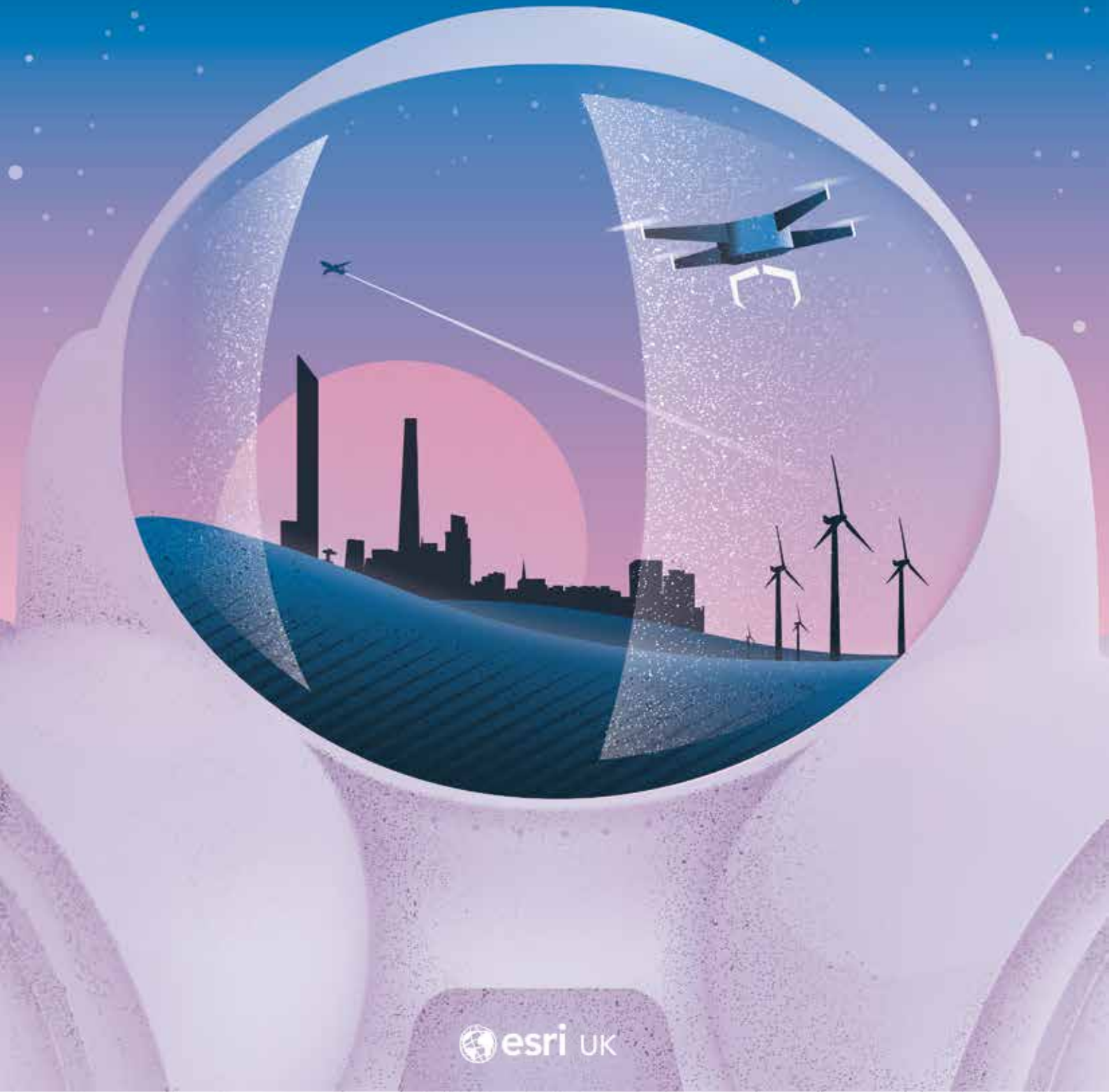
RACONTEUR

A Smarter World



esri UK

Planning for a smarter world

Futurists often fall into two opposing camps, but the issues facing society are everyone's concern

OVERVIEW
CHARLES ORTON-JONES

Are you an Up or a Down? The future of our planet may depend on your decision. There are two tribes warring to control earth's resources, and the victors will determine how we live.

The Uppers gaze at the stars. They dream of a techno-utopia, in which all our problems are solved by innovations. Look at traffic jams: more cars on the roads mean more boring jams, right? In fact, driverless cars may be able to form a peloton to squeeze more vehicles onto our roads. Combine this innovation with real-time routing software and jams may be a thing of the past. Uppers fizz with enthusiasm for solutions like this to solve the world's problems.

Downers look to the earth. Their instinct is to conserve to preserve. According to the science writer Tim De Chant's 2012 calculations we'd need 4.1 earths if everyone lived like Americans currently do, or 5.5 earths if we adopted the habits of the United Arab Emirates. But if we all scale back our shopping and energy usage to the eco-friendly levels of Costa Rica then our solitary planet's resources will cope, according to Mr De Chant.

The World Wildlife Fund runs a campaign to get us to use less power. The WWF's annual Earth Hour asks people to switch off all lights together as a reminder of the need to conserve. An act of collective Down thinking.

RACONTEUR

In partnership with esri UK

Head of publishing **Richard Hadler**

Production editor **Benjamin Chiou**

Digital content manager **Jess McGreal**

Design **Samuele Motta**
Grant Chapman
Kellie Jerrard

Contributors

Adrian Bridgwater
Specialist author on software engineering and application development, he is a regular contributor to *Dr. Dobb's Journal* and *Computer Weekly*.

Alison Coleman
Writer and editor, she is a contributor to *Forbes, The Guardian, Director, Economia* and *Employee Benefits*.

Charles Orton-Jones
Award-winning journalist, he was editor-at-large of *LondonlovesBusiness.com* and editor of *EuroBusiness*.

Mike Scott
Freelance journalist, specialising in environment and business, he writes regularly for the *Financial Times, The Guardian, Forbes* and *2degrees Network*.

The Up-versus-Down terminology was coined in the 1973 work *UpWingers: A Futurist Manifesto* by the Iranian visionary FM Esfandiary. It was the year of the oil crisis. Nuclear war loomed. A population crisis threatened food supply. Those worries are still with us, plus a load more.

It's possible to filter the troubles of the world today through his Up and Down logic. The world is struggling to produce enough food. The founder of the Leon food chain, Henry Dimbleby, recently wrote: "We are putting all this pressure on the land and need to feed all these people. There is a fascinating question, full of moral hazard about how we do that."

Mr Dimbleby weighed up whether we should eat less meat, or accelerate research into Japanese tower farms and lab-grown meat. A classic Up-Down analysis.

Great thinkers sometimes switch sides. The ecologist George Monbiot reversed his position on nuclear power from Down to Up. Once vehemently anti, he gave up hoping people would scale down energy usage. And nuclear is far better than coal. So now he's pro-nuclear.

It's arguable we don't need to chose. Perhaps the ideals of the Downs – protecting fragile resources and fostering beautiful environments – are compatible with the innovations of the Up community. Look at recycling. Sweden announced in December it is so efficient at recycling it has run out of rubbish, and must import debris

1 Growing waste levels is a major concern for Downers, as landfill capacity begins to run out

2 Nuclear energy is a common contentious issue between Uppers and Downers

3 WWF's global Earth Hour campaign asks people to switch off all lights as a reminder of the need to conserve energy

> The more we understand the world around us the better decisions we can make

from other countries. A hippy ideal was filtered through high-tech processes to deliver a result both sides can celebrate.

The same is true for all sorts of global problems. Transport is a nightmare right now. The solutions can take the best of both ideologies. We can work from home (a classic Down solution) by using fibre broadband (Up). We ditch cars and travel by public transport (Down) through new systems like Crossrail (Up).

The key is better planning. Mapping software allows innovators of all creeds to roll out transformative solutions on a vast scale. For example, the UK needs to upgrade mobile phone coverage – currently ranked worse than Albania's. Our base stations are in the wrong places. Better planning through sophisticated mapping is the solution. Apps and mobile broadband can improve productivity and lower the burdens on the planet.

The more we understand the world around us the better decisions we can make. Mapping software gives us astonishing precision – down to 2.5cm resolution. We can fuse multiple data sources, such as traffic flow, geology, population density, utilities and vegetation. As this report demonstrates, maps can solve problems with devastating efficiency.

Whether you are an Up or Down, the problems facing Mother Earth are all our concern. The right software gives us the power to tackle challenges in the manner of our choosing.

Drones are being put to work

From policing to agriculture, drones are set to change the way we live

DRONES
MIKE SCOTT

Until recently, mention of drones would bring to mind either high-tech weapons being used in conflicts around the world or, at the other end of the spectrum, tiny quadcopter toys.

But increasingly, drones are being put to work in a host of applications. While the drone deliveries promised by Amazon and others remain some way off, drones are improving health and safety at industrial plants and on facilities such as oil rigs by being used to inspect difficult-to-access and dangerous sites. They are being used by police to follow criminals and search for missing persons – Devon and Cornwall Police have just announced the country's first 24-hour drone service.

The National Trust, which has banned visitors from flying drones on its properties, is using them to carry out building surveys without the need to erect scaffolding, which is expensive, time-consuming and off-putting to visitors. It is also using the machines to give visitors different views of its properties that were previously unavailable and is considering using them to create 3D models of some of its iconic structures to help visitors to understand them better.

Elsewhere, drones are being used to identify stressed crops and tackle diseases, to survey beaches for erosion and identify crop run-off that is causing water pollution. There are even plans for miniature drones to be used to pollinate plants in areas where bee and butterfly populations are struggling.

It is not just in the air that drones are making a mark – there are suggestions that drone ships could carry freight around the world without the need for crew – or the space to house them.

There are even plans for miniature drones to be used to pollinate plants in areas where bee and butterfly populations are struggling

"The benefits of these cool, little machines are just tremendous," says Kurt Schwoppe, business development manager at Esri. "They provide a new window on the world that allows us to show things that have traditionally been missed by mapping organisations, engineers and government agencies."

They are going to be big business too, with PwC predicting that the market will see explosive growth of more than 6,000% by 2020, up from about $2 billion in 2016 to $127 billion by the end of the decade.

The key to this boom is not going to be the drones themselves – the technology is fairly basic and has been well understood for decades. Some incremental advances such as better batteries and

advanced, lightweight materials may improve their capabilities but not radically. What will really add value is the way they will interact with other technology.

Identifying crop disease, for example, will come from using infrared cameras on drones that will be able to show diseased plants that look healthy to the naked eye. Meanwhile, the University of Buffalo has developed a method of using a swarm of drones to identify the extent of oil spills, in which each individual drone communicates with others in the group to ensure that they do not duplicate information and that they cover as large an area as possible.

However, like any technology, drones are only as good as the people who use them. Fears that they will be abused are typified by criminals using them to smuggle drugs into prisons and track police movements, and fears that terrorists could weaponise them. That's why governments from Canada to China have brought in strict rules to control the use of drones, for example near airports.

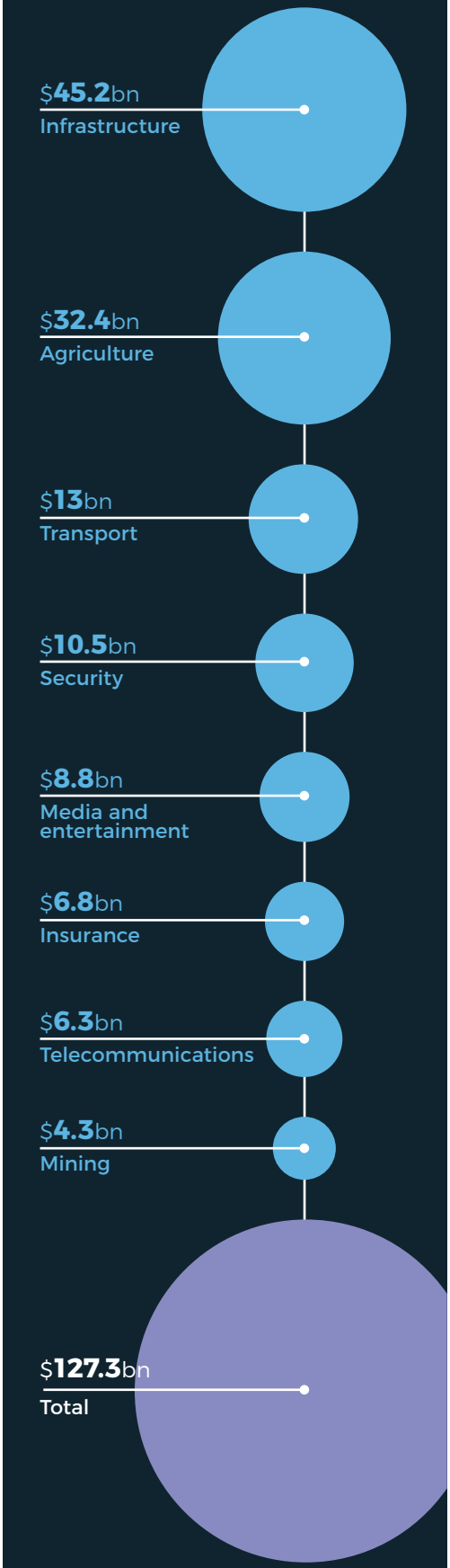
China, the world's biggest producer of the flying machines, has gone a step further, ruling that all drones must be traceable back to an individual owner, while police in Wuhan in Central China have recently taken delivery of drone-busting rifles that emit radio-jamming signals to knock drones out of the sky.

But Mr Schwoppe, for one, remains confident that the future is bright for drones. "We're still at the tip of the iceberg," he says. "These machines are empowering people. They will be a huge benefit for society, they really will."

1 Drone deliveries may be some way off, but they are being used in a variety of other practical ways

2 Drones are driving visitor engagement at the National Trust and enabling 3D modelling of the organisation's buildings and protected sites

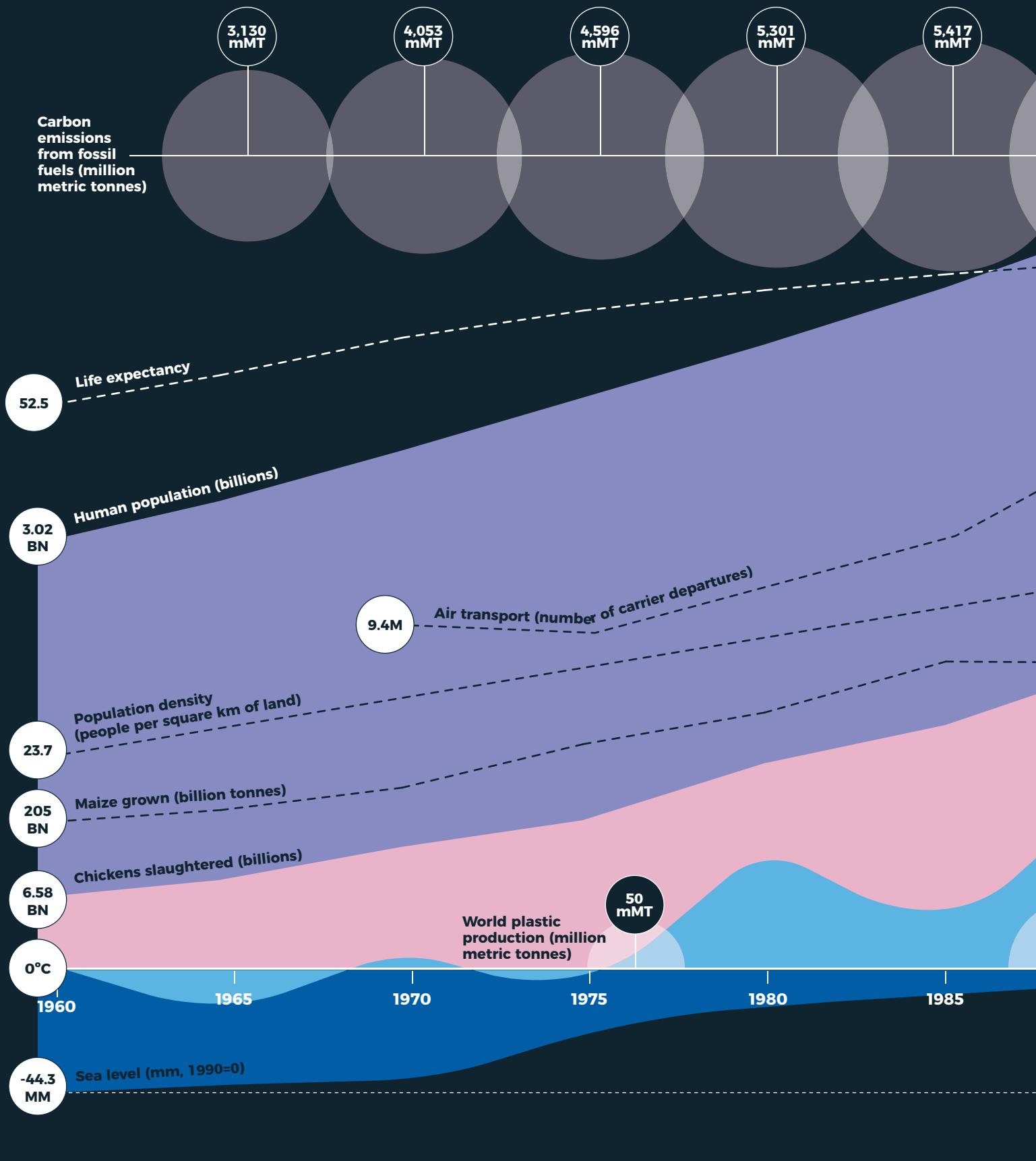
ANNUAL GLOBAL VALUE OF DRONE-POWERED SOLUTIONS BY INDUSTRY



PwC 2016

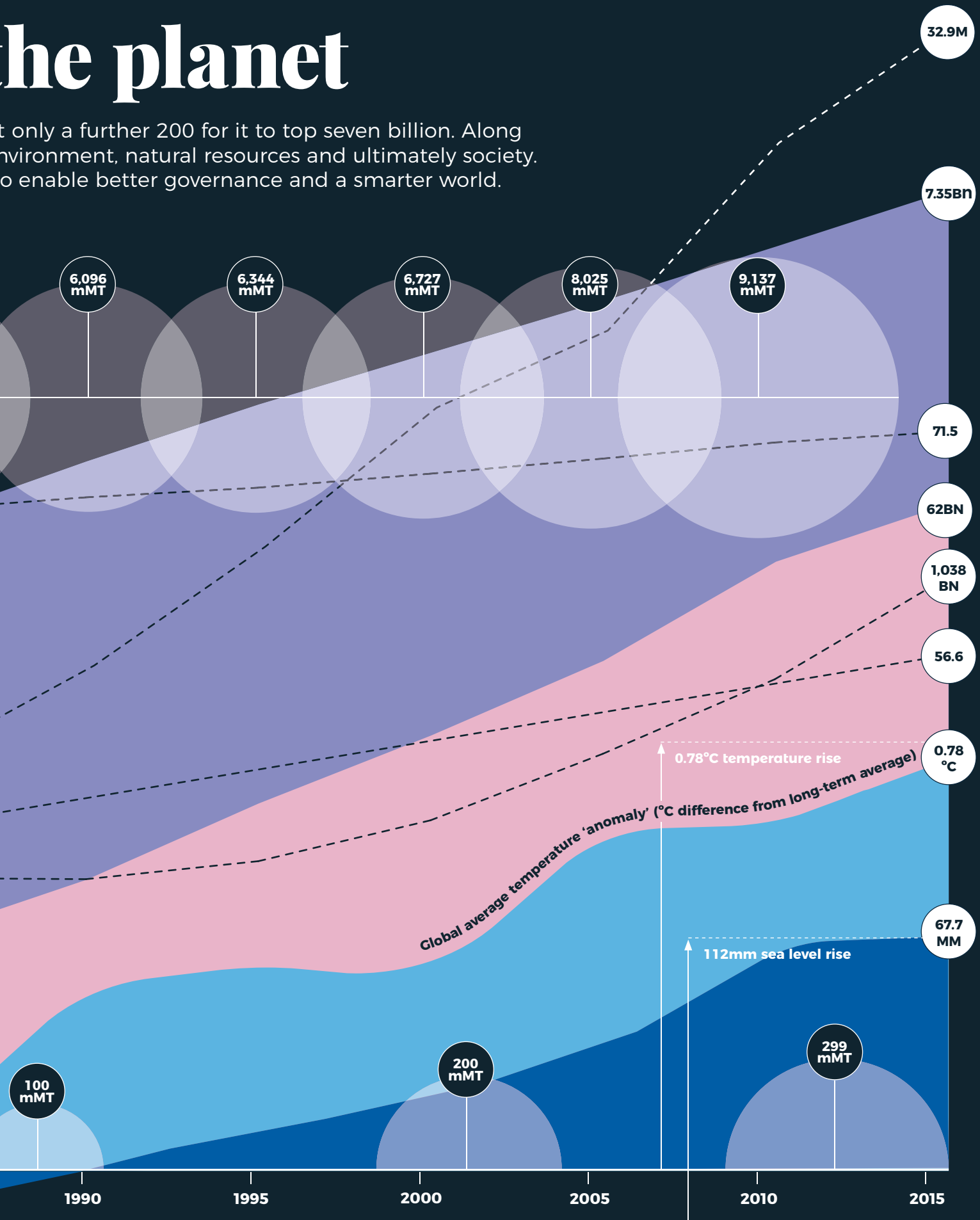
Population growth and t

It took hundreds of thousands of years for the global population to surpass one billion, bu
with a sevenfold increase in Earth's inhabitants comes a multitude of challenges for the e
What is certain is the need for greater awareness and understanding of these challenges t



the planet

t only a further 200 for it to top seven billion. Along
nvironment, natural resources and ultimately society.
o enable better governance and a smarter world.



NASA/Oak Ridge National Laboratory/Earth Policy Institute/Food and Agriculture Organization/United Nations/ICAO/PlasticsEurope/Consultic


Martin Sanchez/Unsplash

Future is now for smart cities

Smart city technologies are already with us, so what will the urban landscape look like in 2030?

SMART CITIES
ADRIAN BRIDGWATER

Smart cities are already with us. We have already brought huge advances to the way we manage our civic utilities with software-based intelligence to control civil engineering infrastructures. This insight allows workers in white shirts and ties across operations departments to perform predictive supply optimisation for us. This same insight also allows engineering staff in hard hats to perform physical predictive maintenance and keep machines online longer. Things work better now.

We can already control traffic flows with cameras and smart traffic lights that have a degree of computer reasoning power. We also can construct buildings with smart meters for power monitoring and the ability to run subdued lighting in unpopulated zones. All this has happened, already.

Further still, we can now build new city areas using geographic information systems (GISs) from organisations such as Esri to create 3D mapping plans of everything from skyscrapers to parklands. Using data-rich 3D maps of buildings, factories and homes, we can use computers to create so-called "digital twins" of rooms, power plants and the turbines inside them, or whole airports.

These digital twins are working visualisations of the real world, programmed to exist in the correct context of their physical existence; for every smart city, there is a software-based version of it sitting on a computer server. This is the bleeding edge; this is happening now.

So if we already have plastic solar-powered palm trees that pump out wi-fi (Dubai did this already), then where can smart cities possibly grow next? Where we will we be by 2030? Is it a question of digitising our entire existence? Chris Pope at service management specialist company ServiceNow thinks the answer is yes; it's digital empowerment from ground zero.

"As we establish this new era of smart cities, it is fundamental that we understand what has happened at the infrastructure level. In the new digital economy, almost every aspect of business becomes defined as a service," says Mr Pope.

He illustrates the reality by explaining that a firm's phone system is now a digitally provided IT service controlled by computers. The amount of food ordered for the staff canteen can also be defined as a controllable IT service. The amount of air pumped through the office air conditioning system is run by an app — and so becomes an IT service that we can turn up, or down.

"When we understand this new approach to codifying and defining our business assets, then and only then can we start to be smart about the way we tune our smart cities for the greater good," Mr Pope says.

So is all that data going to be good for our health? If it is, then shouldn't we be able to create a smarter and healthier world as well? We know that the world population is likely to rise by 50 per cent in the 21st century and reach around 11 billion by 2100, so shouldn't


Jeremy Bishop/Unsplash

For every smart city, there is a software-based version of it sitting on a computer server

smart systems give us a means of all controlling our own wellbeing better in the wider realm of digital smart city healthcare?

"It's only a matter of time before the data society produces has a profound effect on our level of healthcare we receive, what we eat and how we feel and act as human beings," says Nathan Berkley, chief executive of connected fitness platform company Muhdo.

Mr Berkley is suggesting that the smart city of 2030 will be designed with sympathy for our human epigenome — the array of chemical markings that surround our DNA and its protein scaffold. The epigenome's pattern acts like a chemical program to tell our cells which genes to express and which to keep silent. This in turn means that identical strands of DNA can develop into different specialised types for different tissues.

In simple terms, the way you eat, sleep, exercise and behave can have an impact on the way your DNA develops. With the rise of the wearable fitness trackers and the amount of data we all capture and share relating to our behaviour, activity and mood, it's reasonable to suggest that healthcare providers in smart cities will soon plug into epigenetics.

"We are already taking this a step further with DNA sequencing and epigenetics markers as personalised health and fitness becomes a reality," says Mr Berkley. "In the smart city of 2030, healthier people could pay lower insurance premiums. Muhdo is building a machine learning and big data platform based upon an underlining foundation of science to change the way we live."

The trends for future development are clear. We are digitising the world around us into binary 1s and 0s, as we — the humans — are also now forming part of the new big data layer. Does this mean that the data-driven city of 2030 is some kind of guaranteed smart utopia then?

Not at all, there's no easy win for smart cities, according to Hitesh Babhania in his role as industry value engineer for German data analytics firm at SAP. "The value of data alone is negligible," he says. "Local governments require access to the technology which can effectively harness, analyse and deliver insights. In the UK, as with many other developed economies, complex legacy IT systems pose a major challenge to implementing these solutions."

Mr Babhania suggests that London, for example, could never fully emulate Nanjing in China with its intelligent traffic system. This Chinese mega city was able to start from a blank canvas and build models in which technology enables major advances in areas such as congestion and traffic management.

Ultimately, construction of the 2030 smart city and beyond comes back to the same single word much beloved by city planners for the last half century — planning. Some of what we can achieve by 2030 is straightforward augmentation and enhancement of our existing city infrastructures. Other aspects will require a "rip-and-replace" approach. Defining the shape of our next smart city building blocks is where we are at now, so please expect some drilling, a few extra tall cranes and the occasional whiff of rubble.


VCG via Getty Images

Unlike older cities such as London, Nanjing in China was able to start from a blank canvas and build models with efficient congestion and traffic management

There's a map for that

Solving real-world problems such as organised crime and locating multi-million pound retail developments needs high level mapping skills. Here are five brilliant examples of how Esri's ArcGIS platform is unlocking complex problems with maps

FIND THE BEST PLACE FOR A SHOP

The estate agent Knight Frank helps retailers find the perfect locations for their stores. This is no easy task. It's necessary to factor in a long list of commercial factors. These include population density, footfall, rent levels, traffic, local facilities, utilities and so on. To fuse together all variables Knight Frank uses ArcGIS. Brands can thus view all datasets, and add their own and third-party data, to create a comprehensive overview. The results can be shared and viewed through ArcGIS online. Geospatial mapping helps Knight Frank cut search times, and allows brands to perform maximum commercial due diligence on sites before making a decision.

Blog/EsriUK/Knight Frank

CROSSRAIL LAUNCHES ON BUDGET

Crossrail is now live. The Elizabeth line, as it is now known, is running trains from Shenfield to Liverpool Street, the first step towards complete service in 2019 spanning 100km through 40 stations. It was Europe's largest construction project costing £15 billion. A key tool during construction was the Esri ArcGIS platform. It mapped the entire Crossrail route and thousands of assets are all tracked on ArcGIS. The landscape is lavishly illustrated – if a tree threatens visibility it can be flagged on the system, and pruned. Field Engineers on site use the ArcGIS Collector App on mobile tablets to check exact boundaries against map records. The public are kept up to date too through the platform. ArcGIS Online and Esri UK's Open Data Portal is used to publish selected content for the general public, media and third parties.

Resources/EsriUK/Crossrail

SURVEY BY DRONE

There are times when you need a pin-sharp view of a landscape. FERA Science a science-based organisation that works across the agri-food supply chain, renowned for composing high-resolution images of the landscape by drone. Detail can be between 2.5cm to 5cm depending on the height of the drone. Cameras capture data in real colour and infrared. The data is then mapped onto existing databases in ArcGIS. With a perfect visualisation of the land the farmer can make accurate decisions on fertiliser levels and crop management strategies. It's all about the pursuit of yield. An increase of a few per cent — easily achievable by this method — means a farmer can boost profits and make a serious contribution in the global food shortage crisis.

Resources/EsriUK/Fera Science

MAKE BUSES FIRST CHOICE IN YORKSHIRE

The South Yorkshire Passenger Transport Executive runs buses for four local authorities running from Leeds in the North, Scunthorpe in the East

360,000
data points were plotted on an Esri map during a crime investigation

2.5cm
detail can be achieved, depending on the height of the drone

100km
of Crossrail track were mapped by the Esri ArcGIS platform during construction

and the Peak District in the South. For more than a decade the Executive has used ArcGIS to map out routes and handle many different public and private data sources to improve performance. Saad Masood, senior GIS analyst at the Executive, says: "GIS is the starting point for all of the information products we produce. Even when a finished product has no actual map on it, the data that is included in it has been produced using GIS and spatial analysis." For example, when new housing developments are proposed ArcGIS allows analysis of multiple route models to identify the best service levels, given traffic flow, population levels and environmental considerations.

Resources/EsriUK/SYPTE

LOWER CRIME

Predictive policing is a huge trend right now. Police use maps to solve crime statistics, and even guess where the future hot spots will be. Durham Police is at the forefront. It recently led an investigation into organised crime thefts of £57 million-worth of museum quality rhino-horn and jade artefacts. Lasting four years, the search involved 600 officers. Data included automatic number-plate recognition, telephone records, offence locations and several other layers of intelligence. Around 360,000 points were plotted on a map supplied by Esri UK. The result was a successful apprehension and conviction of the gang responsible, with 14 men serving sentences totalling 72 years. The breakthroughs based on advanced mapping won Durham Police The Importance of Where category at the Esri UK Customer Awards 2016.

Blog/EsriUK/Durham Constabulary

Everyone has a story to tell. Harness the power of maps to tell yours. Explore the Esri Story Map Gallery and be inspired.

Chris Ratcliffe/Getty Images

Data holds the answer to NHS dilemma

The healthcare system is flush with data, but analysing and acting upon the numbers is essential to ease the rising pressures facing the NHS

HEALTHCARE
ALISON COLEMAN

The pressures on the NHS show no sign of abating. After the threat of yet another winter crisis, with a surge in patient numbers causing almost a third of hospital trusts in England to warn they needed urgent action to cope, could relief from some of these pressures come from a more effective use of data?

The consensus in healthcare technology circles is a resounding yes. The question is, given the scale of the problems facing the NHS, where do the data experts start?

Collette Johnson, head of medical at Plextek, says a priority is the use of data to better understand bed management. "Bed occupancy has traditionally been managed by teams of people, constantly on telephones, trying to understand where and when beds will be freed up. The result is that every day can feel like the winter crisis in hospitals because the pressure is increasing," she says.

"Using data to understand behaviours and trends in bed management would help to ease the burden, and a group in Cambridge are currently addressing this through a collaboration between Addenbrookes hospital and Cambridge University, so hopefully progress will be made."

Patient transportation could also benefit from better use of data, as Marc Engall, government account director at CA Technologies, explains: "Getting patients home after treatment usually requires a group of people calling local transport firms to collect patients who cannot arrange their own travel, a costly task for what is simply matching data around patient exit time, transport type and a postcode.

Making these solutions a reality that will tangibly ease pressures on the NHS will require a greater investment in data skills and expertise

"Using application programming interfaces, a clinician could discharge a patient and have a car arrive at the right time, while notifying social care that the patient has gone home, saving millions every year on staffing costs and freeing up beds."

However, the use of data to streamline services and save on time and costs offers a much broader range of benefits for the NHS.

The North East London commissioning support unit is using data gathered from a number of healthcare providers to map and segment patient populations in order to better target healthcare interventions and design more efficient services.

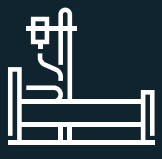
"We are able to tailor this to individual customer needs," says business intelligence analyst Robert Sinfield. "For example, we've recently done a lot of work looking at primary health care population distribution for GP practices. This is new information for a lot of our commissioners, because they've never been able to see where a practice population lives; they can be very spread out or very confined around the area.

"When they are thinking of changing services, for example, taking a practice out, this information can help them evaluate access, understand the travel times between all the practices, and demonstrate what could happen given different scenarios," Mr Sinfield says.

Making these solutions a reality that will tangibly ease pressures on the NHS will require a greater investment in data skills and expertise. In the digital future, data practitioners could become an important a part of NHS staffing as medical staff, suggests Greg Hanson, Europe, Middle East and Africa vice president of cloud at data management specialists Informatica.

He says: "This is a multi-year journey, but as many other industries will testify, quick wins can be made and the earlier this begins, the quicker we can get to those cost savings and service improvements."

NHS Confederation 2016



2.7
hospital beds per 1,000 people in the UK, compared with 8.2 in Germany and 6.2 in France

1M+
patients are dealt with by the NHS every 36 hours

3.73M
patients were on waiting lists for treatment at the end of September 2017