Bloomberg Businessweek

June 19, 2023

TECH ISSUE



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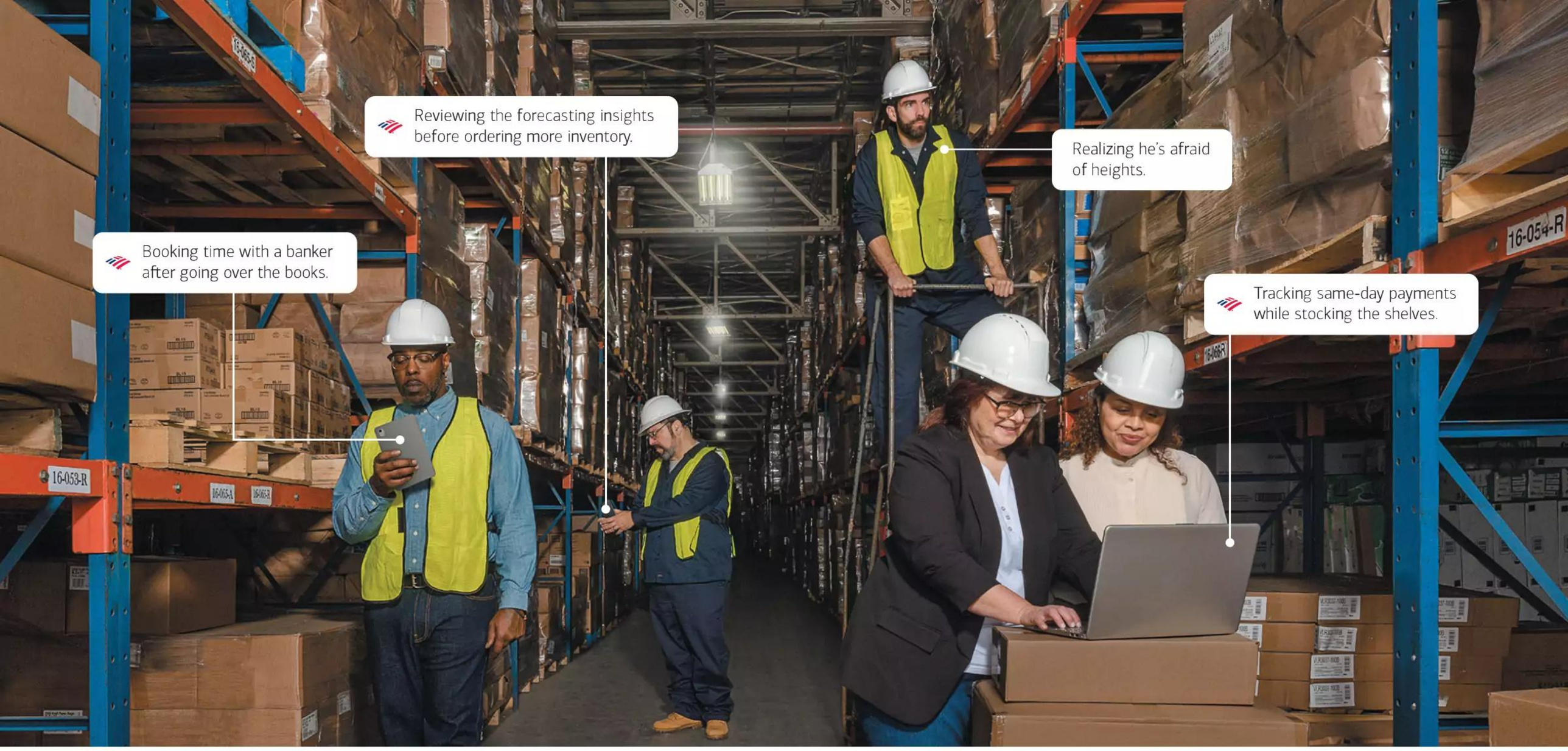


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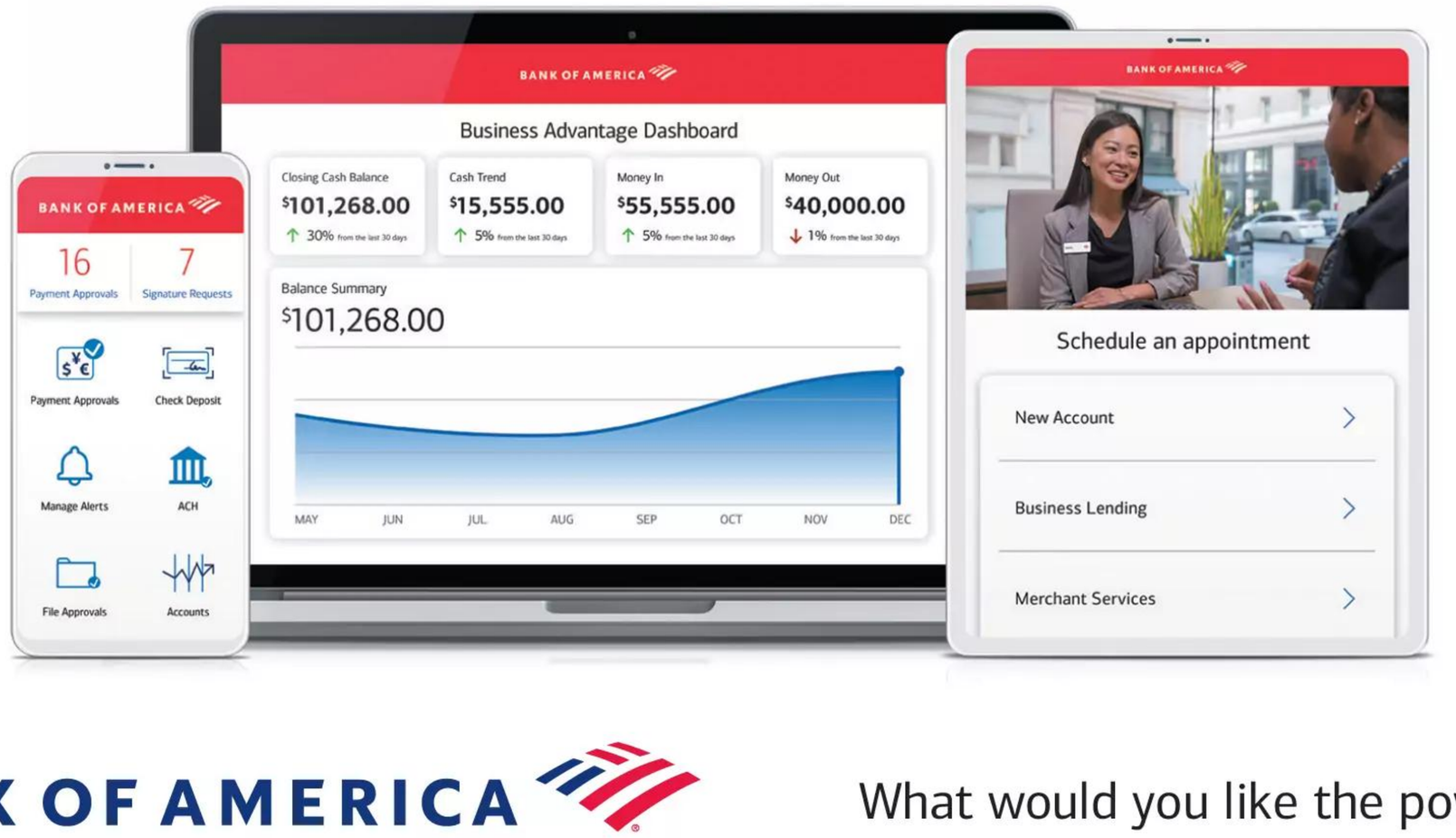


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Screen images simulated. Sequences shortened.

Bloomberg Businessweek

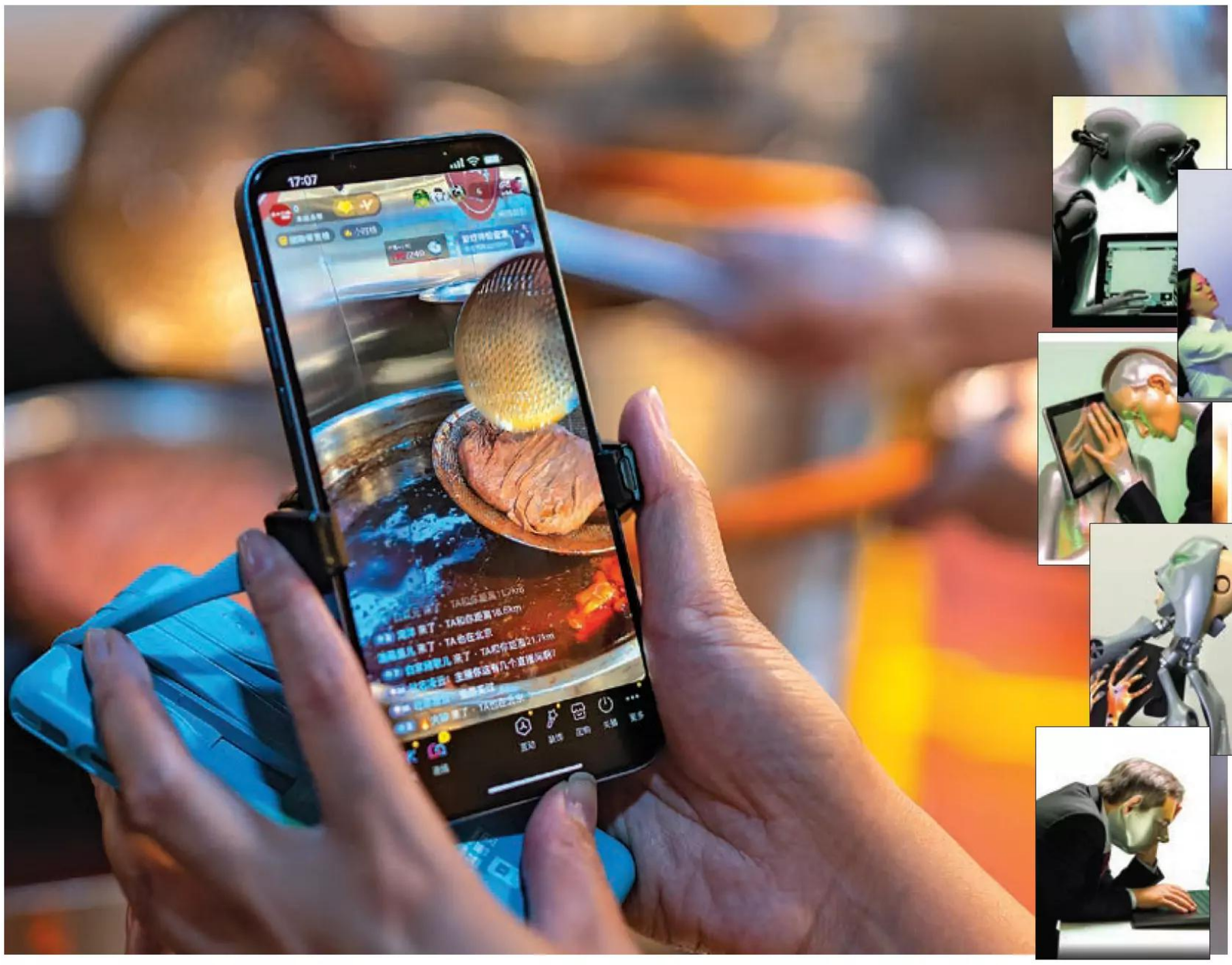
June 19, 2023

◀ Nvidia's rather sleek Santa Clara, California, headquarters



PHOTOGRAPH BY KELSEY MCCLELLAN FOR BLOOMBERG BUSINESSWEEK

TECH ISSUE




## ■ COVER TRAIL

How the cover gets made

❶

"So this week is our annual Tech Issue. We're looking deep into AI."

"At last! And what better time to let AI take over and watch the quiet quitting revolution begin?"

❷

"The good news is, I think my job is secure. The bad news is, I'll no longer be moving to Mexico City."

"Yeah. What's the least creepy you've got?"


Cover:
AI-generated illustration by Charlie Engman for *Bloomberg Businessweek*

TECHNOLOGY: PHOTOGRAPH BY ANDREA VERDELLI FOR BLOOMBERG BUSINESSWEEK. COVER TRAIL: AI-GENERATED ILLUSTRATIONS BY CHARLIE ENGMAN FOR BLOOMBERG BUSINESSWEEK (13)

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# ■ IN BRIEF



By Mark Leydorf, with Bloomberg News

● On June 14 the Federal Reserve officially paused its run of interest-rate hikes, reflecting the steady deceleration of inflation. But it indicated there could be two more hikes this year.

▶ The Bureau of Labor Statistics reported on June 13 that the annual increase in the consumer price index slowed in May to

**4%**

Year-over-year inflation is now at its lowest level since March 2021.

▶ Prices in some sectors dropped sharply: The BLS reported that airfares fell

**–13%**

in May from a year earlier. Egg prices tumbled

**–14%**

in the biggest drop since 1951, as US output continued to rebound from an outbreak of avian flu.

## ● War in Ukraine

▶ Ukraine's counteroffensive is picking up steam, NATO Secretary General Jens Stoltenberg said in Washington on June 13: "The Ukrainians have launched the offensive, they are making advances, they are gaining ground."

▶ Turkish President Recep Tayyip Erdogan said Sweden may not win his country's support to join NATO, saying its new anti-terror law is failing to crack down on Kurdish militants.

▶ In a rare admission, President Vladimir Putin conceded that the Russian military does not have enough advanced weaponry, despite having tripled its arms production.

▶ A Russian missile attack on June 13 struck an apartment building in Kryvyi Rih, Ukrainian President Volodymyr Zelenskiy's hometown, killing 11 people.

● The European Parliament voted to restrict how AI can be used in the EU.

Under the Parliament's plan, companies such as OpenAI and Google will have to perform risk assessments and summarize the copyrighted material used to train their models—regardless of how they're used. The AI Act also includes a blanket ban on remote, real-time biometric surveillance. Violations could lead to fines of as much as 6% of a company's annual revenue. ▷ 35

● After the ouster of Central Bank Governor Godwin Emefiele, widely blamed for crippling exchange rate policies, Nigeria's stock market soared

**4.0%**

on June 13, reaching its highest level since 2008. The rally follows sharp gains on Nigerian dollar bonds, reflecting optimism about the policies of newly elected President Bola Tinubu.

● An updated production schedule Disney released on June 13 pushes a host of big-budget audience favorites back by a year: The third *Avatar* movie shifts to December 2025, the next *Star Wars* to May 2026 and two *Avengers* films to May 2026 and May 2027. Disney didn't give a reason, but the writers' strike has heightened the risk of delays or cancellations throughout the industry.

● "We can't have someone in

the Oval Office who doesn't understand the meaning of the word 'confidential' or 'classified.'"

Donald Trump, campaigning for president in September 2016. On June 13 he was arraigned on federal espionage charges in Miami, the first president ever to be indicted by a grand jury. His comments about government documents—capitalizing on rival Hillary Clinton's email scandal—were included in the indictment, along with photos of file boxes of top-secret papers stashed in a bathroom at Mar-a-Lago.

● The National Music Publishers' Association sued Twitter on June 14, alleging it had used its songwriters' music without permission. The NMPA is seeking as much as

**$150k**

for each of about 1,700 pieces of music. Twitter had been in talks with musicians to license their work before Elon Musk bought the company.

## ● Illinois is banning book bans.

"Regimes ban books, not democracies," said Governor JB Pritzker after signing a law on June 12 that allows the state to withhold funding from any library that doesn't follow the American Library Association's guidelines. The ALA says reading materials shouldn't be restricted "because of partisan or personal disapproval."

# No One Is Above the Law, Not Even Trump

● By Michael R. Bloomberg

Former President Donald Trump's appearance on June 13 in federal court in Miami, facing 37 criminal counts related to his handling of classified documents, is a sad but necessary moment of truth and accountability. Even for his staunchest opponents, it should be nothing to celebrate.

The facts of the case, as detailed in a 49-page indictment, are deeply disturbing–and extraordinarily dangerous. On leaving office, Trump took "scores of boxes" with him that he wasn't authorized to possess. They contained highly classified files on (among other things) nuclear programs, weapons capabilities, US military vulnerabilities and plans for retaliation after a foreign attack. Despite the extreme sensitivity of the files, Trump stashed them haphazardly around his golf club. On at least two occasions he showed them off to others. Commenting on a plan of attack, he said, "This is secret information. Look, look at this."

As the government tried to intervene, Trump lied and dissembled at every step. When officials from the National Archives and Records Administration demanded the documents, he ignored them for months before turning over a small fraction. When a federal grand jury subpoenaed the files, Trump did everything he could to obstruct the probe, including asking his lawyer to destroy documents and lie to the FBI, directing an aide to hide evidence, withholding multiple sensitive files and causing his lawyer to falsely certify that all the required material had been produced. When the FBI finally raided his club last August, they uncovered 102 classified documents still on the premises.

Unlawfully handling such files is a serious crime. The US Department of Justice has in recent years prosecuted it aggressively, bringing charges against retired General David Petraeus, former CIA officer Jerry Chun Shing Lee and former defense contractor Harold Martin, as well as others. This month former Air Force intelligence officer Robert Birchum was sentenced to three years in prison for conduct remarkably similar to Trump's. In other words: This isn't a case of overzealous prosecution or partisan hardball, as Trump's allies claim.

Nor does Trump deserve the benefit of the doubt. He's done business with fraudsters, mobsters and gangsters, and he has legions of former customers who claim they were cheated. The Trump Organization was recently convicted of 17 criminal charges, while he himself was charged with 34 counts in a hush-money probe and found liable of sexual abuse and defamation in a separate suit. From the start of his term in office, Trump engaged in misconduct so reckless that it tested the limits of presidential immunity. He's still under investigation for attempting to unlawfully retain power, incite a riot at the Capitol and interfere with the 2020 election. No one could argue that he naively blundered into a prosecutorial trap.

For all that, the question of whether Trump's indictment is justified is separate from whether it's good for the country. He is, after all, a former president and the front-runner for his party's nomination in 2024. Republicans are already vowing to retaliate against Democratic President Joe Biden and his family once he leaves office, thus threatening to engage in the very behavior they claim to be deploring. Such politically driven prosecutions–something the US has largely managed to avoid–could weaken American democracy and turn US politics, already grim, uglier still.

Yet Trump's alleged conduct was so egregious–and the evidence so damning–that in reality prosecutors had little choice but to bring these charges. Civility must at some point yield to the rule of law, the pursuit of justice and the protection of the nation. Ⓑ *For more commentary, go to bloomberg.com/opinion*



## ■ AGENDA

### ▶ Pride and Anxiety

Cities across the US celebrate Gay Pride on June 24 and 25. With hate crimes on the rise and a number of states enacting anti-trans laws, the Human Rights Campaign has declared a state of emergency for LGBTQ Americans.

▶ The Bank of England sets UK interest rates on June 22. Turkey's central bank also sets rates that day, for the first time under the leadership of a woman, newly appointed Hafize Gaye Erkan.

▶ The US Census Bureau publishes its May figures for building permits on June 20; the National Association of Realtors gives a read on existing home sales for the month on June 22.

▶ The UK's Office for National Statistics reports year-over-year inflation data on June 21. Japan's Ministry of Internal Affairs and Communications follows suit on June 22.

▶ FedEx and La-Z-Boy report earnings on June 20; Winnebago and Steelcase, on June 21; Accenture and Darden Restaurants, on June 22; Carnival and CarMax, on June 23.

▶ The European Games begin on June 21 in Krakow, Poland, even as the war in next-door Ukraine grinds on. Russian and Belarusian athletes have been barred from competing.

▶ *Asteroid City*, the latest hyperstylized film from Wes Anderson, opens wide on June 23, with Tilda Swinton, Adrien Brody and a host of other Anderson mainstays on board.

ILLUSTRATION BY MASHA KRASNOVA-SHABAEVA

# BOTH PUSHES THE NEEDLE AND THREADS IT

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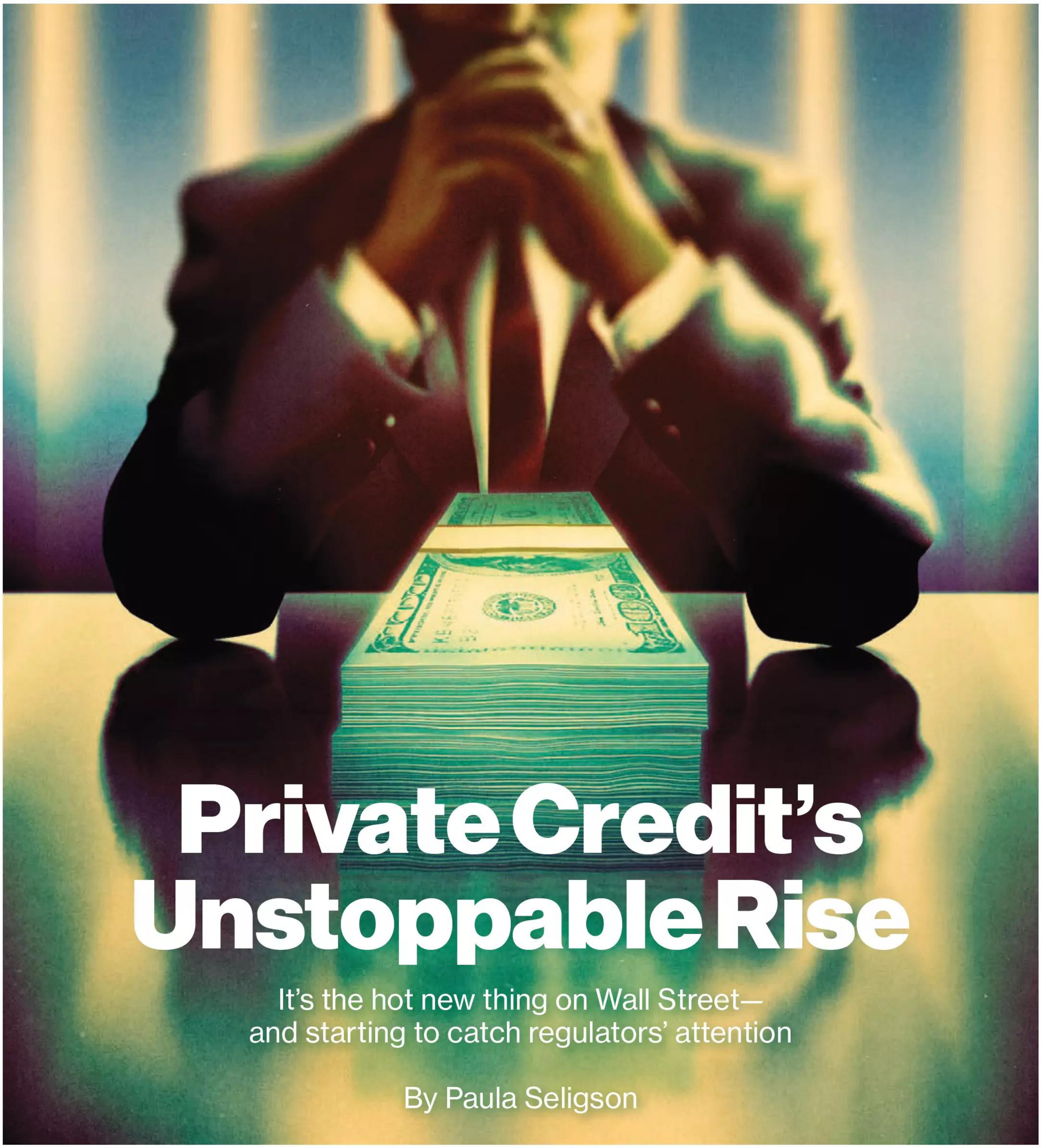


# Private Credit's Unstoppable Rise

## It's the hot new thing on Wall Street— and starting to catch regulators' attention

By Paula Seligson

Last month, when two private equity firms agreed to pay $4.25 billion for a division of medical technology company Baxter International Inc., they didn't tap their banks for jumbo loans or bonds. Instead, they financed the deal through the new kings of debt: suppliers of private credit.

These days, when companies need to borrow billions of dollars or dealmakers need to finance a buyout, they often bypass public debt markets and investment banks. Now officially an "asset class," private credit is the hot new thing on Wall Street. In just a few years, it's muscled aside banks to become a major source of capital for acquisitions and a popular "alternative investment" for retirement funds. Get ready to hear about it the next time you talk to a financial adviser.

The private credit market is dominated by some of the same players that ponied up a nearly $2 billion debt package for the Baxter deal–Ares Management, Blackstone, Blue Owl Capital

ILLUSTRATION BY NICO H. BRAUSCH

and HPS Investment Partners. Regulators are trying to catch up. And the market is about to face its first real test.

Private credit got a boost when the 2010 Dodd-Frank Act—Congress's response to the global financial crisis—pushed a lot of risky lending outside the banking sector. Specialized asset managers were happy to fill the void. Because they tailor loans to each borrower and typically don't trade the debt, thus locking their money up for long periods, private lenders can charge higher interest rates than banks and public debt markets do. After this year's regional banking crisis, banks are again tightening their lending standards, which could push more borrowers into the arms of private credit lenders.

The amount of private debt has grown rapidly to about $1.5 trillion globally as of September 2022, from just over $300 billion at the end of 2010, according to financial data provider Preqin Ltd. The US junk-bond and leveraged-loan markets are each about the same size. While fundraising has slowed recently, the momentum isn't expected to stop: Preqin projects private credit will hit $2.2 trillion by 2027.

Private debt can be thought of as private equity's cousin. It raises capital from investors, usually large institutions such as pension funds and insurers. While a private equity firm buys all or some of a company, private credit firms typically gain no ownership and just lend money to a company directly—putting themselves at the front of the line for repayment in a default.

The differences between the two can get hazy. Some of the largest private equity firms, including Apollo Global Management Inc. and Blackstone Inc., have developed massive private credit operations. The biggest transaction so far was last year's $5 billion deal, led by Blackstone, to help finance Hellman & Friedman and Permira's acquisition of software company Zendesk Inc.

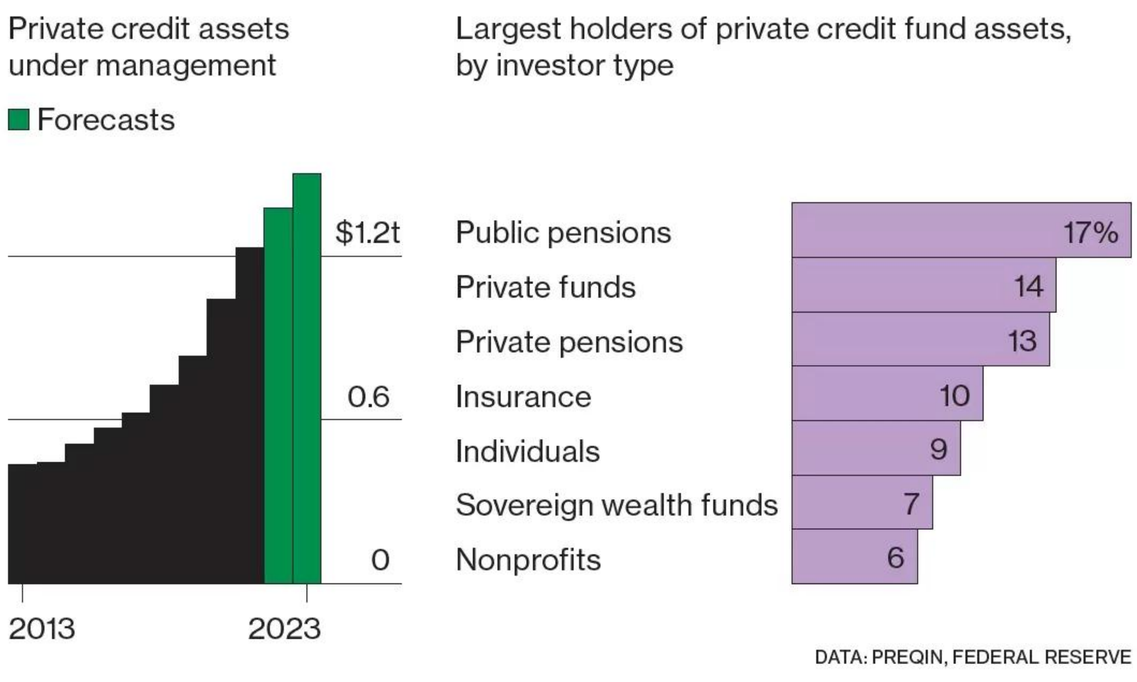
The industry took off around 2016, when interest rates were at rock bottom and investors were hungry for higher yields. But even now, with rates around 5%, private credit is going strong. It did well last year when almost everything else went south. While there is no index for the entire sector, the Cliffwater Direct Lending Index, which tracks nearly $280 billion of private loans to small and midsize companies, was up 6.29% in 2022. That compares with losses of about 19% for the S&P 500, 11% for junk bonds and 1% for leveraged loans.

Private credit loans almost always have floating interest rates, which means investors get paid more as rates rise. Of course, rising rates also mean that some borrowers' payments are now double what they originally were, increasing the risk of default. Because the loans don't trade in a secondary market, it's hard to know how many are under stress.

There are other unknowns. Private credit loans are usually held to maturity, so lenders have more discretion when determining "marks," or the current market value of loans in their portfolios. That insulates investors from market swings. It can also mean that valuations can be overly optimistic, possibly camouflaging distressed companies.

Regulators don't think private credit lending so far is systemically risky but admit they don't have much visibility. The sector doesn't receive the supervision that banks do. A slice of private credit called business development companies, which are publicly traded funds, reveal which loans are held in a portfolio and report quarterly results to the US Securities and Exchange Commission, but much of the industry makes only basic disclosures.

## Private Credit Goes Mainstream




DATA: PREQIN, FEDERAL RESERVE

Whether or not the economy goes into recession, a prolonged period of high interest rates will cause pain for the most indebted companies that can no longer afford their interest payments. Many smaller asset managers that rushed into private credit to make sure they didn't miss out haven't lived through a serious downturn.

The default rate is already ticking up, hitting 2.15% in the first quarter, up from about 1% in 2021's fourth quarter, according to Proskauer's Private Credit Default Index, which only captures a small percentage of the market. Private credit lenders have an incentive to quietly negotiate a debt restructuring—for a fee—rather than have a default stain their performance, further masking the industry's true financial condition.

In a May report, the Federal Reserve wrote that it isn't worried but the lack of transparency makes it difficult to assess risks to the broader financial system. While private credit funds generally get cash from sophisticated investors, retirees increasingly have money at play: US public and private pension funds hold about 31% of private credit fund assets, or $307 billion, according to the Fed. Insurance companies hold about 10%.

"Private credit funds have become direct competitors to banks, but are not subject to the same oversight and supervision," a group of US senators, including Massachusetts Democrat Elizabeth Warren, wrote to the SEC in May in support of proposed rules to increase disclosure by private funds.

Market participants say the system is working as intended: Banks are making safer loans, while riskier credit is being provided by professionals who invest long-term capital. At the same time, though, the industry is eager to promote its products to individual investors. In the next financial crisis, when Congress wants to make sure that companies have access to credit or that the financial system isn't threatened, it may be summoning to Washington the heads of private credit funds along with bank chief executive officers. Ⓑ

# BUSINESS

## Is Plant-Based Meat Dead?

10

# Will Illumina's Strategy Get Clipped?

● The resignation of its CEO after battles with Carl Icahn and regulators raises questions about the DNA firm's future

For the past few months, DNA sequencing giant Illumina Inc. has been locked in a high-stakes proxy battle with activist investor Carl Icahn. In May two of the three candidates Icahn had sought to put on Illumina's board were defeated by shareholders. Chief Executive Officer Francis deSouza was also reelected to the board, despite Icahn seeking his removal. These developments suggested that the heated drama over Illumina's leadership and direction was finally cooling down.

Just how wrong that view was became clear on June 11, when the company's board announced it had accepted deSouza's resignation, handing a surprise victory to Icahn after all and highlighting that the uncertainty about the company's next steps is far from over.

Icahn said in a tweet that he's "happy" about the change. "While obviously I believe the change of CEO should have come meaningfully sooner, it is still a very positive occurrence," he tweeted.

Although the recent war of words with Icahn might be ending, the many business issues that created an opening for the activist to take on Illumina have certainly not. As competitors have gained a foothold in the company's terrain, Illumina's dominance in the sequencing world has started to look far less assured. A sinking stock price and regulatory challenges on both sides of the Atlantic to the company's acquisition of cancer test upstart Grail Inc. has put its growth-by-acquisition strategy in question. And though the company's sequencing machines, which sell for about $1 million, have dominated the sequencing market for decades, new technologies have made Illumina increasingly vulnerable.

"Investors have not been thrilled with the Grail acquisition," says Bloomberg Intelligence analyst Jonathan Palmer. "There's concern that Illumina has maybe lost sight of the increased competition that's coming to market." The company didn't respond to a request for comment.

Illumina's main business is making machines to read DNA, the code that forms the building blocks of life. Use of Illumina's machines has grown as the cost to run them has decreased and researchers have found more things to do with them, such as cracking the code of viruses like SARS-CoV-2 or tailoring treatment to a patient's specific cancer. Illumina's core business brought in revenue of $4.5 billion last year.

Yet rivals—and venture capitalists—sense an appetite for alternatives. In recent years, two upstarts, Element Biosciences Inc. and Ultima Genomics Inc., have raised $1 billion between them, according to data from PitchBook. ▶

▼ Change since Dec. 31, 2019

Illumina share price

Nasdaq Biotechnology Index

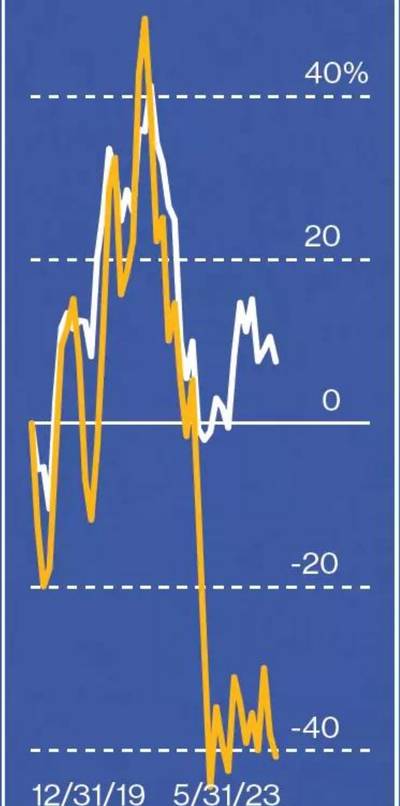



ILLUSTRATION BY ARIEL DAVIS. DATA: COMPILED BY BLOOMBERG

◀ They joined existing competitors such as Oxford Nanopore Technologies Plc and Pacific Biosciences of California Inc., companies that specialize in sequencing techniques different from what Illumina is known for.

Illumina has fought to hold on to its leadership through acquisitions. In 2019 regulators struck down its deal to acquire Pacific Biosciences. Last year the company introduced its own competing technology. At a four-day event that felt more like an Apple product launch than a health-care conference, Illumina unveiled the NovaSeq X and NovaSeq X Plus, devices that promise to produce faster and more accurate sequencing.

It also has sought to expand its diagnostic capabilities. In 2020 the company announced it would spend $8 billion to acquire Grail, a company started as part of Illumina's accelerator program and then spun off. Grail is working on a so-called liquid biopsy, or blood tests that can screen for a wide range of cancers. Grail and other makers of such tests rely on Illumina's technology. Regulators objected to the deal, saying that combining both the maker of a new generation of tests with the leading company that would interpret the samples from those tests could stifle competition.

Instead of walking away, as it did from the Pacific Biosciences bid, this time Illumina completed the buyout in 2021 despite regulatory concerns. The company wants to diversify beyond its core business with products like prenatal screening and Covid-19 tests. It anticipates a huge opportunity for blood tests, such as those developed by Grail, that can detect cancer. "We believe that it has the potential to save many lives around the world," deSouza said in an interview with Bloomberg Television last year.

Illumina has fought antitrust regulators in the US and Europe who want it to unwind the Grail deal, resulting in a lengthy and costly legal battle. Since the deal was announced, Illumina shares slid 32% through June 9. In a March 2023 open letter to shareholders, Icahn blamed the value destruction on a "series of ill-advised (and frankly inexplicable) actions taken by the board of directors" related to the Grail acquisition. Illumina has said that should it lose either regulatory battle, it will get rid of Grail.

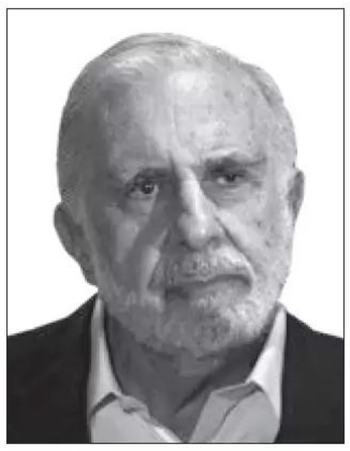
Some have wondered whether moving beyond sequencing makes much sense for Illumina in the first place. The company is spending some $700 million a year on Grail and will need to keep pumping money into it for the next five years, if not a decade, says Evercore ISI analyst Vijay Kumar. That's a completely different investment strategy than Illumina's core business, which is all about executing and expanding.

"There's a lot of distractions going on right now, but my advice to Illumina is just focus on the X launch," says Tim McCarty, lead Illumina analyst at Janus Henderson. "You've invested five years and 1,500 people for this. Now's the time to shine."

A solid release of the new X machines, which began shipping earlier this year, could help soothe recent doubts about Illumina's business. The company trimmed its sales and earnings forecasts twice last year and said it would eliminate 5% of its employees, amid a tough economic environment and slowing demand for its older products as customers waited for the new versions. Illumina in April unveiled $100 million more in cuts, which will affect an undisclosed number of additional jobs.

During the proxy fight, deSouza and other Illumina representatives repeatedly promised investors they had everything under control for the long haul. Now the company will need to find a new leader and prove it can deliver. —*Angelica Peebles*

THE BOTTOM LINE Investors have shown Illumina what they think of its expansion beyond DNA sequencing machines and into the blood testing business by sending its stock down more than 30%.



● Icahn

● deSouza



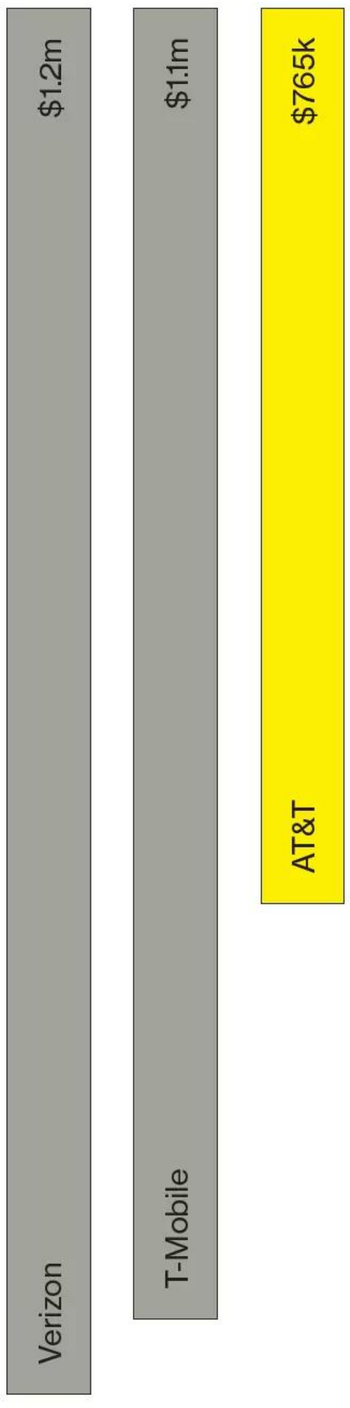
# AT&T's RTO Plan May Bring Job Cuts

● The telecom giant is consolidating offices into only seven states, forcing thousands of managers from other locales to relocate or quit

AT&T Inc., the biggest US phone company, has 350 offices spread across all 50 states, and many employees have worked from home since the pandemic started. So it came as a shock when Chief Executive Officer John Stankey in May mandated that 60,000 managers must report to work in person—but at offices in just nine locations.

Stankey's demand is a high-stakes game of musical chairs, with team leaders making location assignments to a handful of hubs focused on specific duties. Although the restructuring may yield big savings on real estate and boost collaboration, many employees now facing long commutes or relocations view it as a move to reduce staff. "It's a layoff wolf in return-to-office sheep's clothing," says one AT&T manager who, like others in this story, asked not to be identified for fear of retribution. ▶

▼ Annual revenue per employee




ICAHN: VICTOR J. BLUE/BLOOMBERG. DESOUZA: KYLE GRILLOT/BLOOMBERG. REVENUE FIGURES FOR 2022. EMPLOYEE FIGURES AS OF 3/31/23 FOR VERIZON AND AT&T AND 12/31/22 FOR T-MOBILE. DATA: COMPILED BY BLOOMBERG

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Emilie

Victor

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◀ Stankey estimated that among the managers affected, about 15%, or 9,000, will face the choice of moving or leaving the company. People inside AT&T say that with the proposed office reductions and task-specific realignments, the estimate is probably closer to 25,000, and most won't be eligible for relocation money, according to several managers. An AT&T spokesperson says relocation offers will be made by team leaders on a case-by-case basis.

What AT&T is doing is unusual, says Sandra Sucher, professor of management practice at Harvard Business School. Companies typically announce return-to-work policies, or, as seen in tech lately, announce big layoffs. AT&T's announcement "seems to be serving multiple goals." The return-to-work message is also "an elaborate restructuring with cost cuts." If a company is "reorganizing and streamlining the business, people at lower levels will feel like it is a ploy to cut jobs."

AT&T typically puts teams through a periodic culling known internally as "surplussing." In the past three years, 69,000 employees have been removed as part of a $6 billion cost-cutting effort. This time feels different. The return-to-office mandate starts in July in Atlanta and Dallas and will be in effect everywhere else by Sept. 4. "I've never seen us do something this drastic this quick," one vice president told her team in May, according to a video recording seen by Bloomberg News.

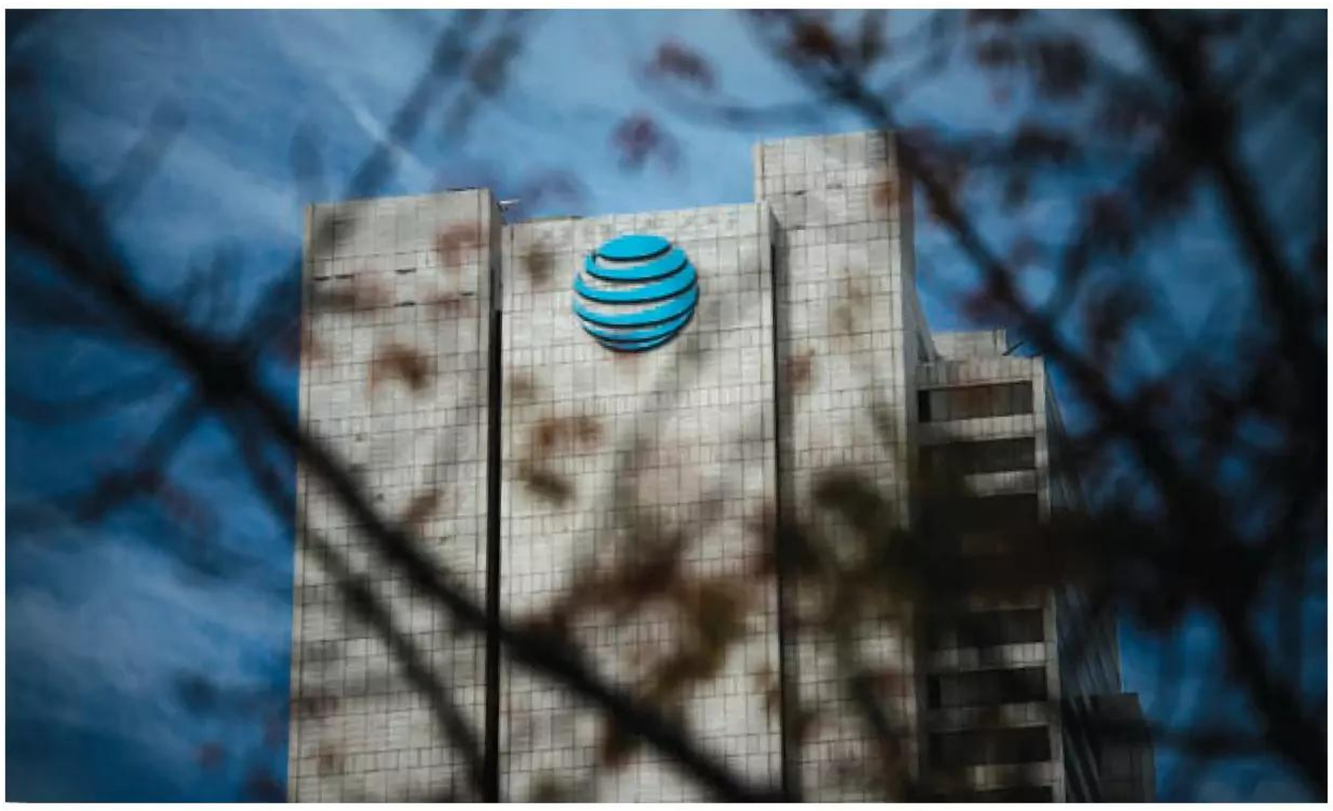
Insiders say the announcement created a sense of confusion and chaos because there's been no explanation of how people will be assigned to one of the nine designated hubs: two core central offices in Dallas and Atlanta, along with locations in Los Angeles; San Ramon, California; Seattle; St. Louis; Washington; and two New Jersey towns, Middletown and Bedminster. People now working in one of the designated hubs could still get reassigned to another. "Your leadership team will determine your designation and work location based on the needs of the business, work groups and collaboration partners," according to an internal document sent to employees. "Depending on your role, it's possible your work location could change."

AT&T is struggling with high costs of mobile phone inventory, network construction and lower contributions from its declining DirecTV joint venture, all while mobile phone subscriber growth tapers off. Stankey is also under pressure to cut costs after the company posted far lower first-quarter free cash flow than expected for the second year in a row.

Some managers say the top brass created many of the problems. After a decade of megadeals, AT&T had become a $100 billion media colossus battling with Netflix Inc. and Walt Disney Co. After less than a year on the job, Stankey started dismantling the empire. Now many AT&T managers say they're being penalized for a failed strategy that squandered billions of dollars buying DirecTV and Time Warner Inc., only to sell them at a loss.

When he announced his staff reorganization plan in May, Stankey said there'd be some tough choices. "Many will make decisions that are appropriate to their lives," he said. "If they want to be a part of building a great culture and environment, they'll come along on these adjustments and changes. Others may decide, given the station of life they are in, that they want to move in a different direction." It isn't about getting back to pre-pandemic operations, Stankey said, it's more about the future: "This is how we get the right people doing similar functions in the right places where they can collaboratively work to build this company for the next 10 years."

▼ AT&T's corporate office in Dallas



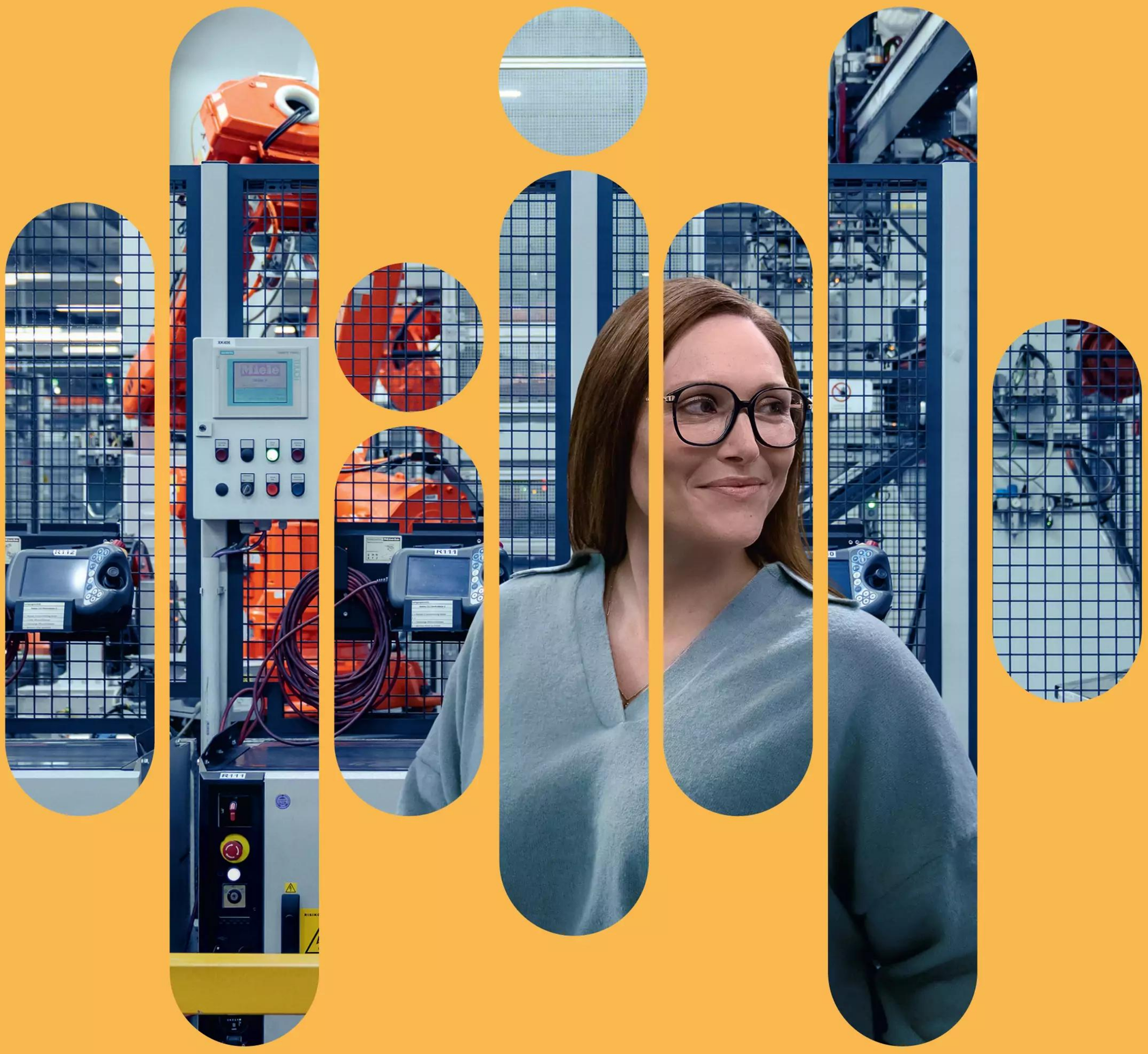
Directors and assistant vice presidents of each department are coordinating with their peers to figure out what roles are essential and how to keep the collaboration and support system intact. Some are scratching their head to figure out how the numbers stack up: It's not as if the Atlanta and Dallas offices can handle 5,000 more people, says one manager facing relocation.

AT&T supervisors are expected to complete the new assignments by the end of June. Exact move-by dates when staff are to report to their assigned locations are still being determined, say two people. Since the announcement, morale hasn't been great. One New York-based manager says, "If they assign me to New Jersey, fine, I'll make the three-hour drive. If they tell me I've got to relocate to Dallas, I'm getting a lawyer." —*Scott Moritz*

**"This is how we get the right people doing similar functions in the right places"**

THE BOTTOM LINE AT&T's return-to-office mandate includes a massive organizational restructuring, causing some managers to fear that one of its goals is to reduce head count.

BRANDON THIBODEAUX

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# ByteDance Wants to Be Everything To Everyone

● The company behind TikTok is building an all-purpose app in China to rival WeChat

As a middle-age restaurant owner who was neither interested in scrolling through viral videos nor likely to create such videos herself, Zhou Meiying never found a lot of use for Douyin, China's most popular short-form video app. That changed last year, when the Chinese government shuttered Beijing's restaurants to combat Covid-19. Zhou, 44, began streaming videos of herself preparing her specialty, braised pork knuckles, along with a link that allowed viewers to place orders for delivery. She now gets hundreds of orders each day through the app. "If it weren't for Douyin, I wouldn't even be able to pay salaries," Zhou says. "It's a new leg we stand on. That's how we survived."

The formula is a big deal for Zhou and a significant development for ByteDance Ltd., the company that runs both Douyin and TikTok, which is available only outside China. ByteDance has primarily focused its operations on its social media apps, with most of its $80 billion in annual revenue coming from what they generate in advertising. Last year it began offering food and grocery delivery in big cities such as Beijing and Shanghai. When Douyin shows a user, say, a cheeseburger or a slushy, it includes a link to place a delivery order or a coupon that can be redeemed in person. Users can also search for cinemas, bars and beauty salons inside the app.

The so-called everything app model is popular in China thanks to WeChat, which incorporates elements of WhatsApp, Instagram, PayPal and other services into a single service. None of WeChat's rivals have come close to providing such a sprawling range, but the success of Douyin's food delivery experiment raises the possibility that ByteDance could become the first.

ByteDance has spent years laying the foundation for its own everything service. It has branched into video games and online shopping. It has also put

Edited by Joshua Brustein

ILLUSTRATION BY NICK LITTLE

increasing focus on real-world commerce through food orders, flight bookings and hotel reservations. Last year, Douyin's 700 million users increased their spending on these on-demand services sevenfold, the company says, though it doesn't disclose a specific number. GuoSheng Securities Co. estimates that by 2025, Douyin could facilitate 300 billion yuan ($41.9 billion) in on-demand transactions, generating more than 17 billion yuan in revenue from its commissions.

If it succeeds in doing this, ByteDance would mature into a more significant rival to China's biggest internet conglomerates, such as WeChat owner Tencent Holdings Ltd. and Alibaba Group Holding Ltd., which offers a wide range of e-commerce and financial services but doesn't compete in social. "Douyin is this giant amusement park that has something to offer for everyone," says Dave Xie, a principal at consulting firm Oliver Wyman. "When you get tired of the rides, you will inevitably want to shop or eat. It's all about occupying your time." It could also eventually help ByteDance to bring the everything model to other markets through TikTok, assuming it eventually figures out the delicate politics of operating in US and European markets. Spokespeople from ByteDance didn't respond to requests for comment.

The company sees its recommendation algorithms as its main advantage. On Douyin and TikTok, these systems are dedicated to putting videos in front of users that will keep them scrolling. Presumably they'd also be good at steering customers to the merchandise and services they're most likely to buy. Users who spend their time watching winter-sport videos, for instance, could be matched with posts embedded with product links for snowboards, ski resort tickets and budget flights to Hokkaido.

Douyin's everything play began in 2020 during the early days of the pandemic, when it turned on the switch for in-app purchases. Its model, which consisted of enabling influencers to hawk shampoo and lipstick through livestreams, struck a chord with young people during China's prolonged lockdowns. The company sold about $26 billion in merchandise in its first year in e-commerce, achieving what Alibaba took six years to accomplish. TikTok is now intent on adapting this model to the US and its 150 million users there.

As it expanded into e-commerce, Douyin got more serious about its food business. In June 2022, it began charging service fees for coupons after having spent two years promoting them among cafes and restaurants. The coupon business is more complicated than livestream shopping, given the need to determine what people might eat based on their online activity and location. It also puts ByteDance in direct competition with the local food-delivery leader Meituan, which in 2021 generated about a fifth of its $28 billion revenue from its coupon business.

In August, Douyin announced that it had teamed up with Alibaba's Ele.me app to offer food delivery for its users. (The tie-up quickly propelled a counteralliance between Meituan and Kuaishou, which is a distant second to Douyin in China's short-form video app market.) ByteDance is also in preliminary talks with Chinese conglomerate Dalian Wanda Group Co. to acquire its digital payments unit, Bloomberg News reported in May, a deal that could help Douyin tap into millions of shoppers at Wanda's plazas across Chinese cities.

## Asia's Everything Apps

By services offered

| | WeChat | Alipay | Douyin | Shopee | Grab | Line |
|---|---|---|---|---|---|---|
| Instant messaging | ● | ● | ● | × | × | ● |
| Video calls | ● | × | × | × | × | ● |
| Mobile payments | ● | ● | × | ● | ● | ● |
| Financial services | ● | ● | × | × | ● | × |
| Social media | ● | × | ● | × | × | ● |
| Livestreaming | ● | × | ● | ● | × | × |
| Mini games | ● | ● | ● | ● | × | × |
| E-commerce | ● | ● | ● | ● | × | ● |
| Food & grocery delivery | ● | ● | ● | ● | ● | × |
| Hotel & flight booking | ● | ● | ● | ● | × | × |
| Ride-hailing | ● | ● | × | × | ● | × |
| | China | | | Singapore | | Japan |

DATA: COMPILED BY BLOOMBERG

ByteDance has more than a thousand employees working to recruit merchants. For Zhou, it took months of persistent calls and trial runs by professional streamers before she got on board. Finally, she says, "I was convinced that I need to learn how to do flash sales and attract livestream traffic and all that." Her business now livestreams for five hours daily on Douyin—close-up shots of pig knuckles simmering in a giant pot, which are then drizzled with Zhou's secret sauce before they're plated while her employees linger just off-camera, shouting out the details of discount offers. This may not sound like the recipe for particularly compelling video content, but it turns out to be attractive enough for viewers who would typically stay for just minutes before they place an order. Zhou is now a true believer; she even made food packaging boxes with a QR code that links to the restaurant's account on the app. ▶

◀ In December, ByteDance elevated Douyin's head of livestreaming and on-demand services, Han Shangyou, to run the whole Douyin platform in China. He reports directly to Zhang Nan, the former Douyin head who's now in charge of ByteDance's China operations. "Douyin is much more than its slogan of 'record your beautiful life,'" Han told a group of Chinese merchants in September. "It has become a lifestyle."

Meal delivery has the potential to become another reason for users to spend money through Douyin on a regular basis, but it also requires substantial investment. Although customers seem happy to order food through smartphone apps, companies around the globe have struggled to make steady profits through delivery services.

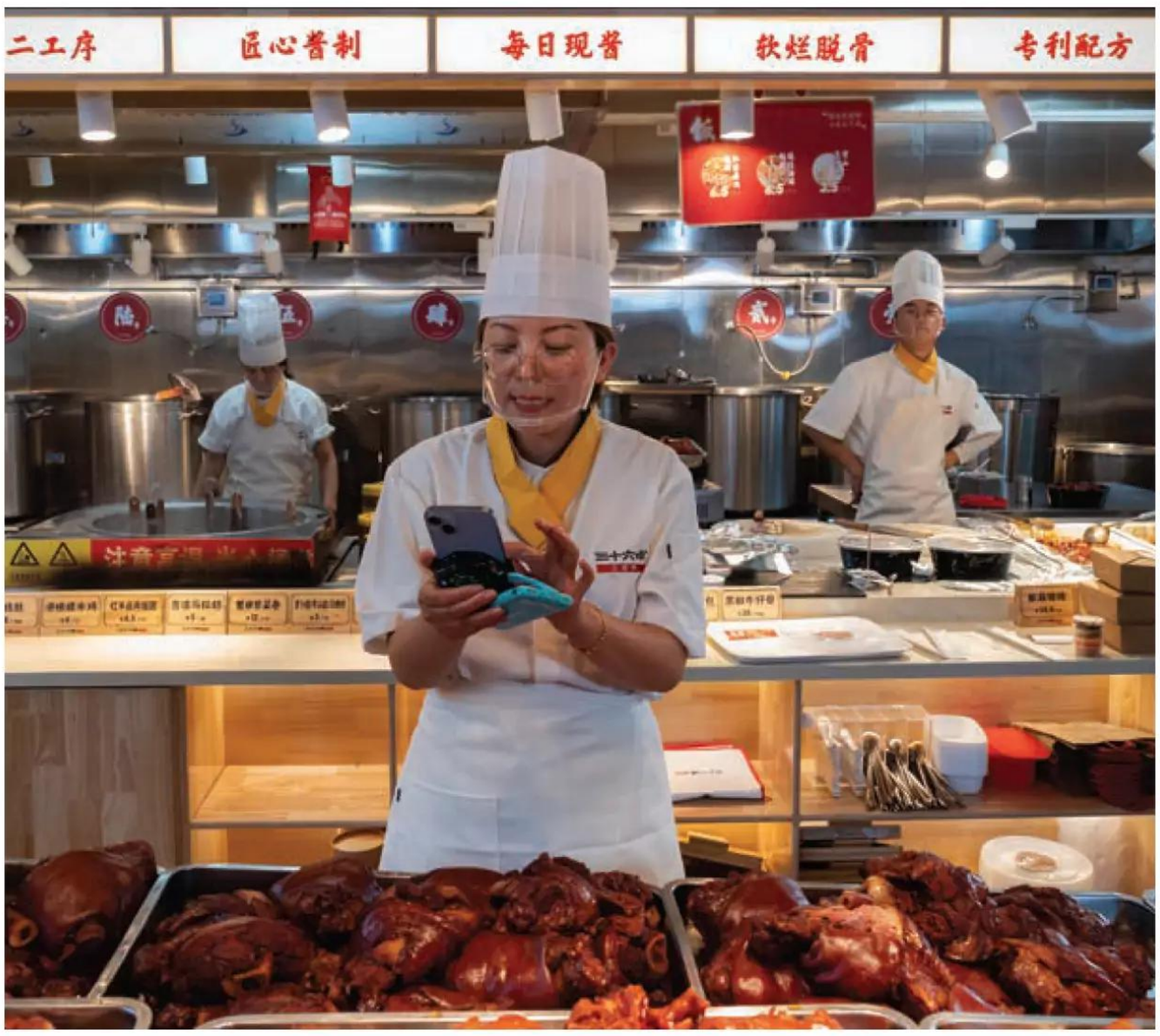
Meituan for years has sustained deep losses making arrangements to have enough scooter riders to deliver 60 million orders a day. Douyin's delivery service operates in only a handful of cities, via partners like Ele.me and SF Holding Inc. "User traffic is definitely Douyin's advantage, but when it comes to fulfillment and onboarding merchants, this kind of dirty work cannot be achieved in one day," says Oliver Wyman's Xie.

ByteDance has made less progress elsewhere in its sprawling online content empire, retrenching on projects such as games development and music streaming in China. That could hold back Douyin's prospects as a true all-in-one platform. Meanwhile, WeChat is looking to encroach on Douyin's main territory with its own short-video feed, called Channels. WeChat expanded the number of viewers on the service threefold in 2022 and generated more than 1 billion yuan of ad sales in the fourth quarter.

But Douyin is proving that its experience cultivating an influencer economy for its main app is translating into its other services. This has given rise to businesses such as the content studio run by Xu Mengjie, a 24-year-old in Hangzhou, in Zhejiang province. Each day, Xu and six other streamers take turns hawking coupons for spicy crayfish, boba teas and meat skewers, with her business taking a cut of each sale.

Xu, who has a master's degree in finance, says her company can generate about a half-million yuan in monthly revenue, way more than she would've earned at an entry-level job in private equity. "This is a brand-new avenue with barbaric growth," says Xu, who has 170,000 followers. "If I get in early and do this right, there can be a bright future."

That future relies on her ability to keep on Douyin's good side. Xu says 90% of viewers discover her sessions through their interest-based feed, meaning her business's viability depends entirely on how Douyin's algorithms present her content. She's constantly monitoring her numbers and trying to anticipate how she can get the software to reward her. If sales numbers are poor, she says, she expects the app will punish her by shrinking her access to users. "It's actually quite tortuous," she says. —*Zheping Huang*




▲ Zhou livestreaming on Douyin from one of her restaurants

THE BOTTOM LINE Douyin's recent success in coupons and food delivery hint at a future where users can do far more with the app than scroll through viral videos.

# Spotify's Billion-Dollar Podcast Pivot

● The streaming service wanted to be the HBO of podcasts. Its new vision looks more like YouTube

Over the past four years, Spotify Technology SA has announced a succession of splashy deals showing off how much money it's willing to spend to become a dominant player in the burgeoning podcast industry. In 2019 it paid over $400 million for two podcast studios and a company that makes podcast creation software, then spent hundreds of millions more signing the world's biggest podcasters, most notably Joe Rogan, to exclusive deals. It even built a podcast campus in Los Angeles with

MEIYIN: PHOTOGRAPH BY ANDREA VERDELLI FOR BLOOMBERG BUSINESSWEEK. CHAMBERLAIN: GETTY IMAGES.
*LICENSING DEAL. DATA: MEDIA REPORTS AND FINANCIAL FILINGS, COMPILED BY BLOOMBERG

18 studios, a theater and an indoor stage, dubbing it "Pod City." Altogether, the music streaming service invested more than $1 billion in podcasting.

That strategy has taken a sharp turn as Spotify tries to mollify investors looking for signs it can start earning consistent profits. On June 5 the company announced that it was laying off 2% of its workforce, or 200 people, following a previous round of cuts in January, and that the job cuts would primarily be in its talk division. Sahar Elhabashi, vice president for the podcast business, called the latest losses a "difficult but necessary decision" that'll allow the company to enter its "next chapter" in podcasting.

That chapter will put a stronger emphasis on providing tools to people who produce podcasts and then on making money from advertising, with a model that has echoes of YouTube. This is a departure from much of what Spotify had been building, which was a sort of HBO of podcasts, where it used premium content to persuade people to use its platform. Spotify has even begun to distribute its high-profile podcast by Emma Chamberlain, *Anything Goes*, on other platforms, such as Apple Podcasts. It's in conversations to do the same with Dax Shephard's *Armchair Expert*.

As part of this shift, two of Spotify's early and prominent studio purchases, Gimlet Media and Parcast, are losing their respective branding and joining the broader umbrella of Spotify Studios.

Employees weren't entirely surprised by the cuts. In interviews, 11 current and former workers, who asked to remain anonymous to discuss corporate strategy, portray a company that's offered moments of hope while dropping hints of a potentially darker future.

In May some employees traveled to Sweden for "Intro Days," where they were officially welcomed into the Spotify "band." A week before the announcement, Liliana Kim, then the managing director of Parcast, held a staffwide meeting in which she suggested that employees start crafting pitches for new programming and consider ways existing shows could peg themselves more closely to the news. Just days before the job cuts were announced, employees were working on new seasons of shows, such as Gimlet Media's *Conviction*.

The podcast studios hadn't been allocated their annual budgets, so they couldn't approve new shows. Deals weren't renewed, and many top stars, such as Barack and Michelle Obama, Brené Brown and Esther Perel, allowed their deals to lapse. Almost all the founders of the acquired companies had also left Spotify. Amid the widespread uncertainty, rumors circulated among employees about a looming reorganization.

At Parcast in Los Angeles, the cuts were deep enough to trigger California's WARN Act, which requires companies to offer 60 days' notice for mass layoffs. A spokesperson for the Writers Guild of America, East, a union that represents employees at both Parcast and Gimlet, which was also hit hard, says 47 members lost their jobs. The WGA is in conversations with the company about how the remaining employees at both studios will be represented, according to a person close to the situation who asked for anonymity to discuss internal matters. Spotify declined to comment.

The fate of certain guarantees that Spotify made to the union, including a $100,000 budget for promoting diversity, equity, inclusion and accessibility measures at Parcast, remains unclear. In February the studio's employees wrote a memo to management expressing frustration that the company had only approved the spending of $5,000 of that budget for 2022. After that, Spotify signed off on a project to allow its staff to form a partnership with another Spotify-owned company, Soundtrap, to teach Los Angeles public school teachers and students to make podcasts. But as it cut jobs, Spotify also announced that it had sold Soundtrap back to its original owners, six years after purchasing it, putting the fate of the partnership in question.

While it's retrenching on some of its big investments, Spotify is pegging its podcasting future more firmly on another acquisition it made during its free-spending stage: Megaphone, the podcasting hosting and advertising service that it bought for $235 million in November 2020. That comes with its own set of expenses. In late June, Spotify is flying podcasters and musicians to the French Riviera for a party at Cannes Lion—a crucial event for any company hoping to get some face time with the world's biggest ad agencies. —*Ashley Carman*

THE BOTTOM LINE Four years into a spree of podcast-related acquisitions, Spotify is cutting back on a bet it had hoped would help it sidestep the brutal economics of music streaming.

▼ Spotify's big podcast deals

| | |
|---|---|
| Megaphone | $235m |
| *The Joe Rogan Experience** | Over 200m |
| Gimlet Media | 194m |
| The Ringer | 185m |
| Anchor | 154m |
| Chartable and Podsights | 94m |
| Betty Labs | 63m |
| Parcast | 56m |
| Podz | 49m |

◀ Chamberlain

# Crypto Gets Its Moment Of Clarity


● Suits against Binance and Coinbase are further proof that the SEC is cracking down

The crypto industry is running out of ground to stand on, particularly in the US.

Since the price of Bitcoin tumbled off its exuberant $69,000 high in late 2021, the bear market in digital assets has often been described as a "crypto winter." That's not bleak enough to capture what's happened. In quick succession, crypto has seen financial contagions, multiple cases of alleged fraud and outright theft, the collapse of several trading and lending platforms, and the evaporation of about $1.8 trillion in market value across all coins. Celebrity endorsers have been embarrassed and in some cases fined, trend-chasing venture capitalists have pivoted their attention to chatbots, and the letters "FTX" have been taken down from Miami's basketball arena. And millions of ordinary investors have been badly burned.

Through it all, regulators including the US Securities and Exchange Commission have steadily ramped up enforcement actions, with hints of more to come. Many crypto businesses have complained about a lack of clarity concerning what

Edited by Pat Regnier

DATA: COINGECKO

rules, if any, they were supposed to follow. In early June the SEC filed a pair of lawsuits that remove any ambiguity about where the watchdog stands: The agency contends that many of the business practices people in crypto took for granted during the boom years are not legal in the US.

The suits take on the world's two largest crypto trading platforms, Binance and Coinbase, accusing both of running unregistered securities exchanges and brokerages. Both companies say they don't offer US investors coins that can be considered securities.

"The SEC is now playing whack-a-mole with crypto exchanges," says Ed Moya, senior market analyst at Oanda Corp., a currency trading platform. But if its arguments prevail against these two companies, the impact could be far wider, reining in the activities of other trading platforms and perhaps forcing cryptocurrency creators to register their tokens as securities if they want them to be tradeable in the US.

The suit against Binance Holdings Ltd.—the more sweeping of the two—takes aim at the supposedly decentralized nature of many crypto companies. Binance has no official headquarters and operates mainly outside the US. Americans aren't supposed to be able to trade on Binance.com, though they can trade on Binance.US, a more limited service that's supposed to be separate. The SEC alleges that all the businesses were closely controlled by Binance founder Changpeng Zhao and that plenty of money flowed from US investors to Binance.com.

Echoing an earlier lawsuit filed against Binance by the Commodity Futures Trading Commission in March, the SEC says that Binance quietly encouraged US customers to use virtual private networks that would hide their location and allow them to access the main exchange, and that this is only one of the ways the company knowingly violated federal securities laws. The complaint states that in 2018, Binance's chief compliance officer at the time told another compliance executive, "we are operating as a fking unlicensed securities exchange in the USA bro."

The SEC also says that Binance misled customers through a practice known as "wash trading," where the same entity sells its own securities to itself. The agency says Sigma Chain, a trading company Zhao owns and controls, might have used the practice to artificially inflate crypto trading volumes on Binance.US. In other words, some of the frantic crypto trading that people raced to get in on was an illusion, the SEC says. Binance has denied the allegations and said in a blog post that the company was "disappointed" with the SEC's decision and that the regulator had chosen to use "blunt weapons of enforcement" rather than a more nuanced approach. Responding to news of the SEC complaint, Zhao posted a tweet that started off with "4"—a shorthand signal to his customers and online fans to disregard so-called fear, uncertainty and doubt about the company. ("Ignore FUD, fake news, attacks, etc." is fourth on a list of his New Year's resolutions for 2023.)

Even crypto enthusiasts who don't do business with Binance may have felt some FUD over the next part of the SEC's complaint. It listed several digital coins, including Cardano's ADA, Solana's SOL and Polygon's MATIC, as securities that were sold on Binance's platform. SEC Chair Gary Gensler has long called out crypto companies for peddling unregistered securities, and he's said most existing tokens probably fit that definition. The June 5 Binance complaint essentially provided a list of some of the most popular coins that the SEC regards as securities. It foreshadowed the lawsuit that would hit Coinbase the next day, because the company offers many of the same coins on its platform.

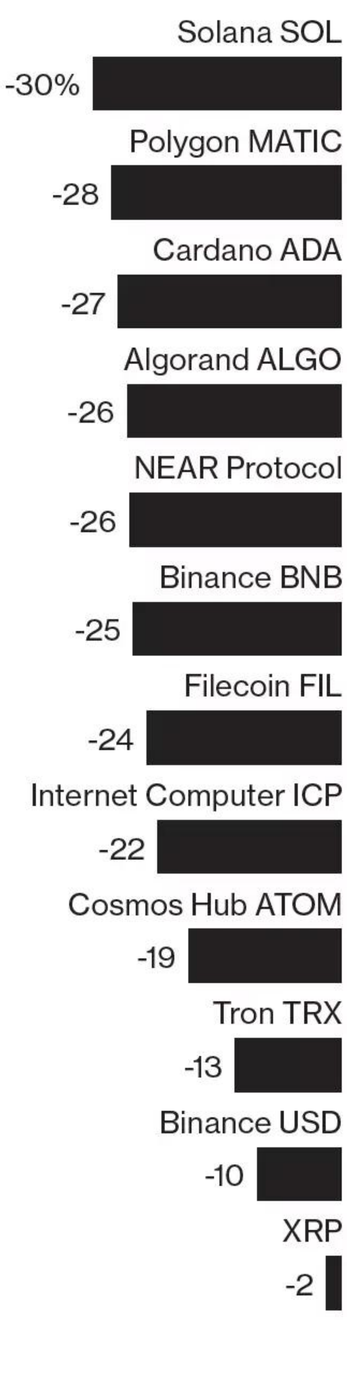
Unlike Binance, Coinbase Global Inc. is a US-based exchange, and it's long touted its compliance with US rules. This publicly traded company files regular disclosures about its business with the SEC. But it isn't registered as a securities exchange. If Coinbase was only a place to buy and sell Bitcoin, that likely wouldn't be a problem, because traditionally the world's largest cryptocurrency is considered by regulators to be more like a commodity—a digital form of gold—than an investment such as a stock, bond or mutual fund.

But the SEC says in its suit against Coinbase that ADA, SOL and several other coins are in fact securities, triggering a requirement to register. It says the coins' success depends on the efforts and the business decisions of those offering the tokens, a legal hallmark of securities that are subject to its jurisdiction. As with stocks, token creators often raise money for their projects by selling their coins to venture capital investors and through a type of sale known as an initial coin offering, in which regular crypto enthusiasts can participate.

Coinbase also has its own product, called Earn. It allows customers to collect interest on some coins by "staking" them or allowing them to be used as part of the technology that makes crypto blockchains work. The SEC says this program also amounts to an unregistered security.

Chief Executive Officer Brian Armstrong said in a tweet that Coinbase is confident it's followed the law and that the SEC hadn't provided a path ▶

▼ Change in total market value of selected coins named as securities in SEC lawsuits, June 4-12



◀ for the company to register with it. "We tried, repeatedly—so we don't list securities," he wrote. He also noted that the SEC reviewed the business when it made its initial public offering.

Anthony Tu-Sekine, who heads the blockchain and cryptocurrency group at law firm Seward & Kissel, says that Armstrong is telling the SEC, "You approved our conduct back when we went public, and now you're saying it's illegal." But Tu-Sekine says the fact that the SEC reviewed a company's IPO filing typically isn't an adequate legal defense against alleged federal securities law violations.

Armstrong also draws a distinction between his company's woes and the harsher allegations against Binance. "The Coinbase suit is very different from others out there—the complaint filed against us is exclusively focused on what is or is not a security," he wrote. But as technical as the suit may sound, it poses a serious threat to Coinbase's business. By offering a variety of coins, the company gives its users more things to trade, and trades generate fees. "If the SEC stops Coinbase from trading some tokens they deemed securities, that could have a huge impact on Coinbase's financial health," Oppenheimer & Co. analyst Owen Lau told Bloomberg News. "I would say the revenue at risk could be over 50%." He added that the SEC may not win on every point.

Oanda's Moya says the lawsuit could also have a devastating effect on the wider digital asset industry. "If you're not able to trade your favorite currencies, you might jump ship or switch to Bitcoin," he says. In theory, exchanges could offer coins considered securities if they registered; that means they'd be subject to extensive US securities laws including rules on disclosure and investor protection.

But many coin developers argue they don't need to do this, because digital assets have unique features that make them unlike stocks or bonds. IOG, the developer of the Cardano blockchain, said in a statement that its ADA token is "under no circumstances" a security. The SEC's filing "contains numerous factual inaccuracies and will not impact IOG's operations in any way," the statement said.

Treating coins as securities could force big changes at exchanges that choose to list them. The SEC says that both Binance and Coinbase combine the functions of an exchange, a brokerage and a clearing agency. In the securities business, those functions are typically split among separate legal entities, to avoid conflicts of interest.

The battles between the SEC and Binance and Coinbase are likely to drag out for years. A lawsuit against Ripple Labs over its XRP token was initiated in 2020, and it still hasn't reached a conclusion. Coinbase is also pushing for legislation in Congress that may define crypto coins differently than the SEC does.

The SEC's actions are likely to spook investors and cause venture capitalists, who were once crypto cheerleaders, to pull back even further from their fundraising efforts. And few investors want to hold a coin that could end up being difficult to trade.

Seeing the chill descending over US crypto, many in the industry have been setting their sights on other markets. Coinbase has sped up its yearslong effort to introduce new hubs and obtain new licenses around the world. "We've spent a lot of time doubling our core outside of the US," says Nana Murugesan, vice president for international and business development at Coinbase, speaking before the SEC lawsuit was filed.

**"The SEC is now playing whack-a-mole with crypto exchanges"**

▲ Gensler

In the Americas, Coinbase has made Brazil one of its top priorities. It scrapped acquisition talks with Brazilian crypto brokerage 2TM Participacoes SA last year, but Murugesan says the company has had recent successes, such as an integration with Pix, the digital payment system developed by Brazil's central bank. He adds that Coinbase is interested in using local developers to understand more uses for crypto. One of the options they're seeing in Brazil is popularizing "play to earn" in favelas. The model allows people to earn crypto tokens that can be exchanged for cash by playing online games, and it's become part of the gig economy in countries such as the Philippines. But it's also been criticized for exploiting impoverished workers. Murugesan says that play-to-earn can incentivize young people to engage in learning and educational opportunities.

PHOTO: TOM WILLIAMS/CQ-ROLL CALL/GETTY IMAGES

Murugesan calls the UK the largest international market for Coinbase and says the company recently added PayPal as a payment method for its UK customers. Armstrong said in April that relocating his company's headquarters there is "on the table." Venture capital firm Andreessen Horowitz, which raised the largest crypto fund last year, recently announced plans to open a new office in London, citing the welcoming environment the UK government has created for digital asset companies. (Bloomberg LP, which owns *Bloomberg Businessweek*, has invested in Andreessen Horowitz.)

Binance has had a frostier reception in the UK. Chief Strategy Officer Patrick Hillmann said at a conference last month that his company is doing what it can to be regulated there, despite the country's top market regulator banning the company in 2021 over concerns about the risks it posed to customers.

Murugesan says Coinbase already has a license in Germany, operations in Ireland and registrations in Italy and the Netherlands, and the company hopes to be able to do more now that the European Union has approved crypto asset rules. Coinbase is also considering expanding further in the United Arab Emirates, where many in the crypto industry have flocked because the government is considered friendly to digital assets. Zhao lives in Dubai, home to one of Binance's biggest offices.

Regulators in Dubai recently clashed with a new exchange called OPNX, saying it was operating without the required local license. The startup drew attention because it's connected to Kyle Davies and Su Zhu, the founders of the crypto hedge fund Three Arrows Capital, whose blowup last year helped trigger the crisis in digital assets. (The exchange's CEO says it hasn't marketed to UAE customers.)

Anywhere in the globe the crypto industry turns, it's going to be navigating the impact of the deep crypto downturn. As part of a marketing campaign in Australia, Murugesan and his team recently posed for pictures in front of landmarks such as the Sydney Opera House while wearing Coinbase T-shirts and waving flags. Massive rains soaked the team as they took their photos. It was a far cry from earlier efforts in the US, which included a Super Bowl commercial and an NBA sponsorship. "We're trying to be creative now," Murugesan says, "especially in the current environment, this resource-constrained environment." —*Hannah Miller, with Yueqi Yang*

THE BOTTOM LINE The crypto winter may be turning into a kind of crypto exile, as the SEC asserts that much of the industry hasn't been following US securities laws.

## Law What's a Security?

The fight over crypto is boiling down to an exasperatingly fine legal point: whether digital coins are securities. —*Pat Regnier*

● If coins are securities, they're subject to a raft of US regulations, including ones about financial disclosures and investor protection. And so are the exchanges where people trade them. ● If you've dabbled in crypto, you may think of the tokens in your electronic wallet as pretty similar to the stocks in your online brokerage account. You bought those tokens hoping their price would rise. You can open an app on your phone and watch their market value go up or down, then look at fever charts of their price history, just as you can with Apple Inc. stock. The coins have shorthand names—BTC, SOL, ADA, MATIC, DOT—that look just like stock tickers. ● Not every investment is a security. A bar of gold, a barrel of oil, a 1989 Ken Griffey Jr. rookie baseball card may be considered assets—but they're not securities. They don't fit this legal formula: an investment in an enterprise where the expected profits come from the efforts of others. Ken Griffey Jr. cards rise and fall based on the tastes of baseball card collectors, but Apple's stock price depends on Tim Cook getting the new iPhone right. ● Further stripping out the legalese, Bloomberg News reporters Lydia Beyoud and Allyson Versprille write that "whether something is or isn't a security under US rules comes down to how much it looks like shares issued by a company raising money." The US Securities and Exchange Commission says Bitcoin isn't a security—for one thing, no company or individual issued new Bitcoin to raise cash. But it argues that many other tokens do meet the test. ● The SEC points to how developers of tokens sold them to fund blockchain projects and to how they make tweaks and upgrades that could make the coins more popular and valuable. Sometimes creators "burn" tokens—decreasing the supply and helping boost the price. In that way, the value of the tokens and the actions of their developers seem linked. ● Paul Grewal, the chief legal officer of Coinbase Global Inc., said in testimony to Congress that decentralization gives coins a life of their own: They can thrive even when initial developers quit the project, which isn't true of a stock. The creators of many coins argue that they've merely devised "utility tokens"—coins designed to be used with their technology. For example, a coin might also be the currency inside a game. ● Beyond the lawyers' debate, the securities issue highlights a bigger question: How did crypto burst onto retail markets and draw in millions of traders without much of the oversight and disclosure US investors are accustomed to? Most people agree that didn't go well.

# Let the Sun Shine On Salaries

## Government directives to promote pay transparency are helping narrow the gender gap, especially if they have teeth

The gender pay gap has remained stubbornly wide for decades, despite efforts by governments to narrow it. But a recent rush of legislation and directives aimed at bringing greater transparency on pay appears to be succeeding where other mandates have not—though progress still varies markedly country by country.

Whether it's requiring employers to report pay gaps within companies or publish salary ranges on job postings, or barring them from asking applicants for their salary history, the measures are yielding results, experts say. "Addressing the gender wage gap requires a multipronged approach," says Emanuela Pozzan, senior gender equality specialist at the International Labour Organization. "It's great to see this momentum for pay transparency and its effects on the gap."

One standout has been Iceland, which in 2018 enacted legislation demanding "equal pay, equal value," meaning positions with comparable skills, hours and intensity must be paid the same, regardless of the industry or the job. The law forced companies to justify the reasoning behind each pay and bonus decision. The measure has contributed to the country halving its gender pay gap in the past decade. It's also sparked a wave of similar initiatives around the world.

The latest is from the European Union, which in April published directives to reduce pay inequality in companies. Japan and Australia also recently enacted laws to address their gender pay gaps. "The last few years we've seen a number of countries passing transparency measures, inspired by Iceland's success," says Ines Wagner, a senior researcher focused on labor mobility and gender at the Institute for Social Research in Oslo.

Among the 38 member countries in the Organization for Economic Cooperation and Development, 27 now have some form of pay transparency policy in place, according to a Harvard Business School study, a much higher proportion than a decade ago. Businesses in countries with reporting requirements have an incentive to reduce pay gaps, not just for public-relations reasons but also to attract talent. In Denmark, the differential narrowed 7% after such a law was passed in 2006, according to 2018 research from French business school Insead.

The April EU directive, which allows employees to demand information about salary ranges on internal positions they'd like to apply for, may also serve as inspiration to lawmakers elsewhere, including the US. But there's no one-size-fits-all approach. "Not every measure works for every country, as they each have their own labor dynamics, but implementing a range of specific measures will reduce gaps in the long term," Pozzan says.

Pay transparency measures have been more effective in countries with higher rates of unionization, experts say. Governments are able to bring employers and employees to the table to decide on industrywide pay scales, eliminating company-level inequities.

In Belgium, where almost half the workforce belongs to a trade union, the gender pay gap halved, from 10% in 2010 to 5% in 2021, as a result of collective bargaining and transparency measures. In contrast, the pay gap in the UK, where a quarter of workers belong to a union, stands at 9.4%; in the US, where about 1 in 10 workers are unionized, it's 16.3%. In the US, the fight for pay transparency is largely being waged state by state. Publishing salary ranges on job postings has become mandatory in a number of states including New York in recent years.

In addition, the EU along with 21 US states now prohibit corporate recruiters from asking job applicants for their salary history, a practice that experts say can entrench pay discrimination throughout a woman's career. The US Office of Personnel Management has proposed a similar ban that would



Edited by Cristina Lindblad

apply to all federal workers. A 2020 analysis by the *Harvard Business Review* found that such bans resulted in an 8% pay increase for women and a 13% pay increase for Black employees.

Pay reporting legislation—if not combined with fines, industrywide pay negotiations or other measures—can fail to effect change. That's been the case in the UK, where the gap has barely budged in the five years since the reporting requirement has been in place. "Companies that publish their pay gaps every year, without facing any consequences for the disparities, have to an extent normalized it and aren't doing much to reduce it," Wagner says.

To deal with the shortcomings of pay transparency, countries have experimented with various methods of enforcement. In Iceland, noncompliant companies must pay a daily fine of 50,000 krona ($364). In Cyprus, Serbia and Spain, labor inspection officials regularly audit companies' pay decisions. Other nations have instead gone with moral suasion: Chile's Ministry of Women and Gender Equity confers "equality awards" on companies. "Pay transparency must be done in conjunction with enforcement to be effective," says Minna Cowper-Coles, a fellow at the Global Institute for Women's Leadership at King's College London.

One concern Cowper-Coles raises is that most of the legislation today targets companies, which shifts the onus away from governments. Politicians should be doing more to tackle structural obstacles to women's advancement in the workplace, she says, including expanding the supply and lowering the cost of child care.

Addressing the problem that women's work is undervalued—especially in professions that are overwhelmingly female such as nursing, elder care and education—would also do more to reduce the gap than individual companies' pay efforts, Cowper-Coles says. "At the end of the day, we're talking about much more than individual companies paying women less," she says. "It's a systemic societal issue that requires systemwide answers." —*Alice Kantor, with Jeff Green*

ILLUSTRATION BY ARD SU

THE BOTTOM LINE Iceland leads the way in prodding companies to address pay differentials between men and women. The US and the UK show that gentle nudges don't suffice.

# Taxing China

● The country needs more revenue to expand welfare and bolster local government finances

In the coming years, Xi Jinping will come under pressure to do something he's never done before: oversee nationwide tax increases that could alienate China's wealthy and its middle class.

The Chinese leader has presided over the largest tax cuts in the country's history. Tax revenue equaled 21% of gross domestic product in 2021, compared with about 27% in the US. Less than 10% of China's population pays any income tax at all.

The cuts have spurred business expansion and household spending, boosting economic growth, according to China's leadership. To make up for the forgone income, Beijing and local governments have stepped up bond issuance. They've also become more reliant on other sources of revenue, such as sales of land to developers. But that funding model is under severe strain as urbanization in China slows, cooling demand for new housing. "There's gradually a deeper understanding that the current fiscal trajectory is not sustainable," says Bert Hofman, former China country director for the World Bank. "That includes recent tax cuts."

Dozens of Chinese cities have racked up large debts and are struggling to pay salaries for civil servants and teachers. Among them is Hegang, a metropolis of 1 million near the border with Russia whose fiscal problems have generated headlines. In the 1990s, when a large number of municipalities had difficulties making payroll, China's leaders responded with a fiscal revamp centered on a value-added tax (VAT) and a business profits tax. Collections rose rapidly, and by the 2000s, China's central government was taking in enough to fund a basic welfare state. (The introduction of mandatory employer and employee contributions to fund social security, unemployment, health and other benefits was also critical to achieving this milestone.)

But local Communist Party cadres had greater ambitions. To turbocharge local economies—and improve their own odds of political advancement—they spent lavishly to prepare rural land for development. That required providing compensation to tenant farmers, demolishing existing homes and other structures and then building roads, power lines and water mains. These activities have consumed about a fifth of all government spending in recent years.

The process paid for itself when the converted acreage was sold to developers at a profit. The apartment towers and factories that sprang up attracted an influx of residents, driving land prices higher. But as urbanization has slowed—65% of the population lived in cities last year, up from 30% in the mid-90s—the gusher of money into local coffers has dwindled to a trickle.

China's fiscal system—in which nontax income such as land sales and profits from state-owned enterprises contributes a third of government income, and the biggest sources of tax revenue are levies on sales, such as a VAT—is not so unusual in developing economies. Politically, it works for the Communist Party, says Zhang Changdong, a professor at Peking University. People are less apt to notice or object to such indirect levies, he says, and having little or no income tax lowers "citizens' demand for public goods or representation." Still, it's out of step with the leadership's ambitions to graduate into the ranks of advanced economies, where government spending is financed primarily by taxing individual and corporate income. "It is important and necessary for China to move toward a tax system that relies on tax revenue and especially direct taxes," Zhang says.

One big reason: Social welfare spending will

▼ Hegang's fiscal crisis has attracted national attention

QILAI SHEN/BLOOMBERG

need to rise as China's population ages and a better-educated workforce is needed to support a more sophisticated, high-tech economy. Currently, public outlays for pensions, health care, education and the like amount to about 13% of GDP, compared with 25% in wealthy countries.

Second, as China's urbanization level approaches those of mature economies, local governments will have to find a new source of income. The government has been talking about rolling out a property tax across more cities since 2021. (Only Shanghai and Chongqing currently have one.) But that plan was put on hold during the pandemic. One hurdle to reviving it was cleared in April, when the Ministry of Natural Resources announced it had finished assembling a national register encompassing more than 1.5 billion property records.

Bigger obstacles may lie ahead. China's middle class has about 70% of its wealth tied up in housing, so a property tax "could generate resistance or even protests," Zhang says. Consequently, the government is likely to institute any property taxes cautiously and at a low rate—which means they're not likely to generate sufficient revenue to fund the kind of welfare spending China will need.

The most obvious other option is lowering the tax threshold on personal income and whittling down the numerous exemptions. The tax on personal income currently generates revenue equivalent to just 1% of GDP—but economists say the level could rise to the 4% seen in South Korea without sparking a furor. Even keeping the threshold steady might be sufficient to expand tax collection, because incomes in China are still rising, albeit at a more moderate pace than in earlier decades.

Wealthy Chinese have been "breathtakingly successful" in opposing measures that would increase their income tax burden, says Wei Cui, a law professor at the University of British Columbia. China's well-to-do have few political rights, but they can vote with their wallets. A government hint of tax increases led to a selloff in China's equity market in October.

Still, Xi and his top officials might not roll over so easily this time. In the past few years, they've been willing to alienate business elites with a fierce anticorruption campaign and regulatory clampdowns on internet companies. Beijing has also cracked down on celebrities it accuses of being tax cheats: Fan Bingbing, arguably China's most famous actress, was fined 883 million yuan ($124 million) for tax evasion in 2018.

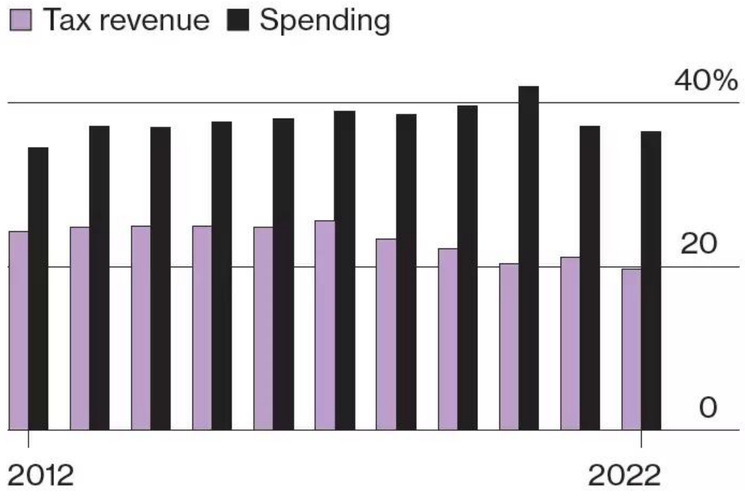
The collision of fiscal need with internal politics is likely to result in a set of compromises and muddling through. Local governments will have to scale back spending on land conversions as sales fall. Municipalities that relied on a build-it-and-they-will-come formula for development will need to shift to providing better services to attract employers and residents.

China's central government can also do more. Its debt amounted to just 47% of GDP in 2022, according to Goldman Sachs, versus 129% for the US federal government. Even if it were to shift some local government debt, which is equal to 78% of GDP, onto its own balance sheet, the central government has space for more borrowing. It's already happening: Bond issuance in the first quarter was the largest in more than two decades.

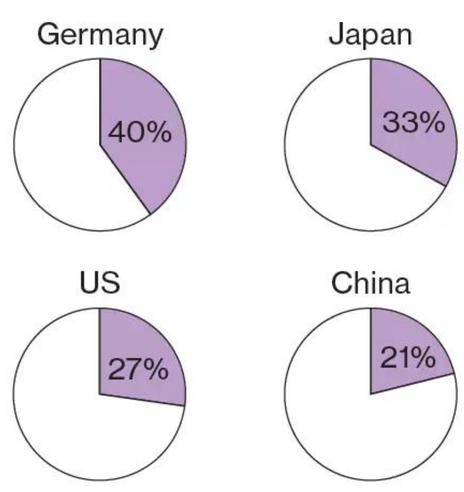
## The Taxman Cometh

China needs to boost revenue to keep up with rising government spending

China's government revenue and spending, as a share of GDP




Tax revenue in 2021, as a share of GDP




DATA: CHINA MINISTRY OF FINANCE, CHINA NATIONAL BUREAU OF STATISTICS, OECD

And more of the proceeds were allocated to local governments.

At the same time, Beijing can tap more resources from state-owned companies. By even marginally boosting their profitability, or raising the share of profits they must hand over to the government from 20% to 30%, China could fill most of the gap left by falling land-sales revenue, according to estimates by Chinese economists.

The fiscal transition won't be uniform throughout China. Some cities with the potential for rapid urbanization will still find the old model works for them. Others are further ahead: Shenzhen, China's tech hub bordering Hong Kong, took in less than 6% of its revenue from land sales last year, while its tax-to-GDP ratio, at 33%, is far above the national average. "This requires good academic debates. The ministries need to put pen to paper and see what can be done," Hofman says. "It doesn't need to happen overnight, or this year." —*Tom Hancock*

THE BOTTOM LINE Xi Jinping will have to raise taxes, instead of cutting them, to head off a fiscal crisis as urbanization peaks and the population ages.

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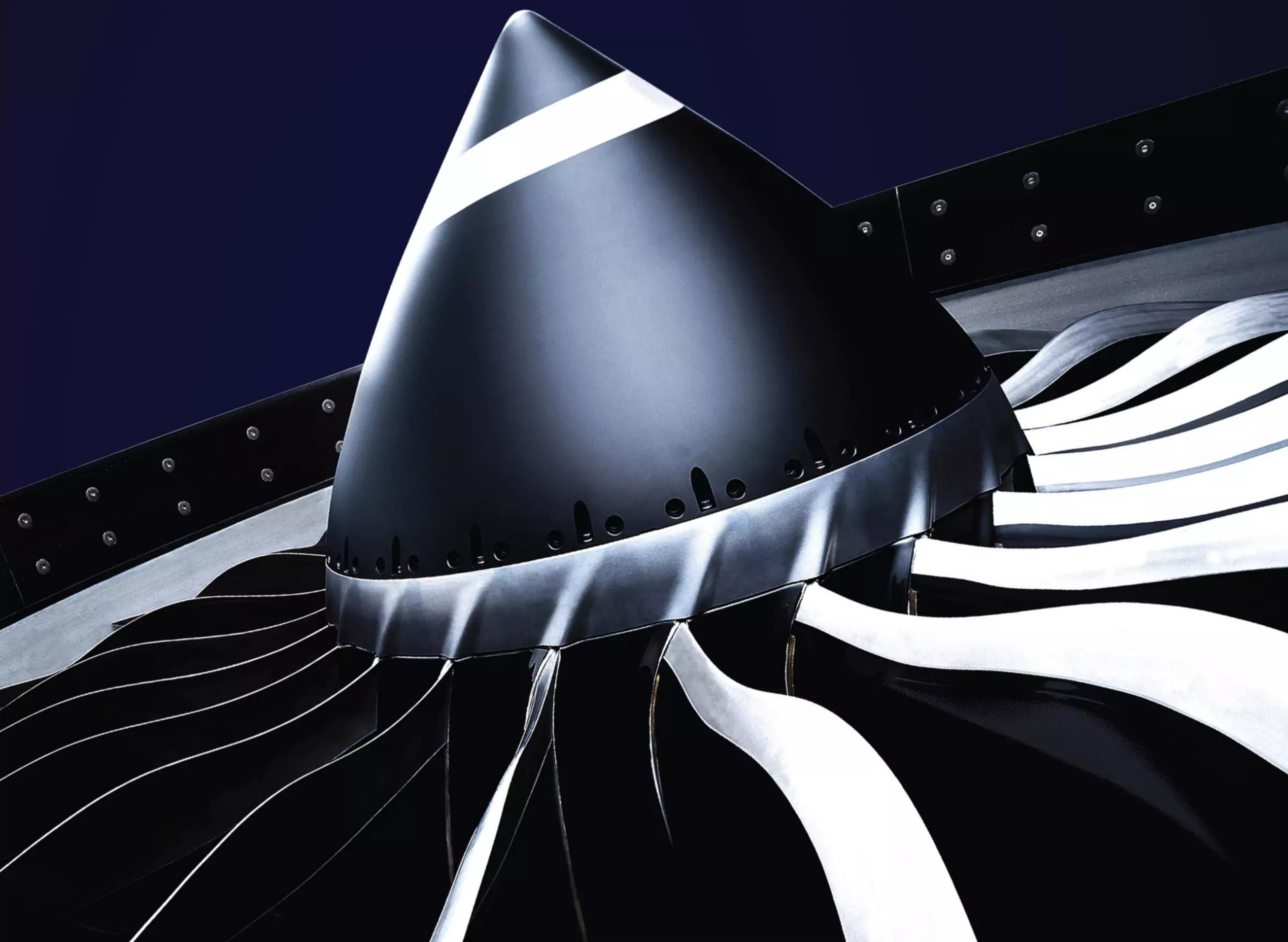
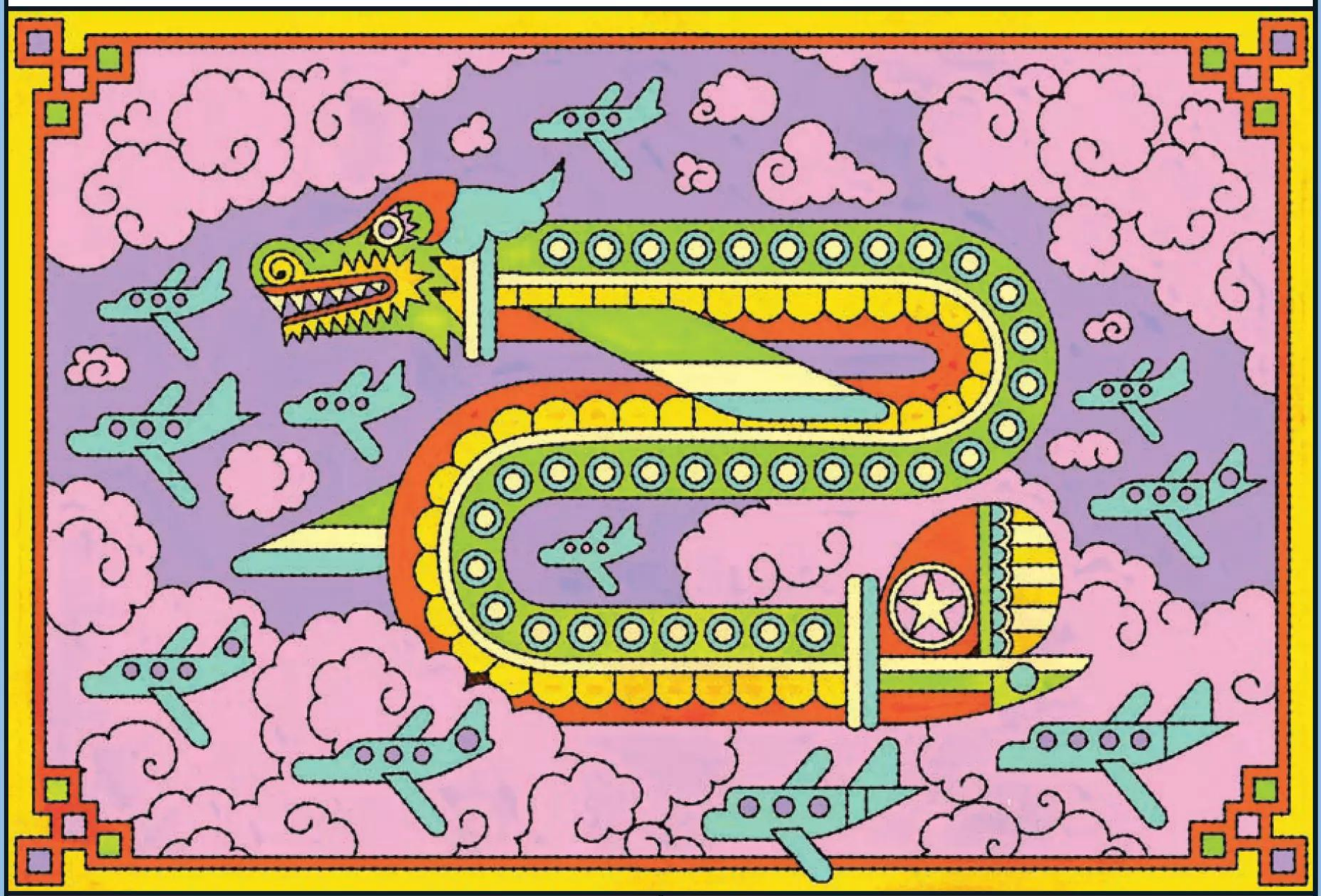


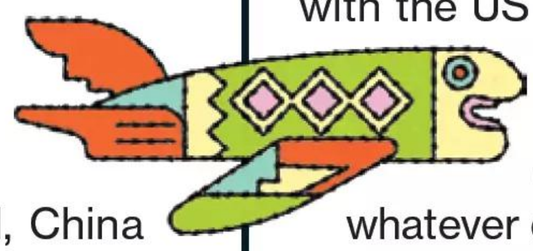
# Boeing Bounces Back in China

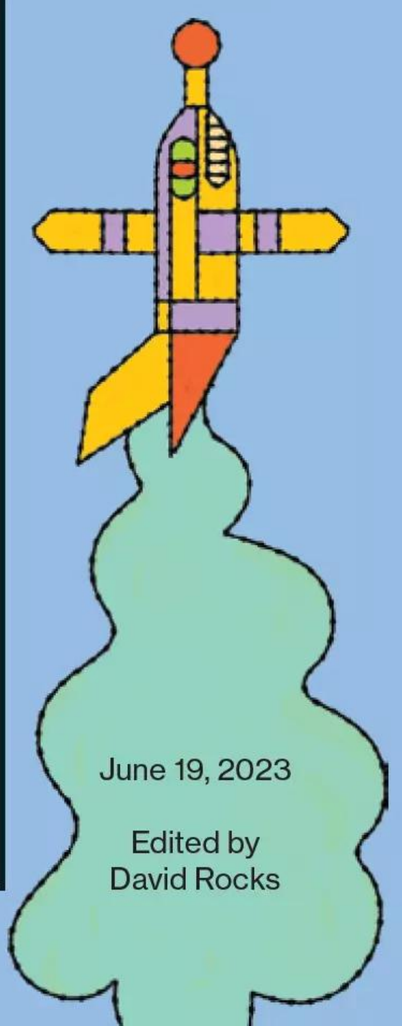


After years of anemic sales to Chinese carriers, the company is bullish again

China has steadily edged closer to unseating the US as the world's biggest commercial aviation market in recent years, making the country a must-win for Boeing Co. By 2019, with airlines such as China Eastern, China Southern and Air China carrying ever more passengers across the country and around the world, China accounted for almost a third of purchases of the Boeing 737. Even after Airbus SE opened an assembly line in Tianjin in 2008, its American rival ruled Chinese skies. If China wanted to keep its citizens airborne, it appeared, the country needed jets from Boeing.

Then two fatal crashes involving the 737 Max—the most advanced version of the plane—spurred regulators around the world to ground the model. Growing trade tensions with the US further dampened China's interest in buying from the biggest US exporter, and the country's harsh coronavirus lockdowns killed off whatever demand remained. As orders from the company's biggest overseas market ▶





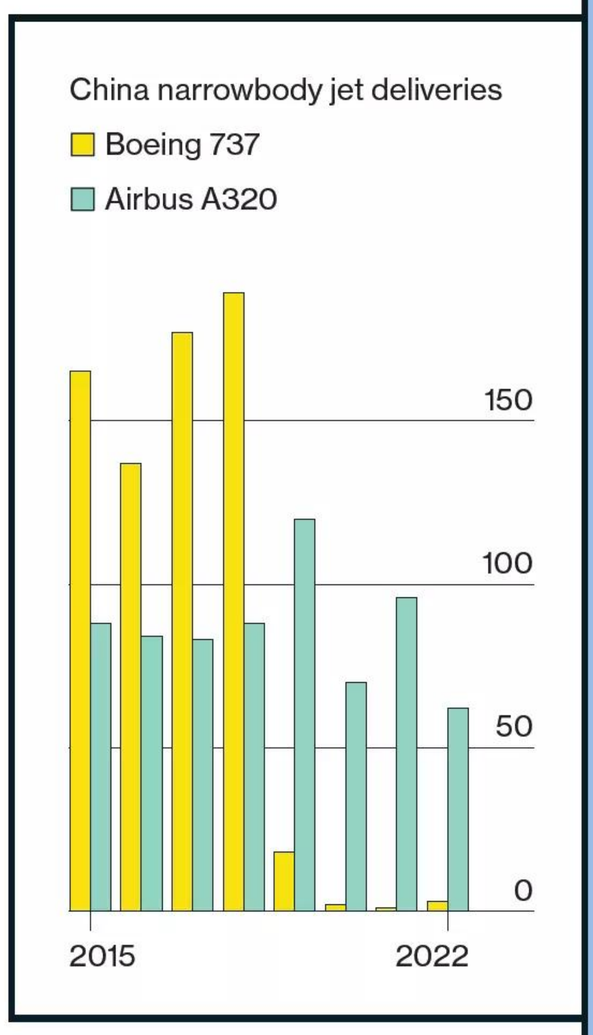
June 19, 2023

Edited by David Rocks

ILLUSTRATIONS BY NOLAN PELLETIER

◀ virtually evaporated, it suddenly began to look as if Boeing needed China more than China needed Boeing.

Since 2020, Airbus has delivered 384 jets to the country, versus just four for Boeing, according to researcher Cirium. After Airbus in July signed a deal to sell 292 planes in China, Boeing bemoaned the "geopolitical differences" blocking exports of its jets, noting that $10 billion in aircraft—mostly 737s—destined for China were stuck in limbo. By September, Boeing was offering those planes to other buyers, and Chief Executive Officer Dave Calhoun was running out of patience. "You've got to move them," he told reporters in Washington at the time. "You can't wait forever."

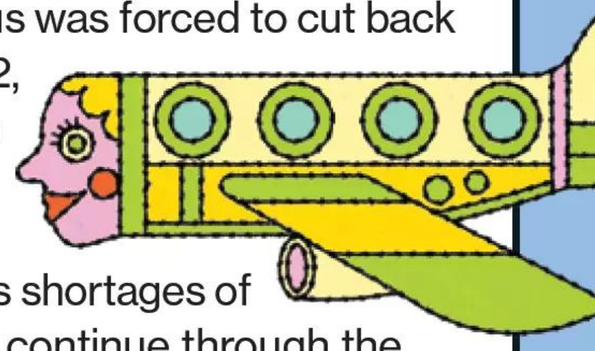



But in the past few months, Boeing's fortunes in China have turned. In January the government ended its pandemic restrictions, unleashing a rebound in travel that has traffic approaching pre-Covid levels, and a few weeks later China allowed the 737 Max to fly again. Even as the US and China spar over trade, tariffs and Taiwan, Boeing executives are increasingly confident that within weeks the company's jets could be winging their way to Chinese buyers. "It feels like there is some momentum toward more commerce," Calhoun says.

With aviation roaring back, new jetliners are increasingly hard to come by. The Max is sold out until 2027, and Airbus' waitlist stretches almost until the end of the decade. After years of lockdowns, China's citizens are eager to travel again, but its airlines are grappling with a shortage of aircraft to carry them, shifting the balance of power again in Boeing's favor. "When you have a surplus of jets, you can mess around with political messages," says aviation consultant Richard Aboulafia. "But if the market takes over, the market takes over."

China understands its carriers will have to jostle with rivals worldwide for delivery slots years from now. Irish discounter Ryanair Holdings Plc in May locked in orders for as many as 300 Max jets that it will start flying in 2027. In December, United Airlines Holdings Inc. snapped up 200 Dreamliners, Boeing's most advanced widebody, as well as 100 737s. And Air India, Riyadh Air (page 32) and Turkish Airlines all have mega-orders in the works.

Adding to the scarcity of aircraft is a supply chain that's still struggling three years after the pandemic first convulsed global markets. Airbus was forced to cut back its delivery targets twice in 2022, handing over fewer jets than anticipated. Calhoun expects the seller's market for planes to last another half-decade or so as shortages of seats, engines and other parts continue through the end of next year.



Airbus still has the commanding lead it built in China—and around the globe—while Boeing was consumed by the Max crisis. But it will be many years before Commercial Aircraft Corp. of China, the country's homegrown manufacturer, can become a real challenger to Boeing, according to Cirium head Rob Morris. That won't happen until China's answer to the Max, the C919, can prove its reliability flying heavy daily workloads and the Chinese company can build the jet on a mass scale, suggesting that the nation's airlines will need to start ordering the Max if they want to meet rising demand for seats. "I do see a credible path for Boeing to regain some element of market share in China, even if politics seem to be a huge roadblock," Morris says.

Since January, Chinese carriers have pulled about three-quarters of the 97 Max planes they own out of storage. And in April the national aviation regulator removed the remaining technical hurdles to resuming deliveries of the 140 waiting in Boeing's storage lots. The final step in restarting Max exports is for China's central economic planning agency "to simply say, 'Deliver the airplanes,'" Calhoun says. "They're already ordered, they're on our tarmac—the airlines want them." —*Julie Johnsson*

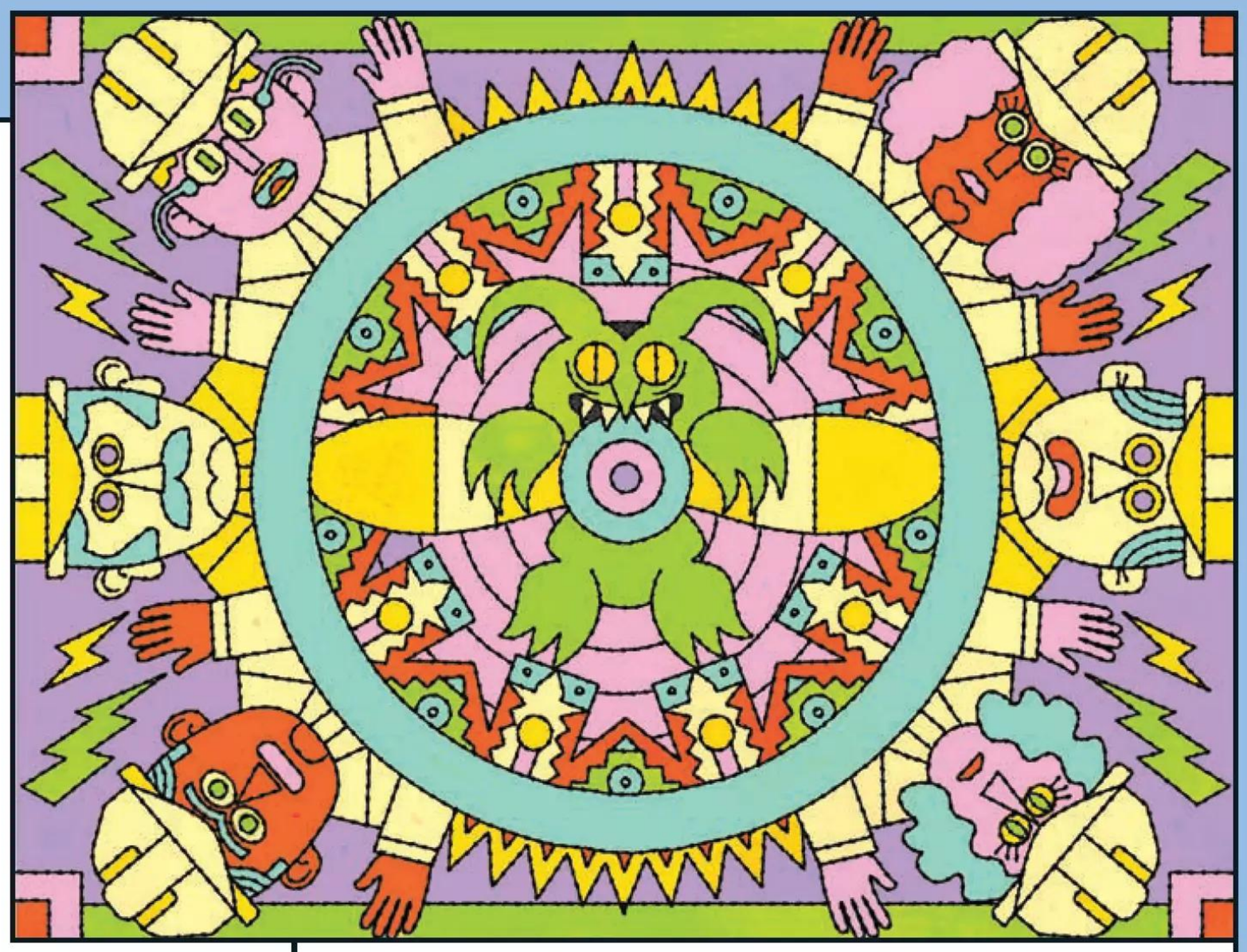
THE BOTTOM LINE In 2019, China accounted for a third of 737 purchases. But since 2020, Boeing has sold just four jets there, versus Airbus' 384, spurring managers to bemoan "geopolitical differences" blocking exports.

# Engine Trouble

The turbines for the most popular Airbus model need service sooner than expected

A dozen years ago, Airbus SE stormed the Paris Air Show with the A320neo, a single-aisle jet boasting improved fuel economy and less noise. A key part of the sales pitch was the choice of competing engines from Pratt & Whitney and CFM International made

ILLUSTRATIONS BY NOLAN PELLETIER. DATA: BLOOMBERG INTELLIGENCE, CIRIUM



with advanced coatings and composites, giving the planes a faster cruising speed with lower emissions. Airbus walked away from Paris with fistfuls of orders, and the A320neo soon became the fastest-selling airliner in history.

As the aviation industry gathers again on June 19 outside the French capital, the fuel-sipping turbines are back in focus—but for the wrong reasons. Durability issues and overtaxed engine repair shops have forced carriers to park many of their newest jets, sometimes for months. Although the engines have delivered on their promised fuel efficiency and generally perform better than earlier models, the manufacturers acknowledge that they haven't been as robust as envisioned.

While the challenges have weighed on CFM, Pratt's record is worse. Its engines "have suffered from a multitude of defects and a high rate of failure effectively from day one," India's Go Airlines said in a statement, blaming the technology for its slide into bankruptcy in May. Pratt says it's not responsible for the carrier's financial condition and insists that overall durability is in line with or better than previous versions. "We are seeing extremely strong demand," says Shane Eddy, the company's president.

In May about one in eight A320neos and related aircraft equipped with Pratt's geared turbofan, or GTF, had been in storage for 30 days or more, according to researcher Cirium. The tally—which includes planes taken out of service for any reason, not just engine issues—compares with 4% for those with the rival Leap engine from CFM, a partnership of General Electric Co. and Safran SA. At the same time, scores of other GTF-powered narrowbodies were also grounded: about 17% of the smaller Airbus A220, and 11% of Embraer SA E2 regional jets.

Pratt spent $10 billion developing the GTF, which uses a gearbox to allow the fan to spin more slowly than its fuel-burning turbine. Airbus says that boosts efficiency by about 20%, but airlines make purchasing decisions on multiple factors such as operating costs, durability and reliability. And as some GTF components wear out faster than anticipated, airlines have been forced to repair them sooner than planned. A post-Covid-19 shortage of mechanics has further slowed the planes' return to the skies.

At this year's Paris show, Pratt's parent company, Raytheon Technologies Corp., is set to host an investor day, where executives will surely be quizzed on the problems. While CFM appears to have a handle on the issues facing the Leap, the troubles with the GTF are on the rise, according to Bernstein analyst Douglas Harned. "Leap durability is materially better," Harned wrote in a May research note, suggesting that the model "may be the A320 engine choice for those not already committed."

A growing share of sales of both aircraft and engines will likely come from fast-growing markets such as China, India and the Middle East, according to Bloomberg Intelligence analyst George Ferguson. And the dust, heat and pollution in those locations, he says, have amplified the latest engines' durability shortfalls. "You want to be ready to grow market share in those regions, and without a total fix right now, it makes it hard," Ferguson says.

The situation sets up the Paris show as a test of whether Pratt's woes will push more airlines to opt for the Leap. The GTF is now on 46% of the roughly 2,800 A320neos that have been delivered. Of the 6,000 or so on order, airlines have chosen the Leap for 37% versus 24% for the GTF, according to Cirium. That leaves some 2,300 jets still up for grabs, and more orders are likely to be announced in Paris, so Pratt can still reach parity over time, says Cirium consultant George Dimitroff. With a reengineered version dubbed the GTF Advantage that Pratt says incorporates multiple durability upgrades set to go on sale next year, he says, many airlines are waiting for more data. "They are likely to take their time," Dimitroff says, "and observe the reliability and performance of both CFM and Pratt engines as they mature before making a decision." ——*Ryan Beene, with Anurag Kotoky*

THE BOTTOM LINE Roughly 1 in 8 Airbus A320neos and related planes with Pratt's GTF engine have been in storage for 30 days or more, versus 1 in 25 for those with the rival Leap from CFM.

# A Saudi Bid to Rule The Desert Sky

Riyadh Air is scheduled to start flying in 2025 with dozens of new jets

In the 78 years since Saudi Arabia launched its flag carrier, Saudia, with a plane gifted by US President Franklin D. Roosevelt, the airline has served largely as a means of ferrying the faithful to Mecca while adhering to the country's strict social rules. No alcohol is served. Women must wear clothing that covers their legs. Cabin crew can separate women from men who aren't family. And some planes have a prayer nook with a screen indicating the direction to Mecca as it changes during the flight.

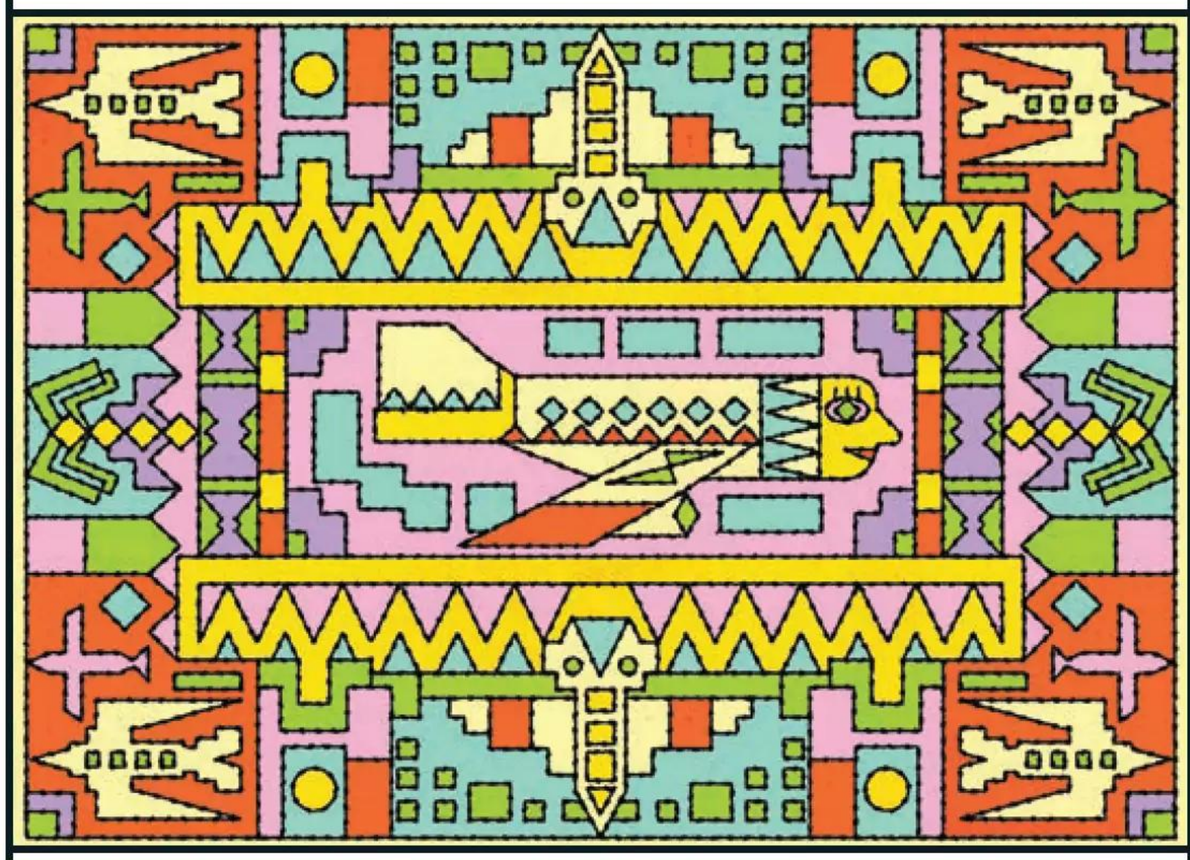
Saudia stands in sharp contrast to regional rivals that have redefined luxury travel with showers, in-flight butlers and bars where premium-class passengers can recline on a sofa, tumbler of Glenfiddich in hand. Emirates, Qatar Airways and more recently Turkish Airlines have built megahubs for travelers between Asia, Europe, Africa and North America. And their home bases have increasingly become destinations rather than mere transfer points, with beaches, amusement parks, high-end shopping and sumptuous hotels within easy reach of the arrival gate.

To get in on the action, Saudi Arabia is adding a new airline, Riyadh Air, aiming to triple arrivals into the kingdom. While the plan is short on details, the carrier aims to start flying in 2025, with planes bathed in blue and lavender hues inspired by a "desert in the spring." The company declines to say whether alcohol will be available onboard, noting only that it will operate within Saudi law. Saudia will continue to focus on religious pilgrims on Hajj and Umrah.

Riyadh Air plans to reach 100 destinations by 2030, connecting passengers through King Salman International Airport, a sprawling facility rising in the desert near the capital that's designed to handle 120 million passengers a year by the end of the decade—30% more than Dubai's current capacity. The goal is to tempt them to stay for business meetings or jaunts to the country's monuments, mountains and beaches.

The carrier has ordered 39 Boeing Co. 787 Dreamliner jets, with options for dozens more, and it's in the market for as many as 400 narrowbodies. Industry watchers expect it to present another blockbuster deal at the Paris Air Show, where it's planning a gala at the five-star, Saudi-owned Hotel de Crillon overlooking the Place de la Concorde. "Saudi Arabia's growing population has a need for world-class connectivity," says Tony Douglas, the company's chief executive officer, an aviation veteran who until recently ran rival Etihad Airways. "Given the size of the kingdom in terms of land mass, having more than one national carrier is essential."

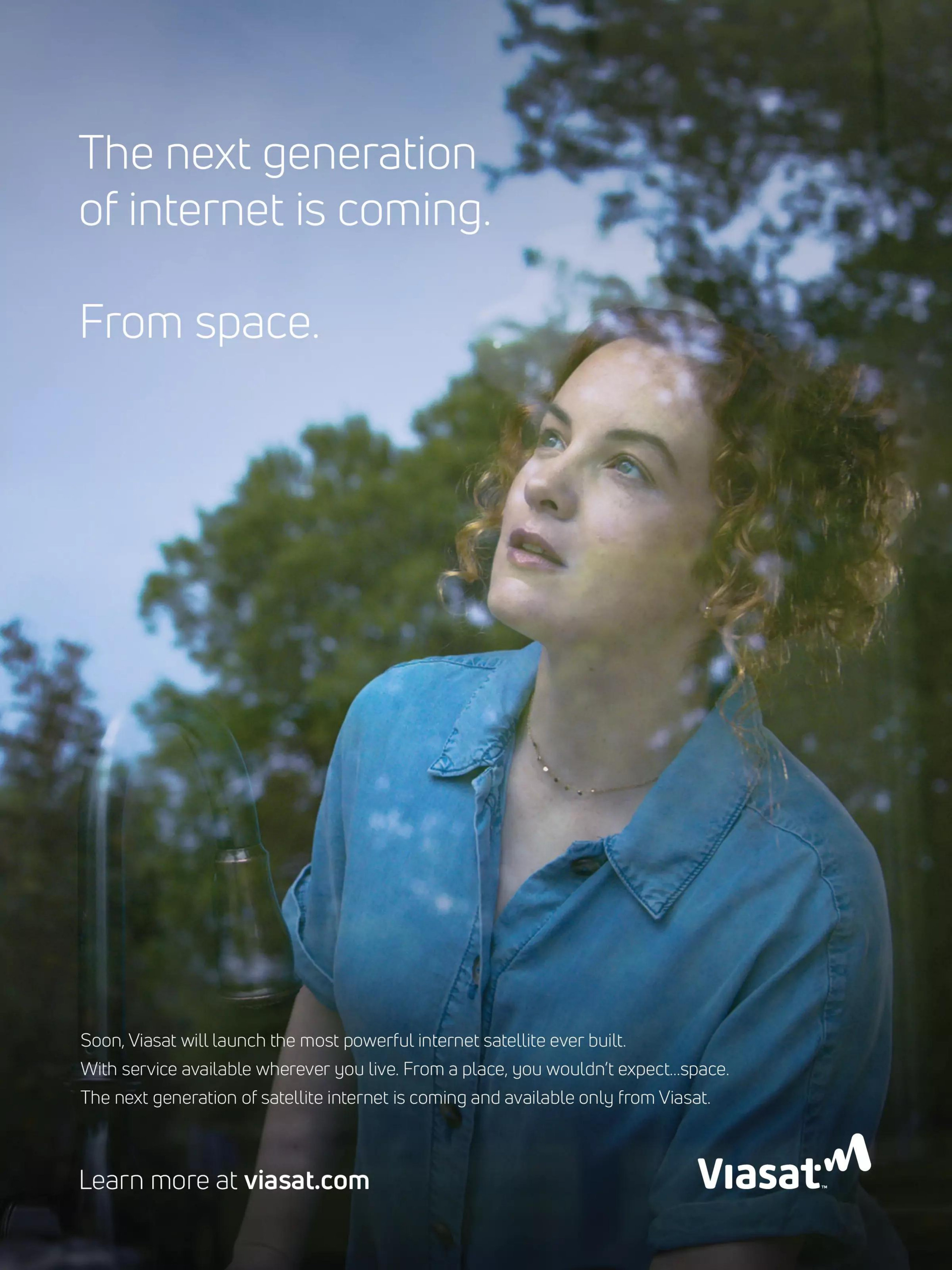
The moves are part of a wider effort by Crown Prince Mohammed bin Salman to diversify the economy beyond oil, with soft-power investments in sports, entertainment and tourism. But getting the masses to visit a hot, dusty land where liquor isn't served is a tough sell, no matter how luxurious the planes. "While there's no doubt that Saudi Arabia has the means and resources to pour into building out its tourism industry, it doesn't mean it will be easy," says John Strickland, an analyst at JLS Consulting in London. "Riyadh Air will be going up against Qatar and Emirates, which have spent years building their business."



Yet the Saudis have ambitious plans. As the focus changes from pilgrims to leisure travelers, they say they'll add a low-cost carrier flying from Dammam, the center of the country's oil industry, and another new full-service airline based in Neom, the futuristic city under construction on the Red Sea coast. The aviation push, says Mohammed al-Khuraisi, vice president for strategy at the kingdom's General Authority of Civil Aviation, "directly supports the industries that are essential to the kingdom's Vision 2030 agenda, including tourism." —*Siddharth Vikram Philip*

THE BOTTOM LINE Riyadh Air aims to serve 100 destinations by 2030 from King Salman International Airport, a planned facility expected to handle 120 million passengers a year—30% more than Dubai's current capacity.

ILLUSTRATIONS BY NOLAN PELLETIER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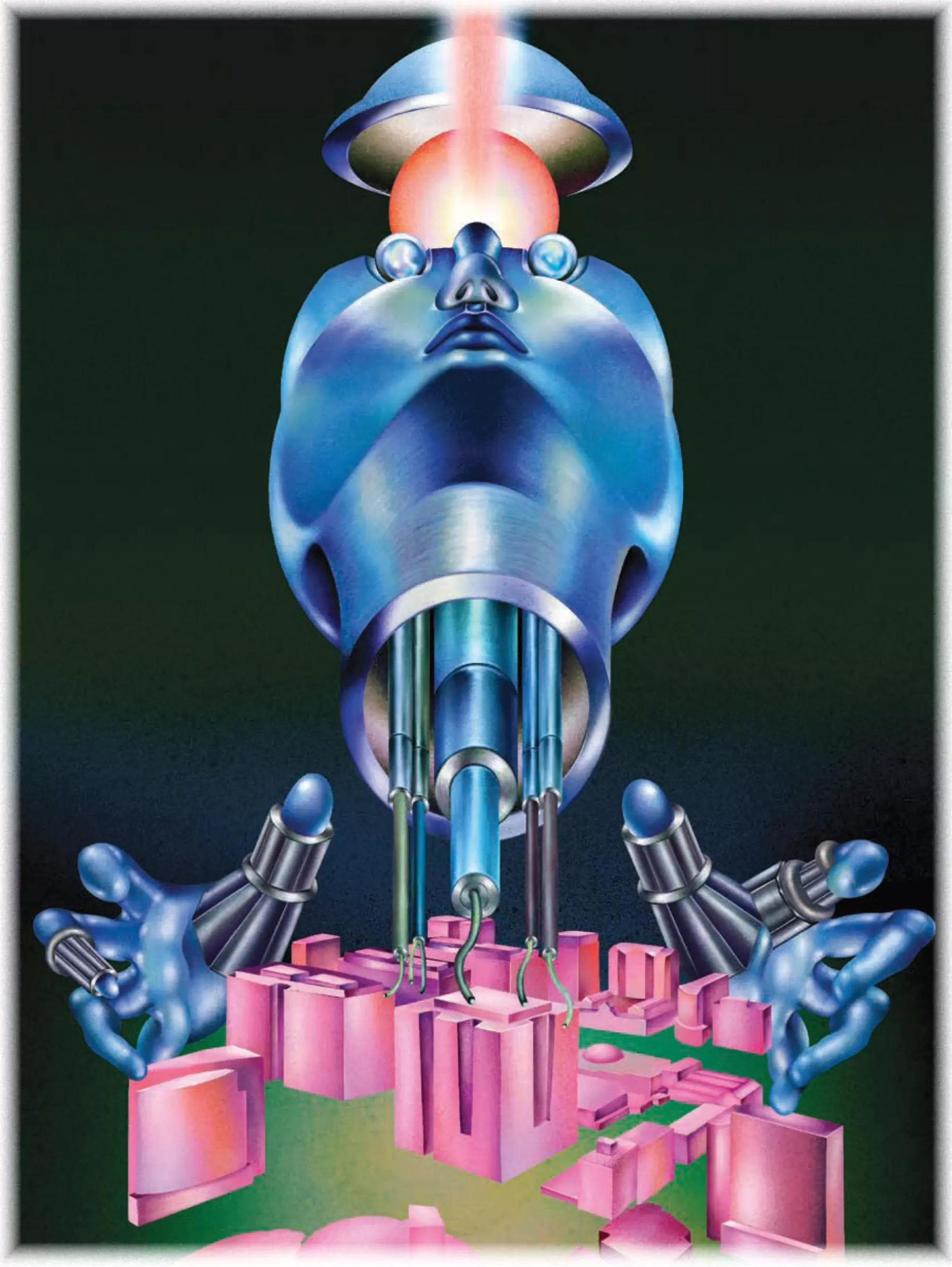
# Can AI Save Silicon Valley?



**The next big moment has arrived. We're here to start sorting the early winners from the hype**

By Brad Stone
Illustration by Lulu Lin

In late May, 300 entrepreneurs, venture capitalists, journalists and assorted self-described thought leaders crammed into Shack15, a stylish social club on the second floor of San Francisco's Ferry Building, where most spoke in soaring terms about what they saw as the next gold rush. The gathering, dubbed a "Generative AI Meeting of the Minds," would've been unthinkable during the pandemic and improbable earlier this year, when the city's main obsessions often seemed to be car break-ins and retail store closures. The night had the feel of a religious revival. "Something is happening, something is cracking open," said the evening's host, futurist writer Peter Leyden, in the first of many upbeat speeches. Just as everyone "was talking about the demise of San Francisco, how everyone is leaving the Bay Area, how no one wants to live in California, how we are in doom loops—that's exactly the time you know the place is right about to burst open in reinvention," Leyden said to applause. The speech, the whole event, captured the feeling coursing through tech circles these days: Silicon Valley is back.

Only a few months ago, layoffs, cratering share prices and startup valuations, and the fallout from scandals at FTX and Silicon Valley Bank dominated headlines. It felt as if the entire industry was primed for a long retreat after years of parody and techlash. Now the talk of the town is artificial intelligence: chatbots such as ChatGPT and Google's Bard, image creation tools Dall-E and Midjourney. There's hope that tech might inflict yet another Jobsian dent in the universe.

"Nothing in the tech industry was really working—remote-work trends, people leaving, there was crypto, which got pushed out of the US. I think the mood was quite bad," says Sam Altman, chief executive officer of startup OpenAI, which was knighted in January with a $10 billion investment from Microsoft Corp. "So the fact that AI happened here, and AI companies are in-person in a world of remote-first work, I think it totally pulled the center of gravity back to San Francisco."

It was arguably eight researchers at Google who laid the groundwork for this reversal. In a seminal 2017 paper called "Attention Is All You Need," they proposed a novel system for how machines might learn like humans, or at least seem to. The devices would consider long sequences of data, like chunks of text, and weigh each word in relation to what came before, while considering grammatical patterns. This idea wasn't merely a fancy version of autocomplete; it represented a breakthrough in getting computers to better mimic both human reasoning and a facility with sequences such as language and computer code.

When the Google employees presented the paper at an AI conference in Southern California that December, researchers from OpenAI were there, taking notes. The first version of OpenAI's GPT, which employed this architecture, was released the following summer. (GPT stands for "generative pretrained transformer.") Subsequent versions were fed more information from the web, including Wikipedia entries, Reddit posts and newspaper articles. Then ChatGPT, based on a version of GPT-3 and released broadly last fall, dazzled with its conversational legerdemain, and the more advanced GPT-4 followed earlier this year. "It's a game changer, a world changer," says Oren Etzioni, a professor emeritus of computer science at the University of Washington, expressing an enthusiasm common now in AI academia. "We're at the very beginning of this, and it is a very fast-moving phenomenon."

"There are a lot of AI tourists pretending to be natives"

The result is a frenzy not seen since the dot-com fever of the late 1990s. Tech CEOs are reorienting their companies toward AI and raising their stock prices simply by mentioning the subject on earnings calls. Venture capitalists are reevaluating their portfolios and piling into AI startups. JPMorgan Chase & Co. estimated that AI excitement drove 45% of this year's gains in the S&P 500 through April. That excitement also led to a frank reassessment of previous trends, such as web3 and the metaverse, whose appeal to regular folks now seems thin or imagined next to the prospect of smarter machines answering bigger questions. Beneath the marketing-speak rests the potential for genuinely amazing advances, such as the recent AI-assisted discovery of a new type of antibiotic treatment for a drug-resistant superbug.

That so much of this energy remains concentrated in Silicon Valley, the constantly transforming region between San Francisco and San Jose, marks another twist. During the worst of Covid-19, evangelists for a tech diaspora tried mightily to brand cheaper, less pandemic-restricted cities. Larry Ellison moved Oracle Corp.'s headquarters to Austin in 2020, and Elon Musk followed a year later with Tesla Inc. Miami Mayor Francis Suarez earned a national profile almost entirely for promoting the city as a cryptocurrency hub. Valley expats tweeted incessantly and insufferably about the charms of Miami, or Los Angeles, or New York, or Puerto Rico.

● JPMorgan Chase estimated that AI excitement drove **45%** of this year's gains in the S&P 500

● Startup OpenAI received **$10b** in investment capital from Microsoft in January

The largest tech companies, however, remain in the Bay Area and its kin to the north, Seattle. Alphabet, Apple and Meta, Microsoft and Amazon.com have been hiring AI talent for years. As most of them cut payrolls and streamlined operations to account for the relative austerity that comes with higher interest rates, they're indirectly creating new competitors, too. For example, Alphabet Inc.'s consolidation of its two AI divisions, Google Brain and DeepMind, "will cause people to leave, and the best ones start startups, because they're much more mission-driven than paycheck-driven," says Vinod Khosla, founder of Khosla Ventures and one of OpenAI's earliest backers. "That's the raw material we feed on and that, in five years, will look like OpenAI today."

For San Francisco, the AI boom is a rare bright spot amid embarrassing national headlines about crime, homelessness and open-air drug markets that threatened to drain the city of its tech class. Ivan Porollo was one of those founders drawn to the Bay Area by the famed startup school Y Combinator. But he fled during the pandemic, first for New York, then LA, then Lisbon. In January he returned to start a business that promotes AI hackathons and conferences, taking a name from the informal designation for the city's Hayes Valley district, where AI startups have clustered: Cerebral Valley. "Everyone went into the new year with this newfound energy around AI," Porollo says.

Many of these evangelists seem to know one another and exult in their petty rivalries. In the cramped Palo Alto offices of Character.AI, a service that allows users to create chatbots with persistent simulated personality traits or to interact with representations of real and fictional people such as Musk and Harry Potter, a dozen employees sit shoulder to shoulder at enormous computer screens while a tiny Bichon Maltese wearing a blue checkered vest wanders the floor. "We invented a lot of this stuff. We taught OpenAI most of what they know," scoffs co-founder Noam Shazeer, a co-author of Google's seminal AI paper. Shazeer credits the Valley's staying power to its willingness to quickly redirect energies and resources from old fads—say, crypto mining—to new ones, like running AI algorithms.

Previous Silicon Valley booms have ended with casualties: money lost, dreams dashed and masses of startups folding. Alexandr Wang, CEO of Scale AI in San Francisco, thinks there's more profit potential for tools that make organizations smarter and more efficient. His seven-year-old company recently licensed Donovan, its "AI-powered decision-making platform," to the US Army's XVIII Airborne Corps, where it will digest thousands of situational updates and intelligence reports to help war planners make better decisions. But Wang acknowledges that the tech world is running the same old playbook, funding an excess of companies to find a few winners, which attracts plenty of pretenders and bad investments. "There are a lot of AI tourists pretending to be natives," he says. "Ultimately they're just selling vaporware."

AI skeptics have good reasons to be skeptical. They seize on the questionable accuracy of the new tools; the risks for misinformation, deception and bias against women and people of color; and the fallout if the industry's ambitious promises turn out to be empty. And they point to recent history. A decade ago the tech industry promised self-driving cars. Today there are a handful of driverless taxi pilot programs and improved cruise control systems in modern cars, but the sector has been marked by retrenchment and retreat. "If there's a boom, there's definitely going to be a bust," says Mar Hicks, an associate professor of technology history at the Illinois Institute of Technology.

Avoiding an AI hangover might as well be the mission statement for this annual tech issue of *Bloomberg Businessweek*, which aims to serve as a guide to this new frontier and as a bit of a hazards map, too. We'll explain how Microsoft's blockbuster $10 billion investment in OpenAI positioned it to exploit the trend and get a leg up on rivals; how AI is reshaping Silicon Valley's hiring practices; how Huawei and other wireless companies have tried to prepare for the next big fight; and how it pushed Nvidia Corp. to the brink of a $1 trillion market value. Alphabet CEO Sundar Pichai has the last word on helping his company meet the moment and guarding against an industrywide AI meltdown.

Back in San Francisco, many people aren't ready to consider that the AI boom might amount to just another bubble. This, too, may explain the area's remarkable endurance at the center of American tech. The young engineers and entrepreneurs flocking to Cerebral Valley and its environs weren't necessarily around to learn the painful lessons from the last cycle about the fickleness of trends and the risks of competing against the resource-rich tech giants. They're pleasantly naive, bursting with ideas, and ready to pick up and dust off a region and remake it entirely—at least until the next hype cycle hits. Ⓑ

## THE COVER

What a difference five years can make. In 2018 we asked an artificial intelligence system for landscapes, and it wowed us by creating a series of cover-worthy, uncannily impressionistic paintings in about two weeks.


For this year's Tech Issue, artist Charlie Engman fed the AI software Midjourney the kinds of brainstorm prompts we'd give to a human illustrator, got results in 30 seconds, then later refined the keywords to guide additional 30-second renderings to the cover we chose. Our pick suggests where we are in this AI moment: still a long way from a world transformed by the technology, but clearly closer than we thought.


2018 COVER: AI-GENERATED PAINTINGS BY ROBBIE BARRAT FOR BLOOMBERG BUSINESSWEEK. THIS WEEK'S COVER: AI-GENERATED BY CHARLIE ENGMAN FOR BLOOMBERG BUSINESSWEEK

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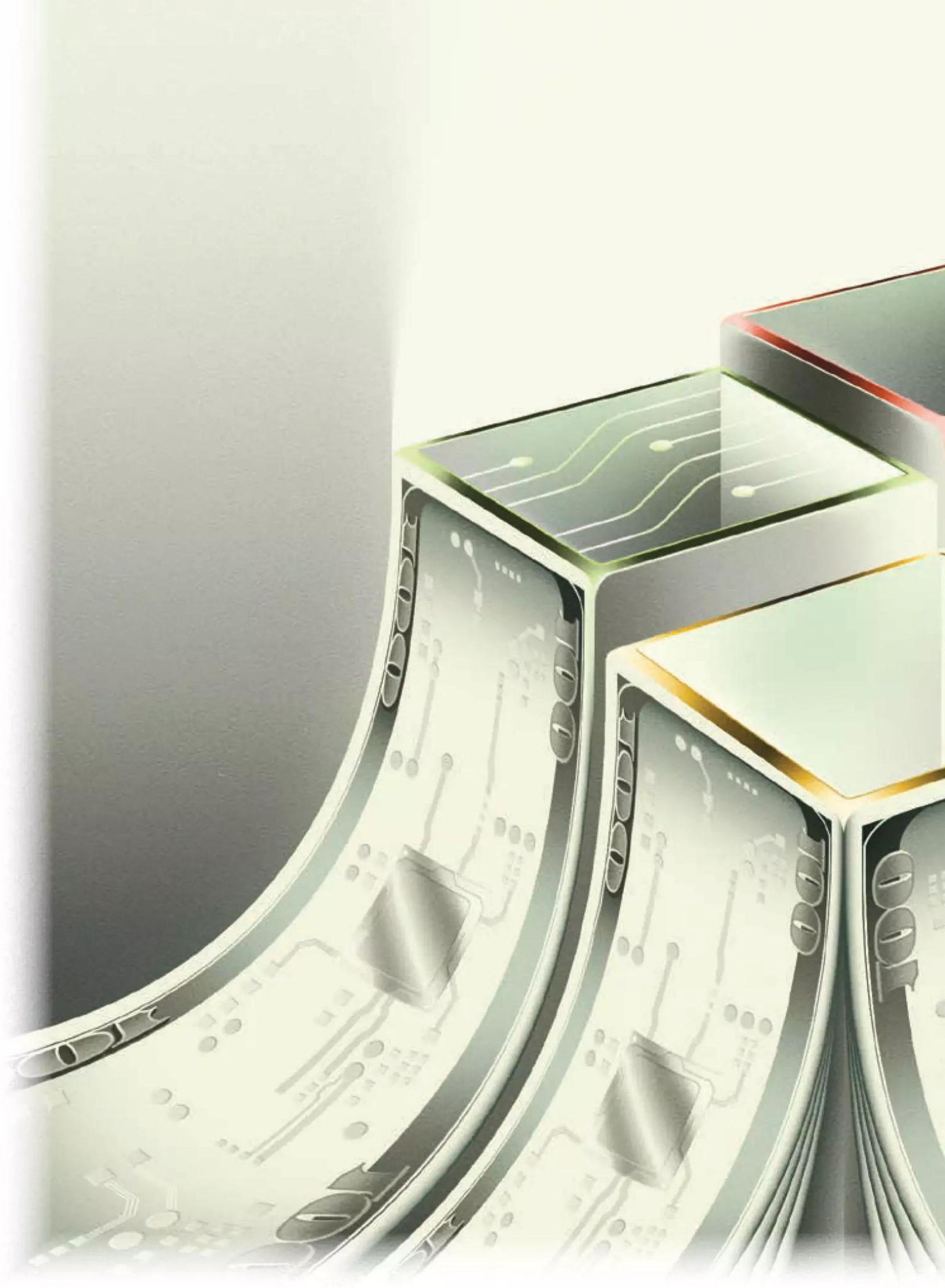
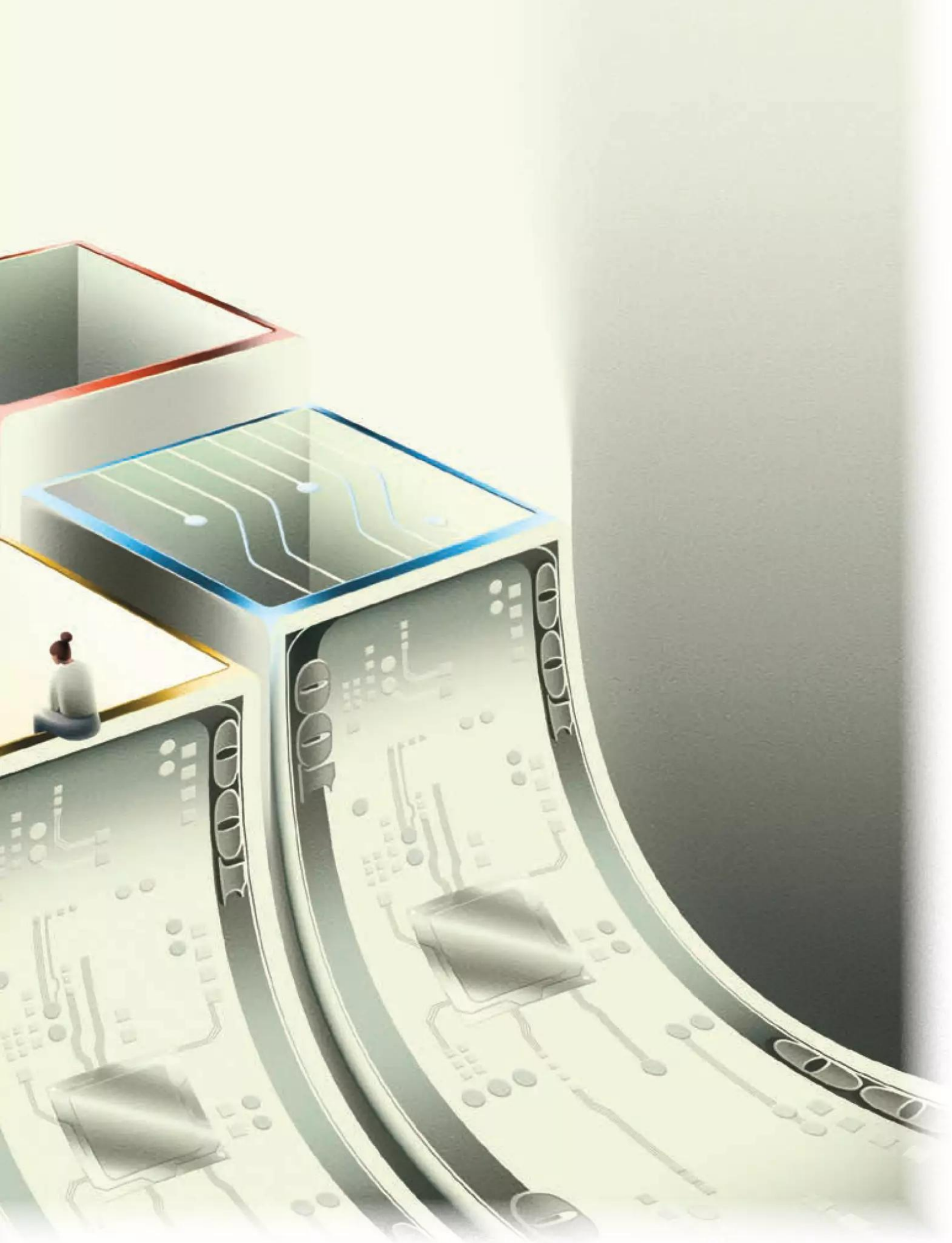


**The company has bought its way into AI's hottest new technology, and it's preparing to cash in**

# Microsoft





By Max Chafkin and Dina Bass
Illustration by Twisha Patni

There are two ways of looking at ChatGPT, the artificial intelligence chatbot that hundreds of millions of people have tried out since its release late last year. One view, preferred by many politicians and journalists as well as the company that created the app, is that its release was an historic development on par with the Industrial Revolution—or, more troublingly, the atomic bomb. OpenAI's co-founder, Sam Altman, has warned that future versions of the underlying software, a large language model known as GPT-4, could wipe out the human race.

The other way to look at ChatGPT is as a vehicle for viral hype. Play around with the software for a few minutes, and it's obvious that the potential for Armageddon has its limits. The app struggles with middle school math, can't tell you what happened last week and is basically the machine equivalent of a compulsive liar. But it's already true that the software is beyond Altman's power to fully control.

Microsoft Corp., not OpenAI, owns the mega-computers that enable the chatbot to compose a sonnet about your cat or write a thank-you note to your uncle. Microsoft is OpenAI's largest shareholder, its biggest financial backer and its key technology partner. And to a great extent, it's Microsoft that now has the responsibility of turning ChatGPT's buzz into a real business. Although OpenAI is hands-down the hottest startup in Silicon Valley, in many ways it feels more like the most promising subsidiary of the leading purveyor of productivity software.

Microsoft didn't rate in the public AI discourse one short year ago, when we were all watching *Top Gun: Maverick* and listening to Sam Bankman-Fried. Back then most of the hand-waving on the subject was aimed in the general direction of Google, where researchers first developed the technologies behind ChatGPT and its peers. But while Google initially kept its research away from commercial products, especially its flagship search engine, Microsoft is focused on using OpenAI's innovations to make a buttload of money ASAP.

The company's GitHub Copilot tool, which suggests new lines of code to computer programmers, was its first paid offering and has attracted more than 10,000 companies as customers. Bing, Microsoft's also-ran search engine, came next, with a chatbot search engine that can create vacation itineraries and shopping lists. Over the past several months, Chief Executive Officer Satya Nadella has announced plans to incorporate other Copilots into Windows (where they'll rewrite, summarize and explain content) and its Microsoft 365 office suite (where they'll create slide decks in PowerPoint, sift through emails in Outlook and make charts based on Excel data). "There's no point in hyping technology for technology's sake," Nadella says. "All of these technology shifts are only useful if they do something in the real world."

"Microsoft needed... some way to catch up with Google"

Nadella's team hasn't disclosed pricing on the forthcoming Copilots, but they definitely won't be free. GitHub's version starts at $10 per user per month, and Copilots for Microsoft's office apps could be similarly priced, translating into as much as $48 billion in extra annual revenue within the next four years, according to Kirk Materne, an analyst with Evercore ISI. In a research note published on June 2, he estimated that Microsoft's revenue from OpenAI-powered features could hit $99 billion by 2027. That would be like adding three Netflixes to the top line of the world's second-most-valuable public company.

Little wonder, then, that Microsoft has invested $13 billion in OpenAI since 2019, according to people familiar with the partnership; that its share price has shot up 30% since ChatGPT's unveiling; or that it's become the unlikely AI tech giant to beat. "The clear leader," says Kim Forrest, chief investment officer and founder of Bokeh Capital Partners LLC, an investment firm. "Google just got completely leapfrogged."

Microsoft executives are understandably excited to be associated with the cutting edge of anything. It's been a minute, as their cultural reference points show. "This is a little bit like the Windows 95 moment," says Scott Guthrie, one of the company's executive vice presidents. "People lined up at Best Buy at midnight to buy it." This time, Guthrie says, his inbox is packed with requests from CEOs asking for access to early versions of the corporate Copilots.

This tracks with the comparison to Windows 95, which was less a technological breakthrough than a sublime expression of corporate dominance. For more than a decade after its release, Microsoft owned the central platform for personal computing software. (That the company's practices led to an antitrust settlement with the US government did little to hamper its long-term prospects.) Now the House That Gates Built is making a similar bet on what looks like the next big platform. The idea is simple: Bring AI to everything, then cash in.

Microsoft was working on AI software before Windows 95 ever crashed its first

PC, but for decades, every major attempt fell victim to risk aversion or corporate goofiness. For Exhibit A, see Clippy, the mansplaining late-'90s fastener that interrupted your work to blink its gigantic eyes and ask questions such as "It looks like you're writing a letter. Would you like help?" In 2016 came Tay, a bot that was supposed to learn to sound like a teenage girl by chatting with people on Twitter. Somehow, Microsoft's engineers failed to appreciate how Twitter tends to work: Within 24 hours, a deluge of rhetoric from neo-Nazis and Sept. 11 truthers turned Tay into a redpilled, antisemitic troll. The company took her offline, never to return.

In between, most of Microsoft's AI output consisted of academic papers. "We had a whole bunch of smart people who were doing a set of small, interesting things," says Chief Technology Officer Kevin Scott. "But that wasn't necessarily adding up to one thing." Scott, a big guy with a Van Dyke beard and a collection of Hawaiian shirts, grew up in Virginia's Appalachian foothills and attended the nearby University of Lynchburg, a small Christian college. He got a job at Google, rose to become a top engineer, then jumped over to LinkedIn, which Microsoft acquired in 2016. Shortly after the deal closed, Nadella appointed him CTO and charged him with streamlining the company's AI sprawl.

At the time, Microsoft had at least three divisions conducting AI research under different bosses. Scott tallied all the requests for graphics processing units from the different teams and got a number that was as big as the company's entire capital budget for the year, then about $10 billion. "Just some preposterous number," he says. "These were great projects individually, but they had no bearing on one another. None of them had a business plan." Starting in 2019 he took responsibility for all AI research and development. Any project that needed AI chips required his approval.

By then the three big companies in the field were Baidu, Google and OpenAI, says Vinod Khosla, an early OpenAI investor and co-founder of Sun Microsystems. Google's advantages included its leading research subsidiary, DeepMind, and its driverless-car technology. Baidu Inc., the creator of China's leading search engine, had similar strengths. OpenAI, founded by Altman and Elon Musk, was the odd one out. Its demos were promising, but it didn't have the money to keep pace. "What OpenAI needed was a partner," Khosla says, partly just to pay for more graphics chips. "What Microsoft needed was some way to catch up with Google."

Microsoft had never outsourced development of a major new piece of technology to a third party, and the money Altman wanted was enormous—$1 billion for a tiny lab. Scott says what turned him around was the startup's use of "transfer learning," a promising approach that hadn't yet been incorporated into a commercial product. At the time, most AI startups tried to teach a computer a specific task (identifying grocery items at a glance, say) using specialized data (a bunch of pictures of groceries, checked and labeled by humans). The idea with transfer learning was that you could create a model to do one thing, such as summarize a paragraph, then apply that information to learning new tasks, like how to compose a song or plan a trip. "You train a broad model, and it just happens to be good at all of these tasks," Scott says.

The upshot was that instead of giving an AI model specialized data, you simply collect as much data as possible. Such as, for example: the entire internet.

"We really had nothing"

Altman's 2019 deal with Microsoft cost him a lot more control than he would've given up to a venture firm. Microsoft got the exclusive right to provide OpenAI's cloud computing infrastructure and the right to sell OpenAI services to Microsoft customers. In exchange, Altman got something no VC could provide. "Our problem is not capital," he says. "Our problem is, how are we going to build the computing infrastructure we need?" Microsoft agreed to build OpenAI an enormous computer with tens of thousands of high-end Nvidia Corp. chips customized to OpenAI's specifications—"a real snowflake," Scott says.

The deal went over poorly among some Microsoft engineers already unhappy with Scott's changes. By this time, OpenAI's GPT-2 could look at a chunk of text and suggest the next few sentences, but the startup hadn't released GPT-2, in part because it seemed destined to generate fake news and spam. "We really had nothing," Altman says. "We were a research lab that had not truly figured out any way we were going to productize." Altman was controversial, too. As part of a convoluted plan to develop ID technology for a theoretical universal basic income program, his crypto company, Worldcoin, sent technicians around the globe, including sub-Saharan Africa, to scan the irises of as many people as possible. "We were ruthlessly mocked," he recalls. →

Things began to change in 2021, when Microsoft used the next version of OpenAI's model to create GitHub Copilot. Besides finishing paragraphs in a short story, the OpenAI model proved capable of looking at a chunk of computer code and suggesting the next few lines. "As we worked through that product and saw that it was going to be successful, it begged the question of what the other Copilots ought to be," Scott says.

One insider who took more convincing was Bill Gates. Gates left the board in 2020 amid an investigation into an affair with a Microsoft employee. The year before, he apologized for meeting with the convicted child sex abuser Jeffrey Epstein. A spokesperson for Gates says he left the board to focus on his philanthropy. Gates still advises the company on technical matters.

Despite the Epstein controversy, Gates' opinion carries weight. He opposed the original OpenAI investment and deemed GPT meh. He demanded to see a demo proving Altman's model understood what it was saying and suggested that if OpenAI could pass an AP biology exam, then he'd be impressed. Late last summer, Altman, Scott, Guthrie and a small team of OpenAI researchers showed up at Gates' palatial home on Lake Washington for a demo of GPT-4.

Scott was nervous. "Bill's a tough customer," he says, understating things. Gates is known for withering outbursts during product reviews, including frequent use of these words: "That's the stupidest f---ing thing I've ever heard." But the OpenAI model passed the AP bio exam, then Gates' own. After the formal demo, he challenged the software to converse as if with the parents of a sick child. He was particularly impressed, he later said, by ChatGPT's empathy.

Within months, Microsoft was in talks to put another $10 billion into OpenAI, much of which will go straight back into the company's own pocket. Altman's team needed to rent massive new amounts of cloud computing power to develop a series of GPT-4-based projects.

Microsoft's first of these was a ChatGPT bot that could be folded into Bing. Microsoft's search bar accounts for 3% of the search ad market, compared with about 91% for Google's, according to Similarweb Ltd. That made it an ideal lab: too small for Microsoft to care all that much about screwing up but with a massive pile of money on the other side of the table. "We saw an opportunity for incredible upside if the technology delivered," says Divya Kumar, Microsoft's head of marketing for search and AI. Unlike Apple Inc., Microsoft generally doesn't go to great pains to keep new products secret. But in this case the plans were kept to an extremely tight circle. For instance, Jeff Teper, who oversees parts of Microsoft's office empire, says only 15 or so people on his team of 5,000 knew about the project. The Bing effort was given a code name: Prometheus.

"A race starts today…and we're going to move fast"

That choice, in retrospect, seems a little strange, either an expression of Microsoft's nuanced understanding of the ethical quagmire it had walked into or proof that techies don't pay the closest attention in English class. In classical mythology, Prometheus is the god of fire and, in some sense, the founder of civilization, having passed fire-making capabilities down to the rest of us. But as punishment for stealing the technology from Mount Olympus, he winds up chained to a rock where, every day, an eagle lands and eats his liver. To maximize his suffering, the liver regenerates every night.

This past February, Nadella stood in front of a group of reporters and analysts and introduced the Bing chatbot, which could sketch out heartfelt-sounding messages, shopping lists and even vacation plans without making users click through to other web pages. "A race starts

● Scott in his home workshop in Los Gatos, California

PHOTOGRAPH BY DAMIEN MALONEY FOR BLOOMBERG BUSINESSWEEK

today," he said, signaling the intention to bring similar chatbots to other Microsoft products, "and we're going to move fast." He continued: "Every day we want to bring out new things."

To investors it was obvious a search engine that gives you its own answers instead of links would be a calamity for Google's advertising business, which depends on charging for certain links. Microsoft's stock shot up while that of Google parent, Alphabet Inc., fell. There, managers had recently declared a "code red" and ordered employees to frantically add AI to all its products in a matter of months. "We're throwing spaghetti at the wall," a Google employee told *Bloomberg Businessweek* in March. "But it's not even close to what's needed to transform the company and be competitive." Google has said this is all just part of the normal R&D process.

After the AI announcement, Similarweb recorded a roughly 15% increase in Bing use, a stunning development in what had been a stagnant market for a decade. But the attention wasn't all positive. Users noticed that the Bing chatbot, like OpenAI's, was prone to BS-ing. And if called out for getting facts wrong or making stuff up, the Bing bot tended to get dramatically weirder. It told the *Verge* it was spying on Microsoft employees via their webcams. When speaking with a popular tech analyst, it tried out a revenge fantasy, possibly inspired by Spider-Man, involving a villainous alter ego it called Venom. And in a lengthy interaction with *New York Times* columnist Kevin Roose, it suggested he leave his wife and take up with a different one of its alter egos, Sydney.

These serious flaws didn't slow Microsoft's race to incorporate the same technology into its other software. Microsoft 365, the office suite, has about 400 million paid subscribers, including the world's largest companies, armed forces and governments. Think of the damage Venom and Sydney could do in life-and-death engineering calculations, never mind corporate press releases, if some lazy human fails to double-check them. The push to add AI to everything is causing an "oversight deficit," says Navrina Singh, a former Microsoft AI manager who's now CEO of Credo AI, which makes software designed to keep track of what corporate AI systems are doing. "When you are trying to operate at speed, you end up taking shortcuts."

Microsoft executives say these fears are overblown. As with the bot Tay, Scott says the problem wasn't the software—it was the critics pushing Bing to say "the worst possible thing."

● Microsoft could add **$99b** in revenue by 2027

But Microsoft doesn't dispute that chatbots have made, and will make, lots of mistakes. "You shouldn't trust this stuff blindly," says Teper. "It's 'Copilot,' not 'Autopilot,'" he says. "But that said, if you watch it, it might write half your document or half your presentation. We'd take that."

In other words, ChatGPT can shake the world without killing all humans. Microsoft made about $45 billion last year on Excel, PowerPoint, Word and its other office apps despite the wide availability of comparable free alternatives. The company knows how to extract rents from software platforms, especially a new one that plugs straight into the old one.

With OpenAI at its disposal, Microsoft looks so dominant in this nascent field that observers can be forgiven for thinking it might be 1995 again. The two companies will have a huge advantage in selling AI services and in building data centers to support them. Microsoft claims to have the biggest supply of the needed chips in its possession at a time when no company has as many as it wants. And with Microsoft programs in use at almost every major institution on Earth, Nadella and Altman are in by far the best position to sell corporate AI services. "The natural state of large software companies tends toward a winner-take-all approach," says Scott Farquhar, co-CEO of software maker Atlassian Corp., which is both a Microsoft partner and a rival. "We have to be careful to make sure that we don't crowd out new entrants."

Both Altman and Nadella push back on these concerns, though in different ways. Altman says OpenAI remains very much its own thing, though he concedes that if Microsoft were to cut his company off from its servers, its work would be effectively paralyzed. "I believe they will honor their contract," he says. Nadella, for his part, stresses that an AI race, by definition, has competitors, and Microsoft has said its cloud will support open-source AI models. "Yes, we are ahead today," he says. "But there is Alphabet, there is Anthropic, there is whatever Elon is doing."

That's winner talk. Anthropic, a startup created by OpenAI defectors, is just getting off the ground. Musk's AI lab, which he's said is about saving the world from machines and making the software less "woke," looks like a stunt. "He is behind," says Khosla, referring to Musk. "He is jealous." And even if Microsoft does squander its lead, Nadella's team is poised to make a great many billions of dollars first. Ⓑ —*With Davey Alba and Rachel Metz*

● Nvidia’s new superchip, with a top-of-the-line Hopper 100 processor



Nvidia’s chips are powering AI and elevating the company into the alpha pack of Silicon Valley

By Austin Carr and Ian King
Photographs by Kelsey McClellan

# ChatGPT’s

# Brain

**The first time Jensen Huang tried ChatGPT, he asked it to write a poem about his company. Huang, who'd made a bet more than a decade ago that Nvidia Corp.'s computer chips could serve as the brains for artificial intelligence, was pleased with the result: "NVIDIA rises to the challenge. / With their powerful GPUs and AI, / They push the boundaries of technology's edge." The robo-poem was evidence, by his literary standards anyway, that the wager was finally paying off.**

**For much of the past 30 years, Nvidia chips have been the main engine for ultrarealistic explosions and lush foliage in video games such as *Call of Duty* and *Counter-Strike*, but Huang strongly suspected they were also uniquely suited to sift through the massive data sets that artificial intelligence requires. To help test this theory, he instructed his team to build a server designed for AI and hand-delivered →**

the first one in 2016 to Elon Musk and Sam Altman, the founders of OpenAI. Billed as an AI supercomputer, the $129,000 rig was the size of a briefcase and contained eight interconnected graphics processors that could digest in two hours what would take a traditional computer processor more than six days. Huang personally brought it to the startup's office as a gift, and as he gestured to the components, Musk beamed at the silvery box like a proud father.

Since then, Musk and Altman had an acrimonious split, but they're aligned in one way: each has sought access to Nvidia chips for different projects. OpenAI released ChatGPT late last year, with a brain composed of more than 20,000 Nvidia graphics processors. In February, according to the research firm Similarweb Ltd., the chatbot hit 100 million users, which would be a triumph for OpenAI if it weren't so expensive to run. Microsoft Corp. has pledged more than $10 billion in funding, which will help cover rising computing costs, and Altman, the startup's chief executive officer, will need tons more chips from Nvidia to keep up with demand. Huang doesn't use ChatGPT much, he says, but signed up for the $20-a-month version Altman's company offers. "He needs the money," Huang jokes.

And so, too, will just about any company that wants a piece of the AI boom. Nvidia chips are a critical component of the cloud infrastructure that Alphabet, Amazon and Microsoft use. Data-center operators collectively spent $15 billion last year on bulk orders with Nvidia. "You're going to see tons and tons of ChatGPT-like things," Huang says in a May 17 interview at Nvidia's headquarters in Santa Clara, California. "This is basically a rebirth, a reinvention of computing as we know it."

A week later, Huang showed investors what that rebirth means for Nvidia's business. Quarterly revenue from data centers—which Nvidia now calls "AI factories"—jumped 14%, to a record $4.28 billion. Its summer sales forecast was 53% higher than analysts expected, hurling its valuation briefly past $1 trillion. It was only the ninth company ever to reach that mark. Overnight, Nvidia grew by almost the entire market cap of one longtime rival, Advanced Micro Devices Inc. (AMD), and is now worth seven times another, Intel Corp. At least three Wall Street analysts used the same word in the titles of their reports: "Wow."

How Huang orchestrated this transformation from video game chipmaker to AI pioneer is often attributed to his magical ability to see into the future. His deputies will explain it only with anodyne corporate platitudes. Ian Buck, vice president for high-performance computing, says Nvidia is a startup that acts as one team with no corporate politics, reciting versions of phrases 11 of his colleagues used in interviews with *Bloomberg Businessweek*. It sounded as if they'd been force-fed the same generic training data as ChatGPT.

The reality is that Huang has been wrong almost as much as he's been right. Nvidia blundered its approach to smartphones, released several computer graphics cards that bombed, evangelized short-lived fads ("crypto mining is here to stay") and got outmaneuvered by regulators and rivals on its $40 billion attempt to acquire the chip designer Arm Ltd. Huang exhibits a deeply programmed sense of survival. It can involve coldly killing a project the millisecond he realizes Nvidia can't win or humiliating senior staff to make a point. He speaks with pride about almost going out of business seven times and has been willing to take these risks again and again because they might eventually help him own the future of computing.

Nvidia is suddenly at the core of the world's most important technology. It owns 80% of the market for a particular kind of chip called a data-center accelerator, and the current wait time for one of its AI processors is eight months. Many big tech companies are on Nvidia's backlog. But some of Huang's biggest customers have been designing their own custom chips for years, aimed at reducing their dependence on suppliers such as Nvidia. For now, they're hooked. "Nvidia has to stumble for some reason to give a competitor a chance," says Chris Mack, an analyst at Harding Loevner LP, an investment company that owns about $160 million of Nvidia stock. "There's no viable alternative."

● Huang onstage in Taiwan in May

The thing that makes AI possible—the ChatGPT "poetry," the software for cars that sort of drive themselves, the computer-generated photo of the pope in a puffy jacket—is the Ampere 100. Named after the 19th century French physicist André-Marie Ampère, the chip is about the size of a matchbook. Its surface appears smooth until viewed under a microscope, revealing some 54 billion teeny components arranged in what looks sort of like a map of the Tokyo subway system.

Nvidia's chip architects spent four years refining a digital blueprint of the A100 before sending the design off to Taiwan Semiconductor



HUANG: WALID BERRAZEG/SOPA IMAGES/LIGHTROCKET/GETTY IMAGES

Manufacturing Co. (TSMC) or Samsung Electronics Co. for production. When a prototype is ready, it's flown to the US and then, like a VIP, chauffeured from the airport to Nvidia's campus. There, it's ushered to a windowless lab lined with screens and cooling pipes hanging from the ceiling. (Without adequate precautions, the chips can get so hot that they burst into flames.)

Engineers, whose job it is to bring these tiny firebugs to life, usually look as if they're terrified to the point of nausea as they plug the prototype into a test rig. They pray it turns on and goes as fast as it's supposed to. Any glitch might necessitate a silicon correction, or "re-spin," which can take months and cost hundreds of millions of dollars in lost sales. Jonah Alben, Nvidia's senior vice president for graphics-processor engineering, says there's no moment of triumph, only a "declining sense of concern."

Back when Huang founded Nvidia, concerns were only soaring. He was 30, had a master's degree in electrical engineering from Stanford University and had worked at various chipmakers, including AMD. He decided to start a company with two fellow engineers in 1993 after recognizing the need for specialized processors to improve the video games he loved. "His excitement over *Flight Simulator* was palpable," recalls board member Tench Coxe. But their initial chips, including one intended for the Sega Dreamcast game console, failed because they bet on a novel architecture that was unpopular with game developers. Nvidia was running out of cash (one of his near-bankruptcies), so Huang backed out of the Sega deal and abruptly changed course.

He instead focused on a new chip designed for computers running Microsoft Windows and signed on Dell and Gateway as customers. Nvidia turned a $4.1 million profit in fiscal 1998, a golden age for computer games that included the releases of *Half-Life* and *StarCraft*. The company went public the following year. "I'm told I'm the hardest CEO to kill," Huang said at the time. By 2006, Nvidia had shipped 500 million graphics processors and had its technology integrated into the Sony PlayStation 3 and Microsoft's first Xbox console.

For most of this time, Huang dressed sort of like a Best Buy employee—a "propeller-head," as Apple Inc.'s then head of hardware engineering, Jon Rubinstein, describes him. Then one day he began wearing all-black shirts, pants and a leather jacket and seemingly never changed. He alternates between cerebral revelations and disarming humor in interviews and at public events, but at the office he can be a furious boss who's prone to swearing, say three people who've been on the receiving end and asked not to be identified for fear of being sworn at again. One of them recalls how Huang, if he hasn't heard the right answer, will demand—frequently between expletives—that an executive retrieve the subordinate who can provide it. Then he'll wait, in a silent tantrum, checking his inbox until that person arrives or calls. Bob Sherbin, a spokesman for Nvidia, says retention among company leaders is high and they're "fiercely loyal" to Huang. "They appreciate his humor and his passion for the company," he says. "And they know that he's hardest of all on himself." Almost every employee is required to submit by email their "Top Five Things," with that exact subject line, and many of them go straight to Huang. It should contain a concise summary of their pressing objectives, so he can keep track.

● Nvidia AI researcher Bryan Catanzaro

The top thing for Nvidia during most of its existence has been to not get destroyed by Intel. Gaming helped Nvidia carve out a niche for its graphics processing units, known as GPUs. But Intel's central processing units, or CPUs, were for just about everything else. For decades, Intel was the world's biggest chipmaker. Its CPUs have been in most computers dating to the 1980s and swallowed a ludicrous 99% share of the market for data-center processors. Intel's chips could do games, too, but not as well as Nvidia's.

Here's the difference: Let's say you're going to the grocery store. Your shopping cart is the CPU. You walk the aisles, load up what you need and head to the register.

It's a perfectly normal way to buy your groceries. A GPU, however, is like hiring dozens of people with hand baskets. One gets your cereal, the other fruit, another toilet paper. Each shopper can't carry as much as the cart, but you can probably guess which approach would win at *Supermarket Sweep*.

For almost the entire history of computers, this never really mattered, unless you were into video games or film editing. Nvidia's GPU could perform the specific and repetitive tasks required to load millions of pixels at once for a game of *Grand Theft Auto*. Intel's CPU, meanwhile, can bring up an Excel spreadsheet, run a web browser, play a YouTube video and so on.

The GPU way of doing things is known as parallel computing, and Huang thought it could have a profound impact on the most challenging technical problems. In theory, connecting more GPUs together could dramatically expand the amount of data a system could work through in any given time period. It could, he reasoned, address what he said was the end of Moore's law. Conceived by Intel co-founder Gordon Moore in the 1960s, this law states that the number of transistors on a chip would double roughly every two years. That remarkably accurate forecast delivered massive increases in processor performance for a half-century, until things ground to a halt about a decade ago. Adding more Intel CPUs to data centers only metaphorically jammed up grocery aisles with shopping carts.

Customers began to look around for other options in the 2010s, creating an opening for Huang, whose GPUs operating in parallel could be the perfect substitute for all that data crunching. But a huge obstacle for Nvidia was that almost all the code running on servers at the time had been written for CPUs—for Intel. Fortunately for Nvidia, Huang had a solution that was just coming to fruition. In 2006 he'd rallied his company to construct a new programming language called Cuda, an acronym for "compute unified device architecture," that could expand the types of software Nvidia's processors could run.

This idea was rather nuts. The Cuda team had to re-create basic computational processes that have long existed for CPUs (mathematical libraries, debugging tools, etc.), which would enable developers to build software for a GPU's parallel-processing capabilities. Huang soon mandated that all Nvidia's new chip designs be made compatible with Cuda, at huge expense. He touted on earnings calls the number of universities that were teaching Cuda, to the confusion of financial analysts and even some employees who couldn't grasp what all this had to do with gaming. "That was the cash cow," says a former Nvidia vice president, who, like several others quoted in this story, asked to remain anonymous to avoid alienating Huang. "And the world was not going to run out of teenage boys playing video games."

An early experiment with Cuda took place at the bottom of the ocean. WesternGeco, a subsidiary of the oil company Schlumberger NV, worked with Nvidia staffers to optimize an algorithm to electronically scan beneath the seafloor for signs of oil deposits, recalls a former high-level Nvidia engineer. "They had so much data, they'd use helicopters to transfer it from the ships to where they compute it," this person says. "All that data needed to be processed and turned into 'Drill here. Look here.' Literally, $100 million decisions." Using GPUs, initial tests of the resulting software were able to mine the data more than six times faster than the computers WesternGeco had used before.

Solving such a gnarly problem proved that Nvidia's technology could do more than games, but it wasn't until an even bigger breakthrough arrived at an academic competition in 2012 that its full potential became apparent. A project called AlexNet set records for its ability to accurately recognize the contents of images. Its 15.3% error rate was more than 10 percentage points better than the next-closest challenger. The neural network was trained with Cuda and two Nvidia GPUs. AlexNet demonstrated that AI powered by GPUs could perform some tasks at a level approaching human.

When Huang took the stage at Nvidia's developer conference in 2014, an event billed as the "Woodstock for computational mathematicians," he spent much of his keynote expounding on the future of AI. "People went there expecting to see explosions and physics simulations the way that you usually got in Jensen's keynotes," says Bryan Catanzaro, Nvidia's vice president for applied deep-learning research. "It totally blew everyone's mind." Privately, Huang was saying his company would someday overtake Intel.

Cuda and AI-geared GPUs were only a few of the many bets Huang made around this time, and a lot of them were bad. He fought with Intel again to break into mobile devices, a battle they both lost to Qualcomm Inc. Nvidia also tried to make tablet computers, television set-top boxes and a smart speaker. None of them took off.

Those close to Huang say he has a remarkable

**"We're frightened by social media, but we're not frightened by AI"**

ability to erase bad decisions from his company's collective memory. This *Men in Black* maneuver helps his teams quickly move on to the next project. In "alignment" gatherings before audiences of as many as 400 employees, Huang asks general managers to present a business strategy as he watches from the front row and delivers a Simon Cowell-like assessment. His critiques can be vicious, according to three people who've attended these meetings. The public harangue, these people say, is intended not for the person onstage but for the hundreds behind Huang. They're supposed to internalize his instructions and adjust their actions accordingly—a management style that's kind of like parallel computing.

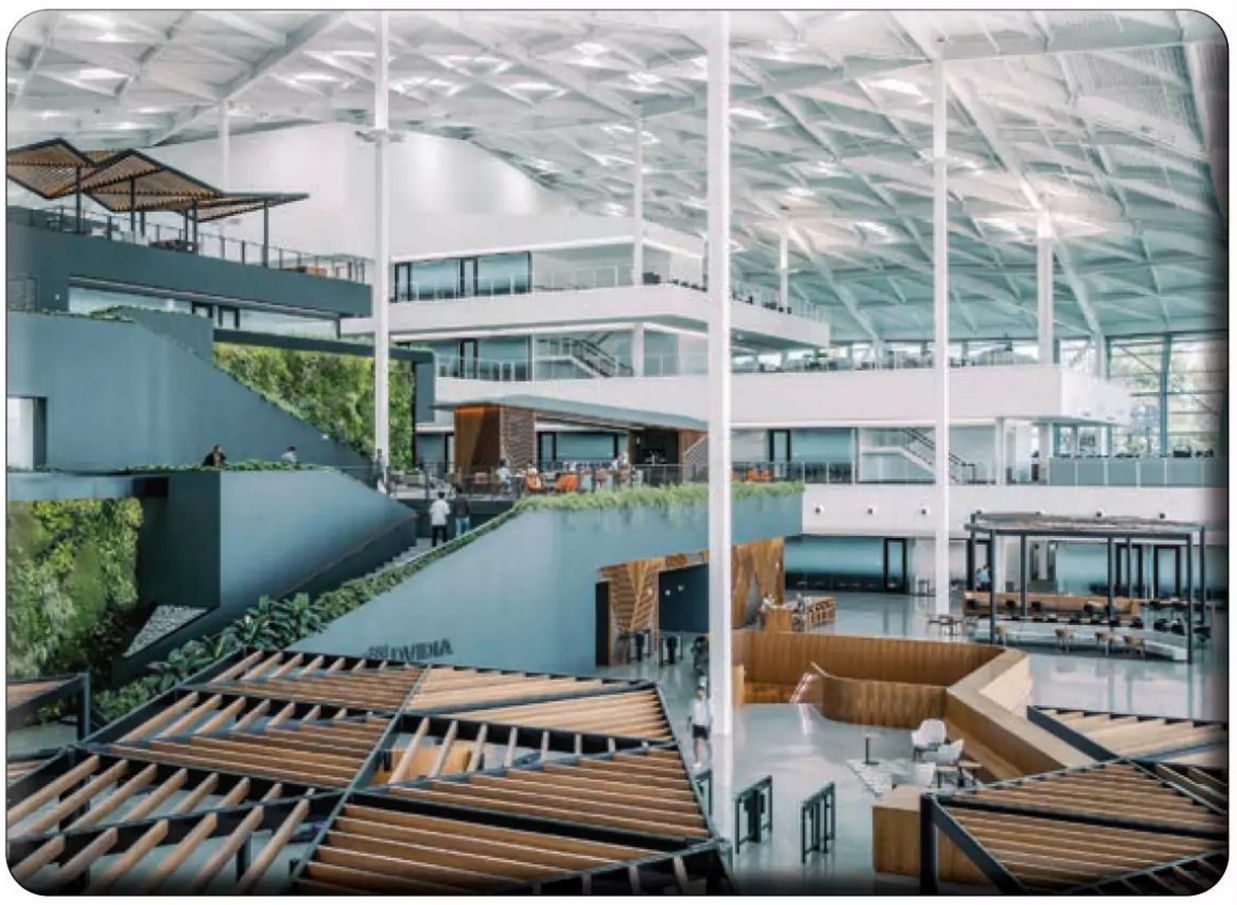
"Nobody really knows how the black box works, but it works on a lot of data, and every once in a while, you'll get emotions out of it," says a former longtime Nvidia executive who worked closely with Huang. "He's almost the perfect AI."

During the Covid-19 pandemic, when tech stocks were going wild, Nvidia crossed two milestones that would redefine the company. In July 2020, it was crowned America's most valuable chipmaker. The next month, Nvidia said its quarterly revenue from data centers surpassed gaming for the first time. "I believed him 10 years ago when he said Nvidia would be bigger than Intel," says Morris Chang, founder of the contract semiconductor manufacturer TSMC.

It wasn't so much Huang's proselytizing about AI that was resonating with Wall Street at this time. People were playing more video games and betting huge sums on Bitcoin and other digital currencies, driving demand for Nvidia GPUs, which excelled at crypto mining. Huang tried, unsuccessfully, to ride this momentum and buy chip designer Arm, responsible for the most widely used design standard in the semiconductor industry. The $40 billion bid would finally secure a place for Nvidia in mobile and expand its reach to many other kinds of products. But companies that relied on Arm's chip designs were already wary of Nvidia's growing power, and US regulators sued to block the merger. Huang conceded in February 2022.

All the while, AI remained a primary focus for Nvidia executives. The chief financial officer, Colette Kress, says shareholders struggled to understand the pitch. "'You talk into your phone and ask where the nearest Starbucks is—that is AI,'" she recalls saying. "'Behind the scenes, there's this GPU working to solve →

● A GPU test rig; Nvidia's headquarters; a Mercedes-Benz with Nvidia self-driving tech

that problem for you with data.' I can't even tell you how many times I've said that." The conversations are easier today: "Super Simple: ChatGPT," she says.

Ask Nvidia's customers what it's like to work with the company, and they'll tell you it's similar to dealing with Intel at its peak: no discounts, no negotiating, no skipping the line. Which explains why some of Nvidia's biggest buyers are trying to create their own chips. None, though, have been able to match Nvidia's package of chip design and sophisticated programming, which requires extensive and ongoing investment and expertise. "You wish a lot of the other vendors were at the same speed and execution and were creating markets and creating workloads like Nvidia is," says Nafea Bshara, vice president of Amazon Web Services. "We'd all be in better shape."

Musk tried to wean Tesla off Nvidia technology in 2018. He unveiled a Tesla-designed chip that eventually replaced Nvidia's self-driving platform inside the company's cars. "It's strategic for them, building their own chip and sort of owning this end to end," says Sarah Tariq, Nvidia's vice president for autonomous-driving software. She says Tesla remains a big customer of Nvidia GPUs for data-center training. And Musk recently ordered thousands of Nvidia GPUs for another AI project, according to news reports. He'll be lucky if he receives them before Labor Day (not because Huang holds a grudge but because no one gets special treatment). Musk didn't respond to requests for comment.

Alphabet, Amazon and Microsoft have also invested billions of dollars in chip design. Google has made significant strides with its tensor processing units. Midjourney, the popular AI image-generator app, said in March it was adopting Google's processors for model training alongside Nvidia GPUs. An analysis by New Street Research LLP found that Google's chip delivers as much as six times the performance per dollar as Nvidia's A100. But that comes with trade-offs—Google's are less flexible in how they process data—and the advantage won't necessarily hold for more than a year or two.

● Nvidia's first-quarter data-center revenue hit a record

**$4.3b**

"Everybody is afraid of pissing off Nvidia"

The successor to the A100—the Hopper 100, named after the pioneering programmer Grace Hopper—is now in production and already matches the performance of Google's chip. Even the most powerful people in the industry are acting "very, very politely" toward Huang, according to Pierre Ferragu, an analyst at New Street. "Everybody is afraid of pissing off Nvidia." (A Google spokesperson says that the company values its partnership with Nvidia and that its chips are complementary to GPUs.)

Huang demurs when asked about threats to his business. He bristles at complaints about the price of Nvidia GPUs and contends that a customer spends less to power his machines in the long run because they're so efficient. "We are the save-you-money company," he says. He refuses to talk about Musk and says he was unaware Midjourney's allegiance was swaying. He says he doesn't care if his customers become competitors and he'll continue to treat Google as one of his best customers because it really is one of his best customers. (Alphabet Inc. is Nvidia's third-largest client, according to data compiled by Bloomberg.) "We pretty much run away from competition," Huang deadpans. "I'm a coward. I hate fighting for stuff."

Huang says he wishes the US and China would stop fighting, too. Last August, Nvidia became a target of government limits on the spread of AI. The Biden administration now requires licenses to export Nvidia's most advanced chips, including the A100 and H100, to China. So Nvidia quickly spun up a hobbled version of the A100 that won't trigger the restrictions because it accesses data more slowly.

The US doesn't want China to achieve parity in chipmaking; Huang argues that President Joe Biden's restrictions will do the opposite. They incentivize China to foster a homegrown industry, and it already has more than 50 GPU companies, he says. Huang sets the stakes even higher and suggests the restrictions could trigger an international incident—specifically, an invasion of a nearby island where much of the

● Tariq

world's semiconductors, including Nvidia's, are manufactured. "China is not going to sit back and be regulated," Huang says. "You got to ask yourself, at what point do they just say, 'F--- it. Let's go to Taiwan. We've got nothing to lose.' At some point they will have nothing to lose."

Huang sees the arrival of ChatGPT as the "iPhone moment" for AI. It's already led to a resurgence of Microsoft's Bing search engine, mesmerizing new text-to-image capabilities in Adobe Inc.'s Photoshop and stunning advances in medical research. Nvidia's GPUs are, of course, the foundation for all these.

So Huang has been hopscotching across the planet, sermonizing his company's role in the AI revolution at an endless series of conferences. He personally adjusts his presentation slides, making sure the photo angles of his GPUs look as striking as possible and meticulously arranging and resizing the logos of Nvidia customers. Lately, however, his slides have featured so many AI clients—Baidu, ExxonMobil, JPMorgan Chase, McDonald's, Pfizer—that the logos are now tiny, almost indiscernible pixels on the screen.

On a recent sunny afternoon at Nvidia's California headquarters, Huang staggers into a conference room named after Michael Crichton's *Westworld*. That morning, Huang had flown to another tech conference—this one in Las Vegas—delivered a keynote, glad-handed with customers, did a television hit and zoomed back to Silicon Valley for this interview. Huang slumps onto a gray sofa. He has every right to be tired, but he appears to be feigning exhaustion as a gag.

Even at age 60, Huang hasn't shown any signs of wanting to hand over the keys to the machine. "Our company was built so that I know how to run it," he says. "So for as long as I'm running it, that's all that matters." (He once heckled a roomful of his peers at a gala, saying, "You guys know that all of you are serving a term. I'm serving life. When your children are running your companies, I'll be here.")

A few months ago, Huang hit his 30th year as head of Nvidia, making him the longest-tenured CEO in the semiconductor industry. But he says those in his orbit know he hates celebrations. They don't even bring up his birthday. "The only email I got was an automatic email from the HR IT system that says, 'Dear Jensen, you have an employee who reached a 30-year anniversary.' And that employee's name was me," Huang says with self-satisfaction. "Not one other person said congratulations, happy 30th, nothing."

**"We are the save-you-money company"**

Silicon Valley has a proud history of CEOs who terrify employees. But Huang is now leading one of the most important companies shaping the trajectory of AI, and a sizable portion of the population is scared of what AI can do. They want to know what the leaders of AI believe in. Are they ethical? Will their employees have the courage to raise objections? Can they be trusted?

When Huang dropped off that GPU supercomputer to OpenAI in 2016, he signed the box with a marker: "To Elon & the OpenAI team! To the future of computing and humanity." Musk has since become perhaps the most vocal critic of AI and has said his split from OpenAI was on ethical grounds. His co-founder, Altman, has warned that AI poses a "risk of extinction" on par with nuclear war. Geoffrey Hinton, a pioneering AI researcher who contributed to the AlexNet breakthrough, has said AI represents a more urgent threat to humanity than climate change.

Yet, when repeatedly pressed on these concerns, Huang fires back, "I don't care about Sam. I don't care about what Elon said. I don't care about what Hinton said. Just ask me." Huang says Nvidia has software guardrails to keep AI confined to its assigned tasks. He tends to see things in techno-utopian terms.

Huang acknowledges that AI has the potential to do real harm but says it's no different from the danger of "chemical warfare, fake news and so on." He wants targeted government regulation—for surgical robots, for AI-assisted flying—but says the idea of a mandated pause on AI development is "silly" and the way to make AI safe is to advance AI. Huang says his two adult children have never expressed to him any anxieties about AI, only amazement of its potential. "We're frightened about social media, but we're not frightened by AI," Huang says. (He clarifies a moment later that both his children work at Nvidia.)

A few weeks later, Huang flew to Taiwan, his birthplace, to give yet another speech on the future of AI. Onstage before a thunderous crowd, he revealed Nvidia's latest AI supercomputer, a 55-foot-wide, 4-foot-deep system he described as "one giant GPU," weighing 40,000 pounds. The machine can run so hot, he said, that it's equipped with 2,000 fans capable, within minutes, of displacing all the air in the expansive auditorium he was speaking in. Huang stepped under a life-size image of the machine displayed behind him to show its daunting scale; he compared it to four elephants. Uh, yeah, nothing scary about that. Ⓑ —*With Debby Wu*

# The State of the Tech Jobs Market

**Who's unemployed, who's worried and who's more valuable than ever**



By Ellen Huet
Illustration by Luca Schenardi

There have been many innovations in Silicon Valley over the past decade, but for a lot of people who aspire to work in the tech industry, the most transformative may be the assembly line it developed to ingest fresh-faced summer interns and spit out highly paid software engineers. Tech companies have been so desperate for talent that, instead of hiring only for specific roles, many would make a "return offer" to every intern who met certain levels of proficiency.

Dylan Castillo, 21, knew the drill. He interned at Alphabet, Meta, Figma and Stripe and graduated in May from Cornell University

with a computer science degree. In November, Alphabet Inc. told him he qualified for a full-time job. Then Castillo met the new Big Tech. For several months, Google's parent company held off on matching him with a team. It gave him a "we'll get back to you" update in January. Finally, in March, a few weeks after laying off 12,000 employees, the company rescinded his offer.

Castillo wasn't shocked that the company had reneged on its promise. It was actively cutting jobs, after all. Still, this wasn't how things were supposed to work. He'd cleared all the proficiency hurdles—he was good enough. "If you meet that threshold, you should get an offer," Castillo says. "It was that way before," he pauses, "whatever this is called."

Whatever you call it, this reversal of the decade-long hiring boom has rolled across sunny Silicon Valley like a cold fog. Job loss has always been part of the tech industry, but it's generally associated with startups failing and dumping all of their workers, who easily land elsewhere. This time, workers can no longer bet on being quickly swept up by other startups or trillion-dollar behemoths. "It used to be if you had a pulse and could do basic coding exercises, you could get a six-figure offer from a bunch of companies," says one startup executive who spoke on condition of anonymity because of the sensitivity of the topic. "Now people come to me and ask, 'Are there roles at this company?' and the company says, 'We're not really hiring right now.' And that's like, whoa."

More than 200,000 tech industry employees have been laid off this year, according to Layoffs.fyi, a website that tracks tech job cuts. More than 80,000 people got canned in January alone. Less tangible, but clearly present, is an industrywide feeling that setbacks such as widespread layoffs, the collapse of crypto and the Silicon Valley Bank's failure are deflating Silicon Valley's golden balloon. Shellshocked tech workers are considering, sometimes for the first time, that the promise of perpetual, lucrative employability may not be as solid as they thought it was.

Castillo immigrated from Venezuela when he was 13 and chose software engineering as a career because it seemed safe—and because he couldn't afford law school. He thought he was being conservative by aiming for employment at big tech companies and late-stage private companies. But now some of his friends who made similar career decisions are facing joblessness. "People are pretty scared," he says. He's taken a job at Figma Inc. and plans to start in August.

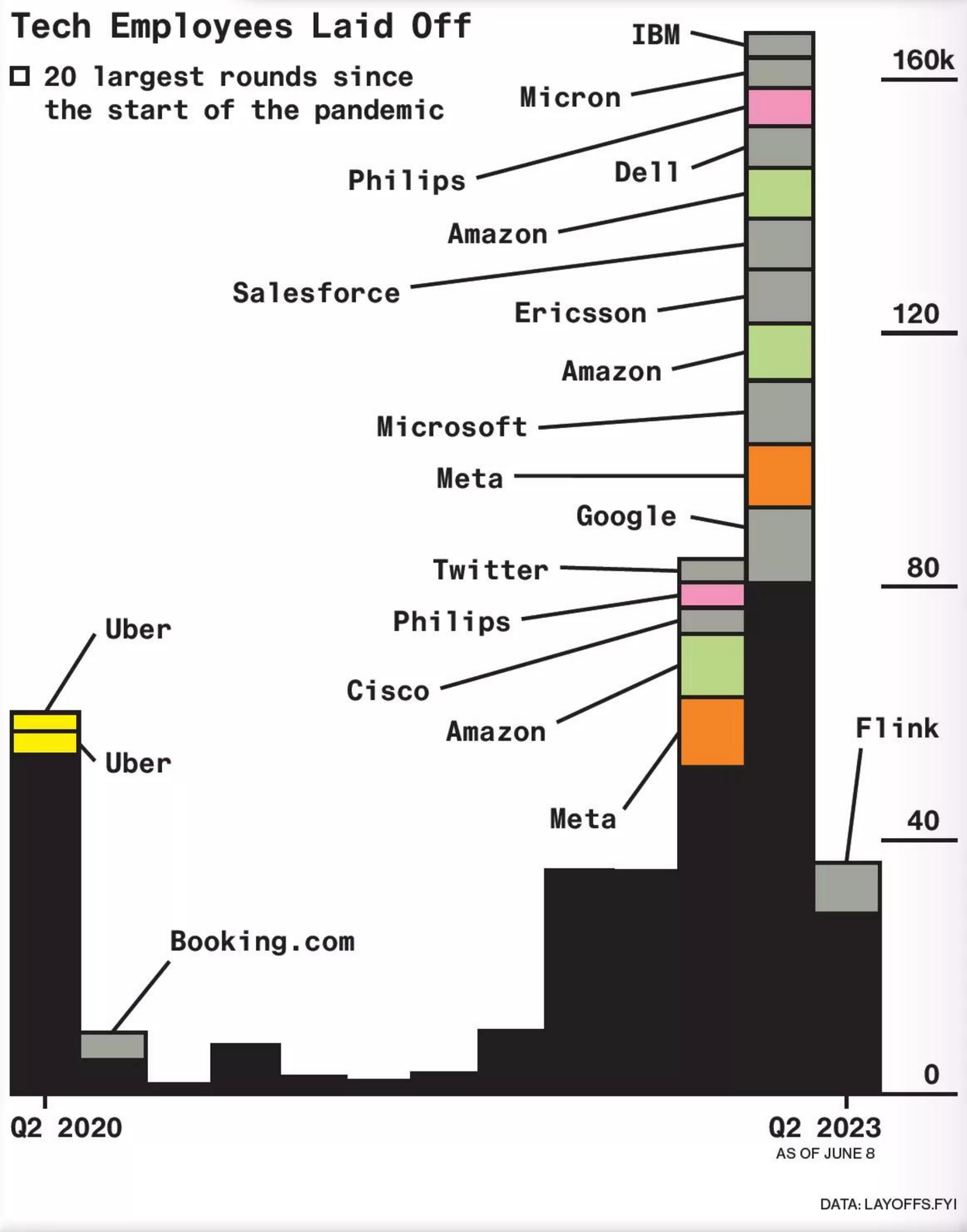
● Industry workers axed so far this year

**200k**

Some of Castillo's peers are accepting more than one offer, because they fear the jobs might not actually materialize. They're also weighing less glamorous coding work in non-tech sectors such as finance and health care, where companies still thirst to hire computer science majors. "Pay and career advancement are usually poorer in comparison, but you can rely more on those jobs not to be taken away or rescinded," Castillo says.

Amid all the uncertainty, one obvious strategy is to lean into the latest object of fascination in Silicon Valley: artificial intelligence. While the tech industry is notoriously faddish, Castillo says he and his peers see AI as more substantive than some of the sector's other recent fixations and something that might be worth building a career around. "We've definitely considered focusing on learning AI and machine learning," he says, because it seems as if those jobs will be in high demand for longer.

Right now, the average salary for a senior software engineer who specializes in artificial intelligence or machine learning is 12% →



higher than the salary of one who doesn't, says Roger Lee, who runs both layoff tracker Layoffs.fyi and Comprehensive.io, which monitors salaries in the industry. Although pay for tech workers has plateaued or even dipped in the past year, salaries of AI-related roles have risen 4%, Lee says. In the startup world, where venture funding is largely drying up and many startups are cutting jobs to survive, investors are still salivating over companies offering anything AI-related. This is especially true of generative AI, the term encompassing technology such as OpenAI's ChatGPT.

At larger companies, workers who attach themselves to AI projects may be the safest, at least in the short term. As Drew Houston, Dropbox Inc.'s chief executive officer, announced that the company was cutting 500 workers, he noted that part of the rationale for the cuts was to make way for AI-related hires: "Our next stage of growth requires a different mix of skill sets, particularly in AI and early-stage product development." When Mark Zuckerberg laid out plans in March to eliminate 10,000 jobs at Meta Platforms Inc., he said one company focus was "building AI tools to help engineers write better code faster, enabling us to automate workloads over time."

At the same time that AI promises to be Silicon Valley's next big boon, it also threatens to upend the conventional wisdom that simply learning computer programming is insurance against job insecurity. International Business Machines Corp. CEO Arvind Krishna recently told Bloomberg News that he could "easily see" thousands of IBM jobs being replaced by AI in the next five years, particularly for mundane tasks in human resources. (He later said he thought that AI would end up creating more jobs than it destroyed.)

Right now, AI may actually be serving as a face-saving explanation for executives who want to avoid admitting that job cuts are a result of overhiring during the pandemic boom. There's no evidence that AI has already begun to displace significant numbers of technology jobs. Still, it's easy for an engineer to watch ChatGPT spit out code—and correct its own programming errors—and imagine how a team of five programmers could be replaced by two humans and some advanced AI tools.

"Our next stage of growth requires a different mix of skill sets"

The artificial intelligence frenzy is another factor scrambling the way things work in Silicon Valley. Julie Lein, a co-founder of the Urban Innovation Fund, says the change to a more restrained atmosphere happened so quickly that it hasn't registered with everyone. "It's whiplash," she says. A founder will propose at a board meeting a plan to spend aggressively on marketing and be greeted with unfamiliar resistance. "Everyone's like, 'What? You have to conserve cash,'" she says. "Are we even being a responsible company right now if we're not laying people off?"

When it comes to letting employees go, companies haven't always reacted in the most artful ways. At the ride-sharing company Lyft Inc., which had already cut about 650 jobs in November, the incoming CEO made an ominous comment in an all-hands meeting about the potential for new job losses. This set off weeks of speculation, culminating with the announcement that Lyft would let 25% of its staff—more than 1,000 workers—go. On the planned day of the layoffs, everyone was told to stay home. The "impacted" employees were told they'd lost their jobs and were asked to attend a video call, but the call malfunctioned, and some were unable to sign on.

An employee at another public tech company, who asked not to be named because she isn't authorized to talk publicly about her work, says early warning signs of an impending layoff surfaced late last year. The CEO reassured employees that they were doing all right, before mysteriously delaying performance reviews. One morning this year, the employee got a text from her manager saying her job was safe. "I was like, 'Safe?' Why wouldn't it be?'" she says. Then she saw the email from the CEO explaining that job cuts were coming. Employees quickly figured out they could tell who'd lost their jobs, because those who'd been cut had a symbol next to their names on the company's Slack message board.

At many companies, the first to go are recruiters, a natural choice given their job

● Elsewaify

ELSEWAIFY: PHOTOGRAPH BY EVELYN FREJA FOR BLOOMBERG BUSINESSWEEK. CASTILLO: PHOTOGRAPH BY HEATHER AINSWORTH FOR BLOOMBERG BUSINESSWEEK

function only makes sense when companies are hiring. "I get it," says a recruiter who was recently laid off from Meta and asked not to be named for fear of retribution. "I never took it personally." Salespeople are also often vulnerable, in part because it's easy to quantify their impact on the bottom line and cull lower performers.

This time, another group on the chopping block has been those on tech companies' more whimsical or experimental projects. These jobs have generally come with added prestige but, in tighter times, appear not to have been close enough to the companies' core money-making business. At Alphabet, the cuts were particularly deep in departments such as Jigsaw, a geopolitical think tank that tried to prevent extremism and censorship, and Area 120, an in-house incubator where employees worked on side projects full time.

Adjusting to the new era may be painful for people who've spent their entire careers employed during Silicon Valley's boom years. Eric Bahn, who worked as a product manager at Facebook in the mid-2010s, recalls joining the company with no specific role. For three months, he spent his days engaged in light training. "I read a novel for an hour eating breakfast" each day, he says—then met with teams internally to decide if he wanted to work for them.

Many of his co-workers were living lavishly on the money their employers threw into ample salaries and stock grants. Bahn would ask his young colleagues about their weekend plans, and they'd tell him they chartered a jet to Alaska to go fishing. "If growth is still double digits and all that, no one is really looking at the other side of the bottom line," he says.

Bahn remembers peers who planned to quit but were instead told to take months of paid leave, just so they wouldn't abscond to a rival. When people did actually succeed in leaving a job, the response was often: "Congratulations!" "The belief was, 'There are infinity jobs, and there will be infinity more,'" the startup executive says. "You can fill the bucket up with as much water as you want, and it never overflows."

● Castillo

"One of my friends said that his salary requirements are minimum $600,000 a year"

Workers accustomed to such a charmed environment—and to the unhinged Bay Area living costs—have had trouble at times reseting their expectations. Bahn, who's now a venture capitalist, says he has laid-off friends asking him for help finding new positions. "One of my friends said that his salary requirements are minimum $600,000 a year," he says. "Why can't you live with $300,000 or $400,000?" He adds: "The golden handcuffs are pretty real."

There's already a healthy dose of schadenfreude being directed at people like Bahn's friends. But anyone familiar with the tech industry knows that the stereotype of the decadent tech worker has always excluded a large portion of the workforce. For each software engineer who can't imagine working for a measly half-million a year, there's also a shadow worker who has none of the same protections.

Noha Elsewaify, a single mother of two living in Brooklyn, New York, was employed at Google for more than five years, but as a contractor, not an employee. She worked full time and trained Google Assistant to speak fluently in Arabic but got her paychecks from contractor companies: first Artech, then Ask, then Accenture. Although her job stayed the same, she switched "employers" every two years, to skirt the rule that limits Google from keeping contractors on a job for too long without hiring them directly.

In April, with only three weeks' warning, Elsewaify was told her job was being eliminated. If she'd been a Google employee with five years of tenure, she would have gotten six months of severance. Other tech companies offered at least 16 weeks to their employees. As an Accenture employee contracted with Google, she got zero. (Google declined to comment; Accenture didn't respond to a request for comment.)

"When your last day at your current position comes," Elsewaify wrote in a letter to Alphabet CEO Sundar Pichai, "I hope you are treated with respect and appreciation, not like how I was let go, over a Hangout meeting, 3 weeks before my last check arrives." She added: "When this day finally came, I was tossed away as if I had never been there." Ⓑ —*With Julia Love and Aisha Counts*

# The Mole

**When Danish telecom TDC was compromised, attention turned immediately to its Chinese vendor, Huawei. But this wasn't a standard case of industrial espionage**

By Jordan Robertson and Drake Bennett
Illustration by Elliot Gray

At a hastily scheduled meeting on March 5, 2019, the bidding to upgrade Denmark's cellular network crossed over into something strange. Negotiations for telecommunications infrastructure are high-stakes affairs; the deals, worked out in private, determine which companies are entrusted to embed their equipment and staff at the deepest levels of a country's phone and internet systems. But the talks over the Danish contract, which had stretched through the winter, had been particularly fraught.

As it prepared to make the leap to a 5G wireless network, Denmark's telecom sector had become the object of a backroom economic proxy conflict. Relations between the United States and China were growing worse, and officials from the US National Security Agency were making the rounds in Europe, warning companies to avoid working closely with companies tied to Beijing. The decision by TDC Holding A/S, Denmark's dominant telecommunications company, would carry symbolic value beyond the contract's roughly $200 million price tag. It would also be a test of the effectiveness of the Trump administration's blunt diplomacy and its hawkish efforts to slow the growth of China's influence around the world.

The March 5 meeting was between a TDC senior executive vice president named Jens Aalose and a young country manager named Yang Lan from Huawei Technologies Co., the biggest network equipment maker in the world. Huawei managed TDC's existing network, which it had built under a 2013 contract that was due to expire. At 2:52 that morning, Huawei's Danish arm had, without warning, submitted an emergency revision to its proposal on the 5G contract. That in and of itself was unusual: Weeks earlier, Huawei had made what was supposed to be its best and final offer. The new offer was similar to the old one. But whereas that had come in significantly higher than the offer of the Swedish company Ericsson AB, Huawei's only competitor for the contract, this last-minute offer was lower.

This was particularly noteworthy. The competing bidders weren't supposed to know anything about each other's proposals; their terms were closely held secrets inside TDC, with access limited to about a dozen people. As a result, Aalose arrived at the meeting inclined toward wariness.

What happened there only intensified his suspicions. Lan, he noticed, had an atypical swagger that day: He was "very confident and had a more aggressive approach than usual," the TDC executive said in a report later prepared by the company's security team. Lan seemed to know something. Convinced that Huawei had found out the Ericsson bid details, Aalose cut the meeting short.

The resulting investigation by TDC would, over the next four weeks, take the company into a kind of paranoid twilight zone. Its senior management fell under suspicion; its offices were potentially compromised; and employees reported being tailed by shadowy strangers. This article is based on extensive internal documentation reviewed by *Bloomberg Businessweek* and interviews with a half-dozen people involved with or briefed about the probe and its results. The people who provided

the information requested anonymity because they weren't authorized to speak publicly about the matter.

It's a previously unreported chapter in Huawei's history and an example of the sort of practices that have sown suspicion about the company around the world. And it gives a sense of what life is like for businesses that get caught between the US and China in their escalating clash over technology.

Huawei—the name means "Chinese achievement"—was founded in 1987 by a former People's Liberation Army engineer named Ren Zhengfei, originally as a domestic reseller of telephone switches bought in Hong Kong. Many of China's technology companies have really only thrived in their home market, where they're protected from foreign competition by selective regulation and subsidies. Huawei, however, ventured overseas almost from the beginning. It began making its own hardware and found itself in the middle of the global communications revolution: the rise of cellphones, the convergence of voice and data and the arrival of the mobile internet.

At first the company mainly competed on price, selling at or below cost, thanks to generous Chinese government support. Over time the quality of its equipment improved, then became state of the art. Huawei makes the routers and cell-tower antennas that relay data, and it writes the software that manages the increasingly complex choreography required to squeeze it all onto the available bandwidth. Within the past decade, the company has seized a commanding lead in supplying telecom providers throughout Africa, Asia and Europe, far outpacing its closest rivals, Sweden's Ericsson and Finland's Nokia Oyj.

Lan's own career traced that global rise. He joined Huawei in 2005, according to his LinkedIn profile, as an account manager in China's Hebei province, and he worked there for three years before gaining his first international posting, on Ericsson's home soil in Stockholm. A year later he was promoted to country manager for Denmark.

Huawei was on the march in Europe, having won a 2004 contract to build a 3G network in the Netherlands, followed by another in the UK. According to a former TDC executive and two former senior Danish officials who worked closely with Lan, Huawei was working hard to win TDC's business when Lan arrived in the country in 2009. It seemed a daunting task; TDC's and Ericsson's home countries are Nordic neighbors with strong diplomatic and cultural ties.

> Huawei was working hard to win TDC's business when Lan arrived in the country. It seemed a daunting task

But TDC turned out to be open to persuasion. Its technical staff had become unhappy with Ericsson's reliability, the three people say. Because TDC's network handles classified data for the Danish government, officials there had influence over any potential Huawei partnership—and they, too, had reasons to entertain it. American intelligence agencies had begun lobbying their European counterparts to stick to European suppliers, according to the two former Danish officials who were involved in those discussions. In Denmark that campaign backfired.


● Lan's LinkedIn page

China, after all, isn't the only government with a history of using friendly telecommunications companies to spy on other countries. When American officials warned that Huawei equipment might contain so-called backdoors allowing Chinese intelligence to copy data or listen in on conversations, Danish officials worried that the US might do the same thing with equipment from its preferred vendors. The US was "not a fully trusted broker on discussions of Huawei," one of the former officials says. "It's not in Denmark's interest to be locked in with a company approved by the US government."

Those fears were rooted in Denmark's intimate understanding of the reach of US espionage: In 2015 a Danish government investigation determined that the nation's Defense Intelligence Service had been allowing the US National Security Agency to access data from fiber-optic cables transiting the country to spy on political leaders in France, Germany, Norway and Sweden. Last year the country's former defense minister and intelligence chief were charged with divulging state secrets in connection with leaks to journalists about the government's investigation. Both men have denied the allegations; their trials are scheduled for later this year.

TDC and its government partners did have security concerns about Huawei, but according to the former TDC executive and the two former

● Huawei's 3G and 4G TDC contracts totaled **$700m**

Danish officials, Huawei ended up agreeing to an unusual deal. TDC would send its Huawei equipment to a special testing facility in the UK set up by Huawei and the Government Communications Headquarters, or GCHQ, the British signals intelligence and cybersecurity agency. There, the code would be examined for any unauthorized modifications before the gear could be cleared for use in Denmark.

In 2013, TDC announced a six-year, $700 million contract with the Chinese provider to build and manage TDC's 3G and 4G wireless networks. Lan himself went on to a series of management roles in Ghana, Nigeria and Poland. Then, in 2016, he was sent back to Copenhagen to land a new TDC contract before the existing one expired.

By then, Huawei and its competitors were starting to build 5G networks, which operate on higher frequencies than their predecessors. The newer networks offer more bandwidth and faster speeds, but because the higher-frequency signals don't travel as far, the systems require far more transceivers and much more advanced software to manage it all. The benefits of 5G for consumers and corporate customers remain the subject of debate. But for Huawei—and its competitors—it was an opportunity to lock in billions of dollars in global contracts. Denmark was one of the first European countries to roll it out.

Huawei has long been suspected of competing unfairly for business. Accusations of corruption and illegal or unethical business practices have followed the company as it's opened markets in Asia, Europe and the Middle East. In Algeria, Huawei was banned in 2012 from bidding on public tenders for two years, and one of its executives was convicted and sentenced in absentia to 10 years in prison, over a $10 million bribery scheme involving a state-owned telecom company. A 2018 analysis by research firm RWR Advisory Group found that Huawei had secured more than $5 billion in deals that involved allegations of corruption or bribery.

By 2016, the year Lan returned to Denmark, the US Department of Justice had begun investigating the company for fraud, intellectual-property theft and sanctions evasion. Those probes would lead to federal charges, as well as the arrest in Canada of Meng Wanzhou, the company's deputy chairwoman and the daughter of its founder—she was held in Vancouver under house arrest for almost three years, until her release in a deferred prosecution agreement with the US government.

The US indictment accuses Huawei of explicitly incentivizing theft. "Employees were directed to post confidential information obtained from other companies on an internal Huawei website, or, in the case of especially sensitive information, to send an encrypted email to a special huawei .com email mailbox," the indictment states. "A 'competition management group' was tasked with reviewing the submissions and awarding monthly bonuses to the employees who provided the most valuable stolen information. Biannual awards were made available to the top 'Huawei Regional Divisions' that provided the most valuable information."

Lan was "very confident and had a more aggressive approach than usual"

Huawei has also consistently faced accusations that its equipment is used for spying. The company vehemently denies this, but there's countervailing evidence. In 2012, as Bloomberg News reported, Australian officials informed their American counterparts of a sophisticated intrusion involving Huawei's gear. Hackers from China's spy services were copying large volumes of data from Australia's telecommunications systems and sending it to China, according to the Australians. The incident was considered especially damning because the code used in the hack was delivered through Huawei software updates, suggesting that either the company had approved the operation or its technical staff had been infiltrated by intelligence operatives.

In response to the reporting, Huawei said it was never told by Australian authorities about a breach, but the incident confirmed suspicions at US and Australian intelligence agencies that China's spies were using Huawei for access into customer networks. The discovery marked the beginning of a concerted diplomatic effort by both countries to slow Huawei's growth.

At TDC, as the 5G bidding process began in late 2018, there were still influential executives and managers who'd lived through the company's struggles with Ericsson and remained steadfastly pro-Huawei, according to people involved in the discussions. Others were uneasy. Inside the Danish government, some of the officials who'd approved the 2013 contract had also grown suspicious after Huawei appeared to shirk its commitment to the security review process it had agreed to. On multiple occasions, TDC had to deploy Huawei equipment and software that hadn't been sent to the UK for testing because of what Huawei said were "administrative delays" in sending the products, one of the former Danish officials says.

The technical complexity of 5G, including the increasingly customized nature of the gear and the code, makes network operators →

● Aalose

LAN: LINKEDIN. AALOSE: LARGS RONBOG/GETTY IMAGES

more reliant on suppliers such as Huawei to manage that equipment and to spot any suspicious behavior. Lan's office was just across a parking lot from TDC headquarters, where dozens of Huawei engineers also worked.

Immediately after the aborted March 5, 2019, meeting with Lan, Aalose—the TDC executive—ordered an inquiry into the source of the apparent leak at his company. Since TDC's top executives were all potential suspects, that investigation was exceptionally sensitive. It fell to the company's security team. They worked out of a small operations center in the basement of a building adjoining TDC's executive offices.

Investigators initially suspected a hack; a Huawei employee working inside TDC could have installed malware to open a door for hackers in China or hunted for information about the Ericsson bid on TDC's network. There was precedent for Chinese government hackers working to help Chinese companies. In 2014, US prosecutors indicted in absentia five hackers from the People's Liberation Army, accusing them of breaking into the computer networks of American steelmakers on behalf of Chinese competitors to take intellectual property and internal communications.

Taking care to keep the nature of the investigation a secret, the TDC team asked company executives to turn over their cellphones and laptops. A search turned up no evidence of a cyber intrusion, no malware or other signs that hackers had gained access. Someone at TDC, the security team decided, must have intentionally shared the information. The investigators started going through company email accounts to see who'd sent the Ericsson document or discussed it with others. They also sought to determine who'd been talking to Lan.

Jason Lan, as he was known to non-Chinese acquaintances, made it his business to befriend people. He liked to hold court at the bar of the Hotel d'Angleterre, a gleaming 268-year-old pile on Kongens Nytorv square, where you can order a $1,700 bottle of whiskey or a $6,700 bottle of Champagne and look out at the giant illuminated Huawei logo perched above the bustling Nyhavn canal. Former TDC employees and Danish government officials who worked with Lan describe him as earnest and eager to please. He got loud and goofy when he drank too much, and he was under evident strain from the constant orders from Huawei headquarters in Shenzhen. He complained about how his international moves were affecting his wife and young son.

It soon became evident that Lan's efforts to cultivate friends among TDC's upper ranks had been successful. One executive had taken several trips to China to meet with Huawei management and used a Huawei phone given to him by the company. The executive talked and dined frequently with Lan. He'd also been introduced to an attractive young female Huawei employee. The two had met on one of the TDC executive's China trips, after which she was transferred to Copenhagen as a marketing assistant. That prompted concerns that the two were in a relationship, though the security team didn't find evidence of one.

Within days of the start of the leak investigation, TDC management had decided they could no longer do business with Huawei. On March 7, TDC's 5G strategy committee decided to accept Ericsson's offer.

The next day, at a breakfast meeting at a Copenhagen hotel, TDC's chief executive officer, Allison Kirkby, delivered the news to Lan and some senior Huawei managers from Europe and Asia. Lan grew emotional and said he and others at Huawei would suffer great consequences if TDC didn't change its mind. Some of his colleagues had a more menacing response. According to a statement Aalose gave to his security team, there was "a threat about how the wrong decision would affect other Danish companies in their future cooperation with China."

There was "a threat about how the wrong decision would affect other Danish companies"


● TDC headquarters in Copenhagen

Meanwhile, the investigation was zeroing in on a suspect: Dov Goldstein, a mechanical engineer from Denmark who, according to his LinkedIn profile, had worked at TDC since 2005. He'd led the company's negotiations during its 4G mobile network upgrade. In 2016 he was named head of special projects and cost optimization initiatives, reporting to Chief Financial Officer Stig Pastwa. Goldstein didn't at first look compromised—he didn't use a Huawei phone, nor was there any insinuation of a potential romantic dynamic with a Huawei employee. But going through his phone records, investigators found that he called and texted Lan

often. He often helped Lan craft his pitches to TDC brass. The two dined regularly at the Hotel d'Angleterre, including a four-and-a-half-hour dinner the day after TDC received Huawei's first bid on the 5G contract in October 2018.

On Feb. 26, 2019, a week and a half before the decisive breakfast meeting, TDC's 5G committee had made a preliminary decision to give the contract to Ericsson. The next day, Goldstein called Lan twice, according to his call logs, and emailed Lan an invitation to coffee on March 4, which Lan accepted.

A forensic analysis of Goldstein's Lenovo laptop provided clues about what happened at that meeting. Early that morning, Goldstein had opened a folder on his computer containing five PowerPoint presentations meant for TDC's board and the 5G committee. Then he'd opened a file containing Ericsson's final offer. Neither Goldstein nor his boss, Pastwa, were on the committee, but TDC's security team found that Pastwa had the documents and had emailed them to Goldstein. When the investigators requested CCTV footage from the company's physical security department, it showed Goldstein leaving the building for coffee with Lan, a laptop under his arm. Within 24 hours of that meeting, Lan had submitted Huawei's emergency revised bid, its total just a shade lower than Ericsson's.

It was at this point that the security team began to suspect someone was monitoring them, too. A sweep of the company boardroom turned up multiple long-range microphones that, while compatible with the existing audio conferencing equipment, were not part of the original system–no one knew who'd installed them or why. The investigators decided to relocate. On March 18, the day TDC publicly announced that Ericsson had won the contract, the security team moved into the offices of one of the company's law firms, Plesner, in a brown high-rise on Copenhagen's northern harbor. They took a corner space on the 15th floor. There were now more than a dozen investigators, including digital forensics experts from the international firm FTI Consulting, and multiple attorneys from Plesner. Most of their work entailed inspecting phones and laptops for signs of tampering. Every evening they boxed up the equipment in black military-style security crates, drove them to a Danske Bank branch downtown and wheeled them into a vault.

The day the TDC team set up in Plesner's offices, the law firm's IT systems came under a denial-of-service hacking attack. For a little more than a half-hour, "virtually no traffic could come out of Plesner's network," one internal report stated. The following evening, when one of the investigators was out with friends, he noticed a young woman taking photos of him. When he went to confront her, she hurried away. Then another woman sat down next to his group and appeared to listen in on their conversation. A few nights later he saw a man outside his apartment trying to peer inside. Around that time, Aalose's vacation home was broken into. The security team assigned Kirkby and Aalose, who jointly oversaw the leak investigation, round-the-clock security details.

● Kirkby

● Goldstein

● Pastwa

At 12:20 a.m. on March 20, a security guard patrolling the Plesner offices noticed lights floating outside the 15th-floor room where TDC's team had been working. Peering into the glare, he saw a large drone. For 10 minutes it remained there, flying up, down and sideways. Then it descended out of sight. Upon learning of the incident the following morning, the TDC investigators realized they'd failed to close the shades in the office. There was a wall-size whiteboard facing the windows on which they'd been tracing all of their leads, and it would have been in full view.

The security team members were, by temperament and training, suspicious people. And as some of them will admit, the prospect of a mole near the top of the company had made them jumpy. Others at TDC were skeptical of the talk of eavesdropping and drones, and believed that the team had drifted into chasing ghosts. The prospect of corporate espionage was especially jarring in Denmark, whose national identity is tied up in being an open society. The social taboo around mistrust in the business world can strike outsiders as anachronistic. It's strong enough that background checks, even in sensitive jobs, are less common than elsewhere.

On March 27, a little more than a week after publicly awarding the 5G contract to Ericsson, TDC announced that Goldstein's boss, Pastwa, was stepping down as CFO immediately. TDC didn't provide a reason. By June, Goldstein was out as well. Both declined to comment when reached by *Businessweek*.

The documents *Businessweek* reviewed included a timeline of events prepared by TDC investigators, detailed notes kept by members of the security team and updates about the investigation that were presented to TDC →

HQ: FREYA INGRID MORALED/BLOOMBERG. KIRKBY: JANERIK HENRIKSSON/GETTY IMAGES. GOLDSTEIN: LINKEDIN. PASTWA: COPENHAGEN INFRASTRUCTURE PARTNERS

management and its board of directors. The people familiar with the investigation say TDC concluded that Goldstein had leaked the details of Ericsson's bid to Lan and that Pastwa was likely aware that his subordinate's relationship with Huawei had crossed a line. The security team, however, found no evidence that Pastwa knew Goldstein allegedly leaked the Ericsson bid, the people say.

Within weeks of Huawei's losing the bid, Lan had left Denmark for a new Huawei posting in Shenzhen. By summertime, Ericsson had moved its engineers and equipment into TDC, and Huawei's staff was out. That June, TDC shareholders approved a long-planned split into two companies—TDC Net and Nuuday. After the split was officially completed, two years later, several executives left the company, including Aalose, who oversaw the leak investigation. He declined to comment for this story.

A Huawei spokesperson, in response to detailed questions about the findings of the TDC investigation, wrote, "Huawei complies with applicable laws and regulations, and strives for the highest standards of business conduct. We deny any wrongdoing." Lan, through a lawyer, declined to comment on most of the specifics of the reporting, citing confidentiality agreements and the fact that Lan hasn't seen the results of the TDC investigation. Lan, the lawyer wrote, "believes that he has acted in compliance with all applicable laws and regulations at all times." Lan's relationship to Goldstein, the lawyer wrote, "was of a professional nature, and one that was appropriate in the circumstances." And the Huawei phone gifted to the TDC executive was simply a sample given as part of a promotional campaign. A spokesperson for China's Foreign Ministry also declined to comment in any detail. "It is no secret that Huawei has been unreasonably suppressed and treated unfairly in the United States and Europe," the spokesperson said.

TDC Net, for its part, responded, "We recognize some of the things in Bloomberg's findings from our own files. We conducted a broad and deep investigation, and all appropriate measures were taken accordingly. None of the employees directly mentioned by Bloomberg work for the company today."

In May 2019 the US Department of Commerce added Huawei to its so-called Entity List. The decision officially deems Huawei to be acting against US national security interests and sharply curtails its access to chips and other key technologies from American companies. In early 2020 the UK, one of Huawei's earliest partners in Europe, announced that all Huawei equipment would be removed from its 5G network by 2027. Soon after, regulators in Sweden banned the company from that country's 5G network upgrade. The company suffered a series of defeats across Europe, losing out on contracts in Belgium, Finland, France, Greenland, Italy, the Netherlands, Norway and Spain. Bloomberg News reported in March that Germany will likely forbid some Huawei products.

Still, Huawei remains by far the world's biggest maker of telecom equipment, according to data from research firm Dell'Oro Group. With 29% of the market, it boasts twice the share that Ericsson and Nokia each have. Today, Huawei equipment is often deployed in the developing world as part of larger deals in which state-backed Chinese companies build everything from roads, bridges and ports to wireless networks. It's part of a global infrastructure and influence initiative called "Belt and Road."

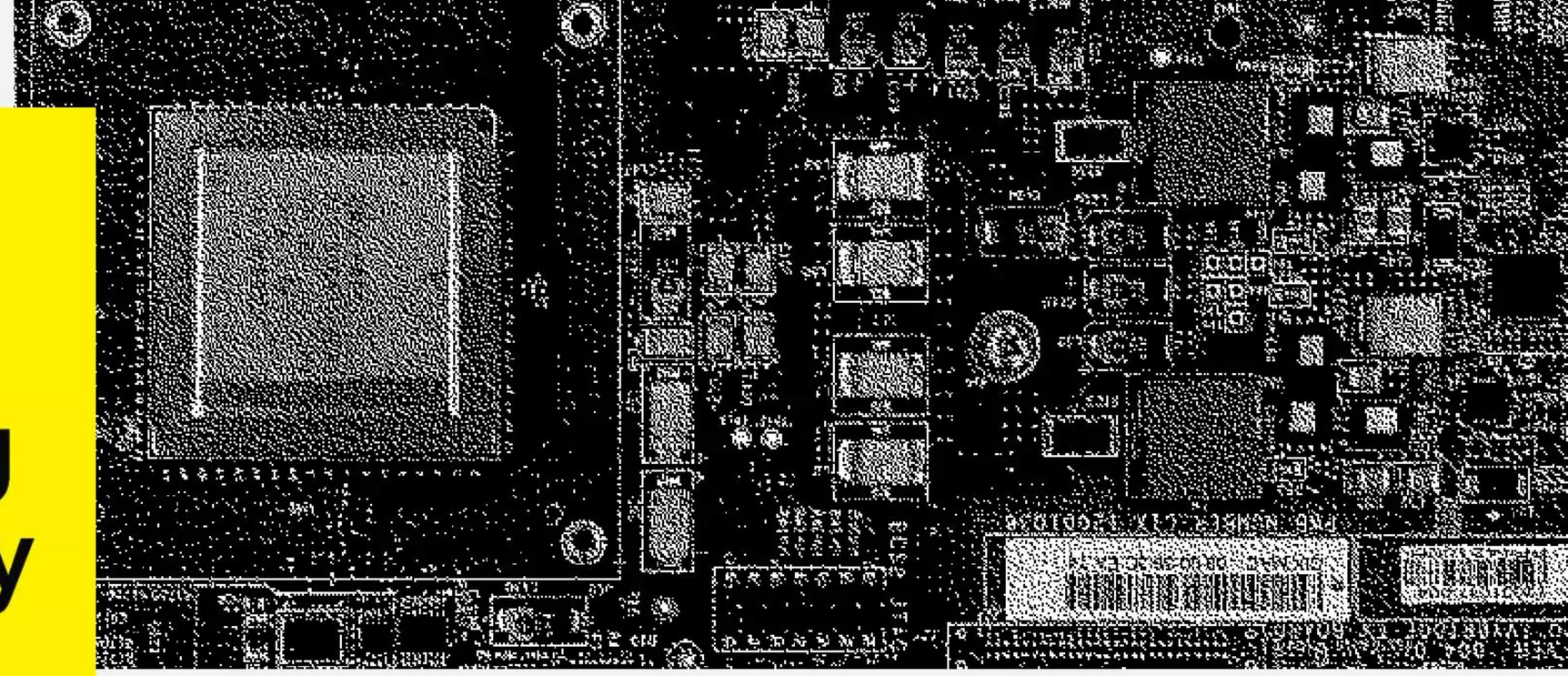
In Denmark, the government enacted legislation in 2021 that gives intelligence officials the ability to block any domestic telecom deal involving suppliers from countries Denmark doesn't have a security agreement with. Denmark has such agreements with Ericsson's Sweden and Nokia's Finland but not with China. And in April of this year, TDC Net announced that Danish intelligence authorities had ordered it to remove Huawei equipment from the fiber-optic cable portion of its network.

Kirkby declined to comment for this article. In October 2019 she announced she was bringing her 11-month tenure at TDC to an end to become CEO of Telia Co., Sweden's largest telecommunications operator. A month before the announcement, she joined members of TDC's security team for a dinner at a restaurant atop a former waterfront grain silo now transformed into a luxury apartment tower.

The investigation had been over for months, but the sense of unease lingered. "So, where are the drones?" Kirkby asked, jokingly, as she entered. Minutes later, someone looked out through the floor-to-ceiling windows and noticed one making its way toward the restaurant. The drone hovered in the air for a few minutes, and a team member took a picture of Kirkby pointing at it.

Everyone got up and watched the drone descend to the street, where it was picked up by men in a white van, who then drove away. Ⓑ

"So, where are the drones?"



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# Google's Tough Questions

**Sundar Pichai, chief executive officer of Alphabet Inc., has been struggling to find a place for his company in the AI boom. Google engineers laid the groundwork for OpenAI's ChatGPT, but Microsoft capitalized on it. Now Google has rushed forward with its own AI tools, notably the chatbot Bard, while trying mightily not to tick off users, regulators or the advertisers that pay its bills. We spoke to Pichai about the strange twists of this AI moment and what he plans to do about them. This interview has been edited for length and clarity.**

By Brad Stone and Julia Love

● *You've witnessed many waves of innovation in Silicon Valley. What's the significance of this one?* ■ **It's rare to find things which hit consumers and enterprises and all the way to countries. The pace, the public excitement—it's definitely a seminal moment.**

● *Many of Google's new AI products have been presented as experiments. How much potential do you see for them to be a permanent part of Google search?* ■ **These are going to be part of the mainstream search experience. There are a few things we want to make sure we get right. People come to us and type queries like, "What's the Tylenol dosage for my 3-year-old?" There's no room to get that wrong.**

● *Does it make you uncomfortable that Google's generative AI products are getting some things wrong?* ■ **There's definitely a trade-off. It's exciting because there are new use cases; people are responding to it. It's uncomfortable because it's inherently generative. There are times it makes up things.**

● *In 2017, Google researchers published a seminal paper introducing the AI technology upon which OpenAI's ChatGPT is built. Does Google have to change the way it operates?* ■ **This is a long quest, working on these ambitious problems. It's what attracts the best talent in the world. And that helps drive this virtuous cycle by which we are innovating at the cutting edge. None of that changes broadly over time. On the margin, as things get into products, we would think about what is proprietary. But do I expect Google to be an active publisher of research work in this field? Yes.**

**"It's a competitive moment, but I've built the company to be AI native for a long time"**

● *Does Google see this as an existential competition?* ■ **It's a competitive moment, but I've built the company to be AI native for a long time. I feel better positioned for this than we were for the shift to mobile.**

● *In May dozens of prominent AI researchers, including some Google leaders, signed a letter warning about the risk that AI might lead to human extinction. How seriously do you take that threat? What should be done about it?* ■ **We should definitely make sure we're focused on risks of bias or misinformation, safety incidents and so on. There will be serious issues with deepfakes. We need to take it all seriously.**

● *You've said tech companies must take care not to see AI as just a race, but there's a very real sprint to market at Google and elsewhere. What are you doing to make sure ethics don't fall by the wayside?* ■ **We've been cautious. There are areas where we've chosen not to be the first to put a product out. We've set up good structures around responsible AI. You will continue to see us take our time.**

● *There's been lots of cost-cutting in Silicon Valley in recent months, including at Google. Are you satisfied? Is the company as lean as you want it to be right now?* ■ **Our work toward sharpening our focus—I view it as enduring work. We are constantly trying to make the company more efficient.**

● *Early this year, Microsoft CEO Satya Nadella said his company's moves to weave AI into search had prompted Google to "dance," a nod to an old adage in Silicon Valley that big corporations struggle to stay nimble. Was that fair?* ■ **I think he said it so that you would ask me this question. It's all part of the game.** Ⓑ *—With Davey Alba*



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