Boldness in Business

March 2019

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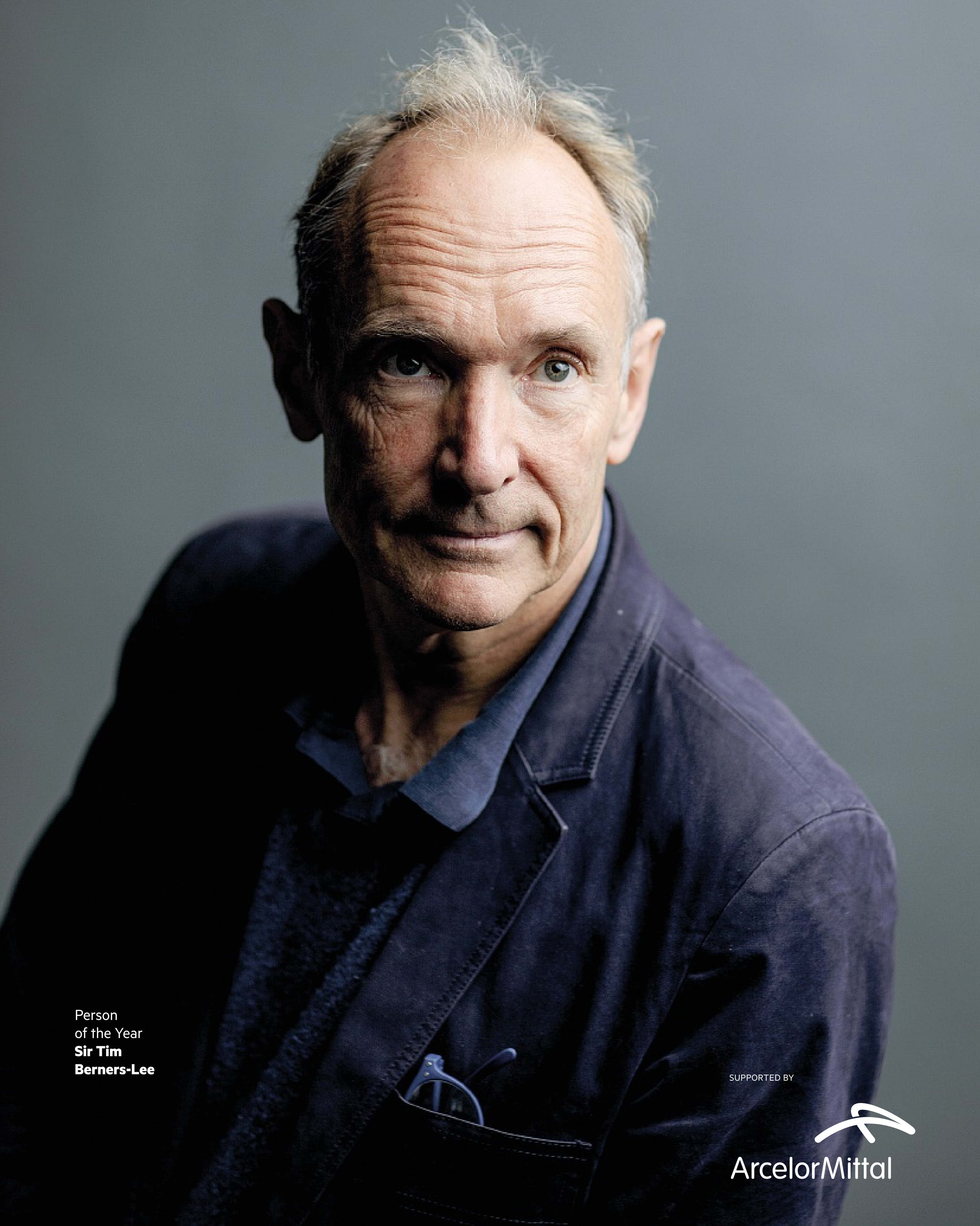

Person
of the Year
**Sir Tim
Berners-Lee**

Inventing smarter steels for a better world

Steel is strong, affordable, easily formed and infinitely recyclable.
But could it really be self-healing as well?

At Fos-sur-Mer in the South of France, ArcelorMittal is in partnership with EDF Energie Nouvelles, operating a 15-hectare solar farm on industrial land owned by ArcelorMittal. The structure that supports the solar panels is made from steel coated with ArcelorMittal's Magnelis® metallic coating product. Offering remarkable corrosion protection, especially necessary in solar farms, Magnelis® combines zinc with 3.5% aluminium and 3% magnesium. The effect of the product is that when the steel surface becomes exposed, such as on edges, welds, perforations or scratches, Magnelis® forms a very dense, practically impenetrable zinc-based protective film, making self-healing steel a reality.

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FOREWORD

‘The stories of the companies these awards recognise are a testament to the resilience of smart businesses in trying times’

Global business has rarely confronted such uncertainty. Protectionist moves have shaken bedrock trading relationships and thrown up new barriers to international commerce. Rising nationalism around the world threatens to push globalisation into a further retreat.

Yet the nominees and winners of this year’s Boldness in Business Awards demonstrate what cross-border business can still achieve. These companies have prospered, despite the unstable global context, in part by harnessing innovation. The power of technology has been a recurring theme in these awards in recent years. This year is no exception.

The work of Sir Tim Berners-Lee, Person of the Year, is a notable example. Founder of the world wide web three decades ago, Sir Tim with his newest project, Inrupt, aims to give individuals ownership of their data and rebalance power on the international network.

This year’s other winners include Gro Intelligence, the agricultural information company using data to help decision-makers reduce food insecurity, Fast Retailing, the innovative global clothing chain, and Lilium, the flying taxi start-up that took investment from Sweden, China, the US and Liechtenstein to get off the ground.

Now in their second decade, the Boldness in Business Awards are well established as best in category, thanks to the collaboration of ArcelorMittal and the Financial Times. These awards were conceived in the depths of the 2008 crisis, and the stories of the companies they recognise are a testament to the resilience of smart businesses in trying times.

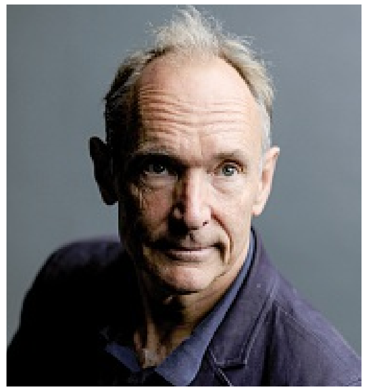
It remains for me to thank my fellow judges — Brooke Masters, FT comment and analysis editor; Edward Bonham Carter, vice-chairman of Jupiter Fund Management; Leo Johnson, partner at PwC; Robert Armstrong, FT US finance editor; Anne Méaux, president and founder of Image Sept; Brent Hoberman, chairman and co-founder of Founders Factory; Peter Tufano, professor of finance as well as Peter Moores dean at the University of Oxford’s Saïd Business School; and, of course, my co-chair, Lakshmi Mittal, chairman and chief executive of ArcelorMittal.

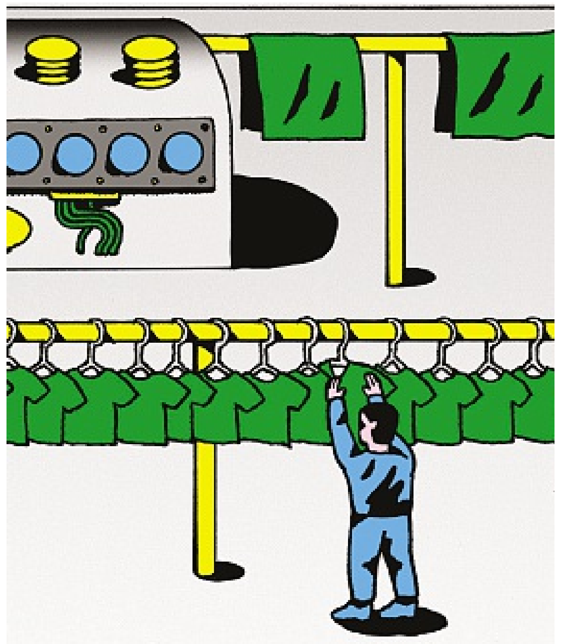
Lionel Barber, FT editor

Courage of conviction

This year's individuals and companies that have demonstrated a particular boldness of vision or execution in their business activities

Person of the Year
Sir Tim Berners-Lee
By designing the world wide web three decades ago, Sir Tim cemented himself as one of the most influential people of the modern era: his creation has had an incalculable impact on our everyday lives. But having grown increasingly concerned at how large interests were exploiting the web's openness — including for electoral manipulation and cyber crime — the British computer scientist designed a data platform called Solid aimed at returning ownership of data to the users who generate it. In 2018, Sir Tim launched Inrupt, a for-profit company intended to put Solid into operation, maximising the upsides of the web while minimising its downsides. The goal, in Sir Tim's words, is to "give people complete control of their data". *(See p16)*





Drivers of Change
Fast Retailing
The Japanese group, whose clothing brands include Theory, J Brand and Uniqlo, has grown to become the world's third-largest casual clothing retailer. It is investing in technology to increase efficiencies: its automation of a Japanese distribution centre enabled 24-hour operations and increased productivity 80-fold. Fast Retailing is now investing nearly $1bn to automate its warehouse and distribution operations worldwide. *(See p20)*

Corporate Responsibility / Environment
Iceland Foods
The UK retailer has long been committed to environmental campaigning, removing artificial colourings from its food in the 1980s and banning genetically modified ingredients in the 1990s. More recently, the company started two key environmental initiatives: to reduce plastic use within five years and to stop using palm oil in its own-brand products. Despite a television ban for its political content, Iceland's Christmas ad about the impact of palm oil — featuring a homeless orangutan called Rang-Tan — received millions of views online. *(See p26)*

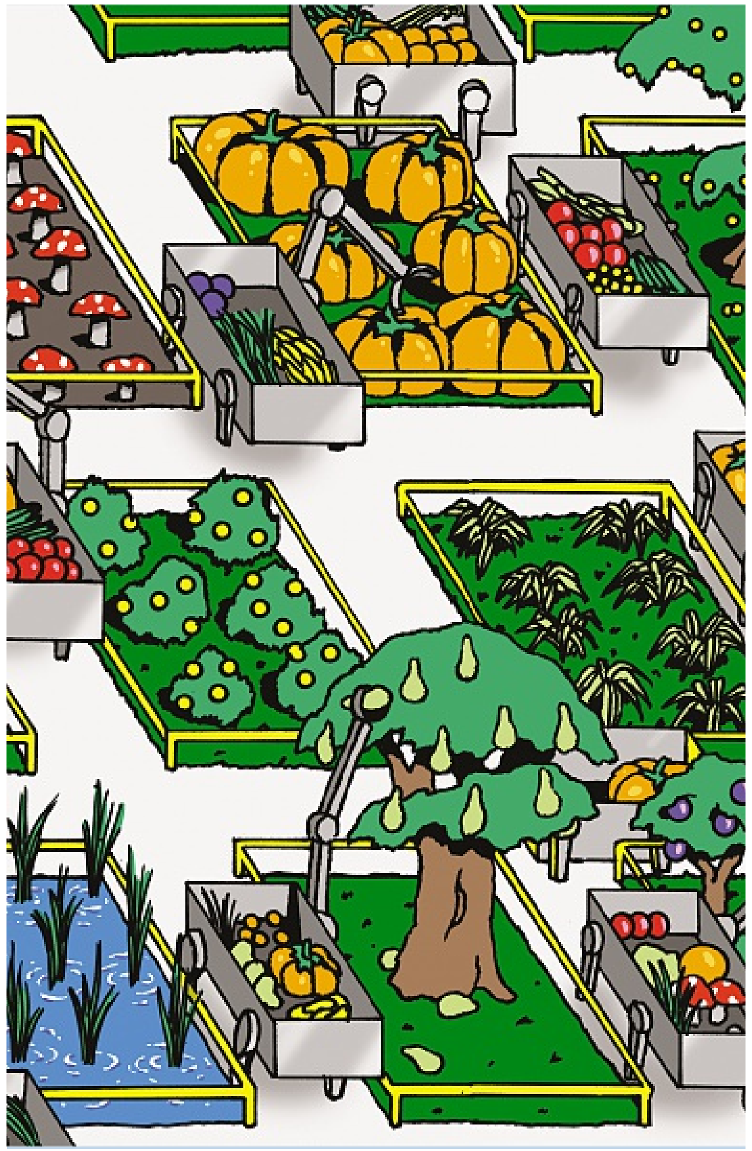


PHOTO: REUTERS ILLUSTRATIONS: FÉLIX DECOMBAT

Entrepreneurship
Halo Top
In 2011, Halo Top founder Justin Woolverton began experimenting in his kitchen to create an ice cream that satisfied his sweet tooth but contained substantially fewer calories than commercial brands. By the end of 2018, Halo Top had a hefty share of the North American market and was generating annual revenues of more than $300m. Halo Top has also started selling its low-calorie ice cream in the UK, Australia and Singapore, and continues to expand internationally. *(See p30)*

Technology
Ocado
The UK online supermarket has evolved into a technology group by selling its warehousing and ecommerce system, the Ocado Smart Platform, to other grocery retailers. In Ocado's warehouses, which are temperature-controlled to store fresh goods, robots collaborate to fetch goods and have the ability to complete a 50-item order in a few minutes. Since 2017, the company has signed deals with leading international retailers in Europe and North America. *(See p34)*

Developing Markets
Gro Intelligence
Founded to provide agricultural data about Africa, Gro Intelligence has expanded to focus on global food markets. Its data help users better plan for droughts, invest in more resilient crops and make better-informed choices about loans and investments. Gro uses machine learning to model data such as future crop yields with high accuracy — recently the US Department of Agriculture revised down forecasts for US corn and soyabean production, bringing them closer to Gro's predictions. *(See p38)*

Smaller Company
Lilium
The German start-up is developing electric air taxis that will be low-noise, high-speed and emission-free. In 2017, the company completed a first test flight of its two-seater jet, which executed its signature transition from vertical to horizontal flight. The launch helped Lilium raise more than $100m in funding to develop the aircraft for commercial use. Lilium is aiming for its flying taxi service to be operational by 2025. *(See p42)*

BOLDNESS IN BUSINESS
JUDGES & NOMINEES

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Editor of the Financial Times

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Financial Times US finance editor and former head of the Lex column

Brooke Masters
Financial Times comment and analysis editor and former companies editor

Edward Bonham Carter
Vice-chairman of Jupiter Fund Management

Leo Johnson
PwC disruption lead and co-presenter of BBC Radio 4 series FutureProofing

Brent Hoberman
Chairman and co-founder of Founders Factory, a corporate backed incubator/accelerator

Peter Tufano
Professor of finance and Peter Moores dean, Saïd Business School, University of Oxford

Drivers of Change

GW Pharmaceuticals
The UK medical group was approached in 2012 by the parents of an epileptic boy to see if its cannabis-based medicine could be developed as a treatment for his seizures. In 2018, the resulting drug, Epidiolex, was the first cannabis-based medication to be approved by the US Food and Drug Administration.

Inrupt
In 2018, Tim Berners-Lee, founder of the world wide web, launched Inrupt, to enable users to take control of their personal data from big tech. Instead of allowing online services to use their Facebook or Gmail accounts to access their details, Inrupt's Solid helps users share that information themselves using a personal online data store.

Just
The US food technology company makes plant-based alternatives to animal products, including Just Mayo, an egg-free mayonnaise. The group has also launched Just Egg, a vegan product with the taste and texture of scrambled eggs.

Monzo
The UK digital bank was founded in 2015, aimed at providing financial services to people "who live their lives on their iPhones". Monzo is constructing a marketplace where customers can access financial services provided by partner organisations. The company has raised £20m from 36,000 investors via crowdfunding and has more than 1m customers.

Revolution
AOL co-founder Steve Case started venture capital group Revolution, which since 2013 has invested in innovative US companies not based in New York or California. On his annual "Rise of the Rest" tour, Case visits start-ups across the US, and has raised more than $1bn to invest in them.

Corporate Responsibility / Environment

BlackRock
In 2018, the world's largest asset manager announced its commitment to "sustainable investing" and launched exchange traded funds that prioritise social, environmental and governance factors. It estimates such ETFs will grow from $25bn to more than $400bn in the next decade.

Covestro
The German company makes a compound called cardyon, used to create foam for mattresses and furniture. It can produce up to 5,000 tonnes a year of the polymer, made with 20 per cent waste carbon dioxide.

Neighbourly
UK-based Neighbourly is an online platform that enables companies and individuals to donate food to local charities, helping UK retailers meet a commitment to reduce food waste by 20 per cent by 2025.

ReNew Power
A developer and operator of wind turbines and solar panels, ReNew is India's largest clean energy producer. Last year it acquired Ostro Energy, and founder Sumant Sinha is eyeing more deals to consolidate India's fragmented renewables industry.

Vindhya e-Infomedia
Two-thirds of the Indian outsourcer's staff are disabled — unusual for a country where disabled people face significant discrimination. The provider of claims processing, payroll and data management has attracted clients such as IBM, Accenture and SAP, while staff turnover is in single digits.

Technology

Astroscale
The Japanese company was founded in 2013 to tackle the problems posed by the estimated 750,000 pieces of debris circling the earth in space. The company's space mission ELSA-d, where a test launch will aim to capture a satellite, is scheduled for 2020.

BenevolentAI
The UK medical start-up uses artificial intelligence (AI) to mine and analyse biomedical data in an effort to discover compounds for development as new medical treatments.

Celonis
The German technology group's AI-driven enterprise software analyses business processes. The software takes flows of information, such as those related to invoices or logistics, and visualises it in a way that makes inefficiencies easier to spot.

Darktrace
The UK cyber security company's Enterprise Immune System uses unsupervised machine learning that can establish a baseline of normal activity for any computer network and identify threats, much like the human immune system. Darktrace was valued at $1.65bn in September 2018.

Oxitec
The UK biotechnology company has genetically modified mosquitoes to prevent their offspring reaching adulthood. In May 2018, Oxitec launched a pilot project in the Cayman Islands and has received funding from the Bill & Melinda Gates Foundation.

Entrepreneurship

Bulb Energy
The company was founded in 2015 to offer renewable energy without the hefty premium charged by rivals. Having raised £60m of funding, it aims to supply 5m UK households within five years.

Fever-Tree
The UK-based soft drinks company produces high-quality mixers. Since launching its first tonic water in 2005, it has developed a wide range and overtook Schweppes as the UK's leading mixer supplier in 2017.

Mercari
The Japanese start-up is an app-based marketplace that enables consumers to sell second-hand goods to one another. It became Japan's first start-up to be valued at more than $1bn, with 30 per cent of Japan's population using the service.

Modanisa
Turkish entrepreneur Kerim Ture founded Modanisa in 2011 to fill a gap in the online market for Muslim women looking for modest but fashionable clothing. It sells more than 70,000 products from 500 brands.

Revolut
The financial services app offers its mostly European users international money transfers, cryptocurrency trading and fee-free currency exchange at the interbank exchange rate. The London-based company had a customer base of 2.8m by the end of 2018, and is expanding into the US and Asia.

Developing Markets

BYJU's
India's largest educational tech company offers app-based learning programmes and test preparation to primary and secondary school pupils. In September 2018 it received a $100m investment for a 5 per cent stake, which it plans to use to expand internationally.

CargoX
The Brazilian company's platform connects companies needing to ship goods with trucks with spare capacity. CargoX expects to reach $1bn in revenue by 2021 and plans to bring the technology to a wider global market.

Tala
Launched in Kenya in 2014, Tala's app offers microfinance loans in emerging markets, using data points from a user's smartphone to assist lending decisions. By October 2018, the company had issued more than $500m in loans, and raised funding from PayPal to expand globally.

Transsion
The Chinese electronics company makes smartphones aimed at sub-Saharan African consumers. It has adapted to that market by improving battery life, enabling phones to house multiple SIM cards, and recognise local languages.

Ualá
The Argentine fintech company's personal finance app is linked to a Mastercard prepaid card. Its widespread adoption is encouraging cash-reliant Argentines to switch to digital banking. Goldman Sachs led a $34m funding round for the group in 2018.

Smaller Company

American Giant
Retailing entirely online, the clothing company was founded with hopes of regenerating the US garment-making industry. The company has gained popularity on the back of the "Made in America" movement.

Goonhilly Earth Station
Once the world's largest satellite station, the site in south-west England provides telecoms and satellite-tracking services. It is upgrading its antennas to meet deep-space communication requirements, which will enable Goonhilly to communicate with missions to Mars or the Moon by 2020.

Icon
The Texan construction tech group was founded to develop tools capable of 3D-printing housing, to lower the time and cost of construction. In 2018, Icon unveiled the first home built to US regulations by the company's 3D printer, Vulcan; it took 48 hours to print the 350 sq ft building and cost $10,000.

Isabel Healthcare
The UK company's software matches users' descriptions of symptoms to clinical terms, enabling doctors and patients to identify the disease.

Science 37
The US-based company enables pharmaceutical companies to decentralise their medical research by conducting clinical trials via smartphones. Patients use their phone to record results and interact with researchers.

Louis Leslie

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CONTENTS & CONTRIBUTORS

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THE WINNERS
ROBERT ARMSTRONG

Making history

A bold business is a sustainable one — but what that means is open to interpretation

When economic historians look back at the present era in a century or two, they might struggle to make sense of the preponderance of a particular word — one that captures the preoccupations of businesspeople in the early 21st century but is devilishly hard to pin down. That word is "sustainability".

Of course, we all have a general sense of what sustainability refers to. For most of the history of business, it was enough that a business made a profit. As the old phrase has it, the business of business is to stay in business. Some time in the 20th century, however, the planet got a little more crowded and it became clear that the profit motive alone might not solve every resource allocation problem. It became evident that companies had better aim for something more than just returns on capital invested. A sustainable business is one delivering on that something.

What is it, then?

Part of the answer is about social responsibility: companies should be responsive to employees as well as shareholders, should not harm our common environment, should support civic life rather than enriching tyrants, and so on. But there is more to sustainability, I would argue, than collective responsibility. It is also about what kind of profit motive drives a business. Sustainable businesses are "long-term greedy": they want to generate prosperity into the distant future, not make a quick buck. And they should create positive economic externalities, not extract economic rent.

Does this all sound a bit abstract? Perhaps, but happily the seven winners of this year's FT ArcelorMittal Boldness in Business Awards provide concrete examples of what it means for a business to be sustainable in the fullest possible sense. And they show how sustainability in business requires intelligence, invention, courage and verve.

What is required for real sustainability is, in a word, boldness.

Let us start with one of the most straightforward forms of sustainability — the environmental one. Iceland Foods' commitment to radically reduce — and eventually eliminate — both palm oil from its products and plastic from its packaging is admirable enough, considered in isolation. But it also dispels one of the most pernicious myths about environmental sustainability: that it is a luxury good to be indulged in only by well-to-do consumers and the top-shelf brands that cater to them. Iceland is a value brand, but it is also an excellent business that is in a good position to take responsibility for all the external costs its operations have the potential to create.

> **Others should follow Iceland's example. Bold leadership is not a luxury good**

Others should follow its example. Bold leadership is not a luxury good, and this year's award for corporate responsibility and environment recognises that.

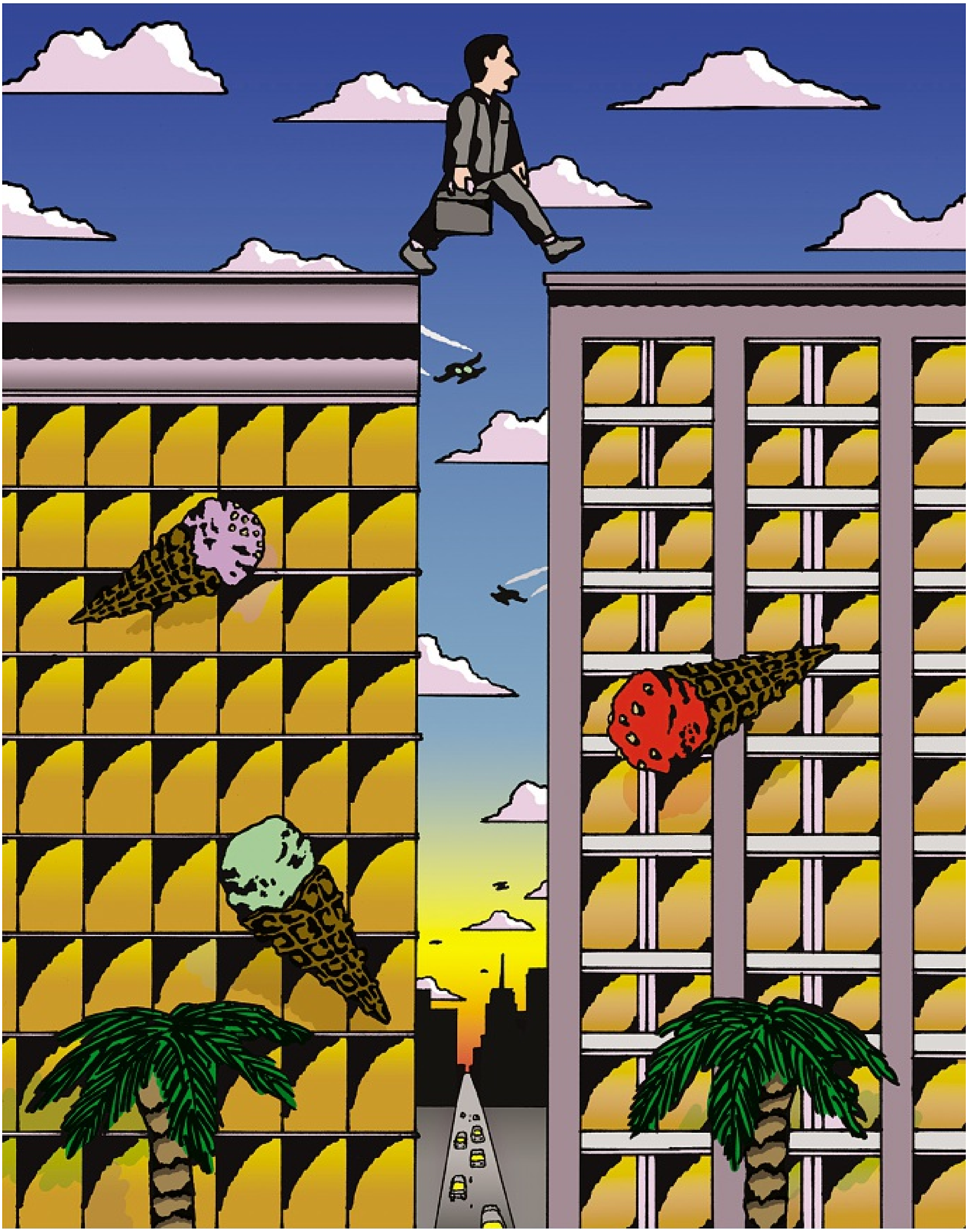
One of the most unfortunate facts of human nature (what we now call a "cognitive bias") is the tendency to see all business situations as zero-sum. "Think win-win," we are told again and again, but the point never seems to sink in. A good definition of a sustainable business is one that makes whole commercial networks work better — enriching all the participants, rather than separating the winners from the losers.

This magic is found particularly in information businesses, and this year's developing market award winner, Gro Intelligence, is an information business with immense potential. By gathering disparate sources of agricultural data, and doing the analytic work of turning the data into decision-making tools, it is set to make agriculture businesses more productive. A bold project the judges were pleased to endorse.

Next comes a gritty, literal sense of sustainability: the sheer ability to stick with it. Bold businesspeople cling to their long-term vision for their business, even when short-term conditions are unfriendly.

I was reminded of how hard it is for long-term-oriented businesses to stick to their guns by a comment that Warren Buffett made at a Berkshire Hathaway annual meeting. He was asked by an investor whether Berkshire's ability to buy high-quality private businesses outright would be maintained when he no longer ran the company. Business owners, the questioner suggested, are drawn to the Buffett mystique.

These opportunities had nothing to do with him, Buffett replied: owners who want to sell their businesses, but want to ensure they will be managed ▶



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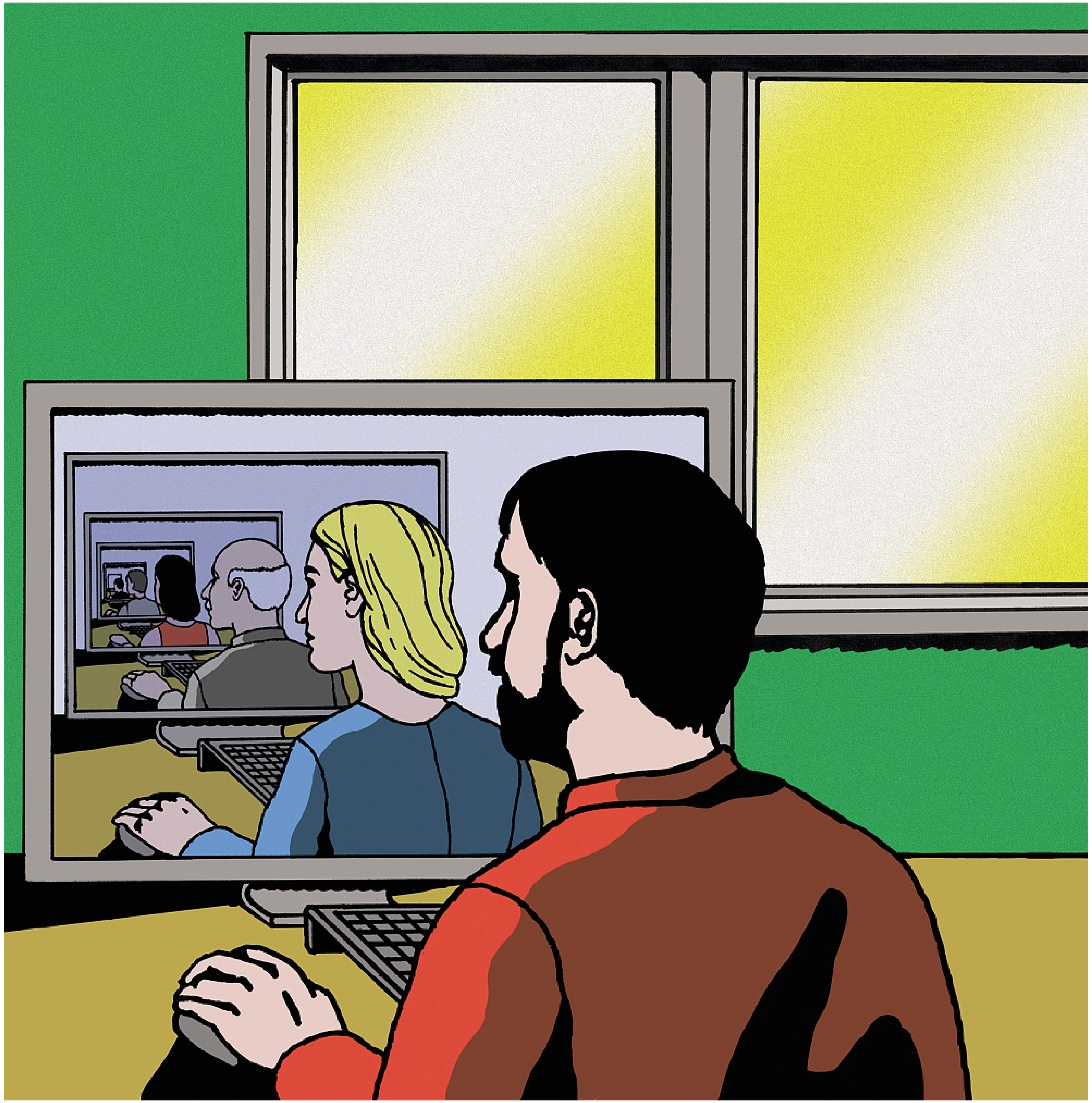


ILLUSTRATION: FÉLIX DECOMBAT

for the long run, have nowhere else to go. Public markets, private equity and everything in between — we live in a short-term world.

Ocado, the recipient of this year's technology award, has borne the full weight of the market's short-termism and come out the other side. The company and its founders endured years of pummelling from the markets as sceptics argued that a sufficient number of grocers would not adopt its technology for automating warehouses to facilitate grocery delivery, and the company would remain subscale for ever. (Full disclosure: even the FT's Lex column under my editorship sided with the sceptics. We were wrong.)

The company stuck to its vision and the customers did appear, in Europe and the US, sending the share price rocketing. At a moment when Britain needs a technology success story, Ocado is providing one.

Britain needs a technology success story, and Ocado is providing one

Next, a somewhat paradoxical meaning of sustainability: the ability to change. Fast Retailing, winner of this year's drivers of change award, has struck a remarkable balance between price and quality in its clothing. The products are inexpensive but not disposable, not meant to be worn for a season and thrown away, as many brands in the same price range are. Indeed, the quality matches that of many high-priced brands, and is forcing them to adapt.

Fast keeps the pressure on rivals by continuing to invest in technology and efficiency. Quality is maintained because underlying processes change.

One of the most reliable ways to win in business is to stay focused on serving a permanent and unchanging human need — especially when that requires doing things in a new way. There is no human desire more fundamental than that to eat ice cream. The entrepreneurship award this year was, for me, an easy choice. Halo Top, a business started in a lawyer's kitchen, made a place for itself in a market dominated by big, entrenched brands by delivering a low-calorie, high-protein product that was just better. Sustainable businesses, at a basic level, do not simply ensure customers pay up. They make sure those customers are happy.

Of course, there may be needs that have not yet been satisfied at all, except in dreams: in a nod to this, the judges' pick for small company was Lilium, which may deliver a low-noise, no-emission air taxi — or, as it is known to the child in all of us, a flying car. A business, or a world, that stops dreaming boldly becomes unsustainable fast, after all.

A final definition of sustainability is one that in my mind is the most important. Truly sustainable businesses — which, I have argued here, are all distinguished by their boldness of spirit — are operated with the recognition that some things are more important than business. There are values to which all commercial endeavours are subordinate.

Sir Tim Berners-Lee, our person of the year, saw how the internet, which he did so much to bring to life, was put to use for the exploitation of individuals rather than their liberation. His latest endeavour, Inrupt, is trying to redesign the web to change this, putting individuals back in charge of their own information.

The judges hope to look back, years into the future, and see that the businesses we have recognised in 2019 are still growing, innovating and striking out for new territory. Bold business is sustainable business. ●

COMMENT
BROOKE MASTERS

The rebirth of retail

Companies are showing that with technical and product innovation, it is still possible to thrive

By all accounts, the retail sector in most of the world is struggling. Rising competition from online shopping has hit bricks-and-mortar retailers hard. Environmental concerns have led customers to question traditional packaging and farming practices. And the growing preference of many consumers, particularly younger ones, to favour “experiences” over stuff has eaten into overall demand.

We see the bad news everywhere: Sears, Nine West shoes and David’s Bridal all filed for bankruptcy in 2018. In the UK, House of Fraser and HMV were each sold for a song. The insolvencies are striking up and down the value chain, from designer BCBG Max Azria to discount shop Poundworld. With these failures came job losses and further pressure on malls and high streets as shoppers had fewer reasons to visit.

Yet with adversity comes opportunity. Whenever a sector is under pressure, it gives those with creative solutions a chance to shine. Amazon emerged stronger from the 2001 dotcom bust, and decades earlier the big three US carmakers ultimately improved their offerings when their dominance was challenged by better-made Japanese imports.

There is some hope that we may be seeing that kind of resurgence today. So many of the strongest candidates for this year’s Boldness in Business awards were retailers that one of the judges was moved to observe that we might be seeing a “retail renaissance”. The winners impressed us with how they have responded to everything from supply chain challenges to environmental degradation.

Two of our winners emerged from the groceries sector, which has been hit especially hard by changing shopping habits, concerns about waste and squeezed margins. Amazon’s entry into the sector, as well as the spread of discount chains such as Lidl and Aldi, have put pressure on supermarket groups to cut costs and improve convenience.

Ocado, the UK online grocer and winner of the technology category, has been around for 19 years. But it has come into its own in the past two years, winning contracts to set up robotic warehouses and e-delivery services for competitors, including Wm Morrison in the UK, Casino in France, Sobeys in Canada and Kroger in the US.

Retailers can prosper when they offer shoppers a real reason to buy there

Under the deals, Ocado will roll out the robotic technology it developed for its own business to improve the online services of other retailers. In other words, it has created a bright spot in the general retail gloom by helping less technologically advanced companies adapt to the shift to online shopping that is damaging so many of its competitors.

The other winner from the grocery sector, Iceland Foods, took the corporate responsibility/environment prize for its efforts to fight plastic waste and the environmental degradation associated with the use of palm oil.

Based in the UK, Iceland focuses on value and frozen food. It has long sought to woo customers concerned about health and the environment — during the 1980s it was the first big UK supermarket to remove artificial colourings and non-essential preservatives from food and to ban genetically modified food.

For this year’s awards, it caught the judges’ eye for its #TooCoolForPlastic campaign to replace all plastic in its own-brand packaging within five years. It has stopped offering single-use bags, removed plastic from 85 per cent of packaging, including egg cartons, and trialled reverse vending machines that give customers a 10p voucher for each empty plastic bottle they put in.

Iceland’s campaign against palm oil, which saw it remove the ingredient from its own-brand foods in 2018, received a big boost when advertising regulators banned its Christmas advert for being “too political”. The video, which features an animated orangutan and highlights the problem of deforestation, has received millions of views on YouTube and social media. Iceland’s next effort will be to promote sustainable fishing by selling “by-catch” species of fish that are caught unintentionally and usually thrown back into the sea as they are considered uncommercial.

The campaigns have helped this relatively small player stand out — like-for-like sales rose 2 per cent in the last reporting period and Iceland was named the UK’s top supermarket for customer service for the second year in a row, scoring highly for “emotional connection” and “ethics”. The results suggest retailers can prosper in competitive markets when they offer shoppers a real reason to buy there.

PHOTO: SHIHO FUKADA/BLOOMBERG

The final retailer to win in this year’s competition, Fast Retailing, took the prize in the “Drivers of change” category. Owner of the Uniqlo, Theory, J Brand and Comptoir des Cotonniers brands, Fast Retailing is the world’s third-largest seller of casual fashion, behind Zara, owned by Inditex of Spain, and H&M of Sweden.

Unlike those fast-fashion chains, which restock daily and have been criticised for encouraging waste, Fast Retailing offers fewer but more classic pieces — ones that are designed to last several seasons but are affordable because of the company’s efforts to keep costs down. One of the first Japanese retail groups to go global, Fast Retailing is now leading the way in automation. It has set a target for annual revenue of ¥3tn ($27bn) by 2022, up from the ¥2.3tn projected for 2019.

Fast Retailing is leading the way in automation

Ocado, Iceland and Fast Retailing are all well positioned to appeal to millennial customers, who do proportionally more online shopping and place greater emphasis on wanting corporate values that reflect their own. These companies serve as a reminder that when change hits hard, well-run, well-positioned businesses are the ones that benefit. ●

PERSON OF THE YEAR
TIM BERNERS-LEE

Reinventing the web

The pioneer of the online age is on a mission to reclaim the internet and give people complete control of their data, he tells **John Thornhill**

Inventing the world wide web might be considered a remarkable enough achievement for one lifetime. But Sir Tim Berners-Lee has another burning ambition: to reinvent it.

Thirty years ago, Sir Tim designed much of the architecture for our information age, ensuring that the web was open, free and accessible to everyone. The creation of this user-friendly interface with the internet has led to an astonishing explosion of communication and creativity, changing our world in incalculable ways. Some 4bn people now enjoy near-instant access to more information than their grandparents could ever have imagined.

But in more recent years the web has taken a dark turn as corporate, state and criminal interests have sought to exploit its radical openness. Our information age, which still promises so much, has been disfigured by the emergence of surveillance capitalism, electoral manipulation and cyber crime.

Sir Tim has grown increasingly distressed at how his invention has turned into an "engine of inequity and division", as he describes it. Fixing this emergent "anti-human" phenomenon has become the urgent priority of his life as the remaining unconnected people in the world today and future generations come online over the next few decades.

"We did create all kinds of wonderful things on the web. But looking back at the past few years, we have realised that there has been a lot of dysfunction in society," says Sir Tim, in an interview down a crackly line from Australia. "People are being manipulated to vote against their own best interests. The foundations of democracy are threatened."

'We know how to fire rockets into the sky. We should be able to build constructive social networks'

The critical question confronting all our societies is whether the web's flaws are a temporary bug that can be fixed or a permanent feature that can, at best, be contained. Ever the computer geek, Sir Tim is convinced there is a technological solution. His purpose is now to fix the bug and build a more respectful and powerful web that answers to our real human needs.

Since 2015, Sir Tim has been working with a small team of computer scientists at the Massachusetts Institute of Technology to design a new data platform called Solid (the name is derived from "social linked data"). Last year, he announced the launch of Inrupt, a for-profit company intended to put Solid into operation.

Thousands of developers across 26 countries are experimenting with 50,000 Solid personal online data stores (PODs). The company is also collaborating with some bigger partners, including an Indian telecoms company and the UK's National Health Service, to explore how Solid could be configured at scale.

To that end, Inrupt is aiming to complete a multimillion-dollar fundraising by the end of March, enabling it to launch a user product by the end of the year. In tech jargon, Solid is ▶

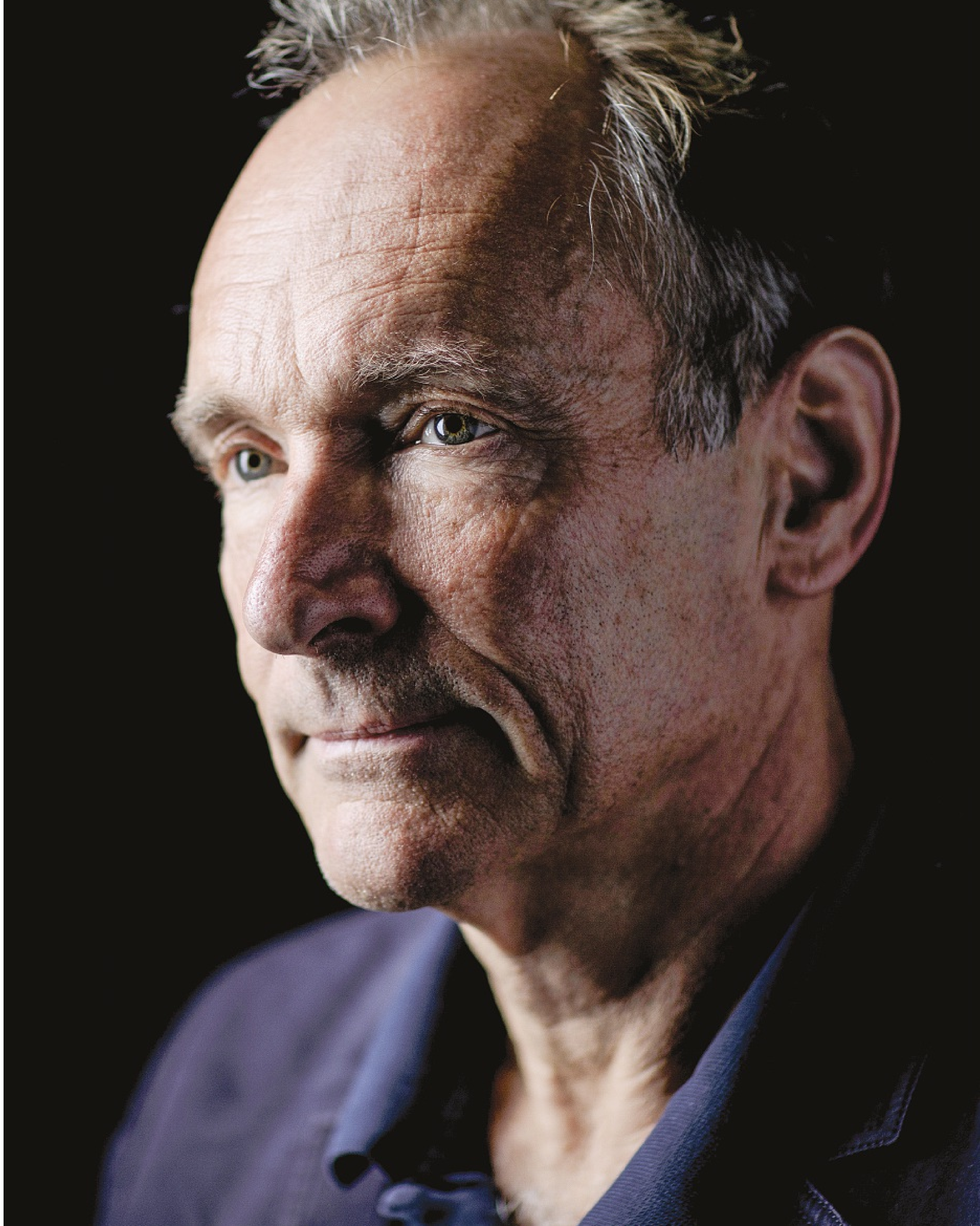


PHOTO: SIMON DAWSON/REUTERS

aiming to "re-decentralise" the web, returning ownership of data to the users who generate it and empowering them to give consent to others to access it.

"Solid solves a few problems at once because it is a paradigm shift," says Sir Tim. "But if you had to pick one it would be: giving people complete control of their data."

The challenges of scaling Solid are daunting, to say the least. Companies and governments have strong vested interests in maintaining the current data ecosystem; billions of users have built their lives around free and convenient services; and the technological and financial demands of launching an alternative platform are immense.

But friends say the 63-year-old computer scientist has been energised by his latest mission. "It is rocket science. It is tricky. Things can blow up on you," says Sir Tim. "But we know how to fire rockets into the sky. We should be able to build constructive social networks."

Given what has happened over the past three decades, the origins of the web now seem a long time ago and far, far away. Back in 1989, Sir Tim was working in Switzerland as a software engineer at Cern, the world's largest particle physics laboratory. Bashing away on his NeXT computer, he devised an online information space in which documents could be identified by uniform resource locators (URLs) and connected by hypertext links, enabling easy navigation between pages.

In his book *Weaving The Web*, he compared the effort needed to launch the web with that required to race a bobsleigh: everyone had to push hard for a seemingly long time, but once the bobsleigh built up momentum, everyone could jump on board and enjoy the ride.

The critical accelerant for the web's development was Sir Tim's selfless decision not to patent his invention, probably passing up the opportunity to earn billions of dollars in the process but keeping cyberspace open and non-proprietary. In the words of the science writer James Gleick, the web was "The Patent That Never Was."

As a result, cyberspace has grown at mesmerising speed. There are now almost 4.2bn internet users around the world, accessing close to 2bn websites, according to the latest ever-changing data from internetlivestats.com.

Ian Goldin, a professor of globalisation and development at the University of Oxford and co-author of *Age of Discovery*, argues that the mass adoption of the web can only be compared to the invention of the printing press in 15th-century Europe and its revolutionary effect on communication. The arrival of the web has opened a new era of information abundance, cheap distribution, radical variety and wide participation, he argues, that is comparable to a new Renaissance.

'Some people say we are turning the web on its head. But we like to think we are turning it the right way up'

"The web has been a huge net positive for humanity. It has been as revolutionary as the Gutenberg press in transforming the way that ideas are shaped and shared," says Goldin. "I cannot think of another technology over the past 30 years that has changed so much for so many so quickly."

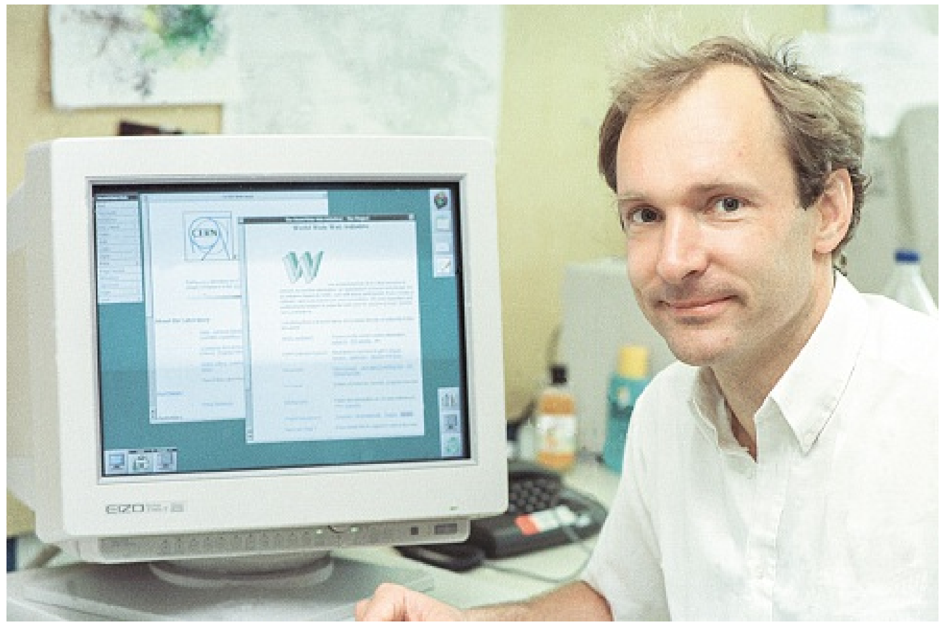
The widespread adoption of the printing press in Europe and the mass diffusion of ideas helped transform one of the most backward regions of the planet into its leading centre of innovation. "This is now happening at a much, much bigger scale with the web, enabling people from all corners of the planet to learn from each other," says Goldin. "Hip-hop dancers in Harlem can now learn moves from hip-hop dancers in Shanghai."

But communication revolutions enable bad ideas to spread just as quickly as good. "The Gutenberg press led to the explosion of genius, but it also led to 200 years of religious wars and gave voice to Savonarola," says Goldin, describing the publicity-savvy Florentine firebrand as a "15th-century Donald Trump".

Inrupt's ambition is to maximise the upsides of the web while minimising its downsides.

John Bruce, Inrupt's chief executive, argues that the Solid platform will create tangible benefits for all three of the web's biggest constituencies: its users, service providers and developers.

Users, he says, will enjoy greater privacy and functionality by integrating all their digital services more securely on their devices. Service providers can concentrate on what they do well, such as selling shoes, rather than worrying about things they do



Sir Tim Berners-Lee at Cern, where he developed an online information space that would become the world wide web

PHOTOS: CERN; PHILIPPE PETIT/PARIS MATCH VIA GETTY IMAGES

A tweet from Sir Tim Berners-Lee is displayed during the opening ceremony of the London 2012 Olympic Games

badly, such as managing data. And developers will be able to design apps for the direct benefit of users, rather than the tech companies and advertisers that stand behind them.

"Solid is hugely liberating for all of us, which is why it is so significant for the web," says Bruce. "Some people say we are turning the web on its head. But we like to think we are turning it the right way up. Inrupt is not just encouraging this new ecosystem but leading it."

Sir Tim says the Solid team are laying down new architectural rules about how things can operate online. "For the moment, it is a team of people with a vision making a very co-ordinated effort to do things in an extremely deliberate way so that we make sure this thing does behave like we want it to and it has the impact it promises," he says.

If Inrupt can get things right, Sir Tim believes Solid could help unleash an exciting new wave of innovation as developers benefit from the freer flow of valuable data. "If you pay a developer to make trusted apps, or you use open-source apps that are not going to advertise to you, or ambush you, or distract you, then you trust them more and you will give them access to a lot more data," he says.

'One problem Solid solves is giving people complete control of their data'

"I think we will be able to use very powerful apps that have access to all our data. We will be able to share anything we want with anybody. I can share my hospital records with my doctor, I can share my photos with my cousin."

The odds would appear to be stacked against Sir Tim and the Solid team. First, they are betting against complacency, assuming that users care enough to pay for trusted apps and spend time managing their own data settings. Second, they are betting against deeply entrenched interests that did not exist when the web was first created.

"It may be possible to create a clean web," says one digital expert. "But there are too many powerful and corrupt state and corporate interests intent on keeping it dirty."

If Sir Tim really does succeed in revolutionising mass communication for a second time, his latest accomplishment may yet be considered almost as significant as his first. One adjective best describes Sir Tim's ambition: bold. ●

Fit for the future

The Japanese fashion group's aggressive adoption of new technology has given it greater scope to compete with online rivals. By **Kana Inagaki**

Tadashi Yanai is one of the few people close to SoftBank founder Masayoshi Son who will openly criticise his penchant for deals. As Son devotes more of his energy to the Saudi-backed $100bn Vision investment fund, the 70-year-old founder of Fast Retailing reminds his old friend to stay focused on his core business.

But while they often collide on risk-taking strategy, what two of Japan's most driven chief executives share is their vision of a digital transformation that has upended the businesses they founded. This is also the area where Yanai turns to Son for his views on big data, robotics and artificial intelligence.

Established in 1963, Fast Retailing has boldly expanded to become the world's third-largest casual clothing retailer, with annual global sales of $19bn. Among other brands, the group operates more than 2,000 Uniqlo stores in over 20 countries, and expects to expand into India and Italy later this year. Overtaking larger rivals Inditex-owned Zara and Hennes & Mauritz had long been Yanai's goal, but with ecommerce on the rise, it is also the likes of Amazon that preoccupy him these days.

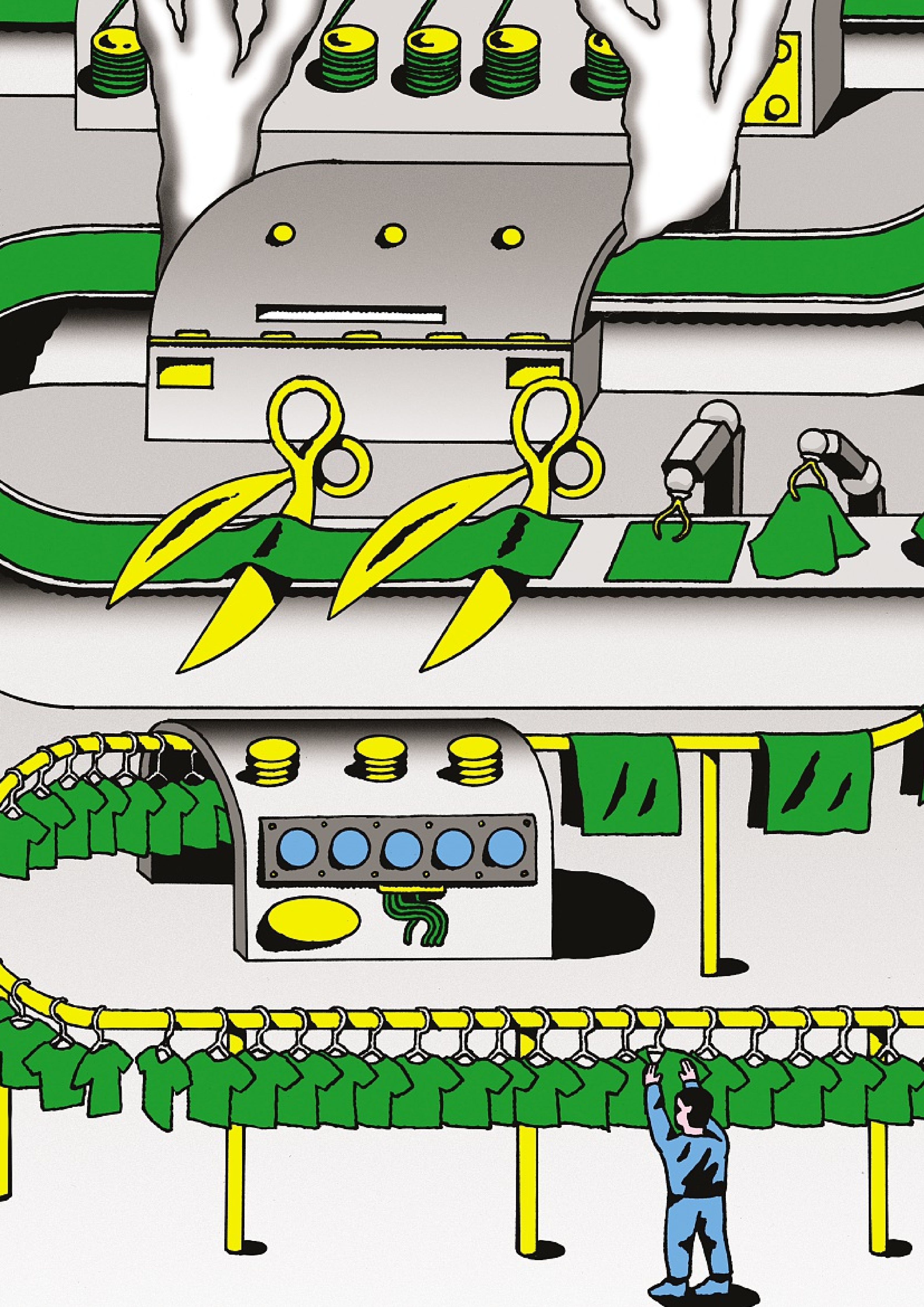
Tadashi Yanai, Fast Retailing chief executive

The key to survival in the digital era, Yanai says, is to have the ability to collect and analyse troves of customer data to create products consumers want. For that, Yanai turned to Google last year for machine-learning and image-recognition technologies to analyse product trends and predict consumer demand. "I want to make clothing the world's cutting-edge business," Yanai said at a Google Cloud Next event in Tokyo last September.

But churning out hit products is not enough in the era of ecommerce. Like Amazon, Fast Retailing needed to establish a seamless logistics and supply chain network that will allow its products to be delivered without delay to the "I-want-it-now" millennial generation.

If Google is Fast Retailing's partner for AI, its ally in the overhaul of its supply chain is global logistics giant Daifuku, which helped transform Fast Retailing's flagship warehouse in Tokyo into a 24-hour operation by replacing 90 per cent of its workers with robots. The company plans to spend $900m to automate other warehouses worldwide within the next few years to address labour ▶

ILLUSTRATION: FÉLIX DECOMBAT; PHOTO: AIKO KON/BLOOMBERG



shortages, storage costs and lags in delivery. "No matter how good our products and stores may be, we need to have strong logistics to connect the two," Yanai says.

At its distribution centre in Tokyo's Ariake district, the only work done by humans is the process of collecting items and placing them in cardboard boxes to be shipped to customers — robotic arms are not yet proficient at picking up soft materials such as clothing. But all the picking of items off warehouse shelves is performed by robots.

The robotics system carries out all other labour, such as inspections and sorting of goods by reading their electronic tags. The products are then wrapped in a cardboard box and whisked away on a conveyor belt. Such methods have cut the time between order and despatch to as little as 15 minutes, compared with the eight to 16 hours it took previously.

The overhaul of Fast Retailing's logistics system did not come easily — nor with the speed that Yanai had originally envisioned.

Hard lessons were learnt when the company suffered a logistics meltdown in 2015, leading to severe supply problems with its best-selling products and the costly accumulation of unsold inventory in its warehouses. In those days, its Heattech thermal underwear was delivered to its warehouses in May, then stored for five months before going on sale in the autumn.

"We used to just leave everything to our warehouse operators and there was no consistency. As a result, cost management was lax and we fell into a situation where the costs just kept on rising," says Takuya Jimbo, an executive in charge of the group's supply chain reform.

Fast Retailing is not alone in trying to adapt to the accelerating shift towards internet shopping and competition from online

PHOTO: PRISMA BY DUKAS/UIG VIA GETTY IMAGES; NICKY LOH/BLOOMBERG

Fast Retailing has more than 2,000 Uniqlo stores around the world, like in Tokyo's Ginza district (left) and in Singapore's Orchard Central mall (above)

entrants such as Amazon. Sweden's Hennes & Mauritz was one of the first fashion retailers into online selling, but in recent years it has focused on the rapid growth of physical stores. As that strategy began to falter, the company tried to adjust that balance, investing in automated warehouses to achieve next-day delivery for 90 per cent of its European customers. But replacing its logistics systems has not been cheap, with rising costs depressing its earnings.

Inditex of Spain has 19 warehouses around the world dedicated to fulfilling online orders, which account for about 10 per cent of its annual sales. The company has invested in improving its "click and collect" services that allow consumers to pick up products ordered online at a nearby store.

For Fast Retailing, analysts say the challenge will be how it can strike a balance between online and physical store customer experience while maintaining margins in the face of pricing pressures. In addition to the risk of declining footfall in stores, finding a balanced logistics strategy for high street stores and ecommerce will not be simple.

> 'The company can take risks, because it controls everything. That's rare in the retail industry'

Fast Retailing's annual online sales are about 7 per cent in Japan, 20 per cent in the US and 15 per cent in China. Yanai says he wants to increase that ratio to 30 per cent globally over the next few years.

"The more you increase ecommerce, the faster you will close down physical stores. That has at least been the standard in Europe and the US, and Fast Retailing could go down the same path," says Kensuke Kojima, a fashion business consultant in Tokyo.

Still, analysts say few in the retail industry have been as aggressive as Yanai in investing in new technologies and seeking out new partners to ensure its business model can survive the age of digital commerce.

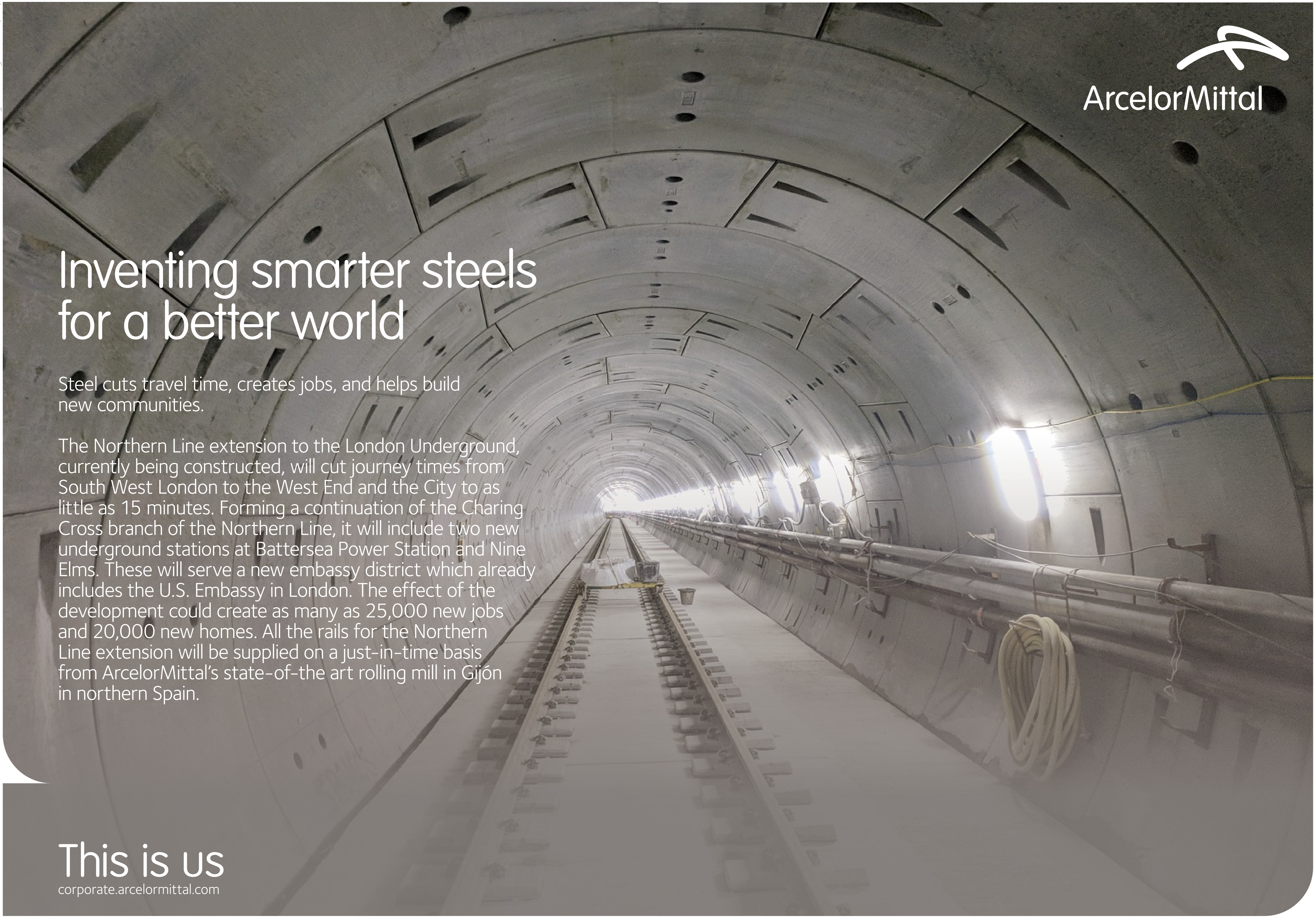
"It's not just about Yanai's leadership," says Dairo Murata, an analyst at JPMorgan Securities. "The company does everything from manufacturing to development of materials, factory management, logistics and distribution. That is why it can take risks, because it controls everything. That's rare in the retail industry."

When asked about the threat posed by Amazon and Zozotown, a Japanese online marketplace, Yanai points to Fast Retailing's breadth of operations. "I firmly don't believe Amazon and Zozo will dominate the entire apparel market. In fact, I think it is our strength that we do everything from planning and manufacturing to sales," he says.

A big part of Fast Retailing's success in launching hit products has been Yanai's ability to pick the right partners. Long before Google and Daifuku, collaboration with carbon fibre maker Toray resulted in new materials, such as Heattech and Sarafine, which retain heat in cold weather or breathe in the sweltering summers, respectively.

Fast Retailing expects its list of technology partners to grow. "In the apparel industry, one company cannot dominate the world and it is necessary to grow together with partners," Yanai said in late 2017.

"I don't think there is any company other than Fast Retailing that can partner with the world's top players, from Toray, Mitsubishi, Accenture, Disney, Apple, Google and Alibaba to Tencent." ●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Steel cuts travel time, creates jobs, and helps build new communities.
The Northern Line extension to the London Underground, currently being constructed, will cut journey times from South West London to the West End and the City to as little as 15 minutes. Forming a continuation of the Charing Cross branch of the Northern Line, it will include two new underground stations at Battersea Power Station and Nine Elms. These will serve a new embassy district which already includes the U.S. Embassy in London. The effect of the development could create as many as 25,000 new jobs and 20,000 new homes. All the rails for the Northern Line extension will be supplied on a just-in-time basis from ArcelorMittal's state-of-the art rolling mill in Gijón in northern Spain.
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ICELAND FOODS

Against the grain

The UK supermarket has not shied away from controversy with campaigns such as a palm oil ban to fight deforestation. By **Jonathan Eley**

The unveiling of Christmas television advertisements is an annual ritual in the UK's hugely competitive retail market. Yet the commercial judged to be the most effective in 2018 never made it on to the nation's TV screens.

Advertising agency Kantar Millward Brown conducts consumer research into the effectiveness of festive campaigns. It says the expensive effort by department store John Lewis featuring singer Elton John and a schmaltzy Sainsbury's supermarket advert about a school play both had less resonance than Iceland Foods' low-budget animated feature about an orangutan made homeless by deforestation.

Richard Walker, managing director of the frozen food chain, says the "Rang-Tan" advert was originally made for Greenpeace, the environmental lobby group of which he is a member. "They showed us a rough cut of this campaign video they had: it brought a tear to my eyes. We thought it would be great if we could use it as our Christmas advert," he says.

Clearcast, the organisation controlled by broadcasters that approves adverts, had other ideas. It refused to clear the advert because it had previously appeared on the Greenpeace website and the group had some of the legal characteristics of a political organisation. Instead, the advert was released online — with a generous dose of "the ad they tried to ban" publicity — and promptly went viral. It was viewed more than 70m times worldwide, while a petition launched in the UK urging Clearcast to reconsider received more than 1m signatures.

Walker is adamant Iceland did not plan for this turn of events as a cost-effective way to upstage bigger rivals. "We thought debadging it would be enough to get it past Clearcast. I genuinely did not think it would be banned." He says the company had booked more than £600,000 of television advertising slots to air the commercial.

The advert refers to the clearing of forests in Indonesia and Malaysia to make way for palm oil plantations. According to Greenpeace, an area equivalent to 146 football pitches is cleared every day in Indonesia alone. "Rainforests cover only 2 per cent of the planet's surface but account for half its biodiversity. They are the crown jewels," says Walker, who in April 2018 pledged to remove palm oil from all Iceland's own-label products by last December to persuade the industry to stop clearing forests.

Iceland's choice of campaign theme might seem an odd one for a company that since its foundation in 1970 has targeted customers at the value end of the shopping spectrum. It lacks the scale of other supermarkets — its annual revenue of £3bn is a fraction of the £51bn (excluding fuel) that UK market leader Tesco achieves, or the SFr91.4bn ($90.6bn) posted by food multinational Nestlé. Iceland's palm oil consumption for own-label products, about 500 tonnes a year, was inconsequential in a global context; consumer goods giant Unilever gets through 1.5m tonnes annually, and total world yearly production is 72m tonnes.

Walker acknowledges the move was at least partly a personal one. "Were [customers] screaming ▶

ILLUSTRATION: FÉLIX DECOMBAT

down the aisles saying, 'If only there was no palm oil'? No, but I am so proud that now some customers, some of whom only have £20 a week or so to spend on food, are talking about palm oil — where it comes from, the pros and cons," he says.

Environmentalists such as Jonathan Porritt say UK retailers generally have a good record on palm oil — the World Wide Fund for Nature rates most of them highly on progress towards ensuring that record is sustainable, mostly via participation in the Roundtable on Sustainable Palm Oil (RSPO), an industry standards body.

But Iceland was the first to propose removing palm oil from its products altogether — a controversial move in many respects. It was derided by Porritt (who is an adviser to Sime Darby, a producer of sustainable palm oil) as "an almost entirely meaningless gesture". Other critics say switching to alternatives would have a catastrophic impact on the smallholders who cultivate palm oil.

Walker acknowledges such matters are rarely clear cut. Palm oil is a widely used ingredient because it is one of the cheapest vegetable fats and is much higher-yielding than many alternatives. Sunflower or rapeseed, for instance, require far more land to produce the same volume. He says his objection is specifically to deforestation, and that "it would be great" if improved sustainability meant he could remove the "No Palm Oil" branding proliferating across Iceland's ranges.

The palm oil ban is not the first occasion Iceland has made a bold move in the name of the environment. Two decades before, it was the first UK supermarket to ban genetically modified (GM) ingredients. Previous initiatives have included recycling freezers containing ozone-depleting chemicals and removing artificial colourings and preservatives from foods.

The man behind many of those decisions was not Walker but his father, Sir Malcolm Walker, the company's founder and executive chairman, who claims to have coined the phrase "Frankenstein foods". "Our business was about walking a tightrope between what people will spend on food and the absolute quality of the product," Sir Malcolm wrote about GM foods in *Best Served Cold*, his 2013 autobiography. "We had to compete but we also had to be ethical. Our customers were mainly on a low income but they had a right to a choice."

Richard Walker says by wrapping bananas in a cardboard girdle, Iceland is saving 10m plastic bags a year

Not that he minded the publicity such moves attracted. "I wasn't embarrassed to shout about them and try to turn them into a point of difference. They were certainly good for sales and our constant high profile in the media brought in new customers."

Richard Walker is more circumspect, saying there was no clear-cut evidence of a sales boost from the Rang-tan advert. The company also incurred significant costs by helping its suppliers remove palm oil from its ranges, at a time when it is carrying a relatively high debt load and facing challenging trading conditions. Iceland's borrowings — more than five times its earnings — stem from a leveraged buyout of the group led by Sir Malcolm in 2012. The ratio of debt to earnings is below two at all the major UK supermarkets.

An even more complex undertaking is Iceland's pledge to remove all plastic from its own-label ranges by 2023, another area where rivals have followed its lead. Plastic, which is cheap and versatile, is integral to food packaging, but the BBC's *Blue Planet* wildlife documentaries have raised public awareness of its environmental effects.

> 'I'm not entirely happy. If you go into our shops now, it is still a wall of plastic'

Walker says there have been some early wins. Wrapping bananas in a cardboard girdle rather than bagging them has saved 10m plastic bags a year, for instance. "We are a fifth of the way on the journey in terms of tonnage, though I'm not entirely happy. If you go into our shops now, it is still a wall of plastic," he says.

Walker also admits there is a degree of contradiction in a company that owns a private jet lecturing others about environmentalism. "There are contradictions in all our lives, but I don't think the answer is to live in a cave and never fly anywhere," he says.

Iceland's 'Rang-Tan' advert was viewed online more than 70m times after it was banned from television broadcast

Rita Clifton, co-founder of BrandCap, a consultancy, says Iceland seemed to have overcome the "radical at the research questionnaire but reactionary at the checkout" situation, where customers profess strong views about an issue but fail to act on them if that would mean bearing additional costs. Last December, Wilmar, the world's largest palm oil trader, said it would improve the monitoring of its suppliers, a decision Greenpeace described as "a breakthrough moment". The previous month, the RSPO had said it would commit to a no-deforestation policy.

It is impossible to know to what degree the advert influenced these changes, given that environmental organisations have lobbied food manufacturers and retailers for years to clean up their act on palm oil.

Clifton says it is easy to criticise the flaws in such initiatives, but adds: "If they're nudging the peanut forward in the right way, they should be encouraged as well as monitored." ●

ENTREPRENEURSHIP
HALO TOP

A scoop of the market

Low-calorie ice cream created in a home kitchen has become a model for 'challenger brands' competing with the consumer goods giants. By **Leila Abboud**

Lift the gold lid of a tub of Halo Top ice cream and you will be greeted with a cheery message printed on the seal, such as "Save the bowl", "Stop when you hit the bottom" or "Guilt-free zone".

The slogans encapsulate the promise that has earned the low-calorie, high-protein ice cream a legion of fans since it was created by Justin Woolverton as an experiment in his Los Angeles kitchen in 2011.

Halo Top offers the indulgence of premium ice cream but with much less of the sugar and fat contained in traditional brands such as Ben & Jerry's or Häagen-Dazs. A 473ml tub of Halo Top's Chocolate Chip Cookie Dough will set you back 360 calories, compared with 1,120 for the Ben & Jerry's equivalent.

Halo Top's simple proposition, paired with the online marketing savvy of Woolverton, 39, and his business partner Douglas Bouton, 33, has won over calorie-counting consumers. In barely six years, Halo Top has become North America's sixth-biggest ice cream brand, with a 3.7 per cent market share in 2018, according to Euromonitor data. The private company does not disclose financial information, but its co-founders say it has about 120 employees, and is profitable and growing rapidly.

Woolverton and Bouton have retained majority control after declining several takeover offers and raising $1.5m from a combination of friends and family, angel investors and crowdfunding.

'Now we're at a level of stability, we can build the business'

To build on its success in the US, Halo Top has embarked on an international expansion drive, launching last year in the UK and Canada with flavours such as Peanut Butter Cup, Mint Chip and Birthday Cake.

The looming challenge will be to encourage international consumers to develop a taste for Halo Top by adapting its sales pitch to countries with differing food cultures and dietary habits.

"So far in the UK, we've seen the same meteoric growth as in the US. We outsell Häagen-

ILLUSTRATION: FÉLIX DECOMBAT

Dazs in Tesco [the UK's biggest supermarket chain]," says Bouton with a hint of disbelief. "It was so hard to build the company in the first few years — we almost went bankrupt. But now we've gotten to a level of stability so we can actually enjoy it, innovate and build the business."

The two Californians, who knew little about ice cream or retail when they started out, surprised many industry executives who scoffed at the idea that a newcomer could break into a category that has long been dominated by multinationals Unilever and Nestlé.

In the process, Halo Top has become a poster child for the new reality shaking the consumer goods industry: the rise of challenger brands in everything from razors to dog food. Pitching themselves as greener, more local, more authentic or healthier than mainstream products, these upstarts often sell directly to consumers via online channels and use social media to attract attention.

Graeme Pitkethly, Unilever's chief financial officer, admits the consumer goods giant "had missed the trend in the US" for healthier ice cream and that Halo Top is taking share "very, very quickly". Unilever and Nestlé have scrambled to catch up; both have introduced copy-cat "healthier for you" ice creams in the US. Launched in mid-2017, Unilever's Breyers Delight mimicked Halo Top by placing the calorie count in large figures on the tub label.

Bouton says the new rival brands were not totally unwelcome, although their arrival slowed Halo Top's growth last year. The company's US retail sales in 2018 fell 6.4 per cent year on year to $329m, while units sold rose 4 per cent to 77.5m, according to IRi, a Chicago-based market research firm.

"It validates the market for healthier ice cream, which we pioneered," says Bouton. "But there are now too many brands for the space, so retailers will cull the brands and keep the best ones."

So how did Halo Top go from being a creation in a home kitchen to filling supermarket freezers? It began with Woolverton, who in 2011 was working as a corporate lawyer in Los Angeles but was bored with his job. A fitness buff who was keen to optimise his diet, he experimented with fasting and often cut out sugar to help control his hypoglycaemia. However, he had a sweet tooth and missed eating ice cream.

Halo Top's prominent display of calorie counts on its packaging has been imitated by rivals

Seeking alternatives, he started tinkering in his kitchen, first by freezing Chobani, a brand of thick, high-protein Greek-style yoghurt, and adding fruit and sugar substitutes.

Eventually his creations became more serious. "I didn't necessarily have weight issues. The driving force for me was that these were low-sugar products," Woolverton told the Financial Times last year. An idea then occurred to him. "If people like Chobani — and I like Chobani, and I like this ice cream I'm making — I think other people might like this ice cream I'm making."

> 'I felt we were having to reinvent the wheel for every new market'

Woolverton hit upon a recipe that was sweetened with stevia, a sugar substitute made from a leafy shrub native to Paraguay, and erythritol, a no-calorie sugar alcohol found in fruits such as pears and grapes that adds texture; both ingredients can, therefore, be described as "natural" in marketing materials. The recipe also includes milk, cream and air.

But scaling up from batches made in his kitchen was not easy. Woolverton looked for "co-packers" — manufacturers that produce packaged foods under contract, often for big food companies or retailers.

The existence of such outsourced manufacturing capacity has been an important factor in the rise of challenger brands in the consumer sector. Without it, few would have be able to turn their ideas into real products at scale.

After almost a year, Woolverton figured out how to make bigger batches of his ice cream and signed a deal with a California-based manufacturer. Using credit cards and loans, he paid a designer to create the packaging and logo, and convinced a local gourmet store to carry the product. He then enlisted Bouton, a friend who was also a lawyer, to join him scaling up the business.

PHOTO: KIRK MCKOY/LA TIMES VIA GETTY IMAGES

When Justin Woolverton, above, turned to outsourced manufacturing, it proved a key factor in scaling up the business

They built the brand initially by using targeted Google search ads and marketing on Facebook; they eschewed television adverts, which they could not afford anyway. But the most important channel for building the brand was Instagram, the photo-sharing app. Halo Top gave free samples to thousands of "influencers" — athletes, gym trainers and healthy-living gurus — with a critical mass of followers the company thought might like the product. "We were constantly reaching out to people to try to get the word out about Halo Top," explains Bouton.

A viral news story in early 2016 was a catalyst for the brand: a science journalist for GQ magazine ate nothing but Halo Top for 10 days and lost more than 4kg. Sales took off.

However, success attracted imitators, and the arrival of competing products in the US made Halo Top realise it needed to expand abroad or risk losing the first-to-market advantage that was crucial to its local success. "With their scale, we knew Unilever and Nestlé would be able to roll out their healthier ice creams much more quickly than we could," says Bouton.

In mid-2017, the business partners began to determine how to get Halo Top on sale in as many countries as possible, as fast as possible.

This was harder than they expected. Since their ice cream was manufactured in the US, it would have to be shipped internationally and be kept frozen during transit.

Figuring out local regulations and securing distribution were also a headache. "I felt like I was banging my head against the wall because we were having to reinvent the wheel for every new market," says Bouton.

Then over the summer of 2017, Bouton heard from a stranger offering to help. Matt Fulbrook, a former sales director for Ben & Jerry's in the UK, sent him an email, asking if Halo Top had thought of expanding to the UK. "We are a team of three ice cream guys with over 50 years collective experience within the UK ice cream sector… and know there could be an opportunity here for you," Fulbrook wrote.

Within weeks, the two had met and signed a deal under which Fulbrook's company, Brand of Brothers, would help Halo Top expand to Europe in exchange for a commission on sales. That connection enabled Halo Top to obtain UK distribution quickly. Tesco was the first to sign up, and by the fourth quarter of 2017, eight other customers, including supermarkets Sainsbury's, Morrisons and Asda, had also agreed to stock the ice cream.

On the branding side, Halo Top knew it had to tailor its advertising and marketing for a British audience or risk not connecting with consumers as it had in the US. "Our brand's voice has to be authentic and genuine — the antithesis of the big corporation or conglomerate," says Bouton.

Halo Top hired local staff and ad agencies, and produced an ice cream flavour called Lemon Wedding Cake: a homage to the choice of Meghan Markle and Prince Harry for their wedding cake last year. Halo Top's efforts appear to be paying off: in its first year on the market, the company recorded UK sales of £20.2m, according to IRi.

The group found a contract manufacturer in Germany, which will soon start making the ice cream that is sold in continental Europe, replacing stock currently shipped across the Atlantic. Halo Top has also started selling in the Netherlands and Germany.

"We're in 12 countries right now," says Bouton. "If we wanted to, we could double that quickly, but we want to go slower to make sure we do it right." ●

TECHNOLOGY
OCADO

Pick of the bunch

The UK online grocer's evolution into a builder of high-tech warehouses has given investors cause for optimism. By **Ian Smith**

Smoke billowed into the chilly night from a fire at Ocado's automated warehouse in Andover, southern England. The blaze, which started in the robot grid, gutted the online grocer's flagship distribution centre.

Not for the first time in Ocado's history, investors were spooked. In two days £1bn was wiped from the company's £7bn market capitalisation. Before the fire in early February, the state-of-the-art Andover depot had handled 10 per cent of the retailer's capacity.

Yet the blaze failed to spark a sustained sale of Ocado's shares. Unlike previous bouts of bearish sentiment towards the company — which was once one of the most shorted on the London Stock Exchange — the shares recovered a good deal of their losses in the days following the fire.

It is Ocado's bold evolution — from an online grocery delivery service to a technology company with a £1.6bn turnover that builds everything from consumer-facing websites to robot-operated depots for other food retailers — that analysts say has underpinned the group's new-found market resilience. This evolution has placated many of Ocado's early critics, who were concerned by what they deemed a high-cost business model with limited growth prospects.

Tim Steiner, a former Goldman Sachs bond trader, co-founded Ocado in 2000, sourcing goods from its trading partner, UK supermarket chain Waitrose.

It was not long after he took Ocado public in 2010 that Steiner encountered market scepticism. Bearish analysts highlighted the company's failure to secure further third-party deals following its 2013 tie-up with Wm Morrison, another UK grocer. Yet the management team held its nerve and focused on developing its technology.

The former short-seller's favourite went on to become the best-performing stock in the FTSE All-Share index in 2018, almost doubling in value during the year on the back of international expansion deals that propelled Ocado into the FTSE 100 index in June.

> 'Ocado's management has focused on ongoing innovation'

On the morning of the fire,

ILLUSTRATION: FÉLIX DECOMBAT

Steiner was unveiling Ocado's annual results and gave a nod to the struggle by lauding his company's "18-year overnight success".

Just weeks later, this transformation was completed in a deal to spin off Ocado's legacy UK grocery retail business into a £1.5bn joint venture with rival Marks and Spencer.

Bruno Monteyne, an analyst at broker Bernstein, credits Ocado's management for its "relentless focus" on creating new technology. "[Management] could have slowed down innovation a few years ago and focused on making the UK a nice cash-generative operation [to] then sell it to Waitrose. Instead, it focused on ongoing innovation," he says.

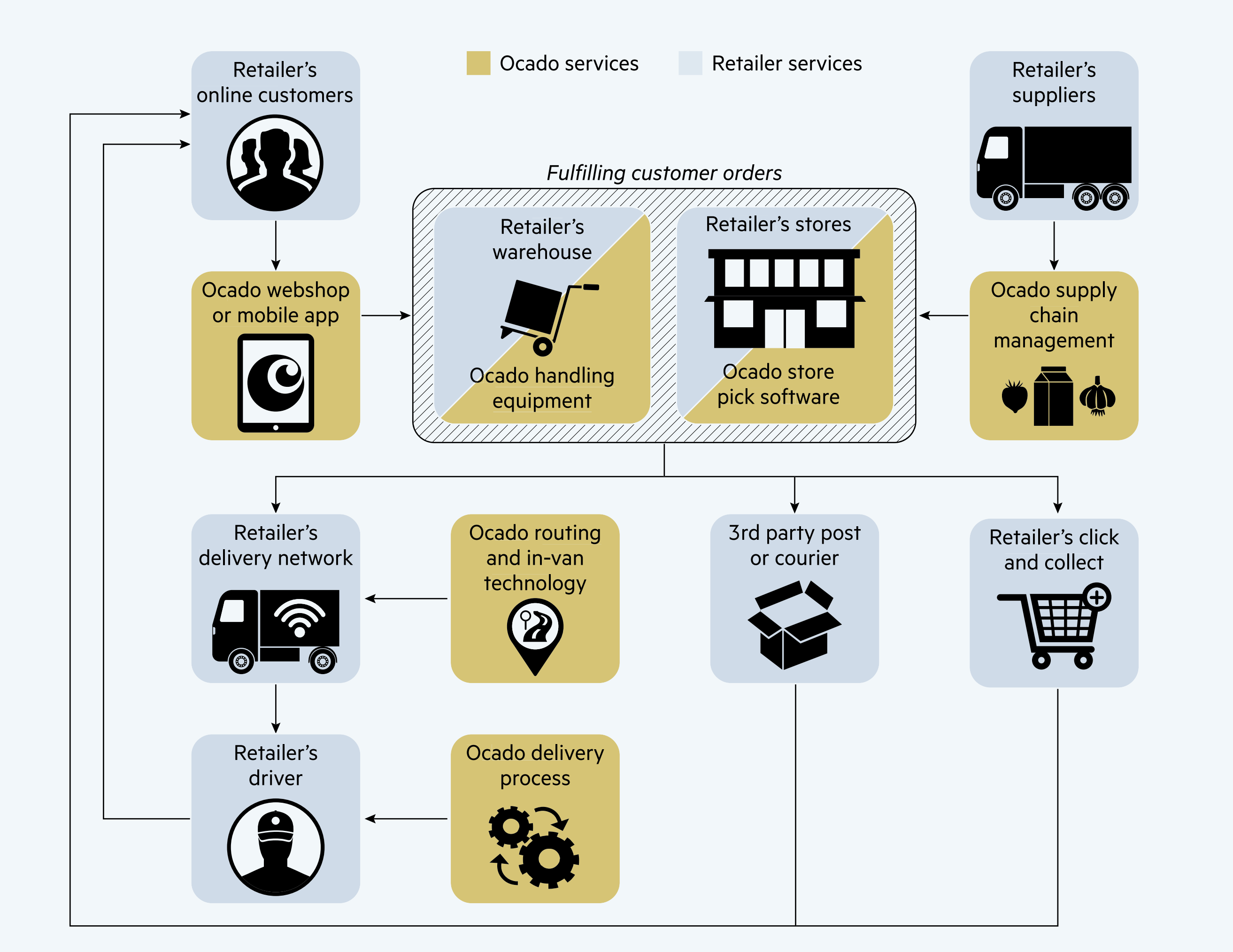
It was always part of Ocado's plan to develop some intellectual property and license it, but management had little idea of how much it would have to create until its technology teams tried to mesh third-party software with the hardware needed to build the infrastructure behind online grocery retailing.

The synthesis did not work well enough. "We started to design the facilities ourselves and write all the software ourselves, and later decided to build our own material-handling solutions and robotics ourselves," says Steiner.

An important early piece of software acted as a "control layer" over its smart warehouses. This balanced the operations of the building. At points this meant slowing down certain zones and moving human pickers to different stations to ensure the irregularity of grocery orders did not create gridlock. "Eventually we created software that meant we could deal with those oscillations and operate right underneath the maximum capacity of the building," says Steiner.

The drive for efficiency and the robotics work led ultimately to the Andover warehouse, which opened in 2016, showcasing Ocado's "hive" automation. More than 1,000 robots use a 3D grid system to ▶

How Ocado’s grocery platform works



GRAPHIC: CHRIS CAMPBELL; SOURCE: OCADO

move groceries from storage to human pickers. Because the robots can pass each other, the potential for gridlock is avoided.

Ocado has now designed everything on its platform (see graphic), from the website search engine (ensuring, for example, that a search for “milk” does not return a handwash or a chocolate bar) to the algorithms in its van-routing software.

The close integration of the warehouse software with the front-end consumer website means Ocado can give customers live availability and automatically reorder stock from suppliers. It also has a growing general merchandise business via brands such as Fetch, which delivers pet supplies through the same platform, and plans to trial a one-hour delivery service in London.

The next frontier is robotic picking, which should go live this year but is still some way off dealing with the 50,000-plus products of varied shape, weight and rigidity that the online grocer handles.

When it came to selling the technology, Ocado originally kept its cards close to its chest. “We had a view that we weren’t spending our shareholders’ money to learn about this market to be [a] free university and to teach the rest of the world,” says Steiner.

‘Over time Ocado’s exclusivity might reduce its potential’

But a couple of years after the 2010 listing, management decided that showcasing Ocado’s technology would not enable copying. Retailers and bankers watched the innovation in action, and soon UK supermarket chain Wm Morrison signed up for a website-to-doorstep ecommerce service.

The market was keen for more deals, but Steiner says Ocado was not ready to run multiple retailers. It focused on building a solid, replicable platform. In 2015, Ocado tried to sell the platform but struggled initially. “We set out to sell it, had a couple of hiccups along the way, but remained resolute in our beliefs,” says Steiner. “We held steady.”

This patience paid off in 2017-18, when Ocado signed up retailers including France’s Casino and Kroger in the US: the latter an agreement in principle to provide 20 automated warehouses. The stock market lauded a turnround. Just prior to the M&S deal, Ocado’s market capitalisation was equivalent to about four times its revenue, reflecting that investors valued it more like a US tech company than a UK grocer. Amazon, the US ecommerce giant, trades on more than three times its own turnover, while Tesco, the UK’s biggest supermarket group, just 0.4 times.

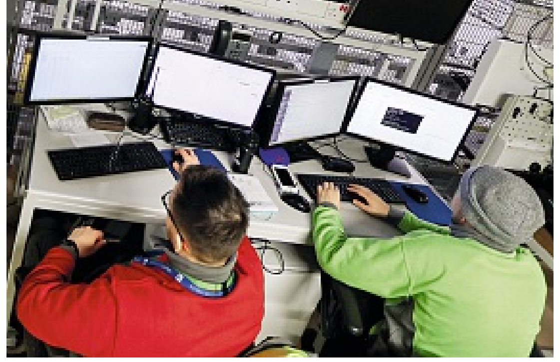
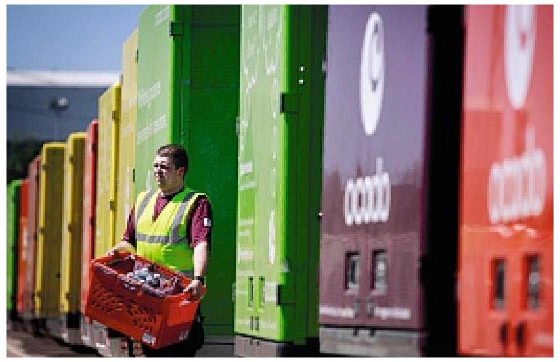


PHOTO: PETER NICHOLLS/REUTERS; JASON ALDEN/BLOOMBERG

Bernstein analyst Monteyne sees Ocado’s advantage in the website-to-truck breadth of the ecommerce platform. For partners, a two-year window to build a smart warehouse is faster than buying separate components and putting them to work, he adds. This pace of innovation means catching up will not be easy. “Everything can be copied, but even copying takes time,” says Monteyne.

Where stock market analysts once focused on Ocado’s failure to do deals, now many are bullish about how about how far those deals can go. James Lockyer, an analyst at broker Peel Hunt, believes the technology business has the potential to become the “Microsoft of retail”.

This would require Ocado to move from exclusive licensing of its platform — as with Kroger — to becoming a standard industry platform. “At the moment [Ocado] is exclusive,” says Lockyer. “It is using that exclusivity to gain its deals, but over time that might reduce its potential.”



Humans are still a key part of Ocado’s warehouse operations, though robot pickers are on the horizon

But innovation is not free. Capital investment of £170m in the 12 months to December eclipsed operating cash flow of £128m, as it has each year since listing. The company’s balance sheet is healthy, but that is after £333m of proceeds from share issues last year.

Every tie-up increases the investment demand. “It’s a slight irony of our accounts and our cash usage that the more successful we are, the worse our accounts will look in the short term and the more capital we’ll require,” says Steiner. The M&S deal will help: it will give Ocado £750m in cash for a half-share of the joint venture, which, according to the latter’s management, will fund all smart warehouses currently planned.

The more bullish market-watchers see Ocado gaining strength to negotiate deals that are better for its cash flow. “As the deals get stronger, there should be more upfront payments,” says Lockyer at Peel Hunt.

But sentiment could again sour. Ocado must now tackle the challenges of fulfilling its deals with Kroger and Casino. If the company is not bought out, analysts expect the group to demonstrate that these third-party tie-ups have been worth it by generating a decent return on capital. Analysts have been given little information on the terms of the deals to forecast how profitable they will be. Despite rising sales, Ocado reported a £45m annual loss for 2018.

The Andover fire was a big disruption and Ocado-watchers have speculated that the blaze could unsettle the company’s partners.

Brexit also looms. Ocado holds just seven days of inventory by volume, as perishables cannot be stockpiled. “We run our business lean,” says Steiner, adding: “We just have to hope that the government and the governments in Europe keep the ports flowing.”

Grocer partners will come and go, but Ocado says it will keep building. Its patent application count is close to 400. “Our biggest innovation was not to try and have a single innovation,” says Steiner. “Our biggest innovation was to become an innovation house.” ●

DEVELOPING MARKETS
GRO INTELLIGENCE

Sowing the seeds

The company's agricultural data services are showing how they can help improve the efficiency of farming, amid a looming global food crisis. By **Peter Wells**

Like many people in business, Sara Menker is trying to fill a gap in the market. For the founder of agricultural data and analytics company Gro Intelligence, that gap is a looming global food shortfall that she says is equivalent to 379bn Big Mac hamburgers — more than McDonald's has sold in its history.

Discussions about global food security often focus on how to satisfy World Bank projections of a 70 per cent increase in food demand by 2050. That date, says Menker, is "so abstractly far away that we don't see the train wreck that's coming in front of us".

The crisis she predicts is a global annual deficit of up to 214tn calories, or 379bn Big Macs, by 2027. A combination of young populations and economic growth in Asia and sub-Saharan Africa could create an unbalanced world in terms of food supply and demand. This could be exacerbated by a possible reversal of India's long-standing self-sufficiency in food, according to Gro forecasts, with the country joining China and Africa as a net importer of calories.

"How do you drive efficiency across farms locally to improve yields and production? It's not like you just keep planting more," Menker argues. "You have to build some efficiencies into the system."

The implications of a planet unable to feed itself is why many are pushing for a change of attitude towards commercial farming in China, India and Africa, and to the approach to agricultural trading and shipping.

Where big data and artificial intelligence companies like Gro are looking to play a role is by uncovering information and trends that send signals to the market. Such data could, for example, encourage the building of storage facilities to cut food waste at the farm level or help to price credit accurately.

> 'It is impossible to understand emerging markets without understanding the agricultural system'

Born and raised in Ethiopia, Menker attended university in the US and landed a job as an energy trader with Morgan Stanley. The decision to start Gro in 2014 emerged as her interest switched from energy to understanding the global agricultural system.

Menker's approach to the interdependencies of the sector — from understanding soils to government policies and trade deals — has shaped Gro. The company, with a team of more than 60 split between Nairobi and New York, has set out to create a map of supply and demand across commodities, countries and languages.

"Initially the thesis was where we could make the biggest impact and the longest-term opportunities: so, developing markets," Menker says.

"But it is impossible to understand emerging markets without understanding the agricultural system. It is impossible to understand corn in Kenya without understanding corn in the US, or wheat in Nigeria without understanding Russia, Ukraine and India.

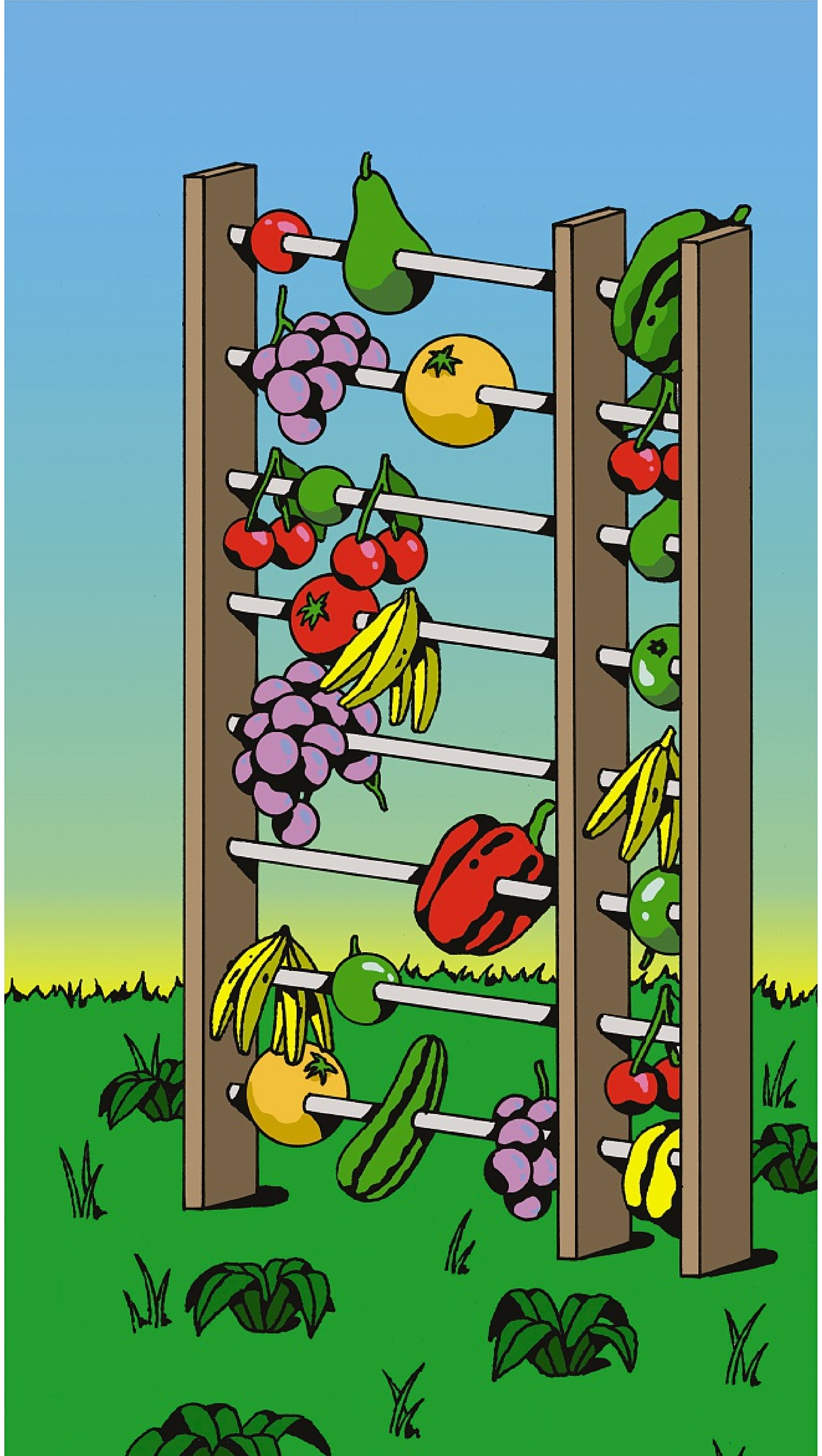


ILLUSTRATION: FÉLIX DECOMBAT

"The thing about developing markets is that they sit in a global market, and looking at agriculture in a fragmented way is dangerous — that is what we are trying to undo."

Although it has spent much of the five years since its inception fine-tuning and testing models, Gro had an opportunity to prove itself during the 35-day US government shutdown between December 2018 and January 2019. This left market participants unsure when they would receive critical crop and livestock data.

Using its machine learning-based predictive models, Gro released its own version of the market-moving World Agricultural Supply and Demand Estimates (WASDE) report, which is published monthly by the US Department of Agriculture (USDA) but was delayed by the shutdown.

Gro has been critical of the WASDE report, saying last year it was based on a "forecasting model that is dangerously out of date" and jeopardised the stability of crops such as corn and soyabeans. Seth Meyer, chairman of the USDA's World Agricultural Outlook Board, which produces the WASDE report, responded: "We don't just let the computer tell us what the estimate is. Satellite imagery is not a replacement for farmer surveys or on-the-ground sampling."

Gro had planned to release a "freemium", or free basic, version of its service in March, but instead granted free access to its website during the shutdown. Menker says more than 1,000 clients signed up within four weeks, including some of "the world's largest institutions".

Beyond Gro's calls for a more transparent and dynamic approach from the USDA, the recent episode highlighted broader concerns around transparency, reliability and ownership of data.

Menker is adamant that Gro should remain independent, to allow it to develop a broad and diverse ecosystem of clients and users. The company has two major backers — TPG Growth, an early backer of Airbnb, Spotify and Uber, and Data Collective, a California-based venture ▶

capital group with a penchant for big-data companies.

A challenge is the ability to "flow and combine" data with other market participants that could improve Gro's value, says Bernard Engel, professor of agricultural and biological engineering at Purdue University in Indiana. "There are some fantastic data sets at different levels of government. If you can't put together data from these entities, you are missing opportunities."

Tied to the question of ownership is a bigger one about who benefits from new technologies and insights, and how quickly and deeply that proliferates in the industry.

For Keith Coble, professor of agricultural economics at Mississippi State University, the question of how big data affects small stakeholders is one he struggles with. "In some instances the economies of scale here are such that you're not going to be able to use this technology unless you have a high-tech office," he says. He adds, however, that big data could help create better insurance products for small farms in a development context.

"In some sense you will see the larger producer being the one to benefit the most, but I don't think every aspect of this will benefit the large farmers only," says Coble.

The cost and availability of financing and insurance to agriculture is one of the main concerns. The sector's share of total global credit supply was just 2.9 per cent in 2017, according to the UN Food and Agriculture Organization. Menker says that in Africa, although 63 per cent of the population is in farming, less than 1 per cent of outstanding bank loans there have exposure to agriculture. Banks and insurers lack a clear understanding of a farm's operations and may be reluctant to lend, or else do so at a punitive rate, she says.

Sara Menker says it is 'impossible to understand emerging markets without understanding the agricultural system'

Gro works with "everyone in the agricultural ecosystem but the farmer", Menker says, reeling off a list ranging from those who sell seed and other farm inputs to banks, insurers and food and beverage companies. "Our thesis is that you get the system around the farmer more efficient. So how the small farmer benefits from a product like ours, or how agriculture benefits from a product like ours, is when your cost of capital goes down."

> 'How the small farmer benefits from a product like ours is when your cost of capital goes down'

Other key questions are how private data are curated, their reliability and their statistical veracity, says Robbin Shoemaker, national programme leader for the Division of Agricultural Systems at the USDA's National Institute of Food and Agriculture. "Data from private sources can be packaged and sold without any understanding of the quality of it. There could be big issues there when it comes to determining actuarially sound premiums for insurance," he says.

Engel at Purdue University says increasing food production is going to require measures ranging from advances in agriculture, to insights provided by big data and analytics groups, as well as changes in consumption habits.

In the meantime, Menker says Gro will continue to promote its vision of a world where access to agricultural data is not a privilege of the few.

"One of the barriers to knowledge in agriculture is complexity — of language, of scientific knowledge, of the format in which the data is reported," she says. "If you take away that complexity, you can increase the base knowledge across the ecosystem. By doing that can you make our markets a lot more efficient." ●

PHOTO: RYAN LASH/TED

ArcelorMittal

Inventing smarter steels for a better world

From the 8th floor through to the 54th, Chicago's 150 N Riverside looks like an impressive, typical, high-rise office building. It's only as the eye travels downwards that the tower reveals its remarkable, signature component.

With its vertical exterior columns apparently terminating eight storeys above ground, the building appears to 'stand on one foot'. Made necessary by the proximity of a century-old rail yard to the west, and the Chicago River just metres to the east, a complex transfer truss system utilising 70 ksi steel sections was designed to enable an extraordinarily small footprint. Offering not only a workable design solution but also considerable savings, 150 N Riverside is the first such implementation of 70 ksi steel sections in the US and only the third globally. All of the sections were produced by ArcelorMittal's Long Products mill in Differdange, Luxembourg.

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SMALLER COMPANY
LILIUM

Green sky thinking

With its eco-friendly electric air taxis, the German company is aiming to stand out in what is forecast to be a lucrative if crowded market. By **Maija Palmer**

It is 2025 and midtown Manhattan is snarled with traffic. But the 19km journey to JFK airport — normally about an hour by road — takes just five minutes in an electric flying taxi and costs roughly $50.

This is not from an episode of *The Jetsons*. It is the vision that Lilium, a Munich-based start-up, is working towards bringing to the public within six years. The company, founded in 2015 by four engineering students, is developing vertical take-off and landing (VTOL) jets for a fleet of flying taxis that will be as easy to book as an Uber car.

"We're not intending to make it a luxury product that only the rich can afford. We want to make it a service that everyone can use," says Remo Gerber, Lilium's chief commercial officer. "It has to be affordable — it shouldn't be just for the select few. We want it to be truly accessible."

Daniel Wiegand, Lilium's chief executive and a lifelong aircraft enthusiast who began piloting gliders at 14, developed the idea while studying electrical engineering and flight propulsion at the Technical University of Munich. He wanted to apply VTOL technology used by military aircraft such as the V-22 Osprey to the civilian sector. This involved making the technology smaller, quieter and more eco-friendly by using electric engines.

Together with three friends — engineer Sebastian Born, aerodynamics specialist Patrick Nathen and Matthias Meiner, a mechatronics engineer — he founded Lilium. By 2017 they had developed an unmanned two-seater prototype, called the Eagle, whose maiden flight was broadcast on YouTube. The company, which employs 300 staff, is working on a larger five-seater version, which it plans to unveil later this year.

> 'We want to make it a service that everyone can use'

Gerber, who previously worked with ride-hailing app Gett and discount website Groupon, joined the team in 2017 to help turn an engineering project into a full-service company. Lilium plans not only to build the jets at a factory in Bavaria, but also to operate the air taxi booking service itself.

Lilium has raised about $100m in two funding rounds. Atomico, the venture capital firm founded by Niklas Zennstrom, was an early investor, putting in €10m in 2016. The company raised a further $90m in 2017 from a consortium led by Tencent, the Chinese internet company.

Investors are attracted by the idea that Lilium might represent a fundamental change in how we will travel in the future. "From underdeveloped regions with poor road infrastructure, to the developed world with traffic congestion and sprawl, new possibilities emerge when convenient daily flight becomes an option for all of us," said David Wallerstein, Tencent's chief exploration officer, when the company invested in Lilium in 2017.

The air taxi market is expected to be worth $1.5tn a year by 2040, according to a report from Morgan Stanley, with passenger traffic comprising $851bn of that. ▶

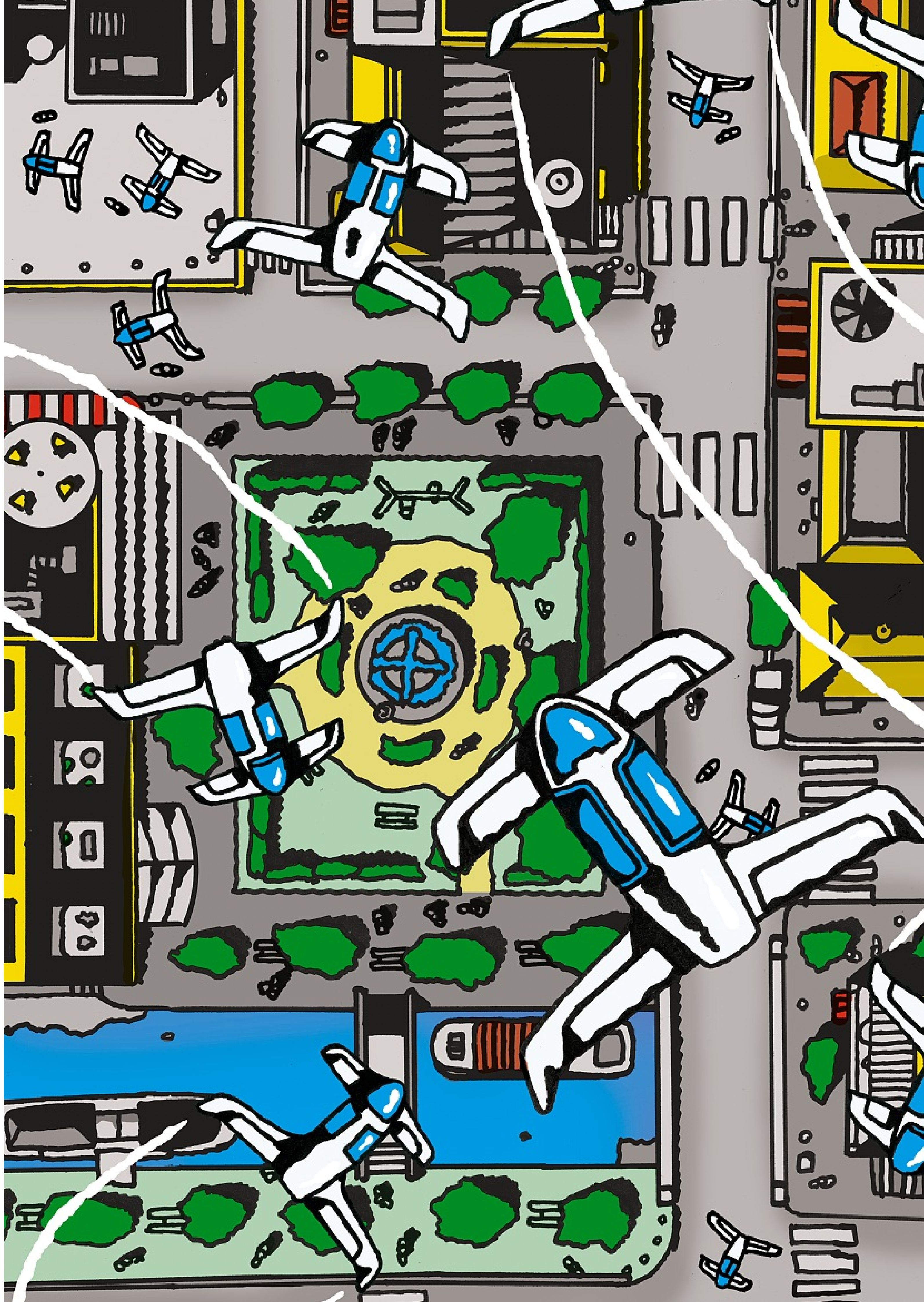

ILLUSTRATION: FÉLIX DECOMBAT

"It is still at a very early stage. The first things being talked about are servicing offshore oil rigs and delivering [donor] organs, trying these out in more controlled environments where there are fewer people around," says Adam Jonas, a research analyst at Morgan Stanley. From there he expects air taxi services to move to areas such as parcel delivery and gradually into full passenger services.

"It is still at the proof-of-concept stage. In two or three years we will have a much better sense of what the market will look like," he adds.

Lilium is not alone in developing urban air mobility vehicles. At least 19 other companies are developing propositions, including big aerospace manufacturers Airbus, Boeing and Bell (formerly known as Bell Helicopter). Lilium is also competing against some of the biggest names in tech: Uber has announced plans to launch its own flying taxi service by 2023, and Google co-founder Larry Page is an investor in Kitty Hawk, a start-up that is testing flying cars in New Zealand. Volocopter, another German company, is testing an aircraft in Singapore and has obtained investment from tech company Intel and carmaker Daimler.

But with roughly $100m in its coffers, according to business information provider Crunchbase, Gerber believes Lilium has the firepower to match its rivals.

'We are a "deep tech" solution with a true competitive stance'

"We have been very successful in fundraising and we are comparable to US competitors," he says. Only California-based Joby Aviation, which, according to Crunchbase figures, has raised a total of $131m from investors including Intel and Japanese carmaker Toyota, is better funded among the start-ups in this space.

Gerber says that Lilium, as an engineering company, is focused on more than boosting its spending power. "We are not building an ecommerce play where the only thing that counts is how quickly you build. This is not another food start-up. We are a 'deep tech' solution — that has given us a true competitive stance," he says.

Lilium is hoping to differentiate itself from rivals with the efficiency of its electric jet. The egg-shaped aircraft's 36 small turbofan engines angle downwards to lift it vertically off the ground, then swivel to a horizontal position so that it flies like a conventional aeroplane. This uses less power than many competitor models, which function more like hovercraft.

The design gives Lilium's jet a longer range. It can fly for an hour on a single charge, covering about 300km, though at a maximum speed of 300kph, it is significantly slower than a commercial airliner. Powered by a battery pack similar to those used in electric cars, the jet is relatively quiet, generating about the same noise as a truck during take-off and landing. This would allow it to operate in cities where helicopters, for example, would be unsuitable.

Gerber says many cities are interested in the Lilium service as a way of solving an infrastructure problem. "We live in an urbanised world and it is only going to become more so," he says. "One of the biggest problems governments have is moving people around. Building infrastructure like roads and rail is very expensive — here is an opportunity to do it a thousand times cheaper. We can connect places that would not be economically viable to connect with a bridge or railway."

Lilium's vision is for its five-seater jets, models pictured this page left, to use central urban rooftop landing pads and to be booked with an app, opposite

Some recent infrastructure projects with hefty price-tags underscore this point. A planned high-speed rail link between Singapore and Kuala Lumpur has been under discussion since the 1990s but has been repeatedly postponed because of high costs — most recently estimated at S$37bn ($27.3bn). In the UK, the cost of Crossrail, a rail link connecting east and west London, has crept up to more than £15bn.

"We are having conversations with a number of cities in Europe and Asia — a number of places are highly interested," says Gerber, adding that Lilium is hoping to have the first "meaningful services" operating in several locations by 2025.

'We can connect places it would not be viable to do so with a bridge or railway'

"By 'meaningful service' we mean more than just one aircraft that is booked a year in advance," he says. Lilium is in talks, for example, with SBB, the Swiss national rail service, over a potential joint project.

Many hurdles remain, however, before Lilium can take off: regulation, for example. The first aircraft Lilium is creating will be flown by human pilots, although the long-term plan is to operate self-flying jets. The company is hoping the human-piloted jets can be classified as light aircraft, making obtaining permission to fly relatively straightforward.

Permission for unmanned flight is a different matter, and would require new regulation from bodies such as the US Federal Aviation Administration and the European Aviation Safety Agency. Discussions on how flying cars would share public airspace have yet to begin.

Obtaining planning permission to build landing pads in cities — and clearance to fly aircraft over densely populated urban areas — will be another hurdle. If Lilium and its competitors can convince authorities that urban aviation is a solution to congestion, they may find city planners sympathetic.

Whether flying taxis can operate in sufficient numbers — and with energy efficiency — to become a mass transport alternative to trains and highways, in unclear.

Jonas at Morgan Stanley believes, however, that regulation will be a tougher challenge than companies in the sector are willing to admit. "Regulation is the elephant in the room. The noise alone is a big issue. Yes, they are quieter than helicopters, but the noise of a drone overhead can still be irritating. Then there are the privacy issues and concerns about safety and cyber security — whether these will be hackable," he says.

The final test will be whether the public will be willing to use an "Uber of the skies". Lilium is endeavouring to make its service feel sleek and desirable: last year it hired Frank Stephenson, a car designer for companies such as Ferrari and McLaren, to give the flying taxis some design pizzazz.

A survey conducted in several US cities last year by Booz Allen Hamilton, the consultancy, found that most respondents were either positive or neutral about the prospect of travelling in an urban air mobility vehicle, with fewer than 10 per cent expressing concern. However, there was increased apprehension when it came to flights with no human pilot.

Gerber hopes that, in time, the experience will come to seem normal. "It is still a flight and some people will be nervous of that," he says. "It will be a different form of flying, however. There is no aggressive take-off, and it is not noisy like a helicopter. People will just have to experience it." ●

Roll of honour

As our awards enter their second decade, these are the individuals and companies that set the agenda in previous years

Moya Greene, Person of the Year, 2013

Person of the Year
2009
Jamie Dimon
2010
Alan Mulally
2011
Michael Woodford
2012
Ivan Glasenberg
2013
Moya Greene
2014
Travis Kalanick
2015
Andy Jassy
2016
Helena Morrissey
2017
James Dyson

Lifetime Achievement
2008
Warren Buffett

Drivers of Change
2008
Ryanair
2009
Fiat
2010
Apple
2011
Amazon
2012
Mondragon
2013
Alibaba
2014
HBO
2015
Fanuc
2016
DeepMind Technologies
2017
Reliance Industries

Technology
2012
3D Systems
2013
Bosch
2014
Open Garden
2015
Tencent
2016
Preferred Networks
2017
23andMe

Corporate Responsibility/ Environment
2011
Helveta
2012
Narayana Hrudayalaya
2013
Skanska
2014
Handelsbanken
2015
Toyota
2016
Dong Energy
2017
Lemon Tree Hotels

Corporate Responsibility
2008
Selco
2009
Standard Chartered
2010
Marks and Spencer

Environment
2008
Masdar
2009
Suntech
2010
Jain Irrigation Systems

Entrepreneurship
2008
Google
2009
Tullow Oil
2010
Free
2011
Hyflux
2012
SoftBank
2013
Pesa
2014
Mobileye
2015
WeWork
2016
Dollar Shave Club
2017
Wheelys Café

Newcomer
2009
Twitter
2010
Groupon
2011
Muddy Waters Research

Smaller Company
2012
GoPro
2013
TransferWise
2014
Xeros
2015
Farfetch
2016
Oxbotica
2017
EthioChicken

Developing Markets
2008
Huawei
2009
Vale
2010
MediaTek
2011
Samsung
2012
Mahindra & Mahindra
2013
Sindicato Antioqueño
2014
Mara
2015
M-Kopa
2016
Empresas Polar
2017
CATL

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PHOTO: CHARLIE BIBBY

COMMENT

LEO JOHNSON

Where is tech taking us?

It is not just speed of innovation that matters but direction: bold businesses will use it to augment, rather than replace, human intelligence

For the first 250 metres it all goes well. I am in Singapore, in the back of a prototype driverless car, gazing at the other side of the road. Then our car decides to veer slowly into the path of the oncoming rubbish truck.

Our emergency driver lunges for the wheel, yanks us back to safety, then tells me the game plan. This isn't a vanilla driverless car, he explains, it is a do-it-yourself driverless car, made with off-the-shelf technology, and the goal is to get it on the road as fast as possible.

But the car, which works a treat for the rest of the day, is only step one. Step two is to fully automate Singapore's economy. Step three is to put all citizens on universal basic incomes. Step four is to use facial recognition technologies to close off the city to unwanted foreign migrants. It is a straight line, in other words, from the technological to the economic to the social, then the political.

If the 2010s were the decade of the unicorn — the mythical beast of the $1bn tech start-up — the 2020s appear poised for a unicorn stampede. With Timandra Harkness, the co-presenter of our BBC Radio 4 show *FutureProofing*, I have spent the past three years scanning the horizon for what is coming in terms of disruptive technologies. The cupboard isn't bare: eggless synthetic biology scrambled eggs, stem cell rejuvenation, weaponised nanobots, the colonisation of Mars, passenger-bearing mega-drones and brain-to-brain communication systems. Across disparate fields, from artificial intelligence to robotics, from 3D printing to nanotechnology, from genetics to quantum computing, a pattern is emerging: technological developments are starting not just to accelerate but to amplify one another.

They are poised to reshape the business landscape. The core capacity we are going to need to survive, says Astro Teller, the so-called Captain of Moonshots at X, Google's research unit, may be dynamic stability — the velocity to stay upright.

> **The question is: what are the problems we are looking to solve?**

But as the rubbish-truck economy of Henry Ford's fossil-driven mass production starts to yield to the age of the algorithm, what is the impact on business and society? Where does this rollercoaster look like it is going to take us?

My hunch it is not just speed that matters, it is direction. If technology is not the answer but the amplifier of intent, there is a primary question we have to answer: what are the problems we are looking to solve?

It looks like there are two different directions emerging. We have the option to prize artificial over human intelligence, to deploy technology in a centralised model that solves for shareholder value at the expense of jobs, that automates — according to projections by University of Oxford academics Carl Benedikt Frey and Michael Osborne — 47 per cent of US and UK white-collar jobs by 2035.

This would hit national balance sheets with the double whammy of lower tax revenues and surging welfare costs, and set the stage — with increased inequality and the perception of an economy no longer working for the many — for broader support for challenger populist movements.

But there is also another option: to do the opposite, not to replace human intelligence but to augment it. Go back 1,000 years and the means of production was the land, and the barrier to entry was the wall. For the past 200 years the means of production has been the factory, and the barrier to entry the capital to own it. But with this new set of technologies, from APIs, the cloud and open data, to the sharing economy and micro-printing, the barriers to entry are dropping fast.

The potential is there, to unlock a new wave of cognitive surplus and put power in people's hands to drive innovations across the challenges that confront us, from distributed solar energy to data-driven banking for the unbanked, from 3D-printed ultra-low-cost housing to sensor-based micro-irrigation for drought-resilient agriculture.

What does real boldness look like for me as we head into the 2020s? It is boldness not just of execution but of intent. ●


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Inventing smarter steels for a better world
Steel protects and preserves symbolic heritage sites.
Mont Saint-Michel in Normandy is an icon of French heritage on a par with the Eiffel Tower or the Palace of Versailles. But over the years, the canalisation of the nearby Couesnon River has reduced the natural water flow. This has caused gradual silting-up of the bay, threatening Mont Saint-Michel's essential island character. The solution to the problem, accomplished over nine years, was to build a dam on the river. Water is held by the dam during incoming tides and then used to evacuate the bay as the tide goes out. Duplex stainless steel valves produced by ArcelorMittal's specialist Industeel unit in Le Creusot, France, form the core of the dam system.
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