TATA IN EUROPE *Issue six*

PERSPECTIVE

PIONEER WITH PURPOSE

PUTTING PEOPLE AT THE HEART OF INNOVATION ISN'T SOFT – IT'S SMART

CONSUMER TO CITIZEN: *an overdue evolution*
SPARKS OF CREATIVITY: *the next generation of entrepreneurs*
STEM, ROOT AND BRANCH: *re-engineering education*
BUILDING, THE FUTURE: *Tata's new European hubs*

JAGUAR F-PACE

BIRDS FLY, FISH SWIM, JAGUARS ROAR.

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With a muscular stance and responsive, agile handling the Jaguar F-PACE speaks for itself. It brings together our latest Ingenium engines, Lightweight Aluminium Architecture and styling cues from the remarkable F-TYPE sports car. And with rear seat flexibility that offers up to 1,740 litres* of loadspace, the F-PACE can adapt to wherever your lifestyle takes you. A car this practical shouldn't feel this exhilarating.

jaguar.com

THE ART OF PERFORMANCE

*When Tyre Repair System is fitted. Official fuel consumption figures for the Jaguar F-PACE range in mpg (l/100km): Urban 23.2-49.1 (12.2-5.8); Extra Urban 39.8-67.2 (7.1-4.2); Combined 31.7-59.2 (8.9-4.8). CO_2 Emissions 209-126 g/km. Official EU Test Figures. For comparison purposes only. Real world figures may differ.

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Welcome

DAVID LANDSMAN, EXECUTIVE DIRECTOR, TATA LIMITED, REPRESENTING THE TATA COMPANIES OF EUROPE

ILLUSTRATION: KATE COPELAND

As we enter 2018, the acronym 'VUCA' – 'volatile, uncertain, complex and ambiguous' – seems to describe our world more appropriately than ever. Like so many acronyms – and, indeed, so many inventions we now take for granted – it originated with the military. But thanks to accelerating technological innovation, political change and economic development, it reflects well the challenges faced today by business, policymakers and society.

Our response to the VUCA world can't be to stick our heads in the sand or to wish for a return to the apparent certainties of previous generations. The 'good old days' rarely were as rosy as they can appear to the memory. Instead, we need to harness the opportunities the modern world brings, while preserving at the core a sense of purpose which is not antiquated, but timeless.

Organisations increasingly articulate their 'mission' going well beyond creating shareholder value. For Tata, that sense of purpose has been embedded in the very fabric of the business since our foundation 150 years ago this year. Our founder himself, Jamsetji Tata, placed philanthropy and community at the very heart of the business, using words that look surprisingly modern: 'In a free enterprise, the community is not just another stakeholder in the business, but is in fact the very purpose of its existence.' And with two-thirds of Tata Sons, the holding company, owned by the Tata (philanthropic) Trusts, shareholder value and purpose come together.

The irony is that, to achieve a timeless purpose, you have to be open to change. During the past 150 years, Tata founded India's first domestic bank, steel plant, power plant and airline. It introduced insurance to the country in 1919, and built its first commercial vehicles and pioneered software development in 1968. Today Tata spans the globe – opening its first offices in the UK in 1907 – and has interests in incredibly diverse fields, from salt to steel and tea to IT, not forgetting Jaguar Land Rover, Taj hotels and many others.

This edition of *Perspective* focuses on the interaction between business and society, from the changing nature of the urban environment to the renewal of the idea of citizenship; from brilliant examples of young entrepreneurs driving change for good to investment in new enterprises bringing jobs and purpose to communities. There's plenty here to reassure us that, with a clear mission, long-established organisations can thrive in a changing – and even a VUCA – world.

If you'd like a taste of the broader global perspective that being part of the Tata group brings, visit *Tata Review*'s website: tata.com/htm/tata_review.htm

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TATA

GROWING IN SOUTH AMERICA?

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TATA COMMUNICATIONS

CLOUD
NETWORK
COLLABORATION
SECURITY

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The colour theme explained: IT AND COMMUNICATIONS | CONSUMER PRODUCTS | MATERIALS | CHEMICALS | ENGINEERING | SERVICES | ENERGY

THE E-TYPE ZERO: THE MOST BEAUTIFUL ELECTRIC CAR IN THE WORLD?

▲ THE JAGUAR E-TYPE ZERO FEATURES A FULLY ELECTRIC POWERTRAIN

The Jaguar E-type was declared 'the most beautiful car in the world' by Enzo Ferrari in 1961. Now, 56 years later, the E-type has gone electric.

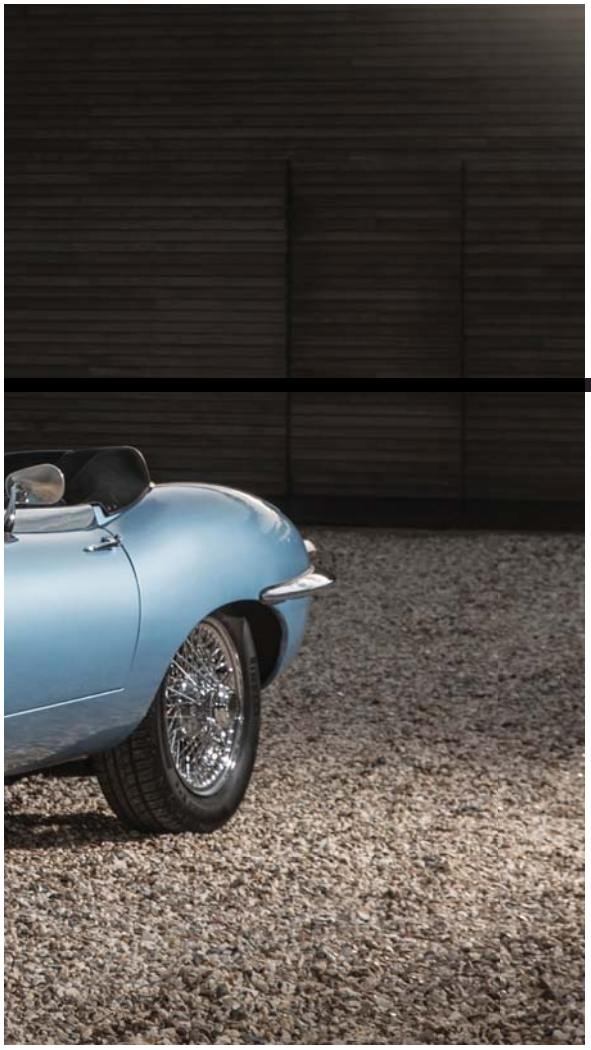
Unveiled at the Jaguar Land Rover Tech Fest, the E-type Zero is a 1968 Series 1.5 E-type Roadster, and was restored and converted at Jaguar Land Rover Classic Works in Coventry, not far from where the original E-type was born.

The E-type Zero features a fully electric powertrain, enabling it to go from 0-62mph in just 5.5 seconds – faster than the original E-type.

Apart from the powertrain and modified instrumentation and facia, all the features meet the vehicle's original specification. The electric powertrain has similar weight and dimensions to the original petrol engine and transmission, which means the car's structure, including suspension and brakes, has not changed. It drives, handles, rides and brakes like an original E-type.

'Our aim with E-type Zero is to future-proof classic car ownership,' Jaguar Land Rover Classic director Tim Hannig said. 'We're looking forward to the reaction of our clients as we investigate bringing this concept to market.'

The E-type Zero was on display alongside the all-electric Jaguar I-PACE, which goes on sale in 2018.



◀ THE E-TYPE ZERO IS A RESTORED 1968 SERIES 1.5 E-TYPE ROADSTER

AT A GLANCE: THE TATA UNIVERSE
- IT AND COMMUNICATIONS
- CHEMICALS
- CONSUMER PRODUCTS
- SERVICES
- MATERIALS
- ENGINEERING
- ENERGY

▲ THE E-TYPE ZERO'S LITHIUM-ION BATTERY PACK HAS SIMILAR DIMENSIONS AND WEIGHT TO THE XK SIX-CYLINDER ENGINE USED IN THE ORIGINAL E-TYPE, EXCEPT THE NEW MODEL IS ELECTRIC (LEFT)

Three new Fellows for Tata and the Royal Society

Tata has offered its support to the Royal Society by appointing three Royal Society Tata University Research Fellows (URFs), as part of the intake of 43 new URFs for 2017.

The URF scheme aims to enable outstanding young scientists to build an independent research career. Each has the potential to be a leader in their chosen field, and all are expected to be strong candidates for permanent posts in universities at the end of their fellowships.

The 2017 fellows will be working on a wide range of activities, including detecting the particles that make up dark matter using data from the Large Hadron Collider; enabling robots to map and track 3D environments for physical interaction; and understanding the degradation mechanisms of fuel cells and batteries.

Dr David Landsman, executive director, Tata Limited, said: 'Behind many of the most important human advances is pure science, which enhances our understanding of the world and forms the foundation for future innovations. That's why we're proud to be continuing our partnership with the Royal Society. "Pioneering with purpose" is at the heart of the Tata ethos, so by supporting some of the brightest minds in UK research, Tata is helping to uncover the answers to some of the most complex scientific questions in the world today.'

The newly appointed research fellows are:

Dr Adriana Paluszny Rodriguez *(Isogeometric fracture growth in heterogeneous media),* Imperial College London

Dr Rowan Leary *(Understanding single-atom catalysts by electron microscopy),* University of Cambridge

Dr David Turton *(Black holes in string theory and holography),* University of Southampton

THE LARGE HADRON COLLIDER IS THE WORLD'S LARGEST PARTICLE ACCELERATOR

1837

THE YEAR THAT TEA FIRM TETLEY WAS FOUNDED BY BROTHERS JOSEPH AND EDWARD TETLEY

FOURTH YEAR OF CSR EXCELLENCE FOR TCS

Tata Consultancy Services (TCS) has been awarded Gold status in the EcoVadis annual report on corporate social responsibility (CSR) performance across global companies. This is the fourth consecutive year TCS has been awarded the honour.

This recognition highlights TCS's commitment to sustainable business practices and to making a positive contribution to the communities in which it operates around the world. TCS was placed in the top 2% of all companies within the report.

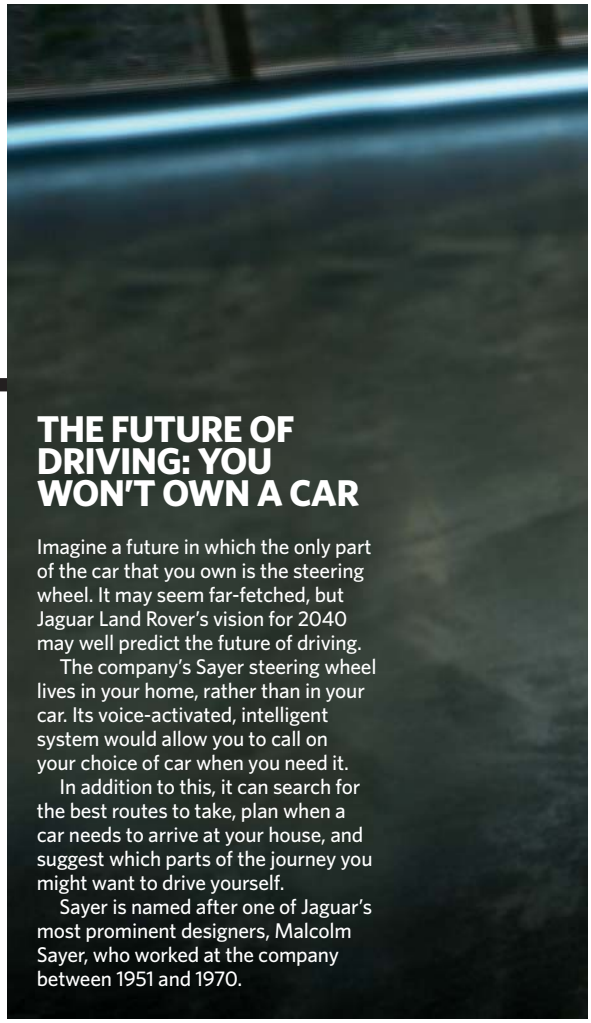
'We've invested heavily in CSR and sustainability, whether in digital skills and adult literacy, or making sure our supply chain and procurement procedures are ethical and sustainable,' Ajoy Mukherjee, executive vice president, TCS, said. 'As a business that is having a major impact around the world through digital innovation, we want to make sure the wider communities we operate in also benefit.'

TCS has now reduced its carbon footprint by more than 9%, and has cut its emissions by 49% since 2007, helping the company edge closer to its target of a 50% total reduction by 2020. By March 2017, the business had supported 664,675 people around the world in areas such as digital skills and education, health and well-being, and environmental sustainability.

In January 2017, TCS also successfully completed the Together for Sustainability audit, an in-depth analysis designed to create benchmarks for sustainable supply chains.

David McClintock, marketing director, EcoVadis, said: 'EcoVadis's annual CSR assessment is a comprehensive analysis that looks at 21 sustainability criteria across four themes. Receiving our Gold recognition is a significant achievement. TCS has shown for the fourth year running an innovative and proactive approach to its CSR initiatives, and the company is ranked in the top 2% globally.'

CSR is a big issue for the whole of Tata Europe. CSR initiatives include the Lady Tata Memorial Trust, which supports research into leukaemia and other blood diseases, the International Social Entrepreneurship Scheme, which provides internships on corporate sustainability projects, and Tetley's use of Rainforest Alliance certified farms.



THE FUTURE OF DRIVING: YOU WON'T OWN A CAR

Imagine a future in which the only part of the car that you own is the steering wheel. It may seem far-fetched, but Jaguar Land Rover's vision for 2040 may well predict the future of driving.

The company's Sayer steering wheel lives in your home, rather than in your car. Its voice-activated, intelligent system would allow you to call on your choice of car when you need it.

In addition to this, it can search for the best routes to take, plan when a car needs to arrive at your house, and suggest which parts of the journey you might want to drive yourself.

Sayer is named after one of Jaguar's most prominent designers, Malcolm Sayer, who worked at the company between 1951 and 1970.

Jaguar Land Rover saves lives with solar

Franklin Kishta, 14, lives in an off-grid community in Kawala, Kenya. He dreams of being an engineer one day, but the lack of power made it difficult for him to study. Now, he's been given a chance to achieve his goals.

'I finish all of my homework now,' he says. 'Before, I could not do it at home when it was dark. I know my parents are much happier now, and so am I.'

Franklin, and thousands of children like him, are benefiting from Jaguar Land Rover and ClimateCare's initiative, Lighting Up Lives, to bring solar technology to off-grid communities

LIGHTING UP LIVES WAS LAUNCHED AT THE 2017 HAY FESTIVAL. EXPLORER BEN SAUNDERS HELPED CELEBRATE BY EXPLAINING THE KEY ROLE OF SOLAR POWER IN HIS POLAR EXPEDITION

across Kenya, in a bid to improve the quality of life across the country.

In many of these communities, the only source of light was kerosene lamps, which create hazardous indoor pollutants that are one of the biggest causes of premature death across Africa. Solar technology offers a healthier, more efficient alternative.

'[We're] using technology for good and supporting the power of engineering to improve lives and help to build a cleaner future,' says Helen McLintock, director, Jaguar Land Rover. 'Our purpose is to make responsible business relevant to everyone. By sharing our skills, our technology, our people and our passions, we can make a difference to people's lives and prosperity.'

Lighting Up Lives is part of Jaguar Land Rover's drive to be more sustainable and ethical. This includes moving to 100% renewable energy in its UK facilities.

Listen to our new podcast, *Dare to Try*, for tales of courageous entrepreneurialism. **bit.ly/DareToTry**

ROBOTIC PHYSIO WINS VARSITY PITCH

A robotic rehabilitation device that provides home physiotherapy for stroke victims won this year's Varsity Pitch Grand Final, securing £10,000.

Imperial College London postgraduates won the prize for their start-up in a national business competition.

Stephanie Hodgson (pictured, far right) and Motus Innovations reached the final in the 'digital and technical' category, sponsored by the Rain Gods, with her technology, which utilises robotics, gaming and AI to help stroke survivors recover on their own.

The Varsity Pitch, run by NACUE (the National Association of College and University Entrepreneurs) in partnership with Tata, saw seven budding entrepreneurs pitch live at Digital Catapult in London to a panel of expert judges from Tata, Swiss Re Institute, Ignite Accelerator and With PR.

The competition seeks to find students or recent graduates with the most innovative, creative and disruptive businesses. This year's Varsity Pitch had over 300 applications.

'To have our work at Motus Innovations recognised in such a way is truly humbling,' says Hodgson. 'We are excited to bring robotic rehabilitation solutions to stroke survivors, and winning the Varsity Pitch competition will definitely help us on that mission.'

NACUE's chief executive, Holly Knower, says: 'Stephanie delivered an exceptionally articulate and high-quality pitch, clearly demonstrating her passion and knowledge of the subject. Year on year, we see an increase in the number of young entrepreneurs who are striving to create their own careers and this year was no different.'

'TO HAVE OUR WORK AT MOTUS INNOVATIONS RECOGNISED IN SUCH A WAY IS TRULY HUMBLING'

LAST YEAR'S WINNERS: WHERE ARE THEY NOW?

Last year, Aeropowder won the Varsity Pitch competition with its proposal to turn feathers into sustainable insulation. Ryan Robinson, co-founder, knew that the hard work had only just begun: 'We have learned so much in the past year, from the legal considerations of starting a company to understanding how to plan for manufacturing at scale.'

Co-founder Elena Dieckmann was present when the first materials rolled off the line: 'It was a great feeling... Suddenly, we had pallets of our material to work with, instead of the small laboratory samples we were used to.'

The company was also featured in the *Forbes* list of '30 Under 30 Europe 2017: Social Entrepreneurs'. Robinson concludes: 'We are close to securing our first sales, so I'm extremely proud of what we have achieved so far and I'm excited for what is to come.'

FLISOM HAS CREATED SOLAR-INTEGRATED SOLUTIONS FOR CARS, UNMANNED AERIAL VEHICLES AND PUBLIC TRANSPORTATION VEHICLES

Tata-backed solar technology rolls out

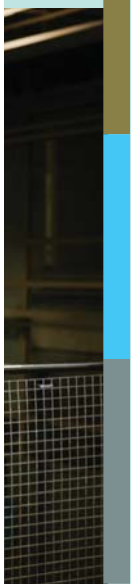
Tata Industries-backed solar tech company Flisom has rolled out a groundbreaking new solar technology across global markets.

The company's solar modules are as light as 200g/m^2 and have up to a 50 times power-to-weight ratio compared to silicon PV panels. They're also ultra-thin – less than 2mm. They have a uniform, jet-black design, to make the technology suitable for use anywhere where aesthetics are important.

Flisom is increasing production in Switzerland to fulfil incoming orders and scouting for locations around the world for further expansion. It is also working with automotive, aerospace and transportation companies to create custom solar-integrated solutions in, for example, cars, drones and public transport.

'We've taken our time to engineer a product that looks better and performs better than the competition,' says Flisom's chief executive, Rahul Budhwar.

KRS Jamwal, executive director, Tata Industries, says: 'It will enable solar to be used in ways and in places never possible before, such as in transportation and aerospace, and much more effectively on all roofs.'



LONDON TAJ HOTELS WELCOME CHEF SHEROY

Executive chef Sheroy Kermani has joined Taj 51 Buckingham Gate Suites and Residences, and St James' Court, a Taj Hotel, as executive chef. He joins the hotels from the Taj Exotica Resort & Spa in the Maldives, where he worked as executive chef for seven years.

Chef Sheroy has worked at Taj hotels for his whole career, starting as a trainee chef at the Taj President Hotel in Mumbai almost 30 years ago. He decided to move to London for the choice and vibrancy that it offers.

'Working at many other Taj hotels around the world, I have gained experience in different ingredients, dishes, cultures and hotels, which, I think, gives me a unique advantage in London,' he says.

During his career, Chef Sheroy launched a new brand within the Taj Group in Bangalore, under the Vivanta banner. This set new culinary standards, and paved the way for more Vivantas within the Taj Group.

He was also part of the team that opened the Taj Exotica Resort & Spa in Mauritius. His first executive chef position was at the Blue Sydney, a Taj business hotel.

Chef Sheroy explains that he is ready to take the food at the London hotels to the next level.

'We may trial some dishes as specials before they have the honour of being part of the main à la carte menu. For example, we have just launched a new tapas and pizza menu, which is a new concept, bringing some very fresh and innovative ideas to the hotel,' he says.

Read more about Chef Sheroy's passion for innovation on page 50.

Tetley celebrates turning 180

In the early 1800s, brothers Joseph and Edward Tetley were selling bags of salt across Yorkshire. In 1837, they decided to start selling tea. They sold it off the back of their pack horse in the early years, before relocating to London in 1856.

The company grew steadily throughout the Victorian era and into the 20th century. In 1953, it introduced the teabag to the UK, and went from strength to strength.

This year the company is celebrating its 180th anniversary with a range of activities and products, including a special limited-edition commemorative tea caddy, a version of which is being sold exclusively through Tesco.

The company is also opening up its never-before-seen archive of historical materials, highlighting the 20 milestones that made the company, the top five adverts from across Tetley's past, and life inside the Tetley factories throughout the years.

The company has also offered 'teatorials' to journalists eager to learn how to blend their own teas.

TETLEY HAS BEEN ENABLING THE CREATION OF REFRESHING BREWS SINCE 1837

IMAGE: TETLEY ARCHIVE

TCS STUDY REVEALS HOW 13 DIFFERENT SECTORS ARE USING AI

Tata Consultancy Services has undertaken a wide-reaching study into how different industries are utilising artificial intelligence (AI).

The company spoke to 835 executives at companies with an average revenue of $20bn across 13 sectors, and in four regions of the world. They found that more than 90% of companies in five of the sectors – energy, high tech, telecoms, retail and automotive – are using AI within their businesses.

Outside of IT, AI is most used for customer service, sales, marketing and finance functions. The majority of those surveyed said they used AI to improve product and service quality. Telecoms companies generated the most value from AI in terms of cost reductions in 2015, while industrial manufacturing, high tech, travel, transportation and hospitality companies believe that AI is more important for staying competitive than the other sectors surveyed.

The biggest aim for all companies was to design an AI system that cannot be hacked.

AI IS MOST USED FOR CUSTOMER SERVICE, SALES, MARKETING AND FINANCE FUNCTIONS

Let's give fresh priority to strengthening relations with India

COLUMNIST GEOFFREY VAN ORDEN

ILLUSTRATION: LAUREN CROW

The scope for greater cooperation between the European nations, the EU and India is enormous. This is not just a matter of shared values and historic bonds but common challenges and mutually beneficial capabilities.

While there is much focus on economic and trade relationships, there is also a strong need for cooperation in other areas, such as the fight against terrorism; climate-change policies; migration issues; and the impact of the information age on governance. How India approaches such issues will directly affect European interests.

Given India's strong economic growth in recent years – over 7% annually – we might ask why the pace of cooperation seems so slow. We should all be encouraged by Prime Minister Modi's mission to make it easier to do business in India – strengthening IP rights, paving the way for a world-leading services sector to operate in the Indian market and opening up new investment opportunities. But, while the statistics may look impressive at first, they conceal a different picture.

The value of trade between Europe and India grew from €28.6bn to €72bn between 2003 and 2013. But this sum is relatively small in terms of the overall trade of the European nations. At the EU level, the Bilateral Trade and Investment Agreement – under negotiation since 2007 – seems to be stuck. Difficulties have arisen over IP, agriculture, the retail sector, and tariff barriers on cars and alcohol, as well as other areas. There seems to be little enthusiasm on either side for making progress. Either a different approach is required, or the process needs more energy and higher political priority.

It is wrong for the EU to monopolise the notion of 'Europe'. It will be even less appropriate when the UK, one of Europe's most powerful nations and the one with the strongest ties with India, is no longer an EU member. And India seems to prefer its bilateral dealings with individual European countries to its EU relations. This is not just a matter of familiarity but also sensitivity to an EU that all too often seeks to intrude on social, cultural and 'human rights' issues in India, or to prioritise relations with China.

While it is natural for countries to carry out much of their foreign trade with close neighbours, many individual European nations – not least Britain, Germany and France – have put a lot of effort into increasing trade with India. Britain still invests more in India than any other G20 country, and India invests more in Britain than it does in all other EU countries put together. Indeed, Indian businesses are a fixture of British life. Modi's decision to open up the defence sector, allowing foreign companies to own as much as 100% equity in a company where it is likely to result in access to new technology or 49% in other circumstances, should provide great opportunities, particularly as India is the world's largest buyer of defence equipment.

Modi's government is grappling with a backlog of structural problems that are holding back economic progress, not least the complications of devolved economic and infrastructure responsibilities at the state level. And just as there is a push for 'Make in India' and for Indian access to the latest technology, so foreign companies and governments are naturally cautious about the long-term implications for their own businesses. The reality is that the growing Indian market has space for plenty of foreign involvement, and there are already many excellent examples of effective partnerships benefiting both sides: the JCB experience stands out in this regard.

It seems to me that the relationship with the great democracy that is India, particularly on the part of the UK, with all its historic and institutional links, should be lifted to a different level. If a solid and reliable strategic partnership can be developed, the trade and investment aspects will also prosper.

Geoffrey Van Orden MBE MEP is chairman of the European Parliament's Delegation for Relations with India, and founding president of the New Direction thinktank. This article was first published in the autumn 2017 edition of *New Direction: Europe & India*

In view...

THE DIGITAL ECONOMY: BITS, BYTES AND VIRTUAL NETWORKS, RIGHT? NOT ENTIRELY. SUSTAINABLE BUSINESSES, EVEN DIGITAL ONES, NEED A PHYSICAL MANIFESTATION IF THEY'RE TO CONVENE GREAT MINDS TO WORK ON THE WORLD'S BIG ISSUES. AND TATA EUROPE HAS BEEN BUILDING...

WORDS *Richard Young*

THE LOBBY OF TATA TECHNOLOGIES' NEW EUROPEAN INNOVATION AND DEVELOPMENT CENTRE IN LEAMINGTON SPA

AROUND 600 STAFF WILL WORK IN THE NEW BUILDING; MORE THAN 200 EXTRA JOBS WILL BE CREATED FOR DESIGN ENGINEERS AND PROGRAMME MANAGERS

Tata Technologies has attained a leading global position catering to the needs of the manufacturing industry. As that sector evolves – and starts to draw more on the digital world and from adjacent sectors too – having a focal point where different disciplines can convene is ever more important.

Enter the new Tata Technologies European Innovation and Development Centre (EIDC) in Leamington Spa. It's a £20m investment that reinforces the company's status as a hub for engineering excellence and its commitment to the UK and Europe – and it will be a big step towards reaching $1bn a year in revenues by the end of 2020.

It's also right in the heart of the new 'motor city' – a resurgent West Midlands region of the UK, where companies such as Jaguar Land Rover and Tata Motors are building a manufacturing base fit for the future. Alongside those companies' investment in NAIC (see page 18), it's a sign that Tata is building for the future, today.

THE NEW CENTRE WILL HOUSE TATA TECHNOLOGIES' ENGINEERING SUPPORT SERVICES, TWO ADVANCED ENGINEERING LABS AND AN R&D CENTRE

THE CENTRE WILL ALSO SERVE AS THE COMPANY'S EUROPEAN HEADQUARTERS

BREAKING GROUND ON BREAKTHROUGHS

NICK SALE IS CONFIDENT THAT EIDC WILL DELIVER ON INNOVATIVE PRODUCTS

Tata Technologies' chief operating officer for Europe, Nick Sale, is clear on the impact of the investment in EIDC. 'The way in which we deliver innovations to our customers and the best practices that evolve in Europe will certainly find their way around the world in our diverse client engagements,' he explains. 'The innovations that our engineers and technicians come up with at EIDC will help our clients take better products to their customers and make a real difference to the people and communities that use these products.'

Tata Technologies identifies world-class innovations that can be applied to global challenges. For example, automotive businesses are driving forward with electric vehicles and lightweight materials. 'At Tata Technologies, we focus on analysing these new propulsion systems, against conventional vehicle technologies, for different client situations,' says Sale.

As well as being at the heart of the UK automotive industry, EIDC is cementing links with academic institutions. 'That gives us access to new talent through internships and graduate recruitment,' says Sale. 'We also collaborate with them on research. Tata Technologies has historically had close ties with Coventry University, where we give our backing to the Ada Lovelace scheme, which supports women studying courses in its Faculty of Engineering, Environment and Computing. We have also developed a relationship with Warwick University and are now exploring collaborations with Birmingham, Aston and Loughborough universities as well.'

'AT TATA TECHNOLOGIES, WE FOCUS ON ANALYSING THESE NEW PROPULSION SYSTEMS, AGAINST CONVENTIONAL VEHICLE TECHNOLOGIES, FOR DIFFERENT CLIENT SITUATIONS'

PIONEERING PLANT

Jaguar Land Rover's new £1bn plant under construction in Slovakia will eventually produce 150,000 vehicles each year, starting in late 2018.

It will be the first factory in Europe to use Kuka's Pulse carrier system, moving vehicles through the factory 30% faster than conventional conveyance systems.

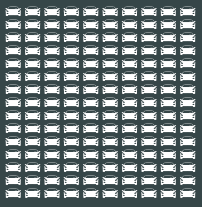
Its highly automated paint shop isn't just faster and more efficient – by using less paint and cutting-edge filtration systems, it also minimises environmental impact.

It's designed to adapt to future innovation too. Tata's other businesses, such as Tata Technologies, Tata Elxsi and Tata Communications, are pioneering smart, connected systems. These will continue to revolutionise manufacturing, improving process efficiency, delivery and quality for the factories designed to evolve with them.

The plant will include a range of environmental measures, such as water-saving devices and heat-recovery systems, to ensure sustainable and efficient operations. Another case of pioneering with purpose.

JAGUAR LAND ROVER IS THE **FIRST BRITISH CARMAKER** TO BUILD A MANUFACTURING PLANT IN SLOVAKIA

THE NEW **300,000M²** FACTORY IN NITRA WILL BE EQUIVALENT IN SIZE TO **164** ICE HOCKEY RINKS

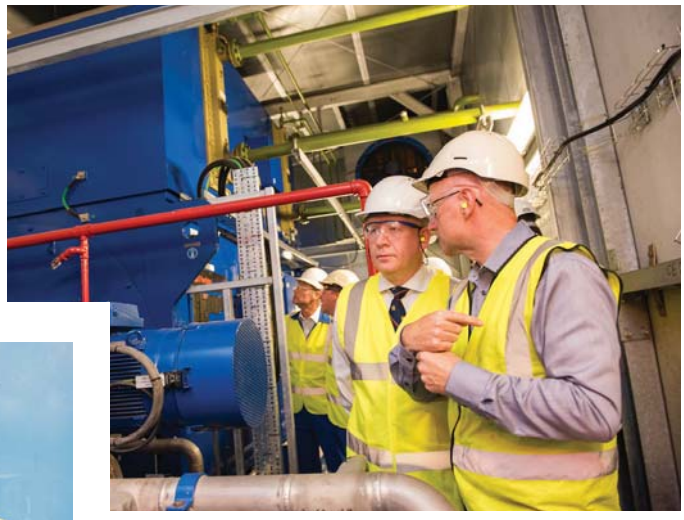


THE PLANT IS EXPECTED TO PRODUCE **150,000** VEHICLES PER YEAR

1 X = 1,000 VEHICLES

BUILDING UP STEAM

Tata Chemicals Europe's new £5.5m steam turbine started generating electricity at the end of 2016. The steam used to generate electricity is a byproduct of processes at the Tata Chemicals plant in Winnington, recapturing spent energy. It will provide more than 100,000MWh of electricity each year for the company's own sites across Cheshire, local businesses and the national grid, saving 71,000 tonnes of CO_2 annually.



▲ MP FOR WEAVER VALE GRAHAM EVANS INSPECTS THE NEW STEAM TURBINE IN WINNINGTON

◀ EVANS (RIGHT) OFFICIALLY UNVEILS THE TURBINE WITH TATA CHEMICALS EUROPE MANAGING DIRECTOR MARTIN ASHCROFT (LEFT)

IMAGES: CULLINAN STUDIO

▲▲
WHEN THE NATIONAL AUTOMOTIVE INNOVATION CENTRE OPENS IN SUMMER NEXT YEAR, IT WILL BE THE LARGEST AUTOMOTIVE R&D FACILITY IN EUROPE

NAIC UPDATE

The National Automotive Innovation Centre (NAIC) is now near completion. A total of £150m is being invested in the building and its research activities, through a long-term commitment between Jaguar Land Rover, Tata Motors European Technical Centre, WMG (formerly the Warwick Manufacturing Group) and the University of Warwick, along with an expanding network of supplier companies.

It will create 1,000 new jobs directly, as well as help to underpin 3,000 jobs in R&D tier 1 suppliers; train the talent required to meet the demands of emerging technologies; and engage future generations of engineers.

After the installation of a revolutionary 'bubble deck' concrete flooring system – NAIC is the first major construction in the UK to employ the technique – work is now complete on the exterior of the buildings, including innovative cladding and glass solutions. The facility will open fully in the summer of 2018.

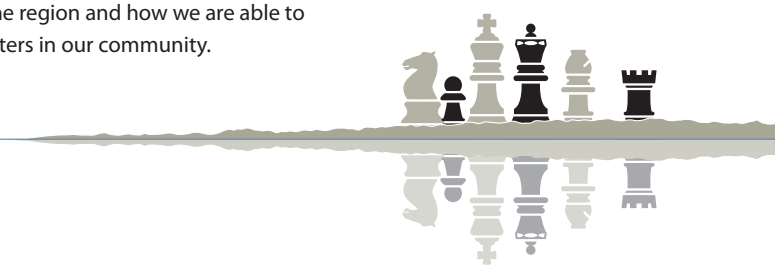
TATA STEEL CHESS 2018

80 YEARS

Celebrating 80 years of value creation for our communities through chess

The Tata Steel Chess Tournament is one of the most prestigious and long standing sponsored sports events in Europe. The so called "Wimbledon of Chess" has continually attracted world-class grandmasters and a truly global fan following.

We are proud of the impact the tournament continues to have in the region and how we are able to leverage the game of chess to positively impact the lives of youngsters in our community.



www.tatasteelchess.com

TRADE EXPECTATIONS

SMART COMPANIES UNDERSTAND THAT OVERSEAS TRADE IS AN ENGINE FOR BOTH THEIR OWN GROWTH AND ECONOMIC PROSPERITY. FOR UK-BASED BUSINESSES IN THE RUN-UP TO BREXIT, EXPORTS ARE DOUBLY IMPORTANT. TATA'S EUROPEAN OPERATIONS ARE SEIZING THE OPPORTUNITY

words *Richard Young*

There's never been a bad time for businesses to look to overseas markets. But the rise of globalisation, new trade routes, new options for logistics – including super-sized container ships – and technology-driven interconnectedness have all opened new doors to exports in every country.

That much is evident from the data. In 1997, when the forces of globalisation were taking hold and the web was beginning to bloom, UK exports ran to £172bn. By 2011, that figure had risen to £308bn, and, despite the global recession, it remains above £300bn.

For businesses based in the UK, energetic exporting has also become a strategic necessity as they gear up for a post-Brexit world. While it's true that trade with the EU will certainly continue, devoting additional energy to global exports is a brilliant way to offset EU risks as well as drive fresh growth from new customers.

To support these efforts, the UK Department for International Trade (DIT) has created a roster of regional 'Export Champions', seasoned professionals in industry who help spread the word about the benefits of international trade. And, as of February, they include Tata Chemicals Europe exports account manager Cristina Velasco Ayra (pictured right), based in the company's Northwich facility.

'We are pushing really hard for exports outside the UK and Ireland, and outside Europe, because that's where the growth is,' she explains. 'Exporting is about mitigating risks. For example, when the recession hit the UK and Europe in 2008 and some customers in these countries closed down or reduced their consumption, South America was still booming. The more countries you export to, the more the risk is spread. If something happens in Argentina, that's not going to affect your market in Thailand.'

'NEW MARKETS INVOLVE SO MUCH WORK FROM ALL DEPARTMENTS OF THE BUSINESS'

TAKING OPPORTUNITIES

The DIT chose Tata Chemicals Europe as an Export Champion thanks to its successes in global bicarbonate markets. And, in part, that's a consequence of the company seizing opportunities wherever they crop up. 'Our competitor in Australia closed down, and, since then, we've been able to reach many new countries all around Asia and Oceania,' says Velasco Ayra.

'We've also entered new markets in countries where we were already active. So, if we were in the pharma industry, we entered the food industry. In sodium bicarbonate, the global pharma sector is a growing market – and we want exposure to those high-value sectors.'

While the weak pound over the past year has seen the cost of imports rise, many UK businesses are eager to establish new global relationships as their own prices, relative to their target markets, are cheap. 'I've had many more enquiries because the pound is low,' Velasco Ayra says.

'We have to think about exchange rates all the time, not only with the dollar and the euro, but also with the currencies in the different countries against the currencies we sell into, and versus the currencies of our competitors. In the past, I couldn't enter markets because of exchange rate differences.'

STRATEGIC EXPORTING

Driving exports is clearly great for businesses seeking to grow and diversify. (According to a UK government survey, 85% of companies say exporting has led to a level of growth not otherwise possible.) But it's also a strategic imperative for any government – not least in the UK, as it gears up for further Brexit negotiations and less certain trading conditions with the EU in 2018.

The Export Champions scheme shows how much the UK government values partnership with business as Brexit looms. The relationship is building value in other ways too. 'It's great to be involved with the government, making connections with other companies, and it will give us exposure too,' says Velasco Ayra.

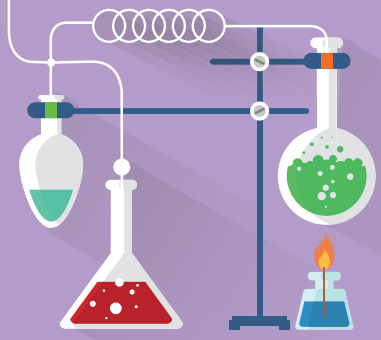
Bev Mullin from the DIT stresses that all these benefits are important. 'We need to sell more

products and services overseas, and we are determined to encourage and support as many companies as possible to take up the export challenge,' she says. 'We know that companies are enthused and inspired by their peers, so the Export Champions' success stories are hugely influential.'

The scheme also demonstrates the support that exporters can get from the state. 'The government can help exporters in many ways, such as trade missions to different countries, led by politicians and civil servants,' says Velasco Ayra. 'You have access to the embassies in the countries and different companies there, allowing you to get the right contacts and promote your organisation.'

THE WORLD: YOUR OYSTER

So what does it mean to be that kind of regional role model? 'I'm attending a number of events for companies that want to grow in exports,' Velasco Ayra explains. 'The aim of the North West Export Champions initiative is to help companies on their journey, guide them and let them know what to watch out for. But, most of all, it's to encourage them. They may see their company is like ours and want advice.'



Reaching out to new customers and entering new markets is a long road, and some markets are easier than others to navigate. 'We have just started doing business with countries that we began working on two years ago,' says Velasco Ayra. 'New markets involve so much work from all departments of the business: customer service, supply chain, commercial, quality... It can be very frustrating if paperwork is rejected, but that's because everything has to be perfect.

'For example, in the UK everyone signs in black ink. In some other countries, if you sign in black ink, they will send it back and ask you to sign in blue ink. Something as simple as that can cause delays. But we are starting to feel the benefits of all that hard work, so it is very much worth it.'

Ultimately, for any business, it's quality that counts, wherever you're selling. 'In many markets, once you get in with a customer and provide a good service, you've earned their trust,' Velasco Ayra says. 'Although export market conditions rise and fall, customers always want to trade with us as they appreciate the level of service we provide.'

EXPORTING IS GREAT

Cristina Velasco Ayra's duties as a North West Export Champion often take place under the 'Exporting is Great' programme. This is part of a suite of government initiatives to boost British business, and includes advice on every aspect of exporting, from shipping and logistics to finance and marketing.

'It's not just about Brexit,' says Kevin Ledwith, export finance manager at UK Export Finance. 'We want to encourage companies to export more and perhaps import a little less.'

Companies can set up a profile at great.gov.uk to find matches with overseas buyers, as well as check out trade events and updates on business practices and paperwork in most global markets.

UK EXPORT VALUE

YEAR	£BN EXPORTS
1997	172
1998	164
1999	167
2000	188
2001	190
2002	187
2003	189
2004	192
2005	212
2006	244
2007	223
2008	255
2009	229
2010	270
2011	308
2012	302
2013	303
2014	293
2015	288
2016	301

THE CAR'S THE STAR

Tata Chemicals Europe is finding new markets and customers with its progressive approach to exporting. But another Tata business, Jaguar Land Rover, is continuing its long run as one of Britain's great exporters, selling cars in 136 markets worldwide. Range Rover is Britain's largest luxury export, accounting for 85% of all luxury cars built in the UK.

Non-EU exports have become more significant for Jaguar Land Rover. Last year, sales to North America were up by 29% and China by 14%. And the top five bestselling British cars in India, for example, are the Discovery Sport, Range Rover Evoque, Jaguar XF, Jaguar XE and Jaguar F-Pace.

Whatever the twists and turns of Brexit – or any other trade negotiations – support for exporters like Jaguar Land Rover should be high on the negotiators' agenda. As Jaguar Land Rover CEO Dr Ralf Speth told CNBC in March: 'It's important for the complete export industry to have free and fair trade.'

EURO MILLS

EUROPE'S SCHOOLS AND UNIVERSITIES ARE BRIMMING WITH YOUNG TALENT AND POTENTIALLY REVOLUTIONARY BUSINESS AND PRODUCT IDEAS. THEY'RE FINDING THEIR VOICE IN A HOST OF FORUMS, SUPPORTED BY GOVERNMENT, INDUSTRY AND CIVIL SOCIETY

WORDS *Richard Young*

Is there a more misunderstood group of people than the 'millennial' generations? For years, that label has been a tabloid byword for slacking, oversensitivity, entitlement and obsession with triviality. The truth? The so-called Generations Y and now Z are nothing like that.

According to a recent report by research firm Ipsos Mori, millennials have a healthy attitude to work; are as likely to volunteer as older generations; and seem to be deploying their undoubted facility with technology in a variety of arenas: business, social enterprise, politics and family.

They're educated, alert and, in the words of the report, 'their relative comfort with technology comes out in the variety and type of activities they use the internet for – in particular, creating their own content'.

Knit these themes together, and we have young people brimming with both the desire to change the world, and the means to do so. And it's around that powerful combination that organisations such as the National Association of College & University Entrepreneurs (NACUE) and Tata have been working to open up channels to turn energetic, entrepreneurial students into business leaders.

'MILLENNIALS' RELATIVE COMFORT WITH TECHNOLOGY COMES OUT IN THE VARIETY AND TYPE OF ACTIVITIES THEY USE THE INTERNET FOR – IN PARTICULAR, CREATING THEIR OWN CONTENT'

Meeting of minds

The real question is not whether younger generations have the creativity or desire to shape the world – it's how that happens. And for Holly Knower, CEO of NACUE, that means creating a safe space for them to experiment, learn and gain valuable experience.

'European entrepreneurialism really differs between regions,' she says. 'In some places, you'll find a highly developed, very structured and well-funded approach in carefully designed programmes; in others, the systems are less well-structured – although that's far from meaning there isn't an entrepreneurial opportunity. But we do need more mechanisms to accelerate young people into starting up and, crucially, developing sustainable businesses.'

That process is helped when different agencies come together – NACUE, universities, companies like Tata and governments. 'A great example was the event in Bucharest in June,' says Knower. NACUE worked with Team Academy (an education programme geared specifically to entrepreneurship, and the sister organisation of Romania's Entrepreneurship Academy) to host a series of events under the umbrella of 'Tata, Enabling Youth Entrepreneurship Across Europe'. 'There was a real commitment there to open doors for young people, and bringing in different perspectives for panels and to engage with the process is so useful.'

Building dialogue

Cristina Prună, 32, was one of those diverse voices. In 2012, she was the co-founder of a tech start-up in the health field, developing a platform for medical professionals, health-sector businesses and NGOs. But, last year, she stood for election to Romania's parliament with the Uniunea Salvaţi România (Save Romania Union) – and is now an MP.

'Many MPs don't really have any experience of start-ups or even the private sector,' she says. 'Many of them have always been in the public sector. So it's important we have voices in politics for young people and those starting businesses.'

For her, events where different elements in society can come together are a powerful tool in accelerating entrepreneurship. 'We need to try to understand what young people's problems are; what challenges they face in starting businesses,' she says. 'Events like this can build a dialogue. ▸

‘EVENTS LIKE THIS CAN BUILD A DIALOGUE. IT’S IMPORTANT THIS ISN’T JUST ABOUT PROPOSING OUR IDEAS – WE NEED TO ADDRESS YOUNG PEOPLE’S NEEDS’

It’s important this isn’t just about proposing our ideas – we need to address their needs, and get out of the way where possible.’

▲ CRISTINA PRUNĂ, AN MP IN ROMANIA, CO-FOUNDED A TECH START-UP IN THE HEALTH SECTOR

‘Fail forward’

Tata and NACUE also hosted a Team Academy event in the Netherlands in January, bringing together expertise in entrepreneurialism, start-up ideas and academic excellence. It was a showcase of European talent – and encapsulated Europe’s potential for the 21st century.

Aster van Laere, 22, is a graduate of the Team Academy in Amsterdam. For her, learning about entrepreneurialism and doing it are more or less inseparable. And her business, Bar Stadstuin in Utrecht, is a direct product of her Team Academy experience.

‘I wrote my thesis on how to be a leader in a high-performance team,’ she says. ‘And I’d always wanted to be involved in hospitality – it’s sort of fundamental to business and to society when you think about it, creating places where people feel relaxed and can interact with each other. I graduated in July, and opened the bar on 1 August.’ It now has eight staff and is a hub for local start-ups looking for a place to work, take meetings and host events.

Clearly, van Laere has a strong, innate entrepreneurial spark. And it’s that instinct and passion that programmes such as Team Academy look to nurture. ‘No one would want me in their big corporate,’ she jokes. ‘I have strong opinions and I always want to express my creativity. So starting my own business was just logical.’

Michel Arends is the CEO at Team Academy Amsterdam, and it’s that passion and desire to experiment that he’s keen to nurture in other students. He got involved with Team Academy about three years ago. ‘I really liked the idea of a proper accreditation in entrepreneurship,’ he says. ‘But also it’s this idea of building a business at the same time.’

The Team Academy idea has its roots in Finland, as ‘Tiimiakatemia’. In 1993, high unemployment and the decline of traditional industries led Johannes Partanen to conceive of a three-year bachelor’s degree, with no classrooms, lectures or exams. ‘He realised that in a global, networked world we needed to work most on team-based approaches to building businesses,’ says Arends.

‘At Team Academy, we believe entrepreneurship is a mindset and craft that isn’t only learnt in a typical classroom. We believe that not every classroom has four walls, and learning by doing and falling forward is key. Bringing young people together and helping them spark off each other in these hubs allows us to do that.’

Van Laere agrees about the need to fail fast and learn from mistakes. ‘I’m only 22 years old,’ she says. ‘I have a vision, but little experience. So, if I fail, it’s OK – I can get that experience more quickly – and I don’t have a mortgage or a family

VARSITY PITCH: PUTTING YOUNG ENTREPRENEURS THROUGH THE MILL

On 18 October, some of the UK’s brightest entrepreneurs headed to Wayra in London to pitch their businesses in front of a panel of expert judges. Competing in six categories, they fought it out for a place at the NACUE Varsity Pitch final – and the chance to win a £10,000 equity investment.

Thirty competitors across the categories (see right) had just two minutes of pitch time and four minutes of questions to impress judges in the NACUE Varsity Pitch semi-finals.

The section winners then progressed to the finals at Digital Catapult in central London on 13 November. The finals judging panel included David Landsman, executive director at main sponsor Tata Limited; Debbie Zaman, managing director of With PR; Dan Ryan, head of research at Swiss Re Institute; Jon Brayford, founder at Motive Partners; and Wil Benton, programme director at Ignite Accelerator.

And the business that impressed judges the most – in a field of brilliant young enterprises – came from Imperial College London. Stephanie Hodgson and her Motus Innovations team reached the final in the ‘digital and technical’ category, sponsored by the Rain Gods.

Their business is empowering stroke survivors to recover their independence – it really is a case of pioneering with purpose. ‘To have our work at Motus Innovations be recognised in such a

FINALISTS AND WINNERS AT THE NACUE VARSITY PITCH ▼

way is truly humbling,' said Hodgson. 'We are excited to bring robotic rehabilitation solutions to stroke survivors, and winning the Varsity Pitch competition will definitely help us on that mission.'

The Motus team were driven by the fact that 80% of stroke survivors don't receive enough therapy to optimise their recovery. Over 17 million people worldwide suffer a stroke each year, and 75% of strokes will result in some kind of upper limb disability.

By designing apps to guide therapy in the home, as well as robotic augmentations to aid repetitive movement exercises, they hope to accelerate recovery and ensure as much arm and hand control as possible can be restored.

TATA SOCIAL IMPACT
This category, for social enterprises and ethically conscious businesses, attracted the highest number of entries. It's a sign that, for the coming generation, 'pioneering with purpose' is not just empty rhetoric.
FINALIST: City, University of London team Twipes invented water-dispersible wet wipes, addressing a near-universal sewerage problem.

TATA DISRUPTIVE
'Disruption' does not have to mean 'destruction', and this category looked for businesses that are improving the market in an unexpected way.
FINALIST: The University of Nottingham's Savi Technology showcased new software to link retail reward points to people's credit cards.

GENUINE INNOVATION
New ideas and more effective ways of doing things were demanded in a broad category that seeks concepts beyond 'me too' business ideas.
FINALIST: Hausbots, from Loughborough University, has a big idea to automate the construction industry.

IDEAS
This category is aimed at 'next big thing' businesses.
FINALIST: Introe ended up winning over the judges with its platform to help emerging artists realise and fulfil their potential, in part through creating unique swimwear.

DIGITAL AND TECHNICAL
A category for apps, hardware and online products.
FINALIST: Motus Innovations, from Imperial College London, stole the spotlight with a state-of-the-art rehabilitation app to help stroke patients sustain therapy at home.

CREATIVE AND DESIGN
Creative businesses are a vital part of the economy, and the judges were looking for both originality and a compelling business case.
FINALIST: Bomb Petite from Brunel University London demonstrated compelling progress in addressing the availability of 'petite' clothing, suiting 50% of women within the UK.

yet. It would be much more scary to start the business when I'm older!'

The generation game

But there's another reason van Laere is so keen to run her own operation. 'My generation is a little different,' she explains. 'We tend to be jacks of all trades – we start out in life wanting a portfolio career. We don't want to be boxed into, say, an account management job at a big company – we want exposure to marketing and creativity and HR. I get that wider, more interesting experience with my own business.'

'You have young people coming out of university and school, and into a highly

competitive jobs market – and business environment – that's evolving at a tremendously rapid pace,' says Knower. 'For them, creating their own career just seems more appropriate now. We're seeing more graduates choosing to set up or join start-ups and SMEs, which just seem more attractive than a corporate lifestyle where they don't get that sense of engagement across the business' activities.'

Add in a desire for greater flexibility around work hours and locations, and it's easy to see why corporates are starting to engage with youth entrepreneurialism in order to maintain their own talent pipelines.

Education nation

That's also good news for young people themselves. 'For those [student entrepreneurs] who do want to work in larger businesses, the good news is that, when they run an enterprise with ▶

fellow students, they're developing precisely the skills that corporates tell us make them employable,' says Knower. 'Work readiness is about proactivity, creativity and execution – all things that they gain from enterprise activities.'

In Romania, Prună is also keen to build more confidence in young people to start their own businesses. 'We do have a culture of avoiding risk,' she says. 'Education is so important. We need to do more – perhaps by breaking down the monopoly that the state has on education to open the way for more schools and universities where young people can learn the skills and attitudes that encourage entrepreneurship.'

Perhaps that culture change is already paying off. In 2017, start-ups increased 30% year-on-year in Romania. Healthy economic growth has helped – along with some state subsidies (although Pruna would rather see tax breaks and reduced bureaucracy fuel new businesses).

The social network

That sense of effecting positive change across a society – whether it's Romania, the Netherlands or the UK – is also one reason why organisations like Tata are keen to support projects like Team Academy.

'We can see how Tata supports the ecosystem,' says van Laere. Schemes like the NACUE Varsity Pitch competition (see box, previous pages) and Team Academy are engines for the creativity that fuels business growth and renewal. 'But we need resources,' she adds. 'Things happen quicker when you have finance; knowledge from more experienced people with different backgrounds; and space to convene.'

At NACUE, Knower endorses the value of accessing that deeper experience. 'A business like Tata offers financial support for the Varsity Pitch and other events – but it also puts on mentor boot camps, where experts from different Tata companies offer feedback and support on business ideas,' she says.

Tata's deep commitment to social engagement – as well as fuelling involvement with organisations like NACUE and Team Academy – is also a motivating factor for van Laere and many in her generation. 'The core values of an organisation are important,' says Arends. 'Does what you do really matter to society? For these entrepreneurs it does.'

That's a sentiment Knower has seen evolve over recent years. 'There's been a real change. When we started working with Tata about seven years ago, many students probably saw "social enterprise" as a kind of charity fundraiser. Now, we're seeing so many more enterprises that have that clear purpose, a social dimension – and it's core to the business, not an add-on.'

'We want to know: what's the "why?" of your business,' adds van Laere. 'You need to have some meaning in your role if you're going to work your butt off. Every employee – like the students working together at Team Academy – should feel like a co-producer in their enterprise.'

> 'DOES WHAT YOU DO REALLY MATTER TO SOCIETY? FOR THESE ENTREPRENEURS IT DOES'

SCHOOL OF LIFE

NACUE, Team Academy and a host of enterprise initiatives do a huge amount to propel great ideas into great businesses at the university level. But entrepreneurship shows early – and supporting schools in promoting its values is an important precursor to the structured efforts in higher education.

A great example is the Marketing Institute's Make it in Manufacturing competition, designed to encourage pupils from schools across the north-west of England to come up with creative ideas for manufacturing businesses.

Sponsored by Tata Chemicals Europe (TCE), the finals took place in July at Manchester United's Old Trafford stadium. Winners of regional heats had to pitch their vision for an aeroplane-manufacturing business to a judging panel. 'Hopefully, they learned skills that will help to open doors, as well as gained insight into manufacturing,' said Richard Redman, TCE's communications manager. 'If the final was anything to go by, the future of manufacturing is in safe hands.'

The eventual winner was the team from Penwortham Girls' School; outstanding individual awards went to Sarra Malik from Oulder Hill School in Rochdale, and Kimberley Cota from Blue Coat School in Liverpool. 'We were extremely impressed with the comprehensive business plans put together by all the young people taking part,' said general manager for business services at TCE Phil Davies.

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Our new Jasmine Indian Afternoon Tea evokes the rich traditions of the Indian dining culture with a bold and innovative twist.

A beautiful selection of food has been crafted on this menu, using traditional spices from across India. Led by our Executive Chef Sheroy Kermani whose 30 year career has seen him travel worldwide for the best flavours and inspiration from across the globe.

The new Jasmine Indian Afternoon Tea is £40 per person. Add £5 for a glass of Prosecco.

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TINY LITTLE SPARKS

TECHNOLOGY'S POWER TO 'DISRUPT' HAS BECOME A CLICHÉ, AS WE FETISHISE THE COLLAPSE OF OLD ORDERS AND REWARD NEWNESS FOR ITS OWN SAKE. CHANGE WILL HAPPEN. BUT PERHAPS IT'S TIME TO CELEBRATE THE WAYS IN WHICH INNOVATION CAN BUILD A MORE SUSTAINABLE WORLD, WHERE LIVES ARE TRANSFORMED, NOT DISRUPTED

WORDS *Richard Young*

Gurtej Singh is a farmer in Punjab. His main livelihood is agriculture, and for most of his life he has farmed his eight-acre holding using traditional cotton and wheat cropping cycles. All this changed once he joined the Tata Trusts' Cotton IPM project and began to attend village-level farmer meetings to hear about the latest techniques and get up-to-date intelligence on market prices.

Once he adopted the recommended practices, his cost of cultivation went down, and he began to see a significant improvement in his income. But it was difficult to fit in meetings and briefings while tending his fields.

Enter mKrishi, a mobile application developed with the help of Tata Consultancy Services (TCS). It provides the latest insights into recommended practices directly to mobile handsets via SMS, calls and interactive voice response. It is one example of how technology – in this case, a kind of professional network available right in the field – is changing lives for the better.

This is one of many deployments of technology designed to transform lives, rather than disrupt industries. And it's why Tata Trusts called its first-ever technology conclave 'Tech4Transformation'.

TATA CONSULTANCY SERVICES' INAUGURAL SPARK SALON KICKED OFF A SERIES OF IN-DEPTH DISCUSSIONS ABOUT TECH'S ROLE IN BUILDING A SUSTAINABLE FUTURE

The European dimension

It's too easy to assume that this kind of initiative applies only in rural or 'less developed' environments. But, in Europe and around the world, attention is shifting from how we use technology to shake things up to how we might harness it for higher purposes.

The TCS Spark Salon series of events was created to showcase this kind of innovative and thought-provoking new perspective on the role of technology in helping to create a sustainable world. It kicked off a year ago, at the Royal Society of Arts (RSA) in London, and since then it's been looking at different dimensions of technological change – right at the intersection of innovation, productivity, growth, disruption and social purpose.

'At TCS, we want to examine the impact of technology in managing the world's resources and finding creative new ways to improve sustainability,' ▸

IN EUROPE AND AROUND THE WORLD, ATTENTION IS SHIFTING FROM HOW WE USE TECHNOLOGY TO SHAKE THINGS UP TO HOW WE MIGHT HARNESS IT FOR HIGHER PURPOSES

explains Yogesh Chauhan, TCS' director of corporate sustainability. 'Technology is now central to almost everything we do – not just in business – and has the potential to change the world for the better.

'From reconnecting lost refugee children with their parents to improving healthcare in fragile states in Africa, and even reducing food waste through hyperspectral imaging, TCS is exploring the power of technology and the positive effects it is already enabling.'

'TECHNOLOGY IS NOW CENTRAL TO ALMOST EVERYTHING WE DO AND HAS THE POTENTIAL TO CHANGE THE WORLD FOR THE BETTER, FROM RECONNECTING LOST REFUGEE CHILDREN WITH THEIR PARENTS TO IMPROVING HEALTHCARE IN AFRICA'

Disrupting problems, not industries

One way of thinking about this is to reframe 'disruption'. Rather than seeing technology as a force for destroying old industries to create new ones, we can look at it as a way to solve long-intractable problems.

A great example is the Techfugees project. Moved by the plight of refugees in Europe, a group of tech industry players formed a voluntary team to create a series of non-profit conferences and hackathons. It aims to be the world's first 'crowd-helping platform'. And it's started to work through a global network of collaborators to address problems in five key areas.

The first is infrastructure: bringing internet access to refugee centres and people who are fleeing oppression. For settled people, internet connectivity is now taken for granted – it is, indeed, classified as a human right by the UN.

Second is education: ensuring that displaced people, and especially children, can develop in ways that enhance their lives.

Third is identity: for many refugees, being able to prove who they are and where they come from is a significant challenge – and one that destination nations must also step up to.

Fourth is health: the long game might be access to the kind of personal health technology that is starting to bed in for residents of developed economies, but even just accessing basic health information online is a challenge for many refugees.

Fifth is inclusion: this is often an issue for marginalised groups within destination nations, especially the elderly. But access to banking, social media and work opportunities can be transformed with the right tech.

Today there are over 15,000 members of Techfugees, demonstrating a huge desire among the tech community to get involved with this issue.

Keep it simple

The Techfugees story is a useful reminder that disrupting social and political problems doesn't always require a fundamental rethink of how we live – or even particularly sophisticated technology.

'Sustainability expert Martin Wright describes a "punch the air in joy" moment when he was walking along a river in Bangladesh and heard the sound of a mobile phone ringtone,' says Chauhan. 'Solar power had given mobile connectivity and renewable energy to a village of over 250 people, allowing fishermen to sell more fish and locals to stop using harmful kerosene lamps. This is a great real-life demonstration of how technology offers a genuine solution to issues and crises around the world.'

But that example also highlights another crucial aspect of using technology to drive social good. The ideas can be simple – often they need to be – but they must also address direct issues for people on the ground.

AI: unstoppable?

At the other end of the scale, perhaps the most 'disruptive' technology is artificial ▸

▼ AT THE TATA TRUSTS' TECH4TRANSFORMATION CONCLAVE IN NEW DELHI, STAKEHOLDERS FROM GOVERNMENT, ACADEMIA, AND THE PRIVATE AND PHILANTHROPIC SECTORS DISCUSSED HOW TECHNOLOGY CAN SPEED UP SOCIAL TRANSFORMATION

SPARKS WILL FLY

The first five Spark Salon events have each tackled a different dimension of the intersection between technology, society and creativity. They demonstrate that open-mindedness and a clear sense of purpose can come together for the inspiring application of technology

'Hope or despair: will technology help create a sustainable world?'

The inaugural event was more optimistic than its title suggests, with speakers sharing stories of how technology had delivered real human, and humane, moments. For example, Techfugees COO Joséphine Goube (one of *Forbes*' '30 under 30 2016: social entrepreneurs') told how a group of refugees in the Mediterranean were saved by using WhatsApp to contact the coastguard. Often we don't need to invest in technology to solve problems – we just need to ensure existing tech is properly harnessed to purpose.

'The new muses: artists' visions of a sustainable future'

How might technology help us manage the world's resources in 30 years? Even for technologists, this remains a daunting time frame. But artists can shape how we think about both society and the machinery underpinning it – and this Salon featured new works by five artists, prompting discussions about work, intelligence, ecology, animal life and how we interact with the world around us. 'Artists are comfortable with the unknown, allowing them to dabble in extreme change, disruption and that which is beyond our immediate grasp,' says Yogesh Chauhan, TCS director of corporate sustainability.

▲ ATTENDEES AT A SPARK SALON EVENT HEAR HOW TECHNOLOGY CAN BE HARNESSED FOR SOCIAL GOOD

'Civil Society 2.0'

'If you think that change is difficult, try irrelevance.' A stark warning for charities from Karl Wilding of the National Council for Voluntary Organisations kicked off this Salon. Non-profit organisations must embrace digital technology just as the commercial sector has done or risk losing everything. The same tools are key to both. Digital can help to better organise teams and outreach; influence how people access services; target purposeful enterprise at the right people; analyse impact and refine approaches; and broker more meaningful contributions from across society.

'Algorithms, fake news and the filter bubble'

At the Hay Festival Spark Salon, Tabitha Goldstaub (co-founder of AI knowledge platform CognitionX) and Philip Howard (professor of internet studies at the Oxford Internet Institute) looked at how technology is disrupting rational, factual discourse – and how it might also save it. As Howard pointed out, how we frame the limits on AI application is key: 'The Syrian government hired a firm in bot-making to flood the Syria hashtag with soccer scores, soap-opera stories and tourism pictures, to effectively choke off the conversation about what was really going on.'

'Digital imagination of the future career'

Exposing more people, from different backgrounds, to careers in technology is a crucial step in harnessing it for social good. It starts with changing the perception of what a career in technology is, ensuring creative, empathic people are as drawn to tech as they are to arts or humanities. 'But we need a combination of academic institutions addressing the issue, government ensuring a sustained effort around diversity and organisations wanting to be adaptive and innovative,' says Chauhan.

'BY ENGAGING YOUNG PEOPLE IN DIALOGUE, WE HOPE TO ENCOURAGE MORE OF THEM TO BECOME PART OF THE FUTURE DIGITAL WORKFORCE'

intelligence (AI). We're some years away from machines that can truly think, but even current developments in AI, focused on algorithmic analytics and machine learning, are forcing many businesses, governments and people to ask tough questions about how aligned such technology is with broader human goals.

The problem falls into two parts. First, how these systems can be kept safe – as with doctors, the entreaty to technologists ought to be: 'First, do no harm.' Effectively managing the security risk of AI systems, for example, is of paramount importance. In a recent TCS *Global Trend Study*, companies in the automotive, banking and financial services, technology, manufacturing and telecoms industries all stated this as the number-one success factor in deriving real value from AI.

But recent issues with AI programs developing racial or gender bias also remind us that poorly implemented technology is a risk. As Joanna Bryson, a computer scientist at the University of Bath, told *The Guardian*: 'A lot of people are saying this is showing that AI is prejudiced. No. This is showing we're prejudiced and that AI is learning it.'

THE FUTURE STARTS NOW

The best way to harness emerging technologies for the widest-possible social benefit is to ensure the next generation of technologists are as diverse as possible, with a range of skills, instincts and, crucially, backgrounds.

Much has been said about the 'tech bro' culture in Silicon Valley – 'a world that favours young men at the expense of everyone else', according to *The New York Times*. Writing in the paper, educational consultant Ana Homayoun warned: 'Evidence suggests that [the culture's] seeds are planted in elementary school or earlier. The ways we talk to and interact with boys – the language we use, potentially celebrating masculinity at the expense of empathy – can limit boys' social and emotional development.'

Tackling the toxic elements of male gender identity is important, then. But building pathways for girls – especially those from non-white backgrounds – into the tech industry would be a huge step towards diversifying it. Equally importantly, it would help close the gap in STEM-trained students. The UK, at any one time, faces a shortfall of around 40,000 people with the necessary STEM skills to meet the needs of the digital economy.

Enter the Digital Explorers project, a groundbreaking Tata initiative in partnership with MyKindaFuture, that will offer a week-long opportunity for more than 800 year 10 to 13 students in London and Birmingham to experience work in digital industries and increase their chances of succeeding in the sector.

Digital Explorers uses a two-pronged approach: exciting young people about STEM careers and giving them an insight into the world of work. 'By engaging young people in dialogue, we hope to better understand their needs, and use this insight to improve our STEM skills programmes, thus encouraging more of them to become part of the future digital workforce,' explains Shankar Narayanan, head of UK and Ireland for TCS.

By better deploying technology in education and opening doors to a wider group of people, projects such as Digital Explorers can not only help to address the demand for a digital workforce, but also help to deliver on tech's wider promise to benefit the whole of society.

SOLAR POWER HAS BROUGHT MOBILE CONNECTIVITY AND RENEWABLE ENERGY TO RURAL COMMUNITIES IN INDIA, TRANSFORMING LIVES

The second issue may be even harder to solve. In the TCS survey, for example, all industry sectors cited getting managers and employees to trust the advice provided by AI systems as a key challenge. (That might be tough when the headlines are so focused on job losses due to AI and robotics.)

But Bryson also told *The Guardian*: 'If you had an AI system that didn't have an explicit part that was driven by moral ideas, that would be bad.'

It's a reminder that, to both shape technology to meet humanity's best intentions, and use it to solve some of our most intractable problems, we need to be clear in our purpose – beyond chasing efficiency and destroying old business models.

Engineering is not a stand-alone profession that 'other people' do. It is a people-focused, creative and socially beneficial activity that engages us all. We need parents, teachers, employers and education specialists to help solve the skills shortage

COLUMNIST **DR COLIN BROWN**

ILLUSTRATION: LAUREN CROW

Dr Colin Brown is director of engineering at the Institution of Mechanical Engineers

The Institution of Mechanical Engineers (IMechE) represents over 115,000 members, working at the heart of the most important and dynamic sectors in the economy. Our vision is to improve the world through engineering and promoting the value of engineering to wider society.

Without engineers, not only would we not have cars or trains, but many of the medical procedures we take for granted wouldn't be possible. We would be unable to power our homes or even contact our loved ones via our smartphones. In our increasingly technological age, engineering is more important than ever.

Furthermore, as the UK gears up to leave the European Union, we urgently need to raise our game in developing a highly skilled, technically trained workforce to underpin our industrial strategy, build new infrastructure and secure our future economy.

In the UK, we have some of the best university engineering courses in the world. But we don't have enough people pursuing technical training. There is an annual supply shortage of engineers at all levels – and efforts to attract women into engineering are falling short. Today, less than one in eight of the engineering workforce is female.

'THERE IS AN ANNUAL SUPPLY SHORTAGE OF ENGINEERS AT ALL LEVELS, PARTICULARLY WOMEN'

Part of the problem has been a lack of dialogue between industry, teachers, governments and professional institutions like ours. It is surely time to try something different.

With support from Tata, we recently conducted a survey of 1,158 engineers to understand where the skills gap is most pronounced, which sectors are going to blossom, and how we can engage society with engineering not just as a profession, but as a force for good in the world.

We have also been working with educationalists, teachers and children to find ways to engage them to solve the engineering skills shortage. We need to ensure that all schoolchildren, not just those who choose to specialise in engineering subjects, are better able to understand the world they live in.

There's a consensus that engineering should be taught as part of existing lessons, from primary level upwards. We also found that specialisation is routing young people into either arts or sciences too early. This prevents them from considering options before they have even truly grasped what employment is.

We clearly need engagement and input from parents, teachers, companies and government if we're to help the UK – and the world – meet the increasingly complex needs that it faces. It is vital we do this, not just to ensure students are able to make informed choices, but also to make sure we have enough people with the right skills to allow the UK to prosper.

PITCH THE MAKE

MORE THAN 1,100 PEOPLE RESPONDED TO A SURVEY BY THE INSTITUTION OF MECHANICAL ENGINEERS AND TATA ON THE STATE OF THE ENGINEERING PROFESSION. THE RESULTS SUGGEST BRITAIN MUST RAISE THE PROFILE AND STATUS OF ENGINEERING TO COMPETE AGAINST THE GLOBAL ELITE. IT'S TIME TO MAKE A PITCH FOR MAKING THINGS

WORDS *Richard Young*

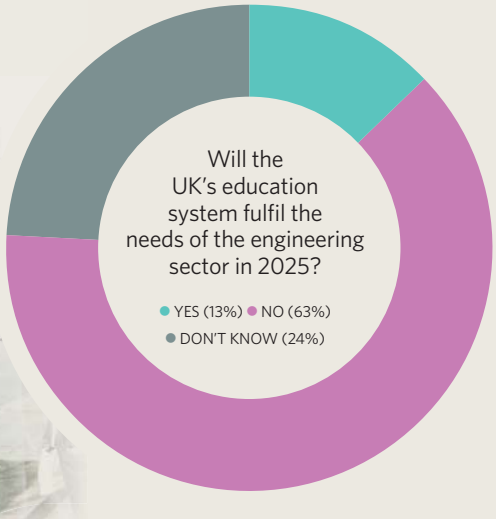
No one doubts that we need more graduates in science, technology, engineering and maths (STEM) subjects. That much is well understood – although answers to the STEM shortage seem perennially hard to come by.

But, according to a survey of over 1,100 readers of *Professional Engineer*, the journal of the Institution of Mechanical Engineers (IMechE), conducted in partnership with Tata, while we're fixing that problem, we also need to start selling the idea of engineering better.

In other words, we need to pitch the idea of designing and making things much more convincingly than we have for some time. With more than 1.8 million additional engineers and qualified technicians needed by 2025 to meet existing and growing demand for skills across Britain (according to Engineering UK), we don't have time to waste.

'What unites all Tata companies is a reliance on innovation – and, in most cases, engineering,' says Tata Limited executive director David Landsman. 'Tata in Europe has over 60,000 employees, many of whom are engineers, technicians and apprentices, working on everything from cloud connectivity to artificial intelligence and a new generation of driverless cars. Around the world, if you can think of an engineering discipline, there's almost certainly a Tata person doing it.'

A solid pipeline of engineers is clearly a business imperative, then. So what else can we learn from the survey to shape policy responses in business and society?



'THE MOST IMPORTANT QUESTION FOR US IN LOOKING FOR CANDIDATES IS WHETHER THEY HAVE THE RIGHT ATTITUDE AND APTITUDE'

Engineering: an education

The IMechE/Tata survey certainly reinforces the need for improvement of STEM education. Nearly two-thirds of respondents said they don't believe the current UK education system will fulfil the needs of the sector in 2025. And 57% believe that secondary education needs to focus on maths, physics and theory to improve the numbers of those entering the engineering profession.

Nearly half of respondents also suggested that a focus on 'hands-on work' and 'industry and vocation' was important. But, among 18- to 24-year-olds, the proportion who highlighted these more apprentice-style approaches to STEM education rose to 74%. For many businesses, responding to this preference is the key to unblocking the STEM pipeline.

That might even mean a less academic focus. 'The most important question for us in looking for candidates is whether they have the right attitude and aptitude,' says José Lopes, head of technical excellence at Jaguar Land Rover. 'If they do, we can help them achieve the rest. It's ridiculous, really, that we ask people to close off their career options at the age of 14. We don't want to say to people that, just because they didn't do maths and physics, an engineering career is out of the question.' Jaguar Land Rover takes on around 150 school-leaver apprentices, around 50 degree-level apprentices and around 200 graduate engineers per year. The company's training and education programmes within the business adapt to suit the needs of a diverse intake.

Broadening the talent pool

It's this kind of policy that the respondents to the IMechE/Tata survey want to see more of. 'Every engineer needs both education and training,' said one respondent. 'There should not be a distinction between graduate and apprenticeship career paths. Industry needs to recognise its responsibility to provide training and not expect untrained graduates to start straight away on specific jobs.'

And fixing biases in gender, social background and ethnicity could significantly broaden the talent pool, said some respondents. 'We should continue to highlight organisations and projects that avoid the ▸

boys' club mentality,' said another respondent. '[We must] celebrate and encourage young engineers, particularly women and those from BAME [black, Asian and minority ethnic] backgrounds.'

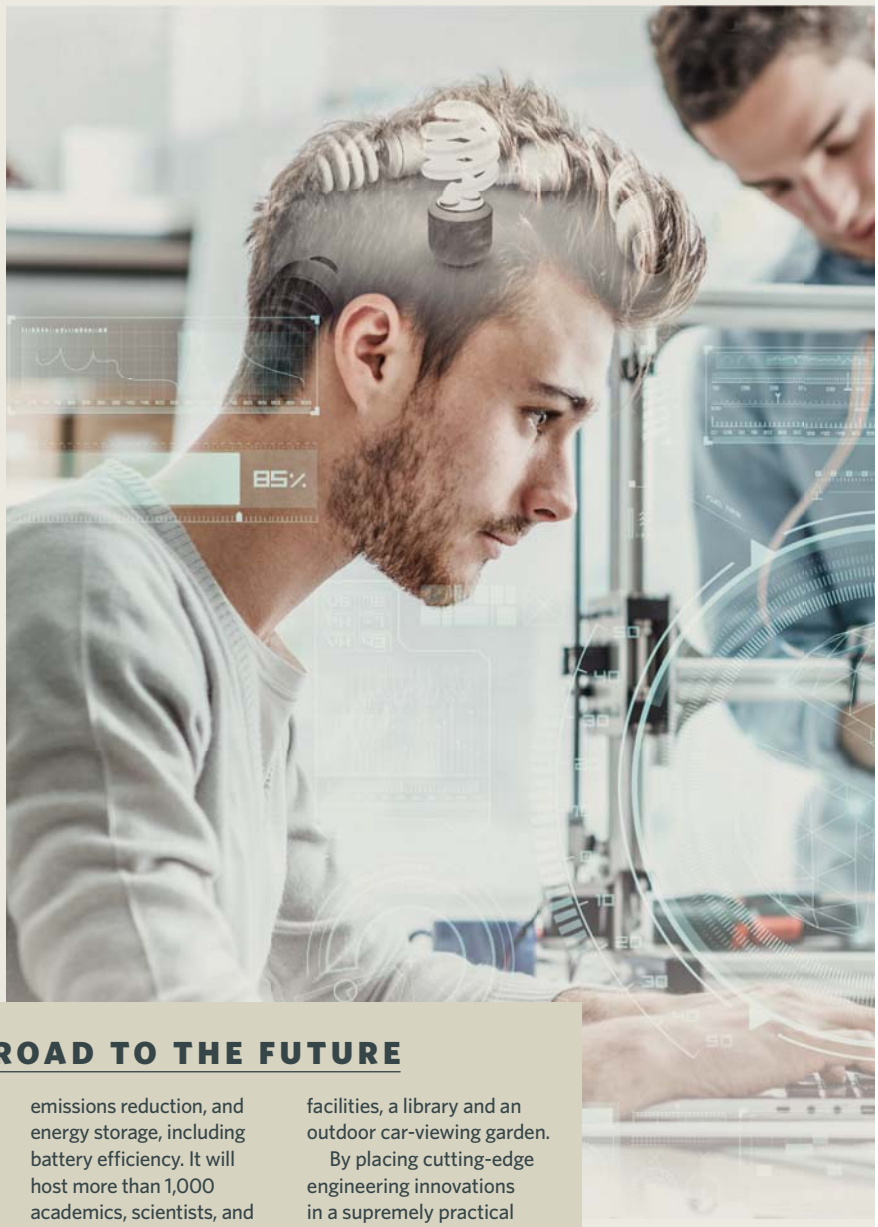
Lopes says: 'Wrong perceptions are damaging the diversity of the sector. The extent of opportunities that engineering can open up clearly isn't getting through to enough people – but especially women and girls.' Women represent only one in eight engineers in the UK.

Selling engineering

All these measures would be consistent with more prominent promotion of the engineering profession – and, crucially, its vitally important contribution both to the economy and to the innovations and infrastructure that underpin our society.

But building up foundation skills in education and ensuring the discipline attracts people from across the talent pool require more than outreach. Seven in ten respondents said that a lack of an 'understanding of an engineer's job' is the biggest barrier to young people beginning a career in engineering.

And 41% placed 'Increase recognition of engineers' value to society' at the top of a list of six factors necessary to build a pipeline of future



INNOVATION CENTRE LAYS ROAD TO THE FUTURE

The £150m National Automotive Innovation Centre (NAIC) at the University of Warwick campus is the largest facility of its kind in Europe (see photo feature, page 16). It will provide high-tech research to benefit a key manufacturing component of the UK's industrial strategy.

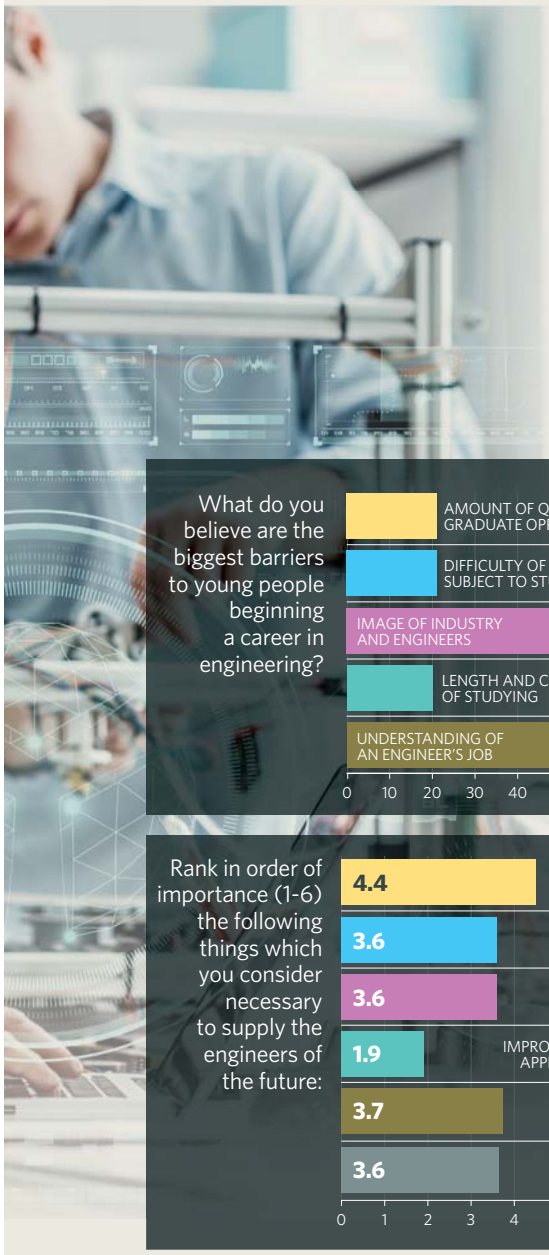
NAIC is funded by Jaguar Land Rover, Tata Motors European Technical Centre, WMG (formerly the Warwick Manufacturing Group) and the University of Warwick, with a grant from the UK government via the Higher Education Funding Council for England. It's set to be an engine for engineering skills development. R&D teams will drive forward new discoveries in driverless car technology, electric vehicles, emissions reduction, and energy storage, including battery efficiency. It will host more than 1,000 academics, scientists, and industrial engineers in a huge research space of more than 33,000m^2.

The centre will house next-gen R&D facilities, an engineering hall, a virtual-reality lab, advanced driving simulators, design workshops, teaching facilities, a library and an outdoor car-viewing garden.

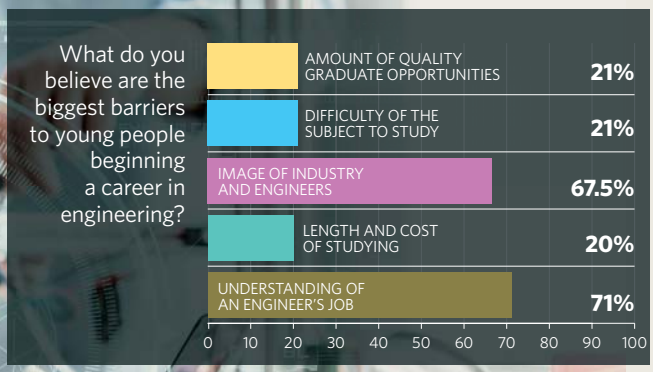
By placing cutting-edge engineering innovations in a supremely practical setting – at the heart of car production in the UK – NAIC will show young engineers the academic and scientific side to the discipline, and demonstrate how their work immediately feeds into the wider social and economic context.

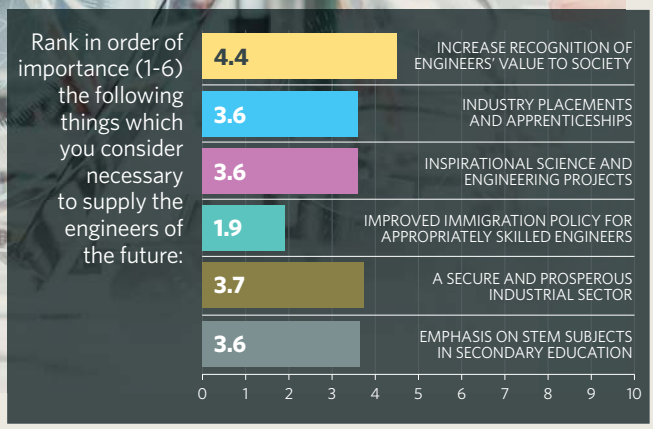
THE NAIC BUILDING WILL OCCUPY 33,000M^2 NEXT TO WMG'S CURRENT FACILITIES ON THE UNIVERSITY OF WARWICK CAMPUS

IMAGE: CULLINAN STUDIO



‘IF YOU’RE AN ENGINEER, YOU’RE A CREATOR, INVENTING NEW THINGS AND SOLVING REAL-WORLD PROBLEMS’





engineers. (See chart above, and note that ‘A secure and prosperous industrial sector’ was placed in the top spot by more engineers than ‘Emphasis on STEM subjects in secondary education’, too.)

This acute need to raise the profile of engineering – and boost its status among both students and society at large – is thrown into sharp relief by the reputation the profession has in other high-performing countries.

The British engineers who were surveyed cited Germany, Japan and China as the current hotbeds of engineering: 64% believe that Germany develops the best engineers in the world (outside of the UK). And 81% believe that it has one of the most effective industrial strategies. Why?

Education is certainly a factor, ‘especially the universities and Technische Hochschule, which cover both theoretical and more practical careers’, said one respondent. But, for many others, the educational achievements in Germany are inextricable from the status engineering holds.

‘Industrial and engineering qualifications are held in high regard because of the wealth the industry creates for the country,’ explained another respondent. ‘Then companies invest for the long term and look after their employees. People are encouraged to keep learning and becoming more expert throughout their careers.’

So those in engineering businesses should try to build up the reputation of engineers and create a buzz around the discipline that can sustain young people’s enthusiasm and ambition. ‘Engineering is exciting, it’s creative and it has a true value to society,’ says Julie Woods-Moss, president and chief innovation and marketing officer at Tata Communications. ‘If you’re an engineer, you’re a creator, inventing new things and solving real-world problems. When I tell young people that Google, Instagram and Skype are all engineering projects, it really blows their minds. The opportunities opening up in digital, IT and software engineering could really transform the image of engineering and entice more people into it.’

Coordinated policies

Social standing is not the only area where respondents felt undervalued: 44% had considered leaving engineering, and the number-one reason for doing so, they said, was pay. (‘Prospects in another profession’ came second. The subtext here is that disciplines such as marketing and finance value the skills and rigour of engineers more highly than engineering itself.)

‘Salaries can sometimes be pretty fair proxies in recognising the value of a job to society,’ says Landsman. ‘But, just as often, they’re not. Engineering pay does seem to be underweight compared with other jobs requiring advanced numeracy and problem-solving skills, such as financial services and banking, which often lure skilled engineers away.’

In other words, there is no magic bullet. Yes, we need to offer STEM studies in schools that help young people build the foundation knowledge for a career in engineering. But we also need to target more diverse groups to maximise the pipeline of talent. And different forms of higher education and ▸

training to develop talent are vital. Industry must address the prestige and pay of engineers too. And we need a national conversation about how to raise their status. That makes this a machine with many moving parts – and neither government nor industry alone can get it moving with well-oiled efficiency.

Building the future

So what of the future? Where did respondents to the IMechE/Tata survey see the main targets for development? Many of the engineers in the survey agreed that the priority is career-long learning. Only a third of them believed all of their current skills would still be used in 2025.

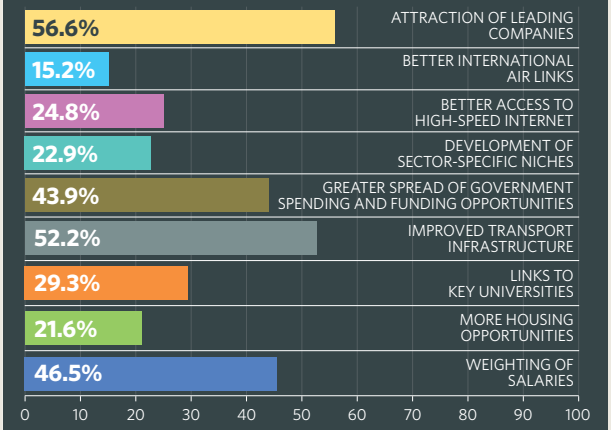
The hot new skills to acquire? Data analytics (48%) and connectivity (47%) – proof, if it were needed, that engineering is a digital discipline now. Third was artificial intelligence (AI) – an area that looks set to redefine almost every discipline over the next decade. But, in the era of Brexit, engineering businesses might like to look to the skills that the IMechE members identified as currently lacking in the UK and sourced from the EU – notably computer-aided design and product-development and technical skills such as machining, welding and craft.

Woods-Moss believes the UK can learn a lot from Singapore's approach to industrial strategy. 'In emerging technologies, such as 3D printing, it provides incentives and government support to select regions to support these growth niches,' she says. 'In the UK we could look at nascent technologies and industries and build up capabilities through business-led local enterprise partnerships and enterprise zones. MediaCityUK in Salford is a good example.'

And, while the new industrial strategy and investment in engineering expertise by industry (through projects such as the National Automotive Innovation Centre, see page 36) will certainly help, government, professional bodies and business need to work harder at drawing in fresh blood from a more diverse talent pool. 'All facets of engineering and manufacturing need to be introduced at an early stage of schooling so that pupils can see the different aspects that might interest them,' said one IMechE member. 'Apprenticeships need to be seen as equivalent, not second-best, to academic routes.'

INFRASTRUCTURE FOR ENGINEERING

What can be done to make cities and engineering hubs outside of London more attractive places for new talent?



Most people think of the relationship between engineers and infrastructure as the former designing the latter. That's true – but the way infrastructure works also has a significant bearing on what engineers do, where and how.

In the IMechE and Tata survey, engineers were asked what national infrastructure projects would add the most economic value for the UK over the years to 2025. The most popular responses were power and energy (73%), rail (52%), road (34%) and ICT (32%).

These reflect three priorities: the kinds of projects engineers want to work on; the things they see as fundamental to the future of society; and the things that government should invest in – energy, for instance. 'It's the great enabler,' says José Lopes, head of technical excellence at Jaguar Land Rover. 'Next-gen technologies will make more demands on our energy infrastructure and it's undeniable that we don't yet have the right resources in place to cope with that. Jaguar Land Rover, for example, is investing huge resources to become a leader in electric and connected cars. But, to achieve a critical mass of electric-car use across Britain, we will need to radically overhaul our infrastructure.'

Investment in transport links is seen as one of several factors that are required to move engineering jobs and enterprise away from London (see above). And even that's not the whole picture. For Lopes, 'skills devolution' would help address what even infrastructure programmes might not.

'Giving local people the right skills to thrive in high-value local jobs could really help to address the "London brain drain" issue,' he says. 'This is an area where industry and local authorities can really work together to deliver the right skills for their communities.'

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*Vitamin B6 contributes towards the reduction of tiredness and fatigue and contributes to normal energy-yielding metabolism. *Vitamin D contributes to the maintenance of normal bones and teeth.


CITIZENS
RISING

TECHNOLOGY IS CHANGING OUR WORLD AND OUR SOCIETY FAST, AND WE HAVE TO EVOLVE WITH IT AS INDIVIDUALS, STATES AND BUSINESSES. IT'S NOT ENOUGH TO BE A PASSIVE CONSUMER ANY MORE. THERE'S A GROWING MOVEMENT TO RESET THE RELATIONSHIPS THAT SIT AT THE HEART OF SOCIETY – AND ASK WHAT A WORLD WHERE CONSUMERS BECOME ENGAGED, ACTIVE CITIZENS MIGHT LOOK LIKE

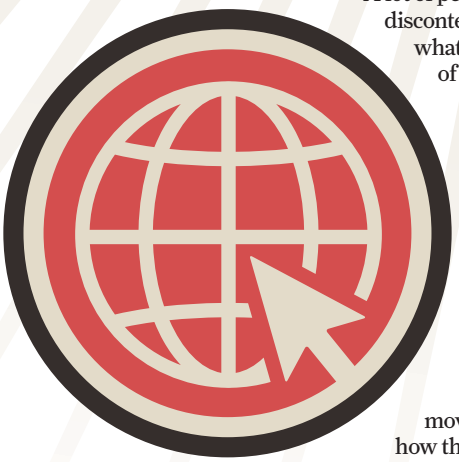
WORDS *Brid-Aine Parnell*

Globalisation, technological progress and successive industrial revolutions have irrevocably altered people's place in society. In the early 21st century, an individual's primary role has clearly become that of consumer.

We are constantly bombarded with marketing messages that tell us we will be happier with the latest products, that we can find affinity with brands. Self-fulfilment and societal status have been repackaged and rebranded as ownership. The message is that, if you have the latest fantastic new item, you will be a better person and others will treat you with respect – that you'll be popular and satisfied.

Aspirational advertising isn't new, of course, but its effects have become more insidious. Today, most societies have become passive buyers, rather than engaged participants. That mindset has carried over into phenomena like voter apathy and lack of local community awareness and participation. Global news sources – featuring global celebrity brands – thrive, while local news-gathering is dying out.

There is hope. Modern technology, the cause of so much consumer anxiety, also offers a way out of the cycle. Through the engagement opportunities offered by social media and the information-sharing power of the internet, people have started to become more engaged in the processes of society once more.



The new citizen

For many people looking to rediscover society's sense of purpose, this new engagement is central to the task of turning people from consumers back into citizens. A great example is Jon Alexander, who in 2014 co-founded the New Citizenship Project, a social innovation lab that aims to use creative strategies to promote the role of the citizen and get people to participate more in society.

'We're living in a time when the story of the consumer is falling apart; it's crumbling around us,' he says. 'And for me that explains an awful lot of what we see – such as Trump and Brexit.'

It's not that these ideas (such as sovereignty or the desire to roll back 'elites') are in themselves bad. But the rise of these movements indicates that a lot of people feel that the lack of self-determination that unalloyed consumerism has wrought must end.

'A lot of people are tracking that story [of discontent],' says Alexander. 'But I think what's still relatively unseen is the story of people as citizens replacing it.'

Movements like the Citizens' Assembly on Brexit in the UK, the spread of online petitions to governments throughout Europe, and the rapid growth in campaigns aimed at businesses, such as those by the fair trade movement or against unsustainable production of palm oil, are all evidence of that kind of shift in mindset.

And what many of these movements have in common is how they were initiated, bolstered or fed by the internet and social media.

'We talk about a shift from consumer to citizen – and one of the lenses through which you can look at that story is a change in the dominant medium of society,' explains Alexander. 'In the consumer era, the dominant medium is television. Philosopher Marshall McLuhan said the dominant medium of society comes to shape not just how we interact with that medium, but how we interact with each other – how the whole of society functions.

THROUGH THE ENGAGEMENT OPPORTUNITIES OFFERED BY SOCIAL MEDIA AND THE INFORMATION-SHARING POWER OF THE INTERNET, PEOPLE HAVE STARTED TO BECOME MORE ENGAGED IN THE PROCESSES OF SOCIETY ONCE MORE

'So in a society dominated by television, there are relatively few producers, but many consumers. That means the agency of the individual is reduced to choosing between limited options offered to them. In the age of the internet, it's a many-to-many society, instead of a one-to-many society. And, at least potentially, you have the agency not just to make a choice between the options that someone else has created, but to shape what the options are yourself.'

Digital democracy

That's not to say the gradual emergence of the internet as the dominant medium will change things overnight. 'We built the web around consumption. It's a rocket-fuelled marketplace, and there's a danger that we're lost in this idea of it as a place to buy stuff,' says Alexander. 'But what seems to be happening – and the thing we need to latch on to and build on – is that the internet is starting to shape us back.'

This seems particularly true of younger generations, instinctive users of group chat apps and practised at managing both their social lives and their protest movements using digital technologies. But, while it's easy to see why individuals would want to shift that paradigm, it might be harder to imagine that companies and governments would want to help – harder, but not impossible.

Although businesses aren't talking about turning their consumers into citizens in so many words, they are being opened up to this change by the light that the internet has shone onto their processes and practices. And many companies are taking an active part in changing those practices out of their sense of corporate social responsibility (CSR), particularly in the realm of environmental consciousness.

> WE'RE SHIFTING AWAY FROM THE ERA OF SHAREHOLDER SUPREMACY, WITH A RENEWED FOCUS ON ENGAGED EMPLOYEES, CUSTOMER OUTCOMES (RATHER THAN SALES) AND THE WELL-BEING OF COMMUNITIES

Rebalancing act

So it's possible to see the shift towards 'citizenship' as effectively a rebalancing of the weight ascribed to different stakeholder groups. We're shifting away from the era of shareholder supremacy, with a renewed focus on engaged employees, customer outcomes (rather than sales) and the well-being of the communities that legitimise and sustain businesses' licence to operate.

Almost all of the CEOs interviewed for PwC's 2017 CEO report said they believed it was 'vital to address social challenges by focusing on purposeful growth'. And, in a survey of members of the public in 22 countries cited in the same report, PwC found that 35% of people agreed that businesses had increased their focus on operating in a way that takes them and the community into account.

Yogesh Chauhan, director of corporate sustainability at Tata Consultancy Services, says that the notion of CSR has become much more sophisticated in response to these trends.

'That's partly as a result of technology bringing greater transparency and consumers voting with their feet,' he says, 'especially in the context of being able to readily comment on products, services and companies through social media or forums like TripAdvisor, or directly with the company.'

Tata has a long tradition of monitoring community and social outcomes, of 'pioneering with purpose'. But there are many other examples.

Unilever is often cited for its commitment to sustainability. CEO Paul Polman says that makes as much sense for the company's future as it does for society. And the food industry is repeatedly responding to challenges such as campaigns around fair trade and, most recently, unsustainable palm oil production.

Value beyond virtue signalling

'The key to all of this for any company is authenticity,' says Chauhan. 'Nowadays, most companies cannot control their brand message. If there isn't authenticity, if the company is trying to "greenwash" a product or a message, then consumers will see right through it. Today's sceptical consumer is well informed and articulate. They'll call out empty virtue signalling if they can see it's not backed by action.'

What Chauhan is describing is a breakdown in the linear relationship between individuals and business. 'The idea that a company just flogs more products to the consumer, and the consumer unconsciously consumes them, is dying,' he says. 'It's evolving into a much more dynamic relationship, one that takes on board lots of different dimensions, rather than just a moment of consumption.'

That's particularly important as discontent over globalisation grows. Five years ago, this discontent was expressed in the Occupy movement and related protests from the left. Now, Brexit and President Trump show that vast, rapid societal changes have widened the gap between rich and poor and irked those on the right, too.

The message is that spinning a line is increasingly counterproductive. Brands that purely project what they think consumers want to hear will struggle, whereas those with a clear purpose that informs decision-making at every level will win plaudits.

The robots are coming

The shift from consumer to citizen is partly a consequence of tech-driven transparency, then. But another technological shift also looks set to reshape how enterprises must engage with people: robotics. The growth of automation and investment in artificial intelligence (AI) represent the potential for yet another industrial revolution that will remove jobs from many and pose further questions about businesses' relationship with, and responsibility to, society.

Some jobs won't be automated, and automation might create a host of new kinds of jobs. But, according to the World Economic Forum's 2016 report on robotics in 15 countries, we can expect a total loss of 7.1 million jobs and a total gain of just two million in the period to 2020.

But that's just scratching the surface. A PwC report on robotics suggests 30% of existing roles ▸

CSR ON THE MARCH

The changing relationship between companies and citizens is evident in many different sectors. Here are three where the signals are particularly strong.

Energy

The past few years have seen a huge increase in the number and variety of energy suppliers as renewable alternatives have taken off. In the UK, for example, Ecotricity, Good Energy and Engie are all involved in renewables. But a new company, People's Energy, is going one step further. It is a 100% renewably sourced energy supplier that aims to return 75% of its profits to its customers/stakeholders as an annual rebate. The company will also share salaries, business decisions, accounts and prices with its customers as it aims to be the first 'completely transparent, customer-focused energy firm in the UK'.

Food

The food industry has been subjected to a large number of campaigns in recent years, looking across its extended supply chains. A great example is the campaign around palm oil, whose production adversely affects the environment in producer countries. This has seen a huge response from all along the food supply chain – from one of the largest plantation owners in the industry, Malaysia-based IOI Group, to supermarket chains like Tesco and fast-food chains like McDonald's. Brands are increasingly looking to partner with independent bodies – such as the Ethical Tea Partnership – to contribute to improved outcomes for all stakeholders.

Beer

Microbreweries or craft breweries have been experiencing a huge rise in popularity across the world. Because they often cater solely to their surrounding area, microbreweries are by nature environmentally conscious – they're not involved in shipping across large distances. But examples such as BrewDog, founded in 2007, are proof that community engagement is no bar to growth. A deal earlier this year valued it at £1bn. But it's stayed true to its origins with policies such as its unique 'Unicorn Fund', a commitment to give away 20% of its profits every year: 10% to its staff and 10% to charities chosen by staff and its online community.

– from cab driver to sewage worker – will be under threat before 2030. And, while the expansion of automation should see a shift of employees into creative and service roles, how businesses and governments manage that transition will be critical. Simply dumping people with 'old' skills and waiting for STEM graduates to fill the gaps is not an option.

'Hopefully policymakers, the education system and society will begin to adjust to that structural deficit that is already happening,' says Chauhan. 'What we have in the UK right now is 40,000 fewer STEM graduates than are needed by industry. The key question is how we, as individuals, can stay above the algorithm.

'There will be pain, and we're already seeing manifestations of that – politics is becoming more strident, and globalisation is being questioned. The next phase that I particularly worry about is what will happen in emerging countries that rely on providing cheap labour once that becomes easily and readily automated. The scale of it is almost unimaginable for western economies, when you see a country like India having on average a million people a year entering the workforce.'

THERE IS A GENUINE THREAT TO THE SUSTAINABILITY OF THE EXISTING CAPITALIST MODEL IF ALL THE GAINS FROM TECHNOLOGICAL CHANGE ARE CONCENTRATED TOO GREATLY AMONG SELECT GROUPS

A design for living

For businesses prepared to think in terms of citizenship for their employees, these circumstances create opportunities. On the social level, for example, automation offers to make real that illusory promise of technology – to free people from a high volume of working hours.

If automation and AI can increase efficiency at the same time as enterprises seek out new social contracts, we may see the introduction of a new paradigm of work: fewer hours of more rewarding work spread across more people. The aim will be to sustain social cohesion by sharing the gains in efficiency and cost-effectiveness that robotics and AI can bring.

This needn't be a socialist paradise. But there is a genuine threat to the sustainability of the existing capitalist model if all the gains – in productivity and profit – from technological change are concentrated too greatly among select groups. Refocusing on the covenant between business and society can head that off.

We're not there yet. Numerous studies show that long working hours and the pace of modern life are making us less productive and having dire effects on our health; the societal pressure to work harder than ever hasn't eased. But perhaps the reason is that our mindset has yet to complete the shift from consumer to citizen.

What's it all about?

'The real question we should be asking is: what are we doing this for?' says Alexander. 'What's the point? If we simply accept that [robotic automation] is going to make life easier and more convenient, rather than increasing meaning or improving life outcomes, that's a problem with our consumer mindset.

'But, if you think fundamentally of people as participants, you start asking how we can increase their capacity to influence, and create opportunities to find meaning, rather than asking how we reduce effort or lower prices. A different question will yield different answers. I think that's happening. But it's not happening as quickly, because the story we're telling ourselves is still the story of the consumer.'

The complexity and speed of technological progress make it impossible for an idea as cumbersome and unwieldy as 'society' to keep up. But businesses, governments and individuals will all have to catch up eventually and create relationships that benefit from and are powered by this new high-tech environment.

Whether the idea of a shift from consumer to citizen is the right, or only, answer is uncertain. But a passive consumer mindset increasingly looks unsustainable. It's time to engage with our future.

If you want to know how to raise money, build a team, reject a Dragon or learn how the art of badminton can make you a pitching guru, then subscribe to Dare to Try on Acast, iTunes or wherever great podcasts are found.

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INNOVATE TO SURVIVE

PRODUCT LIFE CYCLES SEEM TO BE SHORTENING AND TURNOVER OF COMPANIES SPEEDING UP. WHETHER YOU'RE BIG OR SMALL, THE ONLY WAY TO SURVIVE IS TO INNOVATE. BUT THAT'S NOT JUST ABOUT DIGITISATION – IT'S ABOUT FINDING SMART APPLICATIONS AND A GENUINE PURPOSE FOR NEW IDEAS, NO MATTER HOW FAST THEY EMERGE

WORDS *Richard Young*

'For companies, speed is the defining factor for [business model and digital] transformation, and the key to being successful in adopting it. If companies cannot develop at a pace that allows them to win, they will fall behind very quickly.'

A stark warning from the World Economic Forum's March 2017 paper, *Technology and Innovation for the Future of Production: Accelerating Value Creation*. But this isn't just about being caught out by the next Uber or seeing me-too products crowd the shelves before you've built a brand at scale.

Rapidly accelerating innovation brings with it risks as well as opportunities. Can your people keep up with the demands of shortening product life cycles? How will supply chains cope with increasingly agile approaches? And how well can you evaluate the environmental and social sustainability of innovative approaches if speed to market becomes the overriding factor?

The ability to react quickly to technological change has become of paramount importance. 'Businesses are increasingly realising they need to innovate to survive, and the rate of technological change is one of the biggest challenges at the moment,' says John Richmond, chief engineer at the Tata Group Technology and Innovation Office.

'But one problem is that it is often difficult for companies that are very busy to see the threat of emerging technologies. After all, if you're really worried about bringing in your next meal, then to think about planting seeds for next summer is quite difficult.'

Where innovation stalls

Indeed, even just looking at the roller-coaster ride of Uber itself provides a salutary warning. This is a company built on both technological and business model innovation, quickly rolled out around the world, that has undoubtedly increased earning power for many thousands of drivers. But the social and political impact of its innovations is now undermining its position in key markets, such as Frankfurt and London.

UBER IS BUILT ON TECHNOLOGICAL AND BUSINESS MODEL INNOVATION

IMAGE: GETTY IMAGES

'IF COMPANIES CANNOT DEVELOP AT A PACE THAT ALLOWS THEM TO WIN, THEY WILL FALL BEHIND VERY QUICKLY'

At the same time, many businesses struggle to innovate sustainably, thanks to problems with organisational structure and external pressures. Professor Linda Hill at Harvard Business School recently conducted a survey of CEOs with George Davis, vice president of consultancy MacAndrews & Forbes, and discovered that the range of factors hampering innovation was extremely varied.

For some, the process remained too 'evolutionary' – focused on incremental improvements in costs or process design. Others cited short-termism dictated by financial reporting cycles, which makes it hard to plan and invest for long-term innovation that can be sustainably delivered. Time pressures featured as a problem for many decision-makers – as did a lack of diversity, which hampers 'out of the box' thinking and limits the pool of creative ideas.

Innovate with intent

Those challenges are easier to manage when the mission is clearly articulated. 'Tata Technologies is, at heart, an application engineering company,' says Nick Sale, sales president and chief operating officer for Europe at the company. 'Our job is to identify world-class technologies and inventions that can be applied to some of the global challenges we face.'

This clarity of focus makes it easier to identify problems – and to define innovation in ways that solve some of those broader questions about purpose, value and longevity. 'For example, automotive clients are focusing on the electrification of passenger vehicles and on lightweight technology,' says Sale.

'We focus on analysing these new propulsion systems against conventional vehicle-propulsion technologies for different client situations. Our engineers and technologists are collaborating with premium automotive companies, including electric vehicle start-ups from China and a select group from America.'

Inspiration doesn't just come from business partners and their knotty challenges. 'Our ties with academic institutions are important to us, especially since they give us access to new talent through internships and graduate recruitment,' Sale continues. 'We also collaborate with them on research in fields such as lightweight materials technology and automotive propulsion.'

'OUR TIES WITH ACADEMIC INSTITUTIONS ARE IMPORTANT TO US, ESPECIALLY SINCE THEY GIVE US ACCESS TO NEW TALENT THROUGH INTERNSHIPS AND GRADUATE RECRUITMENT'

IMAGE: CULLINAN STUDIO

▲ TIES WITH ACADEMIC INSTITUTIONS ALLOW TATA TECHNOLOGY TO BOTH DISCOVER NEW TALENT...

▼ ... AND DEVELOP SOLUTIONS TO THE PROBLEMS FACED BY AUTOMOTIVE CLIENTS AS THEY PURSUE INNOVATIVE TECH

Being close to real-world problems, but being able to access blue-sky thinking, is a perfect mix for that kind of fast, practical innovation.

R&D: the genesis of innovation

Should innovation only ever be tied to practical problems? Not necessarily. Pure research will always have a crucial role to play in advancing science and social understanding – and it's then up to smart product managers and connected businesses to find ways to support and apply that research.

A great example of that process was the Royal Society's appointment of 44 new University Research Fellows last autumn – an enlarged cohort thanks to support from Tata companies, including

TOP COMPANIES BY MARKET VALUE

Ranking	Company	Founded
1	Apple	1976
2	Alphabet	1998
3	Microsoft	1975
4	Amazon	1994
5	Berkshire Hathaway	1839
6	Facebook	2004
7	ExxonMobil	1911 (Mobil)
8	Johnson & Johnson	1886
9	JPMorgan Chase	1799
10	Tencent Holdings	1998

IMAGE: GETTY IMAGES

Tata Sons, Jaguar Land Rover and Tata Consultancy Services.

'Our partnership with the Royal Society is part of a strategic outreach to academia, and, through this collaboration, we aim to empower these young talented Tata University Research Fellows to achieve their full potential,' said Dr Gopichand Katragadda, group chief technology officer at Tata Sons.

The newly appointed fellows supported by Tata include Dr Alistair Boyer, who is studying sulfonyl triazoles, a molecular building block used to develop disease treatment, future drug discovery, clean energy and green chemistry; Dr Simon Horsley at the University of Exeter, who is working on improved ways to understand how matter affects waves; and Dr Samuel Stranks, who is looking into inexpensive materials to make solar cells and LEDs.

Tortoises and hares

But, while many R&D projects don't have a final product in mind, it's the conversion of innovative ideas into products and services that will better humanity that ultimately creates the positive feedback loops needed to sustain R&D.

That's one reason product marketing managers are currently so highly valued. 'They have to have a very good understanding of the market requirement,' ARM co-founder Hermann Hauser told *Perspective* in 2016. 'But, at the same time, they need enough detailed understanding of the technical possibilities to map the two onto each other.' That means great personal vision, but also organisations where cross-team communication works well, and there is a clear mission and a real appreciation of customer needs.

Keeping track of those needs is no small challenge in itself. There's certainly no doubt that innovations are changing society faster than ever – whether it's facilitating urbanisation or just offering new consumer technology. And that's reflected in the businesses that serve us. Of the top ten global companies by market value, six are technology-based – and the oldest of those, Microsoft, is only 42 years old.

But that list (see table, above) reveals another interesting fact about innovation: it's not exclusively the preserve of young businesses. Extremely venerable organisations have held their places on that list. Indeed, it's the capacity to innovate – and at speeds comparable to those ▸

of the upstarts – that keeps well-established companies and products relevant today.

That process can be nurtured and engineered. At Tata, for example, the global Innovista competition encourages innovators and businesses to showcase their most compelling new ideas – creating an environment where innovation is both fostered and celebrated.

Innovate with purpose

Tata has this passion to innovate deep in its roots – but it's allied to another crucial component of the Tata story, which is purpose. Tata, two-thirds owned by charitable trusts, remains as committed as it was in its founder's time to innovating towards a wider social good.

'IN A FREE ENTERPRISE, THE COMMUNITY IS NOT JUST ANOTHER STAKEHOLDER IN BUSINESS, BUT IS IN FACT THE VERY PURPOSE OF ITS EXISTENCE'

And the business world is increasingly acknowledging the importance of innovating with purpose. In a 2016 survey of more than 1,000 top global CEOs by Deloitte, 80% said a commitment to societal purpose was a key differentiator – and 79% of CEOs attributed the driving force for sustainable change to brand trust and reputation. (They're right to focus on social good: the University of Southern California found that 87% of millennials have shown a desire to make purchases that have an environmental or social benefit.)

Jamsetji Tata, founder of Tata, placed philanthropy and community at the very heart of his organisation. 'In a free enterprise, the community is not just another stakeholder in business, but is in fact the very purpose of its existence,' he said. It's a reminder that supporting R&D, being smart about turning ideas into products and innovating quickly are only parts of the puzzle.

Unless innovation is also in some way advancing humanity, it runs the risk of being short-lived or quickly abandoned. Organisations that patiently and mindfully uncover the confluence of newness, marketability and purpose will be the ones that win.

Nick Sale was interviewed for *Tata Review* by editor Christabelle Noronha

'INNOVATION ENABLES YOU TO CONSTANTLY IMPROVE'

We might look to developers and product designers for innovation in apps, the cloud and artificial intelligence. But humanity innovates in many different spheres – even ones as old as nourishment. And, for executive chef Sheroy Kermani, who recently joined Taj 51 Buckingham Gate Suites and Residences, and St James' Court, a Taj Hotel, it's actually a process that never ends.

'Tastes, flavours and trends are always evolving, and new dishes must keep up with that to give us the edge over our competitors,' he explains. 'We have a very strong team of chefs here in the kitchens, so we always bounce our ideas and opinions between ourselves to bring something unique, yet delicious and modern, to the table of our guests.'

Kermani identifies London's multiculturalism as a key component in being innovative – echoing the growing understanding that boardroom and workplace diversity are essential to healthy innovation in every business. 'London has such an eclectic mixture of tastes and food offerings; we are truly spoilt for choice with what we can offer our guests,' he says.

Like any innovator, he says there is always a process of discovery with new creations. Dishes will be trialled as specials before graduating as sustainable features on the main menu. And that applies as much to ingredients and processes as it does to finished dishes.

'Anything that can make the final dish taste better, or perhaps improve the efficiency of how it is made or the way it is presented, must be fully embraced and championed,' he says. 'So I say: fully embrace what's new. If it works, then use it; if it doesn't, then simply move on.'

Clearly, the diner's pleasure is the ultimate aim. But whether they're engineers or artists, innovators will also recognise Kermani's personal joy in making something new. 'I love trying new techniques, ingredients and combinations; it is this innovation that enables you to constantly improve and become a better chef,' he says. 'There is no end to the learning when you are in the kitchen and it is this beautiful art that motivates me.'

CITIES FOR PEOPLE

THE CITY OF THE FUTURE ISN'T LIKE A NEW SMARTPHONE OR ELECTRIC VEHICLE. INCREDIBLY COMPLEX, INTERCONNECTED INFRASTRUCTURE NEEDS TO CATER FOR A DIVERSE RANGE OF USERS. HOW DO WE BRING TOGETHER PLANNING, ENGINEERING AND TECHNOLOGY WITH A SOCIAL AGENDA THAT RETAINS COMMUNITY VALUES?

WORDS *Tim Phillips*

In 1950, the only city with more than ten million inhabitants was New York. Today, there are 40 in that 'megacity' category. Every day, 187,000 people move to a city looking for a job, an opportunity and a better life; the urban population of the world grew from 746 million in 1950 to 3.9 billion in 2014. By 2050, the world's population will reach ten billion. In Africa alone, this will be equivalent to adding the population of China in a little over a decade. And, by this time, 70% of the planet's inhabitants will be born, live and work in cities. ▸

JUNIPER PREDICTS THAT SMART ELECTRICITY GRID TECHNOLOGY DEPLOYMENT WILL DELIVER $18.8BN IN COST SAVINGS IN 2021 TO US CITIES ALONE

Inevitably, this means that under-pressure cities will become laboratories of innovation to make the best use of their infrastructure – what have been branded 'smart cities'. Often we think of smart cities in technology-first terms. Juniper Research, for example, defines a smart city as an 'urban ecosystem that places emphasis on the use of digital technology to drive efficiencies in existing social, economic and environmental processes, while simultaneously opening avenues for new, data-driven processes'.

Undeniably, technological innovation is essential for cities to become smarter. But this means different things in different locations. On the one hand, in the developed world, there are huge gains to be made from one-off technology projects to enhance an infrastructure that already works.

In Chicago, for example, the city will save money and improve sustainability by replacing 270,000 legacy street lights with energy-efficient LED lights by 2021. Juniper predicts that smart electricity grid technology deployment will deliver $18.8bn in cost savings in 2021 to US cities alone.

These top-down innovations are impressive, with potentially huge returns in cities that create advanced infrastructures. But, globally, the biggest gains may be made when innovation aligns itself with the wider unmet social needs of various city populations, satisfying their desires for security, employment opportunities or simply happiness.

The holistic city

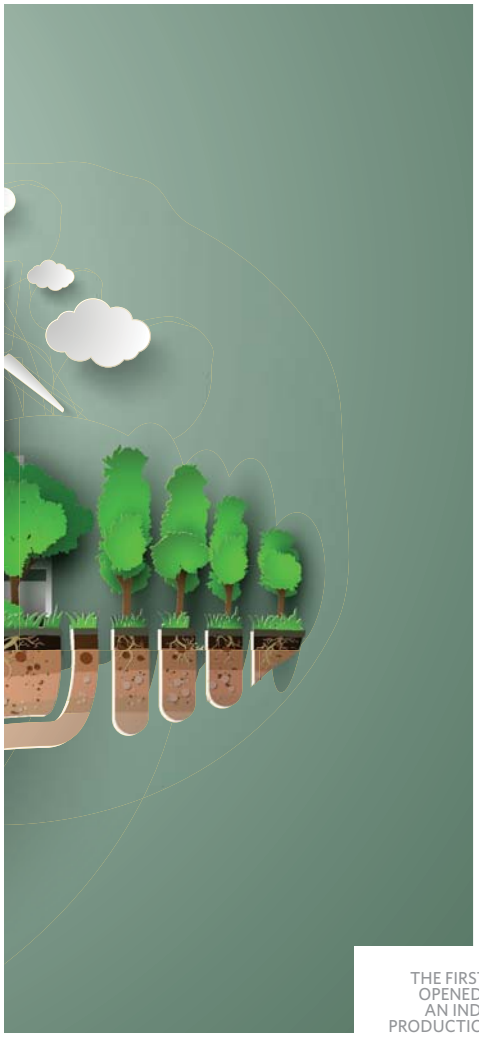
One part of this transition will be to create an environment in which either public or private providers can deliver integrated services, rather than just improving one service in one dimension. But integrated services are often undermined by data and systems that are developed or operate in silos – which is rarely ideal in a city.

Tata Consultancy Services (TCS) is currently working with many cities to break down those silos by integrating existing data to optimise the services they already provide. Its Intelligent Urban Exchange (IUX) is a suite of cloud-based software that aims to make the most of scarce financial resources to enhance services and improve environmental sustainability.

▲ THE HIGH LINE IN NEW YORK IS A 2.33KM-LONG POPULAR LINEAR PARK BUILT ON ELEVATED TRAIN TRACKS ABOVE TENTH AVENUE IN MANHATTAN

IUX lets cities and their business partners analyse historical and real-time data from networks, sensors, systems, social media and open-city data to improve operations. An example is the small French city of Belfort (population: 50,000). It wanted to optimise its public transport, but it lacked integrated data on how many people used which buses, and at what times.

Working with TCS and Gfi Informatique, it discovered that, without deploying any new



THE FIRST CHOTOTEL HOTEL HAS OPENED IN NAGOTHANE, INDIA, AN INDUSTRIAL HUB FOR STEEL PRODUCTION AND CONSTRUCTION

sensors, it could analyse bus billing, ticketing and GPS data to turn its entire bus network into a 'smart' system in just four weeks. The project has persuaded the city to expand its smart cities initiative to other applications, such as water and waste management.

A problem shared

At London-based Future Cities Catapult (FCC), chief business officer Scott Cain estimates that the market for 'advanced urban services' like this is upwards of $600bn today, rising to $3tn by 2025. FCC works with a variety of technology innovators to help create an environment in which improvements can be tested at small scale – and also provides a platform enabling innovators to work with each other. This knowledge-sharing extends to cities themselves, helping both innovation providers and adopters to standardise and meet new requirements.

In essence, it's a global market for good ideas. 'We help test and validate what works in real situations,' explains Cain. 'It helps to diffuse it. The good stuff should flourish, and the less good stuff either gets better or drops out of the market.' ▶

IMAGES: CHOTOTEL.CO.UK

MASS ACCOMMODATION GETS SMART

One of the problems in many fast-growing economies is that people are sucked into cities to work in factories, but are forced to live in substandard accommodation many miles from their work. A start-up based in London has taken a radical approach to improving conditions without waiting for the infrastructure upgrades that would normally be a precondition of new housing.

'The majority of people in many cities are unable to own their own houses,' says Rhea Silva, CEO of Chototel. (PwC forecasts that by 2025, only 40% of London's residents will own their home.) 'Increasingly, people are priced out of the rental market, too. In terms of a temporary or a short-term solution to the housing crisis, there's absolutely nothing available.' That's why she set up the company: to build sustainable accommodation close to industrial zones.

Workers will pay between $2 and $5 a night to stay in a room with a study, kitchenette and bathroom – up to four people can share comfortably. The buildings, though designed to be permanent, are 90% prefabricated. A Chototel hotel should be entirely self-sustaining, because it does not have to be connected to electricity or waste grids.

The first hotel has already been built at Nagothane, 70km from Mumbai. Plans to build a second hotel close to the industrial park outside Pune are well advanced. But while India's migrant workers are an obvious target for development, the company has global ambitions, reasoning that its model will work across all emerging markets.

'Housing poverty is a global issue that requires global solutions,' Silva

said in 2016. 'Our mission is to supply 1% of the world's demand for affordable housing by 2025, and build five million super-budget hotel rooms in the next decade.'

Chototel is responding to a social need, then – but it is also resolutely 'smart'. Tenants pay for their accommodation and utilities on their smartphones. Their fingerprints give them access to their room. Silva describes it as 'a ruthless embrace of technology... the real-estate industry has not embraced tech. We can run hotels, and some day even small communities in cities, completely unmanned because that increases the viability of housing projects like this.'

A commitment to work as part of a community is also put in practice at Geovation, a tenant at the Urban Innovation Centre, which FCC established in London. It's built an ecosystem of around 1,000 innovative developers, and helps fund between 12 and 15 companies a year to innovate using data to help create smart cities. Geovation uses government money in the UK, combined with sponsorship from IBM, Intel and KPMG, among others.

'The companies we work with are global,' says Alex Wrottesley, manager of the Geovation Hub. 'Our data is focused on Britain, but clearly the applications have wider application.' One of the main challenges for smart cities is often not to create fresh data, he adds, but to use existing data more wisely. Some of this data is public but, increasingly, it can be licensed from commercial partners such as Amazon or Google.

Wrottesley argues that, although public-private partnerships are the norm for smart city development, cities themselves should take the lead. Commercial incentives – making business more efficient by increasing traffic flow, for example – may be at odds with the desires of the public.

'How do you make cities more mobile, but also greener and more social?' he asks. 'Our focus this year is to ask communities: how do you respond to that? That's a big challenge. In Europe, smart city projects are becoming very good at asking: what do citizens actually want?'

Finding the city-zen

OrganiCity is a good example of how to involve citizens in the future of cities. Funded by the European Commission, it's in the final year of a three-year collaborative research project, based in Aarhus, London and Santander, providing 'experimentation as a service'.

Citizens can try innovations at small scale, give feedback and make suggestions. The best future outcome, it assumes, will be for the people who live in cities to co-create digital solutions to the problems they face – not have them imposed.

This model of smart city development is particularly important in cities where many live in poverty and face basic problems. One of the challenges for smart city development here is that you're not funding initiatives through market forces or deploying expensive personal technology. For people without large disposable incomes, a cleaner, safer, more sustainable city environment is the key.

That's the philosophy behind India's Smart City Mission programme. The Indian government is encouraging private investment in infrastructure in a public-private partnership framework – but it also has in place safeguards to make sure that developers do not run away with technology projects that have little use for the majority of the population.

'IN EUROPE, SMART CITY PROJECTS ARE BECOMING VERY GOOD AT ASKING: WHAT DO CITIZENS ACTUALLY WANT?'

One way to do this is to ensure that, when cities bid for government grants, their bids are partly ranked according to the level of engagement and support from the general public. As of June 2017, 90 cities have been selected to be upgraded as part of the programme.

'Every smart city project we become involved with starts with a workshop,' says Dilip Sonwane, senior general manager at Tata Consulting Engineers (TCE), who has worked on smart city projects in Bhopal, Guwahati and Raipur. 'Each city is unique and poses a different set of challenges. They all want to retain their unique and existing heritage sites and buildings that reflect the city's history and personality.'

Improvements include solar trees to generate power, undergrounding of utility cables, rainwater

MAPPING THE FUTURE

In the 1940s, the Directorate of Overseas Surveys, part of the British government's 226-year-old map-making operation, used to create detailed maps for its international clients. Today, its successors at Ordnance Survey International (OSI) do the same – but now they are performing complex geospatial analysis that helps places such as Singapore, Bahrain and Dubai create future cities.

'An awful lot of our work is consultancy at the moment, helping governments get investment,' explains Mark Tabor, senior technical advisor. 'And a lot of the time that means we help them come up with case studies on investing in geospatial information to help solve key problems.'

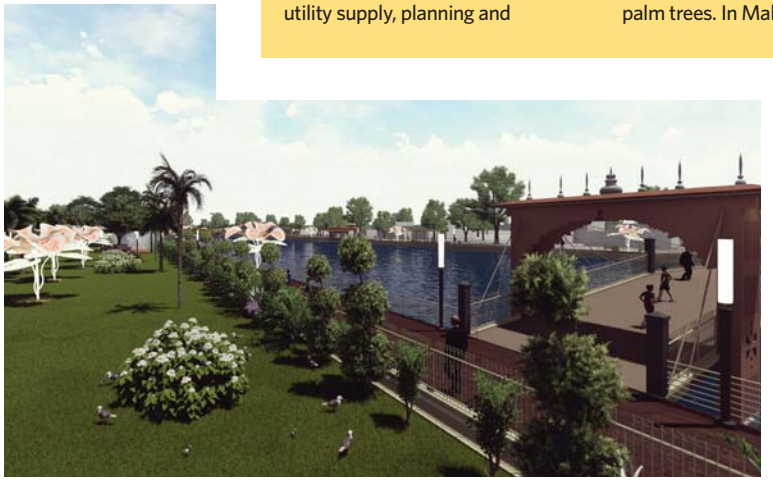
Cities usually have infrastructure that is not functionally integrated: utility supply, planning and transport have historically all been differently governed. 'Better mapping is the first step to solving the problem that they don't know what they have, or the information is distributed and held in silos.'

Each city has different challenges. In Singapore, OSI is helping to create an open, standardised 3D model of the city, semantically enriched with building data. In Bahrain, the authorities need to accurately locate and map assets that have been built underground, to make future development work more efficient.

In Dubai, OSI works with Deimos Space UK and the Mohammed bin Rashid Space Centre to map the city's assets and natural resources from space to improve sustainability. The project includes an algorithm that counts Dubai's palm trees. In Malaysia, Malacca is a World Heritage Site that needs 3D mapping to make sure it can modernise its infrastructure to attract tourists, but not compromise its heritage.

Geospatial data helps map the rapid and unplanned growth that many emerging-economy cities have experienced. That should help them leapfrog a generation of technology to obtain the integrated geospatial information as they engineer future services.

Even here, working alongside the populace has its benefits. 'For a sub-Saharan African country to create a detailed city map, they can use crowdsourcing,' Tabor explains. 'They can equip the local population with mobile phones that have GPS trackers on them. That means we can capture the paths they walk and the roads in the city to create a base map.'



▲ THE RIVERFRONT SMART CITY OF GUWAHATI INCLUDES CANALS TO PREVENT FLOODING CAUSED BY MONSOON RAINS

harvesting, and providing integrated command and control centres. TCE acts as facilitator and project manager for these programmes.

But working on brownfield sites can often be a challenge. For example, there may be many informal businesses established in an area, so land and property rights can be hard to negotiate. According to TCE's Infrastructure Business Unit, India's smart city focus is more on tier 2 cities and greenfield area developments (ABD). Such ABD models can be replicated to create planned, sustainable townships.

This will help in two ways: firstly, decongesting the metros and other core areas; secondly, creating new sustainable hubs in strategic locations that are state of the art, while benefiting citizens. This is one reason why small-scale, local projects are the ideal starting point, Sonwane adds, to demonstrate both progress to the government sponsor, and the potential of smart city improvements for the rest of the population.

People and purpose

TCE's stakeholder engagement and the EU OrganiCity experiment exist in different worlds. But they have an important factor in common: they put the people who live in cities at the centre of smart city development.

At Future Cities Catapult, Cain argues that this style of development will create a diverse set of future cities that help as many people as possible to live happier, more sustainable lives – rather than make us slaves to technology.

'We don't use the term "smart cities" much any more,' he says. 'It can convey a hyped sense of what is possible. Some people who used it may have had an overly simplified concept of what technology will do. They don't recognise that a city is a living organism full of people, and people are messy.' ▶

CONNECTED CITIES

THE HIGH-TECH ADMINISTRATIVE BUILDING AND COMMAND CENTRE FOR A SMART CITY

Cities are perhaps the oldest and most compelling example of the 'network effect' – the phenomenon that describes the way an additional user of a good or service changes the value of that product to others. In tech circles, this is often referred to as Metcalfe's law, which states that the value of a telecommunications network is proportional to the square of the number of connected users of the system.

That goes some way to explaining how social networks – and even the internet itself – have become so dominant in our lives. But, if we think of even ancient cities as systems where people were in close-enough proximity to be thought of as 'networked', it also helps explain why, from the dawn of history, people have been drawn to cities.

We're now in the fourth phase of networking for cities. The first was physical proximity, allowing people of diverse backgrounds and skills to interact, innovate and build at scale. Second was the mass transit of people and information – roads, rail and even the telephone changed and spread the network effect of cities. Third was data – cities became hubs for high-speed data transmission to facilitate social interaction and business development.

The fourth phase is the internet of things (IoT). 'Over the past ten years, we have witnessed a lot of hype building around the concept of smart cities,' says Anthony Bartolo, president of mobility and collaboration enablement at Tata Communications. 'And, finally, the sensors, ubiquitous connectivity, cloud and data analytics capabilities, and IoT platforms exist to make this dream a reality.'

Bartolo is talking about connecting not just people, but devices, buildings and even roads in ways that allow the network effect to be felt by the very infrastructure of the city. 'Companies are developing wireless links that enable driverless cars to communicate with smart city infrastructure and to even bring people new entertainment experiences with sensing and video-processing capabilities,' he explains.

Embedding connectivity into the very fabric of cities only really works when there is clear collaboration between different agencies. City government plays a central role, not just as the owner of much of the infrastructure (and a beneficiary of many of the opportunities that the IoT brings), but also as the guardian of citizens' rights. After all, a hyper-aware city full of autonomous sensors could easily become a tool for total control.

EMBEDDING CONNECTIVITY INTO THE VERY FABRIC OF CITIES ONLY REALLY WORKS WHEN THERE IS CLEAR COLLABORATION BETWEEN DIFFERENT AGENCIES

Businesses play a crucial role – again, as creators of the systems and networks that underpin citywide IoT initiatives, but also as beneficiaries of better data about how the city functions; smoother running of, say, transit systems; better energy distribution; and improved air quality.

And individuals are key. There must be acceptance of IoT capabilities – we must feel comfortable that, for example, cameras are processing our movements. But most people now carry with them a crucial part of smart city network infrastructure: their smartphone.

That also highlights the importance of security. 'Whenever any new connected technology becomes mainstream, there are concerns around security vulnerabilities,' says Bartolo. 'Connecting hundreds of thousands of IoT devices in a smart city represents challenges: every device is a potential vulnerability that can be used by cybercriminals to stage an attack. This can have potentially disastrous consequences, bringing the whole city to a standstill.'

This is no trivial threat. State-sponsored hackers brought the city of Kiev to a near stop at the end of 2016. Here, the network effect runs in reverse: break a key node in the network (a computer in a key power-grid control room) and the whole thing fails. And, in 2014, Argentinian researcher Cesar Cerrudo showed how data from 200,000 traffic control sensors installed in major US cities could be intercepted from 457m away because one company had failed to use encryption.

'That is why close collaboration between governments and private-sector organisations around IT and network security is paramount to safeguard hyper-connected smart cities today and in the future,' says Bartolo. The network effect made cities the dominant habitation for humanity. We can't let IoT network vulnerabilities jeopardise that status.

no_15 LET'S CLEAR THE AIR

Diesel particulates are a huge issue in European markets, leading to tough new regulations. New filtration techniques developed in India may offer some answers

WORDS *Richard Young*

Researchers are working on technology that will help reduce particulate matter (PM) emissions in densely populated areas in India. This could have profound implications around the world.

The small team, based at the Massachusetts Institute of Technology's (MIT's) Tata Center for Technology and Design, is working on low-cost PM filters for small- and medium-sized diesel engines. These filters will be robust, resistant to fuel sulphur and easy to use, helping improve air quality in many Indian cities, where the average PM concentration can be over ten times higher than the World Health Organization's safe limit.

'This project was initiated due to a unique set of circumstances specific to India,' says MIT's Dr Carl Justin Kamp. 'The country is currently going through monumental changes in emissions regulations in an effort to improve air quality.

INDIA GATE IS SHROUDED IN THICK SMOG AND POLLUTION AFTER DIWALI CELEBRATIONS IN NEW DELHI, INDIA

'Exhaust particulate filtration technologies will soon be required for many different types of engine applications as the country attempts to drastically reduce allowable emissions to be comparable to Europe and the US by 2020. PhD student Sujay Bagi and I realised that India needs solutions as soon as possible.'

'INDIA IS CURRENTLY GOING THROUGH MONUMENTAL CHANGES IN EMISSIONS REGULATIONS IN AN EFFORT TO IMPROVE AIR QUALITY'

The unique filtration media is a micron-scale sintered metal fibre mesh with protective aluminium oxide layers. It's electrically conductive, which means that the filter material itself will act as a resistive heater in order to oxidise the trapped particulates.

'We are currently in the design process for our filter technology, after recently returning from a trip to India where we met with relevant players in this field,' says Kamp.

'We plan to partner with an emissions-control system company in the US for testing and prototype development, several agencies in India for testing and validation, and at least one engine manufacturer. We aim to field-test prototype filters within six months.

'One of our primary goals is low cost,' he continues. 'So we intend to do all fabrication in India, and to use as many off-the-shelf components as possible. One of our definitions of product robustness is the ability for the end user to repair and possibly upgrade the product, depending on their specific needs. We hope to accomplish this through additional development in India with locally available materials and fabrication, and repair capabilities.'

When it comes to product design, simpler is better. So the researchers are initially aiming at one of the simplest and most ubiquitous engines in India, the small diesel stationary power generator.

'The small generator is often physically close to people, meaning that it's often a direct source of particles that are being inhaled by humans,' says Kamp. 'It has stable and well-understood exhaust characteristics, and can be used almost continuously in some applications – up to 24 hours a day in telecom towers. We therefore aim to develop our filters for the simplest application, and then scale up the design for larger, more complex applications such as on-road light-duty vehicles.'

IMAGE: GETTY IMAGES

no_16 | THINK SMALL

Artificial intelligence grabs headlines. But, in the small print, nanotechnology is enabling advances in disease detection and invisibility cloaks...

WORDS *Richard Young*

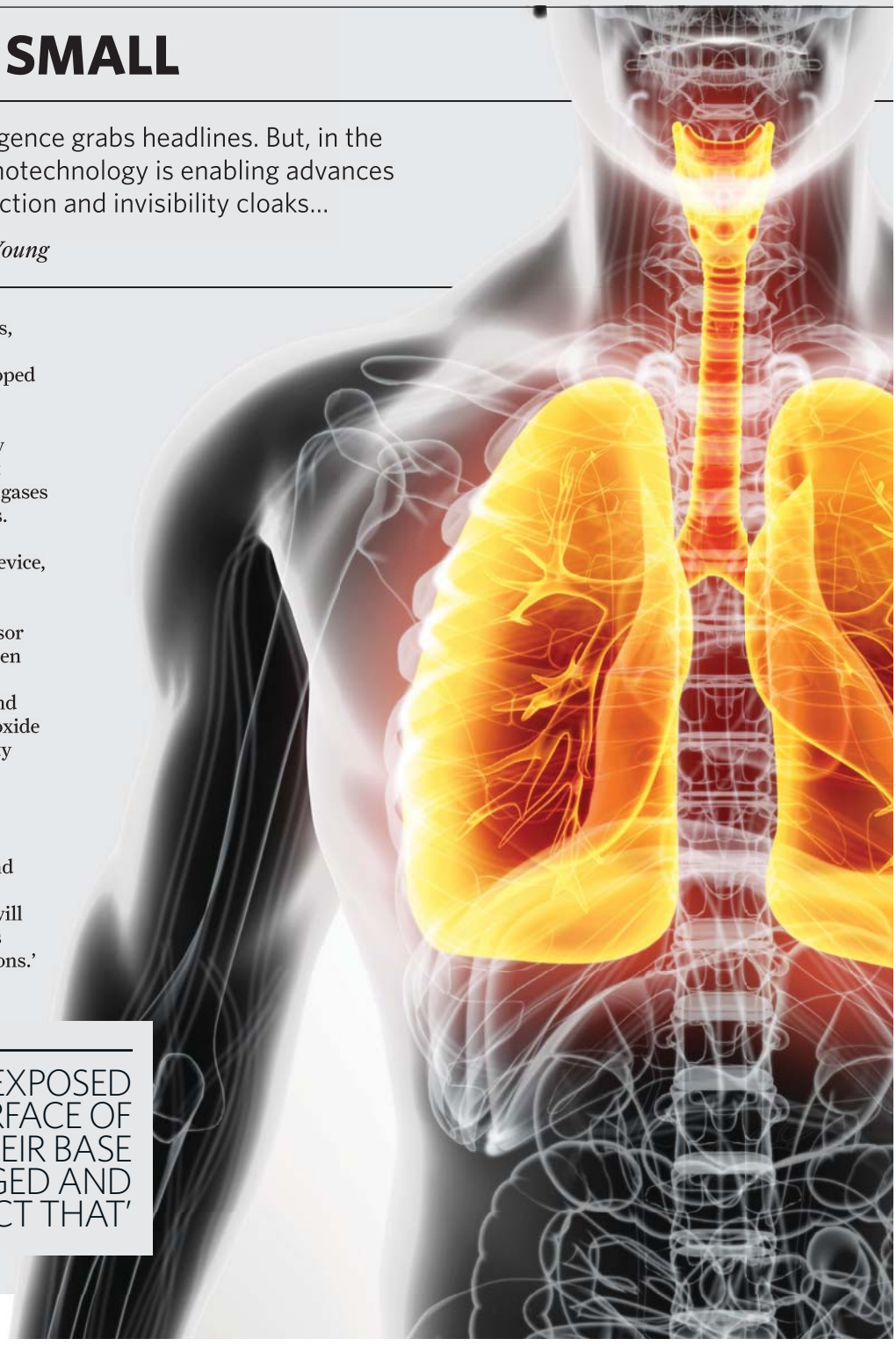
Sensors that can diagnose certain diseases, such as diabetes and lung cancer, just by analysing human breath, are being developed in South Korea.

A research group from the Department of Materials Science at research university KAIST has been working on a sensor that uses pattern recognition of the biomarker gases found in exhaled breath to provide results. However, the group has had to overcome certain limitations in order to create the device, finding the answer in nanotechnology.

'We began work on breath-gas analysis using our nanofibre sensors,' says Professor Il-Doo Kim from the research group. 'When gases are exposed to the surface of metal oxides, their base resistance is changed and we can detect that. However, most metal oxide sensors have suffered from poor selectivity towards specific gases.

'So, in order to enhance the results, we needed different catalysts. We developed protein-encapsulated nanocatalysts that allow us to achieve superior sensitivity and selectivity,' he continues. 'This new and innovative breath-gas analysis platform will be very helpful for reducing expenditures and for continuous monitoring of conditions.'

'WHEN GASES ARE EXPOSED TO THE SURFACE OF METAL OXIDES, THEIR BASE RESISTANCE IS CHANGED AND WE CAN DETECT THAT'



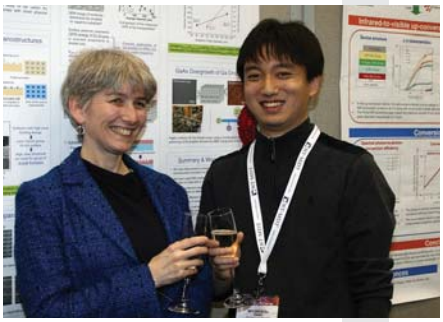
LIGHT MANIPULATION

On the other side of the world, a very different nanotechnology advance has been made. A new, low-cost technique that allows inexpensive growth of nanoparticles on and below the surface of semiconductors could boost LED lighting efficiency by 50% and even help with the development of cloaking devices.

Developed at the University of Michigan (UMich), the nanoparticles increase LED efficiency by reflecting light out of the semiconductor, as well as acting as minuscule antennae that redirect more of the electricity into light.

'Our secret sauce is the array of nanoparticles on or near the surface of an LED,' says Dr Myungkoo Kang, now a postdoctoral research fellow at Pennsylvania State University. 'They produce an electric field, which assists photons with their "escape" from the forward-biased LED.'

'This technique could be used for many applications,' adds Professor Dr Rachel Goldman from UMich, 'such as making brighter light-emitting diodes, high-efficiency solar cells, ultra-sensitive biosensors, ultra-fast waveguides and negative refractive index metamaterials, which can manipulate light. Think bright lights and Harry Potter's invisibility cloak!'



PROFESSOR DR RACHEL GOLDMAN AND DR MYUNGKOO KANG CELEBRATE THEIR LED EFFICIENCY DISCOVERY

IMAGE: GETTY IMAGES

no_17 WILL NANO-SATELLITES TAKE OFF?

Smaller, cheaper communication satellites promise to bring affordable connectivity services to remote areas with dispersed populations

WORDS *Richard Young*

Cheaper to build, launch and replace than traditional communication satellites, nano-satellites could be the answer to affordable connectivity services for remote locations in developing economies. At 10x10x10cm cubic units, the so-called CubeSats have a mass of no more than 1.33kg.

Trialling their capabilities, telecoms firm Sky and Space Global launched its 'Three Diamonds' trio of CubeSats in June from a launch system belonging to Indian space agency ISRO at its Satish Dhawan Space Centre on Sriharikota, a barrier island in the Bay of Bengal. Eventually, its constellation will be 200 satellites strong, designed to offer more affordable communication solutions to remote communities across Africa, Asia Pacific and Latin America.

'It's a good solution for large areas with a low population, where nobody will invest in an information communication infrastructure,' says Sky and Space Global CEO Meir Moalem. 'A space-based infrastructure is the only solution right now.'

The company has developed a proprietary networking-management software platform that equips its satellite constellation with connections that can deliver uninterrupted connectivity irrespective of which satellite the user connects to.

'We're focused on narrowband communication infrastructure in space: anything from machine-to-machine and internet of things (IoT) services through to texting, instant messaging, data transfer, emails and phone calls,' says Moalem.

'So, we're building something in space that's similar to a local cellular network infrastructure. Only, instead of having cell towers on the ground, we have nano-satellites in space.'

Removing the need for a ground station network, it also enables the constellation to function autonomously, performing important transmission activities and 'health checks'. The satellites work as 'routers in space', managing both themselves and the data traffic autonomously.

The company will eventually replace a quarter of its nano-satellites each year. This means that several generations of communication protocols will be supported by the constellation at any given time, keeping the system protocol-agnostic and future-proof.

Moalem admits that ground infrastructure will probably always be better, and cheaper, than space-based communications solutions. However, he believes there will always be a space-based component to any future communication infrastructure.

'There will always be areas of the world where space will be the only option for communication. How large will this contingent be? I think it will only grow, as today there is no such thing as too much information.'

THINK ON

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Pure chance can lead to a great discovery

▶ PAGE 62
Garden cities: an old dream with new possibilities?

▶ PAGE 64
Is evolution, not revolution, the way to innovate?

Serendipity 2.0

Sometimes the most telling inventions – like penicillin or vulcanised rubber – turn up by accident. Are modern businesses trying too hard to innovate?

WORDS *Morgen Witzel*

There is an old Persian fairy tale about the land of Serendip, whose people, according to the 18th-century writer Horace Walpole, 'were always making discoveries, by accidents or sagacity, of things they were not in quest of'. Walpole coined the term 'serendipity' to describe this process of accidental discovery.

That serendipity plays a big role in innovation will come as no surprise. Many great inventions are the result of serendipity, discoveries made by accident when the innovators were actually looking for something else. Penicillin, the microwave oven, Teflon and the ice cream cone are just a few examples.

And everyone surely knows the story of the Post-it note, developed at 3M by chemists looking for a very strong adhesive, who instead accidentally created a weak, reusable, pressure-sensitive glue that would adhere to paper.

All these innovations became highly successful because someone recognised the potential of an accidental invention – and championed it. That makes it sound like their success was highly engineered. Dig a little deeper, though, and we find that serendipity continued to play a part even after the original discovery was made.

Spencer Silver, the chemist who created the glue for Post-its, touted the product around 3M for years, without success; his creation was described as 'a solution without a problem'. It took nine years for the product to be developed and taken to market.

▲ SOMETIMES DISCOVERIES ARE THE RESULT OF CHANCE RATHER THAN ENDLESS RESEARCH

IMAGE: GETTY IMAGES

Chance plus insight

Making discoveries by accident is easy; people do it all the time. The trick is recognising when we have made a discovery that might be significant and useful, and then focusing on developing it. That is not always easy to do.

When, to paraphrase Walpole, we discover something we were not in quest of, we often tend to react with indifference, even irritation. ▶

We already have a clear idea of what we are looking for – or we think we do – and we tend to cast aside anything else we stumble across as not relevant, and push on towards the goal.

And this is where many R&D programmes fall down. These programmes are established, often at vast expense, to solve a particular problem. Resources, time and mental effort are channelled towards solving that problem, for the very simple reason that only by solving that problem will the programme be able to demonstrate a return on investment. Good ideas get thrown away for no other reason than they are not relevant to the task at hand.

Of course R&D projects must have focus. But innovation projects and programmes do need to allow for serendipity. There is not just an outside chance that you will discover something you were not expecting – experience from sectors such as pharmaceuticals suggests that it is almost certain you will. Serendipity is a very powerful force, and innovators – and those who manage them – must be alert and ready to seize chances when they come.

The Kao jumped over the moon

One of the companies that does this best is Kao. From its origins as a simple soap maker, Kao expanded into a wide range of merchandise, including skincare and beauty products, cooking oils and, surprisingly, computer floppy disks. It was, in fact, for a time the world's largest maker of floppies.

Kao describes itself as a learning organisation, and for once that overused tag turns out to be true.

Under its long-time chairman, Yoshio Maruta, the company invested in systems for developing and circulating knowledge through the firm. Most of these channels were informal. Maruta decentralised the company, leaving only a tiny core at headquarters. But he also broke down barriers between departments and divisions to ensure knowledge could flow freely.

In their book *The Knowledge-Creating Company*, Ikujiro Nonaka and Hirotaka Takeuchi describe this model as the 'O-form' corporation, a kind of intellectual doughnut where knowledge circulates and has full currency. Maruta, who described himself as a Buddhist first and a corporate executive second, had a broad and omnivorous approach to knowledge. To him, there was no such thing as a useless discovery. Everything has a use, he said, if only we search hard enough.

Today's innovators need to continue to cultivate that broad mental outlook, as do those who manage and lead them. Even the humblest discovery may, in time, become useful. Keeping an open mind and not being too tied to research objectives is the best way to not only recognise serendipity when it comes, but also take advantage of it.

Green living

The urban landscape is rightly rising up social, political and corporate agendas. So what can we learn from the successes and failures of the garden city movement?

Europe, like most of the world, is more heavily urbanised than ever – with no signs of slowing down. Already three-quarters of Europeans live in cities, which are spreading out and swallowing up the surrounding countryside.

No wonder the search has begun for a new, more human-centred way of living – something that gives us the advantages of urban living without the environmental destruction and other problems that seem to accompany urbanisation.

One source of inspiration for planners, businesses and government alike is the garden city movement, which emerged in England in the late 19th century in response to very much the same problems: rising populations, rapid urbanisation, and the need for healthy living space, especially for young families.

The English social reformer Ebenezer Howard was the first to conceive of the 'garden city' as a solution to the housing problem. In his view, both city and country had their disadvantages. Cities were busy, crowded, often dirty, and very expensive. People had to work excessive hours just to make ends meet. For city residents there was also the 'loneliness of crowds', a breakdown in community and a strong sense of social isolation.

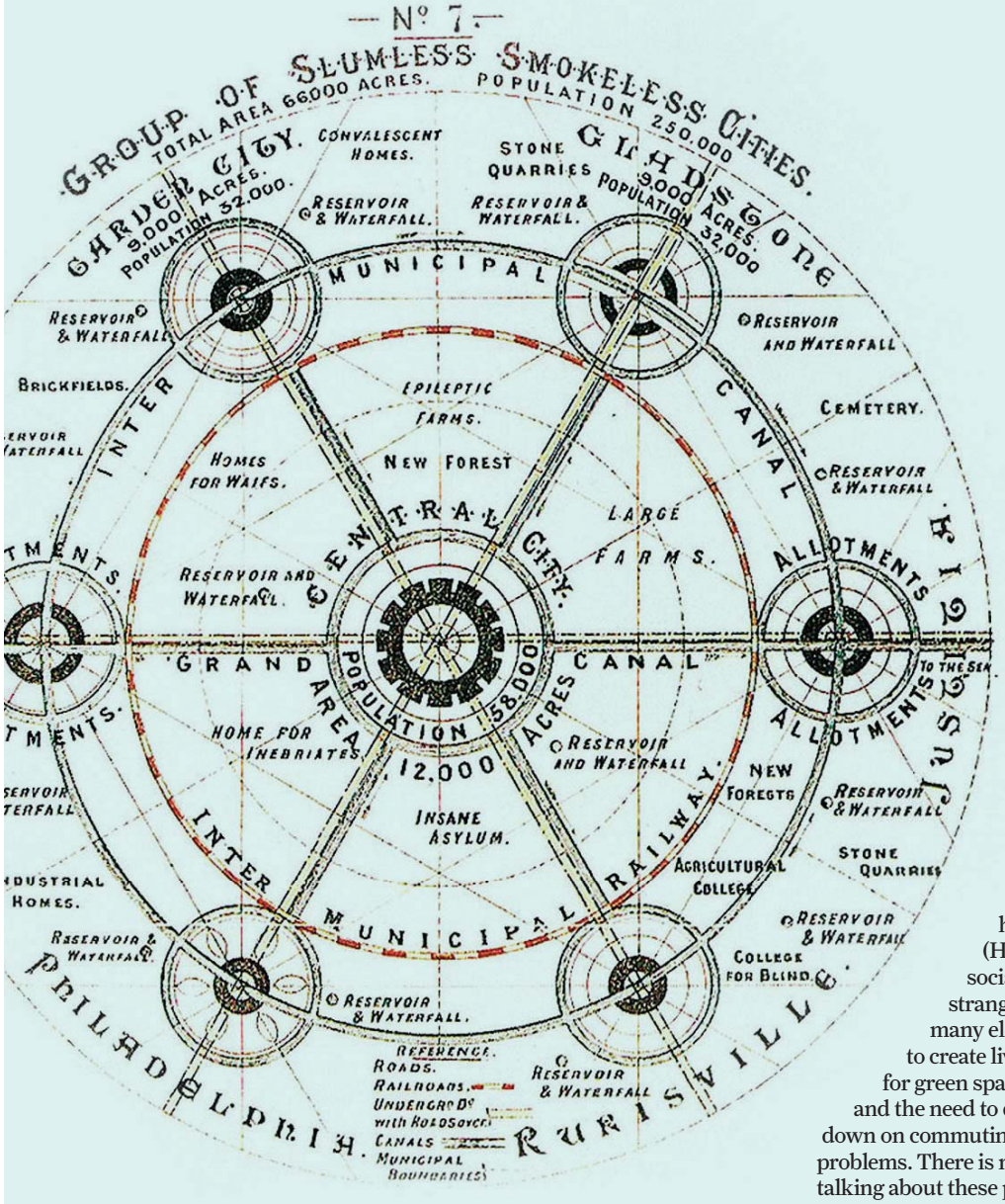
In the country, on the other hand, Howard saw a lack of society and intellectual stimulation; poverty; and equally grinding hard work as people struggled to survive on low wages. (These ills will sound terribly familiar to residents of any European state today...)

Garden of delights

His solution was the 'town-country', or garden city. This would combine the best features of both; the healthy life of the country – especially clean air and water – with the civilised amenities of the city. In Howard's view, garden cities should remain small. He envisaged them as having no more than 32,000 people on a 6,000-acre site. Each should be self-sufficient in terms of shops, resources and amenities, with enough work to keep their populations fully employed.

Howard's ideas became very popular, and during his own lifetime the first two garden cities were built in England – Letchworth and Welwyn.

The idea caught on, and hundreds of garden cities were built around the world. One of these was Jamshedpur, the original



home of the Tata Iron and Steel Company (now Tata Steel) in India. Writing to his son, Jamsetji Tata urged that Jamshedpur have plenty of green open spaces and trees, and a wide range of amenities, including places of worship for every faith.

Today, the garden city of Jamshedpur still exists, even if the city has outgrown the original space and now sprawls across the countryside.

Gardens overgrown?

Not everything is rosy in this garden. Even though many garden cities have been built, they have never really caught on as a dominant form of development. True self-sufficiency has never really materialised. Letchworth and Welwyn themselves quickly became dormitory towns, inhabited by commuters working in London. Most of the later British garden cities have suffered the same fate.

THE ENGLISH SOCIAL REFORMER EBENEZER HOWARD WAS THE FIRST TO CONCEIVE OF THE 'GARDEN CITY' AS A SOLUTION TO THE HOUSING PROBLEM

The 'small is beautiful' idea of the original garden city has also not survived. Many have grown far beyond their intended size and are now as busy and crowded as the conventional towns and cities around them. Some American garden towns have fallen into decay and become ghettos, with high rates of crime and drug use.

Howard was an idealist, and perhaps he took too rosy a view of human nature. (He also hoped garden cities would be ideal socialist communes that would break the stranglehold of capitalism on society.) But many elements of his original scheme – the need to create liveable, sustainable communities, the need for green spaces and fresh air to ensure healthy living, and the need to develop and maintain local services to cut down on commuting – all deserve attention as we face today's problems. There is no doubt that planners are thinking and talking about these principles. But how widely are they being put into practice?

Perhaps this is an area where the private sector can lend a hand. It is worth remembering that many of the early sustainable communities in Britain – New Lanark, Saltaire, Port Sunlight, Bournville – were built not by government, but by entrepreneurs. Many of these lasted longer and had more success than similar government-backed schemes. (Likewise, Jamshedpur, also built with private money, was, and remains, a highly successful community.) More recently, the Duchy of Cornwall's model village at Poundbury in Dorset has been so successful that it continues to expand, with new building projects planned for the site.

And, if businesses are serious about working in the interests of communities, then helping to develop a new model of urbanisation is one area where they surely have much to contribute.

Life in the slow lane

Looking for sustainable innovation? Revolution is massively overrated. So forget the 'disruption' designed to kill existing business models, and ease into evolutionary innovation

What is it about radical innovation – 'disruption', as it's often branded – that excites management consultants, 'tech bros' and business writers so much? In *Blue Ocean Strategy*, authors W Chan Kim and Renée Mauborgne argue that radical innovation is a way of putting a distance between yourself and your competitors. Go beyond what the competition is doing, they argue, and force them to chase you if they want to keep up.

There is no doubt that breakthrough discoveries and brand-new business models make headlines. If you are a successful radical innovator – a Mark Zuckerberg or an Elon Musk – people make films and write newspaper stories about you. (If you're Travis Kalanick, until recently Uber CEO, they write stories about you too – but not quite the same ones.)

People admire 'disruptors'. And, if you have control of the intellectual property that causes the disruption, you may also become quite rich.

'Move slow and build things'

But radical innovation has its downsides. For one thing, it's risky. A great deal of time, energy and capital is usually required to make a breakthrough innovation and then take it to market. For every headline-grabbing innovation, there are scores of others that fall by the wayside, very often taking their innovators' hopes and dreams with them.

And then there are the revolutionary businesses that have succeeded in raising huge sums of capital, disrupting their rivals' income streams... but actually fail to generate much in the way of profits. (You can put Twitter, Uber and even Amazon – which is barely profitable without its Web Services division – into this category.)

The other way of innovating is to gradually improve and shape a product or service to match customer needs. Procter & Gamble does this very well. Its R&D and market research teams work closely together, analysing customer needs and demands and then fine-tuning products accordingly. Brands like Tide are updated and upgraded at least once a year, sometimes more often than that.

In other words, dispense with the philosophy 'move fast and break things' (the original motto of the Facebook developer team – and also the title of a recent book by American academic Jonathan Taplin that's critical of tech disruption) and embrace, 'move slow and build things'.

If it works for Apple...

Perhaps the most interesting example of this (slightly) slower approach is Apple. We're accustomed to thinking of it as a breakthrough innovator. But in fact its true breakthroughs are few and far between. What it does best is constantly observe its customers, listen to them, and then carefully refine its product design in incremental steps.

So, while Apple is a vociferous applicant for patents, it's rarely the pioneering disruptor in any market.

IMAGE: GETTY IMAGES

THE OTHER WAY OF INNOVATING IS TO GRADUALLY IMPROVE AND SHAPE A PRODUCT OR SERVICE TO MATCH THE NEEDS OF CUSTOMERS

The iPod wasn't the first MP3 player. The iPhone wasn't the first smartphone. Apple Watch hit the shelves long after other wearables.

What gave all these 'me too' products the dominance they have acquired is Apple's ability to understand customers and refine its interpretation of a disruptive innovation via incremental change and great design.

It's not the only company to embrace this approach. Lego, which launches a stream of new variants of its core product every year, is in touch with Lego user forums around the world, listening to their ideas. Lego's R&D looks more like a conversation with customers, rather than periodic 'eureka' moments.

Agile, not erratic

In his new book, *The Agile Enterprise*, consultant Mario Moreira urges companies to embrace the incremental approach, not just because it is less risky and requires less capital investment, but, he says, because it keeps companies closer to their customers.

He argues that, in order to get better at incremental innovation, companies need to do two things. First, they must adopt the right mindset – in particular, an absolute commitment to the customer and a driving belief that it is the customer who should define what quality is. Listening to and understanding customers is every employee's duty – not just that of front-line staff and the marketing team, but the designers and engineers behind the scenes too.

Second, Moreira says, employees should be given ownership of problems and encouraged to work with customers to come up with their own solutions. In traditional hierarchical firms, ideas for new products and services need to be costed, approved and signed off at a higher level – and all this takes time. Moreira argues instead for a swift, agile approach, moving quickly to establish customer needs and meet them all in a single process.

The siren call of radical innovation remains strong. We'd all like to be Elon Musk, creating a vision for interplanetary travel. But the reality of business in fast-moving times is that the company that wins is rarely the one with the shiniest toys. In fact it's the ones that stay closest to their customers that usually triumph. And that could well mean that incremental innovation – less flashy and showy than its counterpart – turns out to be the truly radical approach.

Q&A

GENIUS WONG
CHIEF PRODUCT OFFICER FOR CLOUD AND SECURITY AT TATA COMMUNICATIONS

THE WORLD IS HEADING INTO THE CLOUDS, WHERE DATA, APPLICATIONS AND CONNECTIONS ARE ALWAYS AVAILABLE. HELPING MAKE SURE THAT'S A SECURE AND RELIABLE EXPERIENCE IS GENIUS WONG, WHO HEADS UP TATA COMMUNICATIONS' GLOBAL NETWORK, CLOUD INFRASTRUCTURE AND SECURITY BUSINESSES. THESE TECHNOLOGIES ARE THE FOUNDATIONS FOR DIGITAL TRANSFORMATION IN EVERY SECTOR

What's been the biggest change over your 20-year tech career?
The combination of practically ubiquitous internet connectivity and cloud computing has unlocked new growth opportunities for businesses, allowed them to introduce new services faster, enabled organisation-wide digital transformation and transformed entire industries. Just look at the disruptive impact of Airbnb on the hospitality industry. The internet and the cloud mean that there are now very few barriers to entry across sectors, levelling the playing field between nimble start-ups and industry stalwarts.

What about 20 years ahead?
The breakneck speed of innovation means that it's hard to predict what will happen in five years' time – let alone in 2037. But artificial intelligence (AI) will transform technology and telecoms, including how we manage and protect networks. AI will pave the way for faster and more secure networks. And these AI-enabled networks will be the foundation for the hundreds of thousands of driverless cars on our roads in the future, for example.

Cybersecurity: what's your number-one wish?
Business leaders need to stop burying their heads in the sand, thinking that a cyberattack will never happen to them. The impact of the massive WannaCry ransomware attack should have been minimal because Microsoft issued a patch for the vulnerability in March. Yet only 10-15% of businesses had implemented this critical update. IT departments often need to wait for approval for critical updates from up the hierarchy – especially around the end of a quarter, when every penny counts. Delaying updates can leave businesses vulnerable, and the EU's upcoming General Data Protection Regulation will impose hefty fines on businesses that fail to protect themselves.

How does Tata Communications' global network benefit humanity?
Our network carries more than a quarter of the world's internet routes that power the digital world. The internet has become a social equaliser, democratising access to services. It is today in the hands of 3.5 billion people – and, by 2021, there will be 4.6 billion internet users and 27 billion internet-connected devices around the world. From connected homes and e-health facilities to next-generation energy management, personal safety and security systems, everything will be connected, enabling a truly connected society. The internet, underpinned by our network, brings new opportunities to people and businesses, and ultimately improves the lives of everyone.

Advice for a young person looking for a tech job?
Go for it! Technology now permeates all aspects of our lives. Just think about the growing role of data, mobile devices and internet connectivity in how we transport things from A to B, monitor our health or do our shopping. Very soon there won't be any businesses or jobs that don't have a technology element. The opportunities to make your mark in this rapidly moving market will continue to grow.

PHOTO: LOUISE HAYWOOD-SCHIEFER

ST. JAMES' COURT
LONDON
A TAJ HOTEL

St. James' Court, A Taj Hotel Undergoes Renovations

St. James' Court, A Taj Hotel is currently undergoing an extensive renovation to reinforce it as an exceptional hotel in London and within the worldwide Taj hotel group.

The hotel remains open throughout the renovation, with minimal disruption, and they expect them to be completed by May 2018.

The hotel's Wellness Centre and many of their bedrooms and suites will become even more luxurious and comfortable than ever before, encompassing all the needs for the modern traveller, whilst retaining its beautiful traditional features, with a proud nod to both their Indian and English heritage.

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