABORATORY CORP. OF AMERICA Burlington, N.C.	11,333.4	8.5	883.7	255	[30.3]	16,185.3	294	6,971.4	224
279	293	CORNING Corning, N.Y.	11,290.0	11.6	1,066.0	230	—	27,505.0	205	13,792.0	122
280	295	EXPEDIA GROUP Bellevue, Wash.	11,223.0	11.6	406.0	363	7.4	18,033.0	275	4,104.0	296
281	278	AUTOZONE Memphis, Tenn. ⁶	11,221.1	3.1	1,337.5	199	4.4	9,347.0	379	[1,520.4]	489
282	287	W.W. GRAINGER Lake Forest, Ill.	11,221.0	7.6	782.0	274	33.5	5,873.0	433	1,921.0	388
283	316	QUANTA SERVICES Houston, Texas	11,171.4	18.0	293.3	390	[6.9]	7,075.8	418	3,604.2	311
284	338	CROWN HOLDINGS Yardley, Pa.	11,151.0	28.2	439.0	353	35.9	15,262.0	306	937.0	443
285	281	OFFICE DEPOT Boca Raton, Fla.	11,130.0 ⁵	3.5	104.0	435	[42.5]	6,166.0	428	2,126.0	380
286	283	BAXTER INTERNATIONAL Deerfield, Ill.	11,127.0	5.4	1,624.0	173	126.5	15,641.0	302	7,794.0	212
287	354	LAM RESEARCH Fremont, Calif. ⁷	11,077.0	38.2	2,380.7	125	40.2	12,479.5	335	6,501.9	232
288	274	ENTERGY New Orleans, La.	11,009.5	[0.6]	848.7	263	106.2	48,275.1	136	8,844.3	191
289	330	CHARLES SCHWAB San Francisco, Calif.	10,989.0	22.6	3,507.0	83	49.0	296,482.0	24	20,670.0	83
290	276	L3 TECHNOLOGIES New York, N.Y.	10,841.0 ⁵	[1.5]	1,005.0	241	48.4	13,518.0	319	5,839.0	248
291	269	NRG ENERGY Princeton, N.J.	10,797.0 ⁵	[4.2]	268.0	396	—	10,628.0	362	[1,234.0]	487
292	290	LIVE NATION ENTERTAINMENT Beverly Hills, Calif.	10,787.8	4.4	60.2	442	—	8,496.9	393	1,099.0	434
293	268	UNIVERSAL HEALTH SERVICES King of Prussia, Pa.	10,772.3	[4.5]	779.7	275	3.6	11,265.5	349	5,389.3	261
294	275	MOLSON COORS BREWING Denver, Colo.	10,769.6 ^{6E}	[2.1]	1,116.5	220	[28.7]	30,109.8	199	13,507.4	124
295	309	EBAY San Jose, Calif.	10,746.0	12.3	2,530.0	116	—	22,819.0	233	6,281.0	239
296	214	AES Arlington, Va.	10,736.0	[22.5]	1,203.0	214	—	32,521.0	189	3,208.0	334
297	213	DEVON ENERGY Oklahoma City, Okla.	10,734.0	[23.0]	3,064.0	95	241.2	19,566.0	258	9,186.0	182
298	313	PACIFIC LIFE Newport Beach, Calif. ¹⁰	10,699.0	12.5	913.0	253	[33.1]	157,699.0	51	12,177.0	136
299	308	CENTERPOINT ENERGY Houston, Texas ³¹	10,589.0	10.1	368.0	370	[79.5]	27,009.0	209	8,058.0	204
300	409	DISCOVERY Silver Spring, Md.	10,553.0	53.5	594.0	316	—	32,550.0	188	8,386.0	200
301	301	BORGWARNER Auburn Hills, Mich.	10,529.6	7.5	930.7	251	111.6	10,095.3	369	4,225.5	292
302	334	TARGA RESOURCES Houston, Texas	10,484.0	18.9	1.6	455	[97.0]	16,938.2	288	6,325.1	238
303	299	ALLY FINANCIAL Detroit, Mich.	10,466.0	6.1	1,263.0	203	36.0	178,869.0	45	13,268.0	126
304	303	SUNTRUST BANKS Atlanta, Ga.	10,431.0	7.1	2,775.0	105	22.1	215,543.0	39	24,177.0	67
305	304	IQVIA HOLDINGS Durham, N.C.	10,412.0	6.9	259.0	400	[80.2]	22,549.0	237	6,714.0	227
306	311	AMERICAN FAMILY INSURANCE GROUP Madison, Wis. ¹⁸	10,336.2	8.3	295.3	389	89.7	27,502.5	206	9,006.8	186
307	384	DELEK US HOLDINGS Brentwood, Tenn.	10,265.6 ^{5E}	39.7	340.1	374	17.8	5,760.6	434	1,632.6	402
308	342	NAVISTAR INTERNATIONAL Lisle, Ill. ¹⁴	10,250.0	19.6	340.0	375	1,033.3	7,230.0	415	[3,931.0]	493



MARKET VALUE 3/29/19		PROFITS AS % OF...				EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018			
\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank	2018 \$	% change from 2017	2008-2018 annual growth rate % Rank	2018 %	Rank	2008-2018 annual rate %	Rank							
471.4	461	(2.1)	478	(3.3)	486	(21.8)	464	[0.81]	—	—	[67.1]	468	[24.8]	406	24	281		
8,926.4	328	4.0	329	4.2	263	10.0	323	1.52	[11.6]	15.7	55	[41.7]	427	15.1	175	65	282	
22,059.6	206	11.4	144	3.4	295	19.8	177	1.99	—	[7.6]	273	27.7	21	2.3	366	63	283	
7,862.8	345	10.6	160	16.3	31	32.0	90	5.35	59.2	8.4	137	[29.2]	364	13.1	226	41	284	
2,147.0	434	2.2	396	4.9	243	22.2	159	10.86	11.4	—	—	[32.0]	381	38.5	5	5	285	
13,777.3	268	4.0	331	1.5	372	7.2	373	0.81	[75.8]	—	—	[26.2]	344	6.2	335	30	286	
1,793.2	442	0.5	441	0.4	440	3.2	421	0.93	[76.2]	—	—	[52.0]	452	25.5	37	43	287	
108,813.4	51	35.3	13	31.2	4	44.3	52	6.63	37.6	—	—	[30.8]	375	33.4	11	54	288	
34,508.6	155	9.0	203	1.7	362	7.1	377	3.42	238.6	(2.6)	253	4.4	119	13.2	222	63	289	
—	—	(0.6)	467	(0.4)	465	(1.7)	444	—	—	—	—	—	—	—	—	—	36	290
19,335.0	222	3.9	335	2.7	319	13.1	265	1.29	22.9	4.6	184	22.6	29	17.0	136	46	291	
1,186.6	452	1.4	419	3.2	303	14.4	242	7.83	[22.3]	—	—	[24.5]	335	18.4	116	5	292	
7,260.8	358	4.5	318	0.8	413	6.1	386	2.38	[45.5]	3.9	197	[45.1]	438	6.8	326	35	293	
28,903.8	168	10.9	154	2.7	320	10.3	317	2.47	9.8	5.4	177	5.8	108	14.6	183	63	294	
6,054.5	373	5.5	292	7.9	144	13.6	254	8.75	4.9	2.9	203	[15.1]	250	15.7	165	41	295	
5,251.9	384	2.9	370	4.2	262	13.4	260	1.39	[46.7]	[6.1]	269	[40.6]	424	22.7	60	8	296	
49,860.3	103	23.3	49	7.4	163	17.4	214	9.51	[48.9]	7.7	145	5.2	114	15.1	174	51	297	
15,095.8	252	7.8	237	5.5	225	12.7	272	8.61	[29.5]	7.5	146	[20.8]	300	7.0	325	27	298	
25,990.7	180	9.4	187	3.9	275	7.7	364	1.13	—	[10.2]	280	[3.3]	168	14.5	186	15	299	
17,515.6	235	3.6	346	2.3	343	9.9	326	2.65	9.5	—	—	[5.0]	178	31.6	15	38	300	
25,487.9	184	11.9	131	14.3	43	—	—	48.77	10.7	17.1	45	17.8	44	19.6	100	56	301	
16,732.7	242	7.0	260	13.3	50	40.7	64	13.73	37.0	8.6	136	21.6	30	15.8	164	65	302	
5,336.2	380	2.6	381	4.1	265	8.1	359	1.90	[5.0]	8.0	143	[23.0]	325	4.3	357	17	303	
7,384.9	352	3.9	334	2.9	314	46.9	48	3.28	37.8	9.0	130	[26.1]	342	8.0	309	46	304	
1,971.9	436	0.9	431	1.7	366	4.9	392	0.19	[44.1]	—	—	[24.5]	334	[0.7]	380	56	305	
41,558.9	130	14.6	99	10.4	83	20.8	171	2.97	130.2	[0.6]	249	2.8	131	10.6	263	40	306	
27,315.8	175	21.5	57	19.1	20	36.6	75	13.17	42.5	14.3	68	[24.0]	331	21.3	77	54	307	
18,214.6	229	7.7	242	1.8	361	9.6	329	4.63	103.1	[2.9]	256	10.5	80	5.0	347	63	308	
57,051.3	92	31.9	15	1.2	396	17.0	218	2.45	52.2	8.8	131	[18.4]	277	11.2	254	53	309	
18,368.2	244	9.3	194	7.4	158	17.2	217	12.63	48.4	5.0	181	[10.8]	219	11.7	243	2	310	
11,850.9	291	2.5	386	2.5	335	—	—	0.87	—	[14.7]	287	39.6	12	6.5	330	16	311	
13,400.5	275	0.6	437	0.7	423	5.5	390	[0.09]	—	—	—	15.7	52	24.0	48	18	312	
12,144.3	286	7.2	255	6.9	179	14.5	239	8.31	6.4	15.5	57	3.2	130	20.6	91	26	313	
12,958.0	279	10.4	168	3.7	281	8.3	355	5.15	[28.8]	9.4	124	[29.9]	369	3.8	362	6	314	
33,978.7	159	23.5	45	11.1	75	40.3	66	2.55	—	6.5	162	[25.6]	340	16.8	147	38	315	
11,975.4	289	11.2	148	3.7	282	37.5	73	1.81	—	[0.1]	242	39.0	14	7.8	314	63	316	
13,832.7	266	28.5	23	15.7	35	33.4	85	6.10	258.8	—	—	[45.0]	437	[9.0]	397	42	317	
—	—	8.5	216	0.6	430	7.5	368	—	—	—	—	—	—	—	—	—	35	318
15,394.2	251	3.5	352	1.4	385	4.6	397	0.74	[82.1]	[5.5]	267	3.6	126	13.4	214	63	319	
13,632.8	270	5.6	289	1.8	358	7.1	376	0.86	—	5.8	175	10.5	79	13.3	216	18	320	
7,974.3	344	8.8	206	9.2	106	22.0	160	4.44	113.5	—	—	[30.9]	376	13.1	223	43	321	
9,645.6	314	0.0	455	0.0	455	0.0	435	[0.53]	—	—	—	[20.0]	292	—	—	49	322	
11,025.3	300	12.1	129	0.7	424	9.5	332	2.95	44.6	—	—	[20.7]	296	—	—	13	323	
26,262.9	178	26.6	31	1.3	391	11.5	293	5.74	28.4	10.4	114	[19.7]	291	7.1	323	9	324	
28,280.9	171	2.5	385	1.1	401	3.9	410	1.24	[78.9]	—	—	18.7	39	—	—	27	325	
—	—	2.9	372	1.1	404	3.3	418	—	—	—	—	—	—	—	—	—	37	326
2,821.7	426	3.3	356	5.9	212	20.8	172	3.95	[1.3]	—	—	[5.1]	180	—	—	47	327	
3,199.8	421	3.3	355	4.7	249	—	—	3.41	965.6	6.5	164	[39.5]	419	2.0	372	12	328	

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ADOBE There's not a lot of glamour in PDF readers and web-editing tools, but that hasn't stopped Adobe's steady growth; its \$9 billion of revenue in 2018 represented a 24% year-over-year jump. A successful cloud strategy and a lucrative subscription business are keeping shareholders happy too. —J.J.R.

RANK 2018	2017		REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
309	314	CHESAPEAKE ENERGY Oklahoma City, Okla.	10,231.0	7.7	873.0	258	{8.0}	10,947.0	354	344.0	469
310	319	UNITED NATURAL FOODS Providence, R.I. ^{18,32}	10,226.7	10.3	165.7	418	27.3	2,964.5	484	1,846.0	392
311	292	LEIDOS HOLDINGS Reston, Va.	10,194.0	0.2	581.0	318	58.7	8,770.0	390	3,308.0	326
312	341	PULTEGROUP Atlanta, Ga.	10,188.3	18.8	1,022.0	239	128.5	10,173.0	368	4,817.8	278
313	310	EASTMAN CHEMICAL Kingsport, Tenn.	10,151.0	6.3	1,080.0	229	{22.0}	15,995.0	297	5,803.0	250
314	296	REPUBLIC SERVICES Phoenix, Ariz.	10,040.9	{0.0}	1,036.9	235	{18.9}	21,617.0	243	7,927.1	207
315	315	MOHAWK INDUSTRIES Calhoun, Ga.	9,983.6	5.2	861.7	260	{11.3}	13,099.1	326	7,433.8	216
316	298	SONIC AUTOMOTIVE Charlotte, N.C.	9,951.6	0.9	51.7	445	{44.5}	3,796.8	468	823.1	448
317	318	OWENS & MINDOR Mechanicsville, Va.	9,838.7	5.6	{437.0}	484	{700.3}	3,773.8	469	518.4	461
318	291	XEROX Norwalk, Conn.	9,830.0	{4.2}	361.0	371	85.1	14,874.0	307	5,005.0	273
318	328	BOSTON SCIENTIFIC Marlborough, Mass.	9,823.0	8.6	1,671.0	168	1,506.7	20,999.0	250	8,726.0	194
320	344	DCP MIDSTREAM Denver, Colo. ^P	9,822.0	16.1	298.0	388	30.1	14,266.0	314	7,268.0	220
321	289	AUTOLIV Auburn Hills, Mich. ³³	9,801.1*	{5.6}	190.4	412	{55.4}	6,721.6	422	1,883.7	390
322	359	INTERPUBLIC GROUP New York, N.Y.	9,714.4	23.2	618.9	310	6.9	15,620.3	303	2,393.2	367
323	327	PUBLIC SERVICE ENTERPRISE GROUP Newark, N.J.	9,696.0	6.7	1,438.0	189	{8.6}	45,326.0	142	14,377.0	117
324	332	PVH New York, N.Y. ³	9,656.8	8.3	746.4	282	38.8	11,863.7	342	5,827.8	249
325	382	MOSAIC Plymouth, Minn.	9,587.3	29.4	470.0	344	—	20,119.2	255	10,397.3	161
326	317	ADVANCE AUTO PARTS Raleigh, N.C.	9,580.6	2.2	423.8	359	{10.9}	9,040.6	385	3,550.8	314
327	•	ALTICE USA Long Island City, N.Y. ³⁴	9,566.6	2.6	18.8	453	{98.8}	33,613.8	181	3,670.9	309
328	323	HORMEL FOODS Austin, Minn. ³⁵	9,545.7	4.1	1,012.1	240	19.5	8,142.3	395	5,600.8	254
329	329	O'REILLY AUTOMOTIVE Springfield, Mo.	9,536.4	6.2	1,324.5	202	16.8	7,980.8	400	353.7	468
330	336	CALPINE Houston, Texas	9,512.0	8.7	10.0	454	—	16,062.0	295	2,963.0	342
331	335	HERTZ GLOBAL HOLDINGS Estero, Fla.	9,504.0	8.0	{225.0}	478	{168.8}	21,382.0	247	1,061.0	437
332	254	FIRST DATA New York, N.Y.	9,498.0	{21.2}	1,005.0	241	{31.4}	38,327.0	164	4,173.0	295
333	497	PIONEER NATURAL RESOURCES Irving, Texas	9,415.0	72.6	978.0	247	17.4	17,903.0	277	12,111.0	138
334	371	COTY New York, N.Y. ⁷	9,398.0	22.8	{168.8}	475	—	22,630.2	236	8,849.7	190
335	347	AGCO Duluth, Ga.	9,352.0	12.6	285.5	391	53.2	7,626.4	408	2,932.9	345
336	337	MUTUAL OF OMAHA INSURANCE Omaha, Neb. ¹⁶	9,347.2	7.0	277.3	394	{67.9}	43,913.4	147	6,439.9	233
337	499	VISTRA ENERGY Irving, Texas	9,144.0	68.4	{54.0}	464	—	26,024.0	212	7,863.0	210
338	333	AVIS BUDGET GROUP Parsippany, N.J. ⁷	9,124.0	3.1	165.0	419	{54.3}	19,149.0	263	414.0	467
339	389	ADOBE San Jose, Calif. ^{84,35}	9,030.0	23.7	2,590.8	114	52.9	18,768.7	269	9,362.1	179
340	339	PETER KIEWIT SONS Omaha, Neb.	9,025.0	4.0	468.0	345	26.1	4,760.0	450	2,564.0	361
341	350	NEWS CORP. New York, N.Y. ⁷	9,024.0	10.9	{1,514.0}	492	—	16,346.0	292	9,291.0	181
342	•	BRIGHTHOUSE FINANCIAL Charlotte, N.C. ³⁸	8,965.0	—	865.0	259	—	206,294.0	41	14,418.0	116
343	307	VOYA FINANCIAL New York, N.Y.	8,934.0*	{7.5}	875.0	257	—	154,682.0	52	8,213.0	201
344	345	AIR PRODUCTS & CHEMICALS Allentown, Pa. ²	8,930.2	5.8	1,497.8	185	{50.1}	19,178.3	262	10,857.5	156
345	324	HILTON WORLDWIDE HOLDINGS McLean, Va. ³⁷	8,906.0	{2.6}	764.0	278	{39.3}	13,995.0	317	551.0	459
346	322	GAMESTOP Grapevine, Texas ¹	8,850.7*	{4.1}	{673.0}	488	{2,039.5}	4,044.3	465	1,336.2	421
347	346	VERITIV Atlanta, Ga.	8,696.2	4.0	{15.7}	460	—	2,529.7	490	543.1	460
348	353	WILLIAMS Tulsa, Okla.	8,686.0	8.2	{155.0}	473	{107.1}	45,302.0	143	14,660.0	112
349	358	CAMPBELL SOUP Camden, N.J. ³⁸	8,685.0	10.1	261.0	398	{70.6}	14,529.0	310	1,364.0	419
350	415	ROCKWELL COLLINS West Palm Beach, Fla. ³⁶	8,665.0	27.0	1,032.0	237	46.4	19,026.0	267	7,107.0	223
351	343	THRIVENT FINANCIAL FOR LUTHERANS Minneapolis, Minn. ¹⁹	8,635.2	1.3	1,233.9	207	121.0	94,482.9	86	9,129.6	183
352	352	WESTLAKE CHEMICAL Houston, Texas	8,635.0	7.4	996.0	244	{23.6}	11,602.0	345	5,590.0	255
353	349	UNIVAR Downers Grove, Ill. ³⁹	8,632.5	4.6	172.3	415	43.8	5,272.4	444	1,191.7	429
354	395	J.B. HUNT TRANSPORT SERVICES Lowell, Ark.	8,614.9	19.8	489.6	337	{28.7}	5,091.6	447	2,101.4	381
355	325	FRONTIER COMMUNICATIONS Norwalk, Conn.	8,611.0	{5.7}	{643.0}	487	—	23,659.0	231	1,600.0	405
356	376	JONES FINANCIAL (EDWARD JONES) Des Peres, Mo. ^{P,40}	8,594.0	13.1	990.0	246	13.5	15,815.0	301	2,855.0	351



MARKET VALUE 3/29/19		PROFITS AS % OF ...					EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018	
\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank		2018 \$	% change from 2017	2008-2018 annual growth rate %	Rank	2018 %	Rank	2008-2018 annual rate %	Rank				
5,058.3	389	8.5	217	8.0	138	253.8	7	0.85	(5.6)	(2.9)	257	(47.0)	441	(17.2)	404	42	309
671.8	457	1.6	413	5.6	221	9.0	344	3.26	27.3	11.2	106	(78.5)	470	(5.1)	392	67	310
9,205.1	322	5.7	286	6.6	185	17.6	209	3.80	59.7	(0.5)	247	(16.6)	263	5.5	343	33	311
7,758.4	347	10.0	175	10.0	91	21.2	167	3.55	146.5	-	-	(20.8)	301	10.0	275	29	312
10,531.1	302	10.6	161	6.8	181	18.6	193	7.56	(20.2)	12.8	84	(19.3)	287	19.5	103	8	313
25,851.5	181	10.3	170	4.8	245	13.1	267	3.16	(16.2)	23.9	17	8.9	87	14.3	189	64	314
9,121.9	324	8.6	212	6.6	187	11.6	289	11.47	(11.6)	-	-	(57.6)	458	10.5	266	28	315
636.7	459	0.5	439	1.4	386	6.3	384	1.20	(42.6)	-	-	(24.5)	336	14.3	188	5	316
258.4	466	(4.4)	485	(11.6)	494	(84.3)	471	(7.28)	(706.7)	-	-	(64.8)	464	(10.2)	399	68	317
7,307.6	353	3.7	344	2.4	337	7.2	371	1.38	94.4	2.9	204	(29.9)	368	1.3	374	11	318
53,367.4	97	17.0	79	8.0	140	19.1	185	1.19	1,387.5	-	-	42.6	8	16.4	154	40	319
4,736.6	394	3.0	365	2.1	348	4.1	406	0.61	41.9	(15.4)	288	(21.1)	302	20.5	92	49	320
6,413.4	368	1.9	404	2.8	315	10.1	322	2.18	(55.2)	(0.4)	246	(21.2)	304	18.9	109	43	321
8,087.0	342	6.4	273	4.0	271	25.9	126	1.59	8.9	11.8	100	6.2	105	20.4	93	1	322
30,002.0	166	14.8	95	3.2	300	10.0	324	2.83	(8.7)	1.9	214	4.6	118	10.3	272	63	323
9,164.1	323	7.7	239	6.3	199	12.8	269	9.65	41.1	18.6	34	(32.2)	385	16.8	148	4	324
10,527.2	303	4.9	310	2.3	339	4.5	398	1.22	-	(12.6)	283	14.2	62	0.1	377	8	325
12,221.9	285	4.4	321	4.7	250	11.9	280	5.73	(10.7)	8.6	134	58.2	2	17.0	134	56	326
14,708.0	257	0.2	450	0.1	454	0.5	432	0.03	(98.6)	-	-	(14.3)	240	-	-	57	327
23,976.8	193	10.6	162	12.4	83	18.1	202	1.86	18.5	13.6	71	19.6	35	20.7	89	21	328
30,438.4	165	13.9	103	16.6	29	374.5	3	16.10	27.1	27.0	14	43.1	7	27.3	27	56	329
-	-	0.1	452	0.1	453	0.3	433	-	-	-	-	-	-	-	-	16	330
1,457.8	449	(2.4)	479	(1.1)	472	(21.2)	463	(2.68)	(168.0)	-	-	(38.2)	416	(3.8)	389	5	331
24,767.2	190	10.6	164	2.6	329	24.1	142	1.05	(32.7)	-	-	1.2	143	-	-	19	332
25,639.3	182	10.4	167	5.5	224	8.1	360	5.70	17.5	11.9	97	(23.8)	330	23.4	56	42	333
8,639.5	334	(1.8)	476	(0.7)	469	(1.9)	445	(0.23)	-	-	-	(65.6)	466	-	-	31	334
5,335.4	381	3.1	364	3.7	278	9.7	327	3.58	54.3	(1.3)	251	(21.3)	305	9.6	283	12	335
-	-	3.0	368	0.6	427	4.3	401	-	-	-	-	-	-	-	-	35	336
12,647.8	282	(0.6)	466	(0.2)	459	(0.7)	439	(0.11)	-	-	-	24.9	25	-	-	16	337
2,646.2	428	1.8	407	0.9	412	39.9	67	2.06	(51.5)	-	-	(48.8)	447	41.5	2	5	338
130,034.0	38	28.7	22	13.8	46	27.7	114	5.20	53.8	12.6	90	29.1	18	26.7	30	10	339
-	-	5.2	302	9.8	96	18.3	198	-	-	-	-	-	-	-	-	17	340
7,286.8	355	(16.8)	495	(9.3)	492	(16.3)	460	(2.60)	-	-	-	(29.0)	362	-	-	50	341
4,230.2	399	9.6	183	0.4	439	6.0	387	7.21	-	-	-	(48.0)	446	-	-	35	342
7,291.0	354	9.8	180	0.6	433	10.7	307	5.20	-	-	-	(18.8)	281	-	-	13	343
41,940.8	128	16.8	81	7.8	147	13.8	249	6.78	(50.3)	5.0	182	0.1	147	16.3	156	8	344
24,292.8	191	8.6	213	5.5	226	138.7	11	2.50	(35.1)	-	-	(9.4)	212	-	-	30	345
1,036.0	453	(7.6)	493	(16.6)	498	(50.4)	468	(6.59)	(2,038.2)	-	-	(21.7)	310	(1.7)	385	56	346
418.5	463	(0.2)	460	(0.6)	467	(2.9)	447	(0.99)	-	-	-	(13.6)	236	-	-	65	347
94,801.1	152	(1.8)	475	(0.3)	463	(1.1)	442	(0.16)	(106.1)	-	-	(23.7)	329	11.2	253	49	348
11,481.6	297	3.0	366	1.8	360	19.1	186	0.86	(70.2)	(11.9)	282	(29.1)	363	4.0	358	21	349
-	-	11.9	132	5.4	228	14.5	237	6.22	29.9	4.1	194	-	-	-	-	2	350
-	-	14.3	101	1.3	388	13.5	256	-	-	-	-	-	-	-	-	34	351
8,718.3	332	11.5	139	8.6	122	17.8	206	7.62	(23.8)	-	-	(37.2)	408	25.1	41	8	352
3,760.5	408	2.0	401	3.3	297	14.5	240	1.21	42.4	-	-	(42.7)	433	-	-	65	353
11,014.2	301	5.7	287	9.6	99	23.3	148	4.43	(28.3)	11.0	109	(18.4)	278	14.7	180	62	354
209.6	468	(7.5)	492	(2.7)	484	(40.2)	467	(8.37)	-	-	-	(64.8)	463	(26.0)	407	57	355
-	-	11.5	140	6.3	200	34.7	80	-	-	-	-	-	-	-	-	53	356

→ 357-404 500

365

CAESARS ENTERTAINMENT The gaming and resort giant rejoins the list after a 73% jump in revenue [aided by its acquisition of casino operator Centaur Holdings]. Caesars is poised to benefit from the legalization of sports betting, having already signed a sponsorship deal with the NFL. —*Rey Mashayekhi*

RANK 2018	2017		REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
357	388	NATIONAL OILWELL VARCO Houston, Texas	8,453.0	15.7	[31.0]	462	—	19,796.0	257	13,819.0	121
358	364	EVERSOURCE ENERGY Springfield, Mass.	8,448.2	9.0	1,033.0	236	4.6	38,241.3	165	11,486.8	143
359	340	DICK'S SPORTING GOODS Coraopolis, Pa. ¹	8,436.6	[1.8]	319.9	382	[1.1]	4,187.1	460	1,904.2	389
360	348	GENWORTH FINANCIAL Richmond, Va.	8,430.0	1.6	119.0	432	[85.4]	100,923.0	83	12,450.0	134
361	326	FIDELITY NATIONAL INFORMATION SERVICES Jacksonville, Fla.	8,423.0	[7.7]	846.0	264	[35.9]	23,770.0	229	10,215.0	163
362	397	YUM CHINA HOLDINGS Plano, Texas	8,415.0	17.8	708.0	290	75.7	4,610.0	452	2,873.0	350
363	387	RYDER SYSTEM Miami, Fla.	8,409.2	14.7	273.3	395	[65.4]	13,051.1	328	2,910.3	347
364	357	ANIXTER INTERNATIONAL Glenview, Ill.	8,400.2	6.0	156.3	425	43.4	4,653.1	451	1,570.4	408
365		• CAESARS ENTERTAINMENT Las Vegas, Nev.	8,391.0	72.9	303.0	386	—	25,775.0	215	3,250.0	331
366	373	MASCO Livonia, Mich.	8,359.0	9.4	734.0	285	37.7	5,393.0	440	[111.0]	476
367	392	THOR INDUSTRIES Elkhart, Ind. ¹⁶	8,328.9	14.9	430.2	356	14.9	2,778.7	487	1,937.7	387
368	355	ALASKA AIR GROUP Seattle, Wash.	8,264.0	4.2	437.0	354	[57.7]	10,912.0	355	3,751.0	301
369	403	AMPHENOL Wallingford, Conn.	8,202.0	17.0	1,205.0	213	85.2	10,044.9	370	4,017.0	299
370	370	WESCO INTERNATIONAL Pittsburgh, Pa.	8,176.6	6.5	227.3	405	39.1	4,605.0	453	2,135.3	379
371	381	HUNTINGTON INGALLS INDUSTRIES Newport News, Va.	8,176.0	9.9	836.0	266	74.5	6,383.0	426	1,516.0	410
372	241	JEFFERIES FINANCIAL GROUP New York, N.Y. ⁴¹	8,151.8 ¹	[34.3]	1,026.8	238	497.9	47,131.1	138	10,060.9	165
373	393	DANA Maumee, Ohio	8,143.0	13.0	427.0	357	284.7	5,918.0	432	1,345.0	420
374	408	EXPEDITORS INTERNATIONAL OF WASHINGTON Seattle, Wash.	8,138.4	17.6	618.2	311	26.3	3,314.6	477	1,986.8	385
375	368	EMCOR GROUP Norwalk, Conn.	8,130.6	5.8	283.5	392	24.8	4,088.8	463	1,740.5	397
376	396	DARDEN RESTAURANTS Orlando, Fla. ¹¹	8,080.1	12.7	596.0	315	24.4	5,469.6	439	2,194.8	376
377	351	SPARTANASH Byron Center, Mich.	8,064.6	[0.8]	33.6	451	—	1,971.9	495	715.9	453
378	440	ASSURANT New York, N.Y.	8,057.6	25.6	251.0	404	[51.7]	41,089.3	155	5,112.0	271
379	424	UNITED RENTALS Stamford, Conn.	8,047.0	21.2	1,096.0	227	[18.6]	18,133.0	273	3,403.0	321
380	377	LIBERTY MEDIA Englewood, Colo. ⁴²	8,040.0	5.9	531.0	331	[60.8]	40,828.0	158	16,595.0	99
381	378	ERIE INSURANCE GROUP Erie, Pa. ⁴³	8,030.7	6.6	686.3	293	[20.0]	21,178.2	249	9,576.3	177
382	375	AUTO-OWNERS INSURANCE Lansing, Mich.	7,999.3	5.2	754.5	279	16.8	24,476.4	225	11,342.8	149
383	489	CHENIERE ENERGY Houston, Texas	7,987.0	42.6	471.0	342	—	31,987.0	190	[526.0]	484
384	366	FIFTH THIRD BANCORP Cincinnati, Ohio	7,973.0	3.4	2,193.0	136	[0.0]	146,069.0	57	16,250.0	100
385	363	FOOT LOCKER New York, N.Y. ¹	7,939.0	2.0	541.0	326	90.5	3,820.0	467	2,506.0	366
386	321	CONAGRA BRANDS Chicago, Ill. ^{11,44}	7,938.3	[14.0]	808.4	270	26.5	10,389.5	364	3,676.2	308
387	361	ZIMMER BIOMET HOLDINGS Warsaw, Ind.	7,932.9	1.4	[379.2]	482	[120.9]	24,126.8	227	11,271.3	152
388	391	TRACTOR SUPPLY Brentwood, Tenn.	7,911.0	9.0	532.4	329	26.0	3,085.3	481	1,561.8	409
389	399	BERRY GLOBAL GROUP Evansville, Ind. ²	7,869.0	10.9	496.0	335	45.9	9,131.0	383	1,431.0	414
390	365	ALLIANCE DATA SYSTEMS Plano, Texas	7,791.2	0.9	963.1	249	22.1	30,387.7	197	2,332.1	370
391	379	HERSHEY Hershey, Pa.	7,791.1	3.7	1,177.6	216	50.4	7,703.0	407	1,398.7	415
392	380	PPL Allentown, Pa.	7,785.0	4.5	1,827.0	157	62.0	43,396.0	150	11,657.0	141
393	362	DEAN FOODS Dallas, Texas	7,755.3	[0.5]	[326.9]	481	[630.8]	2,118.5	494	303.0	472
394	400	BUILDERS FIRSTSOURCE Dallas, Texas	7,724.8	9.8	205.2	410	429.1	2,932.3	485	596.3	456
395	414	OSHKOSH Oshkosh, Wis. ²	7,705.5	12.8	471.9	341	65.2	5,294.2	443	2,513.5	364
396		• ENLINK MIDSTREAM Dallas, Texas ¹	7,699.0	34.1	[13.2]	459	[106.2]	10,694.1	358	1,728.9	398
397	369	W.R. BERKLEY Greenwich, Conn.	7,691.7	0.1	640.7	304	16.7	24,896.0	221	5,437.9	259
398	372	WEC ENERGY GROUP Milwaukee, Wis.	7,679.5	0.4	1,059.3	233	[12.0]	33,475.8	183	9,788.9	175
399	402	JETBLUE AIRWAYS Long Island City, N.Y.	7,658.0	9.2	188.0	413	[83.6]	10,426.0	363	4,611.0	287
400	457	UGI King of Prussia, Pa. ²	7,651.2	25.0	718.7	286	64.6	11,980.9	341	3,681.4	307
401	404	A-MARK PRECIOUS METALS El Segundo, Calif. ⁷	7,606.2	8.8	[3.4]	456	[147.9]	743.0	500	65.7	474
402	302	FIDELITY NATIONAL FINANCIAL Jacksonville, Fla.	7,594.0	[22.3]	628.0	308	[18.5]	9,301.0	381	4,630.0	285
403	386	CONSTELLATION BRANDS Victor, N.Y. ¹⁰	7,585.0 ⁵	3.5	2,318.9	129	51.1	20,538.7	252	8,046.1	205
404	367	QUEST DIAGNOSTICS Secaucus, N.J.	7,531.0	[2.3]	736.0	284	[4.7]	11,003.0	351	5,216.0	268

BONUS POKER

FORTUNE 500



MARKET VALUE 3/29/19		PROFITS AS % OF ...				EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018		
\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank	2018 \$	% change from 2017	2008-2018 annual growth rate %	2008-2018 annual rate Rank	2018 %	Rank	2008-2018 annual rate Rank	2008-2018 annual rate Rank					
10,214.7	307	[0.4]	463	[0.2]	458	[0.2]	437	[0.08]	—	—	[28.2]	353	3.1	365	45	357	
22,512.6	203	12.2	126	2.7	322	9.0	342	3.25	4.5	6.9	151	6.4	101	14.3	192	63	358
3,544.9	414	3.8	339	7.6	153	16.8	220	3.24	7.6	—	—	11.5	75	10.0	274	56	359
1,918.5	439	1.4	418	0.1	450	1.0	428	0.24	[85.3]	—	—	49.8	5	5.1	346	35	360
36,546.5	145	10.0	174	3.6	288	8.3	352	2.55	[35.1]	8.7	133	10.4	81	21.9	67	19	361
17,019.2	239	8.4	219	15.4	38	24.6	135	1.79	77.2	—	—	[15.3]	253	—	—	23	362
3,302.5	417	3.3	358	2.1	347	9.4	335	5.17	[65.2]	3.9	198	[40.9]	425	4.7	352	62	363
1,878.7	441	1.9	405	3.4	296	10.0	325	4.58	42.7	[1.0]	250	[28.5]	357	8.1	307	66	364
5,823.5	376	3.6	347	1.2	399	9.3	337	0.41	—	—	—	[46.3]	439	—	—	30	365
11,568.7	295	8.8	207	13.6	47	—	—	2.37	42.8	—	—	[32.7]	386	13.8	207	28	366
3,434.3	415	5.2	303	15.5	36	22.2	158	8.14	14.8	17.2	41	[65.0]	465	17.5	123	43	367
6,937.1	362	5.3	299	4.0	270	11.7	284	3.52	[57.8]	—	—	[15.6]	255	24.6	44	3	368
28,151.4	172	14.7	97	12.0	66	30.0	98	3.85	86.9	12.6	87	[6.8]	193	21.8	68	44	369
2,395.8	431	2.8	376	4.9	242	10.6	309	4.82	42.6	[0.2]	243	[29.6]	366	9.6	281	65	370
8,631.3	335	10.2	172	13.1	55	55.1	35	19.09	82.5	—	—	[18.2]	276	—	—	2	371
5,686.9	378	12.6	122	2.2	345	10.2	319	2.90	544.4	—	—	[33.1]	388	0.0	378	13	372
2,545.0	429	5.2	300	7.2	169	31.7	91	2.91	309.9	—	—	[56.5]	457	35.1	9	43	373
13,043.9	277	7.6	245	18.7	22	31.1	92	3.48	29.4	9.8	121	6.6	98	8.8	294	60	374
4,092.3	403	3.5	351	6.9	177	16.3	226	4.85	27.0	6.0	173	[26.7]	346	10.9	259	17	375
15,002.6	253	7.4	253	10.9	76	27.2	118	4.73	24.5	6.2	167	6.9	94	18.7	111	23	376
570.6	460	0.4	442	1.7	365	4.7	396	0.93	—	[5.2]	265	[33.2]	389	[1.0]	381	67	377
5,854.3	375	3.1	362	0.6	429	4.9	391	3.98	[57.6]	0.5	232	[9.2]	211	13.9	202	37	378
9,002.2	327	13.6	105	6.0	205	32.2	89	13.12	[16.6]	—	—	[40.4]	423	27.4	26	69	379
12,349.5	284	6.6	267	1.3	389	3.2	420	—	—	—	—	[7.2]	198	—	—	18	380
—	—	8.5	214	3.2	298	7.2	374	—	—	—	—	—	—	—	—	36	381
—	—	9.4	188	3.1	308	6.7	380	—	—	—	—	—	—	—	—	36	382
17,596.9	234	5.9	284	1.5	378	—	—	1.90	—	—	—	9.9	82	35.4	7	16	383
19,447.4	221	27.5	27	1.5	377	13.5	257	3.06	8.1	—	—	[20.7]	297	13.3	217	9	384
6,841.1	364	6.8	263	14.2	44	21.6	164	4.66	109.9	—	—	16.8	47	25.4	38	55	385
13,471.7	274	10.2	173	7.8	148	22.0	161	1.98	35.6	0.4	236	[41.9]	429	8.7	296	21	386
26,124.8	179	[4.8]	487	[1.6]	478	[3.4]	450	[1.86]	[120.9]	—	—	[13.4]	235	10.5	267	40	387
11,839.7	293	6.7	265	17.3	27	34.1	83	4.31	30.6	22.9	19	13.3	66	26.0	32	56	388
7,024.9	360	6.3	276	5.4	227	34.7	81	3.67	43.4	—	—	[19.0]	284	—	—	46	389
9,273.5	320	12.4	125	3.2	301	41.3	62	17.49	24.0	19.5	30	[40.1]	421	12.7	233	19	390
23,944.3	194	15.1	92	15.3	39	84.2	18	5.58	52.5	15.2	61	[3.0]	165	14.7	181	21	391
22,882.5	199	23.5	46	4.2	264	15.7	232	2.58	57.3	0.4	234	[3.3]	167	4.8	351	63	392
277.9	465	[4.2]	483	[15.4]	497	[107.9]	472	[3.58]	[634.3]	—	—	[65.8]	467	[13.0]	401	21	393
1,538.9	448	2.7	379	7.0	174	34.4	82	1.76	417.6	—	—	[49.9]	448	21.7	72	7	394
5,262.6	383	6.1	282	8.9	115	18.8	189	6.29	66.8	19.5	29	[31.6]	380	22.3	65	12	395
6,219.2	371	[0.2]	459	[0.1]	457	[0.8]	440	[0.07]	[106.0]	—	—	[42.2]	431	13.7	209	49	396
10,337.0	306	8.3	222	2.6	332	11.8	292	3.33	17.4	11.9	96	6.0	106	11.2	255	37	397
24,945.8	187	13.8	104	3.2	302	10.8	303	3.34	[11.9]	8.2	140	7.8	90	16.5	152	63	398
5,014.9	390	2.5	387	1.8	359	4.1	408	0.60	[82.7]	—	—	[28.1]	351	8.5	301	3	399
9,634.4	315	9.4	190	6.0	208	19.5	181	4.06	65.0	11.8	99	16.0	51	15.8	163	16	400
83.7	471	[0.0]	457	[0.5]	466	[5.2]	454	[0.48]	[148.0]	—	—	[18.9]	283	—	—	69	401
10,063.4	309	8.3	223	6.8	182	13.6	255	2.26	—	—	—	[17.2]	271	—	—	37	402
33,209.6	160	30.6	18	11.3	71	28.8	106	—	—	—	—	[28.7]	359	26.7	31	6	403
12,072.8	287	9.8	181	6.7	184	14.1	244	5.29	[3.8]	5.9	174	[13.9]	237	6.5	332	27	404

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TOLL BROTHERS The homebuilder jumps 52 spots this year, with revenue up nearly 23%, to \$7.1 billion, and profits climbing nearly 40% despite challenging conditions in the U.S. housing market. With interest and mortgage rates now flattening out again, 2019 could be another good year. —R.M.

RANK 2018	2017		REVENUES		PROFITS			ASSETS		STOCKHOLDERS' EQUITY	
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
405	401	ACTIVISION BLIZZARD Santa Monica, Calif.	7,500.0	6.9	1,813.0	158	564.1	17,835.0	279	11,357.0	148
406	394	WEYERHAEUSER Seattle, Wash. ^R	7,476.0	3.9	748.0	281	28.5	17,249.0	285	9,046.0	185
407	431	RAYMOND JAMES FINANCIAL St. Petersburg, Fla. ²	7,475.8	14.6	856.7	261	34.7	37,412.9	169	6,368.5	237
408	425	CASEY'S GENERAL STORES Ankeny, Iowa ⁴⁵	7,472.1 ^E	12.5	317.9	383	79.1	3,469.9	475	1,271.1	424
409	418	KEURIG DR PEPPER Burlington, Mass. ⁴⁶	7,442.0	11.2	586.0	317	[45.5]	48,918.0	135	22,533.0	71
410	419	AMERICAN TOWER Boston, Mass. ^R	7,440.1	11.6	1,236.4	206	[0.2]	33,010.4	185	5,336.1	263
411	438	APACHE Houston, Texas	7,424.0	15.6	40.0	449	[96.9]	21,582.0	244	7,130.0	222
412	360	DOVER Downers Grove, Ill.	7,395.8 ^A	[5.6]	570.3	320	[29.7]	8,365.8	394	2,768.7	354
413	412	KEYCORP Cleveland, Ohio	7,393.0	7.6	1,866.0	156	44.0	139,613.0	60	15,595.0	103
414	383	J.M. SMUCKER Orrville, Ohio ⁴⁵	7,357.1	[0.5]	1,338.6	198	126.0	15,301.2	305	7,891.1	208
415	435	CITIZENS FINANCIAL GROUP Providence, R.I.	7,354.0	13.9	1,721.0	163	4.2	160,518.0	47	20,817.0	81
416	443	MOTOROLA SOLUTIONS Chicago, Ill.	7,343.0	15.1	966.0	248	—	9,409.0	378	[1,293.0]	488
417	475	MAGELLAN HEALTH Scottsdale, Ariz.	7,314.2	25.3	24.2	452	[78.1]	2,979.1	483	1,285.3	422
418	449	AMERICAN AXLE & MANUFACTURING Detroit, Mich.	7,270.4	16.0	[57.5]	465	[117.1]	7,510.7	410	1,483.9	411
419	385	NEWMONT GOLDCORP Greenwood Village, Colo. ⁴⁷	7,253.0	[1.3]	341.0	372	—	20,715.0	251	10,502.0	159
420	405	SPIRIT AEROSYSTEMS HOLDINGS Wichita, Kans.	7,222.0	3.4	617.0	312	73.9	5,685.9	436	1,237.6	427
421	476	WESTERN & SOUTHERN FINANCIAL GROUP Cincinnati, Ohio	7,205.0	23.5	495.0	336	59.4	50,635.5	131	5,271.4	265
422	420	FORTIVE Everett, Wash.	7,203.2 ^A	8.2	2,913.8	101	179.0	12,905.6	330	6,595.5	228
423	426	GRAYBAR ELECTRIC St. Louis, Mo.	7,202.5	8.6	143.3	426	100.1	2,491.2	491	866.6	447
424	444	NVR Reston, Va.	7,189.7	13.7	797.2	272	48.3	3,165.9	480	1,808.6	395
425	427	AVERY DENNISON Glendale, Calif.	7,159.0	8.2	467.4	346	65.9	5,177.5	446	955.1	442
426	455	CELANESE Irving, Texas	7,155.0	16.5	1,207.0	212	43.2	9,313.0	380	2,984.0	340
427	413	AMERICAN FINANCIAL GROUP Cincinnati, Ohio	7,150.0	4.2	530.0	332	11.6	63,456.0	110	4,970.0	274
428	480	TOLL BROTHERS Horsham, Pa. ^{1A}	7,143.3	22.8	748.2	280	39.7	10,244.6	367	4,760.2	280
429	411	SANMINA San Jose, Calif. ²	7,110.1	3.5	[95.5]	470	[168.8]	4,085.1	464	1,472.8	412
430	417	INSIGHT ENTERPRISES Tempe, Ariz.	7,080.1	5.6	163.7	420	80.5	2,775.9	488	987.0	439
431	442	OWENS CORNING Toledo, Ohio	7,057.0	10.5	545.0	325	88.6	9,771.0	374	4,283.0	290
432	436	PACKAGING CORP. OF AMERICA Lake Forest, Ill.	7,014.6	8.8	738.0	283	10.4	6,569.7	424	2,672.4	357
433	465	TRAVELCENTERS OF AMERICA Westlake, Ohio ⁴	6,973.6 ^E	15.2	[120.6]	471	[1,401.6]	1,442.1	499	448.9	466
434	448	OLIN Clayton, Mo.	6,946.1	10.8	327.9	381	[40.3]	8,997.4	386	2,832.2	352
435	454	ARTHUR J. GALLAGHER Rolling Meadows, Ill.	6,934.0	12.6	633.5	307	36.8	16,334.0	293	4,498.9	288
436	428	MASTEC Coral Gables, Fla.	6,909.4	4.6	259.7	399	[25.2]	4,440.0	456	1,389.9	418
437	437	ALLEGHANY New York, N.Y.	6,887.2	7.2	39.5	450	[56.1]	25,344.9	219	7,692.7	213
438	410	OWENS-ILLINOIS Perrysburg, Ohio	6,877.0	0.1	257.0	401	42.8	9,699.0	375	786.0	451
439	434	ASBURY AUTOMOTIVE GROUP Duluth, Ga.	6,874.4	6.5	168.0	417	20.8	2,695.4	489	473.2	465
440	429	CMS ENERGY Jackson, Mich.	6,873.0	4.4	657.0	299	42.8	24,529.0	224	4,755.0	281
441	464	MARKEL Glen Allen, Va.	6,841.3	12.9	[128.2]	472	[132.4]	33,306.3	184	9,080.7	184
442	398	BLACKSTONE GROUP New York, N.Y. ⁹	6,833.3	[4.0]	1,541.8	183	4.8	28,924.7	203	6,379.2	236
443	461	AK STEEL HOLDING West Chester, Ohio	6,818.2	12.1	186.0	414	2,900.0	4,515.7	455	99.9	473
444	433	HANESBRANDS Winston-Salem, N.C.	6,804.0	5.0	553.1	324	793.6	7,256.0	414	970.3	441
445	406	R.R. DONNELLEY & SONS Chicago, Ill.	6,800.2	[2.0]	[11.0]	458	—	3,640.8	470	[260.1]	480
446	•	WAYFAIR Boston, Mass.	6,779.2	43.6	[504.1]	485	—	1,890.9	497	[330.7]	483
447	460	REGIONS FINANCIAL Birmingham, Ala.	6,762.0 ^A	11.0	1,759.0	161	39.3	125,688.0	67	15,090.0	107
448	447	WYNN RESORTS Las Vegas, Nev.	6,717.7	6.5	572.4	319	[23.4]	13,216.3	324	2,034.1	384
449	471	ULTA BEAUTY Bolingbrook, Ill. ¹	6,716.6	14.1	658.6	297	18.6	3,191.2	479	1,820.2	393
450	473	REGENERON PHARMACEUTICALS Tarrytown, N.Y.	6,710.8	14.3	2,444.4	120	104.0	11,734.5	344	8,757.3	193
451	459	BURLINGTON STORES Burlington, N.J. ¹	6,668.5	9.1	414.7	361	7.8	3,079.2	482	322.7	471
452	445	ROCKWELL AUTOMATION Milwaukee, Wis. ²	6,666.0	5.6	535.5	328	[35.1]	6,262.0	427	1,617.5	403



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34,777.4	153	24.2	43	10.2	87	16.0	229	2.35	552.8	15.6	56	[26.1]	343	19.4	106	18	405
19,663.4	219	10.0	176	4.3	258	8.3	353	0.99	28.6	-	-	[35.2]	402	9.7	279	69	406
11,340.9	298	11.5	141	2.3	342	13.5	258	5.75	32.8	11.3	104	[15.7]	256	17.6	121	53	407
4,716.9	395	4.3	326	9.2	107	25.0	133	8.34	86.2	17.4	40	15.6	54	20.1	95	56	408
39,328.1	138	7.9	234	1.2	394	2.6	423	0.53	[91.0]	-	-	52.5	3	27.5	25	6	409
86,930.0	62	16.6	83	3.7	277	23.2	152	2.77	3.7	12.7	85	13.3	67	19.8	98	52	410
13,011.6	278	0.5	438	0.2	447	0.6	430	0.11	[96.8]	[25.5]	294	[36.2]	404	[8.7]	396	42	411
13,621.0	271	7.7	241	6.8	180	20.6	174	3.75	[27.2]	1.9	216	[9.0]	210	15.2	173	32	412
15,888.4	247	25.2	38	1.3	387	12.0	279	1.71	51.3	-	-	[24.5]	333	7.7	315	9	413
13,251.5	276	18.2	74	8.7	118	17.0	219	11.78	131.0	14.7	66	[22.5]	320	10.7	262	21	414
14,962.7	254	23.4	47	1.1	405	8.3	354	3.52	8.3	-	-	[27.5]	348	-	-	9	415
23,089.5	197	13.2	115	10.3	86	-	-	5.62	-	-	-	29.8	17	22.4	64	44	416
1,577.2	447	0.3	445	0.8	418	1.9	425	0.97	[78.5]	[7.7]	274	[41.1]	426	3.8	359	25	417
1,599.0	446	[0.8]	468	[0.8]	470	[3.9]	451	[0.51]	[115.9]	-	-	[34.8]	398	14.4	187	43	418
19,053.6	223	4.7	314	1.6	368	3.2	419	0.64	-	[10.2]	279	[6.1]	187	[0.2]	379	42	419
9,672.1	313	8.5	215	10.9	77	49.9	43	5.65	87.7	11.5	103	[17.0]	266	21.8	70	2	420
-	-	6.9	262	1.0	409	9.4	336	-	-	-	-	-	-	-	-	34	421
28,072.2	173	40.5	5	22.6	13	44.2	54	8.21	177.4	-	-	[6.1]	186	-	-	32	422
-	-	2.0	402	5.8	219	16.5	224	6.69	98.9	3.6	201	-	-	-	-	65	423
10,036.5	310	11.1	150	25.2	7	44.1	55	194.80	53.7	27.6	13	[30.5]	373	18.2	119	29	424
9,488.9	316	6.5	269	9.0	110	48.9	44	5.28	88.7	6.9	150	[20.2]	294	13.7	211	46	425
12,606.6	283	16.9	80	13.0	57	40.4	65	8.91	46.3	17.8	37	[14.4]	242	23.4	54	8	426
8,592.7	336	7.4	252	0.8	415	10.7	306	5.85	10.8	13.4	74	[13.1]	229	18.3	117	37	427
5,283.0	382	10.5	166	7.3	166	15.7	231	4.85	53.0	-	-	[30.7]	374	4.6	354	29	428
1,974.2	435	[1.3]	472	[2.3]	482	[6.5]	456	[1.37]	[177.0]	-	-	[27.1]	347	23.9	50	54	429
1,954.8	437	2.3	393	5.9	213	16.6	222	4.55	82.0	-	-	6.4	100	19.4	105	33	430
5,163.4	386	7.7	240	5.6	222	12.7	270	4.89	91.8	-	-	[51.6]	451	10.5	265	7	431
9,391.0	318	10.5	165	11.2	73	27.6	115	7.80	10.3	19.5	28	[28.8]	361	23.7	51	46	432
166.0	469	[1.7]	474	[8.4]	490	[26.9]	465	[3.02]	[1,413.0]	-	-	[8.3]	204	4.6	353	56	433
3,815.5	405	4.7	313	3.6	284	11.6	290	1.95	[40.2]	[0.6]	248	[41.8]	428	4.8	350	8	434
14,466.1	258	9.1	198	3.9	274	14.1	245	3.40	33.9	15.3	59	19.2	37	15.3	172	13	435
3,656.9	412	3.8	340	5.8	215	18.7	191	3.26	[22.7]	13.0	79	[17.1]	270	13.4	215	17	436
8,854.7	331	0.6	436	0.2	448	0.5	431	2.62	[55.2]	[15.9]	289	6.2	102	9.1	290	37	437
2,915.8	424	3.7	342	2.6	327	32.7	88	1.59	44.5	0.5	233	[22.2]	318	[4.5]	391	46	438
1,352.5	450	2.4	388	6.2	201	35.5	77	8.28	25.1	-	-	4.2	123	30.7	17	5	439
15,760.0	248	9.6	185	2.7	325	13.8	248	2.32	41.5	6.6	159	8.2	88	21.5	76	63	440
13,813.2	267	[1.9]	477	[0.4]	464	[1.4]	443	[9.55]	[137.0]	-	-	[8.9]	209	13.3	220	37	441
23,030.9	198	22.6	50	5.3	231	24.2	139	2.26	2.3	-	-	[0.1]	148	23.7	52	13	442
869.8	454	2.7	377	4.1	267	186.2	9	0.59	2,850.0	30.9	9	[60.2]	461	[12.7]	400	41	443
6,463.1	367	8.1	227	7.6	154	57.0	32	1.52	794.1	16.3	50	[38.0]	415	16.0	160	4	444
332.5	464	[0.2]	458	[0.3]	460	-	-	[0.16]	-	-	-	[55.2]	456	[9.3]	398	50	445
13,524.3	273	[7.4]	491	[26.7]	499	-	-	[5.63]	-	-	-	12.2	71	-	-	38	446
14,401.0	259	26.0	36	1.4	383	11.7	283	1.54	54.0	-	-	[20.8]	299	7.2	321	9	447
12,843.5	281	8.5	218	4.3	259	28.1	111	5.35	[26.5]	10.8	110	[40.2]	422	13.8	204	30	448
20,683.9	213	9.8	179	20.6	17	36.2	76	10.94	22.1	38.2	3	9.5	84	40.5	3	56	449
44,871.4	118	36.4	9	20.8	15	27.9	113	21.29	105.9	-	-	[0.7]	151	35.2	8	48	450
10,509.6	304	6.2	277	13.5	49	128.5	12	6.04	10.2	-	-	32.2	16	-	-	55	451
20,975.2	212	8.0	230	8.6	127	33.1	86	4.21	[33.7]	0.8	230	[21.8]	312	19.4	107	15	452

→ 453-500 500

500

LEVI STRAUSS Back in the 500 after a seven-year hiatus, the 166-year-old denim pioneer enjoyed an IPO in March that even tech upstarts would envy. Its revenue growth—up 13.7% in 2018—has come despite a sluggish U.S. retail sector; India and China are key to the company's future. —Erika Fry

RANK 2018	2017		REVENUES		PROFITS		ASSETS		STOCKHOLDERS' EQUITY		
			\$ millions	% change from 2017	\$ millions	Rank	% change from 2017	\$ millions	Rank	\$ millions	Rank
453	486	NORTHERN TRUST Chicago, Ill.	6,658.9	16.5	1,556.4	180	29.8	132,212.5	64	10,508.3	158
454	451	CHEMOURS Wilmington, Del.	6,638.0	7.4	995.0	245	33.4	7,362.0	412	1,014.0	438
455	481	SEABOARD Merriam, Kans.	6,583.0	13.3	[17.0]	461	[106.9]	5,307.0	442	3,318.0	324
456		• MARATHON OIL Houston, Texas	6,582.0	27.7	1,096.0	227	—	21,321.0	248	12,128.0	137
457	423	ASCENA RETAIL GROUP Mahwah, N.J. ¹⁶	6,578.3	[1.1]	[39.7]	463	—	3,570.5	473	798.5	450
458	439	DILLARD'S Little Rock, Ark. ¹	6,503.3	1.3	170.3	416	[23.1]	3,431.4	476	1,678.4	400
459	500	CINTAS Cincinnati, Ohio ¹¹	6,487.4 [†]	19.5	842.6	265	75.3	6,958.2	421	3,016.5	339
460		• ADVANCED MICRO DEVICES Santa Clara, Calif.	6,475.0	21.5	337.0	376	683.7	4,556.0	454	1,266.0	425
461		• HESS New York, N.Y.	6,466.0	19.6	[282.0]	480	—	21,433.0	246	9,629.0	176
462	467	MGT BANK CORP. Buffalo, N.Y.	6,454.7	7.2	1,918.1	152	36.2	120,097.4	69	15,460.2	104
463	498	ABM INDUSTRIES New York, N.Y. ¹⁴	6,442.2	18.1	97.8	438	2,473.7	3,627.5	471	1,454.6	413
464		• BEACON ROOFING SUPPLY Herndon, Va. ²	6,418.3	46.6	98.6	437	[2.2]	6,508.7	425	2,283.5	374
465	432	NCR Atlanta, Ga.	6,405.0	[1.7]	[88.0]	469	[137.9]	7,761.0	404	1,254.0	426
466	452	IHEARTMEDIA San Antonio, Texas	6,325.8	2.6	[201.9]	477	—	12,269.5	338	[11,591.2]	499
467	441	FRANKLIN RESOURCES San Mateo, Calif. ²	6,319.1	[1.1]	764.4	277	[54.9]	14,383.5	312	9,899.2	167
468	453	AMEREN St. Louis, Mo.	6,291.0	1.8	815.0	268	55.8	27,215.0	208	7,631.0	214
469	477	INTERCONTINENTAL EXCHANGE Atlanta, Ga.	6,276.0	7.6	1,988.0	146	[20.9]	92,791.0	88	17,201.0	95
470	463	S&P GLOBAL New York, N.Y.	6,258.0	3.2	1,958.0	148	30.9	9,458.0	377	628.0	455
471		• POST HOLDINGS St. Louis, Mo. ²	6,257.2	19.7	467.3	347	867.5	13,057.5	327	3,050.4	336
472		• ANALOG DEVICES Norwood, Mass. ¹⁴	6,200.9	21.4	1,495.4	186	105.6	20,449.8	253	10,988.5	154
473	421	RALPH LAUREN New York, N.Y. ³	6,182.3	[7.1]	162.8	422	—	6,143.3	430	3,457.4	318
474	407	HARRIS Melbourne, Fla. ⁷	6,182.0	[10.9]	718.0	287	29.8	9,839.0	373	3,322.0	323
475	482	BOOZ ALLEN HAMILTON HOLDING McLean, Va. ³	6,171.9	6.3	305.1	385	20.8	3,603.4	472	554.6	458
476	496	POLARIS INDUSTRIES Medina, Minn.	6,166.0	12.0	335.3	378	94.4	4,124.9	462	867.0	446
477	468	CLOROX Oakland, Calif. ⁷	6,124.0	2.5	823.0	267	17.4	5,060.0	448	726.0	452
478	458	REALOGY HOLDINGS Madison, N.J.	6,079.0	[0.6]	137.0	427	[68.2]	7,290.0	413	2,311.0	371
479	430	HD SUPPLY HOLDINGS Atlanta, Ga. ¹	6,047.0	[7.5]	394.0	368	[59.4]	4,233.0	459	1,281.0	423
480		• GRAPHIC PACKAGING HOLDING Atlanta, Ga.	6,023.0	36.8	221.1	408	[26.3]	7,059.2	419	1,579.5	407
481	450	OLD REPUBLIC INTERNATIONAL Chicago, Ill.	6,021.8	[3.9]	370.5	369	[33.9]	19,327.1	260	5,146.2	270
482		• INTUIT Mountain View, Calif. ¹⁶	5,964.0	15.2	1,211.0	211	24.7	5,178.0	445	2,354.0	369
483	495	NETAPP Sunnyvale, Calif. ⁴⁵	5,911.0	7.1	76.0	440	[85.1]	9,865.0	372	2,067.0	383
484		• TAPESTRY New York, N.Y. ⁷	5,880.0	31.0	397.5	365	[32.7]	6,678.3	423	3,244.6	332
485	492	ON SEMICONDUCTOR Phoenix, Ariz.	5,878.3	6.0	627.4	309	[22.6]	7,587.6	409	3,171.6	335
486	478	INGREDION Westchester, Ill.	5,841.0	0.2	443.0	351	[14.6]	5,728.0	435	2,388.0	368
487		• ZOETIS Parsippany, N.J.	5,825.0	9.8	1,428.0	192	65.3	10,777.0	357	2,185.0	377
488	487	FISERV Brookfield, Wis.	5,823.0	2.2	1,187.0	215	[4.7]	11,262.0	350	2,293.0	372
489	446	TREEHOUSE FOODS Oak Brook, Ill.	5,812.1	[7.8]	[61.4]	466	—	5,599.3	438	2,141.9	378
490		• ROBERT HALF INTERNATIONAL Menlo Park, Calif.	5,800.3	10.1	434.3	355	49.5	1,903.1	496	1,063.2	436
491	483	FIRST AMERICAN FINANCIAL Santa Ana, Calif.	5,747.8	[0.4]	474.5	340	12.2	10,630.6	361	3,741.9	302
492	488	HARLEY-DAVIDSON Milwaukee, Wis.	5,716.9	1.2	531.5	330	1.9	10,665.7	359	1,773.9	396
493	474	WINDSTREAM HOLDINGS Little Rock, Ark.	5,713.1	[2.4]	[723.0]	489	—	10,257.9	366	[1,919.3]	492
494	472	YUM BRANDS Louisville, Ky.	5,688.0	[3.2]	1,542.0	182	15.1	4,130.0	461	[7,926.0]	497
495		• WILLIAMS-SONOMA San Francisco, Calif. ¹	5,671.6	7.2	333.7	380	28.6	2,812.8	486	1,155.7	432
496	493	SIMON PROPERTY GROUP Indianapolis, Ind. ⁸	5,657.9	2.2	2,440.1	121	25.3	30,686.2	194	3,296.7	329
497		• NAVIENT Wilmington, Del.	5,610.0	8.3	395.0	367	35.3	104,176.0	80	3,519.0	315
498	494	WESTERN UNION Denver, Colo.	5,589.9	1.2	851.9	262	—	8,996.8	387	[309.8]	482
499	491	PEABODY ENERGY St. Louis, Mo.	5,581.8	0.1	646.9	300	—	7,423.7	411	3,395.6	322
500		• LEVI STRAUSS San Francisco, Calif. ^{24,48}	5,575.4	13.7	283.1	393	0.6	3,542.7	474	660.1	454
TOTALS			13,721,309.3		1,136,655.2			42,956,412.5		7,378,105.6	



MARKET VALUE 3/29/19		PROFITS AS % OF ...					EARNINGS PER SHARE				TOTAL RETURN TO INVESTORS				Industry table number	RANK 2018	
\$ millions	Rank	Revenues % Rank	Assets % Rank	Stockholders' equity % Rank		2018 \$	% change from 2017	2008-2018 annual growth rate % Rank		2018 % Rank	2008-2018 annual rate % Rank						
19,754.4	217	23.4	48	1.2	398	14.8	234	6.64	35.0	6.7	156	[14.8]	247	7.1	324	9	453
6,179.1	372	15.0	94	13.5	48	98.1	15	5.45	39.4	-	-	[42.4]	432	-	-	8	454
5,001.5	391	[0.3]	461	[0.3]	462	[0.5]	438	[14.61]	[106.9]	-	-	[19.6]	290	11.6	245	22	455
13,677.2	269	16.7	82	5.1	237	9.0	340	1.29	-	[12.6]	284	[14.3]	241	0.7	376	42	456
213.4	467	[0.6]	466	[1.1]	474	[5.0]	453	[0.20]	-	-	-	6.8	95	[7.3]	395	55	457
1,897.6	440	2.6	382	5.0	241	10.1	320	6.23	[17.0]	-	-	1.0	145	32.8	13	24	458
21,207.8	210	13.0	118	12.1	64	27.9	112	7.56	72.6	13.4	73	9.1	86	24.0	47	14	459
27,601.5	174	5.2	301	7.4	159	26.6	119	0.32	700.0	-	-	79.6	1	23.9	49	54	460
18,251.8	228	[4.4]	484	[1.3]	477	[2.9]	448	[1.10]	-	-	-	[13.1]	230	[1.5]	384	42	461
21,741.2	208	29.7	20	1.6	371	12.4	276	12.74	46.4	9.8	120	[14.5]	244	12.7	232	9	462
2,407.8	430	1.5	415	2.7	324	6.7	379	1.47	2,000.0	5.3	179	[13.0]	228	7.8	311	14	463
2,201.0	433	1.5	414	1.5	376	4.3	400	1.05	[36.0]	1.6	221	[50.3]	449	8.6	297	65	464
3,245.9	418	[1.4]	473	[1.1]	475	[7.0]	457	[1.16]	[219.6]	-	-	[32.1]	383	5.0	348	11	465
97.4	470	[3.2]	481	[1.6]	480	-	-	[2.36]	-	-	-	[11.8]	223	[15.1]	403	18	466
16,885.2	240	12.1	128	5.3	232	7.7	366	1.39	[53.8]	[4.6]	263	[23.4]	328	6.5	331	53	467
18,050.6	230	13.0	119	3.0	310	10.7	305	3.32	55.1	1.4	222	13.9	65	11.8	242	63	468
43,074.1	122	31.7	16	2.1	346	11.6	291	3.43	[18.9]	15.2	60	8.2	89	17.2	132	53	469
51,812.4	99	31.3	17	20.7	16	311.8	5	7.73	33.7	11.9	98	1.4	141	24.9	43	19	470
7,274.6	357	7.5	250	3.6	287	15.3	233	6.16	1,132.0	-	-	12.5	69	-	-	21	471
38,772.4	139	24.1	44	7.3	165	13.6	252	3.97	91.8	4.1	193	[1.6]	158	19.4	104	54	472
10,195.7	308	2.6	380	2.7	326	4.7	395	1.97	-	[6.8]	272	1.7	140	9.9	278	4	473
18,839.5	225	11.6	136	7.3	167	21.6	163	5.92	33.3	6.1	169	[3.4]	169	16.7	149	2	474
8,144.4	341	4.9	309	8.5	129	55.0	36	2.05	22.8	-	-	20.2	32	-	-	33	475
5,152.9	387	5.4	294	8.1	135	38.7	70	5.24	94.8	11.6	101	[36.7]	406	21.1	82	61	476
20,565.2	215	13.4	108	16.3	33	113.4	13	6.26	17.4	6.8	153	6.4	99	14.1	197	31	477
1,301.9	451	2.3	395	1.9	356	5.9	388	1.09	[65.0]	-	-	[43.7]	434	-	-	52	478
7,402.1	350	6.5	270	9.3	105	30.8	94	2.17	[56.7]	-	-	[6.3]	188	-	-	65	479
3,733.3	410	3.7	345	3.1	305	14.0	246	0.71	[26.0]	-	-	[29.7]	367	25.9	33	46	480
6,334.1	369	6.2	281	1.9	354	7.2	372	1.24	[35.4]	-	-	4.4	120	11.6	246	37	481
67,724.3	79	20.3	62	23.4	10	51.4	41	4.64	24.7	12.6	86	25.8	23	24.5	46	10	482
17,125.2	238	1.3	421	0.8	419	3.7	411	0.28	[84.5]	[10.6]	281	9.6	83	16.9	143	11	483
9,421.4	317	6.8	264	6.0	210	12.3	277	1.38	[34.0]	[4.4]	262	[20.8]	298	7.6	316	4	484
8,474.8	337	10.7	159	8.3	132	19.8	178	1.44	[23.8]	-	-	[21.2]	303	17.1	133	54	485
6,312.7	370	7.6	246	7.7	149	18.6	194	6.17	[12.6]	5.8	176	[33.2]	390	14.3	190	22	486
48,198.0	108	24.5	42	13.3	51	65.4	25	2.93	67.4	-	-	19.4	36	-	-	48	487
34,603.1	154	20.4	61	10.5	80	51.8	40	2.87	[0.7]	12.6	88	12.1	72	23.2	57	19	488
3,614.1	413	[1.1]	471	[1.1]	473	[2.9]	446	[1.10]	-	-	-	2.5	133	6.4	334	21	489
7,759.2	346	7.5	249	22.8	11	40.8	63	3.57	53.2	8.2	141	4.8	115	12.7	230	58	490
5,765.3	377	8.3	224	4.5	253	12.7	271	4.19	11.4	-	-	[17.8]	275	-	-	37	491
5,670.7	379	9.3	193	5.0	239	30.0	99	3.19	5.6	1.3	224	[30.5]	372	9.5	285	61	492
12.9	472	[12.7]	494	[7.0]	488	-	-	[17.72]	-	-	-	[77.4]	469	[23.8]	405	57	493
30,583.2	164	27.1	28	37.3	1	-	-	4.69	24.4	9.1	128	14.5	58	17.5	125	23	494
4,434.8	398	5.9	285	11.9	67	28.9	105	4.05	34.1	30.6	10	0.5	146	23.4	55	56	495
56,301.7	93	43.1	4	8.0	141	74.0	20	7.87	26.1	15.5	58	2.5	134	17.0	138	52	496
2,828.9	425	7.0	258	0.4	441	11.2	296	1.49	43.3	-	-	[30.2]	370	-	-	13	497
8,050.9	343	15.2	91	9.5	102	-	-	1.87	-	4.2	191	[6.6]	190	4.4	355	19	498
3,065.6	422	11.6	137	8.7	120	19.1	187	4.43	-	-	-	[21.6]	309	-	-	42	499
9,207.8	321	5.1	306	8.0	137	42.9	59	-	-	-	-	-	-	-	-	4	500

22,620,363.7

THE LONG ARCS OF GROWTH AND DECLINE

TWO ESTABLISHED BRANDS, SOFTWARE MAKER INTUIT AND HOME-GOODS GIANT WILLIAMS-SONOMA, ARE AMONG NINE COMPANIES MAKING THEIR DEBUT ON THE 500 (ANOTHER 12 ARE RETURNING TO THE LIST). ON THE OTHER SIDE OF THE LEDGER, MEGA-MERGERS REMOVED INSURER AETNA, AGRICULTURE TITAN MONSANTO, AND MEDIA CONGLOMERATE TIME WARNER FROM THE LIST. BANKRUPTCY, MEANWHILE, DISPLACED FAMILIAR RETAIL NAMES TOYS "R" US AND SEARS HOLDINGS. AND HUGE RECENT LOSSES REFLECT LONG-TERM UPHEAVAL AT GENERAL ELECTRIC AND KRAFT HEINZ.

ARRIVALS AND DEPARTURES

NEWCOMERS AND RETURNEES

		500 rank 2018	1,000 rank 2017	2018 REVENUES \$ millions
1	ADVANCED MICRO DEVICES*	460	506	6,475.0
2	ALTICE USA*	327	—	9,566.6
3	ANALOG DEVICES*	472	520	6,200.9
4	BEACON ROOFING SUPPLY	464	569	6,418.3
5	BJ'S WHOLESALE CLUB*	245	—	13,007.3
6	BRIGHTHOUSE FINANCIAL	342	—	8,965.0
7	BROADCOM	150	—	20,848.0
8	CAESARS ENTERTAINMENT*	365	536	8,391.0
9	ENLINK MIDSTREAM*	396	—	7,699.0
10	GRAPHIC PACKAGING HOLDING	480	565	6,023.0
11	ROBERT HALF INTERNATIONAL*	490	511	5,800.3
12	HESS*	461	501	6,466.0
13	INTUIT	482	516	5,964.0
14	MARATHON OIL*	456	518	6,582.0
15	NAVIENT*	497	515	5,610.0
16	POST HOLDINGS	471	512	6,257.2
17	LEVI STRAUSS*	500	530	5,575.4
18	TAPESTRY*	484	555	5,880.0
19	WAYFAIR	446	545	6,779.2
20	WILLIAMS-SONOMA	495	508	5,671.6
21	ZOETIS	487	507	5,825.0

DISPLACED FROM LIST

		1,000 rank 2018	500 rank 2017	2017 REVENUES \$ millions
1	AETNA	—	49	60,535.0
2	AMTRUST FINANCIAL SERVICES	—	469	5,958.9
3	ANDEAVOR	—	90	34,204.0
4	AVON PRODUCTS	501	485	5,715.6
5	CINCINNATI FINANCIAL	515	484	5,732.4
6	CONDUENT	517	466	6,022.0
7	ENVISION HEALTHCARE	—	198	14,700.5
8	EXPRESS SCRIPTS HOLDING	—	25	100,064.6
9	KINDRED HEALTHCARE	—	416	6,767.6
10	KKR	526	470	5,930.0
11	LIFEPOINT HEALTH	—	390	7,263.1
12	MONSANTO	—	199	14,640.0
13	PATTERSON	510	490	5,593.1
14	PRAXAIR	—	264	11,437.0
15	SEALED AIR	555	456	6,130.6
16	SEARS HOLDINGS	—	172	16,702.0
17	SECURIAN FINANCIAL GROUP	506	462	6,066.5
18	SPECTRUM BRANDS HOLDINGS	505	422	6,650.0
19	TIME WARNER	—	98	31,271.0
20	TOYS "R" US	—	272	11,146.0
21	WYNDHAM DESTINATIONS	561	479	5,821.0

* A RETURNEE TO THE FORTUNE 500 LIST.

THE 45 MONEY LOSERS

Company	500 rank	LOSS \$ millions	Company	500 rank	LOSS \$ millions	Company	500 rank	LOSS \$ millions
GENERAL ELECTRIC	21	22,355.0*	WAYFAIR	446	504.1*	SANMINA	429	95.5
KRAFT HEINZ	115	10,229.0	DWENS & MINOR	317	437.0	NCR	465	88.0
NEWELL BRANDS	243	6,917.9	EDISON INTERNATIONAL	255	423.0	NGL ENERGY PARTNERS	179	70.9
PG&E CORP.	183	6,851.0	ZIMMER BIOMET HOLDINGS	387	379.2	FARMERS INSURANCE EXCHANGE	270	70.5*
QUALCOMM	137	4,864.0	DEAN FOODS	393	326.9	TREEHOUSE FOODS	489	61.4*
DELL TECHNOLOGIES	34	2,310.0*	HESS	461	282.0*	AMERICAN AXLE & MANUFACTURING	418	57.5
CENTURYLINK	132	1,733.0	J.C. PENNEY	261	255.0*	VISTRA ENERGY	337	54.0*
DOLLAR TREE	135	1,590.8	HERTZ GLOBAL HOLDINGS	331	225.0	ASCENA RETAIL GROUP	457	39.7*
NEWS CORP.	341	1,514.0*	IHEARTMEDIA	466	201.9*	NATIONAL OILWELL VARCO	357	31.0*
TESLA	144	976.1*	WHIRLPOOL	148	183.0	SEABOARD	455	17.0
COMMUNITY HEALTH SYSTEMS	223	788.0*	COTY	334	168.8*	VERITIV	347	15.7*
WINDSTREAM HOLDINGS	493	723.0*	AVNET	165	156.4	ENLINK MIDSTREAM	396	13.2
GAMESTOP	346	673.0	WILLIAMS	348	155.0	R.R. DONNELLEY & SONS	445	11.0*
FRONTIER COMMUNICATIONS	355	643.0*	MARKEL	441	128.2	AMERICAN INTERNATIONAL GROUP	66	6.0*
CVS HEALTH	8	594.0	TRAVELCENTERS OF AMERICA	433	120.6	A-MARK PRECIOUS METALS	401	3.4

* ALSO LOST MONEY IN 2017.

DEFINITIONS AND EXPLANATIONS

METHODOLOGY Companies are ranked by total revenues for their respective fiscal years. Included in the survey are companies that are incorporated in the U.S. and operate in the U.S. and file financial statements with a government agency. This includes private companies and cooperatives that file a 10-K or a comparable financial statement with a government agency, and mutual insurance companies that file with state regulators. It also includes companies that file with a government agency but are owned by private companies, domestic or foreign, that do not file such financial statements. Excluded are private companies not filing with a government agency; companies incorporated outside the U.S.; and U.S. companies consolidated by other companies, domestic or foreign, that file with a government agency. Also excluded are companies that failed to report full financial statements for at least three-quarters of the current fiscal year. Percent change calculations for revenue, net income, and earnings per share are based on data as originally reported. They are not restated for mergers, acquisitions, or accounting changes. The only changes to the prior years' data are for significant restatement due to reporting errors that require a company to file an amended 10-K.

REVENUES Revenues are as reported, including revenues from discontinued operations when published. If a spinoff is on the list, it has not been included in discontinued operations. Revenues for commercial banks include interest and noninterest revenues. Revenues for insurance companies include premium and annuity income, investment income, and capital gains or losses, but exclude deposits. Revenue figures for all companies include consolidated subsidiaries and exclude excise taxes. Data shown are for the fiscal year ended on or before Jan. 31, 2019. Unless otherwise noted, all figures are for the year ended Dec. 31, 2018.

PROFITS Profits are shown after taxes, extraordinary credits or charges, cumulative effects of accounting changes, and noncontrolling interests (including subsidiary preferred dividends) but before preferred dividends of the company. Figures in parentheses indicate a loss. Profit declines of more than 100% reflect swings from 2017 profits to 2018 losses. Profits for real estate investment trusts, partnerships, and cooperatives are reported but are not comparable with those of the other companies on the list because they are not taxed on a comparable basis. Profits for mutual insurance companies are based on statutory accounting.

BALANCE SHEET Assets are the company's year-end total. Total stockholders' equity is the sum of all capital stock, paid-in capital, and retained earnings at the company's year-end. Excluded is equity attributable to noncontrolling interests. Also excluded is redeemable preferred stock whose redemption is either mandatory or outside the company's control. Dividends paid on such stock have been subtracted from the profit figures used in calculating return on equity.

EMPLOYEES The figure shown is a fiscal year-end number as published by the company in its annual report. Where the breakdown between full- and part-time employees is supplied, a part-time employee is counted as one-half of a full-time employee.

EARNINGS PER SHARE The figure shown for each company is the diluted earnings-per-share figure that appears on the income statement. Per-share earnings are adjusted for stock splits and stock dividends. Though earnings-per-share numbers are not marked by footnotes, if a company's profits are footnoted, it can be assumed that earnings per share is affected as well. The five-year and 10-year earnings-growth rates are the annual rates, compounded.

TOTAL RETURN TO INVESTORS Total return to investors includes both price appreciation and dividend yield to an investor in the company's stock. The figures shown assume sales at the end of 2018 of stock owned at the end of 2008, 2013, and 2017. It has been assumed that any proceeds from cash dividends and stock received in spinoffs were reinvested when they were paid. Returns are adjusted for stock splits, stock dividends, recapitalizations, and corporate reorganizations as they occurred; however, no effort has been made to reflect the cost of brokerage commissions or of taxes. Total-return percentages shown are the returns received by the hypothetical investor described above. The five-year and 10-year returns are the annual rates, compounded.

MEDIANS No attempt has been made to calculate median figures in the tables for groups of fewer than four companies. The medians for profit changes from 2017 to 2018 do not include companies that lost money in 2017 or lost money in both 2017 and 2018 because no meaningful percentage changes can be calculated in such cases.

CREDITS This *Fortune* 500 Directory was prepared under the direction of list editor Scott DeCarlo. Income statement and balance sheet data provided by the companies were reviewed and verified against published earnings releases, 10-K filings, and annual reports by reporter Douglas G. Elam and accounting specialist Rhona Altschuler. Markets editor Kathleen Smyth used those same sources to check the data for earnings per share. In addition, we used data provided by Refinitiv and S&P Global Market Intelligence to calculate total return and market capitalization. The data verification process was aided substantially by information provided by S&P Global Market Intelligence.

FOOTNOTES

¹ Includes revenues from discontinued operations.

² A cooperative.

³ Excise taxes have been deducted.

⁴ A limited liability company.

⁵ A partnership.

⁶ A real estate investment trust.

⁷ Figures are for fiscal year ended Jan. 31, 2019.

⁸ Figures are for fiscal year ended Sept. 30, 2018.

⁹ Figures are for fiscal year ended March 31, 2018.

¹⁰ Acquired Aetna [2017 rank: 49], Nov. 28, 2018.

¹¹ Acquired Time Warner [2017 rank: 98], June 14, 2018.

¹² Figures are for fiscal year ended Aug. 31, 2018.

¹³ Figures are for fiscal year ended June 30, 2018.

¹⁴ 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.

¹⁵ Acquired Andeavor [2017 rank: 90], Oct. 1, 2018.

¹⁶ Acquired Rockwell Collins [2018 rank: 350], Nov. 26, 2018.

¹⁷ Figures are for fiscal year ended May 31, 2018.

¹⁸ Figures are for fiscal year ended Feb. 28, 2018.

¹⁹ Acquired Twenty-First Century Fox [2018 rank: 104], March 20, 2019.

²⁰ Figures are for fiscal year ended Oct. 31, 2018.

²¹ Changed name from Energy Transfer Equity, Oct. 19, 2018.

²² Figures are for fiscal year ended July 31, 2018.

²³ Acquired Express Scripts [2017 rank: 25], Dec. 20, 2018.

²⁴ A mutual company, not a stock company. It is grouped with stock companies because it reports according to Generally Accepted Accounting Principles.

²⁵ Not a mutual company, but reports financial data according to statutory accounting.

²⁶ Acquired by Disney [2018 rank: 53], March 20, 2019.

²⁷ Acquired Orbital ATK [2017 rank: 541], June 6, 2018.

²⁸ Company reports sale of physical commodities on a gross basis.

²⁹ Redomiciled from Singapore to the U.S., April 4, 2018.

³⁰ Acquired CA [2018 rank: 602], Nov. 5, 2018.

³¹ Figures are for fiscal year ended Nov. 30, 2018.

³² Acquired Convergys [2017 rank: 772], Oct. 5, 2018.

³³ Acquired KapStone Paper & Packaging [2017 rank: 696], Nov. 2, 2018.

³⁴ Acquired by United Natural Foods [2018 rank: 310], Oct. 22, 2018.

³⁵ Acquired SCANA [2018 rank: 620], Jan. 1, 2019.

³⁶ Went public, June 28, 2018.

³⁷ Changed fiscal year from Dec. to March. Figures are for the latest 12 months ended March 31, 2018. Comparison is with fiscal year ended Dec. 31, 2017.

³⁸ Acquired Vectren [2017 rank: 799], Feb. 1, 2019.

³⁹ Acquired Supervalu [2018 rank: 201], Oct. 22, 2018.

⁴⁰ Incorporated in the U.S. and headquartered in Stockholm. Its North American headquarters are in Auburn Hills, Mich.

⁴¹ Spun off from Altice Europe and deconsolidated, May 23, 2018.

⁴² Changed name from Adobe Systems, Oct. 8, 2018.

⁴³ Spun off from MetLife [2018 rank: 44], Aug. 4, 2017.

⁴⁴ Spun off from Hilton Grand Vacations [2018 rank: 988], Jan. 3, 2017.

⁴⁵ Acquired by United Technologies [2018 rank: 46], Nov. 26, 2018. Rockwell Collins and UTC Aerospace Systems merged to create Collins Aerospace.

⁴⁶ Acquired Nexeo Solutions [2018 rank: 625], March 1, 2019.

⁴⁷ Net income before allocations to partners. Total partnership capital subject to mandatory redemption.

⁴⁸ Changed fiscal year from Dec. to Nov. Figures are for the 11 months ended Nov. 30; comparisons are with fiscal year ended Dec. 31, 2017. Changed name from Leucadia National, May 23, 2018.

⁴⁹ Market value of Liberty SiriusXM stock.

⁵⁰ Consists of a nonpublic reciprocal insurer and a publicly held management company.

⁵¹ Acquired Pinnacle Foods [2017 rank: 718], Oct. 26, 2018.

⁵² Figures are for fiscal year ended April 30, 2018.

⁵³ Reverse merger of Dr Pepper Snapple Group and Maple Parent Holdings Corp., July 9, 2018. Dr Pepper Snapple was deemed the legal acquirer and Maple Parent the accounting acquirer.

⁵⁴ Changed name from Newmont Mining, April 18, 2019.

⁵⁵ Went public, March 21, 2019.

BRICKS, CLICKS, AND EARNINGS

FOR YEARS, E-COMMERCE GIANT AMAZON GAVE UP PROFITABILITY FOR GROWTH. OVER THE PAST FIVE YEARS ITS CLOUD-COMPUTING DIVISION, NOW A \$26 BILLION BUSINESS, HAS TURNED IT INTO AN EARNINGS POWERHOUSE AS WELL. BUT EVEN AMAZON'S GROWTH PALED BESIDE THAT OF STARBUCKS, WHICH EARNED MOST OF ITS VENTI-SIZE PROFITS THROUGH SALES IN STORES.

FASTEST-GROWING COMPANIES

GROWTH IN PROFITS
1 YEAR

Rank	Company	500 revenues rank	2018 % growth in EPS
1	RITE AID	107	23,584.2
2	KINDER MORGAN	224	6,500.0
3	AK STEEL HOLDING	443	2,850.0
4	ABM INDUSTRIES	463	2,000.0
5	BOSTON SCIENTIFIC	319	1,387.5
6	POST HOLDINGS	471	1,132.0
7	JOHNSON & JOHNSON	37	1,093.6
8	NAVISTAR INTERNATIONAL	308	965.6
9	INTL FCSTONE	112	825.8
10	HANESBRANDS	444	794.1
11	SALESFORCE.COM	240	741.2
12	CATERPILLAR	58	714.3
13	ADVANCED MICRO DEVICES	460	700.0
14	BROADCOM	150	607.5
15	ACTIVISION BLIZZARD	405	552.8
16	JEFFERIES FINANCIAL GROUP	372	544.4
17	HEWLETT PACKARD ENTERPRISE	102	485.7
18	CBS	217	484.1
19	BUILDERS FIRSTSOURCE	394	417.6
20	COCA-COLA	100	417.2
	THE 500 MEDIAN		17.5

5 YEARS

Rank	Company	500 revenues rank	2013-18 % annual growth in EPS
1	STARBUCKS	121	265.0
2	AMAZON.COM	5	102.6
3	WASTE MANAGEMENT	213	84.2
4	POST HOLDINGS	471	83.0
5	LAM RESEARCH	287	82.0
6	APPLIED MATERIALS	182	72.7
7	HARTFORD FINANCIAL SERVICES	161	70.9
8	AVIS BUDGET GROUP	338	68.9
9	BROADCOM	150	67.0
10	FACEBOOK	57	66.0
11	AES	296	64.6
12	MICRON TECHNOLOGY	105	59.1
13	NETFLIX	197	58.9
14	MOLINA HEALTHCARE	168	56.5
15	ADOBE	339	56.2
16	NVIDIA	268	55.0
17	PLAINS GP HOLDINGS	94	51.3
18	BERRY GLOBAL GROUP	389	50.2
19	RITE AID	107	49.6
20	ENERGY TRANSFER	59	45.7
	THE 500 MEDIAN		9.5

10 YEARS

Rank	Company	500 revenues rank	2008-18 % annual growth in EPS
1	TYSON FOODS	80	42.3
2	LINCOLN NATIONAL	187	42.1
3	ULTA BEAUTY	449	38.2
4	BOOKING HOLDINGS	216	35.5
5	SOUTHWEST AIRLINES	142	33.4
6	SALESFORCE.COM	240	32.2
7	APPLE	3	31.6
8	STARBUCKS	121	31.2
9	AK STEEL HOLDING	443	30.9
10	WILLIAMS-SONOMA	495	30.6
11	NETFLIX	197	30.4
12	AMAZON.COM	5	29.7
13	NVR	424	27.6
14	O'REILLY AUTOMOTIVE	329	27.0
15	CIGNA	65	25.9
16	AMERISOURCEBERGEN	10	25.6
17	REPUBLIC SERVICES	314	23.9
18	BIOGEN	235	23.3
19	TRACTOR SUPPLY	388	22.9
20	ROSS STORES	209	22.0
	THE 500 MEDIAN		7.2

GROWTH IN REVENUES
1 YEAR

Rank	Company	500 revenues rank	2018 % growth in revenues
1	DXC TECHNOLOGY	122	222.8
2	JONES LANG LASALLE	189	105.7
3	TESLA	144	82.5
4	CAESARS ENTERTAINMENT	365	72.9
5	PIONEER NATURAL RESOURCES	333	72.6
6	VISTRA ENERGY	337	68.4
7	LENNAR	154	62.7
8	EDG RESOURCES	181	54.1
9	DISCOVERY	300	53.5
10	CBRE GROUP	146	50.2
11	MICRON TECHNOLOGY	105	49.5
12	JACOBS ENGINEERING GROUP	208	49.5
13	BEACON ROOFING SUPPLY	464	46.6
14	MARATHON PETROLEUM	31	43.6
15	WAYFAIR	446	43.6
16	OCCIDENTAL PETROLEUM	167	42.6
17	CHENIERE ENERGY	383	42.6
18	GLOBAL PARTNERS	254	42.1
19	DELEK US HOLDINGS	307	39.7
20	LAM RESEARCH	287	38.2
	THE 500 MEDIAN		7.1

5 YEARS

Rank	Company	500 revenues rank	2013-18 % annual growth in revenues
1	XPO LOGISTICS	180	89.8
2	TESLA	144	60.5
3	FACEBOOK	57	48.0
4	POST HOLDINGS	471	43.3
5	CENTENE	51	40.1
6	CHARTER COMMUNICATIONS	70	39.9
7	ENLINK MIDSTREAM	396	31.7
8	NGL ENERGY PARTNERS	179	31.4
9	JONES LANG LASALLE	189	29.6
10	NETFLIX	197	29.3
11	INTERCONTINENTAL EXCHANGE	469	28.5
12	LENNAR	154	28.2
13	MICRON TECHNOLOGY	105	27.4
14	DCP MIDSTREAM	320	26.9
15	SALESFORCE.COM	240	26.7
16	REGENERON PHARMACEUTICALS	450	26.1
17	AMAZON.COM	5	25.6
18	SPARTANNAH	377	25.3
19	LAM RESEARCH	287	25.2
20	CBRE GROUP	146	24.3
	THE 500 MEDIAN		4.0

10 YEARS

Rank	Company	500 revenues rank	2008-18 % annual growth in revenues
1	CENTENE	51	32.8
2	AMAZON.COM	5	28.4
3	NETFLIX	197	27.8
4	CENTURYLINK	132	24.6
5	APPLE	3	23.4
6	BOOKING HOLDINGS	216	22.7
7	JEFFERIES FINANCIAL GROUP	372	22.4
8	CELGENE	207	21.1
9	CHARTER COMMUNICATIONS	70	21.0
10	ALPHABET	15	20.2
11	LKQ	262	19.9
12	MOLINA HEALTHCARE	168	19.8
13	JONES LANG LASALLE	189	19.7
14	FREDDIE MAC	40	19.6
15	ENERGY TRANSFER	59	19.3
16	ALLEGHANY	437	19.3
17	WESTROCK	190	19.1
18	COGNIZANT TECHNOLOGY	193	19.1
19	FANNIE MAE	22	18.2
20	MICRON TECHNOLOGY	105	17.9
	THE 500 MEDIAN		3.9

TAKING IT TO THE VAULT

RISING RATES, A HOT ECONOMY, AND LOW TAXES MADE 2018 A GOOD YEAR FOR BANKS, WITH JPMORGAN CHASE, BANK OF AMERICA, AND WELLS FARGO TAKING THREE OF THE TOP FIVE SPOTS FOR PROFITS. MANY OF THE 500'S MOST EFFICIENT COMPANIES, MEANWHILE, SPECIALIZE IN MORE TANGIBLE COMMODITIES, INCLUDING A-MARK PRECIOUS METALS AND FOOD DISTRIBUTOR CORE-MARK.

MOST PROFITABLE COMPANIES

PROFITS		2018 \$
Rank	500 revenues rank	millions
1	APPLE	59,531.0
2	JPMORGAN CHASE & CO.	32,474.0
3	ALPHABET	30,736.0
4	BANK OF AMERICA CORP.	28,147.0
5	WELLS FARGO	22,393.0
6	FACEBOOK	22,112.0
7	INTEL	21,053.0
8	EXXON MOBIL	20,840.0
9	AT&T	19,370.0
10	CITIGROUP	18,045.0
11	MICROSOFT	16,571.0
12	FANNIE MAE	15,959.0
13	VERIZON COMMUNICATIONS	15,528.0
14	JOHNSON & JOHNSON	15,297.0
15	CHEVRON	14,824.0
16	MICRON TECHNOLOGY	14,135.0
17	WALT DISNEY	12,598.0
18	PEPSICO	12,515.0
19	BROADCOM	12,259.0
20	UNITEDHEALTH GROUP	11,986.0
THE 500 MEDIAN		937.1

RETURN ON REVENUES		2018 profits as % of revenues
Rank	500 revenues rank	
1	BROADCOM	58.8
2	VISA	50.0
3	MICRON TECHNOLOGY	46.5
4	SIMON PROPERTY GROUP	43.1
5	FORTIVE	40.5
6	NEXTERA ENERGY	39.7
7	FACEBOOK	39.6
8	MASTERCARD	39.2
9	REGENERON PHARMACEUTICALS	36.4
10	ALTRIA GROUP	35.5
11	TEXAS INSTRUMENTS	35.4
12	AMGEN	35.3
13	NVIDIA	35.3
14	BIDGEN	32.9
15	CHARLES SCHWAB	31.9
16	INTERCONTINENTAL EXCHANGE	31.7
17	S&P GLOBAL	31.3
18	CONSTELLATION BRANDS	30.6
19	BLACKROCK	30.3
20	MBT BANK CORP.	29.7
THE 500 MEDIAN		7.4

RETURN ON SHAREHOLDERS' EQUITY		2018 profits as % of equity
Rank	500 revenues rank	
1	BOEING	3,085.5
2	STARBUCKS	386.3
3	O'REILLY AUTOMOTIVE	374.5
4	LOCKHEED MARTIN	362.0
5	S&P GLOBAL	311.8
6	FANNIE MAE	255.8
7	CHESAPEAKE ENERGY	253.8
8	FREDDIE MAC	206.3
9	AK STEEL HOLDING	186.2
10	UNITED PARCEL SERVICE	158.6
11	HILTON WORLDWIDE HOLDINGS	138.7
12	BURLINGTON STORES	128.5
13	CLOROX	113.4
14	MASTERCARD	108.6
15	CHEMOURS	98.1
16	PEPSICO	86.2
17	MARRIOTT INTERNATIONAL	85.7
18	HERSHEY	84.2
19	ILLINOIS TOOL WORKS	78.8
20	SIMON PROPERTY GROUP	74.0
THE 500 MEDIAN		14.5

MOST BANG FOR THE BUCK

REVENUES PER DOLLAR OF ASSETS		2018 \$
Rank	500 revenues rank	
1	A-MARK PRECIOUS METALS	10.2
2	CORE-MARK HOLDING	7.7
3	WORLD FUEL SERVICES	7.0
4	MURPHY USA	5.3
5	GLOBAL PARTNERS	5.2
6	TRAVELCENTERS OF AMERICA	4.8
7	AMERISOURCEBERGEN	4.5
8	PERFORMANCE FOOD GROUP	4.4
9	SPARTANASH	4.1
10	BJ'S WHOLESALE CLUB	4.0
11	C.H. ROBINSON WORLDWIDE	3.8
12	DEAN FOODS	3.7
13	WAYFAIR	3.6
14	SUPERVALU	3.6
15	INTL FCSTONE	3.5
16	COSTCO WHOLESALE	3.5
17	MCKESSON	3.5
18	UNITED NATURAL FOODS	3.4
19	VERITIV	3.4
20	CARDINAL HEALTH	3.4
THE 500 MEDIAN		0.7

REVENUES PER DOLLAR OF EQUITY		2018 \$
Rank	500 revenues rank	
1	BOEING	298.3
2	A-MARK PRECIOUS METALS	115.8
3	AK STEEL HOLDING	68.3
4	AMERISOURCEBERGEN	57.3
5	INTL FCSTONE	54.7
6	ALBERTSONS COS.	42.9
7	LOCKHEED MARTIN	38.6
8	SUPERVALU	31.0
9	CHESAPEAKE ENERGY	29.7
10	O'REILLY AUTOMOTIVE	27.0
11	DEAN FOODS	25.6
12	GLOBAL PARTNERS	25.5
13	QUALCOMM	24.5
14	UNITED PARCEL SERVICE	23.8
15	SYSCO	23.4
16	CORE-MARK HOLDING	22.8
17	CARDINAL HEALTH	22.6
18	AVIS BUDGET GROUP	22.0
19	WORLD FUEL SERVICES	21.9
20	MCKESSON	21.3
THE 500 MEDIAN		2.5

REVENUES PER EMPLOYEE		2018 \$ millions
Rank	500 revenues rank	
1	A-MARK PRECIOUS METALS	41.3
2	INTL FCSTONE	16.2
3	FANNIE MAE	16.2
4	FREDDIE MAC	11.1
5	VALERO ENERGY	10.9
6	PBF ENERGY	8.3
7	AMERISOURCEBERGEN	8.2
8	PHILLIPS 66	8.0
9	WORLD FUEL SERVICES	8.0
10	NGL ENERGY PARTNERS	7.2
11	BRIGHTHOUSE FINANCIAL	7.1
12	PLAINS GP HOLDINGS	7.0
13	EOG RESOURCES	6.2
14	CHENIERE ENERGY	5.8
15	ENLINK MIDSTREAM	5.3
16	ENTERPRISE PRODUCTS	5.2
17	GLOBAL PARTNERS	5.1
18	NORTHWESTERN MUTUAL	5.0
19	HOLLYFRONTIER	4.9
20	ONEOK	4.7
THE 500 MEDIAN		0.6

TECH FLIRTS WITH THE TRILLION-DOLLAR MARK

FIVE OF THE SIX MOST VALUABLE COMPANIES ON THE 500 WERE TECH TITANS, AND OVER THE PAST YEAR MICROSOFT, APPLE, AND AMAZON WERE EACH VALUED AT MORE THAN \$1 TRILLION BY INVESTORS AT VARIOUS TIMES. AMAZON IS ALSO ONE OF THE BEST LONG-TERM PERFORMERS FOR SHAREHOLDERS. BUT THE 10-YEAR STOCK-RETURN CROWN GOES TO VIDEO-STREAMING PIONEER NETFLIX.

BIGGEST COMPANIES

BY MARKET VALUE		3/29/19	2018
Rank	500 revenues rank	\$ millions	\$ millions
1	MICROSOFT	26	904,860.9
2	APPLE	3	895,667.4
3	AMAZON.COM	5	874,709.5
4	ALPHABET	15	816,824.2
5	BERKSHIRE HATHAWAY	4	493,870.3
6	FACEBOOK	57	475,731.6
7	JOHNSON & JOHNSON	37	372,228.9
8	VISA	153	343,774.2
9	EXXON MOBIL	2	342,172.0
10	JPMORGAN CHASE & CO.	18	331,451.5
11	WALMART	1	279,880.3
12	BANK OF AMERICA CORP.	25	265,938.5
13	PROCTER & GAMBLE	45	260,289.4
14	VERIZON COMMUNICATIONS	19	244,327.9
15	MASTERCARD	210	241,550.3
16	INTEL	43	241,488.9
17	CISCO SYSTEMS	64	237,665.5
18	UNITEDHEALTH GROUP	6	237,255.5
19	PFIZER	61	235,785.1
20	CHEVRON	11	234,049.7
THE 500 MEDIAN			17,298.8

BY EQUITY		2018
Rank	500 revenues rank	\$ millions
1	BERKSHIRE HATHAWAY	4
2	BANK OF AMERICA CORP.	25
3	JPMORGAN CHASE & CO.	18
4	CITIGROUP	30
5	WELLS FARGO	29
6	EXXON MOBIL	2
7	AT&T	9
8	ALPHABET	15
9	CHEVRON	11
10	APPLE	3
11	STATE FARM INSURANCE COS.	36
12	DOWDUPONT	35
13	GOLDMAN SACHS GROUP	62
14	FACEBOOK	57
15	MICROSOFT	26
16	MORGAN STANLEY	63
17	INTEL	43
18	WALMART	1
19	COMCAST	32
20	PFIZER	61
THE 500 MEDIAN		5,743.5

BY EMPLOYEES		2018
Rank	500 revenues rank	number of employees
1	WALMART	1
2	AMAZON.COM	5
3	KROGER	20
4	YUM CHINA HOLDINGS	362
5	HOME DEPOT	27
6	BERKSHIRE HATHAWAY	4
7	INTERNATIONAL BUSINESS MACHINES	38
8	UNITED PARCEL SERVICE	41
9	TARGET	39
10	FEDEX	47
11	UNITEDHEALTH GROUP	6
12	WALGREENS BOOTS ALLIANCE	17
13	CVS HEALTH	8
14	STARBUCKS	121
15	GENERAL ELECTRIC	21
16	COGNIZANT TECHNOLOGY	193
17	ALBERTSONS COS.	52
18	TJX	85
19	AT&T	9
20	PEPSICO	48
THE 500 MEDIAN		24,750

BEST INVESTMENTS

TOTAL RETURN TO SHAREHOLDERS 1 YEAR		
Rank	500 revenues rank	2018 %
1	ADVANCED MICRO DEVICES	460
2	ADVANCE AUTO PARTS	326
3	KEURIG DR PEPPER	409
4	MOLINA HEALTHCARE	168
5	GENWORTH FINANCIAL	360
6	HCA HEALTHCARE	67
7	O'REILLY AUTOMOTIVE	329
8	BOSTON SCIENTIFIC	319
9	TWENTY-FIRST CENTURY FOX	104
10	ELI LILLY	123
11	MERCK	76
12	NRG ENERGY	291
13	NETFLIX	197
14	AES	296
15	SALESFORCE.COM	240
16	BURLINGTON STORES	451
17	MOTOROLA SOLUTIONS	416
18	ADDBE	339
19	ABBOTT LABORATORIES	103
20	AMAZON.COM	5
THE 500 MEDIAN		(13.5)

5 YEARS		
Rank	500 revenues rank	2013-18 annual rate %
1	NVIDIA	268
2	BROADCOM	150
3	NETFLIX	197
4	BURLINGTON STORES	451
5	ADVANCED MICRO DEVICES	460
6	CENTENE	51
7	ADDBE	339
8	AMAZON.COM	5
9	CDW	191
10	UNITEDHEALTH GROUP	6
11	KEURIG DR PEPPER	409
12	WELLCARE HEALTH PLANS	155
13	MOLINA HEALTHCARE	168
14	ANTHEM	33
15	MICROSOFT	26
16	CINTAS	459
17	BOSTON SCIENTIFIC	319
18	HUMANA	56
19	BDOZ ALLEN HAMILTON	475
20	INTUIT	482
THE 500 MEDIAN		6.0

10 YEARS		
Rank	500 revenues rank	2008-18 annual rate %
1	NETFLIX	197
2	AVIS BUDGET GROUP	338
3	ULTA BEAUTY	449
4	AMAZON.COM	5
5	LITHIA MOTORS	265
6	BOOKING HOLDINGS	216
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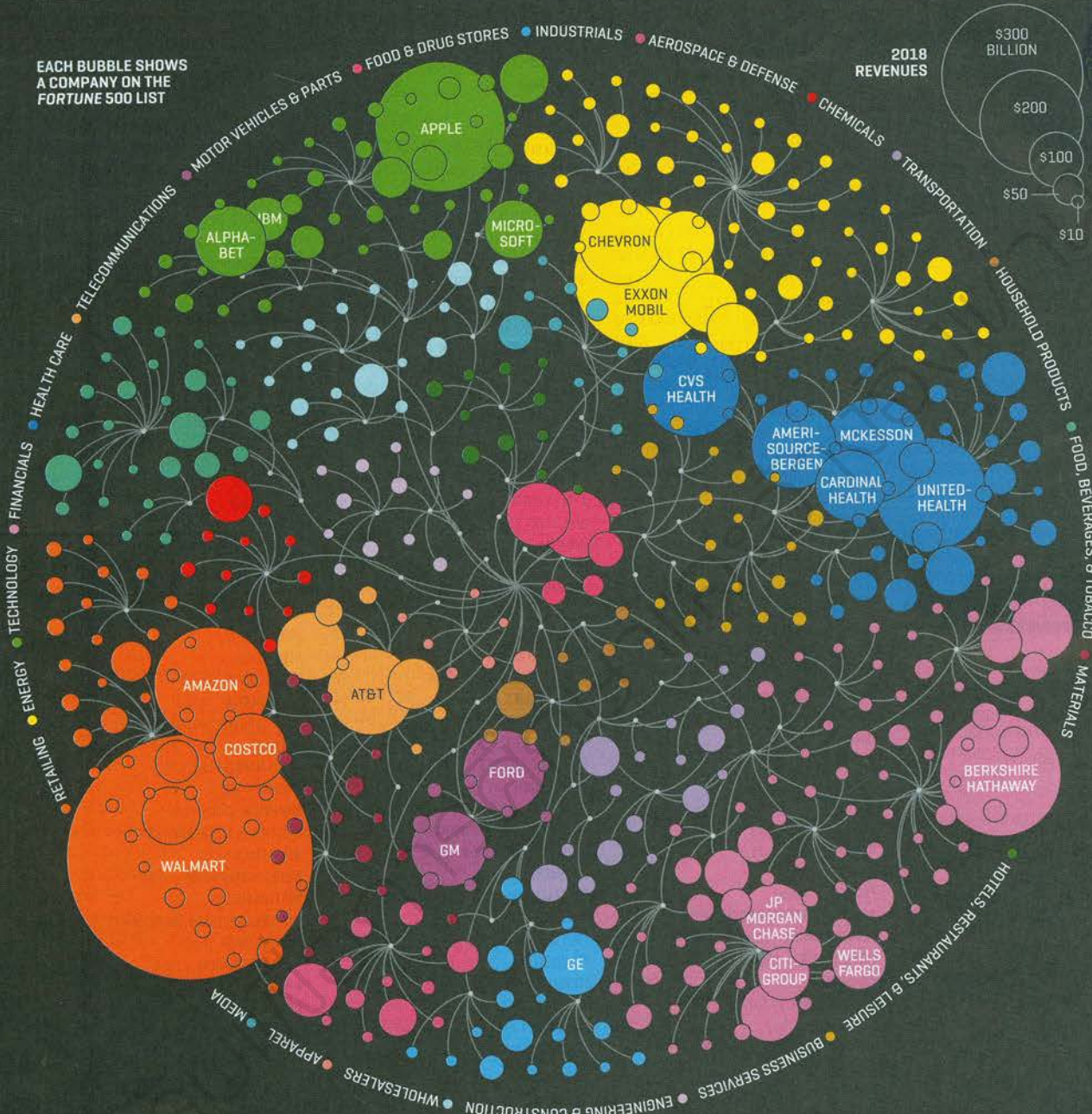
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Biologists tend to see the world in "omes"—genomes that capture our internal universes of genes, microbiomes that reveal the synergistic flora in our guts, and more. With that sense of ecosystems in mind, here is America's "corporatome." The \$13.7 trillion in revenue produced by the *Fortune* 500 equals two-thirds of U.S. GDP. And within this community of commerce, the 42 technology companies (atop, in kelly green) are less overwhelming than they might seem, accounting for less combined revenue [\$1.4 trillion] than the energy, retailing, health care, and financial sectors, respectively. Profits, of course, are another matter. There, tech is indeed gargantuan, accounting for a fifth of all the 500's profits. —CLIFTON LEAF



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