

The Connected Business

Wednesday March 2 2016

www.ft.com/reports | @ftreports

Technophobia is so last century

From the industrial revolution on, machines have prompted human fears, says Adam Jezard

Much of today's technology reporting is focused on the potential threats posed by developments. Dangers are seen in everything from robots to flying drones and two-wheeled "hoverboards". Physicist Stephen Hawking has even warned that full artificial intelligence "could spell the end of the human race".

Such concerns are not new, according to Carl Benedikt Frey, co-director of the Oxford Martin programme on technology and employment at Oxford university. "Fears about technology, and certainly fears that technology will destroy our jobs, have been with us for as long as jobs have existed," he says.

From the weaving machines of the industrial revolution to the bicycle, mechanisation has prompted concerns that technology will make people redundant or alter society in unsettling ways. In the early 1800s, Luddites smashed machines that put them out of work, while historians argue that later in the 19th century the popularity of the bicycle aided female liberation, the growth of socialism and the end of rigid class divisions as people become more mobile.

Earlier dictatorial regimes such as the Roman empire made it easy to block progress as rulers prevented machines from doing work and destabilising society. But that changed after the industrial revolution, "as merchants saw the gains from technological progress and they



have hovered over our species, at least in fictional terms, ever since, from film-maker Fritz Lang's *Metropolis* of 1927 on down.

In Capek's and Lang's dystopias, companies create profits from marginalised, impoverished workforces while spoil elites live privileged lives. Inevitably the oppressed underlings rebel.

While drawing parallels with today's wealth-divided society is almost irresistible, Mr Frey does not see the same "rage against the machine" from the past that is reflected in these dramas. "There are reasons to be concerned, but it is difficult to see which democracy would accept 1 per cent of the population being dependent on machines and the rest of society deprived of work."

However, the latest technological push has created few new jobs in itself. Oxford Martin research found 8.2 per cent of the US workforce moved into careers associated with new technologies in the 1980s. The equivalent number for the 1990s was 4.4 per cent, while in the 2000s it was half a per cent.

Instead Mr Frey says technology has increased the range of tasks skilled workers can perform. "You would have assumed bank tellers would have been replaced by ATMs, but there are now more branch relationship managers, so jobs change," he says.

He adds that for every new tech job created in London, about five jobs are added to the local economy as services from hairdressing to retail grow to meet demand, though in the future automation may do away with some lower-skilled work (see *robots story*, Page 2).

Vivek Wadhwa, a fellow at Stanford Law School in the US who writes often about the "unintended consequences"

Continued on page 2

Inside

Japan starts to play catch-up in fintech

Renewed urgency is driven by need to reduce bond exposure
Page 2

Start-up entrepreneurs aim to boost growth

Ukraine tech sector has ambitions to transform smoke-stack image
Page 2

Robots gain edge over flying drone rivals

Future of goods delivery may remain earthbound
Page 2



Cyber security warning on digital healthcare

Hackers pose a risk to everything from medical data to pacemakers
Page 3

Bioelectrics industry is one to watch

Substantial funds are available for companies breaking new ground
Page 3

became increasing influential", Mr Frey says. Technological growth became linked to policymaking as the industrial revolution became both a political and an economic story. "The more people benefit from technology, you see more rapid adoption of it," adds Mr Frey.

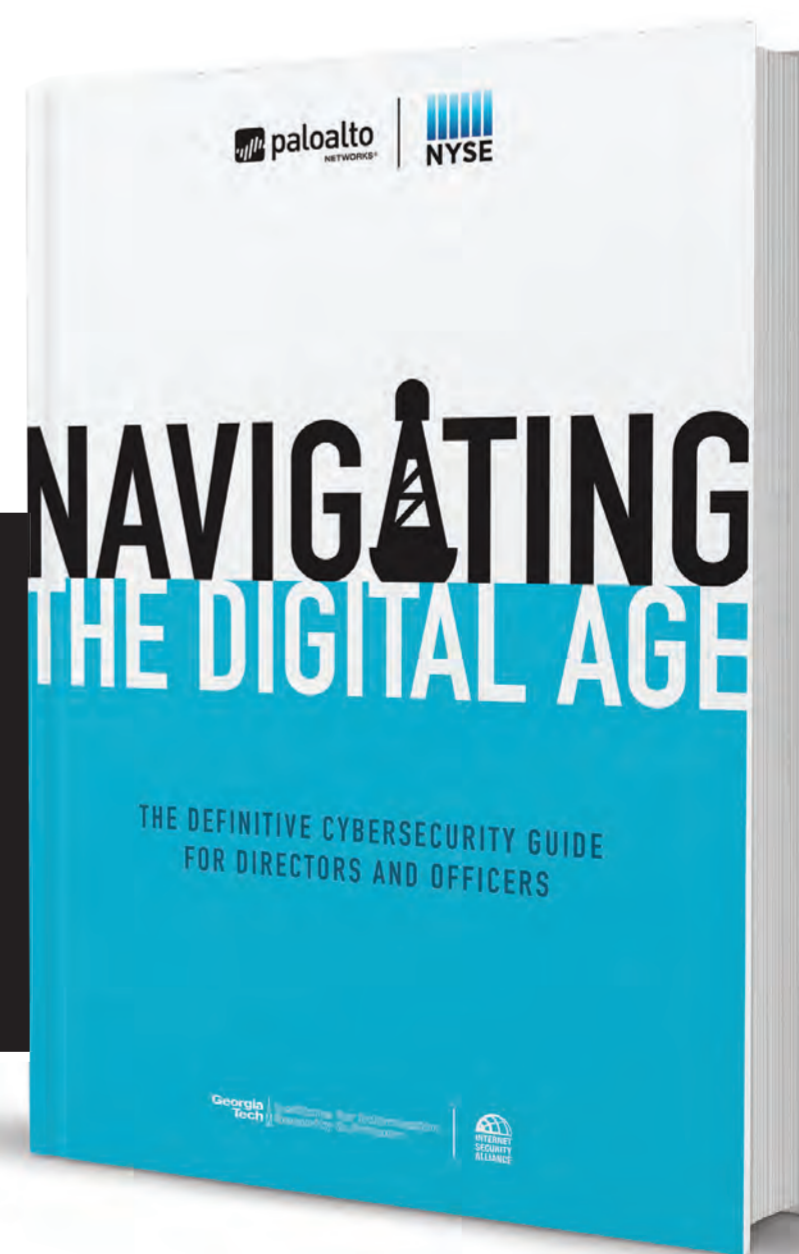
Today's greatest fears, from loss of employment to the end of civilisation, centre on robots and artificial intelligence. But even these are almost 100 years old. The word "robot", from the Czech *robota* meaning "slavery", was coined for writer Karel Capek's 1920

play *R.U.R. (Rossum's Universal Robots)*. In the drama, a sophisticated robot workforce (closer to the human-like replicants of 1982 sci-fi film *Blade Runner* than machines) moves from subservience to eventually destroy humanity. This dark threat seems to

STATE-OF-THE-ART CEO. BE READY.

LEARN THE ISSUES. MASTER THE SOLUTIONS.

DOWNLOAD YOUR COPY & MORE INFORMATION ON THE LEGISLATION:
go.paloaltonetworks.com/regulation



New EU legislation around NISD (Network Information Security Directive) and DRR (Data Protection Regulation Reform) are advancing, with state-of-the-art cyber risk accountability becoming businesses' top priority. Take the appropriate, preventive steps to effectively implement the state-of-the-art security necessary to protect your business. Meet these needs with guidance from *Navigating the Digital Age*, the definitive cybersecurity guide for boardroom members and executive officers. Developed in collaboration with the New York Stock Exchange and Palo Alto Networks, it provides practical, actionable and expert advice on best practices for compliance, implementation, breach prevention and immediate response tactics.

Includes venerated voices such as:

- Visa
- The World Economic Forum
- Internet Security Alliance

The Connected Business

Japan starts to play catch-up in the fintech race

Banks and investment

Sense of urgency is driven by the need to reduce exposure to government bonds, reports *Kana Inagaki*

When Freee, an accounting software provider for small businesses, started out four years ago, few Japanese investors were excited by the machine learning technology behind its services. So the start-up turned to DCM, a Silicon Valley venture capital firm, to raise funds.

But in 2016 the financing environment for Freee has drastically changed, thanks to a big helping hand from the Japanese government.

For the first time since 1998, Japan is preparing to ease banking regulations to allow financial institutions to take larger stakes in "fintech" – financial technology – start-ups.

Currently, the nation's banking groups are mostly restricted from having units operating in areas that are not directly linked to financial services.

Government and bank officials say the push for deregulation is driven by a sense of crisis that Japan was falling behind the US and UK in capturing the growth of online financial services, such as online payments, lending and digital currencies.

"Unless we change drastically in terms of both speed and technology, we feel a strong sense of threat that the market will be overtaken by the rise of technology players," says Sumitomo Mitsui Financial Group, Japan's second-largest bank by market value.

The sense of urgency is further driven by the need for Japan's banks to diversify investments and boost returns by reducing exposure to government bonds. Those pressures have intensified with the Bank of Japan's decision in January to adopt negative interest rates, which have sent the yields on 10-year Japanese government bonds into negative territory for the first time.

With more Japanese companies rushing to join the fintech boom, Freee now has a richer range of funding sources to choose from.

In December, it raised ¥1bn (\$8.9m) from a fintech fund formed by Japanese

financial services company SBI Holdings, bringing its total fundraising amount in 2015 to ¥4.5bn.

"The hurdle for the fintech industry was high due to regulations and the need to work closely with existing financial institutions," says Sumito Togo, Freee's chief operating officer. "In that sense, government support has been a big factor in creating an environment for fostering fintech start-ups."

SBI's fund aims to raise ¥30bn from investors including telecoms group Soft-Bank, regional banks and others, which would make it the largest domestic fund

'Unless the results follow, some players may face fundraising challenges'

focused on fintech start-ups. Japanese e-commerce group Rakuten also launched a \$100m global fintech fund in November.

Both fintech players and investors admit the removal of regulatory hurdles is just one of many steps Japan needs to

take to close its gap with overseas competitors in the field.

Another hurdle is the tiny market. Japan's fintech firms raised about ¥14bn (\$124m) in funds last year, according to data provided by Money Forward, a Tokyo-based fintech business that provides online personal accounting services. Meanwhile fintech investments tripled from \$4.1bn in 2013 to \$12.2bn in 2014, according to Accenture.

Takeshi Goto, managing executive officer at SBI Investment, estimates that there are up to 130 fintech start-ups in Japan. "There is back-up from the government, but we need to see the emergence of more start-ups to spur the industry," Mr Goto says.

The paucity of fintech firms stems from longstanding challenges in nurturing young entrepreneurs. Many people still prefer to work for big companies. In an effort to boost activity, Freee offers software to ease the burden of heavy paperwork associated with starting a business.

Mobile payments emerged in Japan more than a decade ago, and analysts say confidence in existing services and infrastructure led financial institutions

to underestimate the disruption technology companies such as Google and Apple would cause.

"In addition to government regulations, it is undeniable that the response of Japanese banks to fintech has been slow," says Sadakazu Osaki, head of research at Nomura Research Institute's centre for strategic management and innovation.

Many more businesses are now claiming to be fintech start-ups and Japanese banks will need to assess their goals and how they will keep up with the pace of change in the industry.

Companies such as Freee are, in turn, under pressure to deliver the growth to justify the rising investments. Global competition is already intense for the company, with rivals such as Xero and Intuit already offering similar cloud-based financial software.

And Shunsuke Hayashi, business producer at start-up consulting firm Dream Incubator, warns: "Some fintech start-up firms have successfully raised capital, but the next phase is generating concrete results. Unless those results follow, some players may face fundraising challenges."

Our fears of tech are so last century

Continued from page 1

of technological change, says the problem today is that Silicon Valley is in too much of a hurry to make profits.

"In previous times it took technologies ages to advance to the stage where they could become a threat, so we had decades to discuss the transition from old to new," Mr Wadhwa says. "But that is no longer the case. Self-driving cars, for example, will be good for the elderly, but they will take away millions of jobs from people who drive cars for a living. Every technology has a dark side."

Mr Wadhwa also predicts a science fiction-like future, but the bad side would be *Mad Max*. It will be hard to work these things out but I think we'll get there. We need to be aware of the problems and start fixing them."

Perhaps what are needed are better global regulatory models, possibly based on the UK's Human Fertilisation and Embryology Authority, to govern developments. The HFEA recently gave approval for experimental use of the DNA editing process Crispr to switch genes on and off in a newly fertilised egg.

Mr Wadhwa thinks such a framework would be beneficial but hard to enforce. "If we can't agree between countries, how can we agree as the human race to a set of shared ethical standards?"

Instead of science fiction, maybe we should consider the current commercial and ethical success of technologies that were once considered highly disruptive. After all, we have been here before: the introduction of hoverboards and drones has similarities to the birth of the bike and the internal combustion engine.

Like hoverboards and drones, bikes and cars had commercial and leisure uses and we have, with legislation and time, become used to them. They

Unrest does not deter start-ups in their efforts to reform economy

Ukraine Despite the conflict with Russia, the mood in the IT sector is buoyant, says *Yuri Bender*

Ambitious Ukrainian entrepreneurs are endeavouring to move their ailing, crisis-torn economy towards a high-tech one, far removed from the traditional government-subsidised smokestack industries that are controlled by a handful of oligarchs.

Most western start-ups would not encounter the same challenges. Alex Podopryhora, who runs M2Epro in the eastern city of Dnipropetrovsk with his brother, says the conflict with Russia has been unnerving at times.

The company's initial projects included developing electronic platforms for foreign exchange trading and warehouse management systems for western investors. When Russian-backed separatists staged a rebellion in the nearby Donbass region at the beginning of 2014, the fallout threatened to destabilise Dnipropetrovsk.

"The war was just 90 kilometres away, there was a lot of unrest and gangs of thugs were beating up pro-Ukrainian students," recalls Mr Podopryhora, who is also an investment banker at Grupo Santander.

"Our main backer and client, eBay, was concerned about its investment."

So worried was Mr Podopryhora that he almost moved 11 programmers and

their equipment to eastern Poland, but fortunately the situation calmed down.

The company has since worked with eBay to develop e-commerce products, and has developed software that lets sellers trade simultaneously on online market places, including Amazon, eBay and Rakuten for a fee.

M2Epro, which is moving into profit for the first time in its eight-year history, is part of a wave of businesses hoping to move Ukraine from an old-fashioned to a high-tech economy. Some feel this transformation is too slow. Last year, during the Yalta European Strategy summit in Kyiv, former Israeli President Shimon Peres urged Ukraine's businesses to prepare for a high-tech future as a means of freeing the country from its troubles. Others agree.

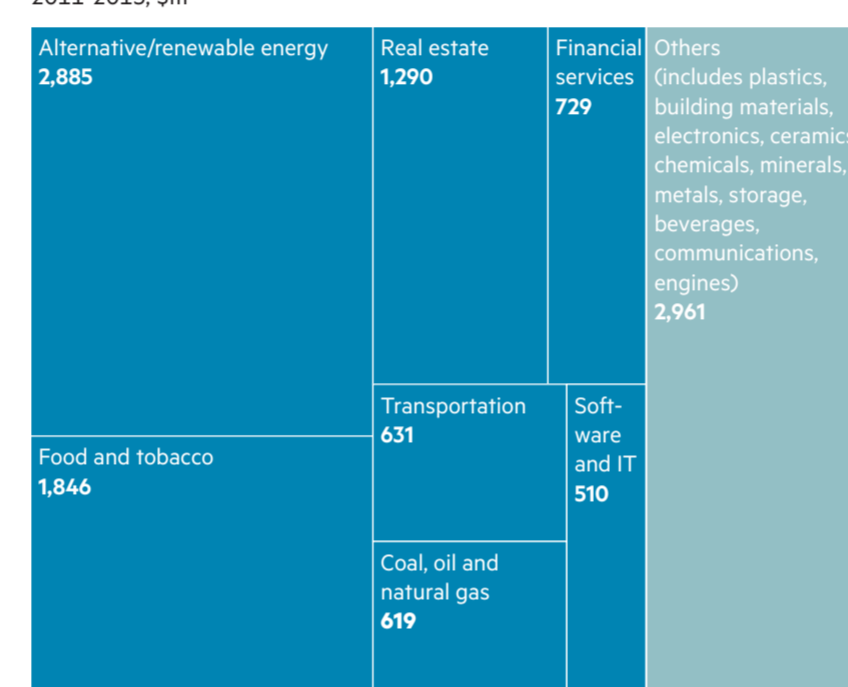
"Information technology is not an oligarchic business like coal, steel or metallurgy and needs western investors to help it thrive," says former Ukrainian presidential adviser Vadym Karasyov.

He adds that the Donbass conflict needs to be resolved and the economy reformed to create better conditions and opportunities for small and medium-sized businesses.

But even without these changes, the country's 2,000 IT start-ups will increase to more than 5,000 within

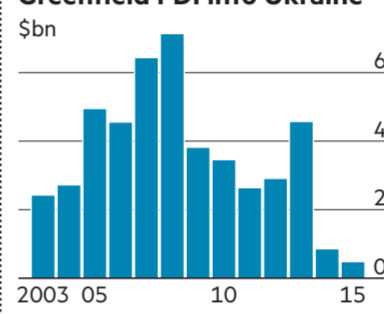
Greenfield investments into Ukraine

2011-2015, \$m



Sources: FDI Markets, Unctad

Greenfield FDI into Ukraine



FDI stocks

As % of GDP, 2014



three years, says Andrey Kolodyuk, founder and chairman of investment firm AVentures Capital, who divides his time between Kyiv and Silicon Valley.

More than \$100m of private equity was pumped into Ukraine start-ups in 2015 alone, says Mr Kolodyuk, citing the success of Viktor Shaburov, who founded the Looksery mobile application for enhancing pictures in 2013. He sold it two years later to Snapchat for \$150m.

Like many companies launched by Ukrainians, Looksery is based in San Francisco. Most start-ups employ programmers in Ukraine, but register companies in Europe or the US, with a marketing office in London, to satisfy western clients.

"The London office is a big selling point for us," says Anton Mishchenko, chief executive of Youteam, which employs four staff in London and four in the Ukrainian city Lviv, and helps other start-ups launch internationally.

Creating an international audience for its products is one of the tasks facing Oksana Borysenko, chief executive of Enable Talk, which has developed sensor-equipped gloves that translate sign language into text on a mobile phone, easing communication between deaf and hearing people.

'The war was just 90 kms away, there was unrest, gangs were beating up students'

Ms Borysenko advises the minister of economic development and trade and is head of the Digital Ukraine trade association.

She works with IT hubs in Kyiv, Lviv, Kharkiv and Odessa as well as training tech entrepreneurs in business techniques including sales, marketing and registering and protecting their ideas.

Ms Borysenko's main concern is the brain-drain, with foreign investors taking Ukrainian IT teams to Poland, Slovakia and Slovenia, for greater safety.

"Start-ups in Ukraine have the possibility to revolutionise the economy, but only if there is no war," she says.

Vitali Klitschko, Kyiv's mayor, is trying to resurrect the mothballed Bionic Hill IT business park. He is also helping develop the Seed Forum Ukraine project, with Norwegian government backing. The forum is a global network that aims to marry would-be entrepreneurs with investors.

Despite the conflict with Russia, the mood in the IT sector is buoyant. Venture capitalist Mr Kolodyuk says Ukraine is now specialising in the internet of things, blockchain and bitcoin. The first \$1bn tech start-up is within reach. "There will be unicorns in five years with founders of Ukrainian origin," he says.

brought economic benefits in terms of jobs and transport, but as Mr Wadhwa says, technology produces unintended consequences.

For example, in 2014, 3.6m cycles were sold in Britain, producing sales of £771m. The total new and used motor vehicle market in the UK was reported to be £88.5bn in 2014, up from £79.4bn in 2013.

Sales mean prosperity and employment for many, but there is a human cost. In 2014, 113 cyclists were killed in Britain and 3,400 seriously injured, mostly after accidents with cars. More than 1,700 UK citizens died in car crashes in 2013. This is before the effects of car pollution on human health and greenhouse gases have been counted, and these figures are for one country.

New technologies are likely to have similar side effects. In 1979 Robert Williams, a Michigan Ford car worker, gained a dubious Guinness World Records mention for becoming the first person to be killed by an industrial robot. In December, a boy fell off a hoverboard in north-west London and was killed by a bus, the first such UK death.

What the total cost of the latest developments will be – whether in terms of incomes, jobs or lives cut short – is hard for anyone to predict.

Robot march to deliver packages is not pie in the sky

Logistics

Terrestrial machines could prove more practical and safer than flying drones, writes *Michael Dempsey*

Amazon, the online retailer, made headlines last year with its trial of flying drone deliveries, but its efforts look puny compared to an earthbound robot that can carry the equivalent of three full shopping bags, or up to 13 kilograms.

Stuart Rivett, managing director of Dutch parcel distribution business B2C Europe, says practical limits on the weight of any drone package are a handicap to introducing flying deliveries and dismisses Amazon's experiments as "a complete PR stunt".

While drone deliveries are still pie in the sky, about 20,000 people have already seen delivery robots undergoing tests on streets in Estonia, Germany and Greenwich in London.

Sensors on a robot's casing detect pedestrians and obstacles and instruct it to slow down, stop or change course

while operators can talk remotely to people who come across it via a speaker.

Human reactions have been monitored by video cameras on the chassis that give 360 degree coverage. Allan Martinson, chief operating officer of Starship Technologies, which makes the robots, says the most common response has been indifference: "Around 80 per cent of people pay no attention to the robot at all. They just walk past as if it is the most normal thing."

Analysts predict the global market for robotics will grow to about £83bn by 2025, so autonomous devices on our roads – from driverless cars to delivery bots – may soon become as commonplace as old-fashioned bicycles.

The Estonia-based company was started by former Skype co-founders Janus Friis and Ahti Heinla.

They believe the retail industry can replace vans for home deliveries within a small radius of a goods depot. The robot's battery

'Take me to your sorting office': a Starship robot at work

life of 2-2.5 hours gives it a range of about 3 miles. But the effective radius is determined by the economics of short-range deliveries. In this niche market, Starship says a machine that moves at walking pace can cut out about 30 per cent of vehicle deliveries.

Vans would drop goods in bulk at convenient centres where local orders could be put into robots, slashing costs of drivers, fuel, vans and congestion.

The initial batch of 15 robots cost

under \$10,000 each, but this should fall with full-scale production. Starship's research and development bill so far has been €2m, much of it being used to employ software engineers to anticipate the situations the robot will encounter and program suitable instructions.

The target is to reduce the cost of local deliveries to under £1. Conventional deliveries can cost £1-£5 or more.

Mr Martinson says that, compared with flying drones, his electrically powered robots use as much energy as a lightbulb, a lot less than that required to lift a small package into the sky in a drone and keep it aloft.

Then there is the question of safety. "If just a few kilograms fall from the sky it will do damage to humans and property. Our robot is like a rolling suitcase, [people] do not consider it to be dangerous."

The robot is safer to use for returns, Mr Martinson adds. Allowing an untrained person to attach something to a flying drone is fraught with risk as packages could be overweight or unbalanced.

Nick Rogers, a partner with UK law firm BLM, says robot technology has been developed in advance of any regulatory framework.



Contributors

Adam Jezard
Commissioning editor

Yuri Bender
Editor in chief, PWM

Clive Cookson
Science editor

Kana Inagaki
Tokyo correspondent

Attracta Mooney
Asset management reporter

Andrew Ward
Pharmaceuticals correspondent

Aime Williams
Reporter, FT Money

Jane Bird
Michael Dempsey
Freelance writers

Steven Bird
Designer
Alan Knox
Picture editor

Advertising contact: Mike Duffy, +44 (0)20 7873 4646, email michael.duffy@ft.com

Advertisers have no influence over or prior sight of articles.

The Connected Business

Let's raise a (smart) glass of real ale to the internet of alcohol



ON TECH
Maija Palmer
 Talk about the internet of things is often dominated by discussions of dull but worthy lightbulbs and home thermostats. So here is something a little more tasteful: the internet of beer. Perhaps digitised drinking was an inevitable development, given the millennial-hipster crowd's intersecting interests in technology and craft ale. There are, for example, machines such as Brewbot, a smart personal microbrewery the size of a small

cabinet, that will create your own batch of beer. It is monitored by sensors, controllable from your smartphone and takes the guesswork out of home brewing. The Brewie, currently available to pre-order in the US and UK, is similar: the hardware is small enough to fit on a kitchen work surface. Both were backed by enthusiastic crowdfunding campaigns. But it is on the industry side that the internet of beer feels as if it is a solution to a real problem. Beer is a "just-in-time" product. It is normally best drunk fresh – ideally a brewery barrel should be consumed within four days of opening before staleness starts creeping in. Inventory management in the bar and pub industry, a key and sometimes

contentious area in a cash-driven sector, is also being transformed. Two years ago SteadyServ, a US company, introduced the iKeg, an internet-based beer monitoring system. Each keg in a bar was fitted with a radio-frequency identification tag that holds information about the brewery, the date the beer was brewed and the delivery location. Each keg sits on top of a sensor that monitors the rate at which the liquid inside decreases, giving bar managers a much more accurate picture of how quickly it will run out. This can help bars waste less and make more money by identifying the top-selling brands. WeissBeeger, an Israeli company, is doing something similar in Europe and is finding that the process can yield interesting data. Pubs can now have

dashboards that show them exactly what beers are being drunk at what time of day and in what combinations. WeissBeeger found, for example, that lager tends to be drunk earlier in the day and that drinkers switch to darker and sweeter options later in the evening, says Hilton Young, the company's managing director. Guinness is often bought as a single item, while lager is a more social drink and usually ordered in twos or threes. "Heineken is a key partner, and it is keen to get this consumer information on how and when its beer is drunk," says Mr Young. WeissBeeger's backers include Eric Schmidt, executive chairman of Alphabet, Google's new holding company. The company plans to take its technology one step further by

introducing the smart glass, which will have a near-field communication chip in it. This device could provide even more granular information about consumption and customers. It could, for example, connect with a drinker's smartphone and offer them exclusive clips of goals during a football match if they bought a certain beer – so perhaps in future beer brands could sponsor sport by the glassful rather than the tournament. The system might notice if someone has had one too many and call them a taxi

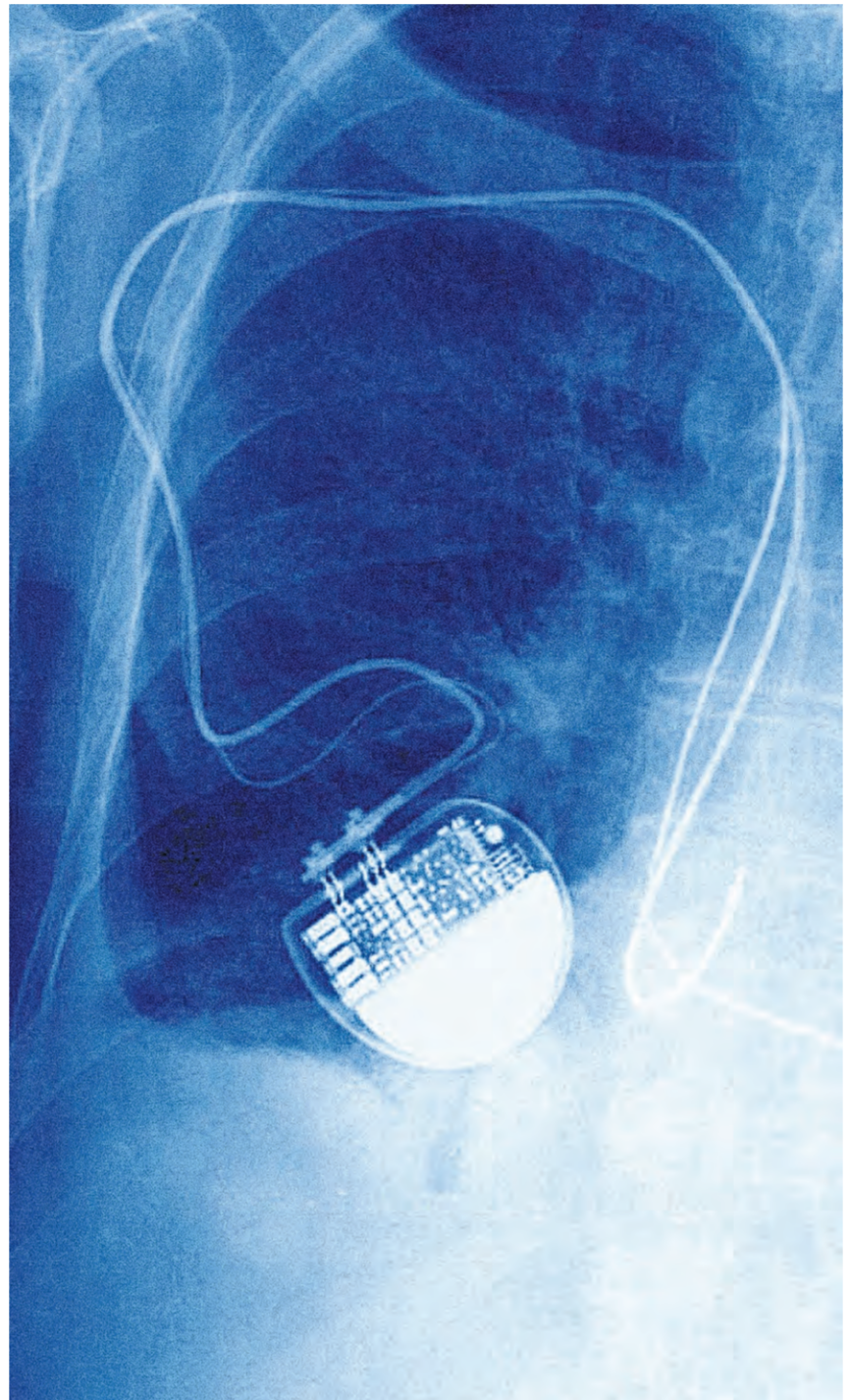
The Glassify smart glass, currently being tested in the US and Israel, could tell pubs and restaurants more about individual drinkers, such as if they are regulars, how long they tend to stay and how many drinks they have. For customers the benefits are less clear, but faster service could be one. A smart glass could work, for example, with some of the self-service draft beer machines being introduced into pubs and bars, particularly in the US. These usually work with wristbands or smart cards, which customers tap on the machine to make purchases. A connected glass seems a logical progression. It could also be used to encourage responsible drinking, as the system might notice if someone has had one too many and call them a taxi.

Healthcare sector warned to be alert for hack attacks

Cyber security Experts say networks could be held to ransom by criminals, writes *Andrew Ward*

For decades, the biggest worry of regulators at the US Food and Drug Administration has been medicines with toxic side effects. Increasingly, however, they are contending with a new danger as the rise of "digital health" makes cyber security potentially a matter of life and death. Some of the most exciting innovations in medicine are coming from the use of digital technology to improve monitoring and management of people's health. But what are the risks of this new era of "connected healthcare" being exploited by people intent on stealing sensitive data, or worse, causing harm to patients? The FDA says the threat is

real. In January it issued recommendations for how manufacturers should safeguard medical devices against cyber breaches, urging them to make security a priority in every stage, from the design process of a device onwards. "All medical devices that use software and are connected to hospital and healthcare organisations' networks have vulnerabilities," says Suzanne Schwartz of the FDA's Center for Devices and Radiological Health. "Some we can . . . protect against, while others require vigilant monitoring." These concerns have been building for some time. Dick Cheney, the former US vice-president, revealed in 2013 that doctors had disabled the wireless



Hostage of the heart: pacemakers are at risk from cyber criminals — BSIP SA / Alamy

capabilities of his pacemaker as a precaution against hacking. This added credibility to a storyline in the TV drama *Homeland* in which terrorists murdered a fictional vice-president by sabotaging his pacemaker. Kevin Bocek, head of security and threat intelligence at Venafi, a cyber security company, says such scenarios are becoming more plausible. He cites the example of wearable devices being developed to manage treatment of chronic diseases. These include diabetes kits that can determine the right dosages of insulin based on a patient's glucose level. "If a hacker was to intercept [wireless] traffic between the dosage tracker and [the] communications network, they could make the device relay lethal dosages of medication to a patient," says Mr Bocek. "It could even be possible for hackers and cyber criminals to take over a healthcare provider's entire network of dosage tracker users and hold their lives to ransom for financial and other nefarious gains." Of course, it is in the interests of cyber security professionals to talk up such threats. However, while there have not yet been any documented cases of physical harm caused by hackers, there is plenty of evidence to show that health technology is vulnerable to attack. In 2015, the Office of Civil Rights in the US said there were 253 breaches of medical data affecting 112m health records. Several big US health insurers, including Anthem and Premera Blue Cross, were among those targeted. "If the bad guys are after health records they'll certainly go after wearables and [connected] devices," says Mr Bocek. Healthcare has become an important front in the wider war against cyber crime, not just because of the growing volume of medical data being generated and shared, but also because of the personal and potentially valuable nature of the information involved.

Critics say that, in the rush to digitise patient records and embrace technology, healthcare systems have not paid enough attention to security. In the UK, the Information Commissioner's Office, the privacy watchdog, says data breaches in the NHS are "a major cause for concern". "The Health Service holds some of the most sensitive personal information available, but instead of leading the way in how it looks after that information, the NHS is one of the worst performers," said Christopher Graham, the Information Commissioner, last year. Such concerns are sure to increase after Jeremy Hunt, UK health secretary, announced plans in September for NHS patients to have access to their medical records online within a year. Policymakers hope digital technology can make health systems more efficient in an era of rising demand and limited resources. They also see an opportunity to promote health and disease prevention by giving people more insight into what is happening inside their bodies. Many people already use wearable apps to monitor information such as physical activity, heart rate or sleep patterns. The focus is now on developing more sophisticated devices that can produce clinically reliable data in front-line healthcare and medical research. PwC, the consultancy, reckons the annual market for digital products and services in healthcare will be worth \$61bn by 2020. Matthew Godfrey-Faussett, a partner at law firm Pinsent Masons, says improved security is crucial if such projections are to be fulfilled. "The integration of technology into healthcare has the potential to revolutionise patient care," he says. "However, the regulatory challenges associated with medical devices and data protection, combined with scepticism among the public about the use and safety of their personal data, leave . . . significant hurdles to overcome."

Scientists aim to harness power of body's electrical impulses

One to watch Bioelectronics
 Substantial funds are available for ground-breaking companies, says *Clive Cookson*

Until now the pharmaceutical industry has been based on chemistry and biology. Patients are treated with drugs that work through biochemical interactions with the body's molecular pathways. Now GlaxoSmithKline, the UK pharmaceutical company, is pioneering a different approach: so-called bioelectronics, or electroceuticals. These aim to turn our electrical impulses into a mainstay of medical treatment. Kris Famm, head of bioelectronics research at GSK, says scientists are learning how the electrical language of the body controls human organs in order to provide precision therapies. "What we've learnt so far looks very promising," he says. The company has established a network of about 50 research collaborations globally and seen remarkable results through animal testing in a range of diseases, Mr Famm says: "We believe a future where clinicians are administering bioelectronic medicines as well as molecular ones is approaching. "Our next challenge is to build the tiny devices that will deliver these interventions and to prove they bring transformational treatments for patients." Substantial US government funding is available for start-ups exploring the same territory. Funds are available from a \$248m programme called Stimulating Peripheral Activity to Relieve Conditions (Sparc), provided by the National Institutes of Health. There is also a \$79m initiative called Electrical Prescriptions (ElectRx) run by the Defense Advanced Research Projects Agency.

The most high-profile research connecting electronics to people involves the human brain. Neurotechnology projects enabling disabled people to control bionic limbs by thought and prosthetic implants that reconstruct damaged brain circuits have received much publicity. However, bioelectronics research is focusing less on the central nervous system than on the peripheral nerves outside the brain and spinal cord, which influence the function of every organ in the body. Doug Weber, who runs Darpa's ElectRx programme, says: "The peripheral nervous system is the body's information superhighway, communicating a vast array of sensory and motor signals that monitor our health status and effect changes in brain and organ functions to keep us healthy." A simple and well established example is the pacemaker, which stimulates the heart to beat at a healthy rate. The aim of researchers is to develop more sophisticated devices programmed to read and correct the electrical signals that pass along the nerves, to treat conditions as diverse as inflammatory bowel disease, arthritis, asthma, hypertension and diabetes. The aim is to develop products without the side effects of today's drugs It may even be possible to use peripheral nerve stimulation to tackle disorders rooted in the brain, according to Darpa, for instance by reducing the body's overproduction of inflammatory molecules, which are implicated in several neurological diseases. One of the first companies to special-

ise in bioelectronics was SetPoint Medical, based in California. It was also the first to receive money from the \$50m Action Potential Venture Capital Fund GSK set up in 2013 to invest in companies developing bioelectronic medicines and technologies. The fund has invested in five companies so far. Moncef Slaoui, GSK's head of vaccines, says: "We see the development of bioelectronic medicines as a collaborative process that will only be successful with the combined skills of world-leading engineers, physiologists, neuroscientists and informatics experts." SetPoint is in early clinical trials with a device that stimulates the vagus nerve, the body's longest individual nerve which extends from the brain stem to the abdomen by way of organs such as the heart, oesophagus and lungs. This exerts an anti-inflammatory effect, SetPoint says, that will help rheumatoid arthritis patients and those suffering from Crohn's disease, caused by inflammation in the digestive tract. EnteroMedics, based in Minnesota, has a more advanced clinical programme also targeting the vagus nerve. Results suggest that intermittently blocking the nerve with high-frequency electrical impulses can help obese people lose weight by reducing their appetite. But some experts worry that treatments aimed at the vagus nerve, which reaches so many organs, may have unwanted side-effects. Most bioelectronic research is still at the stage of animal experimentation. The aim of scientists is to develop ultra-specific bioelectronic products that work without any of the unwanted side effects of today's drugs. Or, as GSK puts it: "To have the first medicine that speaks the electrical language of our body ready for approval by the end of this decade."

Growth of robotics in emerging markets captures investors' imaginations

Investment funds
 China set to drive sector as manufacturers focus on automation, say *Attracta Mooney and Aime Williams*

The headlines are stark: "Robots will steal your job." Machines are already revolutionising medicine and replacing shop assistants. They are expected to take over 11m jobs by the 2030s, according to Deloitte, the consultancy. Advocates wax lyrical about cost savings and increased productivity. Opponents say robots could cause the world economy to implode. Asset managers, meanwhile, think robots and automation are among the best investment opportunities of the decade. Pictet Asset Management, the Swiss fund house with £103.5bn in assets under management, says the industry is forecast to expand as much as four times faster than the global economy over the next decade. Last October it launched the Pictet-Robotics mutual fund, which now has about \$500m in assets under management. "By focusing on this theme, we can get higher growth and should be able to get better returns than a typical European-focused fund," says Peter Lingen, co-manager of the Pictet-Robotics fund. The fund's biggest holdings are spread across technology, medical and industrial companies. They include Alphabet, the parent company of Google, which is working on self-driving cars, and Intuitive Surgical, which designs and builds surgical robotic systems. Industrial group Roper Technologies ranks among its 10 largest holdings. Another manager tapping into the robotics trend is ETF Securities, the

UK-based provider of exchange traded funds, which are traded on a stock exchange and typically follow an index, making them cheaper to invest in. ETF Securities in 2014 launched Europe's first global robotics ETF with RoboStox, which creates fund indices. The product tracks an index of 79 companies involved in the global robotics and automation industry. ETF Securities defines a robot as a machine that takes the role of a human and automates it to allow mass production to take place. Howie Li, co-head of ETF Securities' Canvas platform, argues that much of the growth will be driven by companies in emerging markets buying robotics. The trade body IFR World Robotics estimates that the worldwide annual supply of industrial robots is growing at more than 15 per cent a year on average. "Emerging markets are buying robots," says Mr Li. "Indonesia and Taiwan are aggressively buying robots in manufacturing lines." However, the main driver of growth is expected to be China, which currently has relatively few robots and mechanised systems in the workplace. According to ETF Securities, the global average number of robots per employee in the workplace is 66 for every 10,000 employees. This number falls to approximately 30 for China. "We expect China to catch up on robot density. There is still a lot of manual labour but, as we're going to get wage inflation, we will see robotics come in," says Mr Li.

But not everyone is convinced a robotics fund is the best place to park money. Ben Seager-Scott, director of investment strategy at Tilney Bestinvest, the UK wealth manager, says anyone looking to invest in niche areas must consider the investment case. "One of the challenges to these type of approaches is they are often driven by an attractive story, such as the 'rise of the robots', but investors should be careful that they also give consideration to some of the fundamental metrics, such as valuation," he says. "It's far too easy to get pulled in by the story but [find] it is overvalued. You need to make sure the story is turned into a bona fide investment case." Adam Laird, passive investment manager at Hargreaves Lansdown, the investment platform, adds: "My feeling on this is that investors should be looking more broadly than just this niche itself. Many investors are better off with a broader technology or industrial investment rather than sticking rigidly to this theme. That way they are spreading the risk more." Performance of robotic funds and ETFs has been less than stellar. So far this year, Pictet's fund has fallen 7.1 per cent and ETF Securities' product is down 7.8 per cent, according to Morningstar. Mr Lingen admits that the Pictet-Robotics fund has had a slightly "rocky start", given its exposure to industrials, China and technology, which have all suffered during the recent stock market turmoil. However, he believes that the long-term growth potential is huge. "Two years ago we almost laughed at autonomous cars, but now we're almost there," he says. Marie-Laure Schaufelberger, product specialist in thematic equities at Pictet, adds: "It is still early days. Over the next five to seven years, we expect [this fund] to outperform."



This cloud stands up
to any storm.

Microsoft Azure scales to enable AccuWeather to respond to 10 billion requests for crucial weather data per day. This cloud rises to the challenge when the weather is at its worst.

This is the Microsoft Cloud.

learn more at microsoftcloud.com

 Microsoft Cloud